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(54) **BOAT PROPELLER**

(57) A boat propeller (10) includes a gear box (20), an impeller (30), a stream-guiding ring (50), and a stream-shaping nozzle (60). The gear box (20) has a casing (21) and a transmission shaft (27) partially received in the casing (21). The impeller (30) has an impeller shaft (31) and vanes (38). The impeller shaft (31) has a hollow columnar outer shaft housing (32) and a hollow columnar inner shaft housing (33). The inner and outer shaft housings (32) are connected using a plurality of rib portions (37). The inner shaft housing (33) is further connected to the transmission shaft (27) of the gear box (20). The vanes (38) are integrated formed on an outer peripheral surface of the outer shaft. The stream-guiding ring (50) is assembled to the casing (21) of the gear box (20) to house the impeller (30). The stream-shaping nozzle (60) is connected to a rear end of the stream-guiding ring (50) for providing stream-shaping effects. Thereby, the boat propeller (10) has its water inlet diameter maximized, which helps to improve propulsive efficiency.

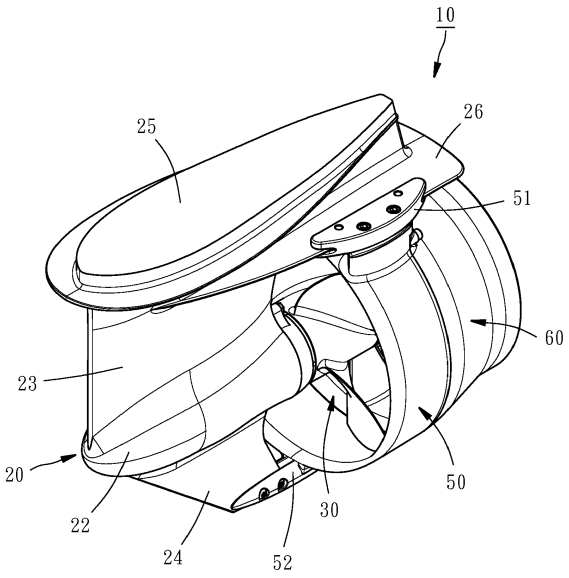

FIG. 1

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to boat propellers, and more particularly to a boat propeller that helps to improve propulsive efficiency.

2. Description of the Related Art

[0002] The existing boat propellers structurally have an outer shaft housing, an inner shaft housing, and a plurality of blades. The inner shaft housing is received in the outer shaft and is connected to the inner peripheral surface of the outer shaft through a plurality of rib portions. Each of the blades is integratedly connected to the outer peripheral surface of the outer shaft. When the propeller is driven by an engine to operate at high speed, the blades push water streams backward and the counter force generated thereby can work for propulsion of the boat.

[0003] To further enhance propulsion, a known approach is to such design the outer shaft housing that it has a changing cross-sectional area, which becomes smaller as the outer shaft housing extends backward. This helps to accelerate water streams flowing therethrough, and to in turn increase the counter force acting on the boat. However, in practical use, since the outer shaft housing is tapered in shape and the space around the propeller tends to be restricted due to boat design and other factors, the blades are consequently limited in terms of dimensional parameter (such as the rake, the pitch and more). This hinders the blades from effectively compressing water streams, leading to compromised propulsive efficiency.

SUMMARY OF THE INVENTION

[0004] The primary objective of the present invention is to provide a boat propeller that has improved propulsive efficiency.

[0005] To achieve the foregoing objective, the disclosed propeller comprises a gear box, an impeller, a stream-guiding ring, and a stream-shaping nozzle. The gear box includes a casing and a transmission shaft. The transmission shaft is rotatably installed in the casing, and the transmission shaft has its front end received in the casing so that its rear end juts out the casing. The impeller has an impeller shaft that includes an outer shaft housing and a hollow inner shaft housing, both being hollow columnar. The inner shaft housing is received in the outer shaft housing and is connected to the outer shaft housing through a plurality of rib portions, while being coaxially connected to the transmission shaft of the gear box, so that the impeller is driven by the transmission shaft of the gear box to rotate. In addition, the impeller further has a plurality of vanes that are integratedly formed on the outer peripheral surface of the outer shaft. The stream-guiding ring is assembled to the casing of the gear box and houses the impeller, so that the impeller rotating draws water streams into the stream-guiding ring. The stream-shaping nozzle is connected to the rear end of the stream-guiding ring, for shaping the water stream drawn into the stream-guiding ring.

[0006] With the foregoing configuration, the disclosed propeller has its water inlet diameter maximized, thereby improving propulsive efficiency. In addition, with the protection provided by the stream-guiding ring, the impeller is unlikely to harm fishes, swimmers or divers around the bottom of the boat. This allows a boat having a shallow draft safe to be used. Even if the impeller is not fully immersed in water, propulsion can still be provided desirably.

[0007] Preferably, the stream-shaping nozzle has a ring portion, a hollow axial portion, and a plurality of stream-shaping portions. The ring portion is connected to the rear end of the stream-guiding ring. The hollow axial portion is defined in the ring portion and coaxially connected to the outer shaft housing of the impeller shaft of the impeller. The stream-shaping portions are connected between the ring portion and the hollow axial portion and arranged equidistantly to circle the hollow axial portion. The stream-shaping nozzle uses the stream-shaping portions to shape the water stream excited by the impeller into linear ejections, thereby facilitating boat propulsion.

[0008] Preferably, the casing of the gear box has a tapered shaft. The tapered shaft and the impeller shaft of the impeller do not contact each other. Instead, an exhaust channel is left therebetween. Thereby, when the boat moves backward, the exhaust gas generated by the engine can escape through the exhaust channel and will not interfere with water streams to cause turbulence.

[0009] Preferably, the inner shaft housing of the impeller is indirectly connected to the transmission shaft of the gear box through a bushing. The bushing has a shock-absorbing layer and a metal layer wrapping the shock-absorbing layer. In the event that a foreign object comes to the impeller during operation, the shock-absorbing layer serves to absorb impact and prevent the metal layer from burst while protecting the transmission shaft from damage.

[0010] The detailed structure, features, assembly and/or use of the boat propeller of the present invention will be explained in detail referred to the following Detailed Description. However, one skilled in the art shall understand that the detailed description and the specific embodiments in which the invention can be practiced are only illustrative and in no way form limitations to the scope of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a perspective view of a boat propeller of the present invention.

FIG. 2 is an exploded view of the boat propeller of the present invention.

FIG. 3 is a point view of an impeller in the boat propeller of the present invention.

FIG. 4 is a side view of the boat propeller of the present invention.

FIG. 5 is a rear view of the boat propeller of the present invention.

FIG. 6 is a partial cross-sectional view of the boat propeller of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0012] It is to be stated at first that in the disclosure, including the embodiments to be described below and the appended claims, all the directional terms are based on the orientations of them in the drawings. Besides, in the embodiments to be described below and the accompanying drawings, like numerals may refer to identical or similar components or structural features.

[0013] Referring to FIG. 1 and FIG. 2, according to the present invention, a boat propeller **10** comprises a gear box **20,** an impeller **30,** a stream-guiding ring **50,** and a stream-shaping nozzle **60.**

[0014] The gear box **20** is provided with a casing **21.** The casing **21** has a tapered shaft **22,** an upper wing **23,** a lower wing **24,** a connecting portion **25** and an anti-swirl baffle **26.** The tapered shaft **22** has a changing cross-sectional area that becomes larger as it extends backward. The upper wing **23** and the lower wing **24** are integratedly connected to top and bottom sides of the tapered shaft **22,** respectively. The connecting portion **25** is integratedly connected to the top of the upper wing **23** and is configured to engage with an engine housing, which is known in the art and not shown herein. The anti-swirl baffle **26** integratedly is connected between the upper wing **23** and the connecting portion **25.** In addition to a gear reduction unit that is known in the art and not shown herein, the gear box **20** further has a transmission shaft **27.** The gear reduction unit is installed in the casing **21,** and is configured to connect a driving shaft of an engine, both known in the art and not shown herein. The transmission shaft **27** has its front end received in the tapered shaft **22** of the casing **21** and connected to the gear reduction unit. The transmission shaft **27** has its rear end jutting out the casing **21** provided with a toothed portion **28.** With the foregoing configuration, the power generated by the engine is transmitted to the gear reduction unit through the driving shaft and then delivered to the transmission shaft **27** after deceleration caused by the gear reduction unit, thereby rotating the transmission shaft **27.**

[0015] The impeller **30** has an impeller shaft **31** and four vanes **38.** As shown in FIG. 3, the impeller shaft **31** has a hollow columnar outer shaft housing **32** and a hollow columnar inner shaft housing **33.** The inner shaft housing **33** is coaxially received in the outer shaft housing **32** and is connected to the outer shaft housing **32** through four rib portions **37.** The vanes **38** are integratedly connected to the outer peripheral surface of the outer shaft housing **32.** Additionally, the outer shaft housing **32** has an engaging flange **34** integratedly extending outward from its rear end (as shown in FIG. 6), and the inner shaft housing **33** has a retaining flange **35** and four positioning recesses **36** formed on the inner peripheral surface in front of the retaining flange **35** (as shown in FIG. 3 and FIG. 6).

[0016] Now referring to FIG. 2 and FIG. 6, the impeller **30** is indirectly connected to the transmission shaft **27** of the gear box **20** through a bushing **40.** The bushing **40** has a shock-absorbing layer **41** and a metal layer **43** wrapping the shock-absorbing layer **41.** The shock-absorbing layer **41** has its outer peripheral surface provided with a plurality of positioning ridges **42,** and the metal layer **43** has its inner peripheral surface formed with a toothed channel **44.** When assembled to the transmission shaft **27,** the bushing **40** is inserted into the inner shaft housing **33** so that its rear end abuts against the retaining flange **35** of the inner shaft housing **33.** The bushing **40** on one hand uses the four positioning ridges **42** on the shock-absorbing layer **41** to pair up and engage with the four positioning recesses **36** of the inner shaft housing **33,** and on the other hand uses the toothed channel **44** of the metal layer **43** to engage with the toothed portion **28** of the transmission shaft **27.** Then two gaskets **46** are arranged at front and rear ends of the impeller shaft **31** for the transmission shaft **27** to pass. At last, a nut **47** is assembled to hold all the components together, thereby making the impeller **30** and the transmission shaft **27** well assembled. As a result, the transmission shaft **27** of the gear box **20** can transmit power generated by the engine to the impeller **30** through the bushing **40,** thereby driving the impeller **30** to operate. In the event that a foreign object comes to the impeller **30** during operation, the shock-absorbing layer **41** serves to absorb impact and to prevent the metal layer **43** from burst while protecting the transmission shaft **27** from damage. Moreover, in the assembly of the impeller **30** and the transmission shaft **27,** there is no direct contact between the impeller shaft **31** and the tapered shaft **22** of the casing **21.** Instead, an exhaust channel **45** is left there between to allow escape of exhaust gas (as shown in FIG. 6).

[0017] At the top edge of the outer peripheral surface of the stream-guiding ring **50,** two upper supports **51** are symmetrically fixed using fixing members **53** such as screws. The upper supports **51** jointly hold the anti-swirl baffle **26** in position and then the upper supports **51** can be further fixed using fixing members **54** such as screws. At the bottom edge of the outer peripheral surface of the stream-guiding ring **50,** a lower support **52** is fixed using fixing members **55** such as screws. The lower support **52** holds the lower wing **24** in position and the lower wing **24** can be further fixed using fixing members **56** such as screws. After so assembled, the stream-guiding ring **50**

houses the entire impeller **30.**

[0018] As shown in FIG. 2 and FIG. 5, the stream-shaping nozzle **60** has a ring portion **61,** a hollow axial portion **62,** and eight stream-shaping portions **63.** The ring portion **61** is fixed to the rear end of the stream-guiding ring **50** using fixing members **64** such as screws. The ring portion **61** has a changing cross-sectional area that becomes smaller as it extends backward. The hollow axial portion **62** is defined in the ring portion **61.** The hollow axial portion **62** has its front end provided with an engaging socket **65.** The engaging socket **65** of the hollow axial portion **62** coaxially receives the engaging flange **34** of the impeller shaft **31** of the impeller **30** (as shown in FIG. 6). The stream-shaping portions **63** are integratedly connected between the ring portion **61** and the hollow axial portion **62** while being arranged equidistantly to circle the hollow axial portion **62.** Thereby, water streams drawn into the stream-guiding ring **50** by the impeller **30** are well shaped into eight linear streams by the eight stream-shaping portions **63** of the stream-shaping nozzle **60.** Then the stream-shaping nozzle **60** jets the linear streams backward to provide the boat with propulsion.

[0019] With such a design, the boat propeller **10** of the present invention has the following advantageous over the prior-art devices:

1) Given that the stream-guiding ring **50** is attached to the casing **21** of the gear box **20** through the upper and lower supports **51, 52** and that the impeller shaft **31** of the impeller **30** is not tapered, the diameter of the combined vanes **38** is enlarged and so is the water volume to be compressed. As a result, the effective water inlet diameter is maximized to provide improved propulsive efficiency.

2) With the protection provided by the stream-guiding ring **50,** the impeller **30** is unlikely to harm fishes, swimmers or divers around to bottom of the boat. This allows a boat having a shallow draft safe to be used. Even if the impeller **30** is not fully immersed in water, propulsion can still be provided desirably. Besides, the stream-guiding ring **50** may be made of aluminum alloy which is of high strength. In this case, the boat propeller **10** is more resident to impact and has a longer service life.

3) When the boat moves backward, the exhaust gas generated by the engine can escape through the exhaust channel **45** and will not interfere with water streams and cause turbulence.

4) The stream-shaping nozzle **60** uses the eight stream-shaping portions **63** to shape the water stream excited by the impeller **30** into linear ejections. This prevents swirls from formed at the back of the impeller **30** and in turn helps to improve propulsive efficiency.

5) The transmission shaft **27** of the gear box **20** and the impeller shaft **31** of the impeller **30** are assembled coaxially, so that the power of the engine can be leveraged, while the bushing **40** works as a buffer against external impacting force.

Claims

1. A boat propeller (10), comprising:

a gear box (20), including a casing (21) and a transmission shaft (27), wherein the transmission shaft (27) is rotatably installed in the casing (21) and has a front end thereof such received in the casing (21) that a rear end thereof juts out the casing (21);
an impeller (30), including an impeller shaft (31) and a plurality of vanes (38), wherein the impeller shaft (31) has a hollow columnar outer shaft, a hollow columnar inner shaft housing (33), and a plurality of rib portions (37), in which the inner shaft housing (33) is received in the outer shaft housing (32) and coaxially connected to the transmission shaft (27) of the gear box (20), and the rib portions (37) are connected between the outer shaft housing (32) and the inner shaft housing (33), while the vanes (38) are integratedly connected to an outer peripheral surface of the outer shaft housing (32) of the impeller shaft (31);
a stream-guiding ring (50), which is assembled to the casing (21) of the gear box (20) and houses the impeller (30); and
a stream-shaping nozzle (60), which is connected to a rear end of the stream-guiding ring (50).

2. The boat propeller (10) of claim 1, wherein the stream-shaping nozzle (60) has a ring portion (61), a hollow axial portion (62), and a plurality of stream-shaping portions (63), in which the ring portion (61) is connected to the rear end of the stream-guiding ring (50), and the hollow axial portion (62) is defined in the ring portion (61) and coaxially connected to the outer shaft housing (32) of the impeller shaft (31) of the impeller (30), while the stream-shaping portions (63) are connected between the ring portion (61) and the hollow axial portion (62) and arranged equidistantly to circle the hollow axial portion (62).

3. The boat propeller (10) of claim 2, wherein the ring portion (61) of the stream-shaping nozzle (60) has a changing cross-sectional area that becomes smaller as the ring portion (61) extends away from the stream-guiding ring (50).

4. The boat propeller (10) of any of claims 1 through 3, wherein the casing (21) of the gear box (20) has a tapered shaft (22), and an exhaust channel (45) is formed between the tapered shaft (22) and the impeller shaft (31) of the impeller (30).

5. The boat propeller (10) of claim 4, wherein the casing (21) of the gear box (20) further has an upper wing (23), a lower wing (24), and an anti-swirl baffle (26), in which the upper wing (23) and the lower wing (24) are integratedly connected to top and bottom sides of the tapered shaft (22), and the anti-swirl baffle (26) is integratedly connected to the upper wing (23) so it is located above the stream-guiding ring (50); two upper supports (51) being symmetrically fixed to a top edge of the outer peripheral surface of the stream-guiding ring (50) for connecting the anti-swirl baffle (26), and a lower support being fixed to a bottom edge of the outer peripheral surface of the stream-guiding ring (50) for connecting the lower wing (24).

6. The boat propeller (10) of claim 5, wherein the casing (21) of the gear box (20) further has a connecting portion (25) that is integratedly connected to a top of the upper wing (23) so as to be located above the anti-swirl baffle (26).

7. The boat propeller (10) of claim 1, wherein the inner shaft housing (33) of the impeller (30) is indirectly connected to the transmission shaft (27) of the gear box (20) through a bushing (40).

8. The boat propeller (10) of claim 7, wherein the inner shaft housing (33) has an inner peripheral surface thereof provided with a positioning recess, and the bushing (40) has an outer peripheral surface thereof provided with a positioning ridge (42), so that the positioning ridge (42) of the bushing (40) engages with the positioning recess of the inner shaft housing (33).

9. The boat propeller (10) of claim 8, wherein the bushing (40) has a shock-absorbing layer (41) and a metal layer (43) wrapping the shock-absorbing layer (41), in which the shock-absorbing layer (41) has an outer peripheral surface thereof provided with the positioning ridge (42), and the metal layer (43) is connected to the transmission shaft (27).

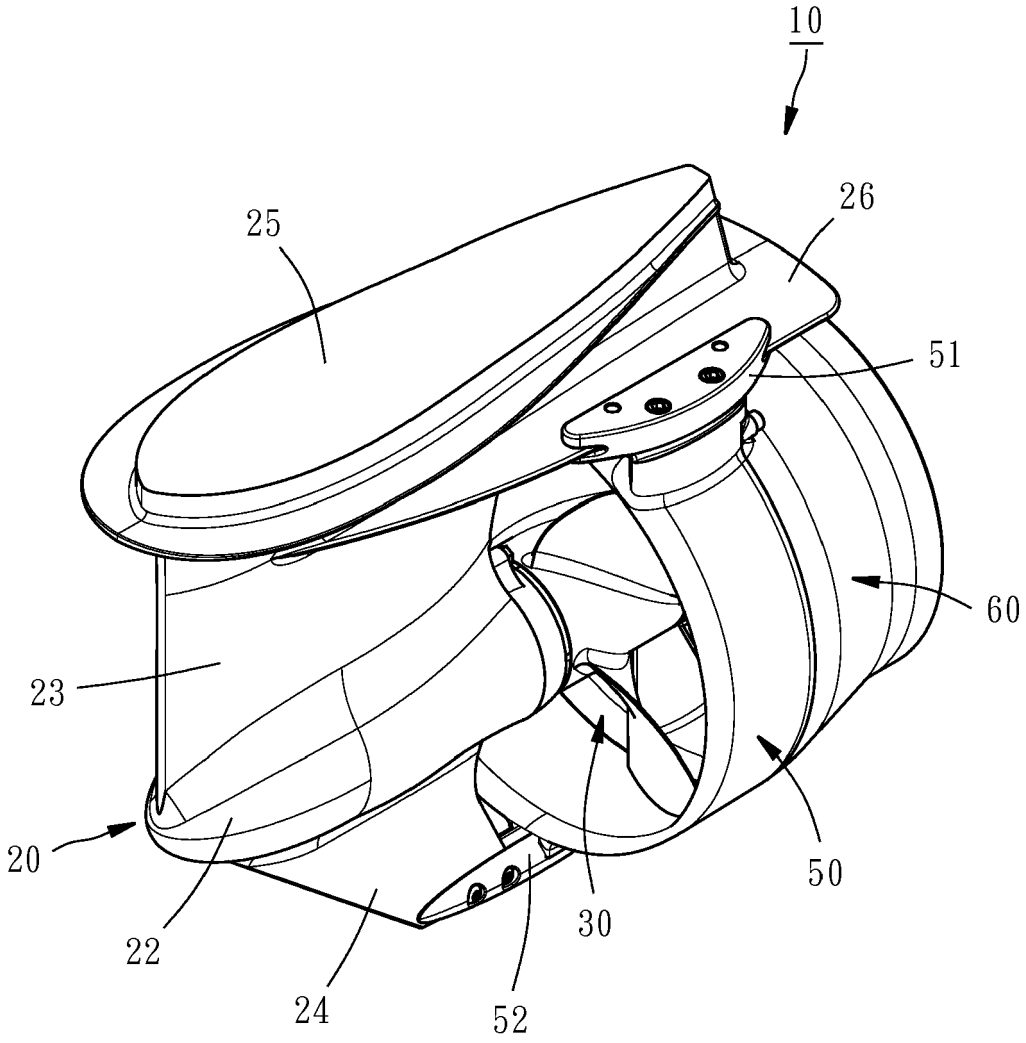

FIG. 1

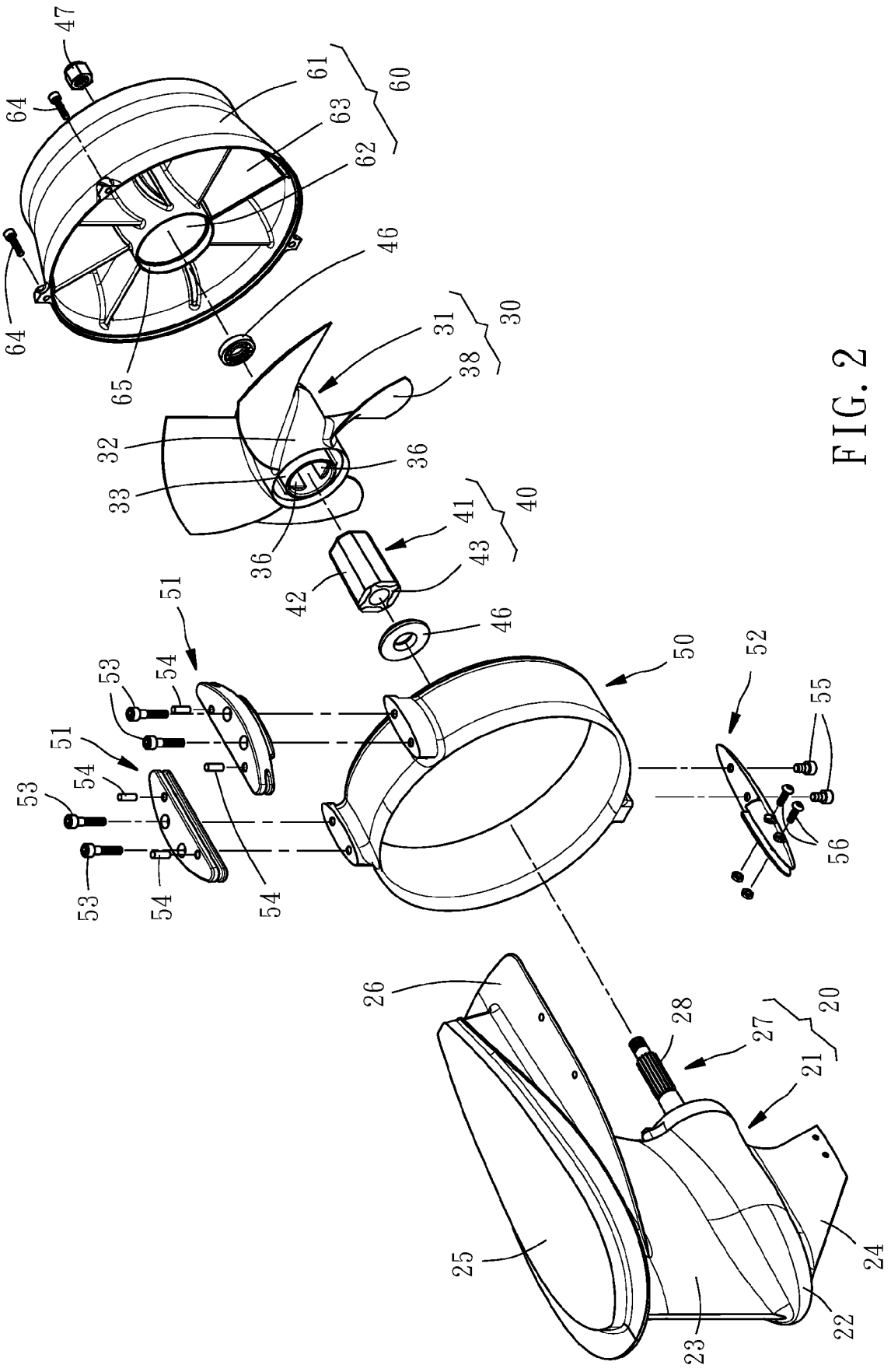
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FIG. 2

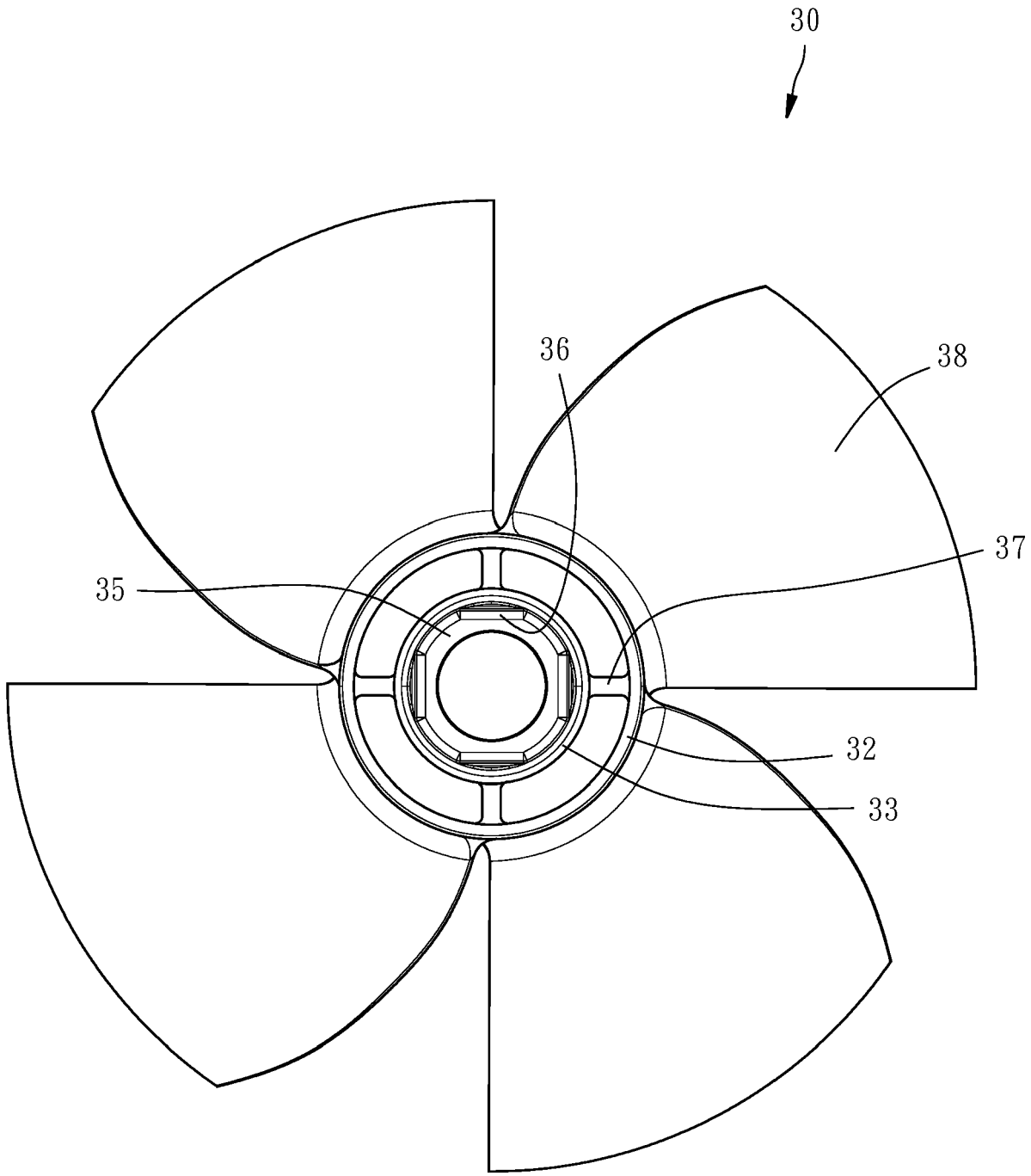

FIG. 3

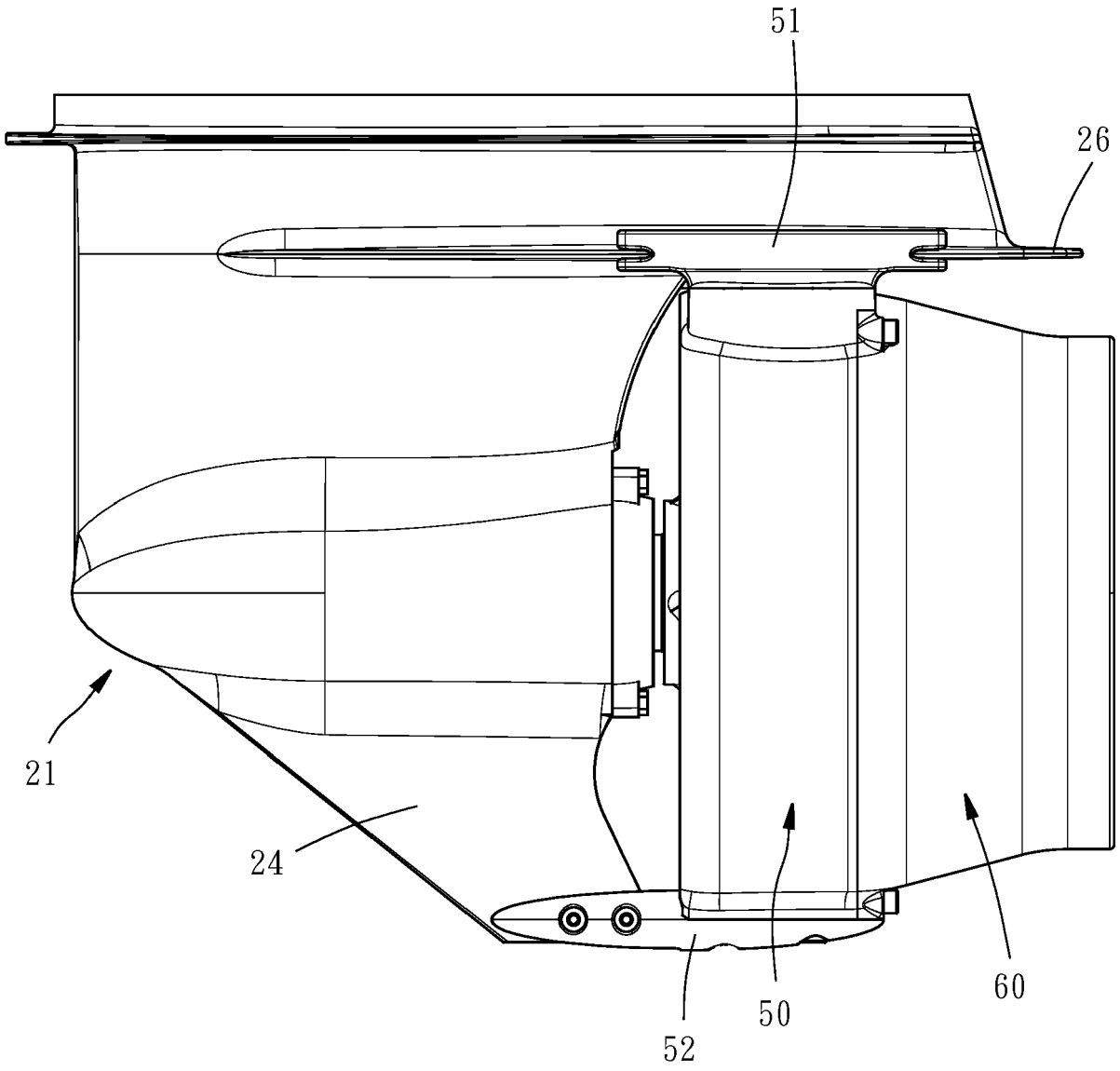

FIG. 4

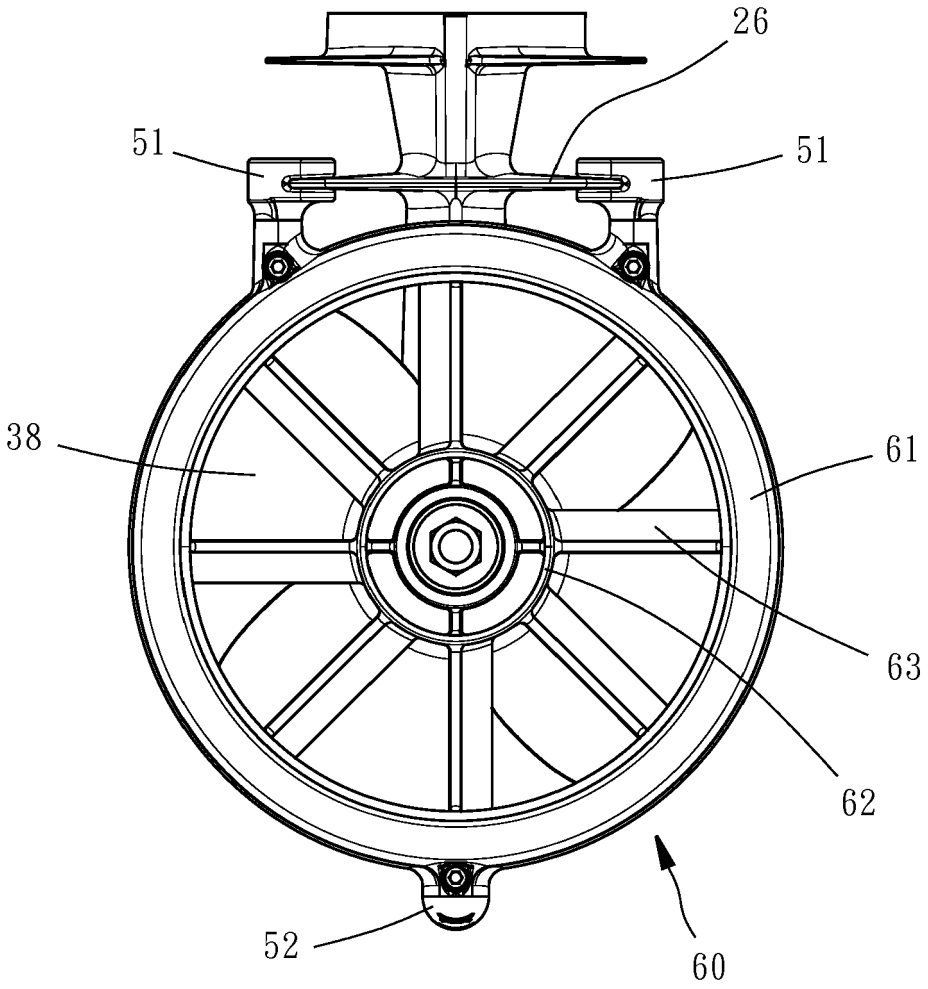

FIG. 5

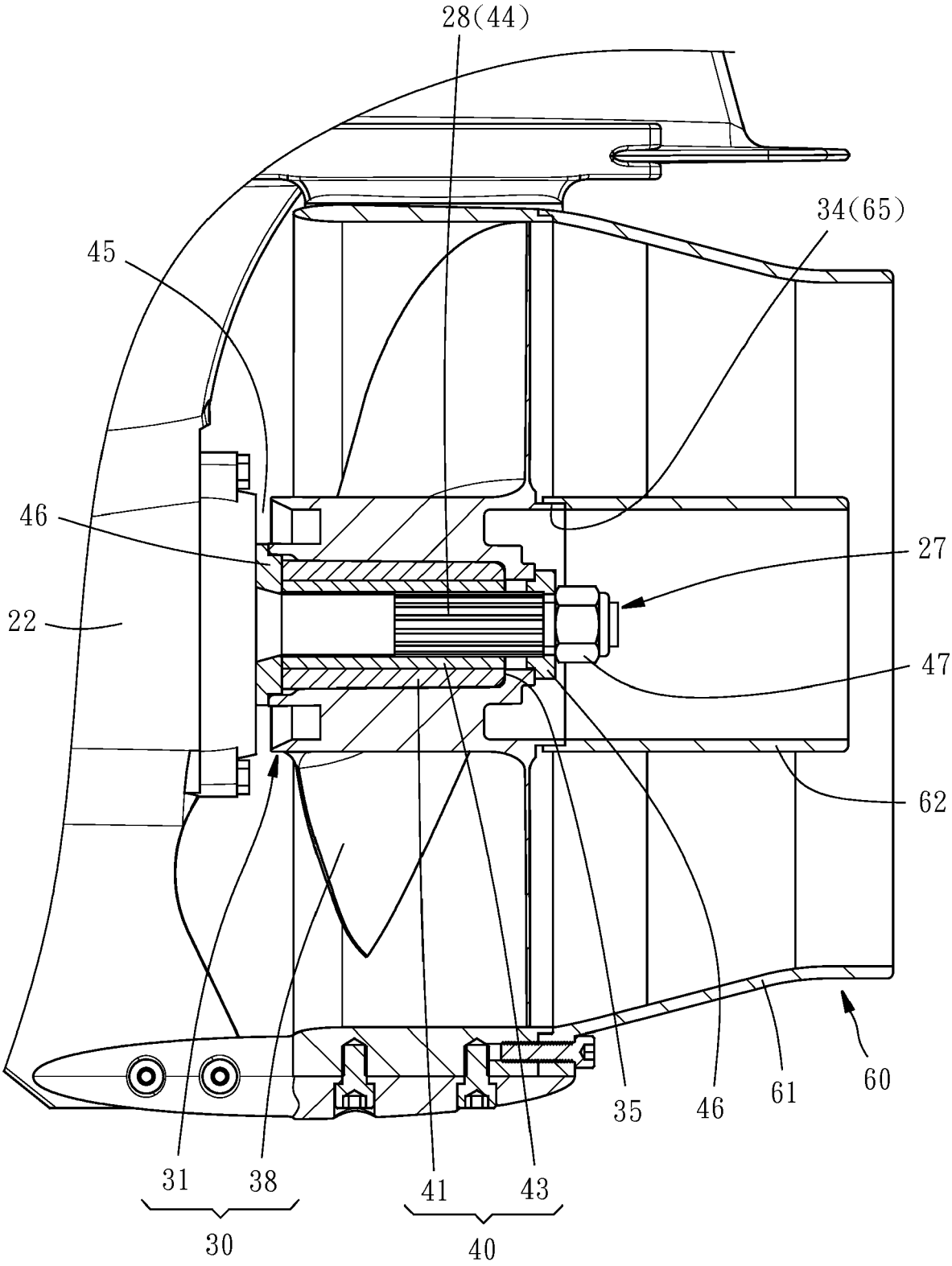

FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 19 17 2225

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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X	US 5 752 864 A (JONES JAMES R [US] ET AL) 19 May 1998 (1998-05-19) * figure 4 * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

B63H
B63J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	31 October 2019	Balzer, Ralf

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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31-10-2019

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