

Sept. 5, 1961

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2,998,729

ENGINE STARTING APPARATUS

Filed Aug. 8, 1960

2 Sheets-Sheet 1

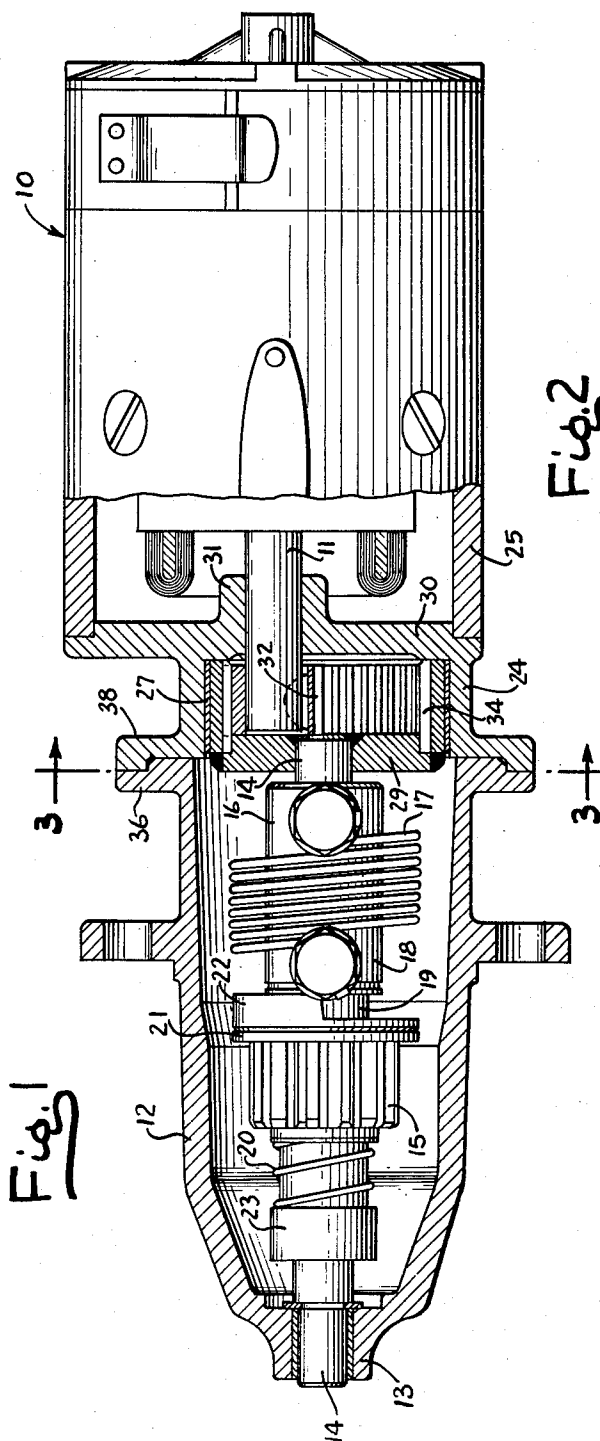
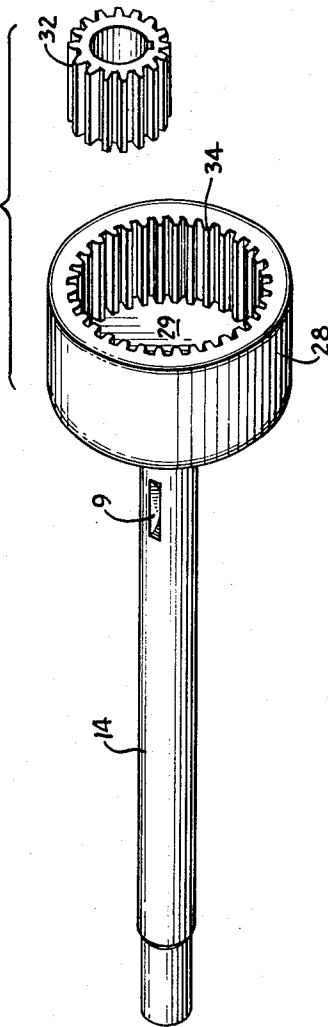


Fig. 2



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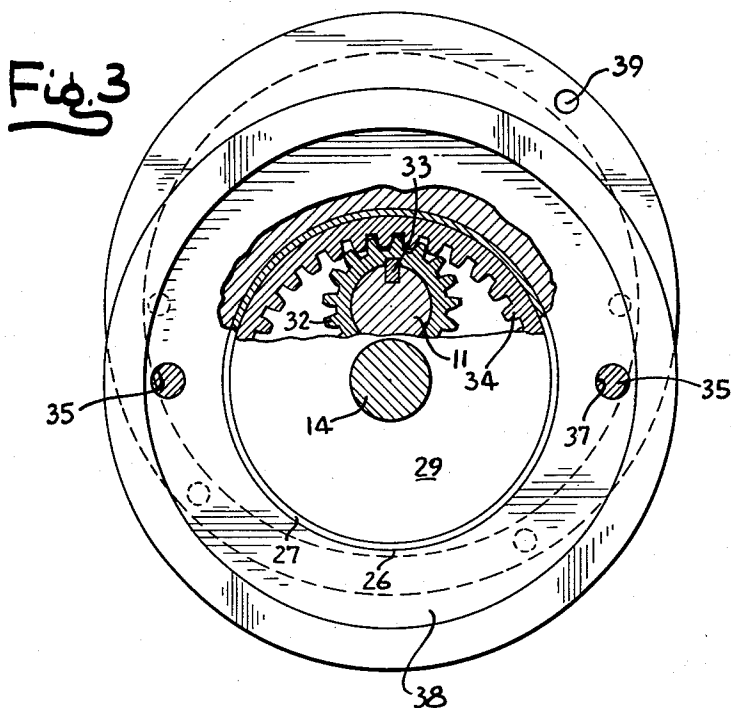
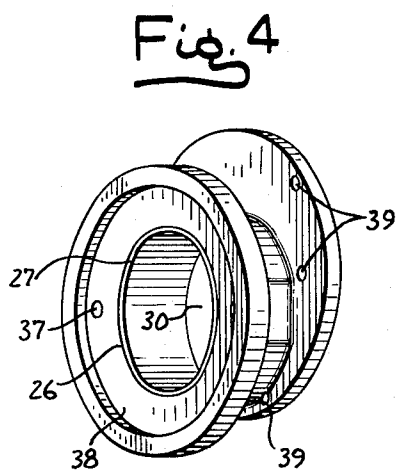
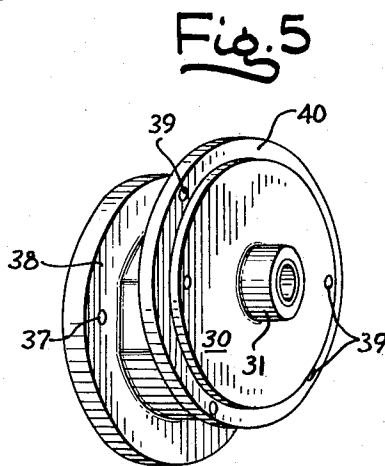
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1 Claim. (Cl. 74-7)

This invention relates to improvements in starters for internal combustion engines of the type comprising a shaft driven by an electrical motor, the shaft carrying a pinion slidably mounted thereon for engagement with a flywheel gear of said engine, of the class generally known as a Bendix drive.

More particularly, the present invention relates to improvements in starters of the foregoing class, for the purpose of obtaining a mechanical advantage therein or for "boosting" or increasing the cranking ability of the starter.

More specifically, the present invention relates to the provision of novel gearing interposed between the conventional electric motor and Bendix or starter mechanism housing, whereby to obtain the aforesaid mechanical advantage.

It is thus the object of the present invention to provide a starter for an internal combustion engine of enhanced ability to crank the engine at all times.

It is a further object of the present invention to materially increase the cranking ability of a conventional starter and thereby facilitate cranking of the "hard" starter.

Other objects and advantages of the present invention relate to the enhanced ability of the starter to crank a stalled, heated engine; to reduce heavy amperage drain on the battery, thereby increasing battery life; and reduce amperage output required to turn the starter and thereby increase the voltage supply available for the ignition system while starting the engine.

Further objects and advantages relate to the details of construction, arrangement of parts, and the economies thereof which will be apparent from a consideration of the following specification and accompanying drawings, wherein:

FIG. 1 is a side elevational view of the starter of the present invention, partly in section.

FIG. 2 is an exploded perspective view of the characterizing intermediate gear components of the present invention.

FIG. 3 is a section substantially on the line 3-3 of FIG. 1 with parts broken away.

FIG. 4 is a perspective view in the direction of the arrows 3-3 of FIG. 1 of the intermediate gear housing of the present invention; and

FIG. 5 is a perspective view thereof from the opposite end.

Referring to the drawings, the reference numeral 10 generally indicates an electric motor having an armature shaft 11 for driving the starter mechanism. At the opposed end of the assembly shown in FIG. 1 is a starter mechanism or Bendix housing 12, the outer extremity 13 thereof journaling the terminal end of the starter shaft 14, the housing 12 being formed with a lateral opening (not shown), as is well known, to permit engagement of the pinion 15 with a conventional flywheel gear of an internal combustion engine.

The innermost end of shaft 14 carries a collar 16 fixedly keyed thereto in the slot 9 and provides an anchor for one end of the torsion of Bendix spring 17. The opposed end of spring 17 is engaged to a similar collar 18, this collar 18, however, being rotatable relative to the shaft 14 and secured to the sleeve 19 which embraces the shaft 14. The sleeve 19 is formed with a helical thread 20, and the pinion 15 is formed with a similar

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internal thread. As is also well known, the flange 21 of the pinion 15 has secured thereto a biasing means or unbalanced weight 22. Thus, when the starter shaft 14 is caused to revolve by energizing the motor 10, the pinion 15 does not immediately revolve, but due to the inertia of the unbalanced flange or weight portion 22, it first moves endwise or in the axial direction of the shaft 14 along the threaded sleeve 20. This movement causes the pinion 15 to become engaged with the annular gear on the flywheel. When the pinion reaches the end of the thread 20 and jams against the stop 23 at the end of the sleeve 19, it then, perforce, turns with the motor armature, and at the same time the shock of connecting and moving with a stationary body is eased by the spring connection 17 between the pinion 15 and the drive shaft 14.

Conventionally, the drive shaft 14 and the armature shaft 11 are unitary. In accordance with the present invention, the shaft 14 is separate from the armature shaft 11 and offset therefrom, although parallel thereto, and in further accordance with the present invention I provide a gear housing 24 interposed between the Bendix housing 12 and the housing 25 of the motor 10.

The gear housing 24 is formed with a cup-shaped or cylindrical seat 26 which may be suitably lined with a bearing material 27 for rotatable reception of the cuplike or cylindrical internal gear element 28. This gear element 28 has an integral bottom or web 29 to which is concentrically or axially secured the opposed end of shaft 14.

The base 30 of the seat 26 is formed with an aperture therethrough disposed eccentrically of the cylindrical seat 26 and has an enlarged boss-forming portion 31 for reception therethrough of the armature shaft 11 which in this case has been shortened. To the inwardly projecting end of the armature shaft 11 there is engaged a pinion 32 which is suitably keyed thereto as at 33, so that it is in meshing engagement with the teeth 34 of the internal gear element 28.

The Bendix housing 12 may be appropriately secured to the gear housing 24 by means of suitable screw or bolt means 35 extended through apertures in its flange 36 and through the apertures 37 in the gear housing flange or plate 38. The housing 24 is secured to the motor housing 25 by similar pin means extended through the holes 39 of the flange 40 of plate 30 and into casing 25.

Thus, in accordance with the present invention, the internal gear may, for example, have thirty-four teeth and the pinion gear 32 sixteen teeth, giving a mechanical advantage greater than two, or an increased cranking ability of over 100%, as distinguished from the employment of an elongated armature shaft of the drive or starter shaft.

In addition, the arrangement of the present invention comprises a rugged construction and an assembly which is simple to install on existing installations with simple hand tools, and essentially requires merely the shortening of the armature or shaft and the keying thereof of the pinion gear 32 after the shaft has been projected through the boss 31 of housing 24. The Bendix spring, gear, sleeve and collars formerly on the extended armature shaft are readily replaced on the internal gear shaft 14 which now becomes the starter shaft.

Although I have shown the preferred embodiment of my invention, various changes in the details may be resorted to without departing from the scope of the appended claim.

I claim:

A starter booster for an internal combustion engine starter device comprising a cylindrical housing, a first

plate integral with said housing adapted to be secured to a starter motor housing and having a central opening therein adapted to receive a shortened drive shaft of the starter motor, a cup-shaped internal ring gear having an integral bottom web rotatably mounted in said cylindrical housing, bearing means disposed between said ring gear and said cylindrical housing, a pinion gear in mesh with said ring gear adapted to be fixed to the shortened end of the drive shaft, a starter shaft integrally secured centrally of said web and extending outwardly therefrom, a second plate having a central opening therein receiving said internal ring gear, said second plate being eccentrically mounted relative to said first plate and

adapted for coaxial mounting on a Bendix housing with said starter shaft extending into said Bendix housing.

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