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(54) **SAIL MANOEUVRING SYSTEM**

(57) The present invention relates to a wind-powered boat comprising at least one hull (2) and at least one rig (5), where said rig comprising at least one sail (10) fastened slidably to an overturning guide (35), where the overturning guide defines a sliding path (S) between two operating positions that are specular between them, said sail has two ends (45) that are opposite in the sliding direction (S), characterized in that said rig comprises:

- a sail manoeuvring system (50) comprising:
 - at least one carriage (70) at each end of the sail (45) so as to be slidable integrally therewith with respect to the overturning guide (35);
- in addition, said carriage (70) can also slide with respect to the sail (10) away from and toward the overturning guide (35);
- said carriage drags a sheet (52) from a point proximal to the overturning guide (PI) to a distal point, called operating clew point (60).

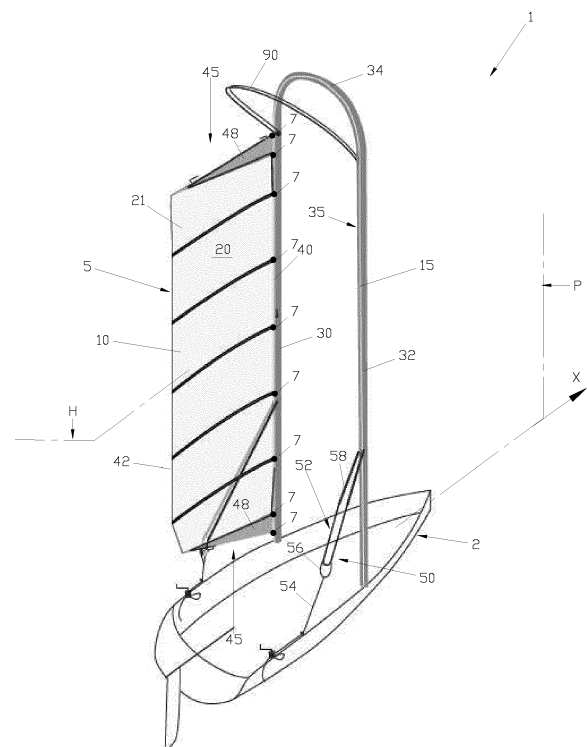


Fig. 1

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Description

[0001] The present invention relates to a sail manoeuvring system. The invention has been made with particular reference to the boats with overturning of the sail by sliding along a path with specular symmetry, preferably U-shaped, preferably upturned. The invention is particularly applicable for manoeuvring a mainsail. Sail means any device for capturing the wind that is deformable in order to follow this overturning path. Therefore, purely by way of non-limiting example, said sail comprises any sail made of fabric or the like, including those with a wing profile, and semi-rigid sails, comprising for example rigid sectors that are movable together. The sail preferably has an asymmetrical cross-section.

STATE OF THE ART

[0002] The state of the art is represented by the rigs described in the previous patent applications of the same Applicant and of the same inventor identified by the publication numbers WO2017178913 and WO2019092533.

[0003] In such rigs the mainsail needs to be hauled and eased in order to adjust its position and thus obtain the right angle of incidence with respect to the direction of the wind. In Bermuda rigs the adjustment is made by means of a sheet fixed to a boom. This cannot, however, be adopted for a rig with a U-shaped overturning path, since the end of the mainsail to be engaged by the sheet changes passing from the one to the other of the two envisaged operating positions.

[0004] The object of the present invention is to partially overcome the problems of the known art.

[0005] A preferred object of the present invention is to provide a system for adjusting the angle of incidence of a sail with respect to the wind direction for a rig with a U-shaped overturning path of at least one sail.

GENERAL INTRODUCTION

[0006] According to a first general aspect thereof, the present invention relates to a wind-powered boat comprising at least one hull (2) and at least one rig (5), wherein said rig comprising at least one sail slidably fastened to an overturning guide, where the overturning guide defines a sliding path (preferably U-shaped) between two operating positions that are specular between them, said sail has two opposite ends in the sliding direction, characterized in that said rig comprises:

- a sail manoeuvring system comprising:
 - at least one carriage at each end of the sail so as to be slidable integrally therewith with respect to the overturning guide;

in addition, said carriage can also slide with respect to the sail away from and toward the overturning

guide;

said carriage drags a sheet from a point proximal to the overturning guide to a distal point, called the operating clew point.

[0007] According to some preferred embodiments, each carriage is driven away from the overturning guide by the sliding of the sail between a point of interception of the sheet and one of the operating positions.

[0008] According to some practical examples, said manoeuvring system comprises a cable with one end fixed to the carriage and a second end sliding integrally with the sail according to the overturning guide up to a retaining point which retains it while the sail continues to slide toward one of the operating positions, the operating clew point is interposed between the carriage and a point of reversal of the direction of the cable, comprising for example a pulley;

by reversing its direction of pull, the cable pulls the carriage toward the clew point when it is retained.

[0009] In this case, the sliding end of the cable is preferably fastened to the overturning guide by means of a sliding block.

[0010] According to some preferred embodiments, the sheet comprises a ring for the hooking to the carriage and the carriage comprises a hook that is open toward the operating clew point so as to engage the ring and drag it toward the operating clew point, the operating clew point comprises a hook that is open toward the carriage to accommodate the loop.

[0011] Preferably, the two hooks couple to form a seat for trapping the ring.

[0012] According to some preferred embodiments, the ring is elastically fixed to the overturning guide so as to intercept the sail before it reaches an operating position and be dragged by it parallel to the overturning guide toward this position.

[0013] For example, the ring is fixed to the overturning guide by interposition of a seat for accommodating the sail that surrounds the overturning guide, said seat is for example an elastic loop.

[0014] According to a preferred general feature of the invention, the sheet comprises a rope, an inextensible ring and an elastic loop, where the inextensible ring is interposed between the other two and the elastic loop surrounds the overturning guide.

[0015] According to some preferable embodiments of the invention, the sail comprises at said opposite ends a pair of rigid elements which keep it pulled between them, each of which houses an operating clew point and a carriage for dragging the sheet.

[0016] According to some preferable general characteristics of the invention:

- the hull (2) is shaped to define a forward direction in the water (X) and a vertical direction with respect to said forward direction, - the rig comprises at least one mast (15) fixed to the hull to support said sail, where

the mast comprises at least a first and a second section (30, 32) projecting upwards with respect to the hull and arranged facing each other in a direction orthogonal to the forward direction, where said sections are spaced apart by at least one connecting section (34) of their tops with which they define said overturning guide, the sail is deformable so as to follow the path defined by the overturning guide in order to pass from a configuration in which it is supported on the first section (30) to a configuration in which it is supported on the second section (32) and vice versa, preferably the mast comprises a second sliding guide (45, 145) positioned at its top and placed aft with respect to the connecting section (34) to support the sail (20) during the passage between the two said configurations.

[0017] According to a second general aspect, the invention relates to a sail manoeuvring system for a boat of the type described above, characterized in that it comprises:

- at least one carriage at each end of the sail so as to be slidable integrally therewith with respect to the overturning guide;

in addition, said carriage can also slide with respect to the sail away from and toward the overturning guide; said carriage drags a sheet from a point proximal to the overturning guide to a distal point, called the operating clew point.

DETAILED DESCRIPTION

[0018] Further characteristics and advantages of the present invention will become clearer from the following detailed description of preferred embodiments thereof, with reference to the appended drawings and provided by way of an indicative and non-limiting example. In such drawings:- Figures 1 and 2 schematically show a boat according to the present invention in which the sail is respectively in a first operating position for powering the boat and in a configuration of passage to a second operating position, specular to the first;- Figure 3 schematically shows a system for manoeuvring the sail of the boat of Figures 1 and 2 in a position preceding a sheet interception position;

- Figure 4 schematically shows the manoeuvring system of Figure 3 in a position with the sheet engaged, i.e. intercepted by the sail and fixed to the operating clew point;
- Figure 5 schematically shows the system for stopping the sheet dragging carriage belonging to the manoeuvring system of the previous figure.

[0019] With reference to Figure 1, a wind-powered boat is shown, indicated as a whole with the reference number

1. The boat 1 comprises a hull 2 and a rig 5, comprising in turn a sail 10 and a mast 15, which supports the sail on the hull.

[0020] The hull 2 can be of any type, possibly even a catamaran, and identifies with its shape a forward direction indicated by the arrow X, as well as a symmetry plane P parallel to this direction.

[0021] The mast 15 has a first and a second section 30, 32 projecting upwards from the hull, preferably they are substantially straight. A third section 34 joins the tops of the first and the second section, and is shaped so as to form a continuity of the extension direction of the entire mast. Basically the shape of the mast is that of an inverted U-shaped bipod.

[0022] According to a general preferable characteristic, the mast has a distance between the first and second section 30 and 32 such as to embrace all or most of the hull 2. The mast 15 acts as an overturning guide 35 to guide the sail 10 slidingly along its own extension line, preferably along the "entire" extension line. The overturning guide 35 is in particular present in each of the three sections 30, 32, 34 and is continuous in the passages between them, so that the sail 10 can be overturned by sliding between two operating configurations that are specular with respect to the symmetry plane P. The line S in Figure 2 indicates the sliding direction. The operating configurations are those in which the sail is supported by the first or second section 30, 32, (Figure 1) while the transition configuration between them is the one in which the device is to pass at the joining section 34 (Figure 2). In general, the sail 10 is preferably a mainsail that has a longer side 40 fastened to the mast, an opposite side 42 called leech, and two opposite ends 45 in the sliding direction S, called feet.

[0023] The luff side in general is preferably slidingly hooked to the mast by means of a series of carriages 7 (Figure 1). The luff is preferably along the entire side, i.e. from foot to foot. The overturning guide 35, for example, comprises a channel, then a bas-relief of the mast, or a rail, then a high-relief projection of the mast. The fastening can take place for example by means of a series of carriages 7 (Figure 1) distributed longitudinally along the entire luff side and sliding in the channel or on the rail. The mainsail generally has a symmetry plane H orthogonal to the overturning guide 35 so that its ends 45 are specular.

[0024] The sail 10 generally comprises a wind capture surface 20 which, thanks to the overturning described above, always remains facing the plane P in each of the two specular operating configurations permitted by the mast.

[0025] Preferably the sail 10 generally comprises two rigid elements 48 at the ends 45, pulled in opposed manner to keep the sail taut between them. Between the two rigid sections, the sail preferably comprises at least one section of canvas or the like 21. The rigid elements are preferably extended substantially from the luff side to the leech. The tension is carried out by means of one or more

ropes, called halyards 49 (Figure 2). The rigid elements 48 are slidably fixed to the overturning guide so as not to tilt in the sliding direction S. In the shown example, their fixing takes place through two or more carriages 7 for fastening the sail 10 to the guide 35. For example, they are made in the form of a plate, preferably substantially triangular. In general, the rigid elements 48 are elements which summarize the functions normally performed by two elements, namely the boom and the vang, and are therefore referred to in the following as "boom/vang elements". In fact, in a traditional boat the boom stiffens the end of the sail, and the vang pulls the boom to tension the leech. The sail 10 can be rotated around the longitudinal extension line of the mast so as to be able to adjust the angle of incidence with respect to the direction of the wind as needed. This means that in both operating positions the leech 42 can be moved towards or away from the symmetry plane P. Such operations are also called hauling and easing the mainsail. For this purpose the rig 5 comprises a sail manoeuvring system 50.

[0026] The manoeuvring system in general preferably comprises a pair of sheets 52, one at each of the operating positions of the sail. The sheets are hung on the mast 15, for example at fixed or elastically movable points. Each sheet 52 preferably comprises a rope 54, an inextensible ring 56, and an elastically extendable loop 58.

[0027] In the transition configuration of Figure 2 the ends of the sail 10 are free with respect to both sheets 52, while in each operating position (Figure 1) they are engaged at one of the two, respectively. The engagement is a progressive operation that includes intercepting the sheet by the sail and its fixing to the operating clew point. The engagement begins during the approach of the sail 10 to one of the operating positions as explained below.

[0028] In particular, the sail 10 slides until it reaches a height of interception "HI" with respect to the hull in which it penetrates in the elastic loop 58 and abuts against its bottom. This is possible since this loop is a U hooked to the overturning guide 35 at points 3 between which the sliding path defined by it runs, so that the loop surrounds it like a tunnel. During the sliding, therefore, the sail is forced to meet the bottom of the loop 58. The point of the sail where it abuts against the bottom of the elastic loop 58 is called the point of interception PI and is generally proximal to the overturning guide.

[0029] The height of interception HI is such that the sail 10 must still continue to slide to reach the operating position towards which it is heading, and therefore, thanks to the elasticity of the loop 58, it drags it along with it up to this position without detaching it from the overturning guide. This means in other words that the height of interception HI with respect to the hull is greater than the height reached by the end 45 of the sail in the operating position. Below the elastic loop 58 there is the inextensible ring 56, made for example with a chord. Thanks to the elasticity of the loop 58, the inextensible

ring can be dragged away from the overturning guide 35 to reach an operating clew point 60 on the relative boom/vang 48 (Figure 3). The operating clew point 60 is the point where the rope is retained with respect to the boom/vang in such a way that the sail can be hauled and eased 10. In general the operating clew point is a fixed point of the sail 10.

[0030] In the operating clew point 60 there is a fixed hook 62 that is open towards the sliding guide in order to receive the inextensible ring 56.

[0031] When the inextensible ring 56 is hooked to the hook 62 it is possible to tension the rope 54 to retain or pull the sail 10.

[0032] When the sail has reached the desired angle of incidence it is possible to lock the length of the rope 54 by fixing it to the hull. In general, the inextensible ring 56 can be dragged from the point of interception PI to the operating clew point, for example, by means of a carriage 70, for example sliding along the lower side of the boom/run 48. The carriage 70 comprises a dragging hook 72 which picks up the inextensible ring 56 at the point of interception PI. When the carriage reaches the operating clew point 60, the two hooks 62 and 70 cooperate to form a seat for trapping the inextensible ring 56 (Figure 4). As can be seen in Figure 4, the inextensible loop 56 and the elastic loop 58 can have a common portion 59, where this portion is caught in the hook 62 and must necessarily be inextensible.

[0033] The elastic loop generally also comprises partially elastic loops, for example because they have portions of elastic attachment to the overturning guide 35 and/or to the inextensible ring, or because they have elastically movable points of attachment to the overturning guide.

[0034] It is not excluded that the elastic loop 58 has rigid portions, just as it is not excluded that the inextensible ring is rigid or partially rigid instead of chord.

[0035] The movement of the carriage 70 towards the operating clew point 60 can be generated automatically by the descent of the sail from the height of interception HI to the operating position.

[0036] For this purpose a cable 74 supported by the boom/vang 48 is provided. The cable 74 has one end fixed to the carriage and the opposite end fixed to a sliding block 76 sliding along the overturning guide 35 until the sail reaches the height of interception HI. At this point, along the overturning guide, an element for stopping 78 the sliding block is provided (Figure 5).

[0037] As a result of the retention, the cable 74 is tensioned and pulls the carriage towards the operating clew point 60 by means of a system of pulleys 80. The latter allows the cable 74 to bend to reverse its pulling direction.

[0038] In particular, there are one or more pulleys 80 fixed to the boom/vang 48, where at least one pulley 80a is positioned in such a way that the operating clew point 60 is between it and the point of interception PI. What described for one end of the sail is repeated identically on the other side for specularity.

[0039] In general, the mast 15 may comprise a second sail guide 90 placed at its top, and spaced horizontally and towards the aft with respect to the first guide 35.

[0040] In general, the second guide 90 is preferably a support for the sail, which rests on it in the passage configuration at the joining section 34.

[0041] The term "fastening" as used in the present invention is to be understood as a general term indicating any type of fixing of the sail to the overturning guide 35, for example it contemplates both the case in which the sail (for example by means of carriages 7) is inserted into an internal channel of the guide, and the case in which it is hooked to an external rail. The term "boom/vang" as used in the present invention is to be understood as a general term that indicates any type of stiffening element of the end of the sail fastened to the overturning guide so as to slide with respect to the latter without tilting in the sliding direction, for this purpose it is for example a plate fastened by means of at least two consecutive carriages 7. In use, it is generally clear that each sheet hangs from the overturning guide, i.e. the mast, waiting to be intercepted by the sail, and when this happens the sheet is dragged towards the operating clew point 60. It is clear that this effect can be obtained with other solutions in addition to the one described, for example solutions are contemplated in which the sheet or the hooking thereof do not have elasticity to be dragged by the mainsail towards the operating position, or the carriage 62 can be moved with a system other than the cable. Ultimately, therefore, the characteristics described can be separated and made independent from each other. For example, it is possible to have a sheet with a rope and an inextensible ring dragged towards the operating clew point without the presence of an elastic loop but in the presence of a different abutment of the sail.

GENERAL INTERPRETATION OF TERMS

[0042] In understanding the object of the present invention, the term "comprising" and its derivatives, as used herein, are intended as open-ended terms that specify the presence of declared characteristics, elements, components, groups, integers and/or steps, but do not exclude the presence of other undeclared characteristics, elements, components, groups, integers and/or steps. The above also applies to words, which have similar meanings, such as the terms "comprised", "have" and their derivatives. Furthermore, the terms "part", "section", "portion", "member" or "element" when used in the singular can have the double meaning of a single part or a plurality of parts. As used herein to describe the above executive embodiment(s), the following directional terms "forward", "backward", "above", "under", "vertical", "horizontal", "below" and "transverse", as well as any other similar directional term, refers to the embodiment described in the operating position. Finally, terms of degree, such as "substantially", "about" and "approximately", as used herein, are intended as a reason-

able amount of deviation of the modified term such that the final result is not significantly changed.

[0043] While only selected embodiments have been chosen to illustrate the present invention, it will be apparent from this description to those skilled in the art that various modifications and variations can be made without departing from the scope of the invention as defined in the appended claims. For example, the size, shape, position or orientation of the various components can be changed as needed and/or desired. The components shown directly connected or in contact with each other can have intermediate structures arranged between them. The functions of one element can be performed by two and vice versa. The structures and functions of one embodiment can be adopted in another embodiment. All the advantages of a particular embodiment do not necessarily have to be present at the same time. Any feature that is original compared to the prior art, alone or in combination with other features, should also be considered as a separate description of further inventions by the Applicant, including the structural and/or functional concepts embodied by those features. Therefore, the foregoing descriptions of the embodiments according to the present invention are provided for illustrative purposes only and not for the purpose of limiting the invention as defined by the appended claims and the equivalents thereof.

Claims

1. Boat comprising at least one hull (2) and at least one rig (5), where said rig comprises at least one sail (10) fastened slidably to an overturning guide (35), where the overturning guide defines a sliding path (S) between two operating positions that are specular between them, said sail has two ends (45) that are opposite in the sliding direction (S), **characterized in that** said rig comprises:

- a sail manoeuvring system (50) comprising:
 - at least one carriage (70) at each end of the sail (45) so as to be slidable integrally therewith with respect to the overturning guide (35);
 - in addition, said carriage (70) can also slide with respect to the sail (10) away from and toward the overturning guide (35);
 - said carriage drags a sheet (52) from a point proximal to the overturning guide (PI) to a distal point, called operating clew point (60).

2. Boat according to the preceding claim, **characterised in that** each carriage (70) is driven away from the overturning guide (35) by the sliding of the sail (10) between a point of interception of the sheet (HI)

and one of the operating positions.

3. Boat according to the preceding claim, **characterized in that** said manoeuvring system comprises a cable (74) with one end fixed to the carriage (70) and a second end sliding integrally with the sail according to the overturning guide (35) up to a retaining point (78) which retains it while the sail (10) continues to slide toward one of the operating positions, the operating clew point (60) is interposed between the carriage (70) and a point of reversal of the direction of the cable (80a), comprising for example a pulley; by reversing its direction of pull, the cable pulls the carriage toward the clew point when it is retained. 5 10 15
4. Boat according to the preceding claim, **characterized in that** the sliding end of the cable is fastened to the overturning guide by means of a sliding block (76). 20
5. Boat according to any one of the preceding claims, **characterized in that** the sheet (52) comprises a ring for the hooking to the carriage (56), and the carriage comprises a hook (72) that is open toward the operating clew point so as to hook the ring (56) and drag it toward the operating clew point (60), the operating clew point comprises a hook (62) that is open toward the carriage to accommodate the loop (56). 25 30
6. Boat according to the preceding claim, **characterized in that** the two hooks (62, 72) couple to form a seat for trapping the ring (56). 35
7. Boat according to the preceding claim, **characterized in that** the ring is (56) elastically fixed to the overturning guide so as to intercept the sail before it reaches an operating position and be dragged by it parallel to the overturning guide toward said position. 40
8. Boat according to the preceding claim, **characterized in that** the ring is fixed to the overturning guide by interposition of a seat for accommodating the sail (58) that surrounds the overturning guide (35), said seat is for example an elastic loop (58). 45
9. Boat according to any one of the preceding claims, **characterized in that** the sheet comprises a rope (54), an inextensible ring (56) and an elastic loop (58), where the inextensible ring (56) is interposed between the other two and the elastic loop (58) surrounds the overturning guide (35). 50
10. Boat according to any one of the preceding claims, **characterized in that** the sail comprises at said opposite ends (45) a pair of rigid elements (48) which keep it pulled between them, each of which houses 55

an operating clew point (60) and a carriage for dragging the sheet (70).

11. Boat according to any one of the preceding claims, **characterized in that:**

- the hull (2) is shaped to define a forward direction in the water (X) and a vertical direction with respect to said forward direction,- the rig comprises at least one mast (15) fixed to the hull to support said sail, where the mast comprises at least a first and a second section (30, 32) projecting upwards with respect to the hull and arranged facing each other in a direction orthogonal to the forward direction, where said sections are spaced apart by at least one connecting section (34) of their tops with which they define said overturning guide, the sail is deformable so as to follow the path defined by the overturning guide in order to pass from a configuration in which it is supported on the first section (30) to a configuration in which it is supported on the second section (32) and vice versa, preferably the mast comprises a second sliding guide (90) positioned at its top and placed aft with respect to the connecting section (34) to support the sail (10) during the passage between the two said configurations.

12. Sail manoeuvring system for a boat according to any one of the preceding claims, **characterized in that** it comprises:

- at least one carriage (70) at each end of the sail (45) so as to be slidable integrally therewith with respect to the overturning guide (35);
- in addition, said carriage can also slide with respect to the sail (10) away from and toward the overturning guide (45);
- said carriage (70) drags a sheet (52) from a point (PI) proximal to the overturning guide to a distal point, called operating clew point (60).

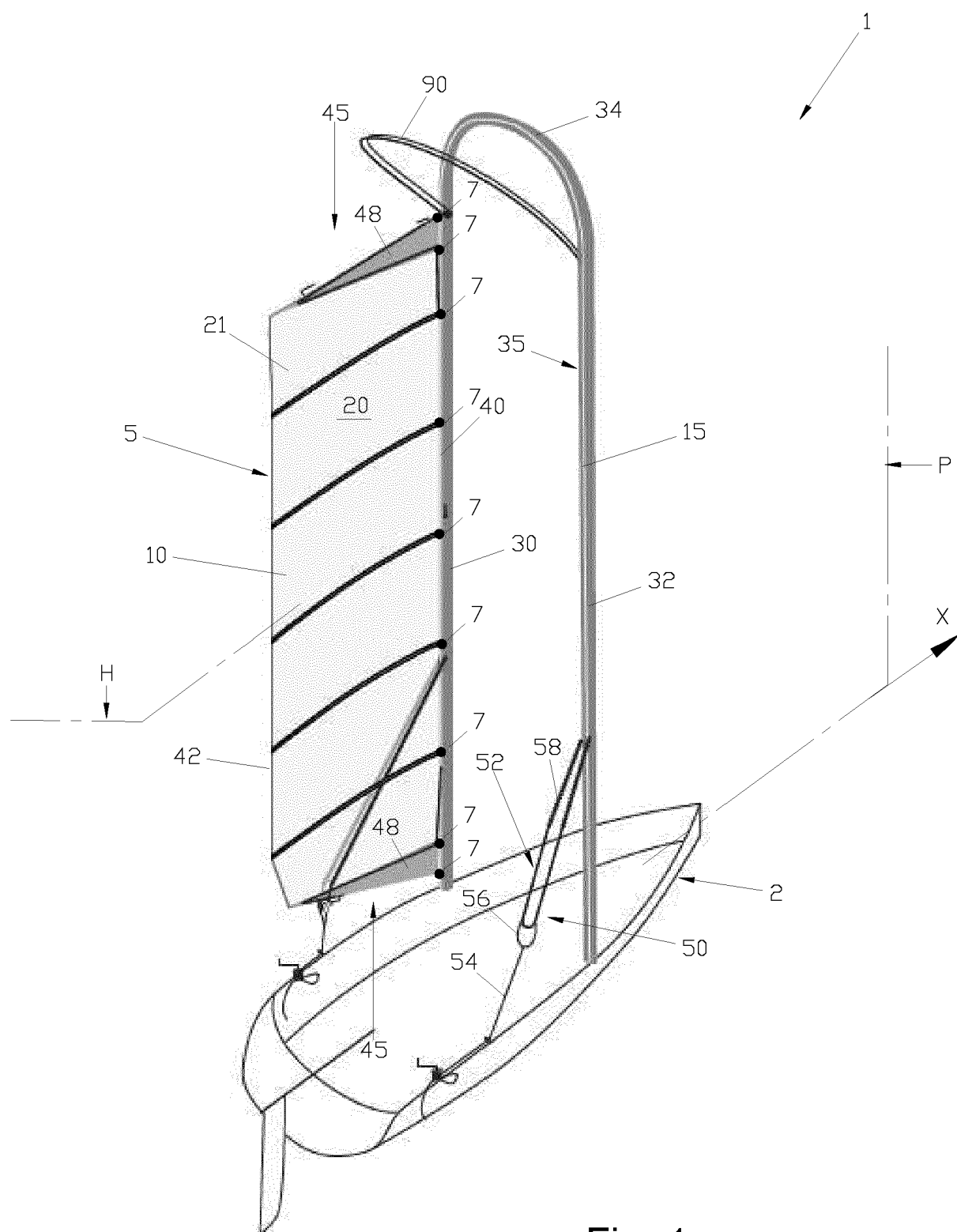


Fig. 1

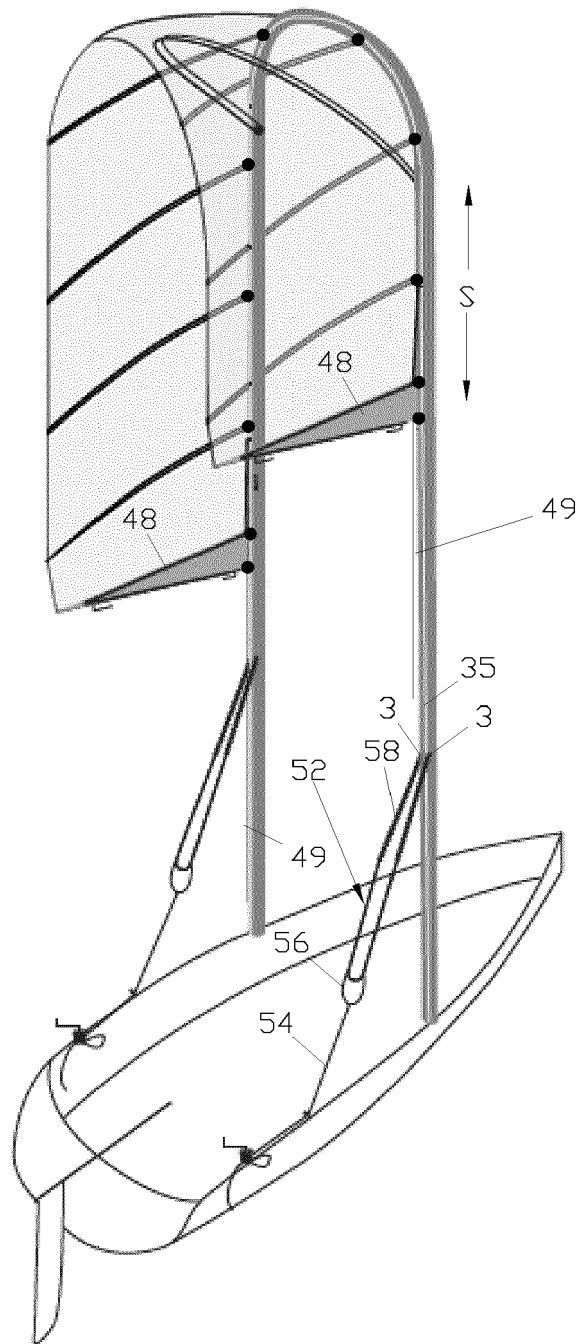


Fig. 2

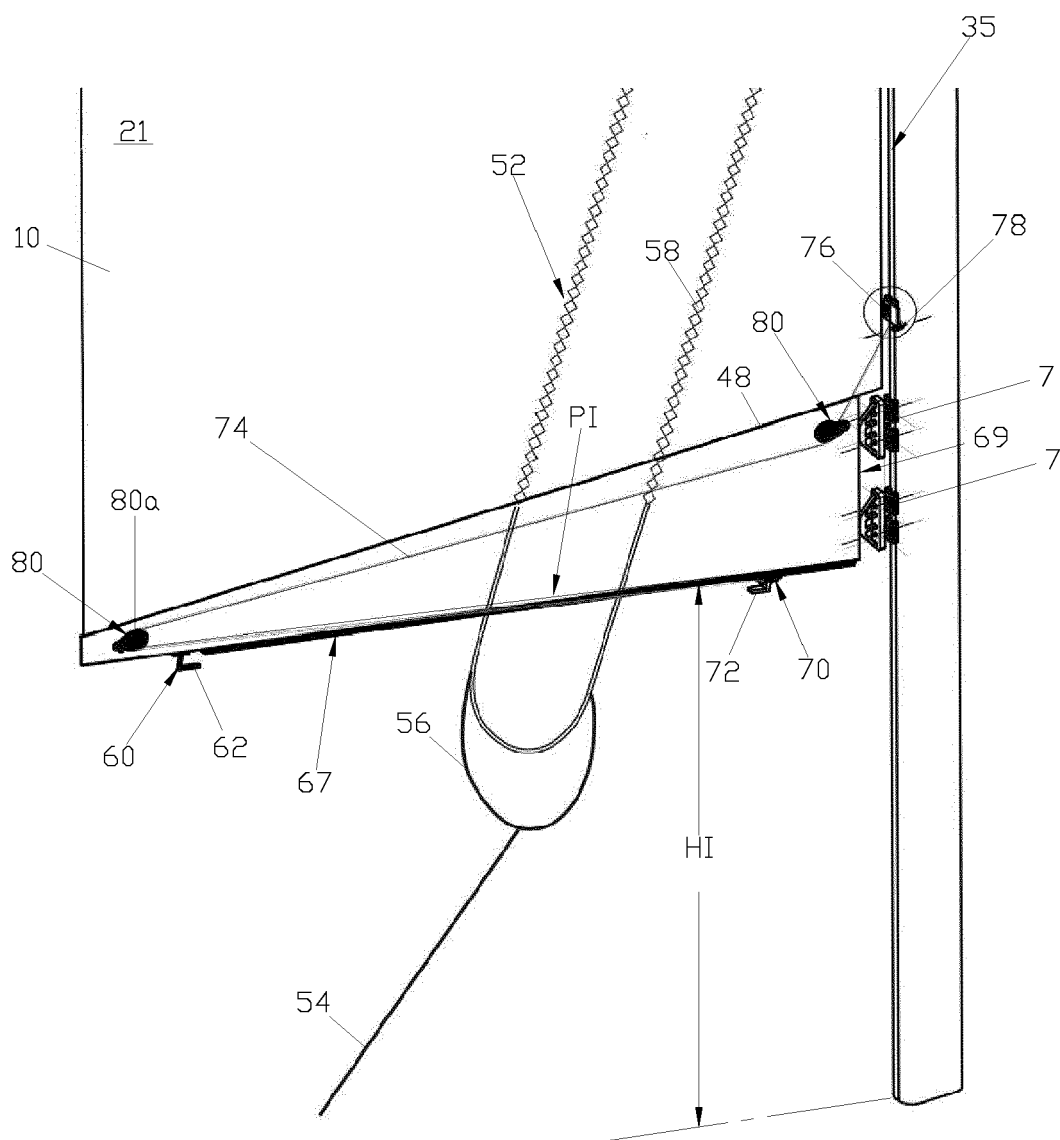


Fig. 3

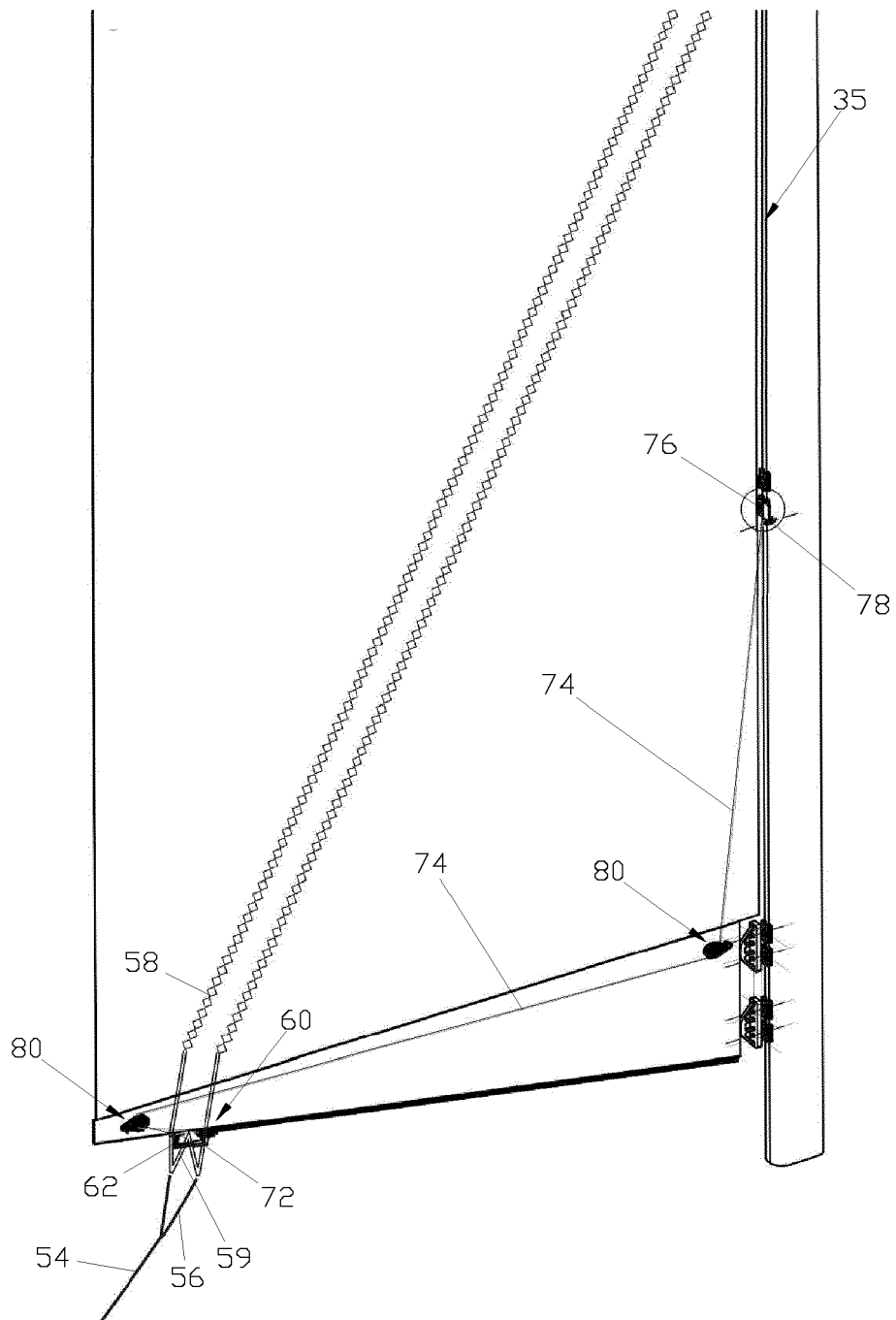


Fig. 4

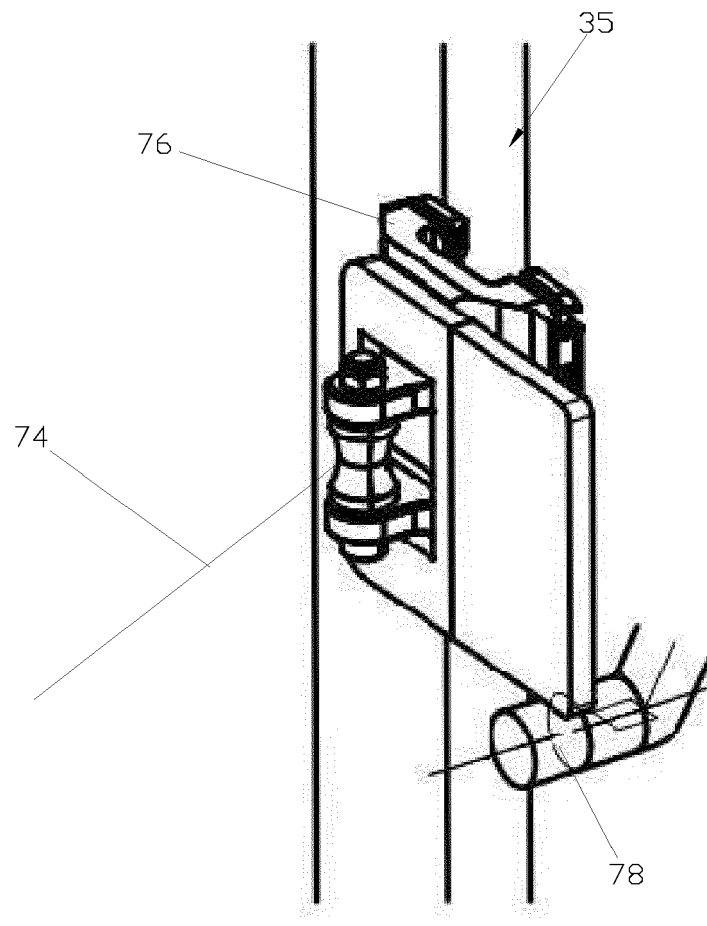


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 21 15 3831

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 24 June 2021	Examiner Schmitter, Thierry
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			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 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
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