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ENGINE STARTING MECHANISM

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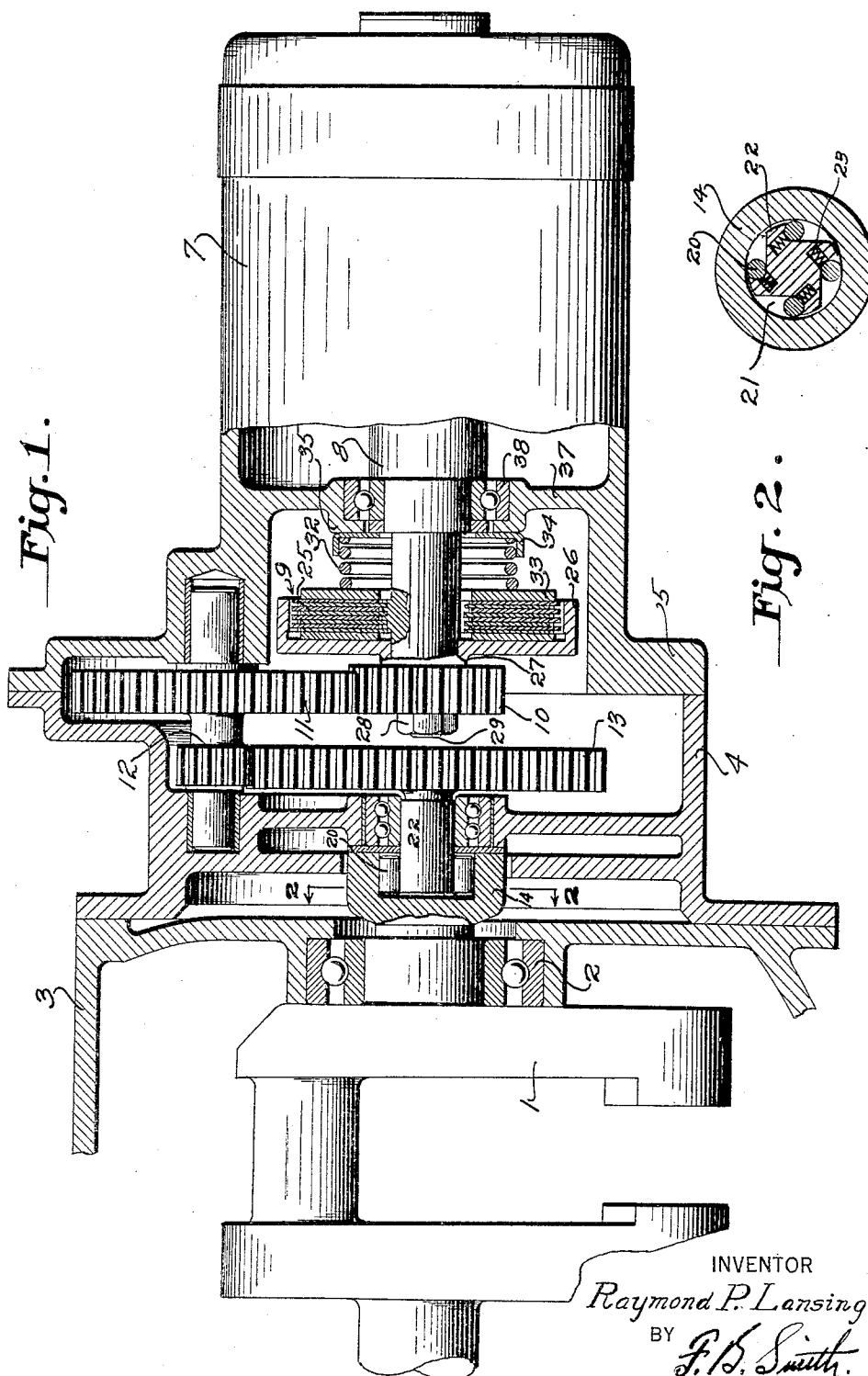


Fig. 1.

Fig. 2.

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ENGINE STARTING MECHANISM

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This invention relates to engine starting mechanisms, and particularly to those adapted to impart the initial turning force to a member, such as the crankshaft, of an engine having other means for maintaining itself in operation after such initial turning or cranking.

One of the objects of the invention is to provide a novel engine starter of the foregoing class which shall be of a simpler and less complicated construction than those of equal or even greater capacity heretofore employed.

Another object of the invention is to provide a novel motor driven starter having a minimum number of parts and characterized by the provision of a one-way driving connection permanently positioned with respect to the driving elements of the starter and the driven member of the engine.

A further object is to provide in a device of the foregoing character, a novel driving connection which is operable to perform its intended function without any movement toward or away from the member of the engine which is drivably associated therewith.

Another object of the invention is to provide a power operated drive for a starter of the above class characterized by the provision of load limiting torque transmitting connections which are adapted to yield whenever the load exceeds the predetermined value, or in the event of a reverse rotation being produced in the engine member as the result of premature ignition of the power charge, or other cause.

A further object is to provide in combination with a drive of the foregoing character, novel means for maintaining a positive, non-slipping one-way driving connection between such drive and the engine member from the moment the prime mover starts to rotate and transmit torque thereto, said connection being adapted to maintain its longitudinal position, with respect to said engine member, even after the engine has started under its own power.

Another object is to provide a novel engine starter which is simple, compact, easily assembled and maintained, inexpensive to

manufacture, and efficient in the performance of its intended functions.

Other objects and advantages to be derived from the use of the invention herein disclosed reside in the construction and manner of combining parts, as will become evident from the following description when read with reference to the accompanying drawing wherein one embodiment of the invention is illustrated. It is to be expressly understood, however, that said drawing is for the purpose of illustration only, and is not to be construed as a definition of the limits of the invention, reference being had to the appended claims for this purpose.

In the drawing:

Fig. 1 is an elevation view partly in section of a device embodying the invention; and

Fig. 2 is a transverse sectional view taken along the line 2—2 in Fig. 1.

Referring more particularly to Fig. 1, reference character 1 designates a crankshaft of a conventional type associated with an engine to be started, and rotatably journaled in a bearing 2 provided in a hub formed on the engine crankcase 3 to which is attached a two part housing as indicated at 4 and 5, the said housing being adapted to enclose a starter mechanism embodying the novel features of the present invention. As shown, the starter comprises a motor having an armature shaft 8, on the outer end of which is provided a load limiting clutch mechanism 9 adapted to transmit the rotative effort of the motor shaft 8 through suitable speed reduction gears 10, 11, 12 and 13, to a clutch mechanism to be described and thence to the crankshaft 1.

One of the elements of the novel combination of the invention disclosed herein is constituted by a one-way clutch by use of which the starter mechanism is maintained in positive driving relation with the engine rather than by means of longitudinally movable mechanism as is customary in the starter devices of this character heretofore used. As shown in both Figs. 1 and 2, the one-way clutch comprises a plurality of rollers 20 loosely positioned in recesses 21 formed on the circumferential surface of the end of shaft 22, the construction being such that upon ro-

tation of shaft 22, as viewed in Fig. 2, the rollers 20 are moved by yielding means, such as springs 23, into wedging engagement with the surface of the member 14, thereby transmitting a positive driving torque to said member and hence to the crankshaft 1, of which the member 14 is an extension. As soon as the engine develops power in excess of that transmitted from motor 8, so that member 14 tends to become the driving member with respect to shaft 22, the rollers 20 move into the deep portions of recesses 21, so that the crankshaft extension is free to rotate independently of the starter mechanism, i. e., the rollers 20 are rendered ineffective to transmit driving torque from member 14 to shaft 22 whereby relative rotation between the shafts 1 and 22 is made possible.

Means are provided for yieldingly limiting the torque transferable from motor shaft 8 to the crankshaft 1 so as to allow relative rotation of the former with respect to the latter whenever the load, or resistance to rotation in the crankshaft 1 and the reduction mechanism, exceeds a predetermined value. As shown, such means preferably comprises a friction clutch 9 consisting of a plurality of annular discs splined alternately to the shaft 8 and the inner surface of drum 26, the latter having a hub portion 27 on which is secured the pinion 10, a nut 28 being threaded to the threaded end 29 of the shaft 8 for the purpose of holding the assembly in place.

Means for maintaining a predetermined pressure on the friction plates 25 is provided, and as shown comprises a coiled spring 32 bearing at one end against the washer 33 and seated at the other end in ring 34, abutting the hub portion 35 formed on the transversely disposed supporting wall 37, the said wall 37 also being provided with a ball-bearing assembly 38, rotatably receiving the shaft 8.

From the foregoing description, it is evident that in the event of excessive load, due to engine backfire or other cause, the friction plates 25 splined to the shaft 8 will be caused to rotate relatively to the associated plates splined to the drum 26, and such relative rotation or slipping will continue until the load recedes to a value such that the friction clutch may overcome the resistance to rotation of the drum 26 and its associated parts, the spring 32 being preferably so adjusted that the clutch 9 will transmit a predetermined torque.

From the foregoing it is also apparent that the driving connection between the motor shaft 8 and the crankshaft 1 is such that normally there is no slipping or relative rotation between the driving and driven members. This feature of the construction insures a continuous transmission of starting torque to the crankshaft 1 from the moment of first rotation of the said crank shaft to the actual starting of the engine under its own power,

except for the possibility of a backfire or other abnormal conditions, in which event the operation will be as above described. Aside from this possibility, it is apparent that the engine will be started with no loss of energy from the prime mover to the driving member 1, except that due to the friction produced between the teeth of the gears and similar losses incidental to the transfer of mechanical energy.

While the particular embodiment of the invention, which is here illustrated, is considered to possess a high degree of practical merit, and is commercially acceptable, in the form shown, it is to be expected that those skilled in the art may modify the structure and arrangement of the component parts, and therefore the claims are not to be narrowed in construction by reference to the drawing. Thus, for example, in place of the double spur gear reduction shown, a system of planetary or co-axially disposed gears may be employed.

It is to be understood that various other changes may be made in the form, details of construction, and arrangement of the parts and the uses to which they are applied, without departing from the spirit of the invention or the scope of the appended claims.

What is claimed is:

1. In combination, a driven member having a recessed end portion, a driving member extending into said recessed end portion in coaxial alignment with said driven member, means for rotating said driving member comprising a motor having a shaft in coaxial alignment with said driving and driven members, a friction clutch operatively connecting said motor shaft to said driving member, and an overrunning clutch operatively connecting said driving and driven members, said last named clutch being mounted in said recessed end portion of said driven member.

2. A starting mechanism comprising a driven shaft having a recessed end portion, a longitudinally immovable driving shaft extending into said recessed end portion in coaxial alignment with said driven shaft, a motor for rotating said driving shaft and means for drivably connecting said motor and driving shaft comprising a speed reduction gear train in which the lowest and highest speed gears are in coaxial alignment with said driving shaft, and a friction clutch, a common housing for said motor and clutch, said common housing including a cylindrical casing and a transversely disposed member integral with said casing and disposed intermediate the ends of said casing, and resilient means bearing at one end against said transverse member and at the other end against said friction clutch to insure trans-

mission of a predetermined torque from said motor to said gear train.

3. In an engine starting mechanism, a driven member drivably engaged at all times with a member of the engine to be started, a power shaft, means including a friction clutch for drivably connecting the power shaft with the driven member, bearing means axially spaced from said friction clutch for rotatably supporting said power shaft, resilient means interposed between said bearing means and clutch for yieldingly maintaining the latter engaged, a one-way clutch for drivably connecting the driven member with said first named member, and bearing means axially spaced from said engine member and adapted to rotatably support said driven member.

en member drivably engaged at all times with a member of the engine to be started, a power shaft, a housing having a pair of registering cylindrical sections one of which rotatably supports said power shaft and the second of which rotatably supports said driven member, and means for drivably connecting said power shaft and driven member, said connecting means including a clutch mounted within said first named housing section, and a gear train, one element of which is journaled at one end in said first named casing section, and at the other end in said second named casing section, another element of said gear train being mounted entirely within said second named housing section.

In testimony whereof I have signed this specification.

RAYMOND P. LANSING.

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