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V. R. KAUFMAN

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RECOIL TYPE OF GASOLINE ENGINE STARTER

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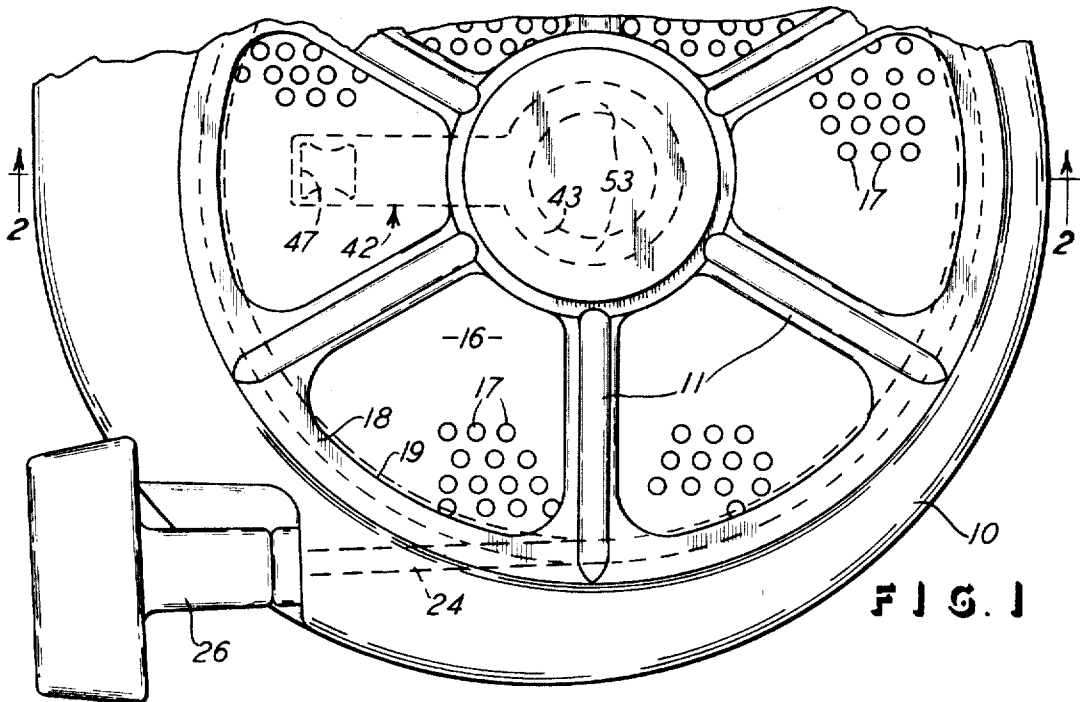


FIG. 1

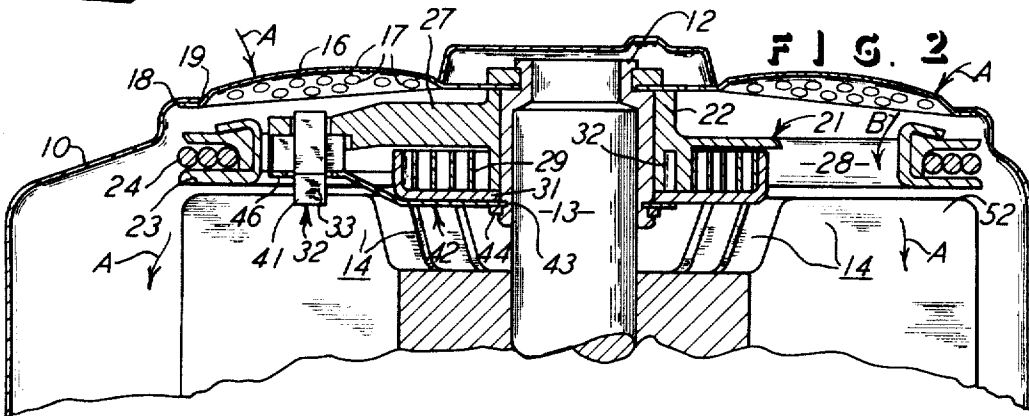


FIG. 2

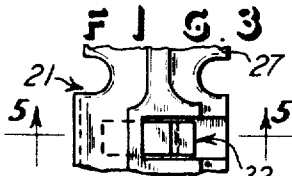


FIG. 3

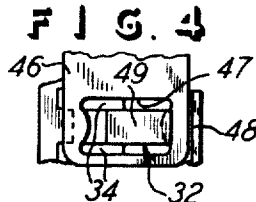


FIG. 4

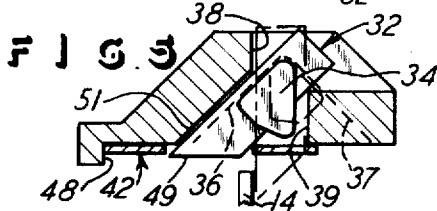


FIG. 5

INVENTOR:
VERNON R. KAUFMAN

Arthur J. Hanemann
ATTORNEY

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RECOIL TYPE OF GASOLINE ENGINE STARTER
Vernon R. Kaufman, Racine, Wis., assignor to Jacobsen Manufacturing Company, Racine, Wis., a corporation of Wisconsin

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This invention relates to a recoil type of gasoline engine starter.

Starters for gasoline engines are known in at least several different forms. These include the type where a rope is wrapped around a pulley and is pulled off the pulley in the function of cranking the engine. Another type is where a spring is wound and then released for exerting its tension in the cranking of the engine. Still a third type is where the rope is used on the pulley, but it is not pulled off the pulley since it is attached thereto, and a recoil spring is used for rewinding the rope on the pulley after the engine has been cranked. It is this third type, namely the recoil type, to which this invention relates.

Still further, gasoline engines commonly include fan blades which are sometimes constructed integrally with the fly wheel and magneto component of the engine. Of course the fan blades are available for cooling the engine while the engine is running. The present invention utilizes the fan blades in the process of cranking the engine, and it also arranges the starter parts adjacent the fan blades in a manner so as to avoid any impedence of the flow of cooling air to the engine.

Other primary objects of this invention include the provision of an engine starter which does not place any load on either the engine shaft bearing or the starter bearing. Further, the starter is arranged to provide optimum leverage with regard to the engagement of the starter with the engine so that only a low torque is required for pulling the rope in the cranking of the engine. Therefore, the starter is easily operated with only this minimum pull on the rope, but nevertheless the engine is rapidly rotated in the cranking operation. This particular feature is accomplished at least in part by eliminating any radial loads on the engine and starter bearings by having the starter engage the engine only in a circular path with respect to the engine center line.

Still another important object of this invention is to provide an engine starter which is arranged to utilize the existing fan blades of the engine for the cranking function, but which nevertheless does not hinder the flow of cooling air to the engine. It is also noteworthy to mention that the engine silhouette is even more compact than those apparent on heretofore existing engines with recoil starters. This is accomplished by having the starter disposed in a position immediately adjacent the engine fan blades with only a minimum of space required for the starter and by providing the air-inlet opening immediately outside of the starter itself.

Other objects and advantages include the provision of a recoil type of engine starter which is inexpensive in its manufacture, easily maintained, especially easy to operate, which is adaptable to existing engine designs, and is reliable and sturdy in its operation.

Other objects and advantages become apparent upon reading the following description in light of the accompanying drawing, wherein:

FIG. 1 is an external view of a fragment of a starter made according to this invention.

FIG. 2 is a sectional view taken along the line 2-2 of FIG. 1 and showing the starter pawl in the engaged position with the engine fan blades.

FIG. 3 is a top plan view of the pawl area of the

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starter shown in FIG. 2, and showing a fragment thereof, with pawl retracted.

FIG. 4 is a bottom plan view of FIG. 3.

FIG. 5 is an enlarged sectional view taken on the line 5-5 of FIG. 3, and showing the pawl in the retracted position in solid lines, and in the extended position in dot-dash lines.

FIGS. 1 and 2 show an engine and starter housing 10 including radially extending ribs 11 which support a bearing 12. An engine crankshaft 13 is rotatably supported in the bearing 12, and the engine fan blades 14 are suitably mounted on the engine shaft 13 to rotate therewith, all in the common and any well-known construction. Of course the fan blades 14 rotate during the running of the engine to bring cooling air into the engine axially of the shaft 13, and the air enters the engine through a screen 16 affixed to the engine housing 10 so the air can move along the axis of the shaft 13 and generally in the direction indicated by the arrows A. Thus the screen 16 has adequate openings 17 spaced throughout the areas intermediate the housing ribs 11 and for the entrance of air into the housing 10 and on toward the engine cylinder (not shown). Thus it will be understood that the housing 10 has its external portion designated 18 defining an air-inlet opening designated 19, and this is actually the area in which the screen 16 is disposed to cover the air-inlet opening 19.

The starter itself is shown to include a pulley 21 having a hub 22 rotatably mounted on the bearing 12. The outer circumference or periphery 23 of the pulley 21 provides the usual groove for receiving the rope 24 which is coiled on the pulley 21. FIG. 1 shows that the extending rope 24 has the usual handle 26 attached thereto for purposes of gripping and thus pulling on the rope 24 in the usual function of rotating the pulley 21 to crank the engine by means of rotating the engine shaft 13.

FIG. 2 also shows that the pulley 21 has radially extending ribs, such as the ribs 27 shown extending between the pulley hub 22 and the outer portion or periphery 23. Thus with only three, for instance, radially extending ribs 27, the pulley is provided with openings 28, shown on the right in FIG. 2. These openings are therefore available for the passage of air along the path described, and more specifically shown by the arrows designated B. Thus the cooling air can of course flow through the pulley 21 by virtue of the pulley being essentially open in the area designated 28, except for only three thin radially extending ribs 27, and FIG. 3 also shows the arrangement with the rib 27.

A recoil spring 29 is disposed in a housing 31 centered on the shaft 13 and bearing 12. Thus the recoil spring 29 would have one end anchored in the opening 32 in the pulley hub 22, and the other end of the spring 29 is suitably attached to the spring housing 31 which is turn is suitably affixed to the stationary bearing 12. Thus the usual pull of the rope 24 will rotate the pulley 21 on the bearing 12, and this will wind the spring 29 as the housing 31 is stationary. Release of the pull on the rope 24 will permit the recoil spring 29 to unwind and thereby rotate the pulley 21 in the reverse direction to again recoil the rope 24 onto the pulley 21.

A pawl 32 is pivotally mounted on the pulley 21 to be pivotal between the extended position shown in solid lines in FIG. 2 and in dot-dash lines in FIG. 5, and to the retracted position shown in solid lines in FIGS. 3, 4, and 5. Of course in the extended position of FIG. 2, the pawl end 33 is extended to abut the fan blades 14. It will therefore now be understood that any rotation of the pulley 21 will likewise rotate the attached pawl 32 which, when extended as shown in FIG. 2, will translate its rotation to the fan blades 14 and thus to the engine shaft 13 to crank the engine.

The pawl 32 has two trunnions 34 which are guided on surfaces 36 and 37 on the pulley 21, as shown in FIG. 5. Also, the pulley includes abutment surfaces 38 and 39 which engage the body 41 of the pawl 32, as when the pawl is in the extended position, as shown in dot-dash lines in FIG. 5. This therefore provides the necessary connection between the pulley 21 and the fan blades 14 when the engine is being cranked.

To retain the pawl on the pulley 21, at least upwardly as shown in FIG. 2, and to also pivot the pawl in the manner described, a lever 42 is utilized. The lever 42 is piloted and connected to the fixed bearing or member 12 by the lever portion designated 43 which surrounds the bearing or sleeve 12. A snap-ring 44 is disposed adjacent the lever 42, and this of course also secures spring housing 31 and the pulley 21 on the sleeve 12. The lever 42 has an arm 46 extending to the pawl 32, and an opening 47 in the arm 46 receives the pawl body 41. The connection and relationship between the pulley 21 and the lever 42 is that they are therefore relatively rotatably mounted with the lever 42 therefore being disposed between two stationary pieces 31 and 44. Therefore, upon initial rotation of the pulley 21 by means of initial pull on the rope 24, the pawl lever 42 will not rotate, and it will therefore engage the moving pawl 32 and cause it to pivot from the retracted solid-line position of FIG. 5 to the extended dot-dash line position. Of course further rotation of the pulley 21 and corresponding movement or rotation of the pawl 32 along with the pulley 21, all will now cause the lever 42 to commence rotation and then rotate in unity with the pulley 21. Nevertheless, the pawl 32 remains extended and thereby engaged with the fan blades 14 for cranking the engine.

When the pull on the rope 24 is released to have the rope recoil on the pulley 21, the spring 29 of course reverses the rotation of the pulley 21. This initial reverse rotation will again bring the pawl 32 into contact with the lever 42 and thus again cause the pawl to pivot. Of course this time the pivot is from the dot-dash line position of FIG. 5 to the solid-line position. It will also be noted and understood that continued rotation of the pulley 21 will bring its abutment surface 48 into contact with the lever 42 and thereby cause the lever 42 to rotate in unison with the rotation of the pulley 21 in the recoil action.

The pawl end 33 is shown to include an oblique or tapered surface 49 and an axially parallel surface 51 on the opposite side from the oblique surface 49. Thus the surface 51 presents a perpendicular surface with respect to the tips 52 of the fan blades 14, and thereby gives flush abutment between the surfaces 51 and 52, as desired. Conversely, when the engine is running and the fan blades 14 are rotating faster than the starting speed of rotation of the pulley 21, then the blades tips 52 will abut the oblique surface 49 and cause the pawl 32 to pivot to its retracted position and thereby be out of the way of the fan blades 14, as desired. This action of course entails the slight rotation of the lever 42 by means of the release on the rope 24 or the overrunning of the fan blades 14 and pivoting of the pawl 32 and the consequent displacement of the lever 42, as described.

It will therefore also be now understood that the pulley 21 is disposed within the plane of the housing air-inlet opening 19 to produce and provide for maximum air flow to the engine, and to have a minimum engine silhouette with only a slight axial distance required in the direction of the engine shaft 13 for the provision of the starter.

Further, the lever portion 43 surrounding the bearing 12 is of a spring material and is effective in an axial direction with respect to the shaft 13 so that it adequately bears against both the bearing 12 upwardly in FIG. 2 and the snap-ring 44 downwardly in FIG. 2. This therefore creates the necessary frictional drag for the lost

motion connection between the pulley 21 and the lever 42 to assure the pivotal action of the pawl 32, as described. This simply entails a bend in the lever portion 42, and such may be along the central lines designated 53 in FIG. 1.

The starter therefore does not require any separate pawl cup which is not only expensive in manufacture, requires special pawls for engagement of the cup, blocks the flow of incoming air, but is simply not needed in this starter which is adaptable to conventional gasoline engines. Further, the starter does not operate with any radial force between the starter and the engine parts, such as the usually provided pawl cup, and thereby a low pulling torque is all that is required for cranking the engine, and the engine and starter bearings are not radially loaded. This results in an 8 percent less friction loss, found according to tests.

While a specific embodiment of this invention has been shown and described, it should be obvious that certain changes could be made in the embodiment and the invention should therefore be determined only by the scope of the appended claims.

What is claimed is:

1. A recoil type of gasoline engine starter for use on an engine having fan blades connected to the engine shaft for rotation therewith, the combination comprising a pulley rotatably mounted for rotation relative to said fan blades, a pawl pivotally mounted on said pulley to be both pivotally retractable and pivotally extendable therefrom and being extendable into abutment with said fan blades to rotatably drive said fan blades in starting said engine, a lever operatively connected to said pawl and being related thereto in a lost motion connection with respect to the initial rotation of said pulley in both directions and being rotatable relative to said pulley for pivoting said pawl between the extended and retracted positions and with said lever being subsequently rotatable with said pulley, a rope trained on said pulley for rotating the latter whereby initial rotation of said pulley pivotally extends said pawl and additional rotation engages said pawl with said fan blades for cranking said engine, and a recoil spring connected to said pulley for rotating the latter in a direction to rewind said rope onto said pulley after said rope is pulled for starting said engine whereby initial rewind rotation of said pulley pivotally retracts said pawl from said fan blades.

2. The subject matter of claim 1, wherein said pulley has a stop on one side of said pawl for limiting the pivot thereof in the extended position, and said pulley has a pocket for receiving said pawl in the retracted position.

3. The subject matter of claim 2, wherein said pawl has a first surface disposed parallel to the plane of said fan blades when said pawl is pivotally extended for abutment with said fan blades, and said pawl has a second surface disposed on the side opposite said first surface and oblique to said plane of said fan blades for being brushed over by said fan blades when said engine is running and said fan blades then overrun said pawl and pivotally retract the latter.

4. The subject matter of claim 1, wherein said pulley and said lever are rotatably journaled co-axially with said shaft, and including two stationary pieces in said starter flanking said lever which rotationally slides between said pieces and under the influence of said pawl upon rotation of said pulley.

5. The subject matter of claim 4, wherein said lever is yieldingly urged axially between said pieces for sliding frictional contact therebetween and thereby assuring the relative rotation between said lever and said pulley.

6. The subject matter of claim 1, including a stationary housing for said recoil spring and with said lever being rotatably slidable on said housing for inducing the relative rotation of said lever with respect to said pulley.

7. The subject matter of claim 1, including a housing surrounding said starter and having an air-inlet opening

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adjacent said pulley on the side thereof opposite said fan blades, and said pulley having openings therethrough in the direction between said air-inlet opening and said fan blades for axial flow of cooling air to said engine.

8. The subject matter of claim 7, wherein said pulley rotates in a plane adjacent the tips of said fan blades and said pulley is at least in part disposed in the plane of said air-inlet opening for optimum flow of cooling air to said engine.

9. The subject matter of claim 8, including a screen disposed in said air-inlet opening.

10. The subject matter of claim 1, wherein said rope is located on the periphery of said pulley and said pawl

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is located only a slight distance radially inwardly from said periphery, and said pawl engages said fan blades only in the direction of rotation of said fan blades and is free of any radial contact with said fan blades and thereby is free of any radial loading of parts of said engine and said starter.

References Cited

UNITED STATES PATENTS

10	2,942,599	6/1960	Irgens	123—185
	3,127,884	4/1964	Rice	123—185

WENDELL E. BURNS, *Primary Examiner*.