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(54) **Recoil starter**

Seilstarter

Lanceur à rappel

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## Description

BACKGROUND OF THE INVENTION

Field of the Invention

**[0001]** An aspect of the present invention relates to a recoil starter in which a rope is pulled to rotate to transmit rotation of the rope reel to a drive pulley connected to an engine crankshaft via a clutch mechanism to thereby start the engine.

Background Art

**[0002]** There is known a recoil starter including a rope reel around which a rope is wound and which is rotationally urged by a recoil spring to rewind the rope, a cam to be engaged with a drive pulley coupled to an engine via a centrifugal clutch to thereby transmit the rotation of the rope reel to the drive pulley, and a damper power storage mechanism interposed between the rope reel and the cam. Rotational power of the rope reel is stored in the damper power storage mechanism and then transmitted to the drive pulley via the cam to start the engine, so that impact due to an abrupt change in an engine-side is not transmitted to the rope reel side.

**[0003]** In such recoil starter, the damper power storage mechanism includes a power storage spring which is disposed within a recess portion on a lateral surface of the rope reel. The damper power storage mechanism also includes, as an engaging/disengaging means, a ratchet member mounted on a radial-outer portion of the rope reel and an engaging portion formed on an outer circumferential surface of the cam, the ratchet member and the engaging portion being made to engage with and disengage from each other. When the rope reel rotates in an engine-starting direction to coil up the power storage spring, the ratchet member is not in engagement with the engaging portion. And, when the rope reel rotates in an opposite direction to the engine-starting direction, the ratchet member is brought into engagement with the engaging portion so as to hold a coiled-up condition of the power storage spring, thereby storing power in the power storage spring (for example, refer to JP-2008-180144-A).

**[0004]** In the damper power storage mechanism of such coil starter, the ratchet member is disposed radially-outside the cam. Since the power storage spring of the damper power storage mechanism is accommodated within the recess portion on the lateral surface of the rope reel, when the ratchet member is mounted on of the outer circumferential portion of the rope reel, the accommodation space for the power storage spring is reduced or narrowed accordingly. To avoid the increase in size, for example, only one ratchet member may be provided.

**[0005]** When only one ratchet member is used, the operating power is not uniformly dispersed or applied between the rope reel and the cam, and hence, the operating power may be applied therebetween while being offset in one direction.

**[0006]** Further, since the ratchet member is disposed radially-outside the cam, dirt and dust easily enter into the ratchet member, for example, through a gap between a rotating pivot of the ratchet member and a bearing portion of the cam.

**[0007]** EP 1647706 A1 discloses a recoil starter-in which a side face of a rope reel is formed-with a ring-like recess portion for containing a damping force storing member, a boss portion of a cam is contained at inside of the ring-like recess portion and the damping force storing member is contained between an inner peripheral face of the ring-like recess portion and an outer peripheral face of the boss portion of the cam. An inner side of the boss portion of the cam is formed with a ratchet mechanism for engaging and disengaging the cam to and from the rope reel, when the rope reel is rotated by traction of the recoil rope, the both members are disengaged from each other, and when the rope reel is rotated in a direction of reeling back the recoil rope, the both members are engaged with each other.

SUMMARY OF THE INVENTION

**[0008]** One of objects of the invention is to provide a recoil starter which has a compact construction, as well as superior functionality and dustproofness and which can realize a reduction in weight and size.

**[0009]** According to an aspect of the present invention, there is provided a recoil starter including: a case that is disposed on a surface of an engine; a reel pivot that is formed on the case; a rope reel that is rotatably supported on the reel pivot and that has a reel portion formed on an outer circumference thereof around which a rope is wound; a recoil spring that rotationally urges the rope reel to rewind the rope; a cam that is engageable with the engine via a clutch so as to transmit a rotational power to the engine; a power storage spring that is interposed between the rope reel and the cam to store a rotational power of the rope reel and that transmits the stored rotational power to the cam to thereby start the engine; and a power storage ratchet mechanism that is disposed between facing surfaces of the rope reel and the cam and that is configured to disengage the rope reel and the cam so that the power storage spring is coiled up when the rope reel rotates in an engine-starting direction, and engage the rope reel and the cam so that the rope reel and the cam rotate together while keeping a coiled-up condition of the power storage spring when the rope reel rotates in an opposite direction to the engine-starting direction.

**[0010]** The power storage ratchet mechanism includes: a cam groove that is formed on a surface of the cam which faces to the rope reel; a ratchet member that is disposed on a surface of the rope reel which faces to the cam and that includes a ratchet pawl engageable with the cam groove; and a friction plate that is disposed between the ratchet member and the cam. And, the friction plate may be configured to retreat the ratchet pawl to disengage the ratchet pawl and the cam groove by being rotated in the engine-starting direction linkedly with the rope reel; and release the ratchet pawl to engage the ratchet pawl and the cam groove by being rotated in the opposite direction linkedly with the rope reel.

**[0011]** The friction plate may include an opening defined therein. The ratchet pawl may be engaged to the cam groove by passing through the opening in the friction plate. And, the ratchet pawl may be disengaged from the cam groove by being retreated along a peripheral edge of the opening.

**[0012]** The opening of the ratchet pawl may be a hole or a notch.

**[0013]** A plurality of cam grooves may be formed on the cam. A plurality of ratchet pawls may be formed on the ratchet member. And, a plurality of openings may be defined in the friction plate.

**[0014]** The cam grooves, the ratchet pawls and the openings may be circumferentially arranged at equal intervals, respectively.

**[0015]** The number of the cam grooves may be twice the number of the ratchet pawls.

**[0016]** The ratchet pawl may be formed to have a triangular sectional shape or a trapezoidal sectional shape.

**[0017]** The ratchet member and the ratchet pawl may form a sectional shape including at least: a flat portion parallel with an axis direction of the reel pivot; a vertical portion perpendicular to the axis direction; and a inclined portion connecting the vertical portion and the flat portion.

**[0018]** The ratchet member may be urged toward the cam by a spring.

**[0019]** The friction plate may be frictionally rotated linkedly with the rope reel via a wave washer.

**[0020]** According to the above configuration, when the rope reel is rotated in the engine-starting direction by pulling out the rope, the engagement between the rope reel and the cam is released by the power storage ratchet mechanism, whereby since only the rope reel rotates, the power storage spring is coiled up. Conversely, when the rope reel rotates in the opposite direction to the engine-starting direction, the rope reel and the cam are brought into engagement with each other and the rope reel and the cam rotate together, whereby since the rope reel and the cam rotate together, power stored in the power storage mechanism is so kept.

**[0021]** When the rope reel is rotated in the engine-starting direction again by pulling out the rope, the power storage spring is coiled up further, whereas when the rope reel rotates reversely, the rope reel and the cam rotate together with the stored power held as it is. Then, in the event that a sufficiently strong spring power is stored in the power storage spring in the way described above, when the rope reel is rotated in the engine-starting direction, the cam rotates by virtue of the spring force stored in the storage spring, whereby the engine starts.

**[0022]** Since the power storage ratchet mechanism is provided between the confronting surfaces of the rope reel and the cam, the power storage ratchet mechanism is made difficult to be affected by dirt and dust at a working site and is hence superior in dustproofness. Further, since the power storage ratchet mechanism can be configured as the compact structure between the facing surfaces, there is required no large installation space for the same mechanism. Consequently, the recoil starter can be reduced in size and weight.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0023]**

Fig. 1 sectionally illustrates a recoil starter according to an embodiment.

Fig. 2 is an exploded perspective view of the recoil starter.

Figs. 3A and 3B are sectional views taken along the line A-A in Fig. 1, Fig. 3A illustrating a condition where a rope is rewound (stored power is held), Fig. 3B illustrating a condition where the rope is pulled (power is stored).

Fig. 4 is a sectional view taken along the line B-B in Fig. 1.

Figs. 5A and 5B illustrate operating conditions of a power storage ratchet mechanism (damper power storage mechanism) according to the embodiment, Fig. 5A illustrating a condition where the rope is rewound (stored power is held), Fig. 5B illustrating a condition where the rope is pulled (power is stored).

## DETAILED DESCRIPTION OF EMBODIMENTS

**[0024]** An embodiment of the invention will be described based on Figs. 1 to 5B. As is illustrated in the sectional view in Fig. 1 and the exploded perspective view in Fig. 2, a recoil starter according to the embodiment includes a case 1 which is formed to cover a part of an engine (not shown) while accommodating a main part of the recoil starter thereinside. A reel pivot 2 is formed on an inner wall surface of the case 1 so as to confront a crankshaft of the engine. A rope reel 4 and a cam 6 are supported rotatably on the reel pivot 2. A rope 3 is wound around the rope reel 4.

**[0025]** The rope 3 is wound round a reel portion 4a formed on an outer circumferential surface of the rope reel 4 so that one end thereof is fixed to the rope reel 4 and the other end thereof is pulled out of the case 1 (not shown). The rope reel 4 is driven to rotate about the reel pivot 2 by pulling the rope 3 at the other end.

**[0026]** As shown in Fig. 1, a recoil spring 5 is disposed between a right-hand surface (in the figure) of the rope reel 4 and the inner wall surface of the case 1 which faces to the right-hand surface. When the rope reel 4 has been rotated in an engine-starting direction by pulling the rope 3 out of the reel portion 4a, the recoil spring 5 rotates the rope reel 4 in an opposite direction so as to rewind the rope 3 onto the rope reel 4.

**[0027]** A recoil spring accommodation portion 1a is formed integrally on an inner surface of the case 1. An inner-side end portion of the recoil spring 5 is fixed to a portion of the rope reel 4 where the rope reel 4 is supported on the reel pivot 2, while the other outer-side end portion is fixed to an annular inner circumferential surface of the recoil spring accommodation portion 1a. When the rope reel 4 is rotated in the engine-starting direction by pulling out the rope 3, a rotational power is stored in the recoil spring 5. And, when the rope 3 is released, the rope reel 4 is rotated in an opposite direction to the engine-starting direction by virtue of the rotational power stored in the recoil spring 5, thereby rewinding the pulled-out rope 3 onto the rope reel 4.

**[0028]** The cam 6 is supported rotatably on the reel pivot 2 at a distal side thereof, and a cam piece 6a is formed on an outer circumferential surface of the cam 6 so as to be brought into engagement with a clutch mechanism formed on a drive pulley (not shown) that is mounted on the crankshaft of the engine. The cam 6 is supported rotatably on the reel pivot 2 together with the rope reel 4 by a fixing member 7. For example, the fixing member 7 has a screw to be screwed into an end portion of the reel pivot 2.

**[0029]** For example, a centrifugal clutch mechanism is formed on the drive pulley as the clutch mechanism, and the centrifugal clutch mechanism includes a centrifugal ratchet (not shown) rotationally urged by a spring (not shown) toward the cam piece 6a formed on the cam 6. When the cam 6 is rotated in the engine-starting direction, the centrifugal ratchet is brought into engagement with the cam piece 6, thereby rotating the drive pulley in the engine-starting direction.

**[0030]** When the engine starts and the drive pulley is rotated via the crankshaft, the centrifugal ratchet rotates against an urging force of the spring by virtue of centrifugal force and moves away from the cam piece 6a, so that a rotation is not transmitted from the engine side to the recoil starter side.

**[0031]** As is shown in Fig. 1, an annular recess portion 8 is formed on a left-hand lateral surface (in the figure) of the reel portion 4a of the rope reel 4 to accommodate a power storage spring 9, which constitutes a damper power storage means, therein. Outer-side end of the power storage spring 9 is fixed to an annular inner circumferential surface of the recess portion 8, while inner-side end thereof is fixed to an outside of a cylindrical portion 6c of the cam 6.

**[0032]** The rope reel 4 and the cam 6 are connected together via the power storage spring 9 to transmit a rotation from the rope reel 4 to the cam 6 via the power storage spring 9. When the cam 6 is prevented from rotating by a starting resistance of the engine, a relative rotation is generated between the cam 6 and the rope reel 4, and the power storage spring 9 stores the rotational power of the rope reel 4.

**[0033]** A power storage ratchet mechanism 10 is provided between facing surfaces of the rope reel 4 and the cam 6 at radial-inner portions thereof. When the rope reel 4 rotates in the engine-starting direction by the rope 3 being pulled out, the ratchet mechanism 10 disengages the rope reel 4 and the cam 6 so as to cause them to move away from each other. On the other hand, when the rope reel 4 rotates in the opposite direction to rewind the pulled-out rope 3, the ratchet mechanism 10 engages the rope reel 4 and the cam 6 with each other so as to be dynamically integrated, whereby the rope reel 4 and the cam 6 rotate together in the opposite direction of the engine-starting direction.

**[0034]** The ratchet mechanism 10 includes a ratchet member 11 having ratchet pawls 11a, cam grooves 6b on the cam 6, and a friction plate 12. An annular recess portion 4b is formed on the left-hand surface (in the figure) of the rope reel 4, and the ratchet member 11 is disposed in the recess portion 4b so that the ratchet member 11 rotates together with the rope reel 4. The cam grooves 6a on the cam 6 are disposed to confront the ratchet member 11, and the ratchet member 11 is urged from an inside of the recess portion 4b toward the cam grooves 6 by an urging spring 13 at all times so as to engage with and disengage from the cam grooves 6a. The friction plate 12 is disposed loosely between the ratchet pawls 11a of the ratchet member 11 and the cam grooves 6b of the cam 6 so as to regulate engagement/disengagement of the ratchet pawls 11a and the cam grooves 6a.

**[0035]** In this embodiment, the ratchet member 11 is formed into a ring-like shape having three ratchet pawls 11a spaced away from each other at equal intervals in a circumferential direction. For example, the three ratchet pawls 11a are made up of serrated projecting pawl portions which each includes a vertical portion, an inclined portion and a flat portion lying between the projecting pawl portions 11a (refer to Figs. 3A, 3B, 5A, 5B).

**[0036]** In this embodiment, the cam grooves 6b are formed on the right-hand surface (in the figure) of the cam 6, which confront the ratchet pawls 11a of the ratchet member 11, so that the cam grooves 6b can engage with and disengage from the ratchet pawls 11a. For example, six cam grooves 6b disposed at equal intervals in the circumferential direction are formed. And, the cam grooves 6b are made up of serrated recess portions each including a vertical portion, an inclined portion and a projecting flat portion lying between the recess portions to be engaged with the projecting ratchet pawls 11a of the ratchet member 11 (refer to Figs. 4, 5A, 5B).

**[0037]** The friction plate 12, which is disposed loosely between the ratchet pawls 11a of the ratchet member 11 and the cam grooves 6b of the cam 6, is made up of a thin plate-like member and is formed into a ring-like shape having projecting arms 12a which project in three directions at equal intervals when viewed from the top thereof as is shown in Figs. 3A and 3B.

**[0038]** Respective distal end portions of the three arms 12a are bent towards the rope reel 4 side (refer to Fig. 1). Projections 4c are formed on the annular inner circumferential surface of the annular recess portion 4b, and these distal end portions are made to be brought into engagement with the projections 4c. In the friction plate 12, three spaces are defined between proximal portions 12b of the three arms 12a. The ratchet member 11 is urged by the spring 13 so that the projecting ratchet pawls 11a thereof pass the three spaces and are brought into an engage with the cam grooves 6b.

**[0039]** When the ratchet member 11 is rotated together with the rope reel 4 in the engine-starting direction from a state where the ratchet pawls 11a have passed through the spaces between the proximal portions 12b, as the ratchet pawls 11a overlap the proximal portions 12b (as the ratchet pawls 11a come beneath the proximal portions 12b), the ratchet pawls 11a are pushed into the annular recess portion 4b of the rope reel 4 against the urging force of the spring 13 by being pressed with lateral surfaces of the proximal portions 12b, thereby releasing the engagement between the ratchet pawls 11a and the cam grooves 6a.

**[0040]** For example, a wave washer 14 is interposed between a lateral surface of the friction plate 12 which confronts the cam grooves 6b and a stepped portion of the fixing member 7. When a pressing force is applied to the friction plate 12 towards the cam grooves 6b side, the friction plate 12 is pressed against the cam grooves 6b via the wave washer 14, whereby the friction pate 12 is brought into friction contact with distal end faces of the cam grooves 6b, so as to suppress the rotation thereof.

**[0041]** Next, an operation of the recoil starter will be described. In a state where the engine is not started and the rope 3 of the rope reel 4 is not pulled out, the rope reel 4 is returned to its initial position by the recoil spring 5, and the rope 3 is rewound onto the rope reel 4. The ratchet member 11 of the power storage ratchet mechanism 10 is pushed out of the annular recess portion 4b of the rope reel 4 by virtue of the urging force of the spring 13, and the three projecting ratchet pawls 11a have passed through the spaces between the proximal portions 12b of the three arms 12a of the friction plate 12 to thereby be engaged with the corresponding cam grooves 6b.

**[0042]** Namely, as shown in Figs. 3A, 5A, in the power storage ratchet mechanism 10, the ratchet pawls 11a pass through the spaces between the proximal portions 12b, and the friction plate 12 is held between the ratchet pawls 11a and the cam grooves 6b so that the pawls 11a are engaged with the cam grooves 6b, whereby the rope reel 4 and the cam 6 are brought into engagement with each other via the power storage ratchet mechanism 10 and are integrated with each other.

**[0043]** When the rope 3 is pulled out to start the engine from a state where the rope reel 4 is in the initial position shown in Fig. 3A, the rope reel 4 rotates in a counterclockwise direction as shown in Fig. 3B, and the recoil spring 5 and the power storage spring 9 are coiled up.

**[0044]** The ratchet member 11 rotates together with the rope reel 4, the ratchet pawls 11a are brought into abutment with the proximal portions 12b of the arms 12a of the friction plate 12, and the inclined portions of the ratchet pawls 11a slide along lateral surfaces of the proximal portions 12b. As a result, the ratchet member 11 is pushed into the annular recess portion 4b of the rope reel 4 against the urging force of the spring 13, and the ratchet pawls 11a of the ratchet member 11 are covered by the lateral surfaces of the proximal portions 12b of the friction plate 12 so that the ratchet member 11 is kept forcibly confined within the annular recess portion 4b and so that the ratchet pawls 11a thereof are prevented from projecting (refer to Fig. 3B).

**[0045]** Almost at the same time, the projections 4c on the annular inner circumferential surface of the annular recess portion 4b are brought into abutment with the distal end portions of the arms 12a of the friction plate 12, whereby the friction plate 12 is caused to rotate together with the rope reel 4 and the ratchet member 11. As this occurs, since the ratchet pawls 11a of the ratchet member 11 are covered by the proximal portion 12b of the friction plate 12, the ratchet pawls 11a is prevented from being brought into engagement with the cam grooves 6b. Consequently, the recoil spring 5 and the power storage spring 9 are coiled up in such a state that the ratchet pawls 11a of the ratchet member 11 and the cam grooves 6b are not allowed to be brought into engagement with each other.

**[0046]** Namely, when the rope 3 is pulled out to start the engine, the rope reel 4 is rotated in a state where the engagement of the pawls is not caused in the power storage ratchet mechanism 10. In other words, the rope reel 4 rotates in a state where the rope reel 4 and the cam 6 are spaced away from each other while surely preventing the ratchet pawls 11a of the ratchet member 11 from being brought into engagement with the cam grooves 6b of the cam 6 (refer to Figs. 3B, 5B).

**[0047]** The engine has a staring resistance, and a rotational load by the starting resistance is applied to the cam 6. As long as a rotational drive force by the coiled-up power storage spring 9 is not higher than the rotational load applied to the cam 6, the cam 6 cannot be rotated via the power storage spring 9.

**[0048]** When the rope 3 is released and rewound from the pulled out condition shown in Fig. 3B, the rope reel 4 is rotated quickly by the rewinding force of the recoil spring 5 in a rope-rewinding direction (clockwise direction in Fig. 3A as indicated by an arrow) that is an opposite direction to the engine-starting direction (counterclockwise direction in Fig. 3B as indicated by an arrow). Thus, the rope reel is returned to its initial position while rewinding the rope 3.

**[0049]** As this occurs, the ratchet member 11 rotates together with the rope reel 4 in the rope-rewinding direction. Since the ratchet member 11 is urged by the spring 13 and since the friction plate 12 is prevented from rotating by the wave washer 14, the ratchet pawls 11a slide on the lateral surfaces of the proximal portions 12b of the friction plate 12 to be pressed towards the cam grooves 6b.

**[0050]** Then, the ratchet pawls 11a are slid along the lateral surfaces of the proximal portions 12b of the friction plate 12 into the spaces opened between the proximal portions 12b. The ratchet pawls 11a are pushed towards the cam grooves 6b by the urging force of the spring 13, and pass through the spaces so as to be brought into engagement with the cam grooves 6b, thereby returning into the condition shown in Figs. 3A, 5A.

**[0051]** The rope reel 4 rotates in the rope-rewinding direction (clockwise direction in Fig. 3A), while keeping the condition as shown in Fig. 3A. This rotation is transmitted to the cam 6 through the engagement of the ratchet pawls 11a and the cam grooves 6b to thereby rotate the cam 6 integrally together with the rope reel 4 and the friction plate 12 in the opposite direction to the engine-starting direction.

**[0052]** The rope reel 4 is returned to its initial condition shown in Fig. 3A by the aforesaid rotation while the power storage spring 9 is held in the coiled-up condition. Shortly after that, the rope 3 is pulled out again to start the engine.

**[0053]** When the power stored in the power storage spring 9 by the pulling out of the rope 3 exceeds the rotational load by the starting resistance of the engine, the rotational power by the pulling out of the rope 3 and the rotational power stored in the power storage spring 9 are released, the crankshaft is then rotated through the rotation of the cam 6 and engagement of the clutch mechanism whereby the engine is started.

**[0054]** According to the recoil starter of the embodiment, since the power storage ratchet mechanism is provided between the facing surfaces of the rope reel and the cam, the power storage ratchet mechanism can be made compact in size and has superior dustproofness. In addition, since the engaging pawls of the ratchet mechanism are configured as the plurality of uniformly-arranged pawls, the engagement force is dispersed uniformly, and the eccentricity of power is avoided.

**[0055]** The invention is not limited to the aforementioned embodiment but can be changed variously without departing from the spirit of the invention.

**[0056]** For example, the ratchet pawl and the cam groove may have a triangular sectional shape or a trapezoidal sectional shape. The any numbers of the ratchet pawl and the cam grooves are formed. A hole or a notch may be formed in the friction plate as an opening for allowing the ratchet pawl to pass therethrough. Contrary to the exemplified structure, the groove may be formed in the ratchet member, and the pawl may be formed on the cam. Although the direction of rotation is exemplified in the above descriptions, the recoil starter may be configured to reversely rotate.

**[0057]** It is explicitly stated that all features disclosed in the description and/or the claims are intended to be disclosed separately and independently from each other for the purpose of original disclosure as well as for the purpose of restricting the claimed invention independent of the composition of the features in the embodiments and/or the claims. It is explicitly stated that all value ranges or indications of groups of entities disclose every possible intermediate value or intermediate entity for the purpose of original disclosure as well as for the purpose of restricting the claimed invention, in particular as limits of value ranges.

## Claims

**1.** A recoil starter comprising:

a case (1) that is disposed on a surface of an engine;
a reel pivot (2) that is formed on the case (1);
a rope reel (4) that is rotatably supported on the reel pivot (2) and that has a reel portion (4a) formed on an outer circumference thereof around which a rope (3) is wound;
a recoil spring (5) that rotationally urges the rope reel (4) to rewind the rope (3);
a cam (6) that is engageable with the engine via a clutch so as to transmit a rotational power to the engine;
a power storage spring (9) that is interposed between the rope reel (4) and the cam (6) to store a rotational power of the rope reel (4) and that transmits the stored rotational power to the cam (6) to thereby start the engine; and
a power storage ratchet mechanism (10) that is disposed between facing surfaces of the rope reel (4) and the cam (6) and that is configured to disengage the rope reel (4) and the cam (6) so that the power storage spring (9) is coiled up when the rope reel (4) rotates in an engine-starting direction, and
engage the rope reel (4) and the cam (6) so that the rope reel (4) and the cam (6) rotate together while keeping a coiled-up condition of the power storage spring (9) when the rope reel rotates in an opposite direction to the engine-starting direction,
wherein the power storage ratchet mechanism (10) includes:

a cam groove (6b) that is formed on a surface of the cam (6) which faces to the rope reel (4);
a ratchet member (11) that is disposed on a surface of the rope reel which faces to the cam and that includes a ratchet pawl (11a) engageable with the cam groove (6b); and
**characterized in that**
the power storage ratchet mechanism (10) further includes a friction plate (12) disposed between the ratchet member (11) and the cam (6), and

wherein the friction plate (12) is configured to

retreat the ratchet pawl (11a) to disengage the ratchet pawl (11a) and the cam groove (6b) by being rotated in the engine-starting direction linkedly with the rope reel (4); and
release the ratchet pawl (11a) to engage the ratchet pawl (11a) and the cam (6b) being rotated in the opposite direction linkedly with the rope reel (4).

2. The recoil starter of Claim 1,
wherein the friction plate (12) includes an opening defined therein,
wherein the ratchet pawl (11a) is engaged to the cam groove (6b) by pasting through the opening in the friction plate (12), and
wherein the ratchet pawl (11a) is disengaged from the cam groove (6b) by being retreated along a peripheral edge of the opening.

3. The recoil starter of Claim 2,
wherein the opening of the ratchet pawl (11a) is a hole or a notch.

4. The recoil starter of any one of Claims 2 to 3,
wherein a plurality of cam grooves (6b) are formed on the cam (6),
wherein a plurality of ratchet pawls (11a) are formed on the ratchet member (11), and
wherein a plurality of openings are defined in the friction plate (12).

5. The recoil starter of Claim 4,
wherein the cam grooves (6b), the ratchet pawls (11a) and the openings are circumferentially arranged at equal intervals, respectively.

6. The recoil starter of Claim 4 or 5,
wherein the number of the cam grooves (6b) is twice the number of the ratchet pawls (11a).

7. The recoil starter of any one of Claims 1 to 6,
wherein the ratchet pawl (11) is formed to have a triangular sectional shape or a trapezoidal sectional shape.

8. The recoil starter of any one of Claims 1 to 7,
wherein the ratchet member (11) and the ratchet pawl (11a) form a sectional shape including at least:

a flat portion parallel with an axis direction of the reel pivot;
a vertical portion perpendicular to the axis direction; and
a inclined portion connecting the vertical portion and the flat portion.

9. The recoil starter of any one of Claims 1 to 8,
wherein the ratchet member (11) is urged toward the cam (6) by a spring (13).

10. The recoil starter of any one of Claims 1 to 9,
wherein the friction plate (12) is frictionally rotated linkedly with the rope reel (4) via a wave washer (14).

**Patentansprüche**

1. Seilstarter, enthaltend:

ein Gehäuse (1), das auf einer Oberfläche eines Motors angeordnet ist;
ein Haspeldrehgestell (2), das auf dem Gehäuse (1) geformt ist;
eine Seilhaspel (4), die drehbar durch das Haspeldrehgestell (2) gestützt ist und die einen Haspelbereich (4a) hat, der an einem Außenumfang von ihr geformt ist, und um den ein Seil (3) gewickelt ist;
eine Schließfeder (5), die die Seilhaspel (4) in Drehrichtung vorbelastet, dass das Seil (3) aufgewickelt wird;
einen Nocken (6), der mit dem Motor über eine Kupplung in Eingriff bringbar ist, so dass eine Rotationskraft an den Motor übertragen wird;
eine Kraftspeicherfeder (9), die zwischen der Seilhaspel (4) und dem Nocken (6) liegt, zum Speichern einer Rotationskraft der Seilhaspel (4), und die die gespeicherte Rotationskraft an den Nocken (6) überträgt zum damit Starten des Motors; und
einen Kraftspeicherratschenmechanismus (10), der zwischen aufeinandergerichteten Oberflächen der Seilhaspel (4) und des Nockes (6) angeordnet ist und der angepasst ist,
die Seilhaspel (4) und den Nocken (6) zu lösen, so dass die Kraftspeicherfeder (9) aufgewickelt wird, wenn die Seilhaspel (4) sich in einer Motorstartrichtung dreht, und
die Seilhaspel (4) und den Nocken (6) in Eingriff zu bringen, so dass die Seilhaspel (4) und der Nocken (6) sich zusammen drehen, wobei ein aufgewickelter Zustand der Kraftspeicherfeder (9) gehalten wird, wenn die Seilhaspel sich in einer entgegengesetzten Richtung zur Motorstartrichtung dreht,
wobei der Kraftspeicherratschenmechanismus (10) enthält:

eine Nockennut (6b), die auf einer Oberfläche des Nockens (6) geformt ist, die in Richtung der Seilhaspel (4) gerichtet ist;
ein Ratschenelement (11), das auf einer Oberfläche der Seilhaspel angeordnet ist, die auf den Nocken gerichtet ist, und das eine Ratschenklaue (11a) enthält, die mit der Nockennut (6b) in Eingriff bringbar ist;

und

**dadurch gekennzeichnet, dass**
der Kraftspeicherratschenmechanismus (10) weiter enthält
eine Reibplatte (12), die zwischen dem Ratschenelement (11) und dem Nocken (6) angeordnet ist, und
wobei die Reibplatte (12) angepasst ist,
die Ratschenklaue (11a) zum Lösen der Ratschenklaue (11a) und der Nockennut (6b) zurückzuziehen, indem sie verbunden in der Motorstartrichtung mit der Seilhaspel (4) gedreht wird; und
die Ratschenklaue (11a) zu lösen zum in Eingriff bringen der Ratschenklaue (11a) und der Nockennut (6b), indem sie in der entgegengesetzten Richtung verbunden mit der Seilhaspel (4) gedreht wird.

**2.** Seilstarter nach Anspruch 1,
wobei die Reibplatte (12) eine in ihr definierte Öffnung enthält,
wobei die Ratschenklaue (11a) mit der Nockennut (6b) durch Durchführen durch die Öffnung in der Reibplatte (12) in Eingriff gebracht wird, und
wobei die Ratschenklaue (11a) von der Nockennut (6b) durch Zurückziehen entlang des Umfangsrands der Öffnung gelöst wird.

**3.** Seilstarter nach Anspruch 2,
wobei die Öffnung der Ratschenklaue (11a) ein Loch oder eine Kerbe ist.

**4.** Seilstarter nach einem der Ansprüche 2 bis 3,
wobei eine Mehrzahl von Nockennuten (6b) auf dem Nocken (6) geformt sind,
wobei eine Mehrzahl von Ratschenklauen (11a) auf dem Ratschenelement (11) geformt sind, und
wobei eine Mehrzahl von Öffnungen in der Reibplatte (12) definiert sind.

**5.** Seilstarter nach Anspruch 4,
wobei die Nockennuten (6b), die Ratschenklauen (11a) und die Öffnungen in Umfangsrichtung unter gleichen Intervallen jeweils angeordnet sind.

**6.** Seilstarter nach Anspruch 4 oder 5,
wobei die Anzahl der Nockennuten (6b) doppelt so groß wie die Anzahl der Ratschenklauen (11a) ist.

**7.** Seilstarter nach einem der Ansprüche 1 bis 6,
wobei die Ratschenklaue (11) geformt ist, dass sie eine dreieckige Querschnittsgestalt oder eine trapezförmige Querschnittsgestalt hat.

**8.** Seilstarter nach einem der Ansprüche 1 bis 7,
wobei das Ratschenelement (11) und die Ratschenklaue (11a) eine Querschnittsgestalt bilden, die zumindest enthält:

einen flachen Bereich, der parallel zu einer Achsenrichtung des Haspeldrehgestells ist;
einen vertikalen Bereich, der senkrecht zur Achsenrichtung ist; und
einen geneigten Bereich, der den vertikalen Bereich und den flachen Bereich verbindet.

**9.** Seilstarter nach einem der Ansprüche 1 bis 8,
wobei das Ratschenelement (11) in Richtung des Nockens (6) durch eine Feder (13) vorbelastet ist.

**10.** Seilstarter nach einem der Ansprüche 1 bis 9,
wobei die Reibplatte (12) durch Reibung verbunden mit der Seilhaspel (4) über eine Wellfederscheibe (14) gedreht wird.

**Revendications**

**1.** Un démarreur à rappel comprenant :

un boîtier (1) qui est disposé sur une surface d'un moteur ;
un pivot d'enrouleur (2) qui est formé sur le boîtier (1) ;
un rembobineur (4) de câble qui est supporté de façon à pouvoir tourner sur le pivot de l'enrouleur (2) et dont une portion de l'enrouleur (4a) est formée sur sa circonférence externe autour de laquelle un câble (3) est enroulé ;
un ressort (5) de rappel qui force par rotation le rembobineur de câble (4) à ré-enrouler le câble (3) ;
une came (6) qui s'engage avec le moteur via un embrayage de façon à transmettre une puissance de rotation au moteur ;
un ressort (9) stockant la puissance qui est situé entre le rembobineur de câble (4) et la came (6) de façon à stocker une puissance de rotation du rembobineur (4) de câble et à transmettre la puissance de rotation stockée à la came (6) afin de faire démarrer le moteur ; et
un mécanisme d'encliquetage stockant la puissance (10) qui est disposé entre les surfaces extérieures du rembobineur de câble (4) et la came (6) et qui est configuré pour
désengager le rembobineur de câble (4) et la came (6) de façon à ce que le ressort stockant la puissance (9) est enroulé lorsque le rembobineur de câble (4) est en rotation dans une direction qui allume le moteur, et
engager le rembobineur (4) de câble et la came (6) de façon à ce que le rembobineur (4) de câble et la came (6) sont en rotation ensemble tout en gardant l'état enroulé du ressort stockant la puis-

sance (9) lorsque le rembobineur de câble est en rotation dans une direction opposée à la direction qui allume le moteur,
dans lequel le mécanisme d'encliquetage stockant la puissance (10) comprend :

une rainure (6b) de came qui est formée sur une surface de la came (6) qui fait face au rembobineur de câble (4) ;
un élément (11) d'encliquetage qui est disposé sur une surface du rembobineur de câble qui fait face à la came et qui comprend un cliquet d'arrêt (11a) engageable avec la rainure de la came (6b) ; et

**caractérisé en ce que** le mécanisme d'encliquetage stockant la puissance (10) comprend également :

une plaque (12) de friction disposée entre l'élément d'encliquetage (11) et la came (6), et
dans lequel la plaque de friction (12) est configurée pour
faire reculer le cliquet d'arrêt (11a) de façon à désengager le cliquet d'arrêt (11a) et la rainure de la came (6b) en le mettant en rotation dans la direction de mise en route du moteur conjointement avec le rembobineur de câble (4) ; et
libérer le cliquet d'arrêt (11a) de façon à engager le cliquet d'arrêt (11a) et la rainure de came (6b) en le mettant en rotation dans la direction opposée conjointement avec le rembobineur de câble (4).

**2.** Le démarreur à rappel selon la revendication 1
dans lequel, la plaque (12) de friction comprend une ouverture qui y est définie,
dans lequel, le cliquet d'arrêt (11a) est engagé avec la rainure (6b) de la came en passant à travers l'ouverture présente dans la plaque de friction (12), et
dans lequel, le cliquet d'arrêt (11a) est désengagé de la rainure (6b) de la came en étant reculé le long du bord périphérique de l'ouverture.

**3.** Le démarreur à rappel selon la revendication 2
dans lequel, l'ouverture du cliquet d'arrêt (11a) est un trou ou une encoche.

**4.** Le démarreur à rappel selon l'une quelconque des revendications 2 à 3
dans lequel, une pluralité de rainures (6b) de came sont formées sur la came (6)
dans lequel, une pluralité de cliquets d'arrêt (11a) sont formés sur l'élément d'encliquetage (11), et
dans lequel, une pluralité d'ouvertures sont définies dans la plaque de friction (12).

**5.** Le démarreur à rappel selon la revendication 4
dans lequel, les rainures (6b) de la came, les cliquets d'arrêt (11a) et les ouvertures sont disposés sur la circonférence selon des intervalles égaux, respectivement.

**6.** Le démarreur à rappel selon l'une quelconque des revendications 4 ou 5
dans lequel, le nombre de rainures (6b) de la came équivaut à deux fois le nombre de cliquets d'arrêt (11a).

**7.** Le démarreur à rappel selon l'une quelconque des revendications 1 à 6,
dans lequel, le cliquet d'arrêt (11) est formé de façon à présenter une forme triangulaire en section transversale ou une forme trapézoïdale en section transversale.

**8.** Le démarreur à rappel selon l'une quelconque des revendications 1 à 7,
dans lequel, l'élément d'encliquetage (11) et le cliquet d'arrêt (11a) forment une coupe transversale comprenant au moins :

une portion plate parallèle à une direction d'un axe du pivot de l'enrouleur ;
une portion verticale perpendiculaire à la direction de l'axe ; et
une portion inclinée reliant la portion verticale et la portion plate.

**9.** Le démarreur à rappel selon l'une quelconque des revendications 1 à 8,
dans lequel, l'élément d'encliquetage (11) est pressé contre la came (6) à l'aide d'un ressort (13).

**10.** Le démarreur à rappel selon l'une quelconque des revendications 1 à 9,
dans lequel, la plaque de friction (12) est mise en rotation par friction conjointement avec le rembobineur de câble (4) via une rondelle ondulée (14).

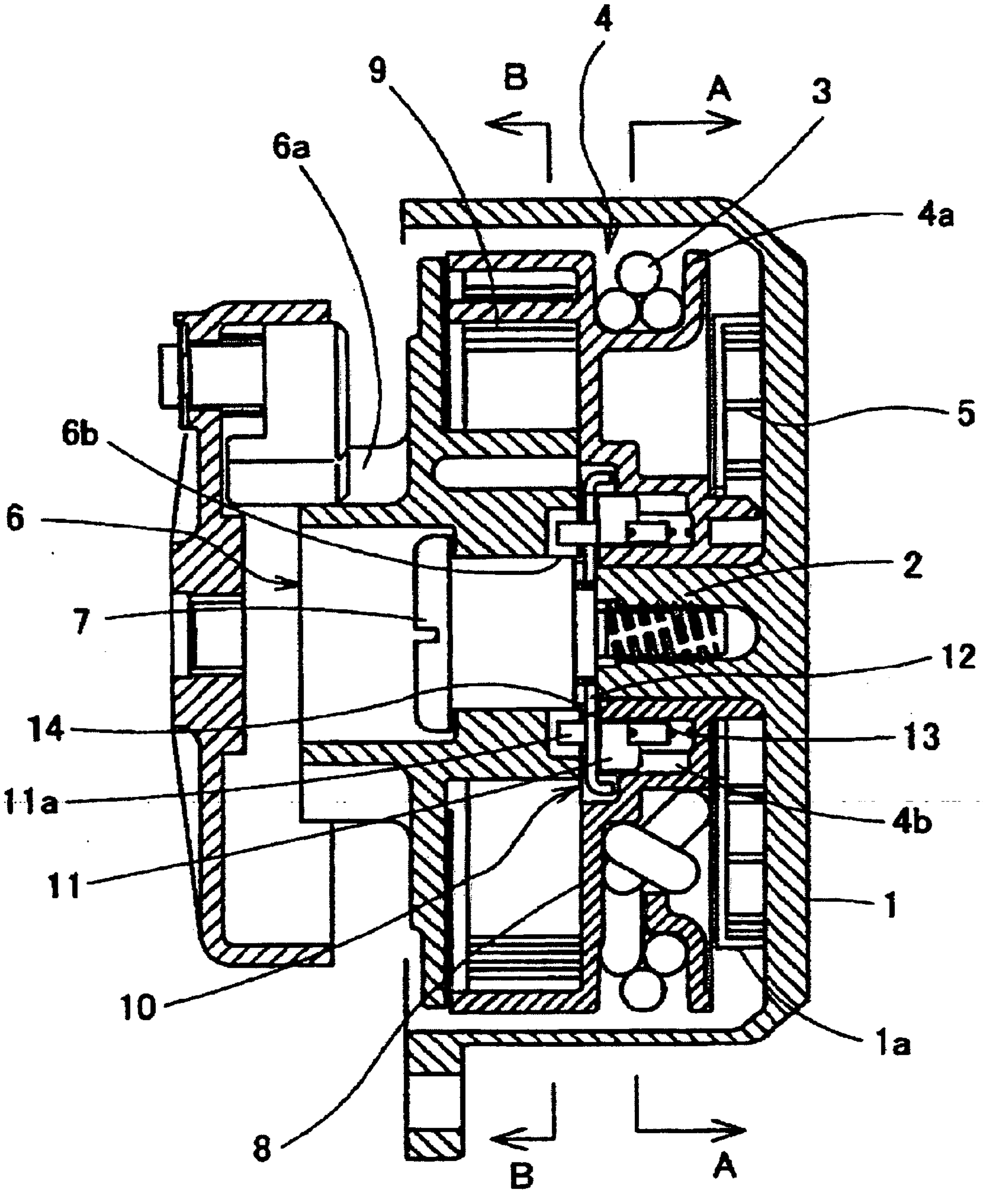



*Fig. 1*

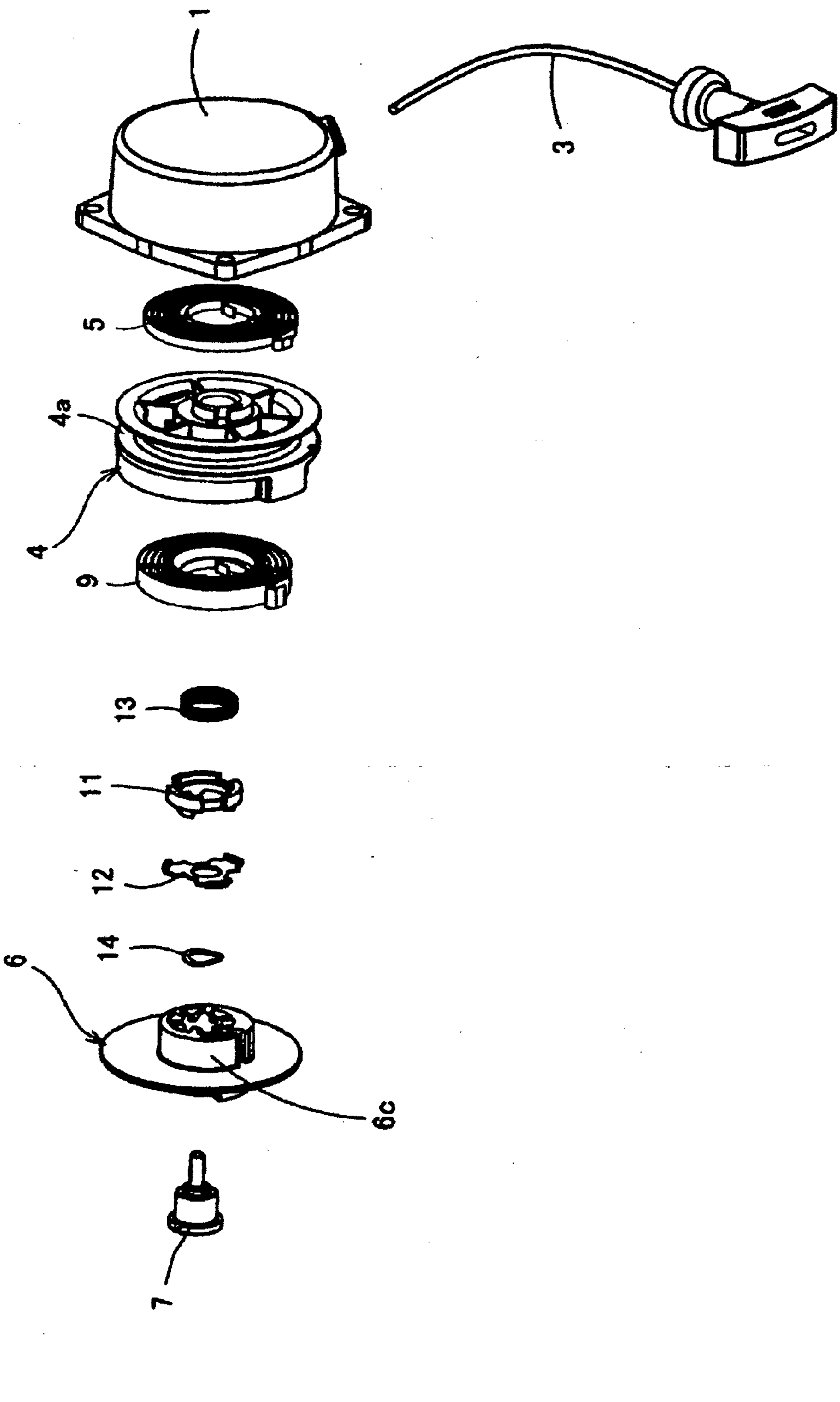



*Fig. 2*

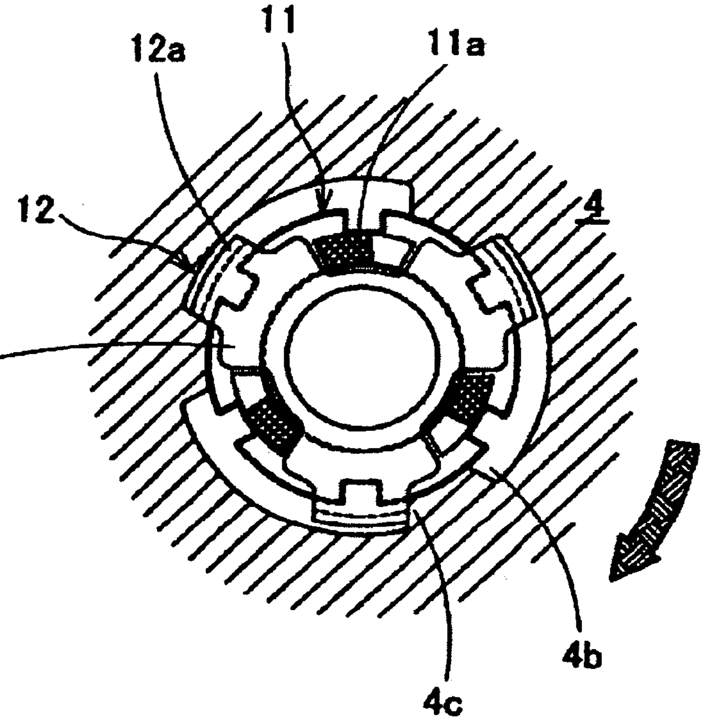



Fig. 3A

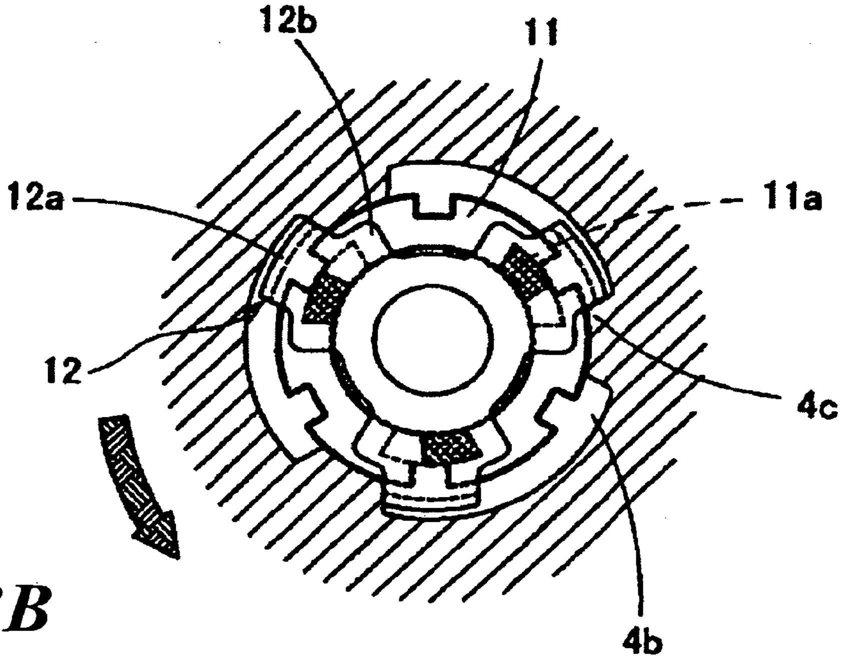



Fig. 3B

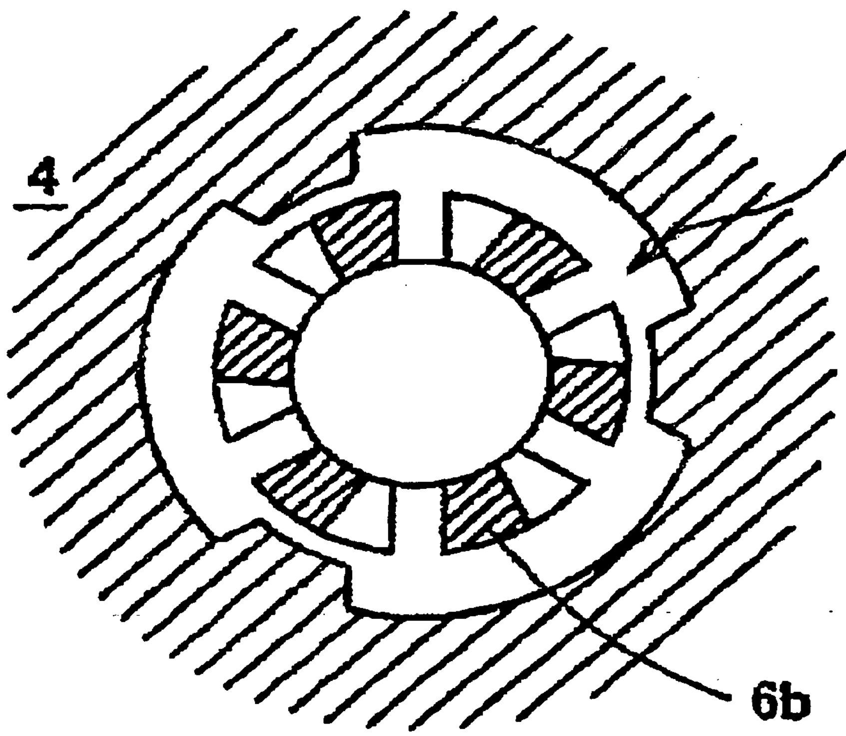



*Fig. 4*

*Fig. 5A*

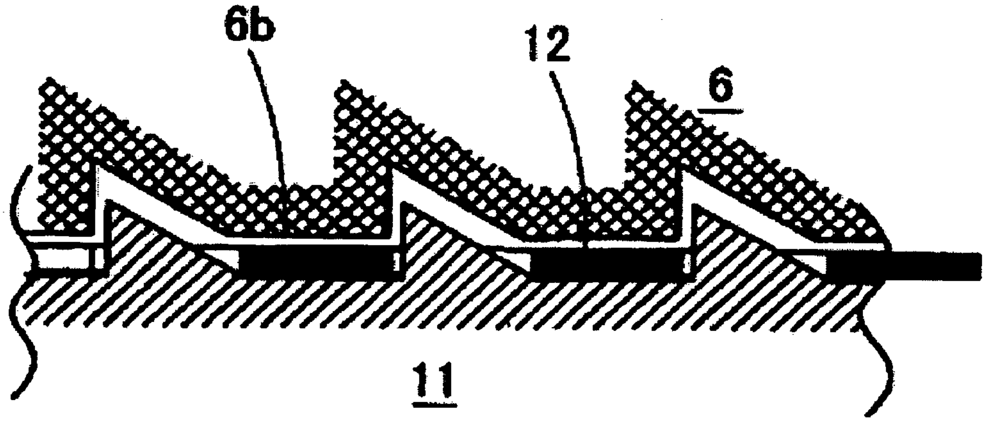
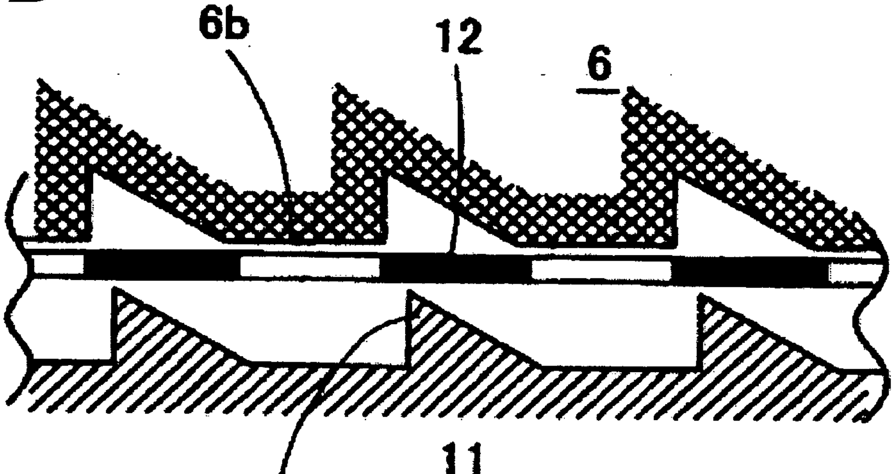



*Fig. 5B*



## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


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