

[Document Name] Description

[Title] Fishing Reel

[Technical Field]

[0001]

The present invention relates to a fishing reel including a magnetic seal mechanism that protects a one-way clutch on a drive shaft from moisture and dust.

[Background]

[0002]

A spinning reel, which is a fishing reel, generally is assembled with a reverse-rotation prevention mechanism that allows for rotation of the rotor in the reel-in direction by means of rotating the handle and prevents the reverse rotation of the rotor when an attempt is made to rotate the handle in the reverse direction. As disclosed in Patent Literature 1, for example, the reverse-rotation prevention mechanism usually is formed of a one-way clutch (bearing member) that includes an inner ring which is fitted to a pinion gear in a detented manner, a retainer which is disposed radially outwardly of the inner ring and retains a plurality of rolling members, and an outer ring which is disposed radially outwardly of the retainer and fixed to a reel body in a detented manner.

[0003]

Patent Literature 1 also discloses a waterproofing and dustproofing structure with a magnetic seal mechanism disposed on the opening side of the one-way clutch. The magnetic seal mechanism is a structure that prevents foreign matter such as moisture and dust from entering the one-way clutch, by means of a gap provided between it and the outer surface of the inner ring (drive shaft) of the one-way clutch, a ring-shaped pole plate attached with a magnet and a ferrofluid filled in the gap.

[0004]

The magnetic seal mechanism described above does not eliminate the possibility that the ferrofluid retained in

the gap enters the one-way clutch due to big shocks or vibrations caused, for example, when the reel is dropped, moved or transported. Thus, Patent Literature 1 discloses a groove formed on the drive shaft between the ferrofluid and the one-way clutch so that the ferrofluid and the grease of the one-way clutch do not touch each other.

[Prior Art]

[Patent Literatures]

[0005]

[Patent Literature 1] Japanese Unexamined Patent Application Publication No. 2012-23965

[Summary]

[Technical Problems]

[0006]

Simply forming a grooves in the inner ring, however, may not completely prevent the ferrofluid from entering the one-way clutch when the reel body is subjected to big shocks or vibrations. In this case, forming a deep groove may be possible, but this reduces the strength of the inner ring. Patent Literature 1 also discloses forming a step in the inner ring and using this step to gouge out the groove, but this configuration also cannot secure enough strength of the inner ring, and the ease of assembly is reduced as the inner ring cannot be assembled after the pole plate of the magnetic seal mechanism is assembled.

[0007]

The present invention was made in view of the above-mentioned problems, and an object thereof is to provide a fishing reel assembled with a magnetic seal mechanism, with a structure that securely prevents a ferrofluid of the magnetic seal mechanism from entering a one-way clutch near the magnetic seal mechanism even when big shocks or vibrations are applied.

[Solution to Problems]

[0008]

In order to achieve the above-described object, a fishing reel according to the present invention comprises: a reel body; a handle that is rotatably supported on the reel body; a drive shaft that is rotated by rotating operation of the handle; a one-way clutch that includes an inner ring detented on the drive shaft and rotating integrally therewith, an outer ring fixed to the reel body in a detented manner, and a retainer disposed between the inner ring and the outer ring and retaining a plurality of rolling members; and a magnetic seal mechanism that forms a sealing membrane, with a ferrofluid, in a gap between it and the outer surface of the inner ring so as to prevent foreign matter from entering the one-way clutch; wherein the inner ring is formed with a circumferential groove that prevents the ferrofluid from entering the one-way clutch; and an O-ring is mounted in the circumferential groove.

[0009]

Since the fishing reel of the above configuration includes the circumferential groove formed on the inner ring, the ferrofluid of the magnetic seal mechanism is prevented from entering the one-way clutch even when the reel body is subjected to big shocks or vibrations. In this case, mounting the O-ring in the circumferential groove increases the surface area that makes contact with the ferrofluid, allowing the ferrofluid to easily stick to the area, thereby more effectively preventing the ferrofluid from entering the one-way clutch.

[0010]

Also, a fishing reel according to the present invention comprises: a reel body; a handle that is rotatably supported on the reel body; a drive shaft that is rotated by rotating operation of the handle; a one-way clutch that includes an inner ring detented on the drive shaft and rotating integrally therewith, an outer ring fixed to the reel body in a detented manner, and a retainer disposed between the inner ring and the outer ring

and retaining a plurality of rolling members; and a magnetic seal mechanism that forms a sealing membrane, with a ferrofluid, in a gap between it and the outer surface of the inner ring so as to prevent foreign matter from entering the one-way clutch; wherein the inner ring is formed with a circumferential groove that prevents the ferrofluid from entering the one-way clutch; and an inner surface of the inner ring is formed with an uneven surface.

[0011]

As described here, forming an uneven surface in the inner surface of the circumferential groove also increases the surface area that makes contact with the outflowing ferrofluid and allows the ferrofluid to easily stick to that portion, effectively preventing the ferrofluid from entering the one-way clutch. In this case, the uneven surface may be formed in the inner wall and/or the bottom of the circumferential groove by embossing or by various roughening treatments, for example.

[Advantageous Effects]

[0012]

The present invention provides a fishing reel assembled with a magnetic seal mechanism, with a structure that prevents a ferrofluid of the magnetic seal mechanism from entering a one-way clutch near the magnetic seal mechanism even when big shocks or vibrations are applied.

[Brief Description of Drawings]

[0013]

[Fig. 1] Fig. 1 is an exploded perspective view of an embodiment of a fishing reel (spinning reel) according to the present invention.

[Fig. 2] Fig. 2 is a sectional view along the axial direction of the main part of the fishing reel shown in Fig. 1.

[Fig. 3] Fig. 3A is a sectional view along line A-A of Fig. 2.

[Fig. 4] Fig. 4 is a perspective view showing a one-way clutch in a fixed state.

[Fig. 5] Fig. 5 is a perspective view of the one-way clutch shown in Fig. 4 with a corrosion-resistant plate disposed therein

[Fig. 6] Fig. 6 is an enlarged view of the main part (area A1) of Fig. 2.

[Fig. 7] Fig. 7(a) to Fig. 7(c) show modified embodiments of the circumferential grooves formed on the inner ring.

[Description of Embodiments]

[0014]

Figs. 1 and 2 show a first embodiment of a fishing reel according to the present invention. (In this embodiment, a spinning reel is described as a fishing reel.) First, an outline of the overall configuration of the spinning reel of the present embodiment will be described. In the following description, front and rear mean the directions shown in Fig. 2.

[0015]

A spinning reel (hereinafter referred to as "reel") 1 comprises a reel body 2, and a reel foot 2A to be mounted on a fishing rod is integrally formed on the reel body 2. In the front of the reel body 2, a rotor 3 is rotatably supported and a spool (not shown) is supported in such a manner that it moves back and forth, synchronized with the rotational motion of the rotor 3.

[0016]

The rotor 3 includes a pair of arms 3a that rotate around the spool, and at front ends of the arms 3a, bail support members 3b are supported in such a manner that they are rotatable between a fishing-line reel-in position and a fishing-line casting position, with base ends of a bail 5 mounted on the bail support member 3b. In this case, one base end of the bail 5 is mounted on a fishing-line guide portion (line roller) 6 integrally provided on the bail support member 3b.

[0017]

A handle shaft is rotatably supported in the reel body 2 by means of a bearing, and a handle is mounted on a protruding end of the handle shaft. A driving-force transmission mechanism 10 is provided on the handle shaft and when the handle is rotated, transmits the driving force to the rotor 3 to rotate the rotor.

[0018]

As is known, the driving-force transmission mechanism 10 includes a drive gear that is mounted on the handle shaft in such a manner that it integrally rotates with the handle shaft, and a pinion 11 that has pinion teeth meshing with the drive gear. The pinion 11 extends in the front-rear direction perpendicular to the handle shaft and serves as a rotary portion (drive shaft) formed with a cavity 11a extending in the axial direction inside. In this case, a spool shaft is inserted into the cavity 11a and engages with a known oscillating mechanism that moves the spool back and forth when the handle is rotated, and the spool is mounted on a tip end of the spool shaft.

[0019]

The pinion 11 is rotatably supported on the reel body 2. The pinion 11 extends toward the spool side, and the rotor 3 is integrally-rotatably mounted on a tip end of the pinion 11. The rotor 3 has a boss portion 3A with a through hole formed in the center, which is fitted externally onto a tip end of the pinion 11, and tightening a nut (not shown) fixes the rotor 3. On the pinion 11, a one-way clutch 20 is disposed and constitutes a reverse-rotation prevention device.

[0020]

With the above configuration, when the handle is operated to reel in, the rotor 3 is rotated by means of the driving-force transmission mechanism 10 and the spool reciprocates in the front-rear direction by means of the oscillating mechanism and the spool shaft. Thus, the

fishing line is evenly wound around the spool by means of the fishing-line guide portion 6 of the rotor 3 that is rotated.

[0021]

Now, the one-way clutch 20 of the present embodiment will be described with reference to Figs. 1 to 5.

As shown in Fig. 1, on the spool side of the reel body 2, a base 2B substantially in a disc shape is disposed, and a cylinder portion 2C is formed on the surface of the base 2B toward the axial direction. The pinion 11 penetrates the center of the cylinder portion 2C and is rotatably supported, and the one-way clutch 20 is disposed in the middle thereof.

[0022]

The pinion 11 is rotated by means of the drive gear by the rotating operation of the handle, and the one-way clutch 20 is disposed in the middle of the pinion 11 to allow the rotation of the pinion 11 in the reel-in direction and to prevent its reverse rotation.

The one-way clutch 20 includes an inner ring 21, an outer ring 27 and a retainer 23 retaining a plurality of rolling members 25, and further includes a cover member 23A (see Fig. 5) which is integrated with the retainer 23. These elements (or some of the elements) may be pre-unitized.

[0023]

The inner ring 21 is detented against the pinion 11 and serves as a drive shaft that rotates integrally with the pinion 11. Specifically, the pinion 11 has a cross section in a shape partially formed with a non-circular portion, and with a non-circular portion of the inner ring 21 fitted to this portion, the inner ring 21 rotates integrally with the pinion 11. The inner ring 21 has a length in the axial direction, and is formed into a cylindrical shape having the same diameter and the same

thickness over the axial direction in the present embodiment.

[0024]

The retainer 23 is disposed radially outwardly of the inner ring 21 and has retaining portions 23a disposed at intervals in the circumferential direction. Each retaining portion 23a is provided with a biasing spring 24, which biases a rolling member 25 disposed between the retaining portions in the circumferential direction (in Fig. 3, counterclockwise direction; reverse-rotational direction).

[0025]

The outer ring 27 is disposed radially outwardly of the retainer 23 and is formed substantially in a ring shape. The inner circumference surface of the outer ring 27 has a wedge region 27a that prevents the rotation of the respective rolling members 25 and a free region 27b that allows the rolling members 25 to rotate freely. The rolling members 25 retained in the retainer 23 are always biased toward the wedge region by the biasing spring 24. The outer circumference surface 27d of the outer ring 27 of the present embodiment is formed in a circular shape except for the portion at which a detent 27c described below is formed.

[0026]

At a portion of the outer ring 27, a protruding piece 27c is provided to radially outwardly protrude. This protruding piece serves as a detent (hereinafter referred to as "detent 27c") to restrict rotation of the outer ring 27. The detent 27c is integrally formed to radially outwardly protrude from the outer circumference surface 27d of the outer ring 27, on one spot or more. In this case, it is preferable to form two or more pieces at equal intervals because if it is provided only on one spot, when a large torque is applied to the outer ring, the stress is concentrated and biasing, etc. may occur. In the present embodiment, two pieces are provided at 180° intervals so

that they face each other across the central axis X. The detent 27c has a width in the circumferential direction and its sides 27e, 27f in the circumferential direction perform a detenting function.

[0027]

The cylinder portion 2C protruding on the reel body 2 has a circumferential wall 2a formed with a notch 2c that radially penetrates the circumferential wall 2a. This notch 2c is formed to the extent that the detent 27c of the outer ring 27 is fitted into it, and the outer ring 27 is fixed in a detented manner (its rotation is restricted) with the detent 27c fitted into the notch 2c and an exposed surface 27g disposed to be radially exposed.

[0028]

The notch 2c only needs to be formed on one spot or more on the circumferential wall 2a, and in the present embodiment, two are formed at equal intervals in the circumferential direction (on two spots at 180° intervals to be symmetrical about the central axis X). In other words, the notches only need to be provided in the same number as that of the detents of the outer ring 27.

[0029]

The outer surface of the detent 27c is radially exposed at the notch 2c of the cylinder portion 2C, and can be touched and picked with fingers. The detent makes it easier to pick the outer ring 27 and improves the ease of attachment and detachment of the one-way clutch 20.

[0030]

In the configuration described above, the diameter of the circumferential wall 2a of the cylinder portion 2C (diameter of the outer circumference surface of the circumferential wall) is the same as the outermost diameter of the outer ring 27 (diameter of the exposed surface 27g of the detent 27c). In this case, the outer ring 27 is configured to fit within the circumferential wall 2a with a gap therebetween, to prevent rattling while ensuring good

rotational performance and to reduce the size in the radial direction. Providing some gap also allows for easy attachment and detachment.

[0031]

The one-way clutch 20 constructed as described above is unitized and assembled into the cylinder portion 2C. In this case, as shown in Fig. 5, the lid (cover member) 23A that covers the retainer 23 and the outer ring 27 is mounted on the surface of the outer ring 27 shown in Fig. 4, and the outer ring 27 is held between the retainer 23 and the cover member 23A. On the cover member 23A, an electric-corrosion-resistant plate (corrosion-resistant plate) or the like may be mounted.

[0032]

As shown in Fig. 1, this corrosion-resistant plate 28 includes a ring-shaped body 28a and a pair of feet 28c to hold the detent 27c. In other words, placed between the detent 27c and the notch 2c, the feet 28c keep the electric current from flowing between the two members and prevents corrosion of the reel body. Also, a restriction plate may be disposed adjacent to the one-way clutch so as to restrict movement of the one-way clutch 20 in the axial direction.

[0033]

The one-way clutch 20 of the above-described configuration prevents rotation (reverse rotation) of the handle (rotor 3) in the casting direction.

Specifically, when the pinion 11 is rotated (in the clockwise direction in Fig. 3) in response to rotation of the handle in the reel-in direction, the inner ring 21 also rotates in the same direction together with the pinion 11. At this time, the rolling member 25 retained in the retainer 23 moves to the free region 27b of the outer ring 27, and thus the rotational force of the inner ring 21 is not transmitted to the outer ring 27 and the rotor 3 rotates with the pinion 11 with no problem.

[0034]

In contrast, when the inner ring 21 together with the pinion 11 is about to rotate in the reverse direction (with the rotor 3 rotating in the casting direction), the rolling member 25 retained in the retainer 23 rolls in the counterclockwise direction and comes to be located in the wedge region 27a of the outer ring 27 by means of the biasing spring 24, and thus the rotational force of the inner ring 21 is transmitted to the outer ring 27. Since rotation of the outer ring 27 is restricted by the detent 27c, this serves as a stopper and prevents the reverse rotation of the pinion 11 and the rotor 3.

[0035]

In the configuration described above, the notch 2c radially penetrates the circumferential wall 2a of the cylinder portion 2C on the reel body, and with the detent 27c that is formed on the outer ring 27 of the one-way clutch 20 and disposed to be radially exposed, the outer ring 27 is fixed in a detented manner.

In other words, unlike a conventional configuration, the outer ring 27 is not detented with a notch, a protrusion or the like formed on the inner circumference surface of the cylinder portion, which allows to reduce the diameter and thickness of the cylinder portion 2C as much as possible, and thus the size and weight of the reel body is reduced.

[0036]

Adjacent to the one-way clutch 20, a magnetic seal mechanism 50 is disposed to enhance the waterproofing and dustproofing effect. The configuration of the magnetic seal mechanism 50 will now be described with reference to Figs. 1, 2 and 6.

As is known, the magnetic seal mechanism 50 includes: ring-shaped pole plates (magnetic plates) 51, 52 disposed with a minute gap between them and the outer circumference surface of the drive shaft (inner ring 21), and a ring-

shaped magnet 53 held between the magnetic plates, with a ferrofluid 55 filled in the gap G between the drive shaft and the pole plates to form a sealing membrane.

[0037]

The pole plate 51 has a ring-shape with an opening in the center thereof, and the inner ring 21 detented on the pinion 11 is inserted into the opening. Likewise, the pole plate 52 has a ring-shape with an opening for the inner ring 21 to be inserted and has a diameter smaller than that of the pole plate 51. The ring-shaped magnet 53 is held between the pole plates 51, 52 and fixed there by adhesion.

[0038]

The pole plates 51, 52 and the magnet 53 may be unitized as a magnet assembly (magnet assy) and may be fixed to the cylinder portion 2C of the reel body or assembled with a waterproof cap 60 described below.

[0039]

The inner ring 21 is formed with a circumferential groove 21A that prevents the ferrofluid 55 from entering the magnetic seal mechanism 50. The circumferential groove 21A may be formed within the region where the one-way clutch 20 is disposed, e.g., within the same plane with the outer ring 27 and the retainer (cover member 23A) which are the ends of the one-way clutch, but as shown in Fig. 6, the groove 21A is preferably formed between the one-way clutch 20 and the pole plate 51 at which the ferrofluid of the magnetic seal mechanism 50 is retained.

[0040]

Since the circumferential groove 21A is formed on the inner ring 21 as described here, even when the ferrofluid 55 is about to enter the one-way clutch 20 as a result of the reel body being subjected to big shocks or vibrations, the circumferential groove 21A restricts its movement (the ferrofluid is retained in the circumferential groove), thereby preventing the ferrofluid from entering the one-way clutch side.

[0041]

Further, an O-ring 21B formed of rubber or the like is mounted in the circumferential groove 21A. This O-ring 21B is provided to increase the surface area that makes contact with the ferrofluid 55 outflowing from the magnetic seal mechanism 50. As described above, forming the circumferential groove 21A between the pole plate 51 and the one-way clutch 20 facilitates the mounting of the O-ring 21B. Also, mounting the O-ring 21B in the circumferential groove 21A increases the surface area and allows the ferrofluid 55 to easily stick to the increased area, thereby more effectively preventing the ferrofluid 55 from entering the one-way clutch 20. Moreover, mounting the O-ring 21B eliminates the need to form a deep circumferential groove, and thus reduction in the strength of the inner ring 21 is also prevented.

[0042]

As shown in Fig. 6, the O-ring 21B is preferably sized to be positioned within the gap G with an outermost diameter R being the outer diameter R1 of the inner ring 21 or larger, when mounted in the circumferential groove 21A. In other words, preferably, the O-ring 21B protrudes from the outer circumference surface 21a of the inner ring 21 and is not taller than the edge of the opening end of the pole plates 51, 52 beyond the gap G.

[0043]

According to this configuration, the O-ring 21B serves as a wall and makes it difficult for the ferrofluid 55 to enter the one-way clutch. In addition, when the above-described components are assembled, the one-way clutch 20 and the magnetic seal mechanism 50 are assembled on the pinion 11 and the inner ring 21 is fitted onto to the pinion 11, and thus, the inner ring 21 with the O-ring 21B mounted thereon are passed through the openings of the pole plates 51, 52 of the magnetic seal mechanism 50. This makes assembly easier and prevents damage to the pole plates.

[0044]

The circumferential groove 21A is preferably formed to a size that leaves a gap G1 (allowance) in the axial direction between it and the installed O-ring 21B mounted therein.

Configuring the circumferential groove 21A with some gap G1 in the axial direction between it and the O-ring 21B, as described here, increases the surface area and retains more of the outflowing ferrofluid 55, while facilitating retention in the circumferential groove 21A of the ferrofluid touching the O-ring 21B.

[0045]

The O-ring 21B described above may not be provided when an inner surface of the circumferential groove 21A is formed with an uneven surface as shown in Fig. 7, for example.

Fig. 7(a) shows an example of the circumferential groove 21A with its whole inner surface (inner walls 21c, 21d and bottom 21e) roughened to have an uneven surface. Fig. 7(b) shows an example of the circumferential groove 21A with an uneven surface (e.g., line-like uneven surface) formed on its bottom 21e. Fig. 7(c) shows an example of the circumferential groove 21A with uneven surfaces formed in its inner surface (inner walls 21c, 21d).

[0046]

The method of forming these uneven surfaces is not particularly limited, and they may be formed by cutting and the like. Forming an uneven surface in the inner surface of the circumferential groove 21A increases the surface area that makes contact with the outflowing ferrofluid 55 and allows the ferrofluid to easily stick to the uneven portion, effectively preventing the ferrofluid from entering the one-way clutch. The above-described O-ring 21B may be mounted in the circumferential groove 21A formed

with these uneven surfaces, and this further increases the surface area that makes contact with the ferrofluid.

[0047]

In this embodiment, as shown in Fig. 1, the reel body may be provided with a waterproof cap 60 thereon so as to enclose the cylinder portion 2C and the one-way clutch 20. This waterproof cap 60 has a shape including a cylinder portion 61 that surrounds the one-way clutch 20 and a cover portion 62 that seals the opening on the spool side, and the magnetic plate 51 of the magnetic seal mechanism 50 may be fixed the inner surface of the cover portion 62.

As described here, since the magnetic seal mechanism 50 is disposed on the spool side of the one-way clutch 20 and the waterproof cap 60 is provided to enclose the cylinder portion 2C and the one-way clutch 20, foreign matter such as moisture and dust is surely kept from entering the one-way clutch 20, and the durability is increased.

[0048]

Although the embodiments of the present invention are described above, the present invention is not limited to those embodiments and may be modified in various ways.

The present invention is characterized in that a circumferential groove is formed in the outer circumference surface of the drive shaft between the magnetic seal mechanism 50 and the one-way clutch (bearing member) 20, and that an O-ring is disposed there or an uneven surface is formed in the circumferential groove. Thus, the configurations of the one-way clutch 20 and the magnetic seal mechanism 50 are not limited. Also, other than for the one-way clutch, the configuration described above may also be used for various bearing members such as a ball bearing, and may also be applied to various types of fishing reels (such as double-bearing reels) other than spinning reels.

[Refence Signs List]

[0049]

1 fishing reel
2 reel body
2C cylinder portion
2c notch
3 rotor
20 one-way clutch
21 inner ring (drive shaft)
21A circumferential groove
21B O-ring
50 magnetic seal mechanism
55 ferrofluid

[Document Name] Claims

[Claim 1]

A fishing reel comprising:

a reel body;

a handle that is rotatably supported on the reel body;

a drive shaft that is rotated by rotating operation of the handle;

a one-way clutch that includes an inner ring detented on the drive shaft and rotating integrally therewith, an outer ring fixed to the reel body in a detented manner, and a retainer disposed between the inner ring and the outer ring and retaining a plurality of rolling members; and

a magnetic seal mechanism that forms a sealing membrane, with a ferrofluid, in a gap between it and the outer surface of the inner ring so as to prevent foreign matter from entering the one-way clutch; wherein

the inner ring is formed with a circumferential groove that prevents the ferrofluid from entering the one-way clutch; and

an O-ring is mounted in the circumferential groove.

[Claim 2]

The fishing reel according to claim 1, wherein the circumferential groove is formed between the one-way clutch and a pole plate for retaining the ferrofluid of the magnetic seal mechanism.

[Claim 3]

The fishing reel according to claim 1 or 2, wherein the O-ring is sized to have an outermost diameter that is larger than or equal to the outer diameter of the inner ring and within the gap, when mounted in the circumferential groove.

[Claim 4]

The fishing reel according to any one of claims 1 to 3, wherein the circumferential groove is sized to have a

gap, in the axial direction, between it and the mounted O-ring.

[Claim 5]

The fishing reel according to claim 4, wherein the inner surface of the circumferential groove is formed with an uneven surface.

[Claim 6]

A fishing reel comprising:

a reel body;

a handle that is rotatably supported on the reel body;

a drive shaft that is rotated by rotating operation of the handle;

a one-way clutch that includes an inner ring detented on the drive shaft and rotating integrally therewith, an outer ring fixed to the reel body in a detented manner, and a retainer disposed between the inner ring and the outer ring and retaining a plurality of rolling members; and

a magnetic seal mechanism that forms a sealing membrane, with a ferrofluid, in a gap between it and the outer surface of the inner ring so as to prevent foreign matter from entering the one-way clutch; wherein

the inner ring is formed with a circumferential groove that prevents the ferrofluid from entering the one-way clutch; and

an inner surface of the inner ring is formed with an uneven surface.