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G. K. ISAACS ET AL

2,908,353

ENGINE STARTING UNIT

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Fig. 1

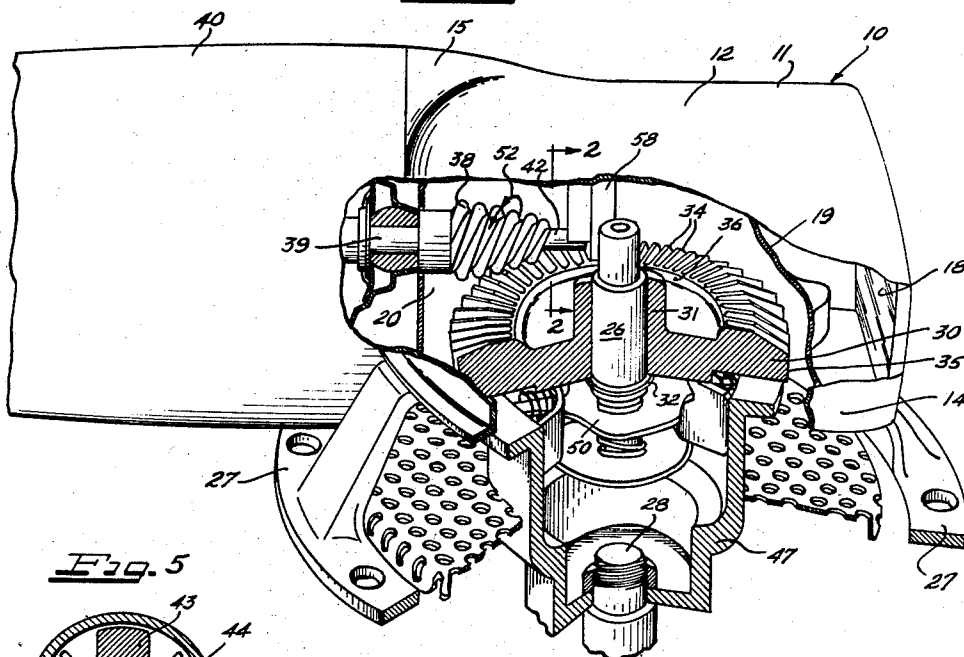


Fig. 5

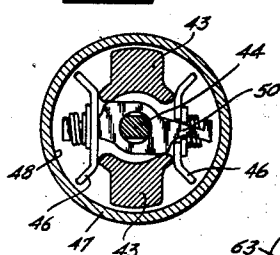


Fig. 2

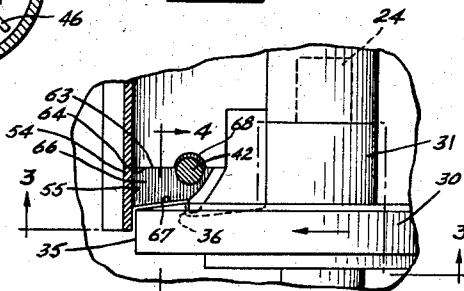


Fig. 4

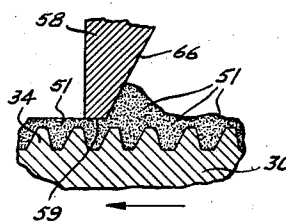
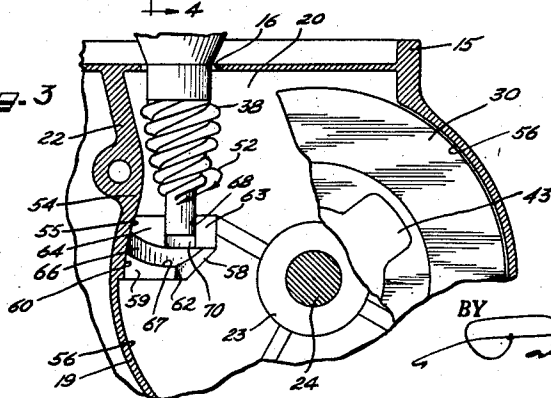


Fig. 3



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ENGINE STARTING UNIT

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4 Claims. (Cl. 184-6)

This invention relates to starting mechanism for internal combustion engines, and more particularly to improvements in electric motor operated starters especially suitable for so-called small engines, as engines utilized to power lawn mowers and the like, small agricultural equipment, and other similar engine powered devices.

An object of the invention is to provide a compact, and highly effective, unit type starter affording a power starting drive for lawn mower engines and the like, wherein the unit is adapted for ready assembly application to such engines, and is desirably compact such as to occupy or require a minimum of mounting space relative to the associated engine.

Another object is to provide an electric motor operated starter of the character aforesaid, embodying screw-type or skew-axis gearing and releasable clutch means between the electric motor and the engine crankshaft, wherein the gearing is lubricated by lubricant material in semi-solid form, and wherein the starter structure includes novel and effective means for retaining the lubricant on the gearing.

A further object is to afford a starter as above characterized, having gearing of the type indicated providing a face-type driven gear and enmeshing drive pinion, wherein the starter structure provides pinion bearing means for limiting or restricting pinion deflection laterally of its axis, consequent to engine back-fire or other forces tending to produce inordinate pinion deflection.

Other objects and advantages of the presently improved starter will appear from the following description of a presently preferred embodiment thereof, as illustrated by the accompanying drawing wherein:

Fig. 1 is a view of the starter unit in perspective side elevation, with parts thereof broken away and parts in section, showing the improved construction thereof;

Fig. 2 is a somewhat enlarged fragmentary view, with certain parts in section, illustrating features of the starter, this view being taken along line 2-2 in Fig. 1;

Fig. 3 is a fragmentary bottom view of the starter as taken along line 3-3 in Fig. 2, illustrating details of the lubricant retaining means;

Fig. 4 is an enlarged fragmentary sectional view of the lubricant retainer means in relation to the gear element of the starter gearing, as viewed from line 4-4 in Fig. 3, and

Fig. 5 is a reduced transverse sectional view of the clutch means shown in Fig. 1.

Referring to the drawing and particularly to Fig. 1 thereof, the presently improved engine starting unit 10 provides a unitary housing or casing member 11 which, by preference, is a single casting of aluminum or other suitable material. Member 11 includes a top wall 12, an outer side wall shown in part at 14, an opposite side wall (not shown), and an end wall 15 having an opening 16 therein (see Fig. 3) for a purpose to appear. The opposite end of the casing is open in the member as cast, and is adapted for the support of a panel closure 18 preferably of suitable material, provided for a starter push-button switch or other control means (not shown).

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Within the casing and depending from the top wall 12 thereof, is a circular wall 19 which is interrupted in the zone 20 thereof opposite the end wall 15, the wall 19 being extended at 22 outwardly from its circular extent to juncture with the end wall 15, all as shown in the view of Fig. 3.

A boss 23 (Fig. 3) integral with the casing top wall 12 on its underside, has embedded therein the upper end 24 (Figs. 1, 2 and 3) of a stub shaft 26, the latter depending therefrom centrally of the circular wall 19 such that the shaft axis is coincident with the axis of the circular wall. Stub shaft 26 provides an operative support for gear and clutch means presently to be referred to.

The casing member 11 as thus far described, is adapted for removable attachment by suitable means as screws (not shown), to a supporting bracket shown in part at 27. Bracket 27 in turn, is mounted on an engine frame (not shown) in a position such as to locate the stub shaft 26 in axial alignment with the engine crankshaft at one end 28 thereof, and spaced from the shaft end as indicated in Fig. 1. Freely rotatable on stub shaft 26 is a face-type gear member 30 having its hub 31 journaled on the shaft and retained thereon as by a suitable split-collar indicated at 32. The gear is disposed to have its annular series of gear teeth 34 uppermost, or facing the underside of the casing top wall 12. Moreover, the teeth 34 extend from the outer periphery 35 of the gear inwardly to termination at an inner peripheral portion 36 of the gear, so that the teeth are upstanding on the gear body. In mesh with the gear teeth is a drive pinion 38 in driven support on the rotor shaft 39 of a suitable electric motor 40. Motor 40 is detachably carried by the casing member in over-hanging relation against the casing end wall 15, such that the motor shaft and pinion 38 project through the wall opening 16, with the pinion extending in the interrupted zone 20 of circular wall 19 to driving engagement with the gear 30. The pinion 38 at its end remote from motor 40, terminates in a shaft tip 42 provided for cooperation with a lateral thrust bearing hereinafter to be described.

The gearing comprising the gear 30 and pinion 38, preferably is of screw or skew-axis type, as of the character fully disclosed by and claimed in Letters Patent 2,696,125 issued December 7, 1954 to Oliver L. Saari. Such gearing affords a number of important advantages, one of which is that it permits relatively close space relationship of the gearing and drive motor, with the longitudinal axis of the pinion in a plane normal to the rotary axis of the gear member and relatively close to the plane of the gear member. These factors contribute to the attainment of a desirable compactness of the unit.

Depending from the underside of the gear 30 are a pair of bosses or projections 43 (Figs. 3 and 5) which are diametrically opposed and equally radially spaced from the lower end portion 44 of the stub shaft 26. These projections comprise the drive elements of a releasable clutch mechanism which include clutch shoes 46 and a cooperating cup-like member 47, the latter which is secured to the engine crankshaft end 28 for rotation therewith, presenting an inner cylindrical wall surface 48 with which the shoes 46 engage in clutched condition during engine starting. The shoes 46 are supported by a carrier element indicated at 50 (Figs. 1 and 5), which with other parts of the clutch is operatively supported by the lower end of the stub shaft 26. The structural details and function of this clutch are fully disclosed in Letters Patent 2,772,669, issued December 4, 1956 to Werner E. Armstrong, and such are incorporated herein by reference to that patent.

An important feature of the present starter unit has to do with improvements concerning lubrication of the

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gearing comprising the pinion 38 and gear member 30. Regarding the unit which is adapted for use on an engine having its crankshaft arranged vertically as indicated by Fig. 1, it would be expensive and difficult, particularly as to leakage seals, to encase the gearing to run in an oil bath. Accordingly, in the present embodiment a suitable lubricant material in semi-solid or paste form, is applied to the gear such as to cover the gear teeth and fill the spaces between the teeth. Such lubricant is indicated at 51 in the enlarged fragmentary view of Fig. 4. In construction of the unit to include gear member 30 of a given outside diameter, the internal circular wall 19 of the casing 11 is provided to have an inside diameter such as to afford a relatively close running clearance between the gear periphery 35 and the wall. Therefore, the wall 19 which thus closely encompasses the gear, except in the interrupted zone 20 of the wall, serves to retain the lubricant material against outward or radial displacement from the teeth.

The pinion 38 being in driving mesh with the gear, will have some of the lubricant wiped thereonto from the lubricant supply on the gear (the pinion also may have lubricant directly applied thereto). However, it will be appreciated that during each operation of the gearing, the pinion rotated in the direction indicated by the arrow 52 (Figs. 1 and 3) to produce clockwise rotation of gear 30 as viewed in Fig. 1, will cause lubricant displacement from the gear teeth as the latter pass through driven mesh with the pinion. Such displacement occurs, of course, on the pinion trailing side of the gear and toward the adjacent portion of wall 19, as the wall portion 54 indicated in Figs. 2 and 3. This condition is overcome by lubricant retaining means embodied in the casing as an integral part thereof, for cooperation with the gear and pinion in the region of the aforesaid wall portion 54.

As shown particularly by Fig. 3, the wall portion presents an internal curved wall surface 55 formed on a radius (relative to the axis of the wall 19) which is less to a predetermined small extent, than the radius of the remaining interior wall surface 56 of wall 19. The smaller radius of wall surface 55 is such that the clearance of the gear periphery 35 relative to said surface is a running clearance of a minimum order, as that closely approaching a sliding or rubbing contact of the gear periphery with the indicated surface. This reduced clearance relationship of the gear and wall surface 55 minimizes or avoids clearance loss of lubricant displaced by the drive action of pinion 38 and tending to accumulate or pile up against the wall surface 55.

Cooperating with wall surface 55 is a lubricant guide device now to be described, which in coaction with the gear, returns to the teeth, lubricant tending to pile up against wall 55. This device comprises an integral casing boss or projection 58 depending from the casing top wall 12 within circular wall 19 and integrally joined with the wall portion 54, as shown particularly by Figs. 2 and 3. The lower end of the boss is recessed to provide a substantially planar surface 59 extending inwardly from the adjacent portion 60 of wall surface 55 and terminating in a shoulder or lip 62 depending relative to the surface. Surface 59 together with the lip 62 and wall portion 60, affords a short length channel through which the gear teeth pass in rotation of gear 30. The channel thus overlies and embraces the gear teeth between the outer and inner gear peripheries 35 and 36, respectively, and such as to provide a close running clearance of the gear teeth therein. Boss 58 is recessed or reduced at 63 above the channel and on the side thereof opposed to the pinion (Fig. 3), to provide a planar top wall or shoulder 64 and a lubricant guide surface or wall 66 between the shoulder and the adjacent edge 67 of surface 59. Guide surface 66 is substantially uniformly inclined upwardly from edge 67 and forwardly (relative to pinion 38) to shoulder 64, such inclination being upwardly and rearwardly relative to the direction of gear rotation, as illustrated

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by Fig. 4. Moreover, the lubricant guide surface 66 is curved in its longitudinal extent inwardly from the wall portion 55, and bears a predetermined angular relation to the curved wall surface 55 such that it will function effectively to direct lubricant in displacement from the wall portion 55, inwardly along the surface for return to the gear teeth through the aforescribed channel. It now appears from the foregoing, that the wall surface 55 and lubricant guide surface 66 form an abutment or pocket to receive lubricant displaced from the gear by the pinion (as hereinbefore noted), and that the guide surface being of the character described and disposed adjacent the path of gear teeth movement, guides the pinion-displaced lubricant transversely over the gear teeth for return to the teeth and spaces therebetween.

As clearly illustrated by Figs. 1 to 3, the boss 58 provides a further feature according to the present invention. The boss shoulder 64 has a semi-circular recess 68 aligned with the pinion 38 and adapted for reception of the pinion shaft tip 42. Under normal conditions the pinion tip 42 has a running clearance in the recess 68, as of the order of about four-thousandths of an inch. However, the recess affords a thrust bearing for the shaft tip, to limit excessive or inordinate displacement of the pinion laterally of its axis in directions away from gear teeth engagement, as may tend to occur in response to engine back-fire at starting, for example. As shown in Figs. 2 and 3, the before described surface 66 is extended such as to span the bearing recess 68 transversely thereof near its inner end 70, whereby to direct lubricant to the bearing and pinion shaft tip therein. Thus, the present lubricant return provision including the lubricant guide surface 66 as extended to the bearing, assures not only return of displaced lubricant to the gear teeth, but also, delivery of lubricant to the bearing and pinion shaft tip for effective lubrication of these parts.

Having now fully shown and described a presently preferred form of the invention, it is to be understood that the invention is not limited thereto, but contemplates various modifications thereof coming within the intended spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. In a gear unit, a casing providing a circular casing wall, a circular gear member having gear teeth on one side thereof extending lengthwise inwardly from the periphery of the member, means carried by the casing rotatably supporting the gear member with its periphery adjacent said casing wall, a pinion in driving engagement with the teeth of the gear member and having a terminal end, lubricant material in semi-solid form disposed on the gear teeth and in the spaces between the teeth, and an element on said casing wall having a bearing recess receiving therein said terminal end of the pinion, said element providing a wall surface extending adjacent the path of travel of the gear teeth and to said bearing recess, and said wall surface being curved in the lengthwise direction of said gear teeth and inclined to the path of gear teeth travel.

2. In a gear unit, a casing having a top wall and providing a circular casing wall depending therefrom, a face-type gear member having its gear teeth extending between the circular outer periphery and an inner circular margin of the gear member, means on the casing rotatably supporting the gear member with its outer periphery relatively closely encompassed by said circular casing wall and the gear teeth thereof facing the casing top wall, a pinion in driving engagement with the teeth of the gear member, lubricant material in semi-solid form on the gear teeth and in the spaces between the gear teeth, said pinion in driving the gear member causing displacement of lubricant material from the gear teeth and spaces therebetween toward the outer periphery of the gear member on the gear trailing side of the pinion, and means for collecting and returning to the

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gear teeth and spaces therebetween lubricant material so displaced, the last said means comprising an element on said casing wall and overlying the gear member, providing a portion embracing the gear member over its teeth and at the outer periphery and the inner circular margin thereof, said element further providing a curved guide surface having a lower margin extending adjacent the path of travel of the gear teeth.

3. A gear unit as defined by claim 2, wherein the said curved guide surface is inclined upwardly from the said lower margin thereof in a direction opposite the direction of travel of the gear teeth.

4. In a gear unit, a casing member including a top wall and providing a circular wall depending from the top wall, said circular wall being interrupted in one zone thereof, a stud depending from the casing top wall centrally of said circular wall, a circular face-type gear member having its gear teeth extending inwardly from the periphery of the member, said gear member being rotatably carried by said stud with the gear teeth facing upwardly and the periphery of the gear member relatively closely adjacent said circular wall, lubricant material in semi-solid form disposed on the gear teeth and in the spaces between the teeth, drive means including a pinion extending through the interrupted zone of said circular wall and meshing with the teeth of said gear

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member, operable for rotating said gear member in one direction of rotation, said pinion in gear driving rotation tending to displace lubricant material from the gear teeth and spaces between the teeth toward a section of said circular wall adjacently beyond the pinion in the direction of gear member rotation, and lubricant retainer means integral with said casing member internally of said circular wall, said retainer means comprising a boss on said section of the circular wall having a curved surface affording a predetermined close running clearance of the gear periphery therewith, and a projection providing a curved lubricant guide surface overlying the gear member in the path of travel of the gear teeth, said guide surface being upwardly inclined in a direction opposite the direction of gear member rotation.

References Cited in the file of this patent

UNITED STATES PATENTS

20	1,054,988	Risberg	Mar. 4, 1913
	1,090,383	Cantrell et al.	Mar. 17, 1914
	1,832,099	Dahlstrom	Nov. 17, 1931
	2,017,871	Strain	Oct. 22, 1935
	2,359,654	Ligh	Oct. 3, 1944
25	2,731,005	Lausen	Jan. 17, 1956
	2,731,006	Hensel	Jan. 17, 1956