

SPINNING REEL

(Detailed Description of the Invention)

Specification

(Field of Industrial Utilization)

The present invention concerns a spinning reel, specifically, a spinning reel provided with a bushing which supports the spool shaft such that it is incapable of relative rotation, but can slide in the axial direction.

(Prior Art)

A spinning reel, in general, is provided with a reel body, a rotor which is rotatably supported on the reel body, and a spool on which the fishing line is wound. Furthermore, the spinning reel is provided with a drag mechanism whereby the spool is stationary and does not rotate with respect to the reel body, but allows the spool to rotate when force in excess of a specified level is applied. In a rear drag type of spinning reel wherein the drag mechanism is provided at the back end of the reel body, the spool shaft, which is fixed to the spool, extends towards the rear into the drag mechanism. The drag mechanism is provided with a bushing which supports the spool shaft such that it cannot rotate relative to the reel body, but can move in the axial direction.

The use of a split-type of bushing is known in these drag mechanisms. Such bushings are composed of a flange which is a disk plate that can frictionally engage the reel body, and a cylindrical member whose shape is virtually cylindrical and that supports the spool shaft so that it cannot undergo relative rotation but can slide in the axial direction. A through-hole having an oval cross section is formed through the center of this

cylindrical member to slidably support the spool shaft so that it does not rotate relative to the reel. In addition, the cylindrical member is provided on its periphery with a chamfered section parallel in the direction of its axis, and thus the periphery of the cylindrical member has an oval shape. An engagement hole of an oval shape is formed in the center of the flange member so that it can be fitted around the periphery of the cylindrical member.

(Problems Which the Invention is Intended to Solve)

In spinning reels, generally, feel is impaired during operation of the handle and such if the spool shaft should wobble in the direction of rotation with respect to the bushing. For this reason, in the aforementioned split-type bushing, the gap between the engagement hole in the flange and the periphery of the cylindrical member must be kept to a minimum. However, if the space between the flange member and the cylindrical member is made small, depending on how the bushing is attached, the flange may be pushed in at an angle so that the cylindrical member gouges the spool shaft. When this occurs, the spool shaft cannot slide smoothly. In order to prevent this situation, either a space be formed between the cylindrical member and the spool shaft so that the cylindrical member can push against the spool shaft, or a space can be formed between the cylindrical member and the flange member to allow the flange to tilt. However, if this kind of space were to be formed, wobbling would be generated in the direction of rotation, as was stated previously.

Bushings in which the cylindrical member and the flange member are a single piece are also known. However, in this single-piece type of bushing, as well, if the flange member is pushed at an angle, it grinds against the cylindrical member, and thus it is necessary to leave a certain amount of space between the cylindrical member and the spool shaft. For this reason, even in a single-piece type of bushing, wobbling is generated in the direction of rotation when a smooth sliding action of the

spool shaft is attempted.

An object of the present invention is to obtain a smooth sliding action of the spool shaft as well as to reduce wobbling in the direction of rotation.

(Means Used to Solve the Aforementioned-Mentioned Problems)

The spinning reel pertaining to invention 1 is for mounting onto a fishing rod, and is provided with a reel body, a rotor, a spool, a spool shaft, a bushing, and a rotation control means. The reel body is provided with a handle and is mountable onto a fishing rod. The rotor is supported by the reel body and is rotated by means of the handle. The spool is located forward of the rotor, is rotatably supported with respect to the reel body and slidably supported along the rotor's axis of rotation. The distal end of the spool shaft is fixed to the spool, and the rear end extends into the back end of the reel body. The bushing is provided with a cylindrical member, a flange member, and a connector means. The cylindrical member is located on the periphery of the back end of the spool shaft such that it can move with respect to the reel body and supports the spool shaft such that it cannot rotate but can slide in the axial direction. The bushing is rotatably supported on the periphery of the flange. The connecting means connects the cylindrical member and flange such that aberrations in rotation are prevented, but relative tilting between these two parts in the axial direction is permitted. The rotation control means controls the relative rotation between these two parts by means of pressing the cylindrical member towards the reel body.

The spinning reel pertaining to invention 2 is a spinning reel described in invention 1, wherein the connector means is at least one protuberance provided on one side of the cylindrical member and the flange such that it protrudes radially, and at least one groove provided to the other cylindrical member and the flange, into which the protuberance fits.

The spinning reel pertaining to invention 3 is a spinning reel described in invention 2, wherein the protuberance is one or a plurality of protuberances having a columnar shape and provided on the periphery of the cylindrical member.

The spinning reel pertaining to invention 4 is a spinning reel described inventions 1 or 2, wherein the protuberance is formed as an integral piece with the cylindrical member and has a columnar shape.

(Effect of the Invention)

In the spinning reel pertaining to invention 1, the connector means between the cylindrical member and the flange in the bushing connects these two parts such that aberration in their rotation is prevented while tilting in the axial direction is accommodated, so that the spool shaft is slidably supported and does not rotate relative to the cylindrical member. In this situation, should the flange be pushed in at an angle by the rotation control means, only the flange will tilt and the cylindrical member will not grind against the spool shaft, since the connector means accommodates the relative tilting of the flange and cylindrical member. Thus, the spool shaft is supported by the cylindrical member such that the spool shaft can always slide smoothly. Furthermore, wobbling in the direction of the spool shaft rotation can be reduced since the connector means prevents aberration in the rotation of the cylindrical member and the flange, making such rotational aberrations more unlikely.

In the spinning reel pertaining to invention 2, the connector means is composed of at least one protuberance and at least one groove into which the protuberance fits, which results in a simple structure for preventing rotational aberrations by the cylindrical member and the flange as well as accommodating relative tilting by these two parts in the axial direction.

In the spinning reel pertaining to invention 3, the

protuberance is a columnar-shaped protuberance provided on the periphery of the cylindrical member, which results in continual linear contact between the protuberance and the groove, thus preventing rotational aberrations by the cylindrical member and the flange as well as accommodating relative tilting by these two parts in the axial direction in a simpler design.

In the spinning reel pertaining to invention 4, the protuberance is a columnar protuberance formed as an integral piece with the cylindrical member set on its periphery, which makes the protuberance easy to form.

(Practical Examples)

A practical example of a spinning reel of this invention is illustrated in Figure 1. The spinning reel is primarily equipped with a reel body 2 having a handle 1a; a rotor 3 rotatably supported and located forward of the reel body 2; and a spool 4 for recovering the fishing line and located forward of rotor 3.

The reel body 2 is equipped with a body 2a and a mounting member 2b is formed on the upper part of the body 2a for attaching the spinning reel to the fishing rod. The body 2a houses a rotor-drive mechanism 5 for rotating a rotor 3, and a level wind-drive mechanism 6 for uniformly winding the fishing line onto a spool 4 by means of moving the spool 4 forward and back along the axis of rotation. In addition, the back end of the body 2a of the reel body 2 is formed as a cylindrical projection 2c that houses a rear drag mechanism 7. A spool shaft 8 is fixed in the spool 4 and extends towards the rear, passing through the rotor 3 and the body 2a, and its rear end is engaged by the rear drag mechanism 7 (described below).

The rotor-drive mechanism 5 is provided with a master gear 11 that rotates in tandem with a shaft 10 to which a handle 1a is affixed and a pinion gear 12 that engages this master gear 11 (tooth section not shown). The pinion gear 12 is formed as a cylinder with its front end passing through the center of the

rotor 3 and extending towards the spool 4. The pinion gear 12 is rotatably supported by means of ball bearings 13 which are supported by the body 2a. Furthermore, a spool shaft 8 passes through the center of the pinion gear 12 so that the spool shaft can move forward and back along the center of rotation. A specified space is maintained between the inside diameter of the pinion gear 12 and the outside diameter of the spool shaft 8.

A level wind-drive mechanism 6 is a component for transforming the rotation of a shaft 10 into forward and back motion by the spool shaft 8. As shown in Figures 1 and 2, the level wind-drive mechanism 6 is equipped with a threaded shaft 21 located below the spool shaft 8; a slider 22 that moves forward and back along the threaded shaft 21; a guide shaft 23 located below the threaded shaft 21; and an intermediate gear 24 (Fig. 1) that engages the pinion gear 12 and that is fixed to the distal end of the threaded shaft 21. The threaded shaft 21 and the guide shaft 23 lie parallel to the spool shaft 8. On the periphery of the threaded shaft 21 is a spiral groove 21a, and an engagement component (not illustrated) is provided in the interior of the slider 22 for engaging the groove 21a.

A fixing plate 25 having a face perpendicular to the axial direction of the spool shaft 8 is inserted in the body 2a with a certain amount of play. In the area where the spool shaft 8 passes through the fixing plate 25, a bearing 26 is provided for rotatably supporting the spool shaft 8. The fixing plate 25 rotatably supports the rear end of the threaded shaft 21 and maintains the rear end of the guide shaft 23 in a fixed manner. The distal end of the threaded shaft 21 is rotatably supported by the body 2a and the distal end of the guide shaft 23 is fixed to the body 2a.

In this manner, by employing the fixing plate 25, which is loosely inserted into the body 2a, to support the threaded shaft 21 and the guide shaft 23, the gap between the spool shaft 8, the threaded shaft 21, and the guide shaft 23 is held constant, even

if the body 2 is bent the slider 22 can be moved smoothly.

The rotor 3 is provided with a sleeve-shaped member 30, and a first arm member 31 and a second arm member 32 which face each other on either side of this sleeve-shaped member 30. The arm members 31 and 32, and the sleeve-shaped member 30 are formed as an integral piece. A front wall 33 is formed at the front end of the sleeve-shaped member 30 and a boss 33a is formed in the center of this front wall 33. A through-hole is formed in the center of the boss 33a, and the front end of the pinion gear 12 and the spool shaft 8 pass through the through-hole. In addition, a thread is formed at the tip of the pinion gear 12 that passes through the front wall 33, and a nut 34 is screwed onto this thread. Furthermore, the pinion gear 12 and the rotor 3 are fixed so that they do not rotate relative to each other.

A first bail support component 40 is oscillatingly attached to the inward facing side of the first arm 31 at its tip (towards the front), and a second bail support component 43 is oscillatingly attached to the inward facing side of the second arm 32 at its tip. The tip of the first bail support component 40 is equipped with a line roller 41 that guides the fishing line onto the spool 4, and a fixed shaft cover 42 for this line roller. A bowed bail 45 with U-shape extends from the fixed shaft cover 42 towards the second bail support component 43.

The spool 4 is located between the first arm 31 and the second arm 32 of the rotor 3. This spool 4 is equipped at its rear end with a ring-shaped skirt member 4a, a line winding body 4b located forward of the skirt member 4a, and a flange member 4c which is fixed to the tip of the line winding body 4b. The peripheral edge of the flange member 4c is bent towards the inward facing side. The sleeve-shaped member 30 of the rotor 3 is located in the interior of the skirt member 4a.

As shown in Figure 3, a fixed bushing 51 made of brass is fitted into and attached at the center of the line winding body

4b. The leading end of the spool shaft 8 is inserted into the fixed bushing 51. The rear end of the fixed bushing 51 has an outside diameter that is larger than its other sections, and a long groove 51a is formed on this end surface in a radial direction. A pin 52 is attached to the groove 51a for fixing the spool 4 and the spool shaft 8. This pin 52 engages the groove 51a to fix the spool 4 and the spool shaft 8. This pin 52 passes through the spool shaft 8 in the direction of its diameter.

When a spool made of resin is utilized, normally the inside diameter of the spool contracts when the fishing line is wound onto the spool. Therefore, to take this into account, it is necessary to provide extra space between the inside diameter of the spool 4 and the outside diameter of the spool shaft 8. Wobbling increases as a result of this space between the spool and the spool shaft. However, by fitting a fixed bushing 51 made of brass into the spool 4, the inside diameter of the spool does not contract even when taking up the line, thus eliminating the need for extra space between the inside diameter of the spool 4 and the outside diameter of the spool shaft 8. As a result, wobbling between the spool 4 and the spool shaft 8 is prevented.

The leading end of the spool shaft 8 extends beyond the line winding body 4b. A one-touch button 54 has been attached to the distal end of this spool shaft 8. A one-touch button collar 55 is located around the one-touch button 54. The one-touch button collar 55 screws onto the line winding body 4b of the spool 4 and keeps the one-touch button 54 in place.

As shown in detail in Figures 4 and 5, the rear drag mechanism 7 is principally composed of: a bushing 61 of disk shape; a friction-contact member 66 composed of a first friction plate 67 and two second friction plates 68; a coil spring 70 for exerting friction; a support member 71; and a fixed cap 72.

The bushing 61 fits around the periphery of the back end of the spool shaft 8, and is not normally supported by a cylindrical

protuberance 2c, but comes into contact with and is supported by the cylindrical protuberance 2c only when a load is applied. As Figure 5 clearly shows, the bushing 61 is equipped with a columnar cylindrical member 80 and a flange 81 located on the periphery of the cylindrical member 80.

Four columnar protuberances 82 are provided on the periphery of the cylindrical member 80 in a radial direction in the shape of a cross. Parallel chamfered surface 8a is formed at the rear end of the spool shaft 8, and the cross-sectional shape of the chamfered section 8a is oval-like. An engagement hole 83, which fits around this oval-like exterior surface, passes through the center of the cylindrical member 80. By means of this structure, the spool shaft 8 is supported by the cylindrical member 80 to be slidable as well as nonrotating.

As shown in Figure 6, a flange 81 is a washer-shaped ring component and its thickness is greater than the diameter of a protuberance 82. As shown in Figure 5, a center hole 85 that fits around the outer surface of the cylindrical member 80 is formed in the center of the flange 81. Four grooves 86 are formed in radial directions in this center hole 85 such that each fits over one of the four protuberances 82. The gaps between these grooves 86 and the protuberances 82 in the direction of the circumference are extremely small, so that wobbling in the circumferential direction (rotational direction) is reduced as much as possible. As shown in Figure 6, the gaps between the grooves 86 and the tip of the protuberances 82 in the radial direction are made large so that the flange 81 can tilt. In this situation, the grooves 86 and the protuberances 82, which protrude in a cross-like configuration, are in linear contact, and gaps are provided in the radial direction, so even if the manner in which the bushing 61 is attached causes the flange 81 to be pushed on at an angle, the flange 81 can tilt accordingly. Specifically, rotational aberration between the cylindrical member 80 and the flange 81 is prevented and a desired amount of relative tilting is allowed by means of the fit between these

protuberances 82 and the grooves 86.

A spline 87 is formed on the rear periphery of the bushing 61 and the inner periphery of the first friction plate 67 fits over this spline 87. The first friction plate 67 and the two second friction plates 68 are arranged in alternating fashion. The outer edges of the second friction plates 68 fit into spline grooves 89 which are formed along the inside of the cylindrical protuberance 2c. Rotatably supported friction facings 88a, 88b, and 88c are respectively located between the first friction plate 67 and the second friction plate 68, the second friction plate 68 and the flange 81, and the flange 81 and the front wall of the cylindrical protuberance 2c. The coil spring 70 supported by the cylinder-shaped support component 71 presses the first friction plate 67 and the second friction plates 68 together. This results in control of the relative rotation by means of the frictional contact between the bushing 61 and the reel body 2.

A fixing cap 72 is screwed from the outside onto the screw thread formed on the periphery of the cylindrical protuberance 2c and holds the support component 71 in a specified position. By means of adjusting the screw tightness of the fixed cap 72, the push force against each of the plates composing the friction contact member 66 can be changed and drag force can be adjusted. Moreover, the fixing cap 72 is fixed to the support component 71 by means of a bolt 73.

A description of this practical example is given below, focusing primarily on the operation of line recovery.

At the time of line recovery, a bail 45 is switched to line recovery position. When the handle 1a is rotated with the bail in this position, this rotational force is transferred via the shaft 10 and the master gear 11 to the pinion gear 12. The torque which is transferred to this pinion gear 12 is transferred via the front part of the pinion gear 12 to the rotor 3. In the meanwhile, the torque of the shaft 10 is transformed into a

forward and back motion with respect to the spool shaft 8 by means of the level wind component 6. Specifically, the spool 4 experiences reciprocal motion. As a result, the line which is guided by the bail 45 and a line roller 41 is evenly wound in the forward and back direction onto the line winding body 4b.

Due to the fixed bushing 51 which has been inserted into the center of the spool 4, even if a lot of line is wound onto the spool 4, the inside diameter of the spool 4 does not contract. In addition, the guide shaft 23 and a screw shaft 21 of the level wind component 6 are supported by the fixing plate 25, which is provided separately from the body 2a. The spool shaft 8 is also supported by this fixing plate 25 via the bearing 26, which averts any effect on the movement of a slider 22 even if the body 2a should bend due to a large load, thus allowing the slider 22 to travel smoothly.

The operation of the rear drag mechanism 7 will be explained next.

For example when a fish pulls the line with great force when the line is being wound by the handle 1a, the spool 4 attempts to rotate in the direction of letting out the line. This force is transferred to the bushing 61 via the spool shaft 8. Subsequently, if this force exceeds the frictional force of the friction-contact component 66, the spool 4 rotates.

Here, it is necessary to ensure a specified gap between the spool shaft 8 and the bushing 61 in the direction of the diameter in order to allow these two parts to slide relative to each other. In addition, depending on the condition in which the bushing 61 was attached, the flange 88 might tilt and be pushed against by the friction-contact component 66. In the past, when the flange tilts and is pushed in this manner, the gap [between the spool shaft and the bushing] had to be increased because the bushing would grind and the two parts would not slide smoothly. However, if the amount of space is increased, wobbling in the

direction of rotation increases, and there is less feeling during handle operation. In this practical example, however, the cylindrical component 80 of the bushing 61 and the flange 81 are connected by means of engaged protuberances 82 and grooves 86, thus preventing rotational aberrations between these parts as well as allowing for relative tilt of these parts. Therefore, even if the flange 81 tilts and is pushed against, the flange 81 tilts so that this force is absorbed and the cylindrical member 80 does not grind. As a result, the amount of space necessary between the spool shaft 8 and the cylindrical component 80 for a smooth sliding action can be minimized and wobbling in the direction of rotation is also reduced.

(Other Practical Examples)

(1) The connection means between the cylindrical member 80 and the flange 81 is not limited to engaged protuberances 82 and grooves 86, but can be any kind of means insofar as it allows the relative tilt of these two parts as well as prevents rotational aberrations.

(2) This invention can also be utilized in spinning reels in which the drag mechanism and the spool shaft are not concentric.

(Merits of the Invention)

In a spinning reel pertaining to invention 1, even if the flange is pushed against by the rotation control means, only the flange will tilt and the cylindrical member will not grind against the spool shaft since the connector means accommodates relative tilt by the flange and cylindrical member, and thus the cylindrical member supports the spool shaft such that the spool shaft can always slide smoothly. Since rotational aberration between the sleeve and flange is prevented by the connector means, rotational aberration between the cylindrical member and the flange is largely prevented, and wobble in the direction of rotation of the spool shaft is reduced.

In a spinning reel pertaining to invention 2, the connector means is composed of at least one protuberance and at least one groove into which the protuberance fits, which results in a simple structure for preventing rotational aberrations by the cylindrical member and the flange as well as accommodating relative tilting by these two parts in the axial direction.

In the spinning reel pertaining to invention 3, the protuberance is a columnar-shaped protuberance provided on the periphery of the cylindrical member, which results in continual linear contact between the protuberance and the groove, thus further preventing rotational aberrations by the cylindrical member and the flange as well as accommodating relative tilting by these two parts in the axial direction.

In the spinning reel pertaining to invention 4, the protuberance is a columnar-shaped protuberance formed as an integral piece with the cylindrical member set on its periphery, which makes the protuberance easy to form.

(Brief Description of the Figures)

(Figure 1)

A vertical cross section schematic of a practical example of the present invention.

(Figure 2)

A partial oblique view of the level wind component.

(Figure 3)

A partial cross section of the spool.

(Figure 4)

A vertical cross section of the rear drag mechanism.

(Figure 5)

An exploded oblique view of the bushing.

(Figure 6)

An enlarged cross section of the flange member

(Key)

- 1 Spinning reel
- 2 Reel body
- 3 Rotor
- 4 Spool
- 7 Rear drag mechanism
- 8 Spool shaft
- 61 Bushing
- 62 Friction-contact member
- 80 Cylindrical member
- 81 Flange member
- 82 Protuberance
- 86 Groove



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Claims

1. A spinning reel for mounting on a fishing rod, wherein the spinning reel is provided with:

a reel body that has a handle and that is mountable on a fishing rod;

a rotor that is supported by the aforementioned reel body and rotated by the aforementioned handle;

a spool that is located forward of the aforementioned rotor and supported on the aforementioned reel body such that it is capable of relative rotation as well as slide along the axis of rotation;

a spool shaft with a distal end fixed to the spool and a rear end that extends into the rear section of the aforementioned reel body;

a bushing that comprises a cylindrical member which is located at the periphery of the rear end of the aforementioned spool shaft and which supports the spool shaft such that relative rotation is prevented and such that it is capable of relative rotation as well as slide in the direction of the axis;

a flange member which is located rotatably at the periphery of the cylindrical member; and a linking member which links the cylindrical member and the flange member such that aberrations in rotation between the cylindrical member and the flange member are prevented while relative tilting of the two members in the direction of the axis is permitted; and

a rotation control means for controlling the relative rotation of the two components by pushing the aforementioned flange member towards the aforementioned reel body.

2. A spinning reel as defined in Claim 1 , wherein the connection means is composed of at least one protuberance, provided to either the aforementioned cylindrical member or a

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flange member, which projects radially, and at least one groove, provided to the other cylindrical member or flange member, into which the aforementioned protuberance fits.

3. A spinning reel as defined in claim 2, wherein the protuberance is a columnar protuberance provided to the periphery of the aforementioned cylindrical member.

4. A spinning reel as defined in Claims 2 or 3, wherein the protuberance is a columnar protuberance formed on the periphery of the aforementioned cylindrical member as one piece with the cylindrical member.