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(54) **FENDER DEVICE FOR BOATS**

(57) A fender device is positioned inside a boat near its side (F) which has a passage opening towards the outside for a fender (2) in a deflated condition. The fender device includes a container (5) which contains a winch (4) and is connected to the side of the boat by means of a frame (10) that surrounds the passage opening of the fender (2). The fender (2) is able to unwind and wind itself on the winch (4) and is equipped with a pressure hose (3), connected to a compressed air generator. A door (1) collaborates with the frame (10) to close the fender passage opening (2) under the operation of an opening and closing mechanism that brings the door (1) closer to and away from the side (F) of the boat.

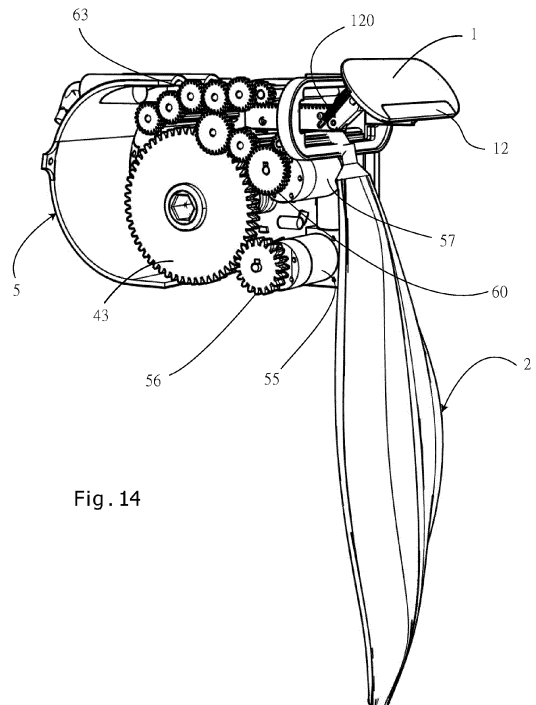


Fig. 14

Description

[0001] The present invention relates to a fender device for boats.

[0002] US 6161494 A describes a fender device comprising a body adapted to protrude from the side of a boat and to inflate. The inflatable body is located, at rest, in a housing inside the boat communicating with the outside with an opening closed by a hatch that can be opened on command. The above cited patent does not explain how the hatch can be made and how it can be opened on command in relation to the operation of the inflatable body.

[0003] French patent 2896227 discloses a hull protection device comprising an inflatable element, which is in the deflated state inside the hull, and in the inflated state outside the hull. The device includes maneuvering means for moving the inflatable element between an internal position and an external position. In its free end, the inflatable element has a cap which forms a closure of the side when the inflatable element is retracted inside the hull in a deflated position. The cap does not constitute an adequate closure of the side.

[0004] US 9038556 describes a concealable fender assembly comprising a fender and a cover having a shape compatible with the shape of the side of the hull of a boat in closed position. The assembly also has a mechanism for actuating the cover for closing and opening thereof with respect to the side of the hull. The cover is associated with the fender so that when the cover is in open position the fender outwardly extends from boat hull lateral surface. The fender is always swollen.

[0005] US 2010/0031862 A1 discloses an inflatable fender comprising an enclosure mounted on or in the boat hull and connectible to a fluid supply, an inflatable flexible member mounted within the enclosure and capable of extending therefrom when inflated by fluid supplied into the enclosure, and separate retraction means associated with the enclosure and operable to withdraw the inflatable into the enclosure when deflated. US 2010/0031862 A1 provides various embodiments, almost all external on the side of the boat; these involve a modification of the side of the boat to provide for the protruding housing of the flexible member. Other embodiments that have a housing inside the boat, provide means for withdrawing the flexible element into the housing and a closing cover hinged in the side that closes after the flexible element has returned into the housing.

[0006] The aforementioned documents, which provide for an automatic restoration of the continuity of the side when the fender is retracted, nevertheless present solutions that are difficult to implement. In any case, those solutions are not satisfactory either from a functional or an aesthetic point of view.

[0007] The present invention aims to overcome the drawbacks mentioned above.

[0008] The main purpose of the present invention is to provide a fender that can be deployed in working position

by actuating an opening of an exit port of the fender from the side of the boat and can be withdrawn to rest position by actuating a closure of the same exit port.

[0009] Another object is to provide an opening and a closing of the exit port automatically performed in conjunction with controlling the deployment and the withdrawal, respectively, of the fender by operation means.

[0010] These and other objects are achieved by a fender device for boats as defined in claim 1 and in dependent claims.

[0011] Further characteristics and advantages of the invention will be most apparent in the detailed description of the present fender device for boats, illustrated by way of indicative and non-limiting example in the accompanying drawings in which:

- Figures 1 to 6 are perspective views of a portion of the boat hull with a fender device according to the invention in successive deployment positions of a fender assembly outside the boat;
- Figure 7 is a complete schematic perspective view of the fender device in the previous figures with a door closed;
- Figure 8 is an exploded partial schematic perspective view of the fender device of Figure 7 with the door open and the fender assembly partially extracted;
- Figure 9 is a partial schematic perspective view of the fender device, the view being limited to parts of the container and to the door opening mechanism shown in Figure 8;
- Figure 10 is a schematic perspective view of the door opening mechanism shown in Figure 9;
- Figure 11 is a partially sectioned schematic perspective view, showing a drum of the fender device and the fully unwound fender assembly;
- Figure 12 is a partial exploded perspective view of the fender device of Figure 8 showing in particular means to facilitate the unwinding and winding of the fender assembly, but for simplicity without the fender assembly inside;
- Figure 13 is a partial schematic perspective view of the fender device showing the interior, in particular the means to facilitate the unwinding and winding of the fender assembly, with the fender assembly partially extracted; and
- Figure 14 is a partial schematic perspective view of the fender device showing the interior, with the fender assembly completely extracted. Reference is initially made to Figures 1 to 6 which are perspective views of a portion of a boat hull with a fender device according to the invention in successive deployment positions.

[0012] In particular, Figure 1 shows a door 1 on the side F of a boat. The door 1 is part of the fender device according to the present invention. In Figure 2, the door 1 is shown partially open. In Figure 3, a portion of the

fender assembly 2 protrudes from the side F through the open door 1. In Figure 4, the fender assembly 2 is completely extracted and hanging through a pressure hose 3 thereof acting as a rope for the fender. Figure 5 shows the fender assembly 2 partially inflated, while in Figure 6 the fender assembly 2 is completely inflated and the door 1 of the fender device according to the present invention is closed. These phases of extraction of the fender assembly 2 for its deployment on the boat side F are controlled by means of a control panel not shown, located in a control console of the boat and not further described. The control panel simultaneously manages several electro-pneumatic devices installed inside the boat, preferably in the vicinity of the sides of the same. The control panel controls opening and closing of the door 1 on the boat side F, unwinding and winding of the fender assembly 2 from and on its winch, and inflation and deflation of the fender assembly 2, as will be seen later. The fender device, generally indicated as 100, is shown in Figure 7 which is a complete schematic perspective view thereof with door 1 closed. The fender device 100 comprises a container, indicated generally as 5, having side walls 500 and 501. The container 5 is intended to be fixed on the internal side of the boat side F with the side walls 500 and 501 perpendicular to the same boat side F not shown in Figure 7.

[0013] Reference is made now to Figures 8 and 9 which are a partial schematic exploded perspective view of the fender device in Figure 7 with door open and fender assembly partially extracted and, respectively, a partial schematic perspective view of the fender device, the view being limited to parts of the container and to the opening mechanism of the door shown in Figure 8. The container 5 of the fender device has a port closed by the door 1, from which the fender assembly 2 protrudes and re-enters in its deflated condition.

[0014] A frame 10, fixed on the boat side F, surrounds that port. A gasket 11 is arranged between the periphery of the door 1 and the frame 10 for an adequate hermetic seal on the boat side F. The door 1 has in the lower part an area occupied by a sheath 12. The sheath 12 is elastically deformable to allow a hermetic seal also around the pressure hose 3 of the fender assembly 2, when the fender assembly is inflated and the door 1 is closed, as shown in Figure 6, so as to maintain the continuity of the boat side F. As shown in Figure 9, the door 1 has two articulated arms 13 hinged at the front to the sides of a plate 14, integral with the door 1, and at the rear to respective racks 15 sliding on sliding guides 50, provided as recesses perpendicular to the boat side F in the side walls 500, 501 of the container 5. Orthogonally to the side walls 500 and 501, the container 5 has a curved wall 502 on the opposite side to the boat side F joined to a front part 503 of the container 5. The container 5 has at the top a horizontal wall 504 in front continuation of curved wall 502. As also shown in Figure 10, which is a schematic perspective view of the door opening mechanism shown in Figure 9, the racks 15 are engaged with

respective pinions 16, integrally keyed to the end of a shaft 17. One of the two pinions 16 is engaged with a worm screw 18 of a transmission shaft 19. The other end of the transmission shaft 19 carries a first bevel wheel 190 in engagement with a second bevel wheel 191 integral with the shaft of a first motor 52, mounted inferiorly in the container 5.

[0015] Reference is made now to Figure 11, which is a partially sectioned schematic perspective view, showing a winch 4 of the fender device and the fully unwound fender assembly 2. The winch 4 comprises a winch drum 40 with a winch shaft 41. The fender assembly 2 is preferably composed of an external containment bag 20, of an air chamber 21, made of an extensible material and contained in the external containment bag 20, of the aforementioned pressure hose 3 and of a compressed air fitting 22 made integral with the winch shaft 41.

[0016] Reference is made now also to Figure 12 which is a partial exploded perspective view of the fender device of Figure 8 showing in particular means to facilitate the unwinding and winding of the fender, but for simplicity without the fender assembly inside. The shaft 41 is mounted at its ends on the walls 500, 501 of the container 5 and supports discs 42 of the winch drum 40. One of the discs 42 peripherally has a toothed crown 43. As shown in Figure 11, on the facing sides of the discs 42 a plurality of protrusions 44 tapering towards the periphery is provided. The protrusions 44 are arranged circumferentially to ensure adequate retention of the fender assembly 2 when wrapped around the drum 40 of the winch 4.

[0017] A pneumatic system, which can serve one or more fender devices, is powered by a compressed air generator (not shown), which can be installed in the engine compartment of the boat.

[0018] The winch drum 40 is driven by a second motor 55 having a drive shaft on which a first toothed wheel 56 is keyed. The toothed wheel 56 is in engagement with the toothed crown 43 of the winch drum 40.

[0019] Reference is made now to Figures 12, 13 and 14 which are partial perspective views showing means to facilitate the unwinding and winding of the fender assembly. In particular, in Figure 12 the fender assembly is not shown for simplicity, in Figure 13 the fender assembly is shown schematically inside the container and in Figure 14 the fender assembly is shown completely outside the container beyond the door 1.

[0020] The means adapted to facilitate the unwinding and winding of the fender assembly 2 are provided in the upper part of the winch drum 40. Said means comprises a plurality of upper rollers 58 and a plurality of lower rollers 59 supported on said side walls 500, 501 of the container 5. A third motor 57 has on its shaft a wheel 60 and a plurality of gears 63 conjugated in series. The plurality of upper rollers 58 and the plurality of lower rollers 59 serve to help the unwinding and winding of the fender assembly 2 in the deflated condition, as shown in Figure 13.

[0021] The operation of the fender device according to the present invention is now described.

[0022] The first motor 52 by means of the bevel gear formed by the first bevel gear 190 integral with the transmission shaft 19 and by the second bevel wheel 191 integral with the shaft of the first motor 52, drives the transmission shaft 19, the worm screw 18, the pinions 16 and the racks 15, allowing the opening and closing of the door 1.

[0023] A limit switch of the opening and closing of the door 1 can be set by means of inductive sensors thanks to ferromagnetic contacts provided on the racks 15 on their side opposite to the door 1. Optionally, at least one helical return spring 120 (Figure 14) operating under traction is connected, in an offset position with respect to the articulated arm 13 of the door 1, on one side to the rack 15 and on the other side to the plate 14 of the door 1. In this way, when the racks 15 are moved by the electric gearmotor 52, the door 1 is able to lean in such a way as to facilitate the exit of the fender assembly 2.

[0024] The control of the clockwise and counterclockwise rotary motion of the winch drum 40 is made by the second motor 55 (Figure 12) on whose shaft the first toothed wheel 56 is keyed, which engages with the toothed crown 43 of one of the discs 42 of the winch 4. The third motor 57 overhangs the second motor 55 to drive the plurality of upper rollers 58 and the plurality of lower rollers 59, by means of the toothed wheel 60 through the plurality of gears 63 conjugated in series. The upper 58 and lower 59 rollers are preferably rubberized and grooved to help the extraction and rewinding of the fender assembly 2 in a deflated condition. The first motor 52, the second motor 55 and the third motor 57, all equipped with a reduction gear, are electric motors located in an airtight compartment of the container 5. In general, a speed of rotation different from that of the drum 40 determined by the second motor 55 can be selected for the rotation of the upper rollers 58 and lower rollers 59 so that the upper rollers 58 and lower rollers 59 engage with the fender assembly 2 in order to allow uniform advance and regression.

[0025] The operation of the second motor 55 is limited by limit switches, preferably inductive, which can be positioned in the vicinity of the winch shaft 41.

[0026] In operation, with reference to Figures 1 to 6, the door 1 of the passage opening of the fender assembly 2 is first shown closed. Then (Figure 2), the door 1 begins to open being operated by the control panel of the console thanks to the motor 52 which, by means of the transmission shaft 19, with the bevel gear formed by the first bevel wheel 190 and the second bevel wheel 191 and the endless wheel 18, drives the racks 15 sliding on the side walls 500, 501 of the container 5 of the fender device.

[0027] As shown in Figures 3, 8 and 13, the fender assembly 2 begins to come out thanks to rotation of the winch drum 40. In Figure 4, the fender assembly 2 is completely extracted in the deflated condition, thanks to the drive of the motor 55 of the winch 4 and to the motor

57 which moves the plurality of upper rollers 58 and lower rollers 59, and hangs from the boat side F with its pressure hose 3. Figure 5 shows the fender assembly 2 inflated by the compressed air generator and Figure 6 shows the fender assembly 2 in working position with the door 1 completely closed. The pressure hose 3 can be unwound from the drum to the extent necessary to position the fender assembly at the required height. This is achieved without requiring the presence of a person near the deployment point of the fender; with a big gain from the point of view of safety, especially in unfavorable marine conditions, at the time of both the deployment and the withdrawal of the fender. The positioning of the fender could be aided by sensor systems and micro cameras visible from the control console.

[0028] The sheath 12 on the door 1, adapting to the pressure hose 3 coming out of the exit port, maintains the hermetic seal of the same port. When the fender assembly 2 has to be withdrawn inside the hull, it is deflated and rewound on the drum 40 of the winch 4 by the motors 55 and 57 which work in the direction opposite to that of the deployment, until the stop determined by the inductive sensors.

[0029] With reference to the materials, the fender device according to the present invention, also to reduce its weight, is made in its components, such as gear wheels, bearings, bushings, wheels and worm screws, bevel gears and racks, in Teflon (PTFE), an anticorrosive material with excellent mechanical performance.

[0030] The rubberized rollers are made with the injection moulding process of ABS or other suitable thermoplastic polymer and coated with polyurethane rubber to increase the grip.

[0031] The container 5, the sealed compartment of the engines and the winch 4 can also be made with thermoplastic polymers for injection moulding. A prototype was made with the following maximum measurements: width 14 cm, height 17 cm, depth 17 cm. It should be understood that the container 5 has very small dimensions and takes up minimal space inside the boat. The door could be even smaller than the container 5, for example 15 cm wide and 5 cm high. Thanks also to its small size and its compact and per se complete structure, the fender device can be applied easily and quickly on newly built boats or, with minor modifications, even on already built boats.

[0032] The fender device according to the present invention provides the advantage to a person of being able to deploy a desired number of fenders on the boat side as needed with simple commands from the control panel of the boat and subsequently to withdraw the fenders always with remote control, without leaving the control panel. Thanks to the invention, the boat sides maintain their traditional appearance that is substantially unchanged both with fenders deployed from the boat sides and with fenders withdrawn inside the boat.

Claims

1. A fender device for boats, comprising:

- a container (5) positioned inside a boat and communicating with the outside through a passage opening in a boat side (F) closed by a door (1),
- a winch (4) inside the container (5), comprising a winch drum (40) and a winch shaft (41) containing inside a compressed air fitting (22),
- a compressed air generator connected to said compressed air fitting (22),
- a fender assembly (2) suitable to be wound on the winch drum (40) and comprising an air chamber (21) made of extensible material in order to be inflated and deflated, an external containment bag (20) for the air chamber (21) and a pressure hose (3) having a first end fastened to the air chamber (21) and a second end fastened to the compressed air fitting (22) so that the air chamber (21) is inflated by said compressed air generator, the fender assembly (2) in deflated condition being adapted to be wound on the drum (40) when the winch (4) turns in a direction and to be unwound from the drum (40) when the winch (4) turns in the opposite direction, for passing through said opening passage in the boat side (F),
- characterized in that**
- the door (1), suitable to open and close said passage opening, is joined laterally to a pair of racks (15), the door (1) being provided inferiorly with a sealing sheath (12),
- the container (5) is connected to the boat side (F) by a frame (10) surrounding said opening passage in the boat side (F) and is provided with side walls (500, 501) including sliding guides (50), perpendicular to the frame (10) for the sliding of said racks (15), a gasket (11) being interposed between the door (1) and the frame (10),
- a door opening and closing mechanism includes a first motor (52) that drives said racks (15) in such a way as to open and close the door (1),
- the winch (4) is driven by a second motor (55) for unwinding the fender assembly (2) from the winch drum (40) and winding up it on the winch drum (40), and
- means adapted to facilitate the unwinding and winding of the fender assembly (2) comprise a plurality of upper rollers (58) and a plurality of lower rollers (59) both rubberized and grooved, supported on said side walls (500, 501) of the container (5), and a third motor (57) is capable of driving through a wheel (60) and a plurality of gears (63) conjugated in series, said plurality of upper rollers (58) and said plurality of lower rollers (59) to make easy the unwinding and winding of the fender assembly (2) in a deflated condition on the winch drum (40),

the door opening and closing mechanism, the winch (4) for unwinding the fender assembly (2) from the winch drum (40) and winding up it on the winch drum (40), and means adapted to facilitate the unwinding and winding of the fender assembly (2) being adjusted for deploying the fender assembly (2) on the boat side (F) and for withdrawing it from the boat side (F).

2. The fender device according to claim 1, wherein the door opening and closing mechanism comprises

- a kinematic chain including:

the pair of racks (15) suitable to slide on the sliding means (50) of the container (5) and being joined to the door (1),
a pair of pinions (16) joined to each other by a shaft (17) and in engagement with the pair of racks (15),
a drive shaft (19) having, at a first end, a screw wheel (18) in engagement with a pinion of the pair of pinions (16) and, at a second end, a first bevel wheel (190), and

- the first motor (52) having a shaft with a second bevel wheel (191) engaging said first bevel wheel (190) and suitable to operate said kinematic chain, to open and close the passage opening in the boat side (F).

3. The fender device according to claim 2, wherein the racks (15) are joined to the door (1) by means of respective articulated arms (13).

4. The fender device according to claim 3, wherein at least one helical return spring (120) is connected, in an offset position with respect to an articulated arm (13), on one end to a rack (15) and on the other end to the door (1).

5. The fender device according to claim 1, wherein

- the winch drum (40) has a pair of end discs (42),
- a disc of the pair of end discs (42) peripherally carries a toothed wheel (43), and
- said second motor (55) has a shaft on which a first toothed wheel (56) is keyed in engagement with the toothed wheel (43) of the winch (4).

6. The fender device according to claim 5, wherein the end discs (42) have facing sides in which a plurality of projections (44) arranged circumferentially and tapered towards the periphery of the disc are provided, to ensure the retention of the fender assembly (2)

when wound around the winch drum (40).

7. The fender device according to claim 1, wherein a plurality of limit switches made with inductive sensors and ferromagnetic elements is provided for controlling the rotation of the winch drum (40) and the door opening and closing mechanism.

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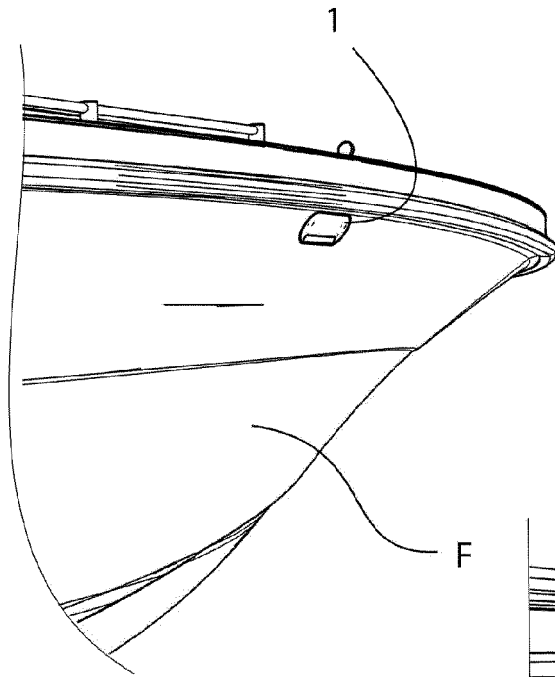


Fig. 1

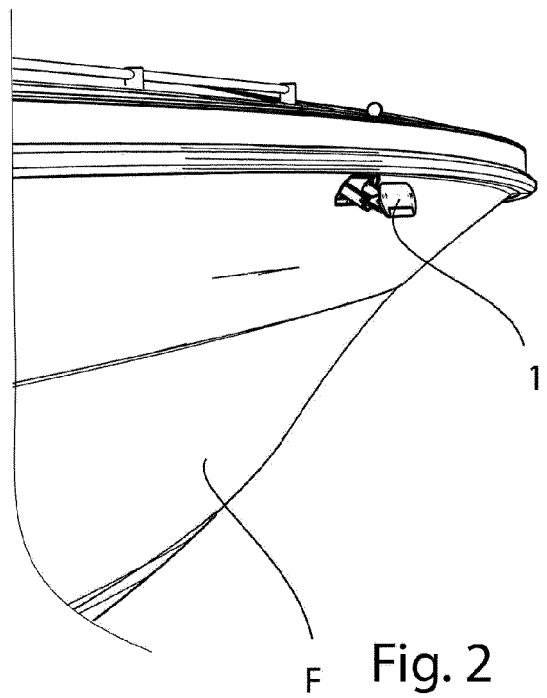


Fig. 2

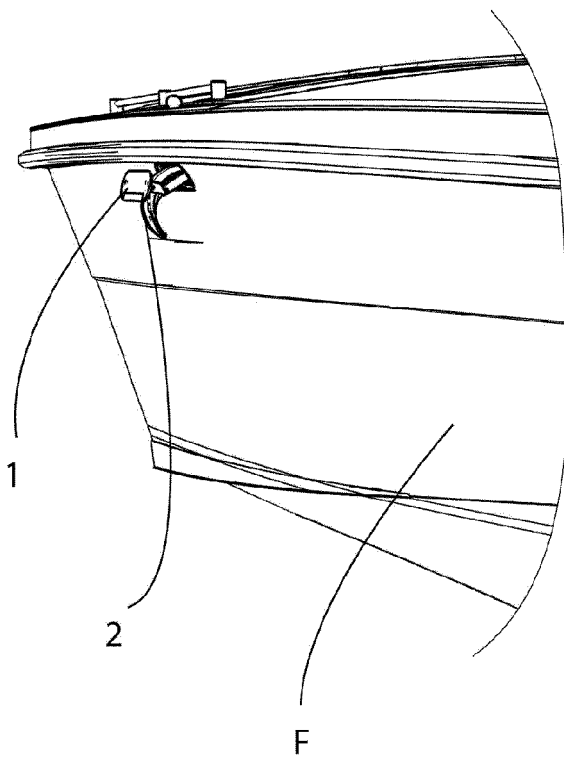


Fig. 3

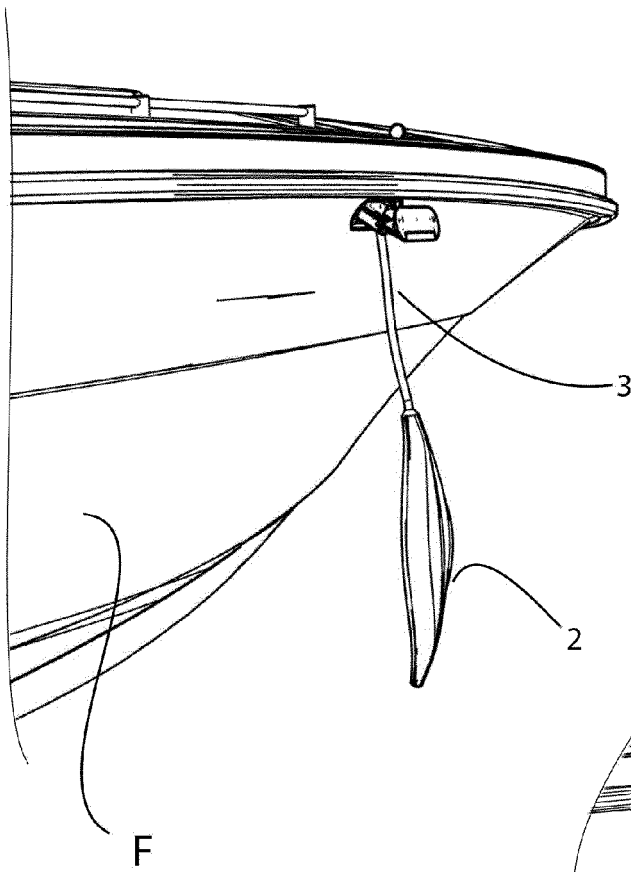


Fig. 4

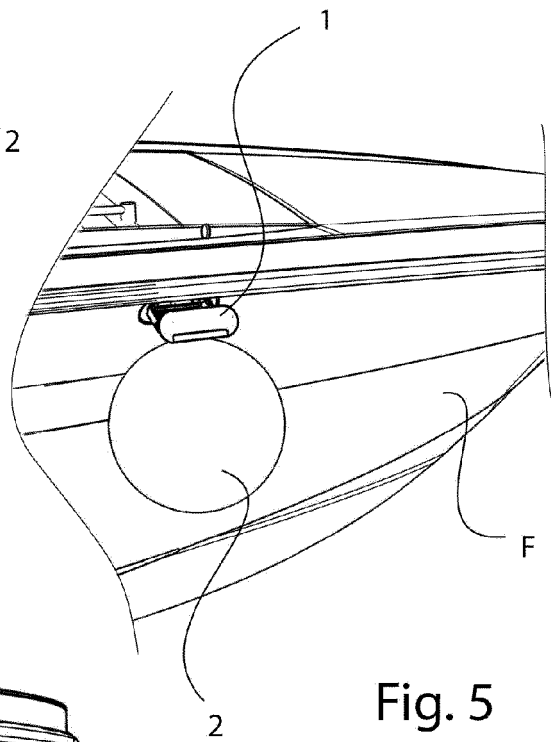


Fig. 5

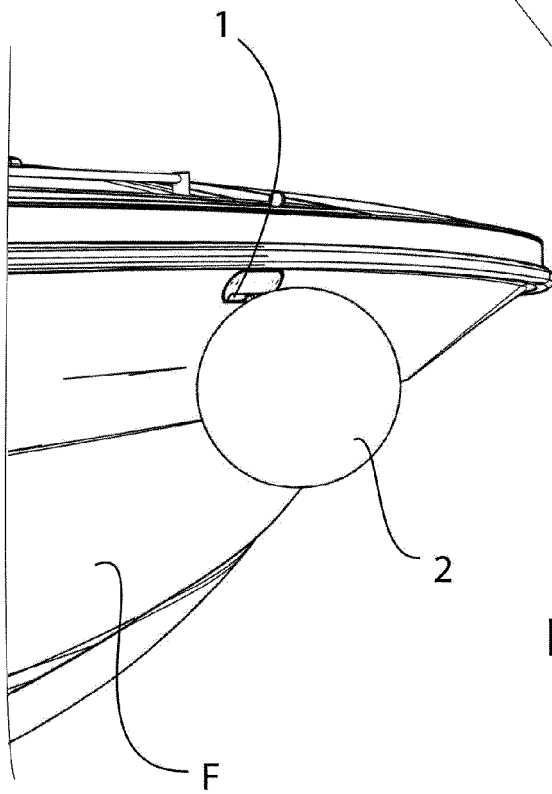


Fig. 6

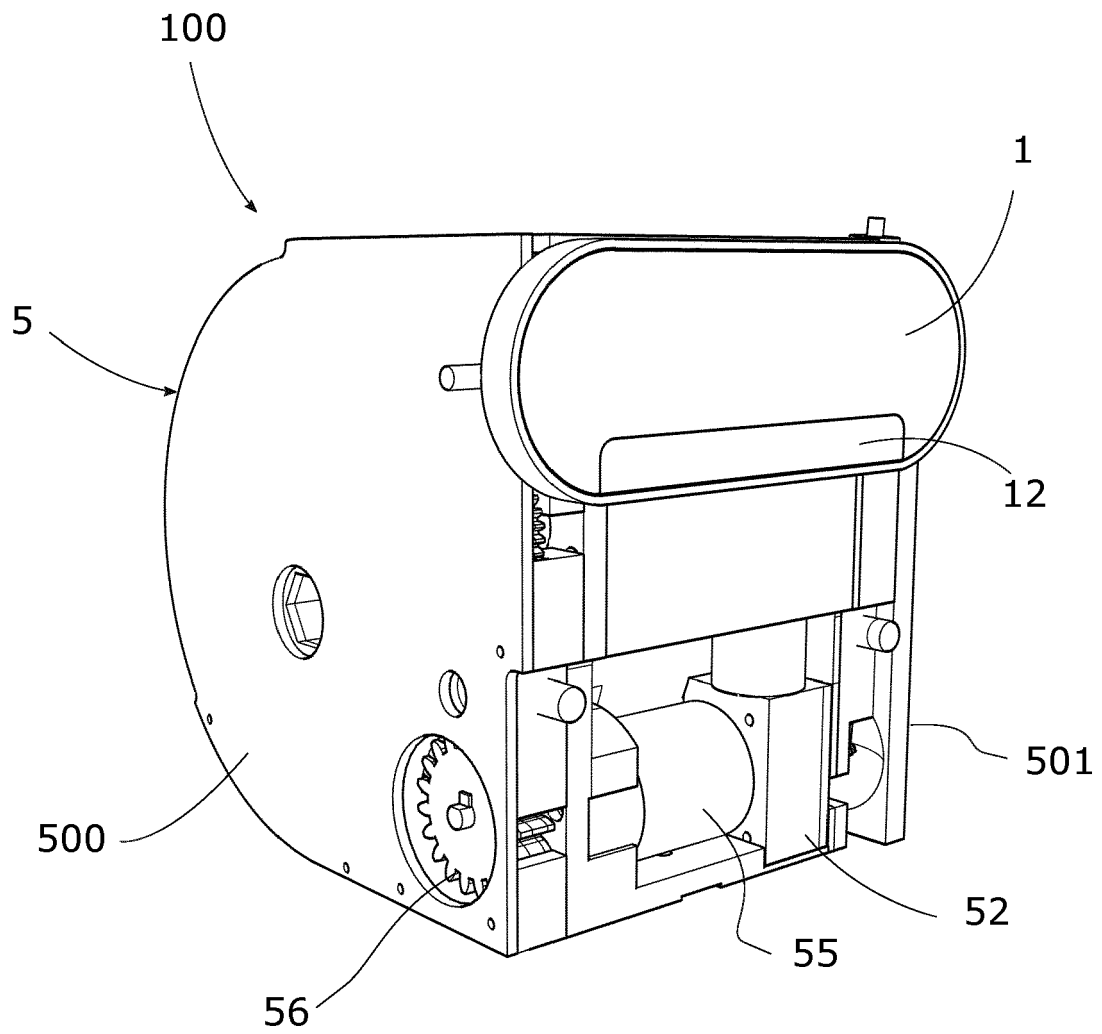


Fig. 7

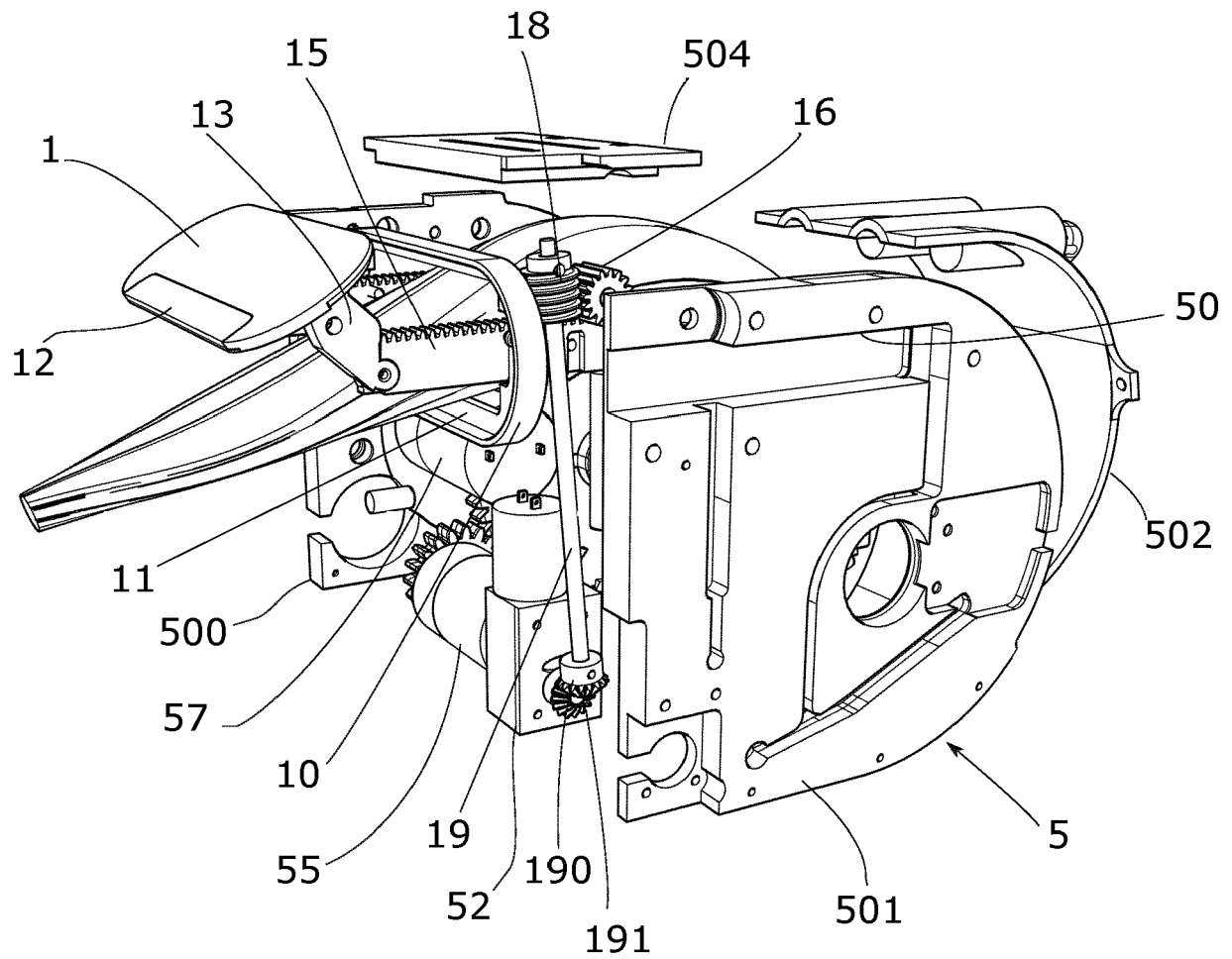


Fig. 8

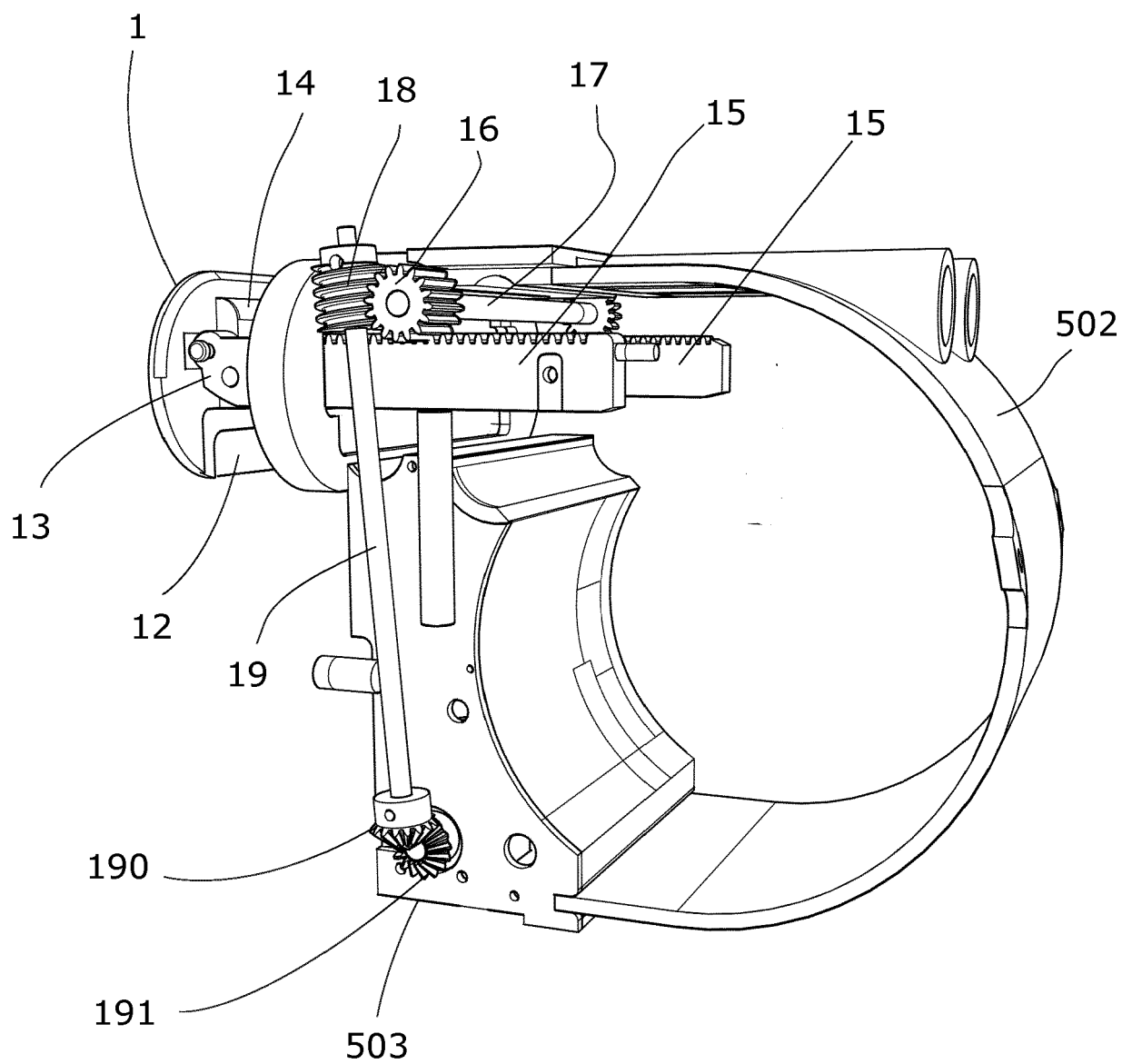


Fig. 9

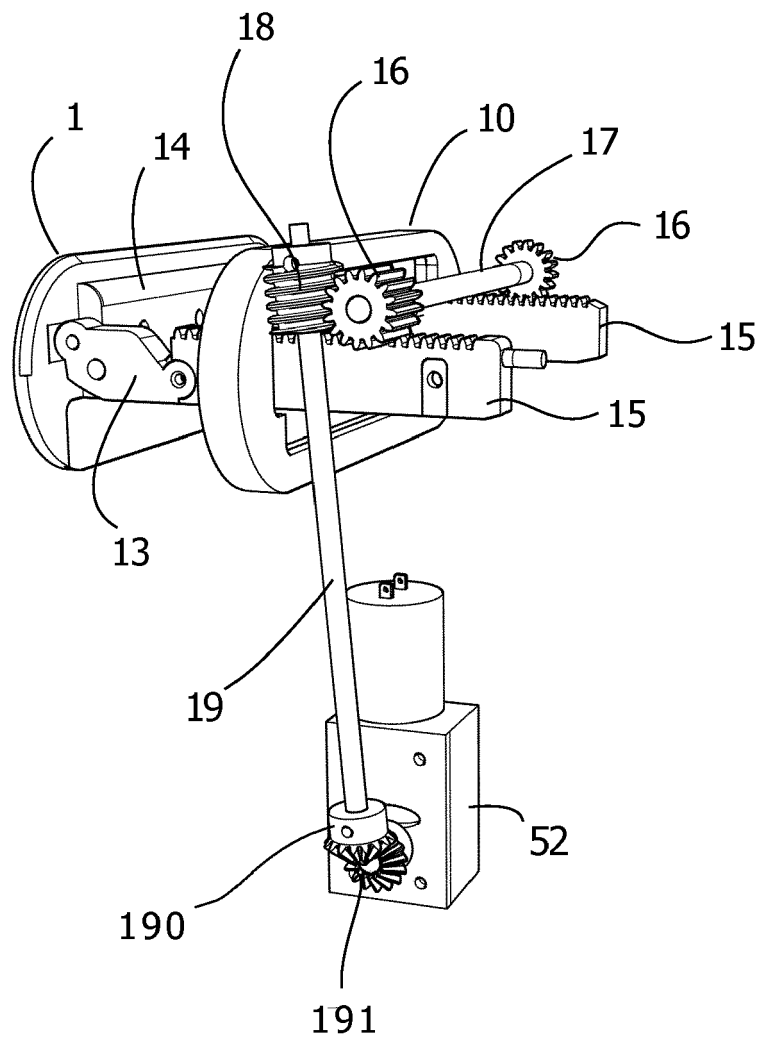


Fig. 10

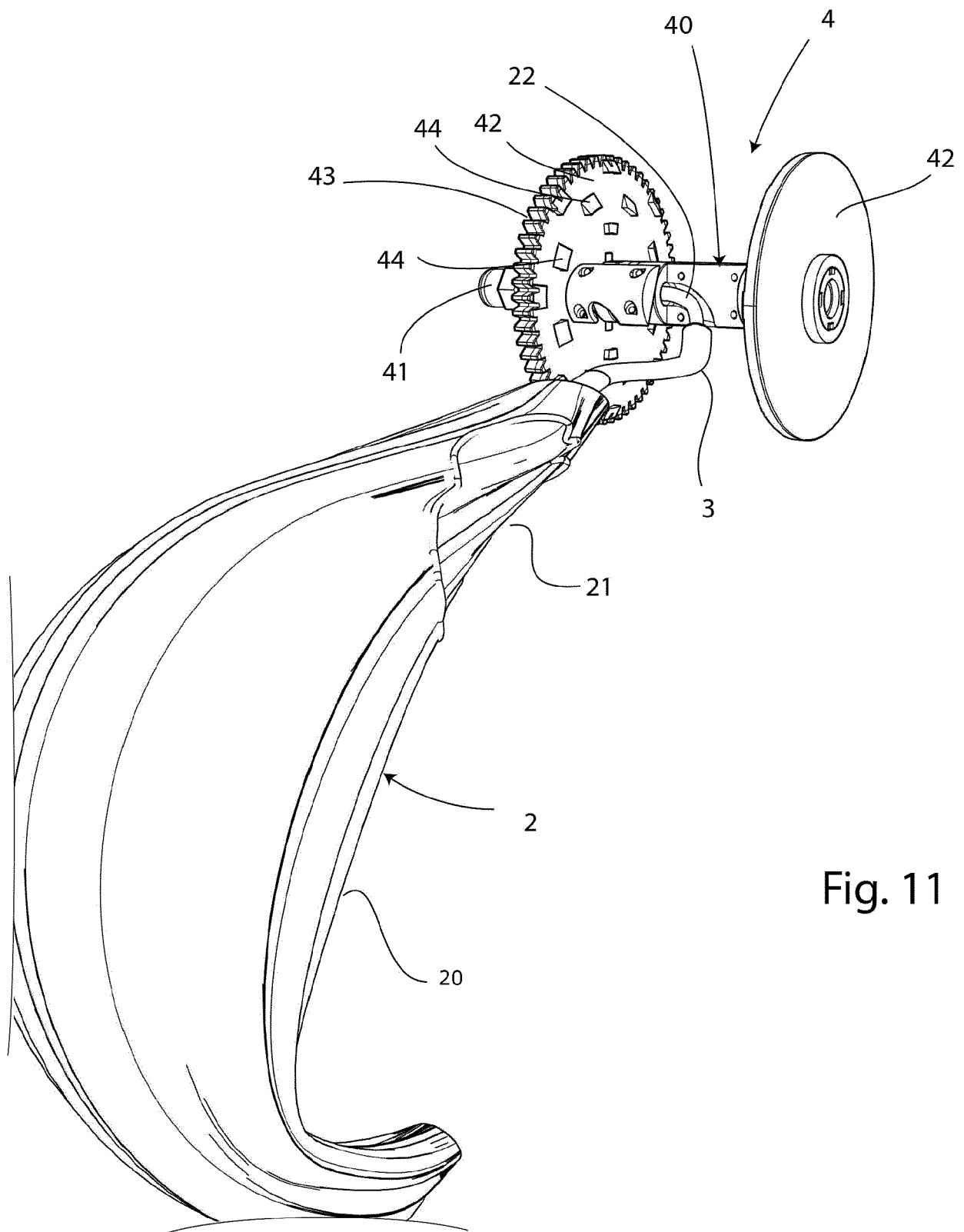


Fig. 11

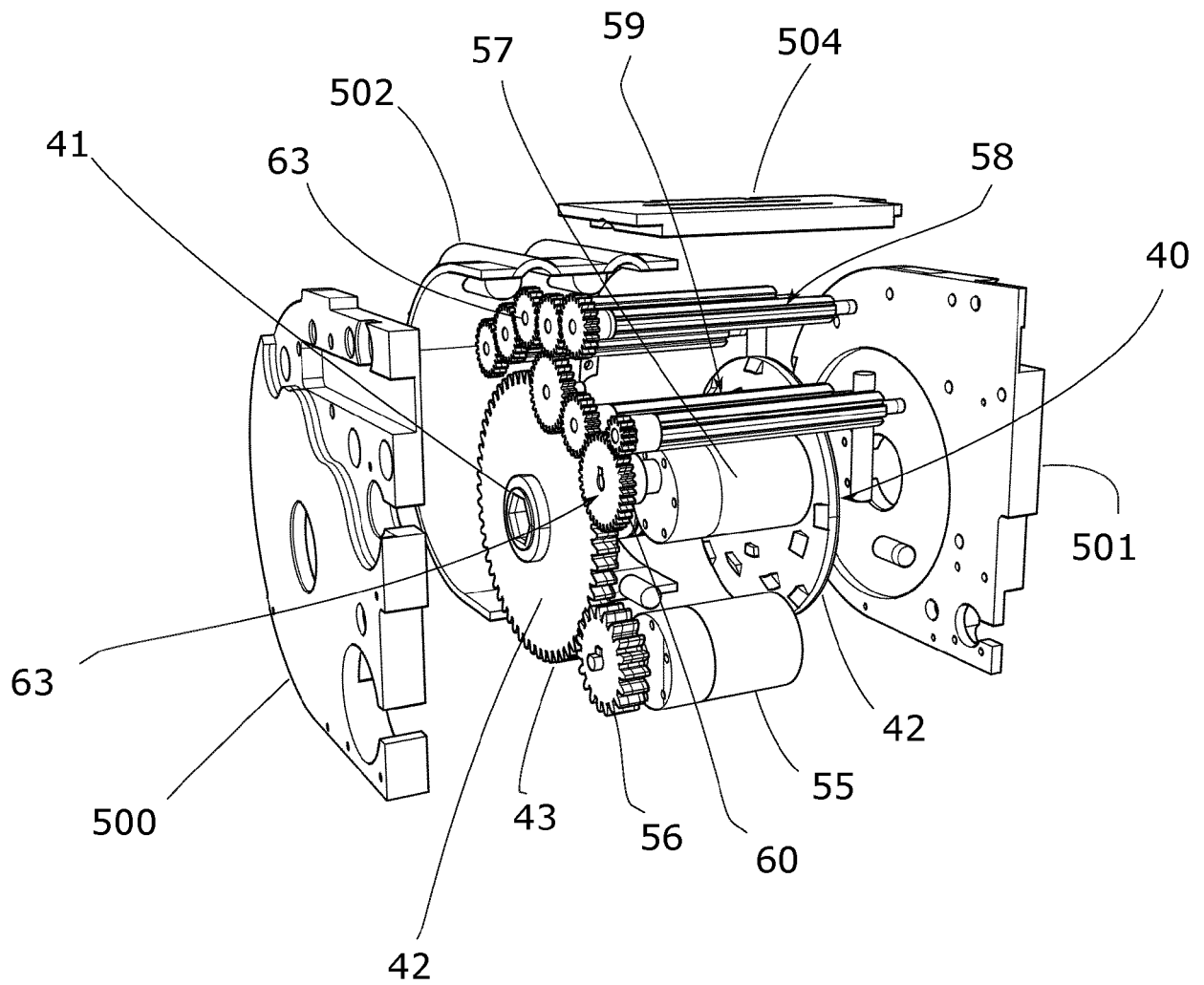


Fig. 12

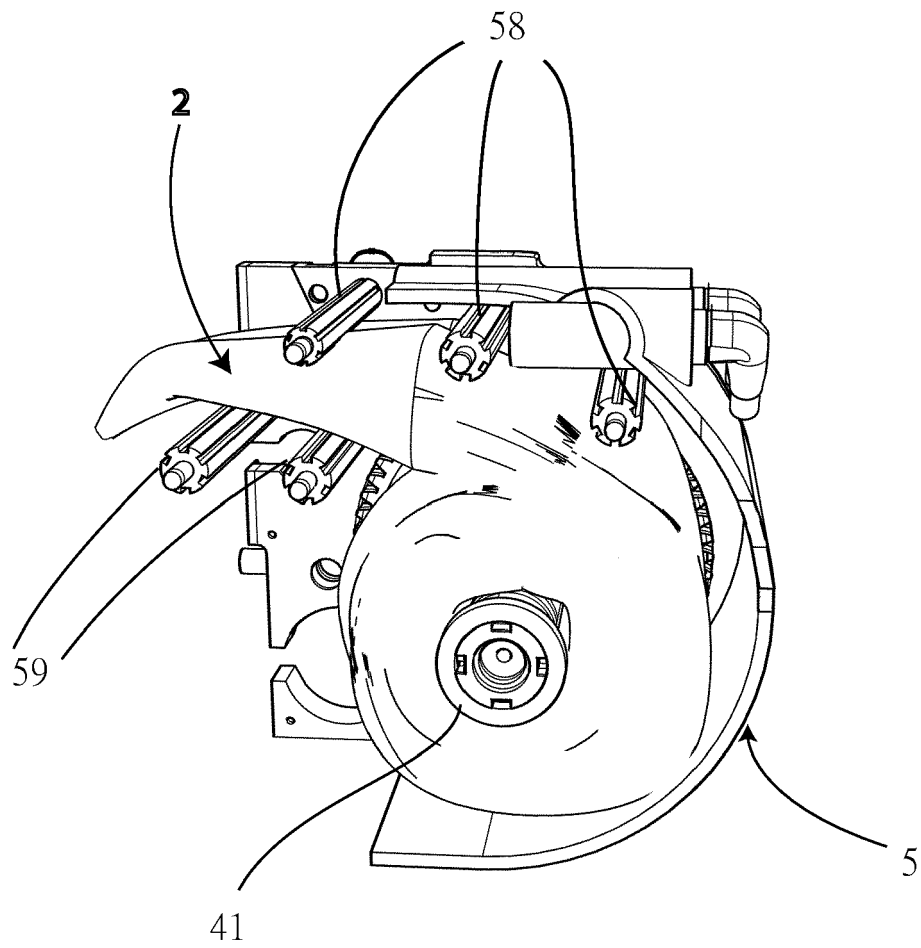


Fig. 13

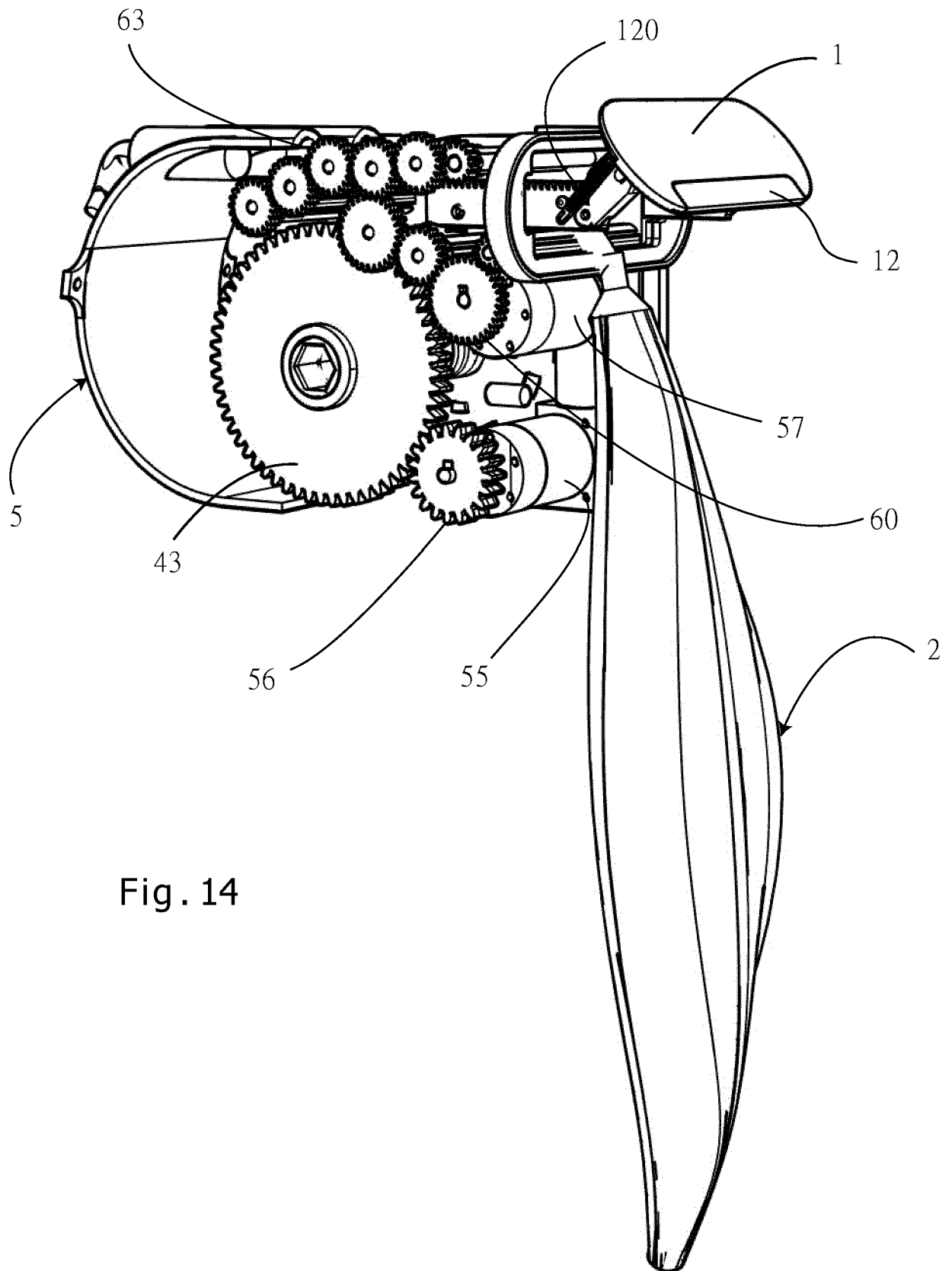


Fig. 14



EUROPEAN SEARCH REPORT

Application Number

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EPO FORM 1503 03.82 (P04C01)

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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 1 March 2022	Examiner Gardel, Antony
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	

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

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