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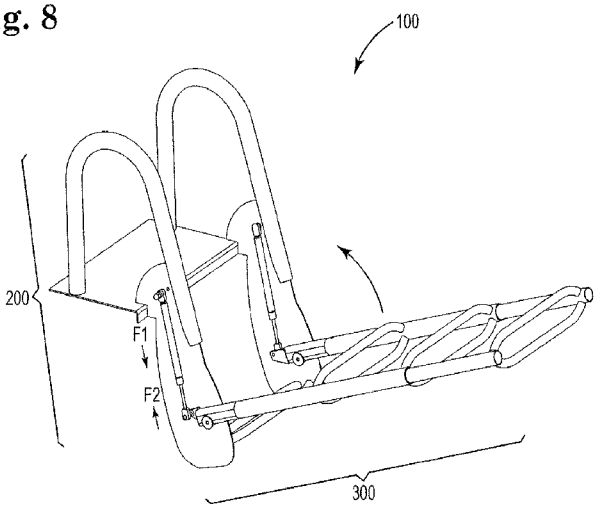
(54) Title: RETRACTABLE MARINE BOARDING LADDER

Fig. 8



(57) Abstract: The present system is directed in various embodiments to marine ladders comprising movement assistance for the transition from a deployed position to a stowed position and to assist in controlling the transition from the stowed position to the deployed position. In certain embodiments, the gas springs and associated pivot point brackets hold the deployed ladder biased in the deployed position with a biasing force that may be overcome by application of force by the user to initiate an automatic stowing process. The initial force to initiate the stowing process is provided by the force of water flowing against an aft-mounted ladder as a result of the boat moving forward. In the case of movement assistance from the stowed to deployed position, the user applies force to initiate the transition while the gas springs apply an opposing force that slows the transition for safety.

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RETRACTABLE MARINE BOARDING LADDER

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] None

FIELD OF THE INVENTION

[0002] The present invention generally relates to systems for marine boat ladders generally. More specifically, the present invention relates to systems enabling retractable marine boarding ladders.

DESCRIPTION OF THE RELATED ART

[0003] Generally, various embodiments of the present invention comprise an improved marine boarding ladder. As the skilled artisan will recognize, marine boarding ladders, e.g., swim ladders, and the like, are well known.

[0004] However, the known marine ladders do not incorporate mechanisms to hold the ladder in the deployed position nor do they reduce the force required to raise the ladder into a stowed position or automatically retract the ladder into the stowed position.

[0005] For example, some known ladders rotate at a point near the top of the ladder to stow or deploy. This requires application of force by the user throughout the process and may be quite awkward and difficult for some users. Some ladders also comprise a telescoping lower section that must be manually extended in order to achieve the deployed position and manually retracted. Still other ladders are permanently affixed to the boat. One feature all known non-permanent ladders have in common is that they all require a user to apply force throughout the processes of stowing and deployment sufficient to move the ladder into a stowed or deployed position.

[0006] Thus, a need exists in the art generally for a marine ladder that provides movement assistance for the transition from a deployed position to a stowed position. A further need exists in the art for a deployed marine ladder that, following an initial application of force, automatically stows without further user intervention.

[0007] The present invention addresses these, among other, needs.

BRIEF SUMMARY OF THE INVENTION

[0008] The present system is directed in various embodiments to marine ladders comprising movement assistance for the transition from a deployed position to a stowed position and from the stowed position to the deployed position. In certain embodiments, the gas springs and associated pivot point brackets hold the deployed ladder biased in the deployed position with a biasing force that may be overcome by application of force by the user to initiate an automatic stowing process. Alternatively, and most preferably, the initial force to initiate the automatic stowing process is provided by the force of water flowing against an aft-mounted ladder as a result of the boat moving forward. The remainder of the force required to complete the automatic stowing process is provided by the gas springs. In the case of movement assistance from the stowed to deployed position, the user applies force to initiate the transition while the gas springs apply an opposing force that slows the transition for safety.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 illustrates perspective view of one embodiment of the present invention in a stowed position;

[0010] FIG. 2 illustrates a cutaway perspective view of one embodiment of the present invention in the stowed position;

[0011] FIG. 3 illustrates a side view of one embodiment of the present invention in the stowed position;

[0012] FIG. 4 illustrates a perspective view of one embodiment of the present invention at a point in the transition from the stowed position to a deployed position;

[0013] FIG. 5 illustrates a perspective view of one embodiment of the present invention at a point in the transition from the stowed position to the deployed position;

[0014] FIG. 6 illustrates a perspective view of one embodiment of the present invention in the deployed position;

[0015] FIG. 7 illustrates a perspective view of one embodiment of the present invention at a point in the transition from the deployed position of FIG. 6 to the stowed position of FIG. 1; and

[0016] FIG. 8 illustrates a perspective view of one embodiment of the present invention at a point in the transition from the deployed position to the stowed position of FIG. 1.

DETAILED DESCRIPTION

[0017] While the invention is amenable to various modifications and alternative forms, specifics thereof are shown by way of example in the drawings and described in detail herein. It should be understood, however, that the intention is not to limit the invention to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention.

[0018] The present invention provides a marine ladder 100 that is connected to a boat for boarding and disembarking and comprising a fixed section 200 and a rotatable section 300. As illustrated in Figures, the ladder 100 is preferably fixedly mounted to the aft portion of boat, however, alternate locations for the ladder 100 mounting are within the scope of the present invention. Mounting bracket 102, having a right side, a left side, a front side and a rear side is

mounted to the boat surface by a variety of means, including bolting, screwing and the like, all of which will be well known to the skilled artisan.

[0019] Fixed section 200 of ladder 100 comprises first 110 and second 120 handrails. First handrail 110 is shown with a first fixed proximal section 112 that is mounted or otherwise affixed to the left side of mounting bracket 102 at point A, proximate the rear side of bracket 102, a first fixed curvilinear section 114 connected to the first proximal section 112 and a first fixed extension section 116 connected to the fixed curvilinear section 114.

[0020] The second handrail 120 is illustrated with a second fixed proximal section 122 mounted or otherwise affixed to the right side of mounting bracket 102 at point B, proximate the rear side of bracket 102, a second fixed curvilinear section 124 connected to the fixed proximal section 122 and a second fixed extension section 126 connected to the fixed curvilinear section 124. Fixed section 200 further comprises brackets 118 and 128 fixedly attaching fixed extension sections 116, 126, respectively, to the front side of mounting bracket 102. Certain embodiments of fixed section 200 may comprise, as illustrated, one or more step elements 150 fixedly connected between the first and second handrails 110, 120.

[0021] Fixed extension sections 116 and 126 comprise distal ends 117, 126, respectively, where channels C1, C2 are defined.

[0022] Rotating section 300 of ladder 100 is a rigid structure that rotates in a single plane relative to fixed section 200. Rotating section 300 comprises a left handrail L, capable of aligning with first handrail 110 of fixed section 200; a right handrail R, capable of aligning with second handrail 120 of fixed section 200 and with one or more step elements 150 disposed therebetween as in the Figures. Left and right handrails L, R each comprise a proximal end P, P', that are rotatingly disposed within channels C1, C2 , respectively, of first and second handrail

110, 120. As illustrated, proximal ends P, P' of left and right handrails L, R are rotatingly affixed within channels C1, C2 by a fastener 147, e.g., a nut and bolt system or the equivalent as the skilled artisan will readily recognize, each such equivalent fastener is within the scope of the present invention.

[0023] Rotating section 300 further comprises two pivot point brackets B, B' fixedly attached to the top T of each of proximal ends P, P', respectively, of left and right handrails L, R. As can be seen in the Figures, when rotating section 300 is transitioning to the straightened, deployed position, the pivot point brackets B, B' engage channels C1 and C2, respectively, extending partially therethrough in certain embodiments. Pivot point brackets B, B', are attached to the top T of each of proximal ends P, P' of left and right handrails L, R, with an angle α therebetween. Angle α is illustrated as obtuse and approximately 135 degrees, though other angle degrees may be functionally equivalent and are also within the scope of the present invention.

[0024] Identical first and second gas springs 400, 400', comprising a gas-filled cylinder 402, 402' and a rod 404, 404', wherein the rod 404, 404' is subject to the force of the gas within cylinder 402, 402' and is translatable into and out of the cylinder 402, 404' depending on the magnitude of the opposing forces that the rod is subjected to. As shown in Figure 2, the force F1 produced by the gas within cylinder 402, 402' tends to push the rod 404, 404' outwardly from cylinder 402, 402' while any force applied to rod 404, 404' by point brackets B, B' tends to push the rod 404, 404' in the opposing direction, i.e., translate back into the cylinder 402, 402'. The force, F1 or F2, that has a larger magnitude will dictate generally the translated position occupied by rod 404, 404', relative to the cylinder 402, 402' as well as point brackets B, B'. Gas springs 400, 404' are illustrated as connecting between each of the brackets 118, 128 and the pivot point

brackets B, B', respectively. Thus, the gas spring cylinder 402 corresponding to the first gas spring 400 is fixedly connected to bracket 118 with its rod 404 rotatably connected to first pivot point bracket B. Similarly, the gas spring cylinder 402' corresponding to the second gas spring 404', is fixedly connected to bracket 128 with its rod 404' rotatably connected to second pivot point bracket B'. The rotatable connections of rods 404, 404' to first and second pivot point brackets B, B', respectively, can be made in a variety of ways known to the skilled artisan, e.g., rod 404, 404' may comprise an eyelet and thereby rotatably secured to first and second pivot point bracket B or B' by a bolt or the equivalent.

[0025] Having described the structure of the present invention, we now turn to the operation of the subject ladder. Figures 1, 2 and 3 illustrate the ladder 100 in the stowed position. In this stowed position, the rotating section 300 is rotated upward and held in place by the force F1 relative to force F2 of gas springs 400, 400' as described above.

[0026] Figure 4 illustrates the rotating section 300 transitioning downward as indicated by the arrow and out of the stowed position of Figures 1-3 toward a deployed position as will be described further. To reach this transitional position, a user may have supplied sufficient force to the rotating section 300 to overcome force F1, so that force F2 overcomes force F1 and allows the rods 404, 404' to translate into cylinders 402, 402' with the result that rotating section 300 begins rotating downward around fasteners 147 and relative to fixed section 200. The force F1 of gas springs 400, 400' provides an continued oppositional force to the downwardly transitioning rotating section 300, wherein the rods 404, 404' are biased to be fully translated away from gas cylinders 402, 402' by the force of the pressure of the gas within gas cylinders 402, 402'. This oppositional force allows the rotating section 300 a smooth and controlled downward rotation toward the deployed position.

[0027] At a point in the transitional downward process, the mass of the rotating section 300 provides a force sufficient to overcome force F1, without aid of the user's added downward force on rotating section 300 as seen in Figures 4 and 5. To be clear, the user's added downward force is initially required to initiate the downward transition from stowed to deployed, but only until the mass of the rotating section 300 is positioned to provide sufficient force to overcome force F1 on its own. Once this point is reached, the rotating section 300 will continue rotating downward without need of any additional force application, using only gravitational force to overcome force F1. As described above, force F1 applied by gas springs 400, 400' continues to provide oppositional force to the downwardly transitioning rotating section to allow the freely downwardly transitioning rotating section 300 a smooth and controlled downward rotation to the deployed position. In practice, the rotating section 300 may require a small amount of user-applied force to counteract the buoyancy effects of water, if the rotating section 300 is rotated downwardly into water, to complete fully the transition to deployed.

[0028] The continued freely downward transition of rotation section 300, i.e., without need of any additional downward force provided by, e.g., a user, results in the deployed position which is illustrated in Figure 6. There, the handrails L, R of rotation section 300 substantially align with the fixed extension sections 116, 126 of fixed section 200, placing the step elements 150 in the fixed section 200 and in the rotating section 300 in substantial alignment, thereby enabling the user to climb the step elements 150 at a constant pitch as in, e.g., a staircase.

[0029] Once the deployed position of Figure 6 is achieved, the rods 404, 404' are fully engaged within the respective cylinders 404, 402' of gas springs 400, 400', the gas springs 400, 400', the fixed extension sections 116, 126, and the pivot point brackets B, B' may function to

hold the ladder 100 in the deployed position. Pivot point brackets B, B' may extend outwardly through channels C1 and C2 when fully deployed.

[0030] Turning now to Figures 7 and 8, the assisted transition from the deployed position to the stowed position is illustrated. In Figure 7, the rotating section 300 is beginning the upward rotation necessary to achieve fully stowed position. An initial upwardly, or horizontally, applied force is required to move the rotating section 300 out of the deployed position and to reach the upwardly transitional position of Figure 7. This force can be provided by a user or, if the ladder 300 is mounted on the aft section of a boat, as illustrated in Figure 1, then simply moving the boat forward in the water will provide sufficient force in certain embodiments to bring the rotating section out of the deployed position.

[0031] At a point in the upward transition from deployed to stowed, the force F1 will overcome the downward forces, i.e., the mass of, on the rotating section. At this point, the forces F1 provided by gas springs 400, 400' work to extend the rods 404, 404' from the gas cylinders 402, 402' with concurrent and smooth upward rotation of the rotating section as in Figure 8. This assisted upward rotation to stowed position continues, without requirement of further force provided or applied by a user, until the rotating section 300 reaches the fully stowed position of Figure 1. When fully stowed, the forces F1 applied by gas springs 400, 400' keep the ladder 100 in the stowed position.

[0032] The present invention should not be considered limited to the particular examples described above, but rather should be understood to cover all aspects of the invention. Various modifications, equivalent processes, as well as numerous structures to which the present invention may be applicable will be readily apparent to those of skill in the art to which the present invention is directed upon review of the present specification.

WHAT IS CLAIMED IS:

1. A marine boarding ladder attached to a boat and comprising:

a fixed section;

a rotating section capable of rotating upward into a stowed position and downward from the stowed position into a deployed position; and

gas springs fixedly attached to the fixed section and rotatingly connected to the rotating section, whereby the rotating section is assisted by the gas springs to the stowed position.

2. The ladder of claim 1, wherein the rotating section is assisted by the gas springs from the stowed position to the deployed position.

3. The ladder of claim 2, wherein the fixed section further comprises:

a mounting bracket attached to the boat and having a left side, front side, right side and a rear side;

a first handrail having a fixed proximal section affixed to the left side of mounting bracket, proximate the rear side of the mounting bracket;

a fixed curvilinear section connected to the first proximal section and a fixed extension section connected to the fixed curvilinear section;

a second handrail having a fixed proximal section affixed to the right side of the mounting bracket, proximate the rear side of the mounting bracket;

a second fixed curvilinear section connected to the second fixed proximal section;

a second fixed extension section connected to the second fixed curvilinear section; and

one or more step elements fixedly connected between the first and second handrails.

4. The ladder of claim 3, wherein the fixed section further comprises a first bracket fixedly attaching first fixed extension section to the front side of the mounting bracket.

5. The ladder of claim 4, wherein the fixed section further comprises a second bracket fixedly attaching second fixed extension section to the front side of the mounting bracket.

6. The ladder of claim 5, wherein the first fixed extension section comprises a distal end and defining a channel therethrough, and wherein the second fixed extension section comprises a distal end and defining a channel therethrough.

7. The ladder of claim 6, wherein rotating section comprises:

a left handrail that is capable of aligning with the first handrail of the fixed section and comprising a proximal end having a top and capable of rotational engagement with the channel defined by the first handrail;

a right handrail that is capable of aligning with the second handrail of the fixed section and comprising a proximal end having a top and capable of rotational engagement with the channel defined by the second handrail; and

one or more step elements disposed between the right and the left handrails.

8. The ladder of claim 7, the rotating section further comprising:

a fastener to rotatingly affix the proximal end of the left handrail within the channel defined by the first handrail; and

a fastener to rotatingly affix the proximal end of the right handrail within the channel defined by the second handrail.

9. The ladder of claim 8, wherein rotating section further comprises:

a pivot point bracket fixedly attached to the top of the proximal end of the left handrail and comprising an obtuse angle therebetween; and

a pivot point bracket fixedly attached to the top of the proximal end of the right handrail and comprising an obtuse angle therebetween.

10. The ladder of claim 9, wherein the gas springs each comprise a cylinder section and a rod section in translatable engagement with the cylinder section and wherein the cylinder section of a first of the gas springs is fixedly connected to the first bracket and the rod of the first gas spring is rotatably connected to the first pivot point bracket.

11. The ladder of claim 10, wherein the gas springs each comprise a cylinder section and a rod section in translatable engagement with the cylinder section and wherein the cylinder section of a second of the gas springs is fixedly connected to the second bracket and the rod of the first gas spring is rotatably connected to the second pivot point bracket.

12. The ladder of claim 11, wherein the cylinder sections comprise a gas under sufficient pressure to exert a force sufficient to hold the rotating section in the stowed position.

13. The ladder of claim 12, wherein the cylinder sections comprise a gas under sufficient pressure to allow exertion of a force sufficient to enable an assisted upward rotation of the rotating section into the stowed position.

14. The ladder of claim 13, wherein the cylinder sections comprise a gas under sufficient pressure to exert a force sufficient to enable an smooth and controlled downward rotation of the rotating section into the deployed position.

15. The ladder of claim 1, wherein the fixed section of the ladder is attached to the aft section of the boat.

16. A method of assisting a marine boarding ladder mounted on a boat into position, comprising:

providing a fixed section affixed to the boat;

providing a rotating section rotationally connected to the fixed section and capable of rotating up or down relative to the fixed section and the boat;

providing two gas springs, each gas spring having a gas cylinder with gas under pressure therein and a rod that is in translatable engagement with the gas cylinder, in operational connection with the fixed section and the rotating section, the gas springs configured to provide an upwardly rotational biased force to the rotating section.

17. The method of claim 16, further comprising:

assisting, with the gas springs, the rotating section to rotate upwardly from a deployed position into a stowed position.

18. The method of claim 17, further comprising:

assisting, with the gas springs, the rotating section to controllably rotate downward from the stowed position into the deployed position.

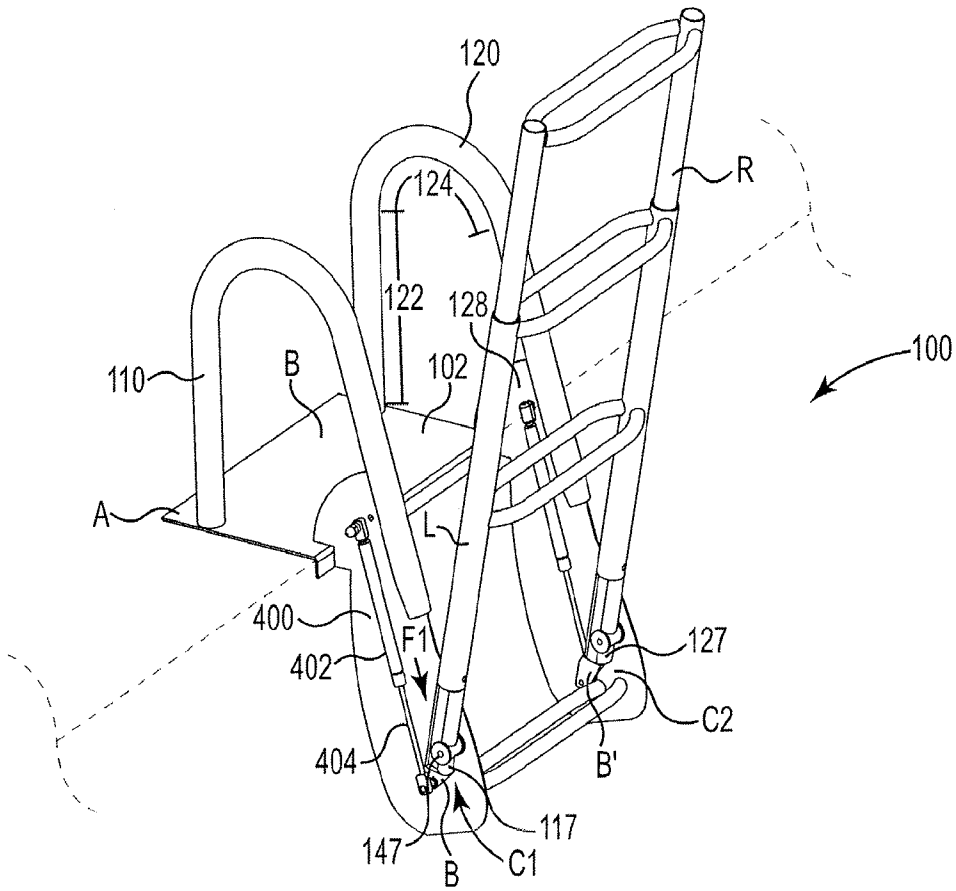
19. The method of claim 18, further comprising:

mounting the ladder on the aft section of the boat;

placing the boat in the water;

assisting with the gas springs, the rotating section to controllably rotate downward from the stowed position into the deployed position, and

initiating the upward rotation of the ladder from the fully deployed position by moving the boat, and the portion of the rotating section that is under water, forward through the water.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124
R
122
128
100
110
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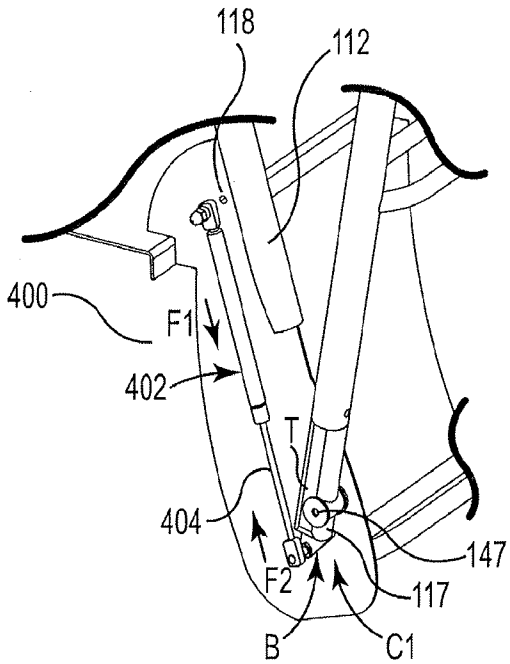
102
A
L
400
F1
127
402
C2
404
B'
117
147
B
C1

Fig. 1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F2
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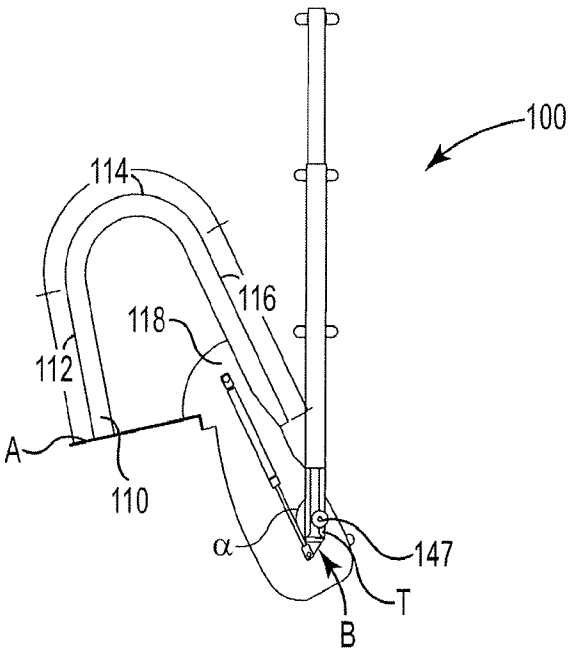
B
C1

Fig. 2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116
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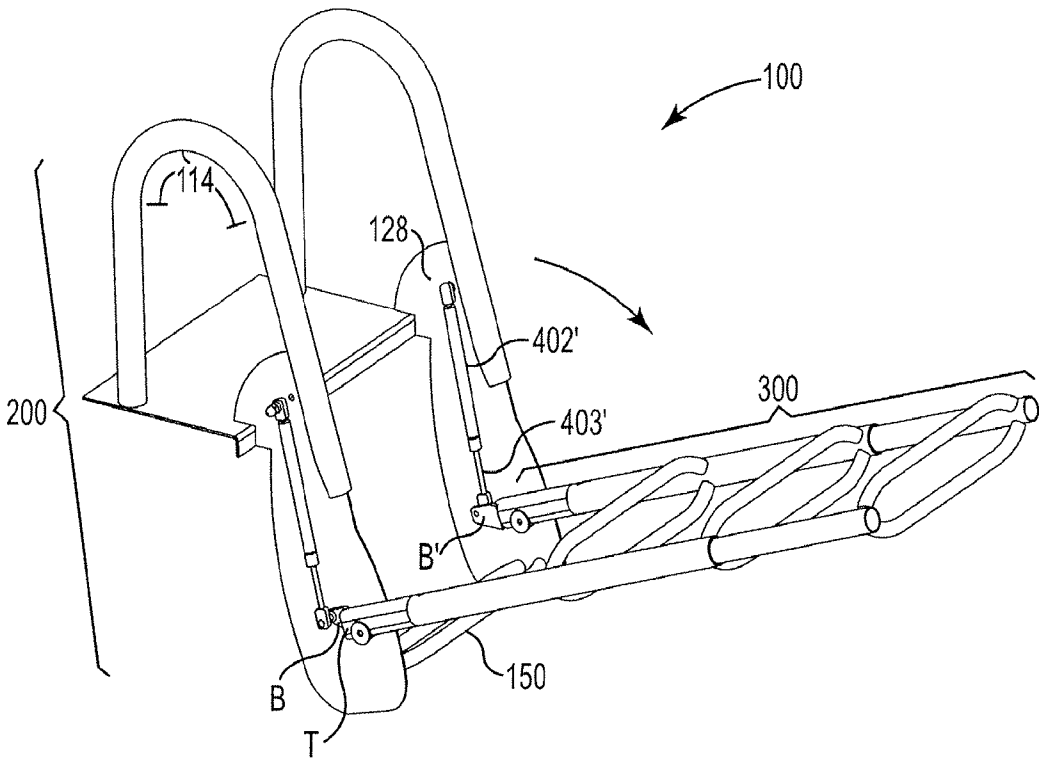
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300
200
403'
B'
150
B
T

Fig. 4

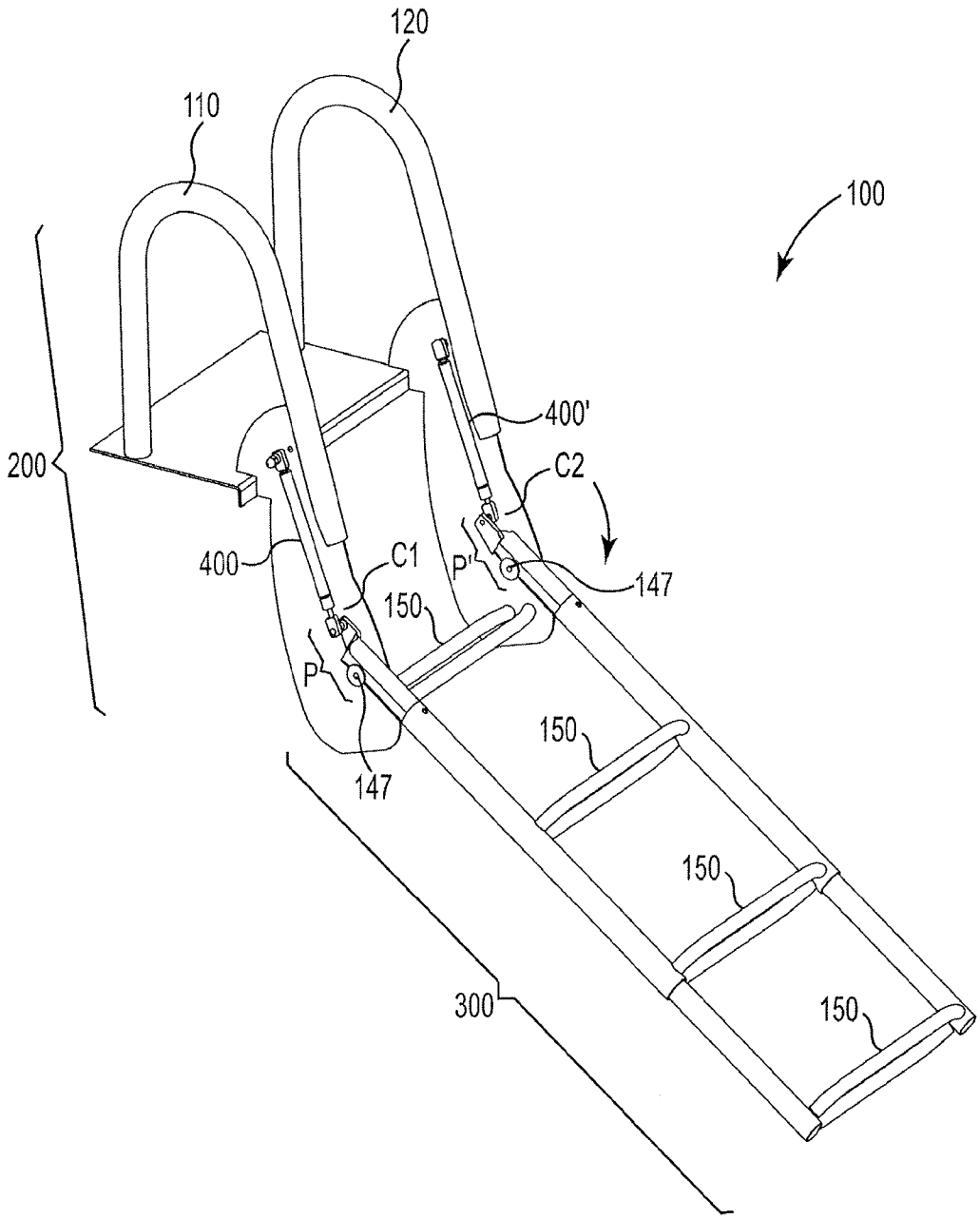

Fig. 5

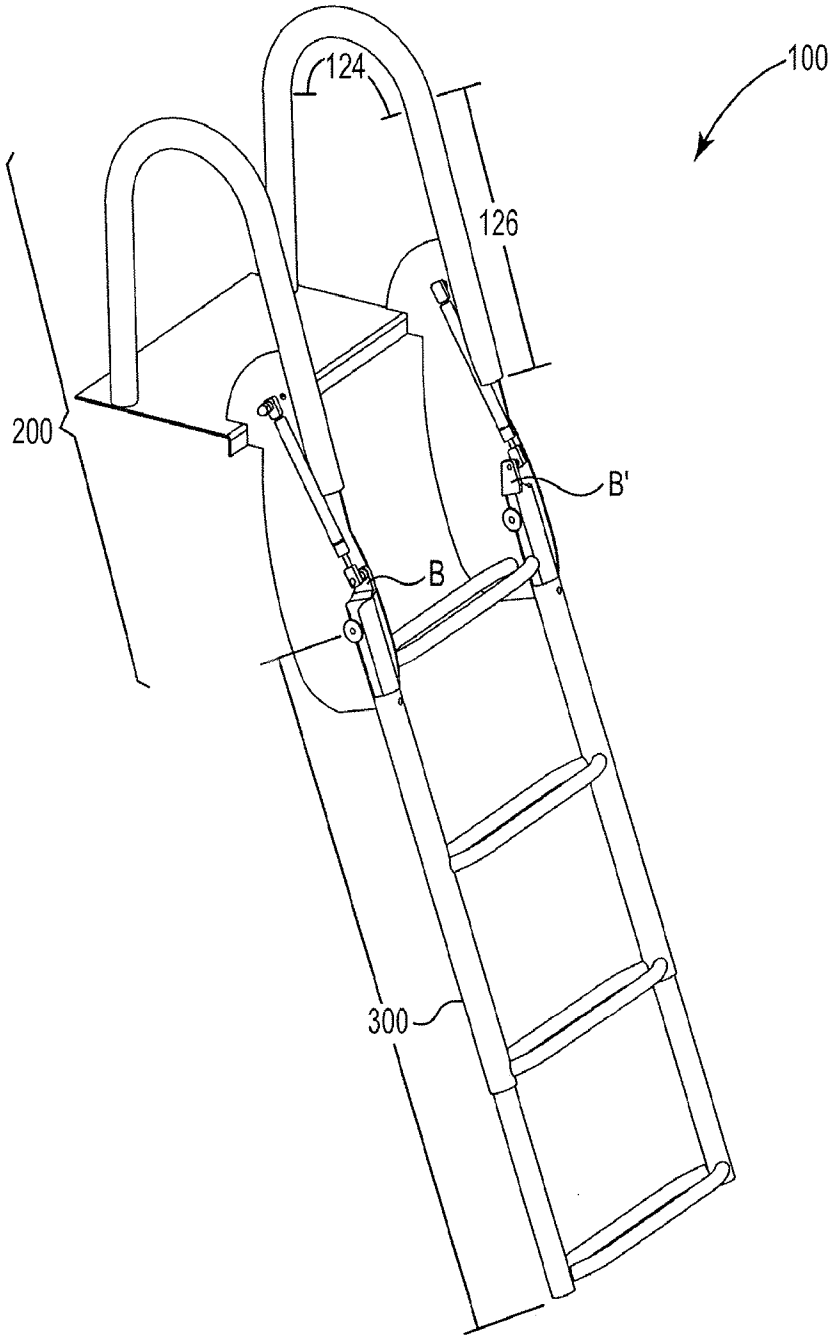

Fig. 6

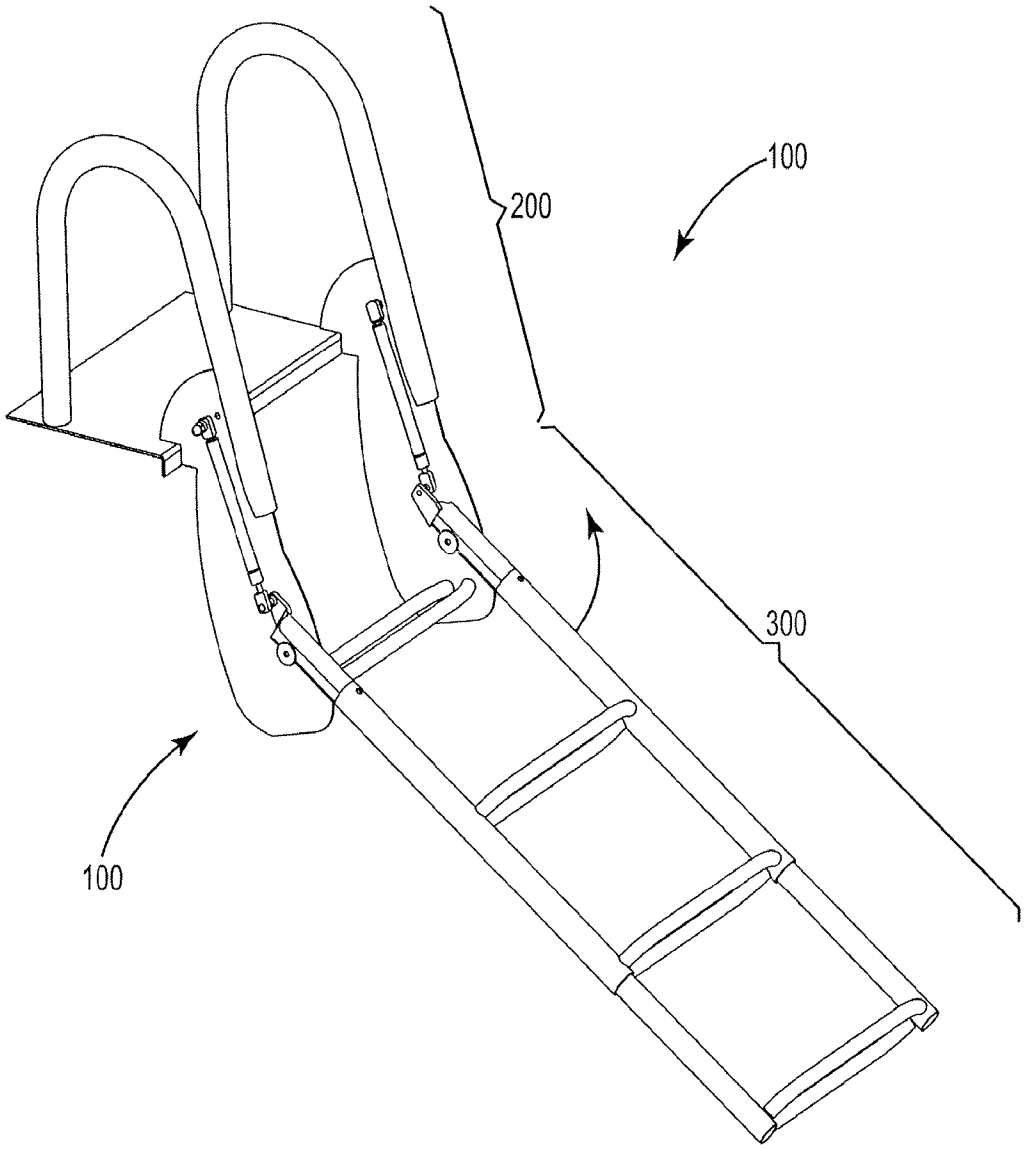

Fig. 7

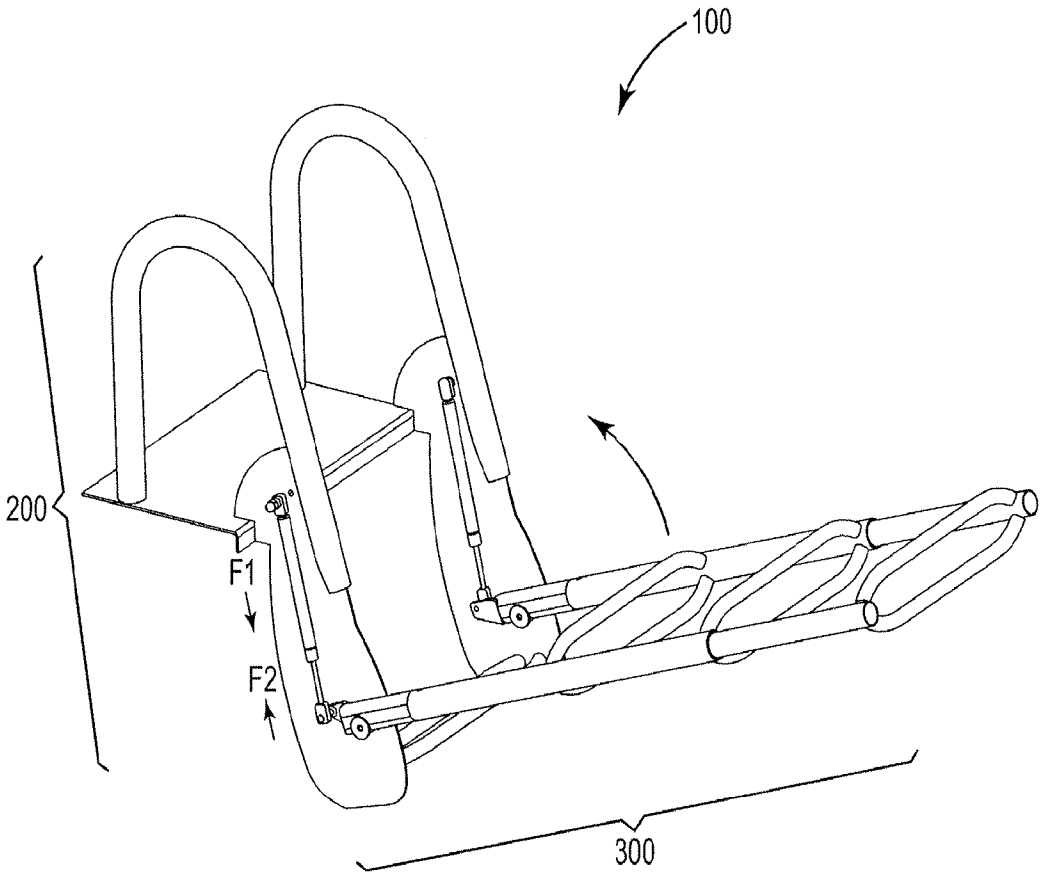

Fig. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US15/25643

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - B63B 27/14; E06C 5/06 (2015.01)
CPC - B63B 27/14, 27/146; E06C 5/06
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8): B63B 27/14, 35/73; B66F 11/00; E06C 5/00, 5/06, 5/16, 5/22, 5/24 (2015.01)
CPC: B63B 27/14, 27/146, 2027/141; B66F 11/00; E06C 5/00, 5/06, 5/16, 5/22, 5/24; B66F 11/00; E04F11/06

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatSeer (US, EP, WO, JP, DE, GB, CN, FR, KR, ES, AU, IN, CA, INPADOC Data); Google/Google Scholar; Ebsco Host; McMaster-Carr; Proquest; KEYWORDS: ladder, board, gas, pneu*, boat*, ship*, marine*, naut*, water*, watercraft, piston*, "gas spring", "gas strut", jack, assist*, retract*, fold*, channel*, groove*

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 3153564 B2 (YAMAHA MOTOR CO LTD) 09 April 2001; figures 1-6; paragraphs [0005], [0008], [0010]	1-2, 15-19
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Y		1-15
Y	US 3,794,140 A (SELL, J) 26 February 1974; figures 1, 2; column 2, lines 41-44	1-15
Y	"Dive Ladders" Diving Equipment Specialties [online]. 01 June 2003. Retrieved on 23 June 2015. Retrieved from the internet: <https://web.archive.org/web/20030601092530/http:/www.techdivetools.com/boat/ladders.html>; figure 1, page 3; page 2, second paragraph	6-14
A	US 4,926,965 A (FOX, M.) 22 May 1990; entire document	1-19
A	US 5,427,049 A (MARDIKIAN, A.) 27 June 1995; entire document	1-19
A	US 6,904,863 B2 (MARDIKIAN, A. et al.) 14 June 2005; entire document	1-19

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 June 2015 (23.06.2015)	14 JUL 2015
Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300	Authorized officer Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (January 2015)