

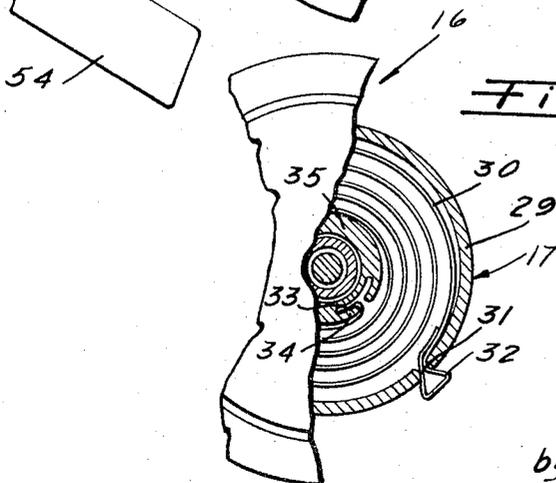
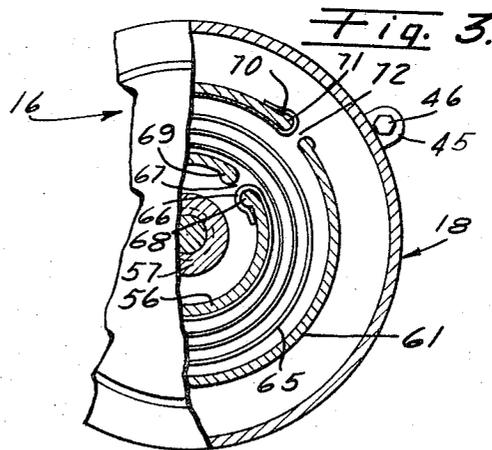
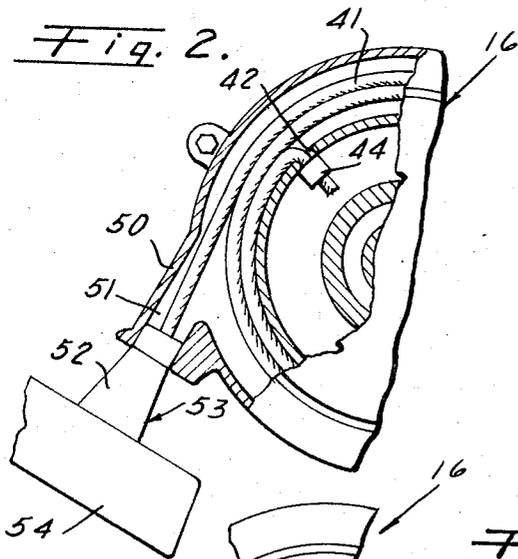
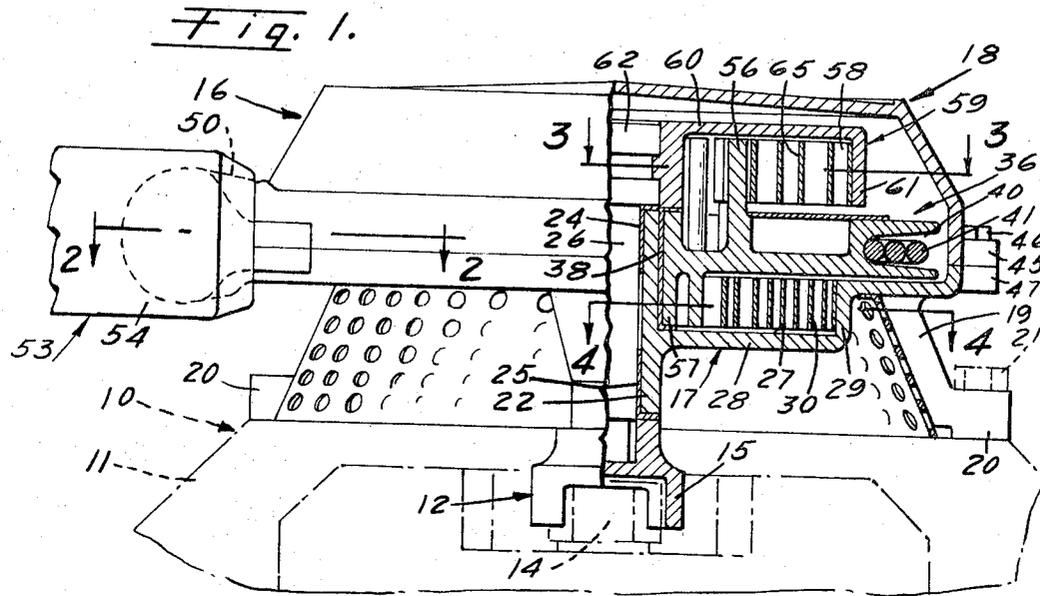
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SPRING STARTER FOR INTERNAL COMBUSTION ENGINES

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3,306,277

**SPRING STARTER FOR INTERNAL COMBUSTION ENGINES**

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This invention relates generally to starters for internal combustion engines and relates more particularly to manually actuated starters therefor.

While the invention has particular utility in connection with starters for small internal combustion engines such as are used on lawn mowers, outboard motors and the like, wherein there is an element, such as a pulley upon which a cord is wound, the element being actuated when the cord is pulled, thereby effecting starting of the engine, it is to be understood that its utility is not confined thereto.

As is well known, there are certain difficulties in providing a suitable and safe starter of this type for internal combustion engines and it is an object of the present invention to provide a starter for such engines that overcomes said difficulties.

It is another object of the invention to provide mechanism of this character that will quickly start the engine.

It is still another object of the invention to provide a starter of this character which eliminates kick-backs on starting an engine even when the spark is advanced.

It is a further object of the invention to provide a mechanism of this character that eliminates violent pulling or jerking of the rope when starting the engine.

A still further object of the invention is to provide mechanism of this character which will start the engine with a relatively easy and steady pull on the rope.

It is another object of the invention to provide a starter of this character that will start the engine with a minimum of manual effort.

It is still another object of the invention to provide mechanism of this character that will require a reduced pull on the rope, relative to previous starters of which I am aware, without sacrificing engine starting speed.

It is a further object of the invention to provide mechanism of this character that eliminates uncomfortable jerk on the rope and high peak pull.

A still further object of the invention is to provide mechanism of this character having an elastic member interposed between the rope pulley and the starter shaft engagement clutch.

It is another object of the invention to provide mechanism of this character that is relatively inexpensive to manufacture.

It is still another object of the invention to provide mechanism of this character that is simple in construction and reliable in operation.

A further object of the invention is to provide a mechanism of this character that is compact and easily and economically manufactured.

It is a further object of the invention to provide a mechanism of this character that requires a minimum of maintenance.

The characteristics and advantages of the invention are further sufficiently referred to in connection with the following detailed description of the accompanying drawings, which illustrate one embodiment. After considering this example, skilled persons will understand that many variations may be made without departing from the principles disclosed, and I contemplate the employment of any structures, arrangements or modes of operation that are properly within the scope of the appended claims.

Referring to the drawings, which are for illustrative purposes only:

FIG. 1 is a side view of the mechanism embodying the present invention, a portion being broken away to show the interior construction;

FIG. 2 is a sectional view taken in line 2-2 of FIG. 1; FIG. 3 is a sectional view taken on line 3-3 of FIG. 1; and

FIG. 4 is a sectional view taken on line 4-4 of FIG. 1.

Referring more particularly to the drawings, there is shown the upper end of an engine, indicated generally at 10. The engine includes a fan housing 11 at the upper end of which is a one way clutch, indicated generally at 12, which includes a driven part 14 and a driving part 15. The clutch is of the usual well known character and hence details thereof are not shown.

Above the fan housing is the starter mechanism, indicated generally at 16, said starter mechanism including a lower casing member 17 and an upper casing member 18. The lower casing member is provided with a plurality of annularly spaced struts 19 which have their lower ends formed in bosses 20 with openings therethrough for reception of screws 21 whereby the lower casing member 17 is secured to the upper end of the fan housing. The lower casing member includes a tubular bearing support 22 which is arranged in axial alignment with the clutch members and the engine shaft to which the driven clutch member 14 is secured. The bearing support 22 extends upwardly above the top of the lower casing member and disposed within said bearing support are bearings or bushings 24 and 25 within which is operably disposed starter shaft 26, driving clutch member 15 being secured to the lower end of said shaft 26.

The lower casing member 17 has an annular chamber 27 disposed about the bearing support 22, said chamber being spaced upwardly of the lower end of said bearing support. The bottom wall 28 of said chamber and the outer annular wall 29 thereof define a drum in which is disposed a rewind spring 30.

Drum wall 29 has a vertical slot 31 therein through which an end portion of the rewind spring 30 extends and the end portion of said spring is formed in a loop 32 which retains the outer end of said spring 30 in position and anchors same against movement. The inner end of the rewind spring 30 is provided with a hook 33 disposed about a projection 34 formed in the hub 35 of a pulley, indicated generally at 36. Spring 30 is normally under some load and when the pulley 36 is rotated in the direction to start the engine said spring is further loaded and will return the pulley to its normal inoperative or rest position when said pulley is allowed to return to said position.

Pulley 36 is operably mounted on the upper end portion of the bearing support 22 and there is a bearing 38 between the hub of the pulley and the adjacent part of the bearing support. This pulley 36 is provided with a peripheral groove 40 of the usual character for reception of the starter rope 41 in which groove said rope is normally wound.

The inner end of starter rope 41 extends through an opening 42 provided therefor and there is a collar 44 secured to said end of the rope to prevent said end from slipping out of said notch when the rope is pulled outwardly to its fullest extent.

The upper casing member 18 of the starter housing is provided with ears 45 having openings therethrough for reception of bolts 46 which extend downwardly and are screwed into tapped openings provided therefor in ears 47 of the lower casing member 17.

The upper and lower casing members 17 and 18 have parts cooperating to form a tubular guide 50 having a

passage 51 therethrough generally tangential to the pulley 36 and communicating with the interior of the starter housing 16. The outer end of the starter rope 41 extends into the passage 51 and is secured to an aligned member 52 of a starter handle, indicated generally at 53, and including a transverse handle member 54 which is grasped in the hand of the operator and pulled to pull the rope 41 outwardly through passage 51 and rotate the pulley 36.

Pulley 36 has an upstanding central flange 56 concentric with and adjacent its hub 57. Flange 56 extends upwardly into the hollow interior 58 of a drum, indicated generally at 59, said drum having an upper wall 60 and a downturned peripheral flange 61 which wall and flange define the interior 58. Drum 59 is open at the bottom for reception of the upper portion of flange 56 of the pulley and said drum is secured to a member 62 which in turn is secured to the upper end of shaft 26. Within drum 59 is a spring 65 which has its inner end formed in a hook 66. Flange 56 of the pulley 36 has a slot 67 therein which is defined by rounded end portions 68 and 69 of said flange 56. Hooked portion 66 of spring 65 is hooked about the rounded end portion 68 so as to be anchored to the flange 56. The outer end of spring 65 is formed into a hook 70 and is hooked about a rounded end portion 71 defining one side of a slot 72 in flange 61 of the drum 59.

Thus the spring 65 forms part of the operative connection between the handle 54 and the driving member of the clutch 12.

In order to start the engine the operator grasps the handle 53 of the starter rope and pulls said rope to thereby rotate the pulley 36. This pull on the rope winds up the rewind spring 30 and at the same time actuates the drum 59 sufficiently to cause the driving clutch member 15 to engage the driven clutch member 14. Thus the clutch 12 is engaged for starting and a further pull on the rope 41 exerts a torque on shaft 26 through the spring 65.

Engine compression resists rotation of the shaft 26 and the spring 65 winds up under the continued pull on the rope until the piston goes over top dead center. A continued pull on the rope combined with the stored energy of the spring 65 snaps the engine over the next compression, thereby starting the engine without jerking the rope.

Quick starting is effected due to rapid acceleration of the engine by the combined forces just described, said engine starting with a modest, steady rope pull, which is followed through to keep the spring wound ahead of the pulley, which produces an impedance matching effect that smoothly accelerates the engine to maximum speed for starting with a minimum of manual effort.

The invention and its attendant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the form, construction and arrangement of the parts of the invention without departing from the spirit and scope thereof or sacrificing its material advantages, the arrangement hereinbefore described being merely by way of example, and I do not wish to be restricted to the specific forms shown or uses mentioned except as defined in the accompanying claims, wherein various portions have been separated for clarity of reading and not for emphasis.

I claim:

1. In an engine starter:

- (A) a rotatably mounted shaft;
- (B) a rotatably mounted pulley;
- (C) a flexible member wound on said pulley for rotating said pulley when pulled;
- (D) rewind means, energizable by the rotation of said pulley, for returning said pulley to its original position after said pulley has been rotated by said flexible member;
- (E) and means interconnecting said pulley and said shaft including a starter spring energizable in response

to the rotation of said pulley, whereby a starting rotational force is yieldingly applied to said shaft by pulling said flexible member.

2. The invention defined by claim 1, wherein the rewind means includes a coiled spring which preloads the pulley in a rewind direction independently of said starter spring.

3. The invention defined by claim 1, wherein the means interconnecting said pulley and shaft includes a hollow drum secured to said shaft, said drum being positioned adjacent said pulley and having a peripheral flange extending toward said pulley, the side of the drum adjacent said pulley being open, and an annular flange on said pulley adjacent its center, said flange extending into the hollow interior of the drum, said starter spring having one end connected to the flange of the drum and the other end connected to the flange of the pulley.

4. An engine starter comprising:

- (A) a housing adapted to be mounted on a fixed part of an engine;
- (B) a pulley rotatably mounted within said housing, a flexible member wound around said pulley for rotating the pulley when pulled;
- (C) yielding means loaded by the rotation of said pulley in one direction and tending to return the pulley to its original position;
- (D) a clutch shaft adapted to have a one-way driving connection with a rotatable part of the engine;
- (E) a hollow drum fixed to said shaft adjacent said pulley and open at its side facing the pulley, said drum including a part extending towards said pulley;
- (F) a part on said pulley extending into said drum in inwardly spaced relation to said part of said drum;
- (G) and a starter spring having one end connected to said part of said drum and the other end connected to said part of said pulley so as to provide a resilient element between said pulley and said drum.

5. In a starter for internal combustion engines:

- (A) a tubular support member;
- (B) a clutch shaft rotatably mounted in said support member;
- (C) a clutch driving part secured to one end of said shaft;
- (D) a hollow drum secured to said shaft in spaced relation to said one end thereof and open at one side, said drum having an annular peripheral flange extending laterally at one side;
- (E) a starter pulley rotatably mounted on said support member and positioned adjacent the open side of said drum;
  - (a) a flange on said pulley, said support member and said flange extending into the open side of said drum;
- (F) a flexible member wound on said pulley and adapted to rotate said pulley in one direction when pulled;
- (G) resilient means interconnecting the flange of said pulley and the flange of said drum; and
- (H) resilient means for returning the pulley to its original position after it has been rotated by said flexible member.

6. The combination of a starter mechanism with an internal combustion engine having a rotatable crankshaft, and a tubular support member axially aligned with said crankshaft, said starter mechanism comprising:

- (A) a starter shaft rotatably mounted in said support member;
- (B) a pulley having a hub rotatably mounted on said support member, said pulley having a peripheral groove therein and an annular flange adjacent the hub and extending laterally of said pulley;
- (C) a one way clutch for starting interconnection of said starter shaft and said crankshaft;
- (D) a hollow drum having a hub portion connected to said starter shaft, said drum including an end wall

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- and a peripheral flange extending toward said pulley, said drum being adjacent to said pulley and having the side adjacent said pulley open with the flange of the pulley extending into said drum;
- (E) resilient means interconnecting the flange of said pulley and the flange of said drum;
- (F) a flexible member normally wound in the groove of said pulley for rotating said pulley in one starting direction when pulled; and
- (G) means for returning said pulley to its original position after said pulley has been rotated by said flexible member.

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