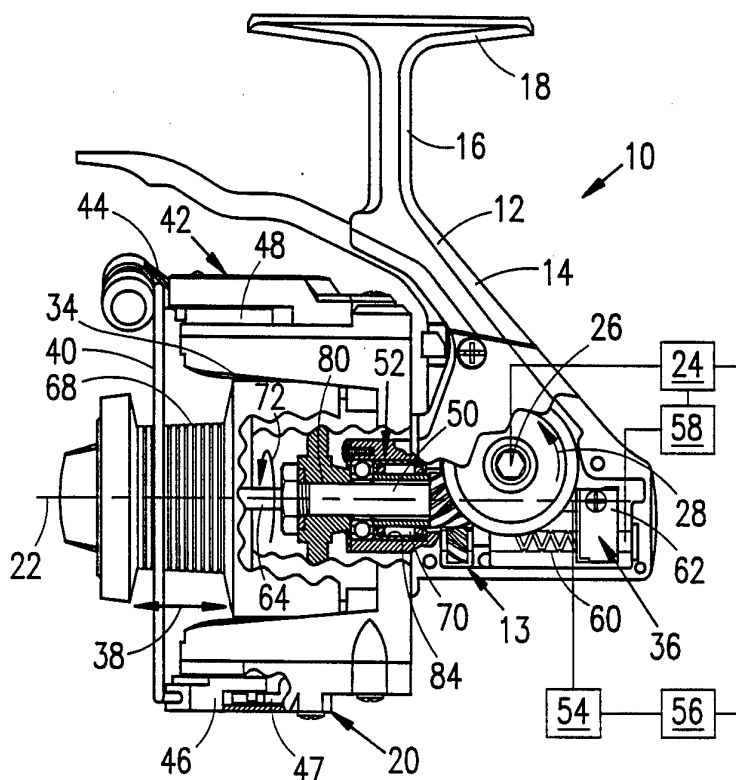




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(21) International Application Number: PCT/US93/02023 (22) International Filing Date: 10 March 1993 (10.03.93) (30) Priority data: 07/913,854 15 July 1992 (15.07.92) US (71) Applicant: ZEBCO CORPORATION [US/US]; 6101 East Apache Street, Tulsa, OK 74115 (US). (72) Inventor: FEEHAN, Richard, J. ; R.R. 3, Box 381, Pawnee, OK 74058 (US). (74) Agent: MORTIMER, John, S.; Wood, Phillips, Van Santen, Hoffman & Ertel, 500 W. Madison Street, Suite #3800, Chicago, IL 60661-2511 (US).		(81) Designated States: JP, KR, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i>

(54) Title: CONTINUOUS ANTI-REVERSE MECHANISM FOR A FISHING REEL



(57) Abstract

A fishing reel (10) has a structure (70) cooperating between drive train (126) and frame (12) downstream of first and second drive elements for preventing the rotor (20) from rotating in a second rotational direction that is opposite to a first rotational direction.

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CONTINUOUS ANTI-REVERSE MECHANISM FOR A FISHING REELBackground of the InventionField of the Invention

5 This invention relates to fishing reels of the type having a rotary element that is movable in a first rotational direction to direct line onto a line carrying spool and, more particularly, to a mechanism for preventing movement of the rotary element in a second rotational direction that is opposite to the first rotational direction.

10 Background Art

In virtually all types of fishing reels, a rotary element is utilized to direct line onto a line carrying spool. In a spinning reel, a rotor rotates in a line winding direction around an oscillating line carrying spool. In spin cast fishing reels, a spinner head rotates to wrap line around a line carrying spool. In bait cast fishing reels, the spool itself is rotated to retrieve line.

It is well known to incorporate anti-reverse mechanisms into all types of fishing reels to confine backward movement of the rotary element. It is common in all of these reel constructions to employ a cooperating pawl and ratchet to confine this backward rotation. Typically, the pawl directly or indirectly follows movement of the rotary element. With the rotary element advancing in a line retrieve direction, the pawl is disengaged from the ratchet. In response to backward rotation of the rotary element, the pawl shifts to contact the ratchet teeth and thereby arrest the backward movement of the rotary element.

There are at least two significant drawbacks with the pawl and ratchet anti-reverse mechanisms in the prior art. First of all, the ratchet teeth are normally spaced

2

from each other sufficiently that a certain amount of backward movement of the rotary element occurs before the pin locks in between adjacent ratchet teeth. This lag time, commonly referred to in the industry as a "dead spot", is undesirable particularly when the fisherman is setting the hook in a fish's mouth.

This lag time is not only undesirable from the standpoint of how it compromises the performance of the fishing reel, but it also may result in damage to the fishing reel. For example, as the user snaps the rod to set the hook, the rotor, spinner head, or spool back up and jolt the drive train downstream of where the anti-reverse mechanism is situated. Consequently, over time, there may be excessive wear on, or premature failure of, the reel parts.

One proposed solution to the above problem has been to increase the number of ratchet teeth to thereby diminish the lag time. However, this solution is somewhat self-defeating in that the finer teeth are more prone to being sheared by the pawl during operation.

Another problem with the prior art anti-reverse mechanisms is that they are normally located on the drive train so that a substantial portion of the drive train moves in reverse prior to the anti-reverse mechanism's locking. Further, the shock induced by the arresting of the backward movement of the rotary element may be transmitted through a significant portion of the drive train. The problem of parts being excessively stressed and/or failing is thus constantly contended with.

30 Summary of the Invention

The present invention is specifically directed to overcoming the above enumerated problems in a novel and simple manner.

More particularly, the present invention comprehends a fishing reel having a frame, a line carrying spool on the frame, a rotor mounted to the frame for rotation relative thereto about an axis, a bail assembly mounted on the rotor for movement relative thereto between cast and retrieve positions and causing line to be directed onto the line carrying spool as the rotor is rotated in a first rotational direction with the bail assembly in its retrieve position, a structure for actuating the rotor, a drive train downstream of the rotor actuating structure for causing the rotor to be rotated as the rotor actuating structure is operated, first and second cooperating and relatively movable drive elements on the drive train, and structure cooperating between the drive train and frame downstream of the first and second drive elements for preventing the rotor from rotating in a second rotational direction that is opposite to the first rotational direction.

With the inventive structure, the first and second cooperating and relatively movable drive train elements are protected from forces induced by the rotor as it moves in the second rotational direction. With the inventive structure, it is not necessary to promptly arrest rotation as the sensitive drive train elements can be protected by the rotation preventing structure.

In one form of the invention, the preventing structure operates full-time to continuously prevent rotation of the rotor in the second rotational direction.

In one form, the rotor has a shaft that is fixed for rotation therewith. The preventing structure cooperates between the frame and the rotor shaft.

In one form, the preventing structure is a clutch ring that surrounds either the rotor shaft or another appropriate rotated element.

4

In one form, the first element is a first gear on the rotor shaft and the second element is a second gear in mesh with the first gear and the preventing structure is located downstream of the first and second gears. The
5 first gear may be a pinion gear, and, in one form, the preventing structure is located adjacent thereto.

The invention further comprehends a fishing reel having a frame, a line carrying spool on the frame and having an axis, a structure rotatable about the axis of the
10 line carrying spool for directing line onto the line carrying spool, an actuating structure for the line directing structure, a drive train downstream of the actuating structure for causing the line directing structure to be rotated in a first rotational direction about the line carrying
15 spool axis as the actuating structure is operated to direct line onto the line carrying spool, first and second cooperating and relatively movable drive elements on the drive train, and structure cooperating between the drive train and frame downstream of the first and second guide elements
20 for preventing the line directing structure from rotating in a second rotational direction that is opposite to the first rotational direction.

The inventive structure can be incorporated into all different types of fishing reels and achieves the same
25 result in each. For example, the fishing reel could be a bait cast type reel in which the line carrying spool itself is rotated to direct the line thereon. The spool may have a shaft fixed thereto which is in a location that is suitable to be operated on by the rotation preventing structure.
30

Alternatively, the line directing structure could be a spinner head on a spin cast fishing reel, which spinner head could also have a fixed shaft to cooperate with the line preventing structure.

In a bait cast reel, drag structure is commonly provided to allow the line carrying spool to be rotated in the second rotational direction upon the application of a predetermined torque on the line carrying spool. The preventing structure preferably cooperates between the drive train and housing downstream of the drag structure.

Brief Description of the Drawings

Fig. 1 is a cross-sectional view of a spinning-type fishing reel having an anti-reverse mechanism according to the present invention therein;

Fig. 2 is a schematic representation of a spin cast fishing reel with the present invention incorporated therein;

Fig. 3 is a schematic representation of a bait cast reel with the present invention incorporated therein;

Fig. 4 is a cross-sectional view of a one-way clutch ring that can be used as part of the inventive anti-reverse mechanism;

Fig. 5 is an end elevation view of the clutch ring of Fig. 4;

Fig. 6 is a side elevation of a conventional pawl and ratchet anti-reverse mechanism; and

Fig. 7 is a cross-sectional view of a portion of a bait cast reel having a conventional, continuous anti-reverse mechanism incorporated therein.

Detailed Description of the Drawings

In Figure 1, one type of fishing reel is shown that is suitable for incorporation of the present invention. The fishing reel at 10 is a spinning-type fishing reel. The details of the operating mechanism for a conventional spinning reel are set out fully in U.S. Patent No.

4,676,450, to Carpenter et al, which is incorporated herein by reference.

5 Briefly, the spinning reel 10 has a frame 12 that contains the internal operating mechanism 13 for the reel 10. The frame 12 defines a housing 14 that extends upwardly to define a mounting stem 16, which terminates in a mounting foot 18 that can be attached to a fishing rod (not shown) in conventional fashion.

10 The frame 12 carries a rotor 20 at its forward end. The rotor 20 is mounted to the frame 12 for rotation about a fore and aft axis 22. Rotation is imparted to the rotor 20 by a crank handle, shown schematically at 24. Rotation of the crank handle 24 about a laterally extending axis 26, in the direction of arrow 28, through the operating mechanism 13, effects rotation of the rotor 20 about
15 the axis 22 in a line winding direction.

The rotor 20 is configured to direct line onto a line carrying spool 34 in a wrapping motion. An internal oscillating mechanism 36, also operated by the crank handle
20 24, moves the spool 34 in a reciprocating fore and aft path as indicated by double-headed arrow 38, so that line 40 is evenly distributed along the length of the line carrying spool 34.

The line 40 is wrapped around the spool 34 by a
25 bail assembly at 42. The bail assembly 42 is attached to the rotor 20 to follow movement thereof and has diametrically opposite arms 44,46 that are pivotably attached to the rotor 20 to allow the bail assembly 42 to be selectively repositioned about an axis 47 between a cast position,
30 shown in solid lines, and a retrieve position, shown in phantom lines, in Fig. 1.

The bail arm 44 has a wall 48 that draws the line 40 around the spool 34 as the rotor 20 is operated. Operation of the crank handle 24 simultaneously rotates the

rotor 20 and causes the oscillating mechanism 36 to reciprocate the line carrying spool 34 in a fore and aft direction.

5 More specifically, the rotor 20 is carried on a shaft 50 that is journaled for rotation relative to the frame 12 through a bearing assembly 52. The shaft 50 carries a pinion gear 54 (shown schematically in Fig. 1) at its rear end, to mesh with a face gear 56 (also shown schematically in Fig. 1) that is rotated by the crank handle 24 about the laterally extending axis 26. The crank handle 24, through a gear, or other suitable component, shown schematically at 58 in Fig. 1, effects rotation of a worm shaft 60 about its length. The worm shaft 60 has an associated follower 62 that connects to a shaft 64 projecting rearwardly from the spool 34 and moves the spool 34 reciprocally in a fore and aft direction as the crank handle 24 is operated.

15 Accordingly, the crank handle simultaneously effects rotation of the rotor 20 and operation of the oscillating mechanism 36 so that the line 40 is evenly distributed along the fore and aft extent of a recessed line receptacle 68 defined on the spool 34.

20 According to the invention, a one-way clutch ring/bearing 70 is incorporated into the reel 10 to prevent backward rotation of the rotor 20, in the direction of arrow 72, i.e. in a counterclockwise direction as viewed from the front of the reel 10. The clutch ring 70 surrounds the rotor shaft 50 forwardly of the pinion gear 54 and cooperates with the frame 12 to continuously prevent other than forward rotation of the rotor shaft 50.

25 30 The clutch ring 70 is shown in greater detail in Figs. 4 and 5. The clutch ring 70 has an outer housing 74 with an inner race 76. The housing 74 and race 76 cooperatively support cylindrical rollers 78 in equidistantly

spaced relationship. The rollers 78 define an inside diameter closely matched to the diameter of the outer surface 80 of the rotor shaft 50. The outer surface 82 of the clutch ring 70 has an undulating configuration to be keyed against rotation within a receptive bore 84 defined in the reel frame 12.

A suitable one-way clutch ring is currently commercially available through Koyo Seiko and identified by its number P/N 1WC1012 one-way roller bearing. Other types of clutch rings are contemplated by the invention.

It can be seen that any force tending to torque the rotor 20 backwards is absorbed by the clutch ring 70 so as not to be transmitted to the pinion gear 54 or any other drive train element upstream of the clutch ring 70.

Because the clutch ring 70 instantaneously arrests backward movement of the rotor shaft 50, the drive train is not shocked, as occurs with prior art anti-reverse mechanisms which have a built in lag. Consequently the entire drive train for the reel is protected.

The invention can be practiced in other types of fishing reels, such as a spin cast reel, as shown schematically at 86 in Fig. 2, and a bait cast reel, shown schematically at 88 in Fig. 3.

The spin cast reel 86 has a line carrying spool 90. A spinner head 92 rotates about a fore and aft axis 94 to direct line onto the spool 90 as a crank handle 96 is operated. The crank handle rotates a face gear 98 about a laterally extending axis 100. The face gear 98 is in mesh with a pinion gear 102 which connects to a shaft 104 that carries the spinner head 92.

In the spin cast reel 86, the clutch ring 70 is preferably located on the spinner head shaft 104 between the spool 90 and the pinion gear 102. Accordingly, any backward torque on the spinner head 92 is absorbed by the

clutch ring 70 so as not to be transmitted to the pinion gear 102 or either of the face gear 98 or crank handle 96 in the drive train.

5 In the bait cast reel 88 in Fig. 3, a spool 106 is shown to be rotatable about an axis 108. A crank handle 110 rotates a shaft 112 that is fixed to and coaxial with the spool 106, to effect rotation of the spool 106 and thereby direct line thereon. The crank handle 110 applies the spool rotating torque on the spool shaft 112 through a
10 drag mechanism 114 and a gear coupling 116.

The inventive clutch ring 70 is preferably located downstream of both of the drag mechanism and gear coupling so that the backward torque exerted by the spool 106 is fully absorbed by the clutch ring 70 so as not to be
15 transmitted to either of the drag mechanism 114 or gear coupling 116.

The clutch ring 70 is preferably constructed to afford full-time continuous one-way braking. The clutch ring 70 described above arrests backward rotation almost
20 instantaneously. This is a significant improvement over conventional pawl and ratchet anti-reverse mechanisms as shown at 120 in Fig. 6. The anti-reverse mechanism 120 has a toothed ratchet wheel 124 that is connected to the reel drive train 126 to rotate in a clockwise direction as the
25 drive train is moved forwardly and in a counterclockwise direction as the drive train 126 is moved backwardly.

The ratchet wheel 124 cooperates with a pawl 128 that is pivotable about an axis 130 that is substantially parallel to the axis 132 of the ratchet wheel 124. The
30 pawl has a sharp nose 134 that rides over the teeth 136 on the ratchet wheel 124 with the drive train 126 operating in a forward direction. Rearward movement of the drive train causes the nose 134 on the pawl 128 to wedge into the root

138 between adjacent teeth 136 and thereby stop rotation of the ratchet wheel 124.

5 It can be seen that there is a significant circumferential spacing X between adjacent teeth 136. If the backward movement of the drive train 126 is initiated with the pawl nose 134 on the apex 140 of one of the teeth 136, the ratchet wheel 124 will pivot backwardly the full distance X before the pawl 128 blocks rotation. Depending upon the size of the teeth, this distance X may be very
10 substantial.

Additionally, the teeth 136 are prone to being sheared off by the pawl 128 during operation.

15 In Fig. 7, a conventional casting reel is shown at 144 with a one-way clutch ring 146 incorporated therein. The reel 144 has a line carrying spool 148 that is rotatable about an axis 150 to cause line to be wrapped around the spool 148. The spool 148 has a shaft 152 fixed thereto and projecting laterally beyond the one side 154 of the spool 148.

20 A crank handle 156 rotates a crank shaft 158 about an axis 160 that is substantially parallel to the spool axis 150. The crank shaft 158 has a drive gear 162 remote from the crank handle 156 that is in mesh with a gear 164 on the spool shaft 152. A friction-type drive
25 mechanism 168 determines the holding force of the drive gear 162 on the crank shaft 158 and is settable to vary the reel drag characteristics.

30 It can be seen that the clutch ring 146 is attached to the crank shaft 158 downstream of both the drag mechanism 168 and cooperating gears 162,164. Accordingly, backward movement of the spool is transmitted through the drag mechanism 168 and gears 162,164 before being arrested by the clutch ring 146. Accordingly, the drive mechanism 168 and gears 162,164 are prone to being damaged or worn

under the forces applied as the spool 148 is rotated in a backward direction. The present invention obviates this problem.

5 The foregoing disclosure and specific embodiments is intended to be illustrative of the broad concepts comprehended by the invention.

CLAIMS

1. A fishing reel comprising:
- 2 a frame;
- 4 a line carrying spool on the frame;
- 6 a rotor mounted to the frame for rotation relative thereto about an axis;
- 8 a bail assembly;
- 10 means for mounting the bail assembly on the rotor for movement relative thereto between cast and retrieve positions,
- 12 said bail assembly causing line to be directed onto the line carrying spool as the rotor is rotated in a first rotational direction with the bail assembly in its retrieve position;
- 14 rotor actuating means;
- 16 drive train means downstream of the rotor actuating means for causing the rotor to be rotated as the rotor actuating means is operated,
- 18 said drive train means including first and second cooperating relatively movable drive elements; and
- 20 means cooperating between the drive train means and frame downstream of the first and second drive elements for preventing the rotor from rotating in a second rotational direction that is opposite to the first rotational
- 22 direction.
- 24

2 2. The fishing reel according to claim 1 wherein
the preventing means comprises a full-time continuous means
4 for preventing rotation of the rotor in said second rota-
tional direction.

2 3. The fishing reel according to claim 1 wherein
the preventing means comprises a clutch ring.

2 4. The fishing reel according to claim 1 wherein
said rotor has a shaft that is fixed for rotation therewith
and the preventing means surrounds the rotor shaft and
4 cooperates between the frame and the rotor shaft.

2 5. The fishing reel according to claim 4 wherein
the first element comprises a first gear on the rotor shaft
and the second element comprises a second gear in mesh with
4 the first gear, said preventing means being downstream of
the first and second gears.

2 6. The fishing reel according to claim 5 wherein
the first gear comprises a pinion gear and the preventing
means is located adjacent to the pinion gear.

2 7. The fishing reel according to claim 5 wherein
the preventing means surrounds the rotor shaft.

8. A fishing reel comprising:
2 a frame;
a line carrying spool on the frame,
4 said line carrying spool having an axis;
means rotatable about the line carrying spool
6 axis for directing line onto the line carrying spool;
actuating means for the line directing means;
8 drive train means downstream of the actuating
means for causing the line directing means to be rotated in
10 a first rotational direction about the line carrying spool
axis as the actuating means is operated to direct line onto
12 the line carrying spool,
said drive train means including first and second
14 cooperating relatively movable drive elements; and
means cooperating between the drive train means
16 and frame downstream of the first and second guide elements
for preventing the line directing means from rotating in a
18 second rotational direction that is opposite to the first
rotational direction.

9. The fishing reel according to claim 8 wherein
2 the line directing means comprises the line carrying spool
which is rotated to direct line thereon.

10. The fishing reel according to claim 9 where-
2 in the line carrying spool has a shaft that is fixed for
rotation therewith and the preventing means cooperates
4 between the spool shaft and the frame.

11. The fishing reel according to claim 10
2 wherein the preventing means comprises a clutch ring.

12. The fishing reel according to claim 9 where-
2 in the drive train means includes drag means for allowing
the line carrying spool to be rotated in a second rotation-
4 al direction upon the application of a predetermined torque
on the line carrying spool and the preventing means cooper-
6 ates between the drive train means and housing upstream of
the drag means.

13. The fishing reel according to claim 10
2 wherein the preventing means comprises a clutch ring that
surrounds the spool shaft.

14. The fishing reel according to claim 9 where-
2 in the preventing means comprises a full-time continuous
means for preventing rotation of the line carrying spool in
4 the second rotational direction.

15. The fishing reel according to claim 8 where-
2 in the line directing means comprises a rotor.

16. The fishing reel according to claim 8 where-
2 in the fishing reel is a spinning fishing reel.

17. The fishing reel according to claim 8 where-
2 in the fishing reel is a spin cast fishing reel.

18. The fishing reel according to claim 8 where-
2 in the line directing means comprises a spinner head for
directing line onto the line carrying spool as the spinner
4 head is rotated.

19. The fishing reel according to claim 18
2 wherein the spinner head has a shaft that is fixed to the
spinner head to rotate therewith and the preventing means
4 comprises means cooperating between the spinner head shaft
and the frame.

20. The fishing reel according to claim 19
2 wherein the preventing means comprises a full-time continu-
ous means for preventing rotation of the spinner head in
4 the second rotational direction.

21. The fishing reel according to claim 20
2 wherein the preventing means comprises a clutch ring that
surrounds the spinner head shaft.

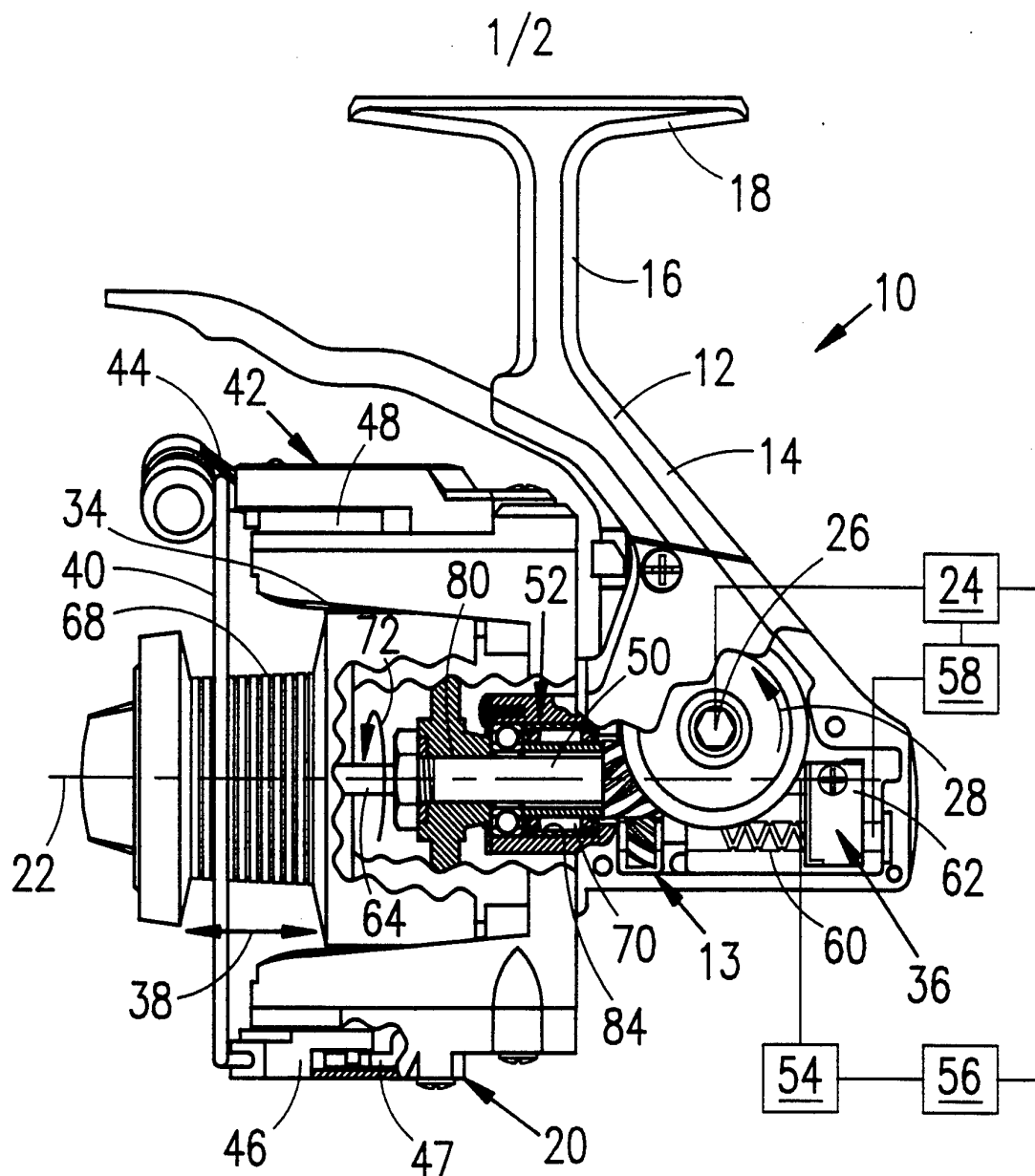


Fig. 1

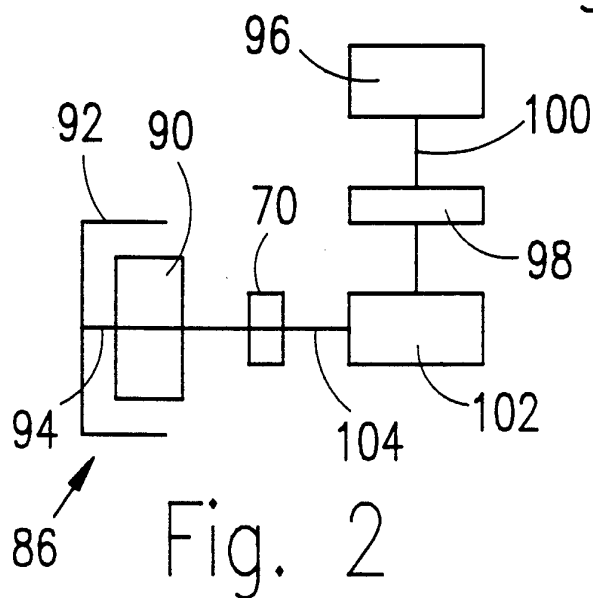


Fig. 2

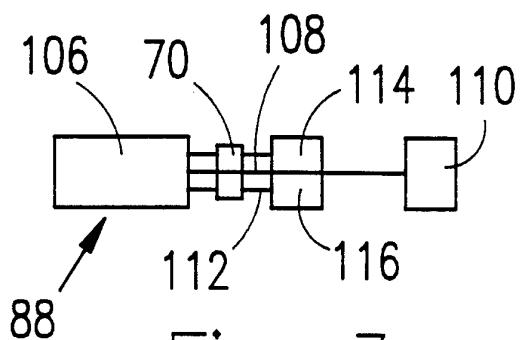


Fig. 3

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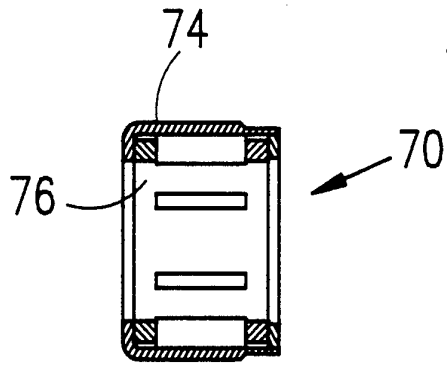


Fig. 4

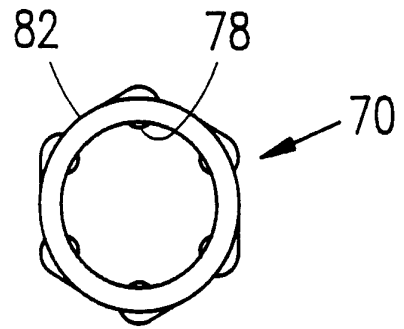


Fig. 5

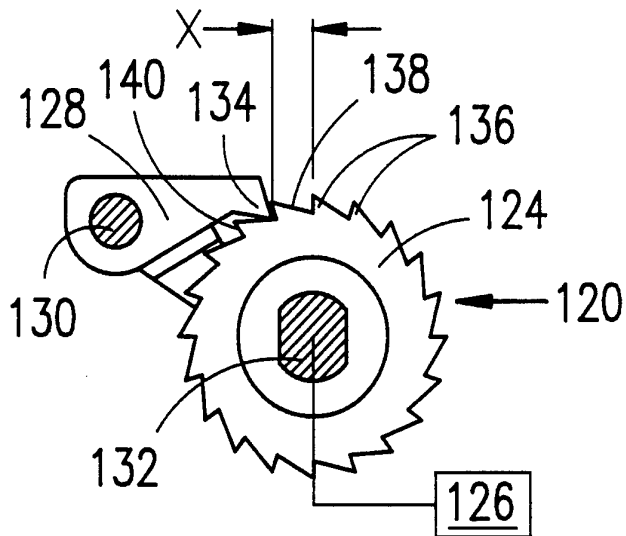


Fig. 6
(PRIOR ART)

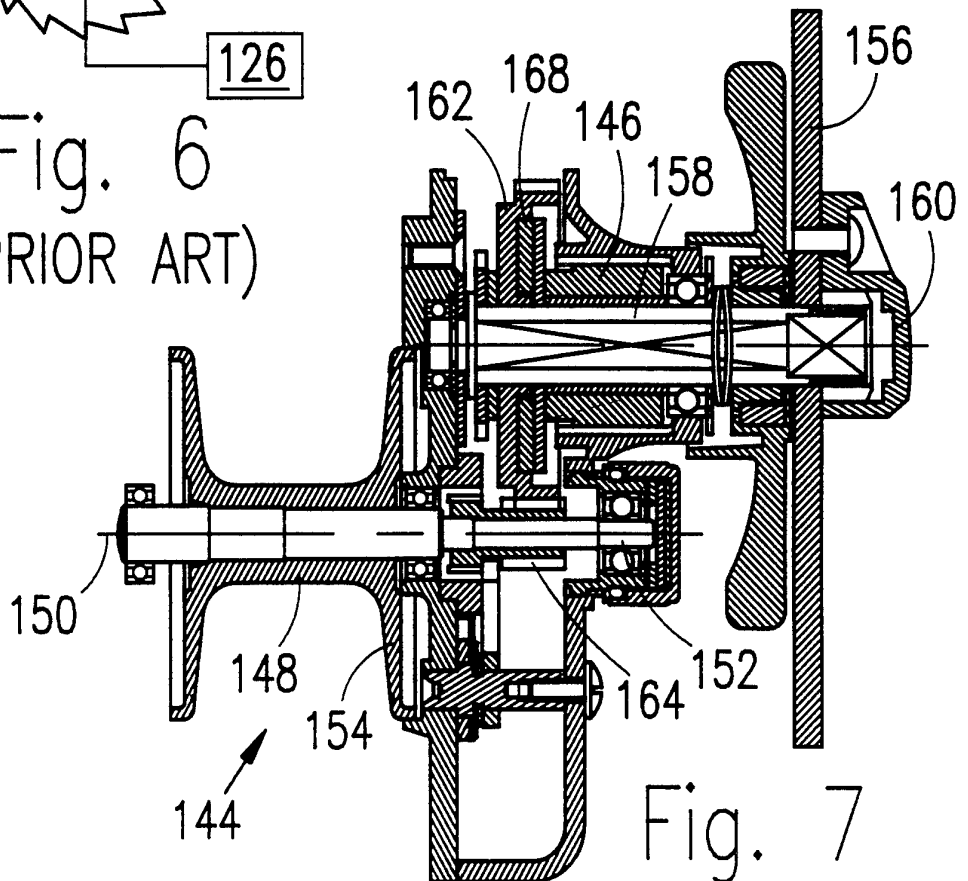


Fig. 7
(PRIOR ART)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/02023

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) : A01K 89/01

US CL : 242/247, 248, 298

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 242/247, 248, 298

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 5,020,738 (Yamaguchi) 04 June 1991, col. 11, lines 21-56 and col.12, lines 1-44.	1-17
X	US, A, 3,298,456 (Wood) 03 August 1965, col. 3, lines 4-21.	8 and 17-21
A	US, A, 3,050,271 (Hull) 21 August 1962	1-21
A	US, A, 3,146,966 (Dunn) 01 September 1964	1-21
A	US, A, 3,259,333 (Hull) 05 July 1966	1-21
A	US, A, 4,676,450 (Carpenter et al.) 30 June 1987	1-21

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search

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Authorized officer

MICHAEL R. MANSEN

Telephone No. (703) 308-0771

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/02023

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 4,923,141 (Sazaki et al.) 08 May 1990	1-21
A	US, A, 5,042,741 (Aota) 27 August 1991	1-21
P	US, A, 5,139,214 (Sato) 18 August 1992	1-21