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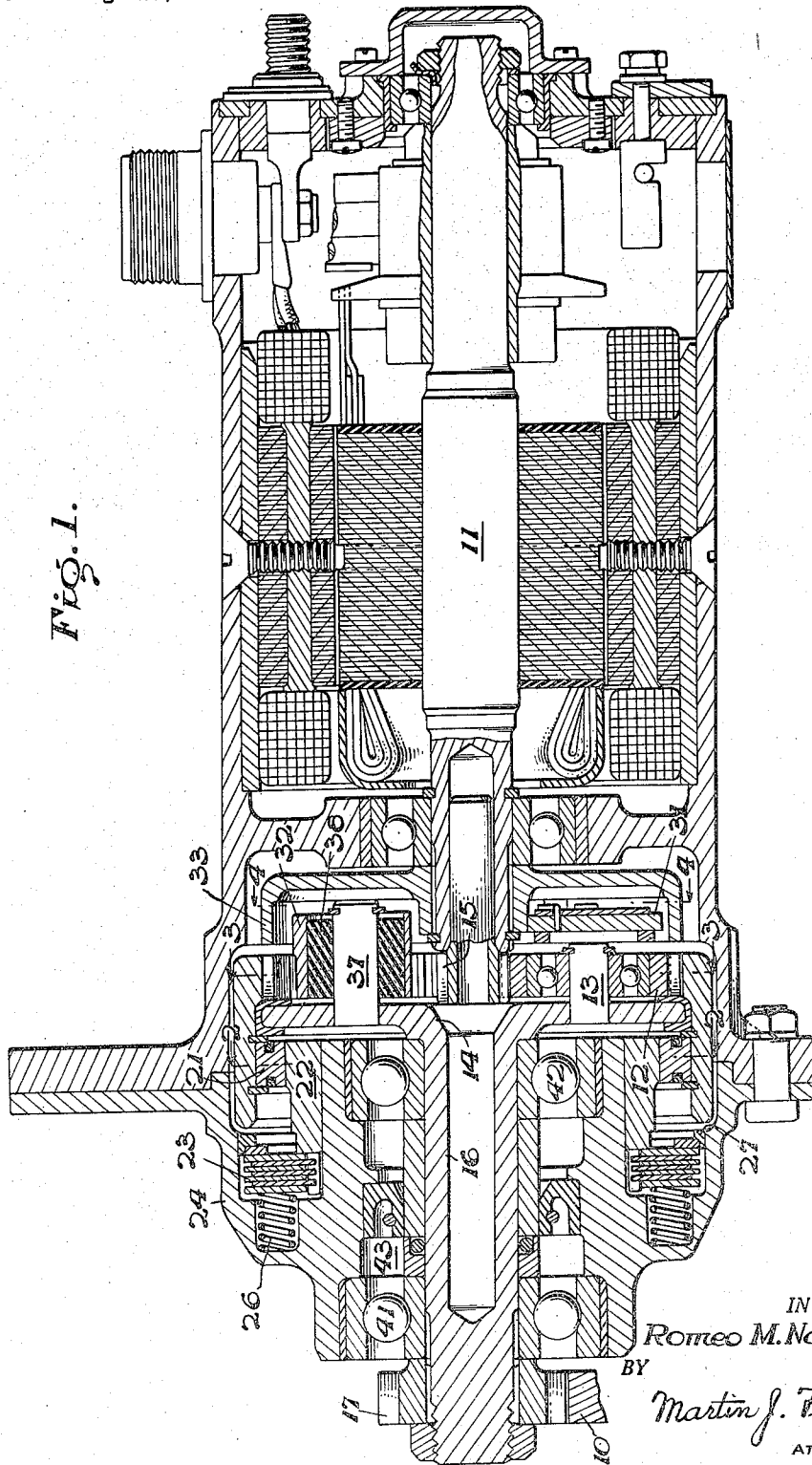
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2,562,568

TWO-WAY DRIVE

Filed Aug. 27, 1946

2 Sheets-Sheet 1



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FIG. 4.

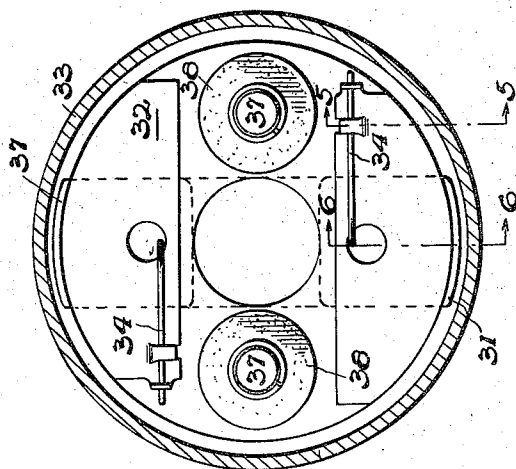


FIG. 3.

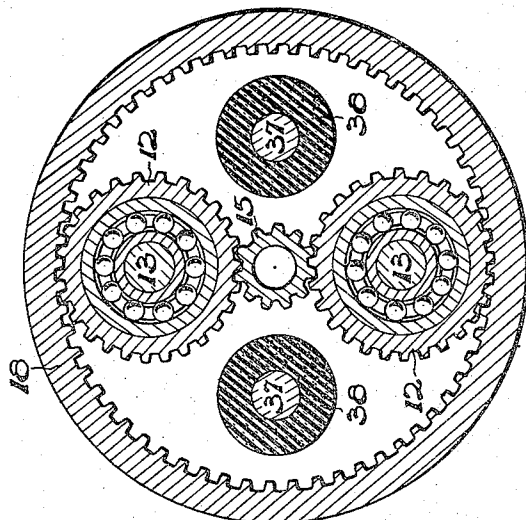


FIG. 2.

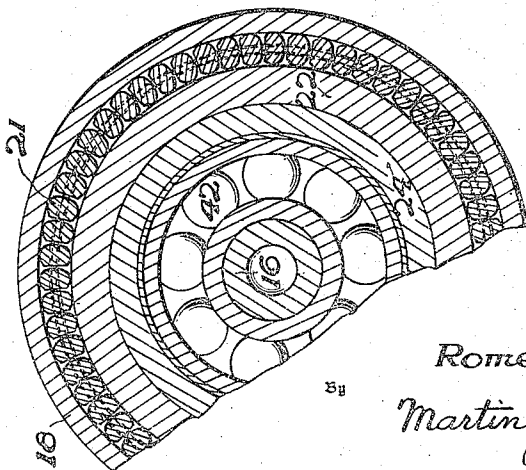


FIG. 6.

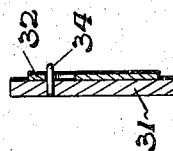
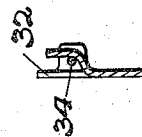


FIG. 5.



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TWO-WAY DRIVE

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3 Claims. (Cl. 74—810)

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This invention relates to engine accessories, and particularly to the energization and utilization thereof.

An object of the invention is to provide a two-way drive of novel construction between an engine and a unit associated therewith—as, for example, an electrical unit capable of serving successively as a starter for the engine and as a generator driven by the engine.

Another object of the invention is to provide an accessory and associated driving connections capable of operating differentially, that is, at different speed ranges and ratios, depending upon the service to be performed.

A further object is to provide, in combination with a gear train connection between two units, novel means for by-passing such gear train when the direction of drive is reversed, that is, when the driven unit becomes the driver of the unit previously acting as driver.

Another object is to provide a novel relationship between a gear train of the character referred to, and a clutch or coupling means for by-passing said gear train; said clutch or coupling constituting an alternative driving connection between two associated units that are otherwise connected through said gear train.

Another object is to provide novel load-controlling means adapted to cooperate with said gear train and also with said by-pass means, a feature of such load-controlling means being the inclusion therewith of uni-directional locking means which may yield to a limited degree in response to over-loading impulses, and thereby limit the transmitted torque to a pre-determined maximum.

These and other objects of the invention will be explained in the following description of the embodiment of the invention illustrated in the accompanying drawings, wherein:

Fig. 1 is a longitudinal sectional view of an engine accessory in association with a rotatable element of an engine; the view including the novel two-way drive therebetween;

Fig. 2 is a transverse sectional view on line 2—2 of Fig. 1;

Fig. 3 is a sectional view on line 3—3 of Fig. 1; and

Fig. 4 is a sectional view on line 4—4 of Fig. 1.

Fig. 5 is a cross section view taken along line 5—5 of Fig. 4.

Fig. 6 is a cross section view taken along line 6—6 of Fig. 4.

In these drawings numeral 10 designates a gear (shown only fragmentarily) secured to the crank-

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shaft or other power rotor (not shown) of an internal combustion engine, and numeral 11 designates the armature shaft of an electrical machine having two sets of field coils on its pole shoes: one set being connected in the circuit during use of the machine as a motor for starting the engine above referred to, and the other set being connected in the circuit after the engine has started, at which time the engine drives the armature shaft 11 to cause such shaft to operate the machine as an electric generator.

The driving connections between armature shaft 11 and engine element 10 include a central (sun) pinion 15 rotated by shaft 11, and planetary gears 12 mounted on pins 13 pressed into a plate 14 integral with a shaft 16 axially aligned with armature shaft 11; the said shaft 16 carrying at its end a pinion 17 which is in mesh with engine element 10. The planet elements 12 mesh with an internally toothed orbit gear 18 with which is associated the uni-directional locking means above referred to.

The uni-directional locking means, as shown, is in the form of a roller clutch 21 whose sprags engage with race 22, the latter having splines to receive and actuate alternate discs of a disc clutch 23 constituting the load controlling means above referred to. The discs not splined to race 22—that is, those frictionally engaged therewith—are correspondingly connected to splines on housing section 24. A series of springs 26 apply pressure of a preset amount on the disc pack, and a lock ring 27 retains the assembly in the pressure applying pre-set position. During over-loading torque surges, alternate discs may slip along their complementary friction elements, thus permitting limited rotation of the orbit gear 18 and race 22. Normally, however, gear 18 will be held against rotation so long as the planetary drive is in operation to transmit starting torque to engine element 10, to rotate the latter at a speed which is, of course, much lower than the driving speed of motor shaft 11, in view of the interposed gear reduction.

When the engine begins to make its own (combustion-induced) power effective upon engine element 10, the latter becomes a driving agency with respect to armature shaft 11, thereby converting the electrical unit from operation as a motor to operation as a generator; the drive from element 10 to shaft 11 being directed through connections which establish a one-to-one ratio of rotation between the two aligned shafts 16 and 11, and thus eliminate the planetary action previously prevailing.

The one-to-one driving ratio is established by way of a set of centrifugally shiftable weights 31 carried by a plate 32 adjacent a drum 33 whose central hub is secured to the armature shaft 11. Springs 34 hold the weights 31 in their inner positions until the speed becomes sufficient to produce outward movement thereof into engagement with the inner cylindrical periphery of drum 33. When this occurs, the rotation of plate 32 is communicated to armature shaft 11 by way of the shoes 31 and drum 33; the plate 32 being itself driven by the plate 14 carrying pins 37 which coast with rubber bushings 38, mounted in plate 32, to establish a resilient or shock-absorbing coupling drive between the said two plates. Plate 14 is an integral part of shaft 16 which carries the pinion 17, as heretofore noted.

Shaft 16 is supported on ball bearing assemblies 41 and 42, and an oil sealing element 43 blocks infiltration of oil to the interior of the housing.

While I have described my invention in connection with a particular embodiment which illustrates its nature and operating principles, it will be understood that this has been done by way of example only, and not as an indication or limitation of the scope of said invention; other embodiments and uses of the invention being contemplated, as heretofore noted.

What I claim is:

1. In a device of the class described, an armature shaft, an engine gear, means responsive to rotation of said armature shaft to produce initial rotation of said engine gear to start the engine associated therewith, said means including a planetary gear train having an orbit gear yieldably restrained against rotation in one direction, and means for rotating said orbit gear and armature shaft as a coupled unit in response to starting of the engine, said last-named means including a drum secured to said armature shaft, and radially movable and centrifugal clutch means rotated by said engine gear and having arcuate driving faces normally separated from but engageable with an inner cylindrical surface on said drum for drivably connecting said armature shaft to said engine.

2. In a device of the class described, an armature shaft, an engine gear, a yieldable torque multiplying drive from said armature shaft to said engine gear, and means for converting at least a portion of said drive to a one-to-one ratio when said engine gear accelerates to a speed beyond that derived from operation of said torque multiplying drive, said last-named means including a drum rotatable with said armature shaft and radially movable clutch elements rotated by said engine gear and having arcuate driving faces engageable with said drum in response to development of centrifugal force of predetermined magnitude.

3. In a device of the class described, an armature shaft rotatable at relatively high speed, a gear train including an orbit gear freely rotatable in one direction and yieldable for limited rotation in the opposite direction, an engine element rotatable by said armature shaft and gear train to accelerate the engine from zero speed to a speed having a predetermined ratio to that of said armature shaft, and means operable, as said engine element accelerates, to reverse the direction of drive by converting said engine element into a driving agency in relation to said armature shaft, and means responsive to such conversion to change the driving ratio between said engine element and armature shaft, said last-named means comprising a drum secured to said armature shaft, and radially movable clutch elements engageable with said drum for establishing a driving connection which by-passes at least a portion of said gear train.

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