Aug. 27, 1957 F. O. DE MILLAR 2,804,173

TURNING DEVICE FOR ROTATABLE BODY

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Fig. 1.

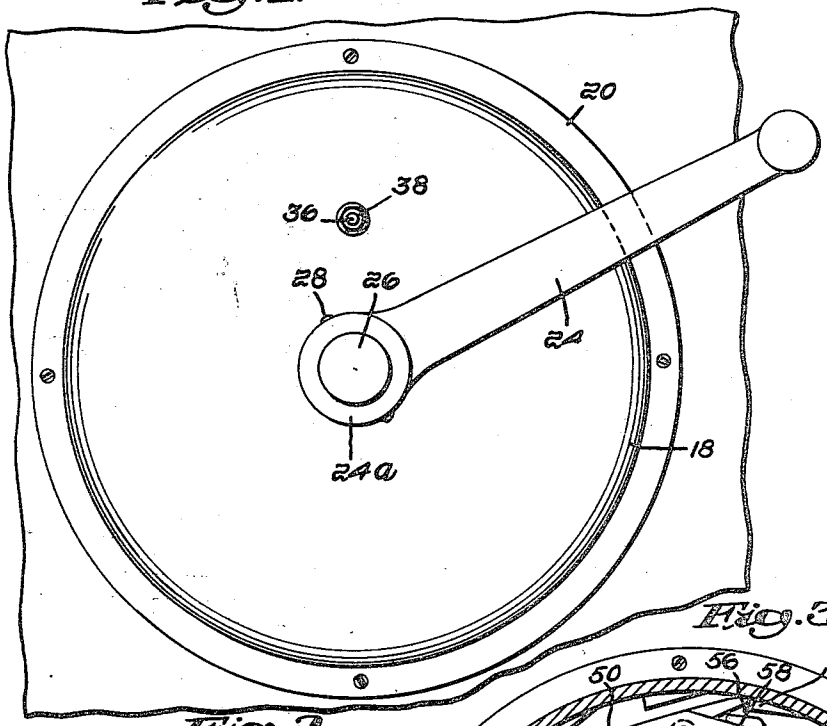


Fig. 3.

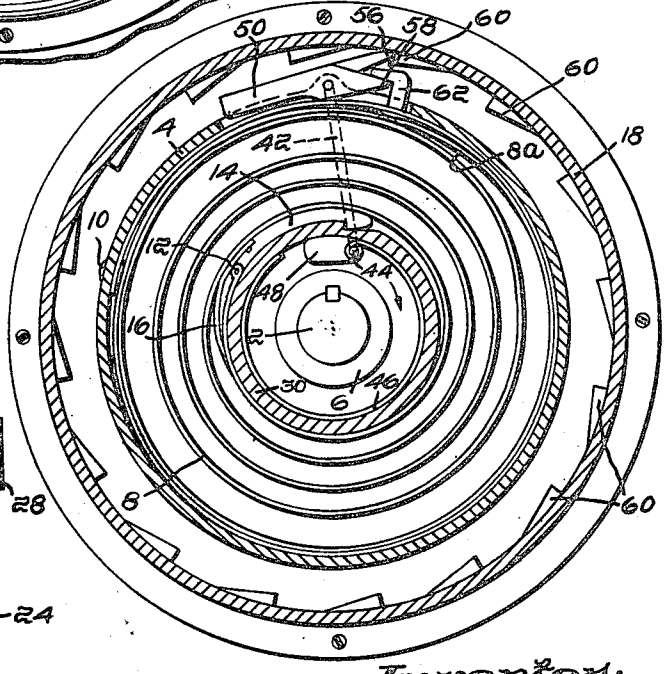
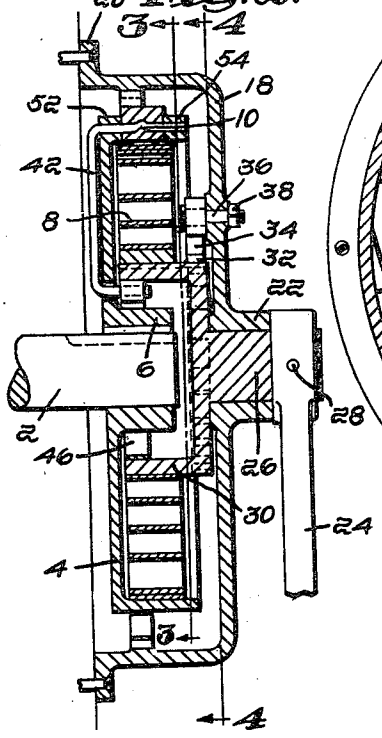


Fig. 2.



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Fig. 4.

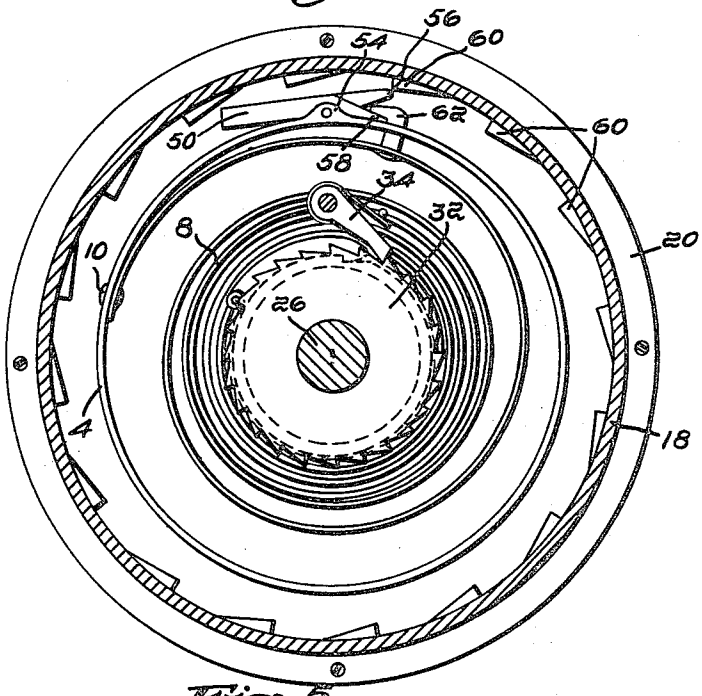


Fig. 5.

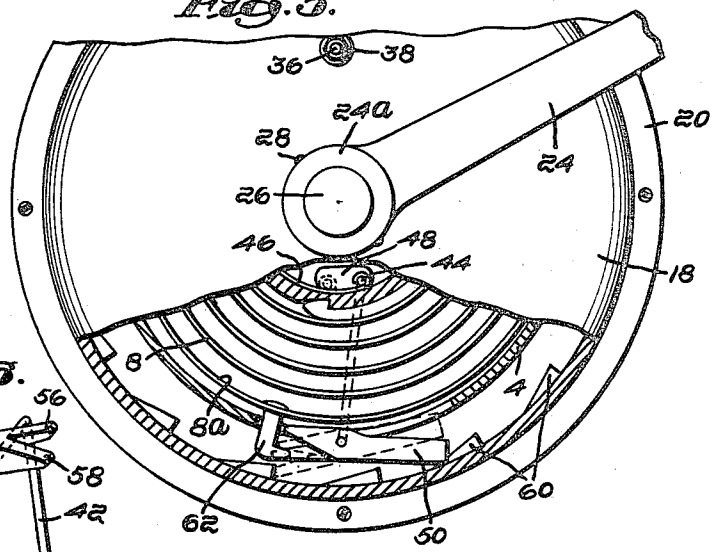
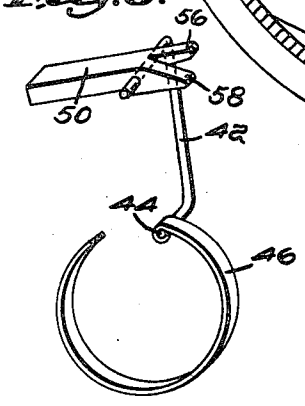


Fig. 6.



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TURNING DEVICE FOR ROTATABLE BODY

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Application July 20, 1955, Serial No. 523,209

11 Claims. (Cl. 185—40)

This invention relates to a mechanical turning device for a rotatable body and, more particularly, to a starting mechanism for an internal combustion motor of the type having a rotatable shaft portion which may be utilized to spin the motor and start it in operation.

Difficulty has been experienced in devising a satisfactorily simplified and positive starter mechanism which is practical and economically feasible for use with small internal combustion engines such as are represented by outboard motors, lawnmower motors and the like. In devices heretofore proposed, of which there have been a considerable number, it has been attempted to apply a turning force by means of spring members so arranged as to become disengaged from the driven shaft as soon as the stored energy of the spring has been released. Various drawbacks have been found to develop in using these disengaging spring type devices and, as a result, most motors, other than those provided with electrical starting systems, are, so far as I am aware, equipped with a standard hand-operated pull cord by means of which an operator spins the motor shaft to start the engine. The hand-operated pull cord has many disadvantages which have long been recognized.

It is, in general, an object of the present invention to deal with the problem indicated and to devise a mechanically driven turning device for a rotatable body with a view especially to providing a satisfactory spring starter mechanism for starting small internal combustion engines of the class used in outboard motors, power lawnmowers and the like. It is a further object of the invention to design a mechanical starting mechanism which is simple to operate, which has a very long operating life, and whose construction is of greatly simplified form, lending itself to cheapness of manufacture and ease of installation on both new and presently existing motors of various types.

The foregoing objectives may, I find, be practically realized by applying the stored energy of a coiled spring in a different way than that heretofore attempted. I have discovered that I may successfully exert the turning energy of a coiled spring on a rotatable body by means of a special spring rotor unit wherein the spring rotor is permanently attached to the rotatable body and may, therefore, rotate with the rotatable body at all times during its operation.

In such a basic spring rotor organization, I have further determined that I may combine therewith a separate winding drum or arbor member so arranged that the operation of winding the spring of the spring rotor unit may, at one predetermined point, serve to trigger a release of the spring connection with a crank mechanism.

One preferred embodiment of the spring rotor unit in combination with a rotatable body to be driven has been illustrated in the accompanying drawings, in which—

Fig. 1 is an elevational view of the turning device of the invention viewed from the crank end thereof;

Fig. 2 is a cross-section taken on the line 2—2 of Fig. 1 and further illustrates the turning device of the invention associated with a rotatable shaft body indicated fragmentarily;

Fig. 3 is a cross-sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a cross-section taken on the line 4—4 of Fig. 2;

Fig. 5 is an elevational view broken away to show a part of the spring rotor release mechanism; and

Fig. 6 is a detailed perspective view of a spring actuated rod element for the spring release mechanism shown in Fig. 5.

The principal parts of the structure shown in the figures noted above include a shaft which is intended to be illustrative of any desirable form of rotatable body to which a turning force may be applied such as, for example, an outboard motor shaft, a power-driven lawnmower motor shaft and the like; a spring rotor unit permanently associated with the shaft; a stationary housing; and a special crank mechanism and winding drum apparatus adapted to be releasably connected to the spring rotor unit.

Considering these parts in greater detail, numeral 2 denotes the shaft member which is to be driven and which, for purposes of illustration, may be considered to be the main driving shaft of an outboard motor. On the shaft 2 is secured the spring rotor unit of the invention which comprises a cylindrical spring casing body 4 formed with a central hub portion 6 (Fig. 3) which is keyed or otherwise solidly secured to the shaft 2 so as to move with the shaft when it is rotated.

Mounted around the inner peripheral surface of the casing 4 is a coiled flat spring 8 which normally occurs in a tightly coiled position so that the outermost convolution of the spring lies firmly in contact with the casing in its ordinary position in the casing structure. The outer extremity of this spring member 8 is secured to the spring casing periphery in some suitable manner, as by a rivet 10, better shown in Fig. 4, and, when the spring is in its normal coiled position with the outer end anchored to the spring casing, it surrounds the casing hub 6 and occurs in spaced relation to this hub 6, as shown in Fig. 3.

The inner extremity of the spring 8 has pivotally secured to itself by a pin member 12 an engaging element 14 which is normally supported in a slightly radially inwardly extending manner by means of a flat spring 16. The latter spring is anchored to the engaging portion and is bowed so that it may extend into contact with an immediately adjacent portion of the main spring body, as shown in Fig. 3.

Numeral 18 denotes a stationary part which comprises a housing overlying the spring casing 4 and arranged in spaced relation to it, as shown in Fig. 2. This stationary housing may vary in design, depending upon the type of motor structure with which it is to be employed and may, for example, have a flange portion 20 which can be secured by bolts or other fastenings to some convenient part of a motor structure. The stationary housing is further formed with a bearing portion 22 occurring in axial alignment with the shaft 2 and adapted to rotatably support therein the crank mechanism and winding drum apparatus above described.

The crank mechanism referred to includes a crank arm 24 (Fig. 1) having a handle 26 which is supported at right angles to the crank arm 24, as shown, and which is adapted to be gripped in the hand to turn the crank arm 24 in a clockwise direction, as viewed in Fig. 1. Fixed to the crank 24 in the annular bearing portion 24*a* is a stub shaft 26 which is rotatably received in the bearing portion 22 of the stationary housing, as shown in Fig. 2. The crank may be keyed or fastened by means of a screw or pin, as suggested by part indicated at 28.

The shaft 26 preferably forms an integral part of an arbor member 30 which constitutes a winding drum for the spring 8, as hereinafter described in further detail.

Fixed around this arbor member **30** and in close proximity but spaced away from the outer wall of the housing **18** is a ratchet wheel portion **32** and arranged to operatively engage with this ratchet wheel is a pawl **34** pivotally supported on a stud **36** whose outer end may, for example, be threaded through the outer wall of the stationary housing and secured by means of a threaded member **38** (Fig. 1). It is pointed out that the arrangement of the pawl and ratchet wheel is so chosen that the crank arm **24**, although it may freely turn in a clockwise direction with the pawl sliding over the ratchet wheel piece, cannot be turned in a counterclockwise direction at any time.

The inner section of the arbor, which I may conveniently refer to as the winding drum portion of this member, comprises a cylindrical body whose diameter is chosen to exceed the diameter of the spring casing hub **6** but is less than the inner diameter of the last convolution of the spring **8** when in its normally coiled position such as shown in Fig. 3. In this relative position, the engaging hook **14** will normally seek, by reason of the spring action of the flat spring **16**, to move into contact with the outer peripheral surface of the winding drum and, at one point, will fall into a notch **40**, formed on such surface, as illustrated in Fig. 3.

With the spring engaging element thus interlocked with the winding drum **30**, it will readily be seen that counterclockwise rotation of the crank and the winding drum which is fixed to it will produce a winding action on the spring **8**. If the spring rotor is held in fixed relation to the stationary housing, this will tend to increase the number of coils into which the spring is formed and, in particular, will progressively draw the convolutions away from the spring casing member. It will thus be apparent that it is a relatively simple operation to turn the crank and store considerable energy in the spring, which energy, if released, will turn the spring rotor and shaft **2**.

For the purpose of holding the spring rotor in fixed relation to the stationary housing, I further provide a special releasing stop mechanism which includes the following parts: a pivoted lock mounted on the spring casing; a series of stops arranged around the inside of the casing to engage with the pivoted block at any one of a series of stations; and, finally, an actuating rod and releasing bar for controlling the position of the pivoted block member.

Attention is directed to Figs. 2, 3 and 4 in which there is shown an actuating rod **42**, one end of which passes through the spring casing and is received in a looped portion **44** of a spring **46** snugly fitted around the inner periphery of the winding drum **30**, as shown in Figs. 2 and 3. With the spring **46** in this position, turning the drum in a clockwise direction causes it to frictionally engage the spring **46** and move it in the same clockwise direction. The actuating rod at the portion which is received in the loop **44** of the ring **46** is bent at right angles and extends through a slot **48** formed through the inner wall of the spring casing **4**. The slot **48** is clearly shown in Fig. 5 and the spring **46** and actuating rod **42** is shown in detail in Fig. 6.

At its opposite end, the actuating rod **42** is again bent at right angles and this bent portion is received through a pivoted lock member **50** which is pinned in bosses **52** and **54** formed on the outer peripheral surface of the spring casing **4**, as shown in Fig. 2 and in Fig. 4. The lock member consists of an elongated member having two separated projecting ends **56** and **58**. The projecting end **56** is adapted to extend outwardly so that, in one position of the locking member **50**, as shown in Fig. 3, it will come into abutting relation with a stop member **60**. This stop member **60** constitutes one of a plurality of such members, either integral with or fixed to the stationary housing and extending all the way therearound, as suggested in Fig. 3. The second projecting end **58** of the locking member **50** normally assumes a position as suggested in Fig. 3 and, in this position, is resting in contact with the hooked bar member **62** riveted to the outermost convolution **8a** of the spring **8**, as shown in Figs. 2 and 3.

The operation of the actuating rod and the hooked bar element **62** is as follows. Crank **24** is turned producing clockwise rotation of the winding drum. The drum moves the spring **46** which in turn moves the lower end of the actuating rod **42** in a clockwise direction, as viewed in Fig. 2, for the distance permitted by the slot **48** and into the position shown in this figure. As a result of this displacement, the locking bar is pivoted slightly outwardly into the position of Fig. 3 in which the projecting end **56** comes into abutting relationship with the stop **60**, thus preventing any turning movement of the spring and spring casing when the crank is turned.

Continued rotative movement of the crank arm **24** produces a continuous coiling of the spring **8** around the drum and, as this occurs, successive convolutions of the spring move away from the spring casing until a point is reached at which the last convolution **8a** is caused to move radially inward carrying with it the bar or hook **62** and, as this occurs, the locking member **50** is suddenly pivoted in a clockwise direction, as viewed in Fig. 2, and the projecting end **56** is disengaged from the stop **60**. This releases all of the stored energy of the spring with the result that the spring rotor and the shaft **2** are suddenly rotated together at relatively high speed and starting of the motor is accomplished. Simultaneously, the pivoted hook **14** is caused to move radially outwardly away from the winding drum and to remain in this position as long as the rotor is turning.

It will be observed that a maximum of simplicity and safety is provided for at all times since there are no gears employed and, by reason of the ratchet wheel **32** and pawl **34**, there is no possibility of the handle and crank being reversed in direction to cause injury to an operator.

It is also pointed out that a maximum turning force is initially applied to the rotatable shaft at the instant energy is released with the result that, in actual practice, much more positive starting is realized.

There is eliminated all possibility of accidental driving connection between the crank mechanism and the spring rotor once the spring rotor disengages itself by movement of the last convolution of the spring radially inwardly. The action of centrifugal forces positively forces the pivoted spring hook outwardly and holds it there while the ratchet wheel **32** and pawl **34** are additional insurance against any undesirable locking.

While I have shown one preferred construction, it is intended that various changes in details of structure and assembly may be resorted to within the scope of the appended claims.

I claim:

1. A turning device for a rotatable body comprising a rotor unit secured for movement with the rotatable body, a stationary part located externally of the rotor unit, means mounted in the stationary part for releasably storing energy in said rotor unit, said rotor including a coiled spring provided with a pivoted engaging end, means for releasing said pivoted engaging end at one point when the convolutions of the coiled spring are drawn radially inwardly.

2. A structure according to claim 1 in which the rotor unit presents a hub portion located around the said rotatable body and said pivoted engaging end of the coiled spring being located in radially spaced relation with respect to said hub.

3. A structure according to claim 1 in which the means for releasably storing energy in said rotor unit includes a winding drum disposed around said hub portion and presenting a notched peripheral surface for engagement with the said pivoted engaging end of the coiled spring.

4. A structure according to claim 1 including a crank

mechanism for turning the winding drum in one direction only.

5. A structure according to claim 1 in which the crank mechanism includes a ratchet wheel mounted for rotation with the crank mechanism and a cooperating pawl pivotally secured to the inner side of the said stationary part.

6. A starting device for a motor having a rotatable shaft portion, said device comprising a spring rotor unit, a stationary housing overlying the spring rotor unit, a spring winding mechanism operatively connected to said rotor unit, said rotor unit including a cylindrical spring casing having a central hub portion adapted to be solidly secured to the said rotatable shaft portion, a spring member having one end anchored to the peripheral surface of the spring casing and coiled upon itself around the spring casing in spaced relation to the said hub portion, said spring winding mechanism including a winding drum located between the said spring and the central hub portion, means for releasably attaching a free end of the spring with said winding drum and means for holding the casing in engagement with the stationary housing for a limited period while the spring is wound around the drum.

7. A structure according to claim 6 in which the means for holding the casing in engagement with the stationary housing includes a pivoted abutment member supported on the outer peripheral surface of the said spring casing.

8. A structure according to claim 7 in which the pivoted abutment member presents a recessed portion and rod means adapted to engage with said recessed portion of the abutment member and move said member out of a position of engagement with the stationary housing.

9. A structure according to claim 8 in which the said rod means extends radially inwardly along one side of the spring casing and is formed with an angularly disposed extremity projecting into the space between the casing

hub portion and the said winding drum and means in said drum responsive to rotative movement of the drum in one direction for displacing the rod radially outwardly into a position in which the said abutment member assumes a stop position with respect to the stationary member.

10. A structure according to claim 9 in which the said means for displacing the rod consists of a spring member operatively connected to the angular extremity of the rod and occurring in frictional engagement with the inner peripheral surface of the said winding drum.

11. A starting device for a motor having a rotatable shaft portion, said device comprising a spring rotor unit, a stationary housing overlying the spring rotor unit, a spring winding mechanism operatively connected to the rotor unit, said rotor unit including a cylindrical spring casing solidly secured to said rotatable shaft portion, a spring member having one end anchored to the peripheral surface of the spring casing and coiled upon itself around the spring casing and defining a central opening within said spring casing, said spring winding mechanism including a winding drum located within said central opening, means for releasably attaching a free end of the spring with said winding drum, and means for holding the casing in engagement with the stationary housing for a limited period while the spring is wound around the drum.

References Cited in the file of this patent

UNITED STATES PATENTS

1,144,410	Grose	June 29, 1915
1,216,416	Chalmers	Feb. 20, 1917
2,568,136	Weimer	Sept. 18, 1951