Aug. 21, 1951 P. E. MACK 2,564,787

REWIND TYPE ROPE STARTER

Filed Oct. 11, 1950 2 Sheets-Sheet 1

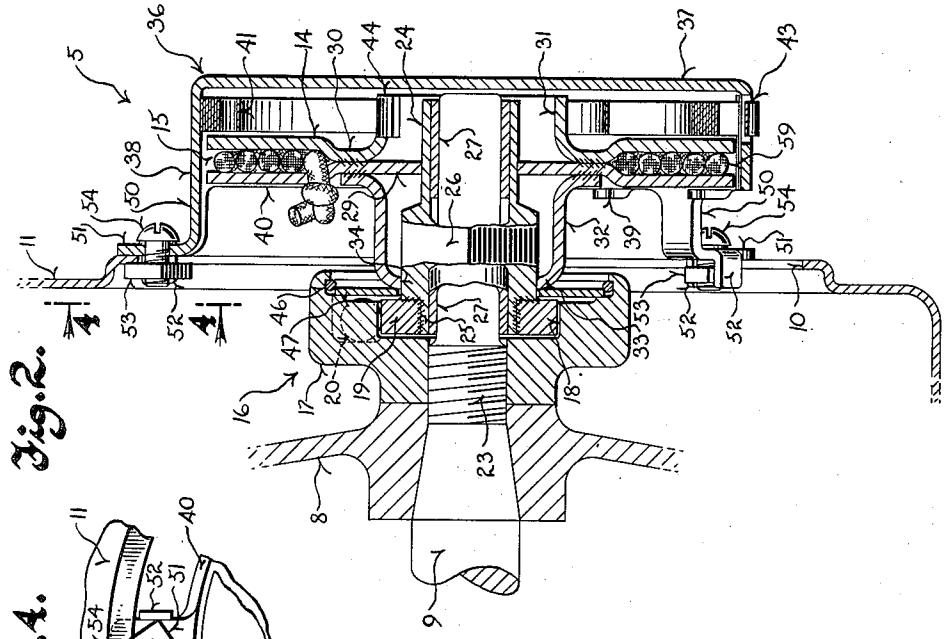


Fig. 2.

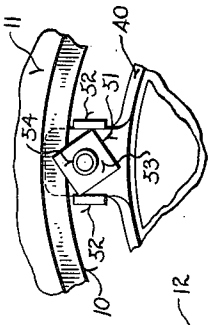


Fig. 4.

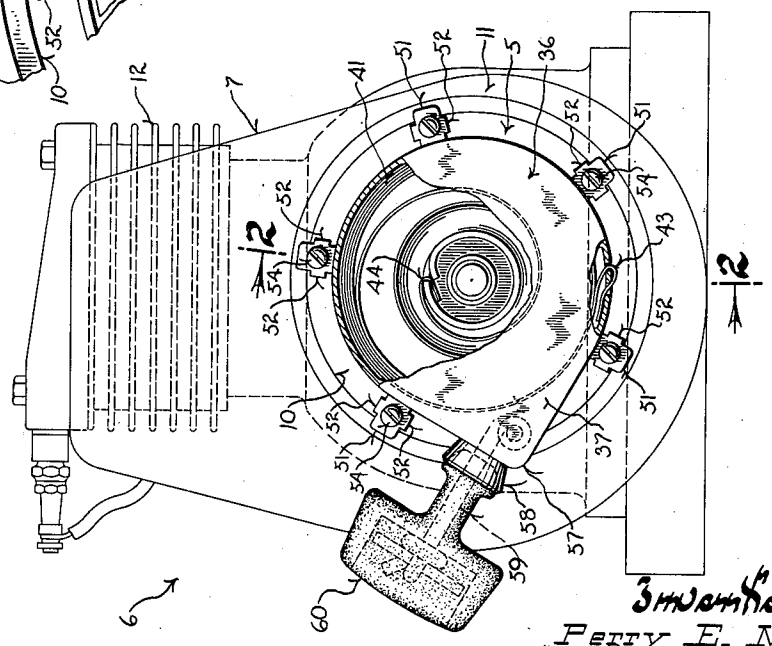


Fig. 1.

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REWIND TYPE ROPE STARTER

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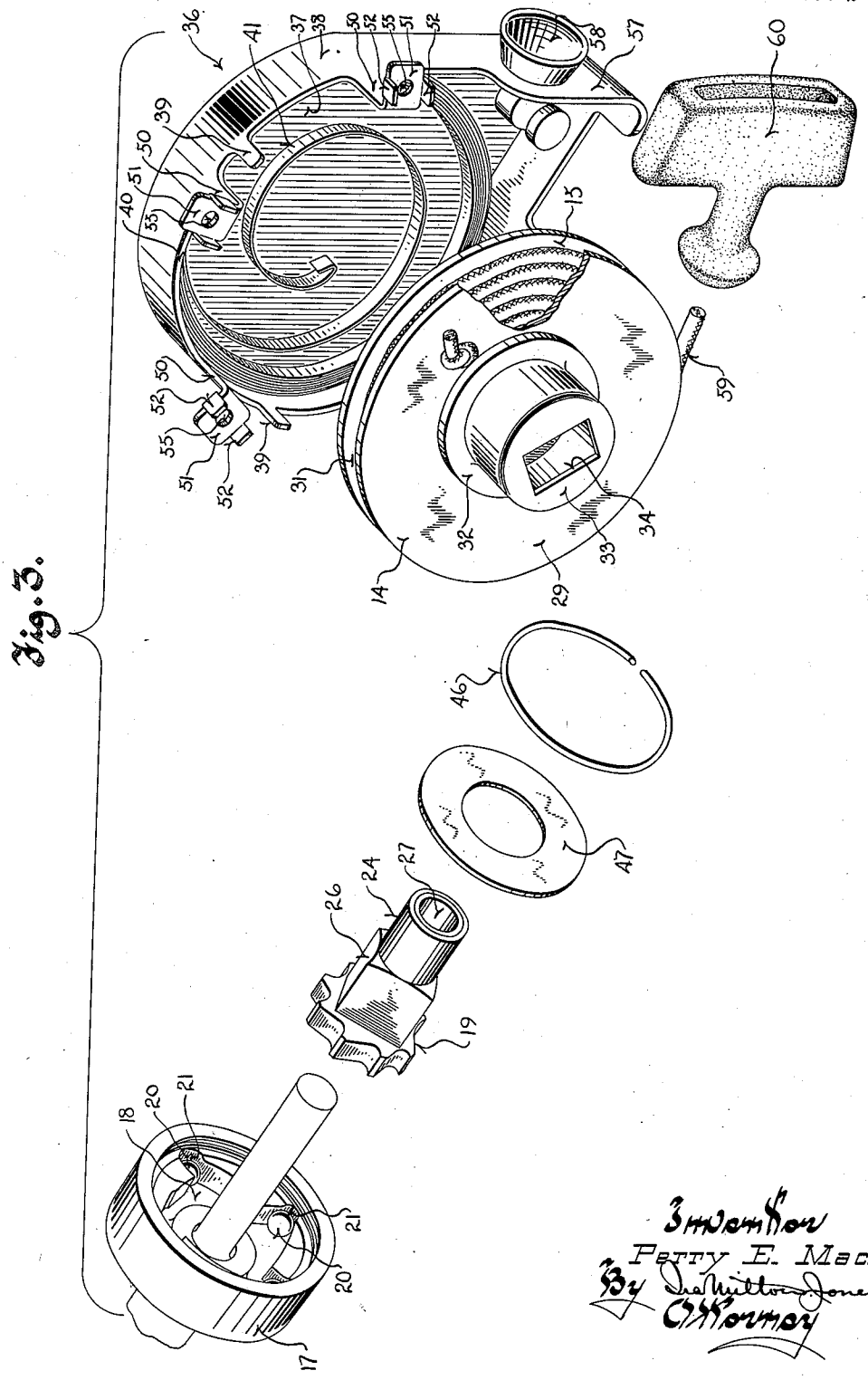


Fig. 3.

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Patented Aug. 21, 1951

2,564,787

UNITED STATES PATENT OFFICE

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REWIND TYPE ROPE STARTER

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8 Claims. (Cl. 123—179)

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This invention relates to starting mechanisms for internal combustion engines and has more particular reference to improvements in rewind type rope starters for small internal combustion engines.

Rope starters have been used extensively in recent years on outboard motors and other small internal combustion engines. Their characterizing features are that the starter pulley about which the pull rope is wound is rotationally biased in a rope winding direction by a relatively long coiled torsion spring; while the pulley is drivingly connected with the crankshaft of the engine through a unidirectional clutch.

The main purpose of this invention is to provide a rewind type rope starter of the character described which is particularly adapted for use with small internal combustion engines of the air cooled type. Such engines have a flywheel which also serves as an impeller; and the flywheel is enclosed within a blower housing at one side of the engine so that air may be drawn through an air inlet opening in the side wall of the blower housing by the flywheel and directed by the housing walls over cooling fins on the cylinder of the engine.

It will be readily appreciated that the application of a rewind type rope starter to the flywheel end of the crankshaft of an engine of this type presents several problems which result chiefly from the necessity of securing the starter casing to the blower housing without interfering with free passage of air into its air inlet opening, and without causing too much strain to be imposed upon the relatively weak housing during starting of the engine; and from the fact that there is very frequently a degree of eccentricity between the crankshaft and the air inlet hole in the blower housing.

With these problems in mind it is one of the purposes of this invention to provide a rewind type rope starter of the character described in which the strain incidental to cranking of the engine by the starter is borne entirely by the crankshaft of the engine so that the relatively weak blower housing is relieved of such strain and does not have to be reinforced.

In this connection it is a more specific purpose of the invention to provide a rewind type rope starter for a small air cooled internal combustion engine wherein the driving element of the unidirectional clutch on the engine crankshaft is constructed to rotatably journal the rope pulley of the starter on the crankshaft so that the pulley is supported thereby rather than by the starter casing encircling the pulley.

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A further purpose of the invention is to provide a rewind type rope starter of the character described for small air cooled internal combustion engines wherein the casing of the starter is provided with means for attaching the starter to the blower housing with the casing centered with respect to the air inlet hole in the housing and spaced therefrom to permit free flow of air into the blower housing; and which attaching means is adapted to hold the casing in any desired position of angular adjustment with respect to said air inlet hole to enable the pull knob of the starter to be disposed at the most convenient location at the exterior of the engine.

Still another purpose of this invention resides in the provision of attaching means by which the starter of this invention may be attached to the blower housing of the engine without necessitating modification of the blower housing in any way.

A further object of this invention resides in a provision of a rewind type rope starter of the character described which is capable of being manufactured as two subassembled units, one of which comprises the unidirectional clutch; and the other of which comprises the starter casing, the rope pulley therein, and the coiled rewind spring connected between the pulley and the housing to yieldingly urge the pulley in one direction of rotation.

With the above and other objectives in view, which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate one complete example of the physical embodiment of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a side elevational view illustrating the application of the rope starter of this invention to a small air cooled internal combustion engine;

Figure 2 is an enlarged sectional view taken through Figure 1 along the plane of the line 2—2;

Figure 3 is a group perspective of the two subassemblies which comprise the starter of this invention, with the component parts of said subassemblies separated but in their proper order of assembly; and

Figure 4 is a fragmentary detail view taken along the line 4—4 of Figure 2.

Referring now more particularly to the accompanying drawings in which like numerals designate like parts throughout the several views, the numeral 5 generally designates the rope starter of this invention, while the numeral 6 generally designates a small internal combustion engine to which the started is attached.

The engine 6 is of the air cooled type, having a blower housing 7 enclosing the flywheel 8 on the projecting end of the crankshaft 9. As is customary, the flywheel is provided with spokes (not shown) which constitute an impeller by which cooling air is drawn through a relatively large air inlet hole 10 in the outer side wall 11 of the blower housing for passage upwardly in the housing and over the cooling fins 12 on the engine cylinder. The flywheel end of the crankshaft, of course, projects out through the air inlet hole 10 in the blower housing, substantially coaxially thereof, to have the starter mechanism 5 connected therewith.

The starter mechanism 5 is similar to all rewind rope starters of this type in that it comprises the usual rope pulley 14, having a relatively deep rope receiving groove 15 in its periphery, and drivingly connected with the engine crankshaft through a unidirectional clutch 16 on the crankshaft. The clutch may be of a more or less conventional type having an annular driven element 17 with a cavity 18 therein opening to its outer side to receive the driving element 19 of the clutch. In the present case the driving element is a racthet the teeth of which cooperate with balls 20 in the cavity 18 to impart rotation to the driven element when the driving element is rotated in one direction, but which cam the balls radially outwardly into wells 21 in the s de of the cavity upon rotation of the driving member in the opposite direction. Hence, during such opposite rotation of the driving element, the latter rotates freely relative to the driven element 17.

Referring to Figure 2 it will be noted that the driven element 17 of the clutch is drivingly connected to the crankshaft by screw threads 23 and preferably also by being keyed thereto; while the driving element 19 is freely rotatably journalled on the projecting end of the crankshaft by an elongated sleeve 24 of special construction.

For ease and low cost of manufacture, the ratchet is preferably brazed to the inner end of the sleeve, with the ratchet received on a reduced neck 25 at the inner end of the sleeve and seated against an enlarged square nut-like part 26 on the sleeve intermediate its ends. Bushings 27 pressed into the interior of the sleeve at its opposite ends provide for freely rotatably journalling the sleeve, and the ratchet, on the projecting end of the crankshaft; and as will appear shortly the sleeve 24 serves to drivingly connect the ratchet with the rope pulley 14 and to mount the rope pulley on the engine crankshaft so that the pulley is entirely supported thereby when the starter is in place on the engine.

In the present instance the rope pulley is shown as being fabricated from three stampings, welded together. The intermediate stamping 29 is ring-shaped and its outer marginal portions provide one of the pulley flanges; while the inner portion of this ring-shaped stamping snugly but slidably fits the cylindrical outer end of the sleeve 24, outwardly of the nut 26.

The other pulley flange is formed by a stamping 30 which has its inner portion drawn axially

to one side of the stamping 29 to provide a hub 31 on the pulley encircling but spaced from the outer end of the sleeve 24.

The third stamping 32 is substantially cup-shaped and is welded to the opposite side of the intermediate stamping 29 to provide a hub which encircles the inner end portion of the sleeve. The bottom 33 of this cup-like hub has a square hole 34 to snugly but slidably fit the nut-like part 26 on the sleeve 24 so that the pulley is in effect splined to the sleeve but capable of being slid onto and off of the projecting end of the crankshaft.

Hence it will be seen that the bottom 33 of the hub 32 cooperates with the stamping 29 to support the rope pulley on the sleeve 24 and consequently on the projecting end of the crankshaft.

The rope pulley is loosely contained within a cup-like casing 36 having a bottom or end wall 37 and a side wall 38 which encircles the periphery of the pulley to substantially close the rope receiving groove therein. A series of tangs 39 bent inwardly from the side wall of the cup at its rim 40 overlie the outer side of the pulley to preclude motion of the pulley out of the casing, while a coiled torsion spring 41 in the bottom of the cup encircling the hub 31 on the pulley limits inward motion of the pulley toward the bottom of the casing. For this purpose the outermost convolution of the torsion spring is looped through circumferentially spaced apertures in the side wall of the casing, as at 43, in a manner which anchors the outer end of the spring to the casing at a point adjacent to the inner flange of the pulley. The inner convolution of the spring has its end hooked in a slit in the hub 31 of the pulley, as at 44. The spring of course is tensioned to yieldingly urge the pulley and consequently the driving element of the unidirectional clutch in a direction opposite to that in which the crankshaft must be rotated to start the engine.

From the description thus far it will be apparent that the rope pulley, its casing, and the torsion spring connected therebetween comprises a subassembly which may be attached to the engine separately of the unidirectional clutch. The unidirectional clutch is also capable of being subassembled and applied to the engine crankshaft separately. For this purpose, the driving and driven elements are maintained connected together by means of a spring ring 46 snapped in an angular groove in the wall of the driven clutch member adjacent to its open side and holding a retaining washer 47 in position closing the cavity 18 and engaged over the ratchet 19 to prevent endwise separation of the ratchet and sleeve connected thereto from the driven clutch element.

The starting mechanism of this invention is easily attachable to the side wall 11 of the blower housing and capable of rotational adjustment relative to the housing. Since the casing for the starter is adapted to be applied over the projecting end of the crankshaft and hence in line with the air inlet opening 10 in the blower housing, it is also essential that the casing be constructed so as not to obstruct the flow of cooling air into the blower housing.

For these purposes the side wall of the casing has a plurality of circumferentially spaced legs 50 projecting forwardly therefrom with outturned feet 51 on their extremities. These feet engage flatwise against the outer surface of the side wall 11 of the blower housing to hold the rim 40 of the casing spaced a distance from the

plane of the wall to which the casing attaches. This enables cooling air to flow in front of the casing for free passage into the air inlet hole 10.

In the present case the air inlet opening 10 is larger in diameter than the casing, and hence the feet 51 extend outwardly sufficiently far as to overlie the blower wall portions adjacent to the air inlet hole 10. In addition each of the feet 51 has a pair of pilot lugs 52 bent over from its opposite side edges, and these lugs are arranged to loosely engage the edge of the hole 10 to hold the casing centered or coaxial with the hole, while allowing the casing to rotate relative to the housing.

Aside from their function of centering the casing with respect to the air inlet hole 10, the pilot lugs also embrace nuts 53 which overlie the rear marginal edge portions of the wall 11 adjacent to the hole 10. Since the nuts are held against rotation by the lugs, tightening of screws 54 passing through apertures 55 in the feet, through the air inlet hole, and threading into the nuts causes the marginal edge portions of the wall 11 at its air inlet hole to be releasably clamped between the nuts and their feet. In this manner, the casing is releasably held on the blower in any desired position of rotational adjustment; and the connection is highly advantageous in that it permits the attachment of the casing to the blower housing without entailing the drilling of holes therein or the provision of any special means for such attachment.

Inasmuch as the air inlet hole 10 very seldom is exactly coaxial with the crankshaft, the starter must be constructed to compensate for such eccentricity. This is easily accomplished in the starter of this invention by reason of the fact that the starter pulley is more or less floatingly contained within its casing. Edgewise or lateral motion of the pulley in the casing is possible by reason of the fact the pulley has a diameter slightly less than that of the side wall of the casing 36. Consequently the pulley is capable of motion laterally to bring it into coaxiality with the crankshaft during application of the starter unit to the engine. However, both the pulley and casing are self adjusting laterally, with respect to the air inlet hole 10 and the crankshaft during application to the engine.

The casing 36 is also provided with an outwardly projecting corner 57 having a socket 58 fixed thereto and through which the pull rope 59 passes to the exterior of the casing to have the pull knob 60 attached to its outer end. Consequently upon pulling the rope to rotate the pulley 14 in a clockwise direction, as viewed in Figure 1, rotation is transmitted from the pulley to the drive element of the unidirectional clutch, and through the driven member to the engine crankshaft to start the engine. When the rope is released the torsion spring 41 rotates the pulley in the opposite direction to rewind the rope thereon, and at this time the driving element of the unidirectional clutch rotates freely relative to the driven member 17.

Inasmuch as the rope pulley is mounted directly on the sleeve 24 and hence on the engine crankshaft and is relatively free of its casing, all of the strain incidental to starting the engine is imposed directly on the crankshaft, thus freeing the relatively weak blower housing from such strain.

In the event the location of the engine renders it difficult or awkward to apply the starting pull to the pulley rope, the casing 36 may be rotated in the air inlet hole 10 by loosening the clamping screws 54, to dispose the pull knob wherever

it is most convenient for the operator of the engine. Thereafter the screws 54 may be retightened to lock the casing in place in the desired position of angular adjustment on the blower housing.

From the foregoing description together with the accompanying drawings, it will be apparent that the rope starter of this invention may be easily attached to the blower housing of a small internal combustion engine without requiring any change in the housing; that it can be secured in any position of angular adjustment relative to the crankshaft of the engine; and that the manner of floatingly mounting the rope pulley inside its casing and of supporting it on the engine crankshaft assures that all of the stress incidental to pulling the rope is imposed directly on the crankshaft rather than on the blower housing.

What I claim as my invention is:

1. A rewind type rope starter for a small air cooled internal combustion engine having a blower housing and a crankshaft one end of which projects through the side wall of the blower housing to be drivingly connected with the rope pulley of the starter through a unidirectional clutch on the crankshaft, said clutch having a driving element rotatable relative to the crankshaft and a driven element secured thereto to transmit rotation of the driving element in one direction only to the crankshaft, characterized by: a casing in which the starter pulley is received, said casing having a side wall encircling the pulley; attaching means on the casing for securing the same to the side wall of the blower housing over the projecting end of the engine crankshaft; means on the starter pulley for drivingly connecting the same with the driving element of the unidirectional clutch; and a sleeve fixed to the driving element of the clutch and journalled on the crankshaft of the engine for freely rotatably mounting the driving element of the clutch and the starter pulley on the crankshaft, and by which the pulley is supported by the crankshaft when the starter is attached to the blower housing of the engine so that the strain incidental to rotation of the pulley by means of its rope is transmitted directly to the crankshaft to relieve the blower housing of such strain.

2. A rewind type rope starter for a small air cooled internal combustion engine having a blower housing and a crankshaft one end of which projects through the side wall of the blower housing to be drivingly connected with the rope pulley of the starter through a unidirectional clutch on the crankshaft, said clutch having a driving element rotatable relative to the crankshaft and a driven element secured thereto to transmit rotation of the driving element in one direction only to the crankshaft, characterized by: means on the starter pulley for drivingly connecting the same with the driving element of the unidirectional clutch, including a sleeve fixed to the driving element of the clutch and freely rotatably journalled on the engine crankshaft for freely rotatably journalling the driving element thereon and for detachably mounting the starter pulley on the crankshaft, and by which the pulley is supported by the crankshaft; a casing in which the starter pulley is loosely retained, said casing having a side wall encircling the pulley in spaced relation to the periphery thereof to provide for lateral movement of the pulley relative to its casing; and

attaching means on the casing for securing the same to the side wall of the blower housing over the projecting end of the crankshaft.

3. A rewind type rope starter for a small air cooled internal combustion engine having a blower housing and a crankshaft one end of which projects through the air inlet hole in the side wall of the blower housing to be drivingly connected with the rope pulley of the starter through a unidirectional clutch on the crankshaft, said clutch having a driving element freely rotatable on the crankshaft and a driven element secured to the crankshaft to transmit rotation of the driving element to the crankshaft in one direction only, characterized by: a cup-like casing in which the starter pulley is loosely retained, said casing having a side wall encircling the pulley but spaced slightly therefrom to accommodate a degree of eccentricity of the pulley in the casing; means on the casing for attaching the same to the side wall of the blower housing over the projecting end of the crankshaft, said attaching means including pilot means insertable into the air inlet hole in the housing to hold the casing centered with respect to said hole; and means on the pulley for drivingly connecting the same with the driving element of the clutch including a sleeve fixed to said driving element and journalled on the engine crankshaft for rotatably mounting the starter pulley on the crankshaft, and by which the pulley is supported by the crankshaft for rotation on its axis despite a degree of eccentricity between the air inlet hole and the engine crankshaft.

4. A rewind type rope starter for a small air cooled internal combustion engine having a blower housing and a crankshaft one end of which projects through the air inlet hole in the side wall of the blower housing to be drivingly connected with the rope pulley of the starter through a unidirectional clutch on the crankshaft, said clutch having a driving element rotatable relative to the crankshaft and a driven element drivingly connected with the crankshaft to transmit rotation of the driving element to the crankshaft in one direction only, characterized by: a cup-like casing in which the starter pulley is loosely received; attaching means on the side wall of the casing at the open end thereof for attaching the casing to the side wall of the blower housing, over the air inlet hole therein, with the rim of the cup-like casing spaced outwardly from the side of the blower housing so as not to restrict the flow of air through said air inlet hole; retaining means on the casing engageable with the pulley therein to prevent motion of the pulley out of the casing prior to attachment of the casing to the engine; and means on the starter pulley for drivingly connecting the same with the driving element of the unidirectional clutch.

5. A rewind type rope starter for a small air cooled internal combustion engine having a blower housing and a crankshaft one end of which projects through the air inlet hole in the side wall of the blower housing to be drivingly connected with the rope pulley of the starter through a unidirectional clutch, said clutch having a driving element rotatable relative to the crankshaft and a driven element drivingly connected with the crankshaft to transmit rotation of the driving element to the crankshaft in one direction only, characterized by: a cup-like casing for the starter pulley; and means for attaching said casing to the side wall of the blower housing in line with the hole therein including pilot means on the casing insertable into said air inlet hole to hold the casing centered with respect thereto, said pilot means permitting rotation of the casing relative to said hole, and releasable clamp means carried by the casing and adapted to be clamped onto the edge portions of the housing wall defining said hole so as to releasably hold the casing in any desired position of rotational adjustment on the blower housing.

6. The rewind type rope starter set forth in claim 5 wherein said attaching means comprises circumferentially spaced legs on the side wall of the starter casing projecting forwardly from the open side of the casing and having feet at their extremities bent therefrom to lie flatwise against the exterior of said housing wall adjacent to the air inlet hole therein, pilot lugs extending forwardly from said feet into said air inlet hole for engagement with the edge thereof to locate the casing laterally on the housing and to guide the casing for rotation on the axis of said hole, and bolts passing through said feet and the air inlet hole and threading into nuts inside the housing to draw said nuts firmly against the inner side of said housing wall for clamping the portions of the housing wall adjacent to the air inlet hole between said nuts and the feet and releasably holding the casing in any desired position of rotational adjustment on the housing.

7. The rewind type rope starter of claim 6 further characterized by the fact that said feet have pairs of pilot lugs thereon embracing said nuts to hold the same against rotation with their screws during tightening or loosening of said screws.

8. In a rewind type rope starter for a small internal combustion engine having a blower housing and a crankshaft one end of which projects through the side wall of the blower housing and has a unidirectional clutch thereon, a starter unit comprising: a cup-like casing having means thereon for attaching the same to said side wall of the blower housing; a rope pulley loosely received inside the casing near the open end thereof; means on the casing for precluding motion of the pulley out of the open end of the casing; a coiled torsion spring in the casing confined between the pulley and the bottom of the casing; a connection between one end of said spring and the pulley; means anchoring the opposite end of said spring to the casing at a location directly alongside an adjacent portion of the pulley so that said anchored end of the spring limits movement of the pulley toward the bottom of the casing, and whereby the spring exerts a yielding torsional force on the pulley tending to rotate the same in a rewinding direction; and means on the pulley providing for drivingly connecting the same with the engine crankshaft through said unidirectional clutch thereon.

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No references cited.