June 16, 1942. W. F. KRENZKE 2,286,419

RECOIL STARTER FOR SMALL MOTORS

Filed April 4, 1940 2 Sheets-Sheet 1

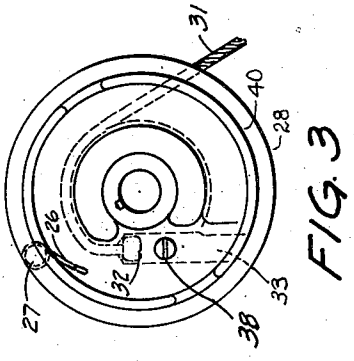


FIG. 3

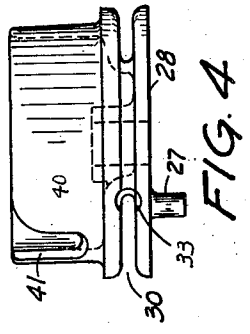


FIG. 4

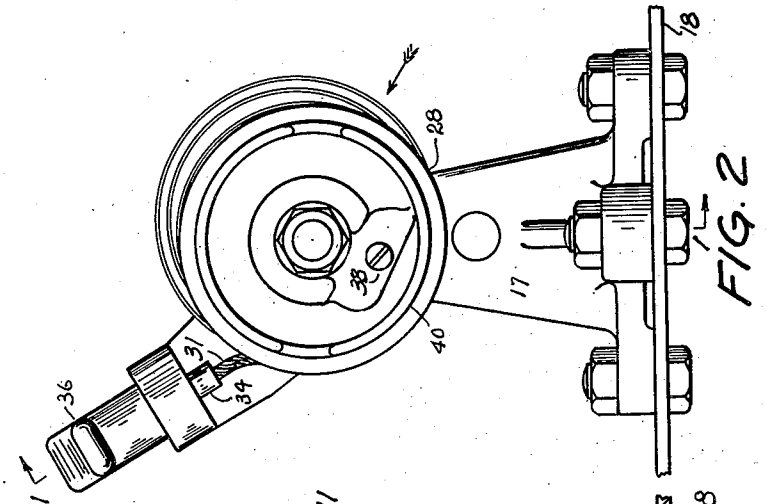


FIG. 2

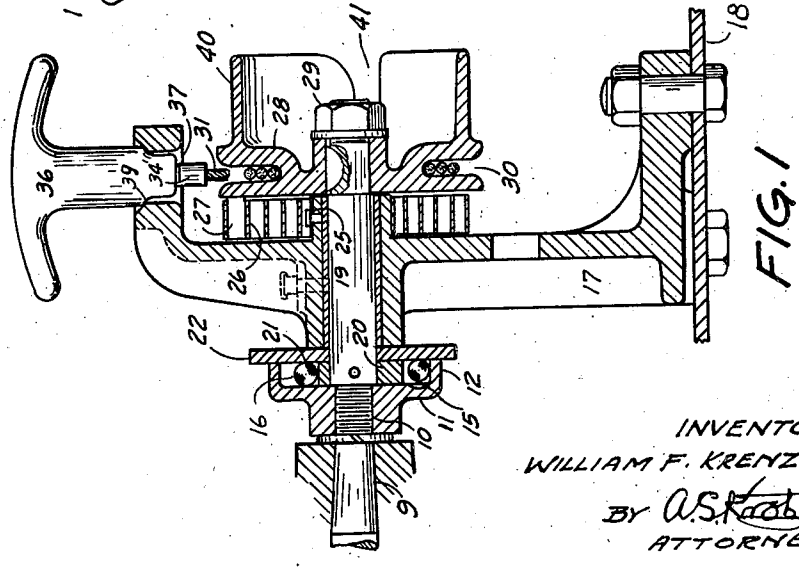


FIG. 1

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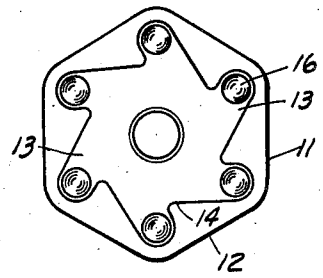


FIG. 6

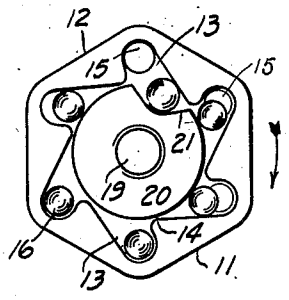


FIG. 5

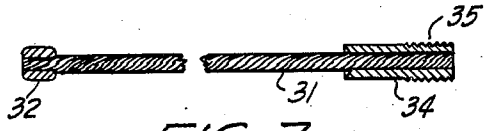


FIG. 7

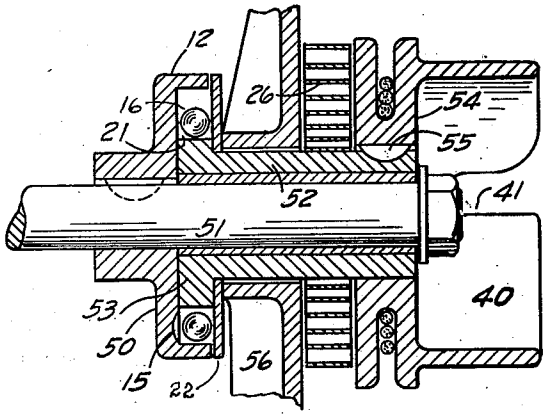


FIG. 8

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Patented June 16, 1942 2,286,419

UNITED STATES PATENT OFFICE

2,286,419

RECOIL STARTER FOR SMALL MOTORS

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Application April 4, 1940, Serial No. 327,779

4 Claims. (Cl. 185—41)

The present invention relates to manually pulled means for starting small motors and has for its objects, providing a device of the class which is simple, light, easily assembled and mounted, certain in its operations and durable.

An object of the present invention is to provide a device which may be operated by means of a manually pulled cable and means whereby the starter will always return to the same position and remain out of contact with the engine when the engine is operating and remains in position for immediate operative engagement with the engine when the engine and starter are at rest.

Another object of the present invention is to provide a simple and efficient cable connection in the bottom of the narrow cable groove.

A further object of my invention is to provide a torsional coil spring made from flat material and being secured at its outer ends to the cable drum by means of a hinged joint.

Another object of the present invention is to provide a device of the class which is easily assembled and disassembled and easily installed.

Another object of the present invention is to provide a clutch in which a number of balls are positioned in suitable grooves so any one of the balls may act to lock the starter to the crank shaft, the pockets having at their peripheral ends, depressions deep enough to retain the balls or at least prevent them from rolling out of the pockets when the member is in a vertical or nearly vertical position so the device may be easily assembled.

To these and other useful ends, my invention consists of parts, combinations of parts, or their equivalents, and mode of operation, as hereinafter described and claimed and shown in the accompanying drawings in which:

Figure 1 is a transverse vertically sectioned view of my improved recoil starter taken on line 1—1 of Figure 2.

Figure 2 is a front view of the starter illustrated in Figure 1.

Figure 3 is an end view of the cable showing some of the parts by dotted lines.

Figure 4 is a side view of the sheave viewed from Figure 2 as indicated by arrow.

Figure 5 is a front view of the clutch members also illustrating the balls in normal position when the starter and engine are at rest.

Figure 6 is a view similar to Figure 5 showing the position of the balls when the engine is in operation and the starter at rest.

Figure 7 is a fragmentary drawing of the cable the end members thereon being shown in section.

Figure 8 is a longitudinal sectional fractional view similar to Figure 1 illustrating a modification.

As thus illustrated in Figures 1 to 7 inclusive, the fractional end of the engine shaft is designated by reference numeral 9 having screw threaded thereon as at 10 the clutch member 11. Member 11 has on its exterior surface preferably a longitudinally extended hexagon surface 12 on the inner edges of which are formed cutaway grooves 13 which are positioned at a considerable angle as clearly indicated in Figure 5, the grooves 13 forming lips 14. Grooves 13 at their outer ends are provided with shallow depressions 15. Each groove 13 is provided with a ball 16 which is free to move longitudinally in the groove. The object of depressions 15 is to assist in assembling the device as will hereinafter appear. It will be noted that members 12 and 14 form an annular overhanging member which with its hub may be classed as one member of a ratchet.

I provide a bracket 17 which may be mounted on an engine supporting plate 18. I rotatably mount a shaft 19 in member 17 so this shaft is in axial alignment with engine shaft 9.

I securely mount on the inner end of shaft 19 a collar 20 and I mount a ball retaining washer 22 on the shaft as illustrated. Member 20 fits loosely between the ends of lips 14 and has a length about equal to the depth of the annular overhanging member. A pocket 21 is provided in member 20, the shape of the sides of the pocket being about as illustrated in Figure 5. The shape and depth being such as will cause whichever ball is in the pocket (see Figure 5) to act as a rachet to turn the engine shaft in the direction indicated by arrow in Figure 5 when member 19 is turned in the starting direction. The other side of pocket 21 is angled so it will push the ball into the pocket if the starter is turned backward or when the engine starts. Thus these clutch members act as a rachet.

Thus it will be seen by scrutinizing Figure 5 that when the engine is standing, all of the balls except one will lie loosely in pockets 13. The upper ball will be permitted to fall into cutaway portion 21, because member 21 is preferably arranged to be in the position shown when the starter is at rest. However, if the cable is adjusted so member 21 is held normally at the bottom, then the rachet action is effective only after the starter handle is pulled far enough to

move member 21 to near the position shown in Figure 5. Thus it will be seen that the engine may stop in almost any position and still one of the balls will either lie in pocket 21 or be in position to fall immediately into this pocket when the starting cable is pulled.

Bracket 17 is provided with an annular projection 25 around which the spring 26 is coiled, the inner end of the spring being secured to this projection as illustrated in Figure 1. The outer end of the spring is arranged to rotatably embrace a pin 27 which is secured to sheave 28. This sheave is keyed to shaft 19 and securely held thereon by nut 29.

Thus it will be seen that member 28 may turn in the direction indicated by arrow in Figure 2 and that it will be pulled back to its starting position by spring 26 and without undue strain on the fastenings of the spring.

A cable groove 30 is provided in sheave 28 having a width slightly wider than the diameter of the cable 31. The inner end of this cable is provided with a collar 32, the coller having rounded corners and being slipped over the end of the cable and then compressed providing a suitable anchor to the cable.

Grooves 33 are cut into the opposite sides of grooves 30 and a tangent to the bottom of this groove as illustrated in Figure 3 so member 32 may be pulled into the bottom of the groove after which a screw 38 is inserted and made fast in a threaded opening so member 32 cannot leave the groove but will be permitted to turn hinge like.

Thus it will be seen that the inside end of the cable will be firmly anchored in the bottom of groove 33 but that this anchor provides means whereby the cable may wind into the groove by the action of the spring and that when unwound it will be free to swing hinge like in groove 33.

A sleeve 34 having one end screw threaded as at 35 is positioned over the other end of the cable and the inner end compressed so as to form a permanent fastening to the cable and a contact surface for a suitable tool with which the sleeve may be screwed into handle member 36. Cable 31 is of a length whereby the spring will cause the cable to be wound in its groove and the handle 36 pulled into an opening 37 provided in the upper end of bracket 17 as clearly illustrated in Figures 1 and 2.

The lower end of handle 36 is reduced in size so a shoulder 39 is formed and will rest in the counterbored part of opening 37 as illustrated. Cable 31 is of a length which will hold member 21 in the position shown in Figure 5.

When the engine starts, the balls will immediately be thrown into the outer ends of grooves 13, (see Figure 6). Thus there will be no mechanical connection between the engine and the starter when the engine is operating. The opening between projections 14 is slightly larger than the diameter of member 20 so that when the starter is at rest there need be no contact between these parts. Projection 14 will however, act to maintain practical axial alignment between shafts 9 and 19 when the operator is pulling on the handle 36.

Member 28 is provided with an annular flange 40 having oppositely positioned grooves 41—41; thus if the cable or spring should be out of working order, or for any reason if it is desired, a rope may be wound around this flange, the inner end having a knot and being moved into the bottom of one of the openings 41 so the rope may be pulled for starting the engine instead of the cable. In place of the rope, a crank may be inserted loosely over the hub of member 28 having pins which engage slots 41. Thus additional means are provided for manually operating the starter. Member 40 also acts as a shield to prevent contact with nut 29.

Thus it will be seen that I have provided a very simple, efficient and easily installed recoil starter for small internal combustion engines, that a simple and efficient rachet means is provided between the starter and engine and that the starter will be light and strong and not apt to get out of order.

It has already been noted that no definite connection is made between member 11 and member 20 except through balls 16. In order to assemble the starter and attach it to the engine, member 11 is placed on a bench or otherwise held in a vertical position and the balls placed in depressions 15. The clutch parts are then held together and the starter positioned so member 11 is pressed against the threaded end of shaft 9. Then by giving handle 36 a pull, member 11 will engage the threads and turn into the position shown in Figure 1.

If it is necessary to remove member 11 from the engine shaft, bracket 17 is first loosened from its support and a wrench placed over the hexagon part of member 11 with which to loosen this member from the shaft and then it may be turned by hand without being moved out of position with member 20. If it is desired, the bracket may be removed first and the balls permitted to fall out of the clutch. Either method may be used for detaching the starter.

In Figure 8, I illustrate a modification which is generally is like the device illustrated in the other figures except a member 50 is keyed to an extended part of the engine crank shaft 51. A sleeve 52 is rotatably mounted on shaft 51 and carries a flanged member 53 which is equivalent to member 20 in the other figures.

Member 54 is equivalent to member 28 of the other figures and is keyed to the sleeve 52 as at 55. The inner end of the coil spring is secured to member 52 and the outer end secured to member 54 as in the other figures. All of the other parts of the starter are similar to the parts illustrated in the other figures except that bracket 56 is loosely mounted on sleeve 52. The looseness of this mounting is equivalent to the looseness between projections 14 and member 20 in the other figures and being such as will insure against frictional contact between the bracket and sleeve 52 except possibly when the operator is pulling on the handle for starting the engine. The operation of this modified form of starter will obviously be the same as the operation of the other design shown.

The operation of my device is as follows: Normally a ball will lay in notch 21 (see Figure 5) and when handle 36 is pulled, this member will be turned clockwise, the ball acting to transmit the motion to member 12 and start the engine. Regardless of the pull against bracket 17, member 20 will be held in practical axial alignment with the engine shaft by the projections between slots 13.

When the cable is pulled and the engine starts, the ball in slot 21 will be released and either be pushed into its slot by notch 21 or moved out into the slot by centrifugal force. Cable 31 is nearly always pulled until it is entirely unwound.

Sleeve 32 will turn in passageway 33 so as to prevent bending the cable near the sleeve but

even if the sleeve turns slightly further by inertia, it will be caused to pull against the side of passageway 33 and perhaps against stop 38.

After the operator discontinues pulling hard on the handle, the spring will rewind the cable in the slot until handle 36 rests against the opening in the bracket, so that notch 21 will again stand about as shown in Figure 5 but all of the balls will continue to remain in the outer ends of their slots so there need not be metal contact between any of the starter parts and member 11 and its balls. Generally member 20 is made slightly shorter than the depth of the slots and slightly smaller in diameter than the inside diameter of member 12 for the purpose.

In addition to the modification illustrated in Figure 8, it will be apparent that many minor detail changes may be made without departing from the spirit and scope of my invention as recited in the appended claims.

Having thus shown and described my invention, I claim:

1. A recoil starter of the class described, comprising an engine having a crank shaft with a protruding end, a supporting bracket having a shaft rotatably mounted therein and being held in axial alignment with said crank shaft, a hub secured to said protruding end and having an annular member, a number of spaced elongated grooves positioned at an angle in the inner surface of said annular member, balls in each said grooves, a collar secured to said last shaft and being held in axial alignment in said annular member and having a groove arranged to receive a portion of one of said balls by gravity and means to thereby act as a ratchet, a sheave secured to the outer end of said second shaft, a retrieving spring positioned between said sheave and bracket and having a connection at one end to said bracket and a connection at the other end to said sheave, a cable pivotally anchored at one end to said sheave, the other end extending through an opening in said bracket, a handle secured to the other end of said cable and adapted to act as a limit stop against the retrieving action of said spring.

2. A starter of the class described, comprising in combination an engine having a crank shaft with one end protruding, a clutch member secured to said protruding end having an overhanging annular member, a number of elongated spaced angularly positioned grooves in the inner surface of said annular member, a free ball in each said grooves, a rotatably mounted member positioned in axial alignment with said crank shaft and having secured to its inner end a collar having a length and diameter slightly less than the length and inside diameter of said annular member and being positioned therein, a notch in the periphery of said collar, said grooves and notch adapted to cooperate whereby one of said balls is always adapted to fall into said notch by gravity to thereby provide a rachet connection between said annular member and collar and whereby the ball will move out of said notch by centrifugal force when the engine is operating, means adjacent said annular member adapted to prevent said balls from escaping from their grooves, a manually operated means arranged for turning said rotatably mounted member to thereby cause said rachet connection to turn said engine shaft, retrieving means adapted to return said rotatably mounted member to its normal position.

3. A starter of the class described, comprising an engine having a crank shaft with a protruding end, a supporting bracket having a shaft rotatably mounted therein being held in axial alignment with said crank shaft, a rachet connection between said shafts, a sheave secured to said last shaft, a coil spring, the inner end of which is secured to said bracket and the other end being secured to said sheave, a cable pivotally connected at one end to the bottom of the groove in said sheave, the other end extending through an opening in said bracket, a handle secured to the other end of said cable and adapted to act as a limit stop against the action of said spring when said sheave is in its normal position, said groove being slightly wider than the diameter of the cable, a pivotal connection comprising a collar secured to the inner end of the cable, channels in opposite sides of said groove forming a free passageway for said collar to the bottom of the groove, said passageway being on a tangent with the bottom of said groove, the bottom of which is adapted to receive the normal pull of said collar, a stop in said passageway forming a retainer for said collar.

4. A recoil starter of the class described, comprising an engine having a crank shaft with a protruding end, a rotatably mounted member in axial alignment with said crank shaft, a ratchet connection between said crank shaft and rotatably mounted member, a sheave rigidly mounted on said rotatably mounted member having a narrow groove and a cable adapted to be wound in a single row therein, the inner end of said cable having a collar, an enlarged opening formed by grooves in opposite sides of said first groove and extending to the bottom thereof wherein said collar is positioned, a stop in said enlarged opening near said collar, the inner end of said enlarged opening adapted to receive the normal pull of said cable, a hand grip secured to the other end of said cable, a stationary bracket having an opening through which said cable extends, a spring having one end secured to said bracket and the other end secured to said sheave, said spring adapted to rewind said cable to the limit permitted by said hand grip.

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