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Braun

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[54] **COMBINED ROPE STARTER AND GUARD FOR GASOLINE ENGINES**

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[73] Assignee: **Briggs & Stratton Corporation**, Wauwatosa, Wis.

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[52] **U.S. Cl.** ..... **123/185 A**, 123/41.7, 123/179 SE, 123/185 G

[51] **Int. Cl.** **F02n 3/02**

[58] **Field of Search** ..... 123/179 SE, 185 A, 123/185 G, 41.7

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[57] **ABSTRACT**

On an engine having a flywheel blower enclosed in a shroud, a driven clutch element is fixed on the adjacent end portion of the cranksnaft, spaced from the shroud. A cooperating driving clutch element is slidable and rotatable on the crankshaft between the driven element and the shroud. A rope pulley is concentrically fixed to the driving clutch element and has an apertured coaxial skirt projecting towards the shroud and releasably engageable with a clip thereon. A cup-shaped outward extension on the pulley encloses the driven clutch element.

4 Claims, 3 Drawing Figures

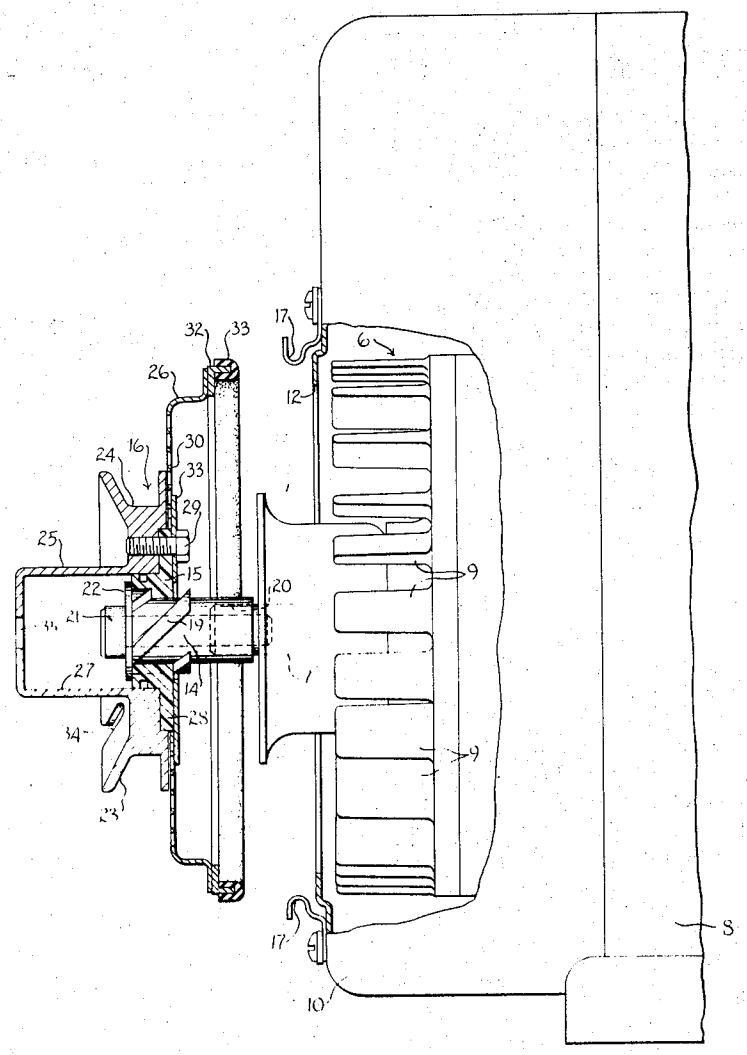

FIG. 1.

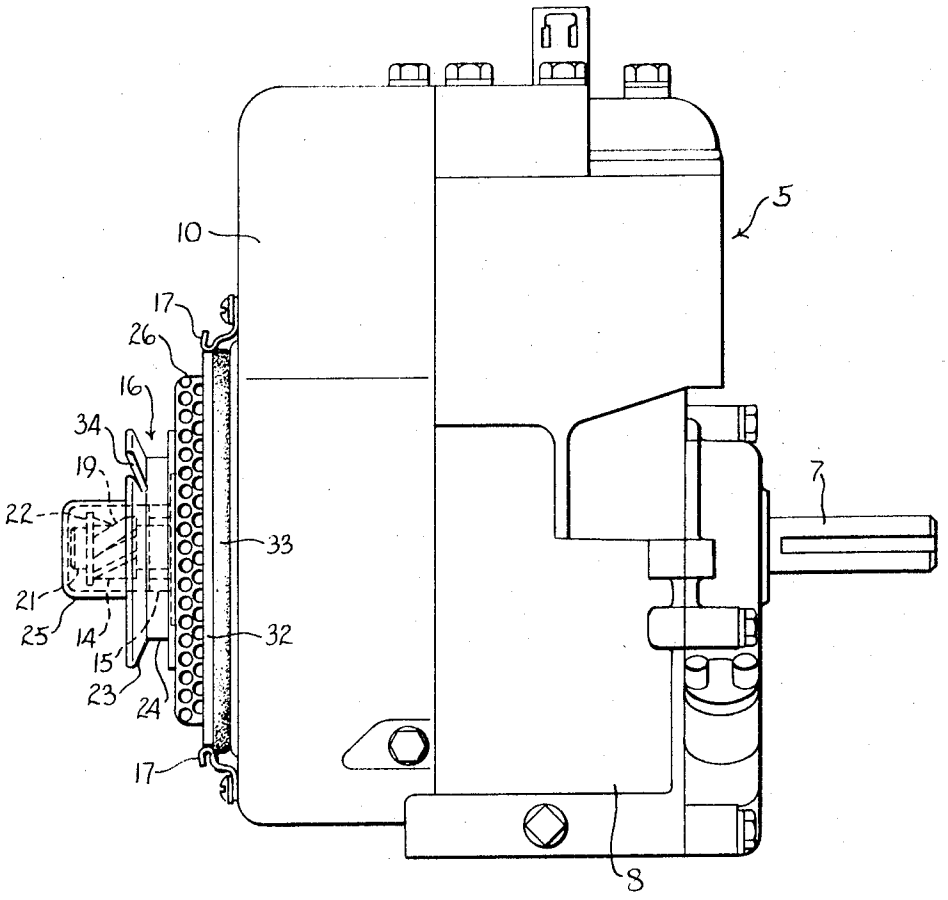

FIG. 2.

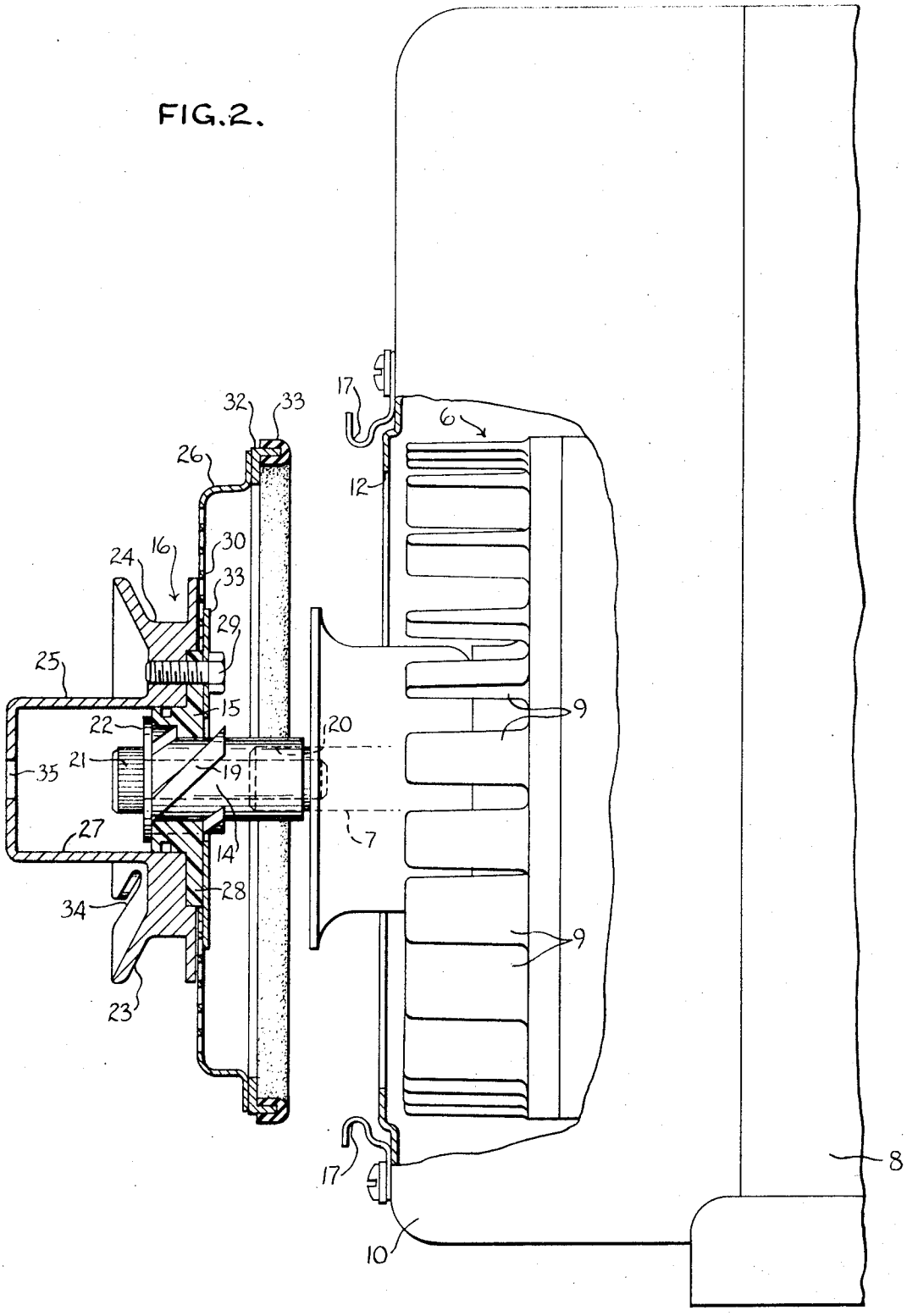
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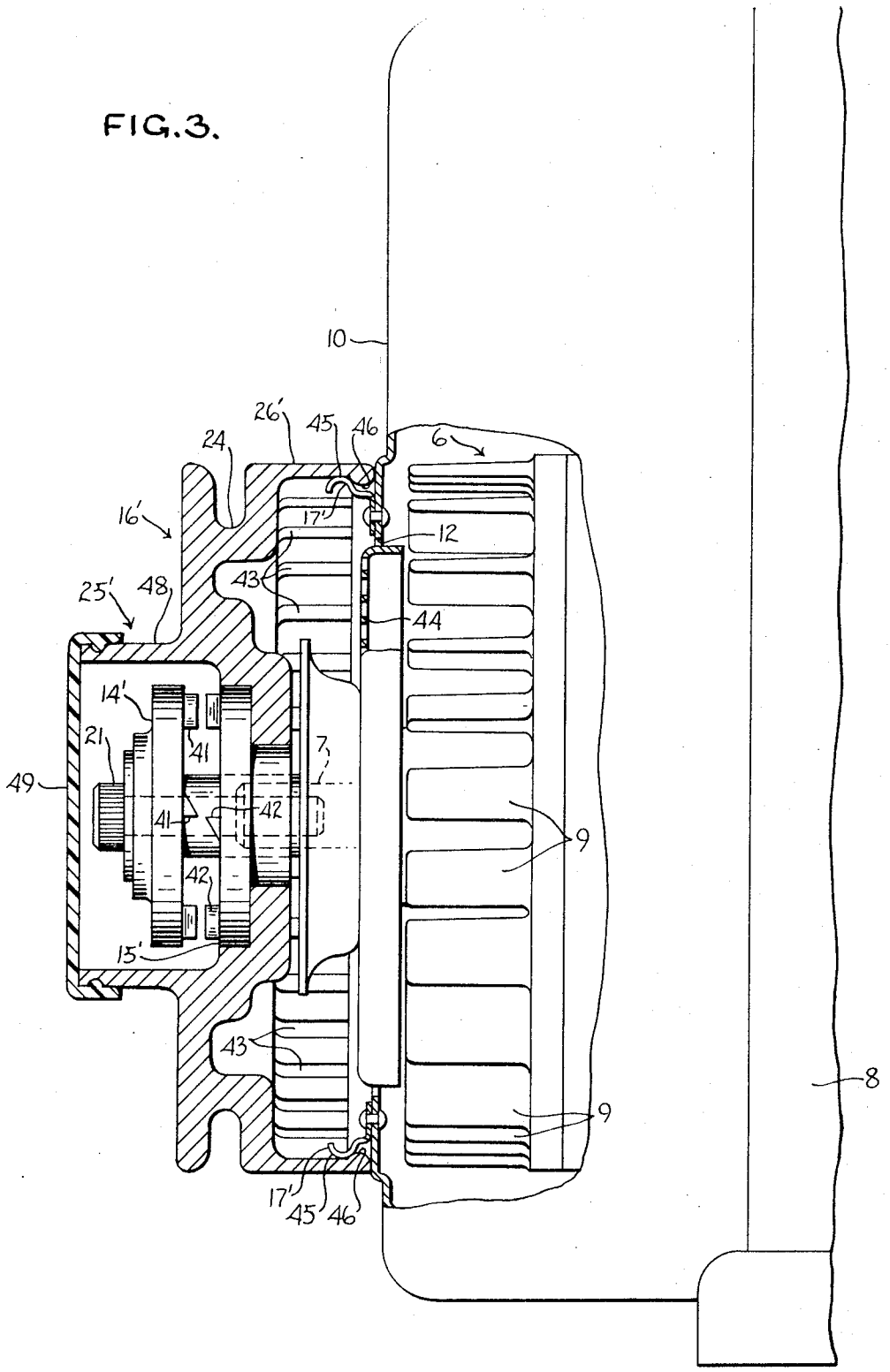
FIG. 3.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COMBINED ROPE STARTER AND GUARD FOR GASOLINE ENGINES

This invention relates to single-cylinder gasoline engines such as are used for powering lawn mowers, air compressors and similar machines; and the invention is more particularly concerned with a simple and inexpensive pull-rope starter for such an engine that also serves as a normally stationary guard for the rotating parts at the flywheel end of the crankshaft.

On a small gasoline engine of the type with which this invention is concerned, one projecting end of the crankshaft is coupled to a load, and a flywheel mounted on its other end has vanes or blades on its periphery for blowing cooling air across the engine body. The flywheel is enclosed in a sheet metal shroud that distributes and directs the cooling air across the hot parts of the engine. The shroud has a rather large air intake opening concentric with the flywheel, through which the adjacent end portion of the crankshaft projects outwardly, and in most cases the driven element of a starter is secured to this projecting end portion of the crankshaft.

In the interests of safety, it is desirable to have all rotating parts of a power machine guarded by normally stationary enclosures. On an engine, therefore, there should be a guard across the air inlet in the shroud and around the adjacent projecting end portion of the crankshaft.

On a small engine which does not have an electric starter, and which is intended for powering such machines as power lawn mowers and rotary tillers, the manual starter may be of the spring wind-up type or of the rope-recoil type, but in either case the starting mechanism is usually arranged to have stationary parts which serve as a guard for rotating parts at the flywheel end of the crankshaft.

However, on engines intended for such construction industry equipment as pumps, generators and air compressors, where the engine runs for many hours and sometimes for days after each start, a very simple pull-rope starter is preferred. Heretofore such non-recoil rope starters have consisted of a rope pulley anchored to the flywheel end portion of the crankshaft, which pulley had a rope receiving slot in one of its flanges. A knotted end portion of a pull rope was simply engaged in the slot and manually coiled around the pulley, and the engine was turned over by pulling the free end of the rope. A similar pulley has also been provided as an auxiliary manual starter on engines equipped with an electric starter.

This simple starter was undoubtedly the ultimate in simplicity, low cost and dependability, but, offsetting these advantages, it presented an exposed, slotted, rotating pulley that could be dangerous in itself, and it afforded no protection against inadvertent engagement of fingers or clothing against other rotating parts at the flywheel end of the crankshaft, including the blower vanes on the flywheel.

The present invention has as its general object to provide a simple, non-recoil rope starter for small engines that is only slightly more expensive than the one just described, but which has the very important feature of normally serving as a non-rotating guard that protects all rotating parts on the flywheel end of the crankshaft.

It is also an object of this invention to provide a simple and inexpensive rope starter of the character described that does not interfere with the flow of cooling air into the air intake opening in the shroud but nevertheless serves as an effective guard over that opening as well as over the end portion of the crankshaft that projects through it.

Another object of this invention is to provide a simple and inexpensive rope pull starter that is automatically moved to and releasably retained in a position in which it serves as a guard immediately upon starting of the engine and in consequence of such starting, and which must be deliberately moved out of that position in order to permit it to be used as a starter.

With these observations and objectives in mind, the manner in which the invention achieves its purpose will be appreciated from the following description and the accompanying drawings, which exemplify the invention, it being understood that changes may be made in the specific apparatus disclosed herein without departing from the essentials of the invention set forth in the appended claims.

The accompanying drawings illustrate two complete examples of embodiments of the invention constructed according to the best modes so far devised for the practical application of the principles thereof, and in which:

FIG. 1 is a view in side elevation of a small engine upon which there is installed a device that embodies the principles of this invention;

FIG. 2 is a fragmentary view, mainly in section and on an enlarged scale, of the engine shown in FIG. 1, with the device illustrated in its engine starting position; and

FIG. 3 is a view generally similar to FIG. 2 but illustrating a modified embodiment of the invention and with the device shown in its guard position.

Referring now to the accompanying drawings, the numeral 5 designates generally a single-cylinder gasoline engine that has a blower flywheel 6 mounted on its crankshaft 7, at one side of its crankcase body 8. The flywheel has the usual blower vanes 9 on its periphery for generating a stream of cooling air, and it is enclosed within a sheet metal shroud 10 that partially embraces the engine body and directs the cooling air across the hot parts of the engine.

Through a concentric cooling air inlet opening 12 in the shroud a front end portion of the crankshaft projects beyond the flywheel and out of the shroud. To this projecting end portion of the crankshaft there is fixed a driven clutch element 14 of the manual starter of this invention. A cooperating driving clutch element 15 comprises part of a pulley unit 16 that is normally stationary and serves as a guard for the rotating parts at the flywheel end of the crankshaft.

The driven clutch element 14 is fixed to the crankshaft 7 in forwardly spaced relation to the shroud 10. The pulley unit is both rotatable and axially slidable on the crankshaft, with its driving clutch element portion 15 normally disposed between the shroud and the driven clutch element. In its normal position the pulley unit 16 is contiguous to the shroud, as illustrated in FIG. 1, and is releasably held against rotation and axial motion by clips 17 on the front wall of the shroud. For engine starting the pulley unit is manually moved forwardly away from the shroud, out of engagement with the clips and into a position in which its driving clutch element is engaged with the driven clutch element. The pulley unit can then be rotated for engine starting by means of a pull rope coiled around it. As soon as the

engine starts, the clutch elements cooperate to disengage from one another and move the pulley unit back to its normal guard position, engaged with the clips **17.**

Turning now to a more detailed consideration of the embodiment of the invention illustrated in FIGS. **1** and **2,** the driven clutch element **14** comprises a generally tubular member having a male helical spline **19** on its cylindrical surface and having a concentric rearwardly opening well or counterbore **20** in which the front end portion of the crankshaft is received with a close fit. The driven clutch element is secured to the crankshaft by means of a bolt **21** that extends through the bore in it and into a concentric threaded forwardly opening well in the crankshaft. The driven clutch element can be keyed to the crankshaft or otherwise confined against rotation relative thereto. A washer **22** that is larger than the outside diameter of the driven clutch element is confined between its front end and the head of the bolt **21** to serve as a stop for the driving clutch element.

The pulley unit **16** is here shown as comprising three main parts, namely the driving clutch element **15** which serves as a hub by which the unit rides on the crankshaft, a pulley part **23** in which there is a rope groove **24** and which has an integral cup-shaped forward extension **25,** and a skirt part **26** that extends concentrically rearwardly from the pulley part. The pulley part **23** has a rather large bore **27** therethrough that is continuous with the interior of the cup-shaped extension **25.** Closely received within this bore is the hub-like driving clutch element **15,** which has a female helical spline that is cooperable with the male helical spline **19** on the driven clutch element. The driving clutch element also has as its rear a concentric flange-like enlargement **28** that is partway received in a shallow well or counterbore in the rear of the pulley part. Bolts **29** extending through this flange **28** and threaded into the pulley part secure the driven clutch element to the pulley part.

The skirt portion **26** of the pulley unit is made of light foraminous metal, since it must serve as a guard across the air inlet opening **12** in the shroud but must not interfere with flow of air into that opening. The skirt part is more or less bowl-shaped, with a flat central portion, as at **30,** having a concentric hole therein in which is received the flange **28** on the driving clutch element. A washer-like ring **33,** secured to the pulley part by the bolts **29,** overlies the flat central portion of the skirt, around the edge of the hole therein, and the skirt is spot welded or otherwise secured to that ring. The periphery of the skirt terminates in an axially rearwardly projecting concentric rim **32.** In this case the rim is shown provided with a bead or edging **33** of rubber-like material that extends all the way around it, to enable the skirt to engage the hook-shaped spring clips **17** with a detent action, and to prevent drumming vibration between the skirt and the shroud.

The male helical spline **19** extends along only about the front half of the driven clutch element, and the driving clutch element **15** has an axial length which is somewhat less than half of that of the driven clutch element. Hence when the pulley unit is in its normal position, in which the skirt **26** is engaged with the clips **17,** the unsplined rear portion of the driven clutch element can rotate freely within the driving clutch element. However, when the engine is to be started, the pulley unit is manually pulled forwardly to disengage it from the clips and to bring the male and female splines into engagement. The engine can then be turned over by means of a rope (not shown) having a knotted end engaged in a slot **34** in the front flange of the pulley and coiled around the pulley. When the engine starts, the helical spline connection between the clutch elements causes the pulley unit to be propelled rearwardly to its normal position.

The cup-shaped extension **25** of the pulley portion of the unit **16** projects far enough forward to clear the front end of the crankshaft when the unit is in its normal rearmost position. A concentric hole **35** in the end wall of that extension admits an Allen wrench or other screwdriver to the bolt **21** that secures the driven clutch element to the crankshaft. Because the pulley unit rides on the driven clutch element, removal of the latter from the crankshaft permits access to the flywheel and to other parts that are mounted on and near the projecting front end portion of the crankshaft.

The embodiment of the invention illustrated in FIG. **3** differs from that disclosed in FIGS. **1** and **2** mainly in having its pulley unit **16'** formed essentially in one piece, and in having a somewhat different type of one-way clutch.

In FIG. **3** the driven clutch element **14'** is a more or less disc-like part that is concentrically secured to the front of the crankshaft **7** by means of a bolt **21** threaded rearwardly into the crankshaft. On its rear face the driven clutch element has ratchet-like clutch dogs **41** that cooperate with similar dogs **42** on a hub portion **15'** of the pulley unit that serves as the driving clutch element.

In this case the pulley unit **16'** rides directly on the front end portion of the crankshaft, between the driven clutch element and the shroud **10,** and its hub portion **15'** is a snugly inserted hat-shaped sintered metal bearing that has the dogs **42** formed on the front face of its enlarged diameter front end. The bearing of the pulley unit must have low friction and good resistance to wear, inasmuch as the crankshaft rotates inside it, and the sintered metal, imprgenated with oil, provided these qualities.

The pulley unit **16'** is formed with a circumferential rope groove **24** near its front end, defining a front pulley flange in which there is a slot for the knotted end of a starter rope. From the rope groove rearwardly the pulley unit is formed as a generally cylindrical skirt **26'** in which there are numerous axially elongated slots **43** that admit cooling air to the air inlet **12** in the shroud. As here shown, the flywheel **6** is equipped with the conventional rotating screen **44** across the cooling air inlet, but of course that screen can be omitted.

In this case the clips **17'** that releasably confine the pulley unit in its normal rearmost position comprise resilient fingers that project forwardly from the front wall of the shroud and have bowed end portions **45** that engage over a circumferential bead or ridge **46** on the inner surface of the skirt, at its rear edge. The fingers are under outward flexing bias, and their ridge portions **45** thus tend to engage over the ridge **46** on the skirt with a detent action. Note that when the pulley unit is in its normal position, the fingers or clips **17'** are covered by the skirt and cannot catch on clothing and the like.

For uncomplicated molding or casting of the unitary main body of the pulley unit **16',** the cup-shaped extension **25'** on its front end, which encloses the driven

clutch element, is preferably formed in two parts, one of them an integral tubular forward extension **48** of the pulley, and the other a cover **49** which fits over the front end portion of that extension. The cover **49** is preferably made of plastic, and its connection with the extension **48** should be a readily removable one such as a snap connection, as here shown, or a bayonet connection.

From the foregoing description taken with the accompanying drawings it will be apparent that this invention provides a very simple and inexpensive rope starter for single-cylinder gasoline engines that also serves as a normally stationary guard for protecting rotating parts at and near the flywheel end of the engine crankshaft.

Those skilled in the art will appreciate that the invention can be embodied in forms other than as herein disclosed for purposes of illustration.

The invention is defined by the following claims:

I claim:

1. In an internal combustion engine having a crankshaft on which there is a blower flywheel and having a shroud enclosing the flywheel, said shroud having a cooling air inlet opening through which an end portion of the crankshaft projects outwardly,

means providing both a manual starter for the engine and a normally nonrotating guard covering said opening and enclosing said end portion of the crankshaft, the last mentioned means comprising:

A. a driven clutch element fixed to said end portion of the crankshaft in outwardly spaced relation to the shroud;

B. a pulley unit having

1. a hub portion which is freely rotatable on said end portion of the crankshaft and axially slidable between the driven clutch element and the shroud and which comprises a driving clutch element,

2. a peripheral pulley portion which is fixed to the hub portion and about which a pull rope can be wound,

3. a cup-shaped cover portion fixed to and projecting axially outwardly from said pulley portion and enclosing the driven clutch element and its adjacent end of the crankshaft, and

4. a skirt portion concentric to the crankshaft and projecting axially toward the shroud;

C. cooperating one-way clutch means on the driven clutch element and on the hub portion of the pulley unit, engageable to constrain the driven clutch element to rotate in one direction with the pulley unit and cooperable to translate rotation of the driven clutch element in the opposite direction relative to the pulley unit into axial motion of the pulley unit toward the shroud; and

D. a clip on the shroud, engageable with said skirt portion to restrain the pulley unit against rotation and from which the skirt portion is disengageable upon axial movement of the pulley unit away from the shroud and to a position of engagement of said clutch means.

2. In an internal combustion engine having a crankshaft and a shroud from which an end portion of the crankshaft projects outwardly through a cooling air inlet in the shroud, said shroud partly enclosing the body of the engine to direct cooling air thereacross from a flywheel blower on the crankshaft,

means providing both a manual starter for the engine and a normally nonrotating guard over the cooling air inlet and said end portion of the crankshaft, the last mentioned means comprising:

A. a driven one-way clutch element fixed to said end portion of the crankshaft in outwardly spaced relation to the shroud;

B. a driving one-way clutch element rotatable and axially slidable on the crankshaft between the driven clutch element and the shroud;

C. cooperating one-way clutch means on said clutch elements, by which the driving clutch element is forced axially away from the driven clutch element when the latter relatively rotates in the direction in which it is declutched from the driving clutch element;

D. pulley means concentrically fixed to the driving clutch element for axial and rotational motion therewith and around which a pull rope can be wound;

E. a concentric cup-shaped enclosure means fixed on the driving clutch element, enclosing the driven clutch element and the portion of the crankshaft outwardly of it;

F. a concentric skirt fixed on the pulley means, projecting axially towards the shroud; and

G. cooperating means on the shroud and on the skirt for releasably confining the skirt, and thus the driving clutch element and the enclosure means, against rotation with the crankshaft and against axial motion away from the shroud by which the clutch elements tend to be engaged.

3. The internal combuation engine of claim **2,** further characterized by said cooperating means on the shroud and on the skirt comprising:

1. a finger on the shroud projecting outwardly therefrom generally parallel to said end portion of the crankshaft and substantially in line with the radially inner surface of the skirt, said finger being yieldingly biased radially away from the crankshaft; and

2. cooperating interengaging ridge means on the finger and on the skirt, the ridge means on the skirt extending circumferentially around the inner surface thereof, said ridge means being engageable with a detent action upon movement of the pulley means axially into proximity to the shroud.

4. The internal combustion engine of claim **2,** further characterized by said cup-shaped enclosure means comprising:

1. a tubular concentric outward projection on the driving clutch element; and

2. a cover detachably secured to said projection for closing the open outer end thereof.

* * * * *