Nov. 17, 1936. E. B. NOWOSIELSKI 2,061,245

MAGNETO

Filed Sept. 19, 1934 2 Sheets-Sheet 1

Fig. 1

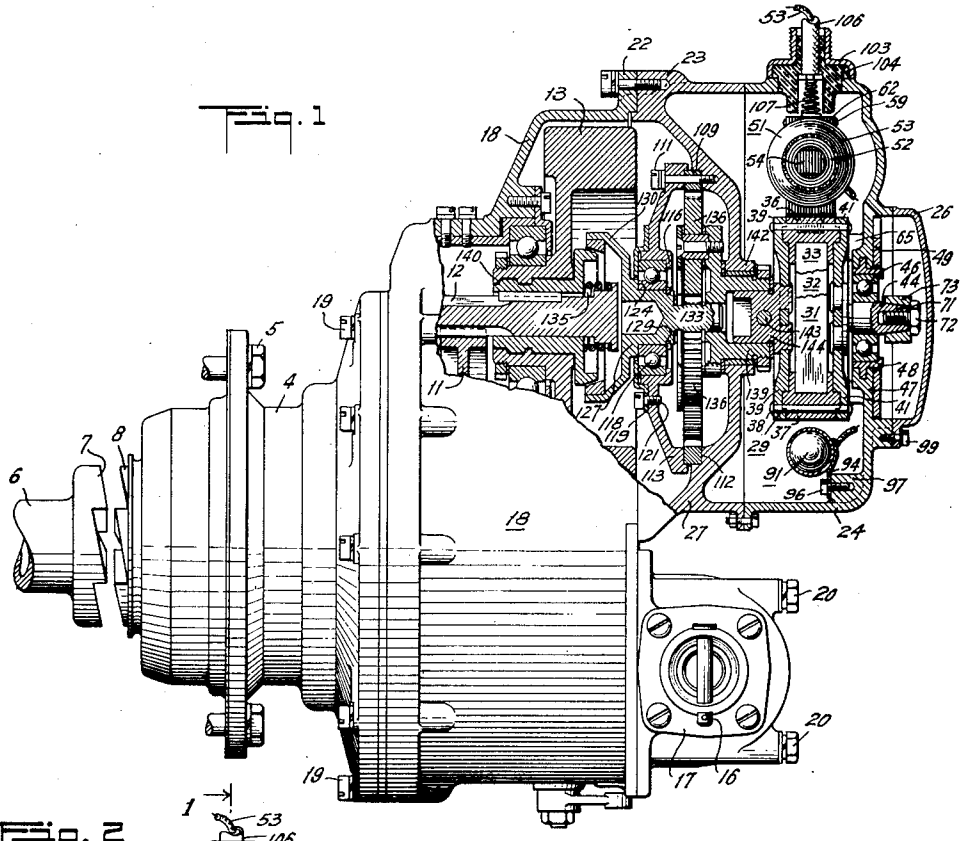


Fig. 2

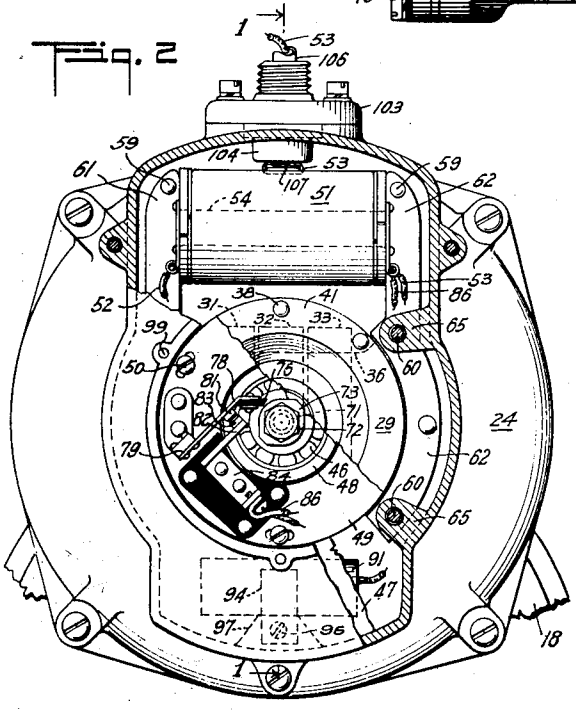
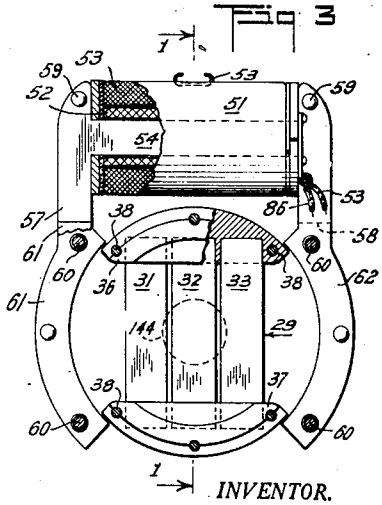


Fig. 3



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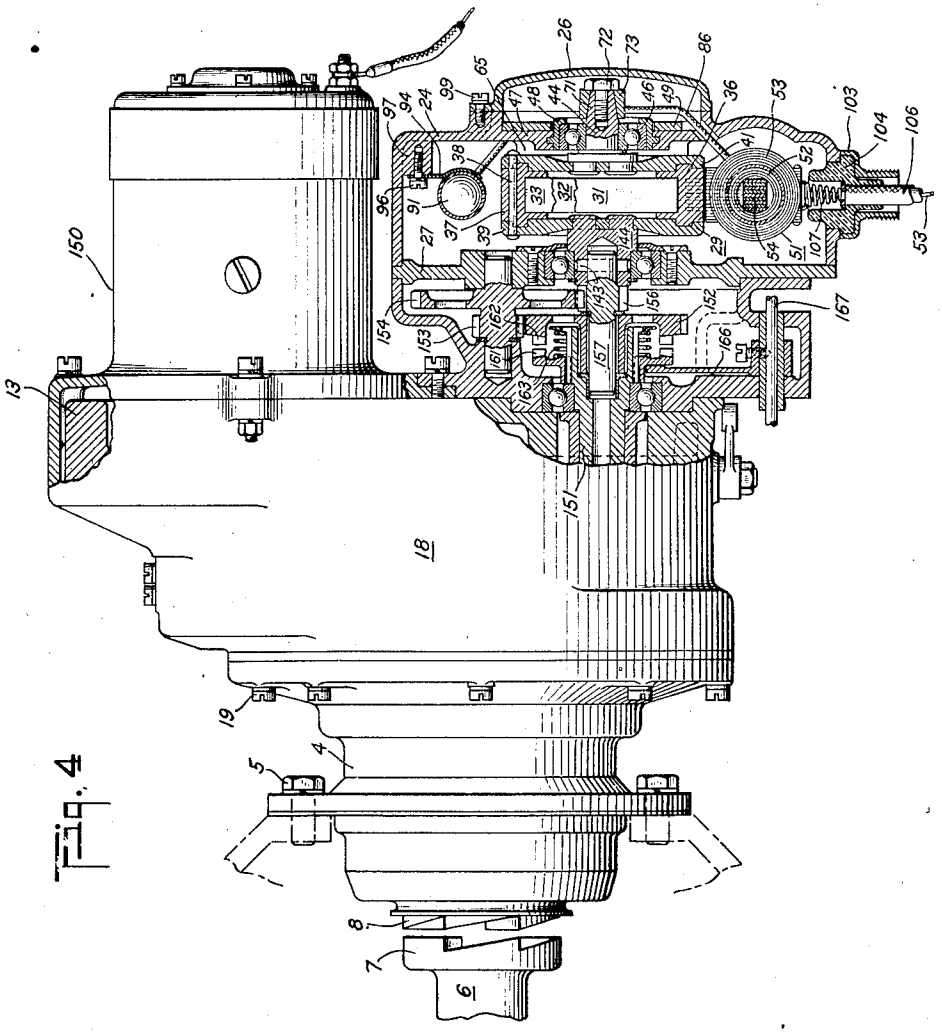


Fig. 4

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UNITED STATES PATENT OFFICE

2,061,245

MAGNETO

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Application September 19, 1934, Serial No. 744,719

2 Claims. (Cl. 123—179)

This invention relates to internal combustion engines, and particularly to means for supplying starting energy for internal combustion engines, such as those of the type employed on aircraft.

In aircraft engine installations it is common to employ auxiliary ignition mechanism, usually in the form described as a booster magneto, for the purpose of providing ignition current of sufficient intensity during the cranking operation. Usually such booster magneto is drivably connected to a rotatable element of the engine starter and is housed in a casing forming an appendage to the engine starter housing; but in many installations the space and weight requirements are such as to make it impossible to provide the necessary room for such appendage; and even where the space is available, the resulting overhang produces an objectionable cantilever effect and the added weight is also an objection.

The present invention provides a means of avoiding this difficulty in that it may be embodied in a unit which is of such small overall dimensions that it may be secured directly to the engine starter housing without any substantial increase in the overall dimensions of said starter housing, either in a longitudinal or transverse direction. Specifically, the embodiment of the invention herein illustrated is particularly well suited for attachment to an inertia starter of the character disclosed in the Lansing Patent No. 1,784,190, wherein it may be secured to the portion of the housing enclosing the inertia element. When used in this connection, the invention may be embodied in a compact, self-contained structure having a diameter or width comparable to the outside diameter of the motor casing of the Lansing starter above referred to, and an axial length decidedly less than that of the aforesaid motor casing 64, with a resulting saving in space occupied, and the degree of unsupported overhang.

In this same use the invention has the further advantage that it makes it possible to employ a concentric gear reduction of negligible overall dimensions as the driving connection between the inertia element of the starter and the rotor of the magneto, and eliminates the necessity of employing right angle drives of the character heretofore employed in order to accommodate the types of booster magnetos which are characterized by an axial length several times that of the axial length of the magneto herein disclosed, and therefore unsuitable for mounting in axial alignment with the inertia element of the starter.

These and other objects and advantages of the invention will become apparent upon an examination of the following specification when read with reference to the accompanying drawings illustrating the preferred embodiment thereof. It is to be understood, however, that the drawings are merely illustrative and are not designed to indicate the limits of the invention, reference being had for this purpose to the appended claims.

In the drawings,

Figs. 1 and 4 are longitudinal sectional views of a magneto embodying the present invention, as it appears when applied to an inertia starter of a character basically similar to that of the aforesaid Lansing Patent No. 1 784,190, a portion of the starter only being shown in longitudinal section and the remainder in outline;

Fig. 2 is an enlarged view in elevation with cover removed, parts broken away and others sectioned, of the magneto portion shown in Fig. 1, the view being taken at right angles to the viewpoint in Fig. 1; and

Fig. 3 is an enlarged view in elevation, with parts sectioned, of the electro-magnetic elements of the magneto, and showing the path of magnetic flux.

Referring first to Fig. 1, the invention is shown applied to an inertia starter having a housing constituted by a flanged inner portion 4 adapted to be secured, through the instrumentality of bolts 5, to a suitable mounting flange (not shown) on the crankcase of an internal combustion engine. A portion 6 of the engine crankshaft, or crankshaft extension, is indicated as terminating in a toothed face 7 adapted to be engaged by a correspondingly toothed clutch element 8 driven through a gear train including a gear 11 and a pinion 12, the latter being drivably connected with the flywheel 13 constituting the inertia element of the starter. Flywheel 13 is energizable to a high speed through a second gear train, of which the elements 11 and 12 also form a part, the second gear train being actuable through rotation of a manually operable shaft 16 journalled in a housing 17 secured by means 20 to the central housing section 18, the latter being in turn secured by means 19 to the flanged section 4 above described. As shown the central housing 18 is flanged as indicated at 22 for registry with the corresponding flange 23 on a magneto housing which, as shown, includes a central section 24, an end cap 26, and a connecting section 27 enclosing and supporting the driving connections between the inertia element 13 and the rotor 29 of the magneto.

In order to make it possible to mount the rotor 29 in axial alignment with the inertia element

13 and at the same time effect a decided reduction in axial length of the rotor without any corresponding reduction in the efficiency of the magnetic circuit through which the starting or "booster" ignition current is developed, the rotor 29 is of a novel construction involving a plurality of bar magnets 31, 32 and 33, each preferably (though not necessarily) of rectangular cross-section and all arranged in juxtaposition with the axes thereof disposed in a common plane normal to their common axis of rotation. As shown, the ends of the bar magnets are embedded in arcuate segmental shoes 36 and 37 through which pass bolts or rivets 38 serving to hold end plates 39 and 41 of the rotor in position so that the former may act to transmit the drive from the inertia element 13, and the latter may connect with a stub shaft 44 rotatably mounted in a ball bearing cage 46 which is in turn supported by the transversely disposed wall 47 formed on the central casing section 24, and retained therein from lateral movement by an inset sleeve 48.

The induction coil 51 has the usual primary and secondary windings 52 and 53 respectively, and is preferably mounted with the axis of its core 54 disposed in the plane of the axes of the inductor elements 31, 32 and 33, and parallel to said axes when the rotor 29 is 90 degrees displaced from the position indicated in Fig. 3. As shown, the core 54 is of laminated soft iron, with its ends 57 and 58 secured by suitable means to cooperating laminæ which extend downwardly and are curved, as indicated at 61 and 62 respectively, to correspond to the curvature of the arcuate pole pieces 36 and 37 above described, and thus coact therewith in causing an alternating magnetic flux to traverse the magnetic circuit passing therethrough, as the oppositely magnetized pole pieces 36 and 37 traverse the core ends 61 and 62 in their rotation about their common axis. Pins 60 extend through core extensions 61 and 62, and are received at their ends in ears 65 on the supporting wall 47.

The tapered end 71 of the shaft 44 has mounted thereon, in a suitable manner, as indicated at 72, a cam 73 having a plurality of lobes adapted to actuate a member 76 of insulating material constituting a cam follower, and as shown is affixed to the end of a flexible metallic arm 78 suitably anchored, as indicated at 79, to a disc 49 adjustably secured (for angular movement relative to the cam lobes as indicated at 50) to the transverse wall 47 of the casing section 24 and having intermediate its ends a contact post 81 normally in abutment with a corresponding contact post 83 mounted on the end of the extending arm 82 of the insulated terminal post 84, to which the primary circuit lead 86 may be secured. The portion of the housing diametrically opposite that in which the induction coil is mounted may be utilized to house the condenser 91 which is preferably included in a circuit connected in shunt with the contacts 81 and 82 just referred to. As shown, the condenser is mounted on a plate 94 secured by suitable means 96 to a boss 97 of the inner surface of the casing section 24. The end cap 26, secured to the casing section 24 by the screw 99, is readily removable to permit inspection and servicing of the interrupter mechanism just described.

Diametrically opposite the boss 97, the casing section 24 is apertured to receive a fitting 103 enclosing an insulator member 104 which is centrally apertured to receive a cable 106 having the usual flexible connection 107 with the secondary winding 53 of the induction coil.

In the event that the speed of the inertia element is such as to make it advisable to employ a gear reduction between the said inertia element and the rotor 29, such a gear reduction will preferably take the form of a planetary gear set involving a fixed annular, internally toothed element 109 secured in position between the opposing faces on the surfaces of the transverse wall 112 of the casing section 27 and an annular supporting plate 113 acting to clamp the gear 109 to the wall 112 and is in turn secured to said wall by the fastening means 111. The plate 113 is flanged, as indicated at 116, to retain in place the outer race of the ball bearing assembly 118, in which function it is assisted by the retainer ring 119 secured as indicated at 121 to the plate 113, the inner race of the ball bearing assembly being held against the shoulder 124 of the flywheel driven stub shaft 127 by the provision of a retainer collar 129 secured in a circumferentially cut groove on the said stub shaft 127.

Farther along the shaft 127 there is a reduction in diameter as indicated at 133, and at this point the shaft is toothed to form the sun gear of the planetary gear train, the said sun gear being adapted to mesh and drive a plurality of idler pinions or planets 136 which are thus caused to roll about the gear 109 as a circular track, and thus transmit rotation at reduced speed to a sleeve 139 journalled in a sleeve bearing located in a boss 142 formed centrally of the transverse wall 112.

A pin 143 passes through the extended hub 144 integral with, or secured to, the end plate 39 of the magneto rotor the ends of said transversely disposed pin being adapted to pass through diametrically opposed apertures in the lateral surface of the sleeve 139 to drivably connect the gear train with the rotor 29.

Driving connection between the flywheel 13 and the gear train may be effected by any suitable means, but as shown takes the form of a clutch 130 which is held disengaged by a spring 135 during manual acceleration of the flywheel 13, and is thereafter engaged by the screw action of the threads 140 on the flywheel and clutch hubs as described and claimed in a co-pending application of Romeo N. Nardone.

There is thus disclosed a unitary structure embodying a magneto, condenser, and interrupter, as well as means for driving said magneto and interrupter from a source of energy to which said parts may be secured in such a manner as to conserve space and weight and avoid the decided overhang which is characteristic of prior devices applied to the same service.

It is to be understood that the invention may be embodied in structures differing in function and method of operation from that disclosed in Fig. 1, and it is to be further understood that changes may be made in the inter-relation and number of parts employed, and in the driving means therefor. Thus, for example, the gear train shown as connecting the driving member 13 with the rotor 29 may be replaced by other connections, or eliminated entirely where a one-to-one drive is preferred. Likewise, other changes may be made within the scope of the broadest of the appended claims.

One such other change may be to drive the magneto from the second gear train 12, 11, in which case the magneto housing will take the position occupied by the sub-housing 17, and

the manual means 16 for accelerating the flywheel may be replaced by a motor to be placed in any suitable relation thereto, such as that shown at 150 in Fig. 4, and corresponding to motor 64 in Fig. 3 of the Lansing Patent 1,784,190, above referred to.

The construction of the magneto as shown in Fig. 4 is identical with that of Fig. 1 but in view of the fact that the flywheel actuated shaft 151 rotates at relatively low speed due to the speed reducing effect of the gear train, the driving connections between said shaft 151 and the magneto rotor include a train of gears 152, 153, 154, the effect of which is to step up the speed so as to produce rotation of the magneto rotor at a speed comparable to that obtained by the arrangement in Fig. 1. As shown, the gear 154 meshes with teeth 156 formed on a stub shaft 157, one end of which is drivably connected to the magneto hub 144 by means of the coupling pin 143, the said hub and pin corresponding to the similarly designated part in Fig. 1.

The driving connection between the flywheel driven shaft 151 and the magneto rotor also preferably include a clutch element 161 normally held out of engagement with a correspondingly constructed set of clutch teeth 162 by means of a compression spring 163 interposed between the clutch element 161 and the gear 152 on which the clutch teeth 162 are cut. It will be understood, however, that these driving connections as well as the clutch engaging means 166 and 167 form no part of the present invention and the same is true of the driving connections between the flywheel 13 and the motor 150, and also the driving connections from the flywheel 13 to both the engine engaging member 8 and the magneto driving shaft 151. It may be helpful, however, to point out that the driving connections last referred to are preferably similar to those shown and described in detail in the Nardone Patent No. 1,951,487, granted March 20th, 1934, wherein suitable connections for this purpose are indicated by the reference characters 56, 41, 39, 22, 16 and 15, the part last named corresponding in structure and function to the element 151 of the present disclosure, and the parts 41 and 39 corresponding in structure and function to the parts 12 and 11 respectively, shown in Fig. 1 of the present disclosure. All other parts shown in detail in Fig. 4 are designated by reference characters corresponding to those shown in Fig. 1 as applied to the corresponding elements therein.

This application is a continuation in part of my application No. 644,861, filed November 29, 1932.

What is claimed is:

1. In a magneto of the type adapted to constitute part of an internal combustion engine starter mechanism, a box-like rotor frame including circular end plates and segmental connecting shoes having pockets aligned in parallelism with said end plates, a plurality of bar magnets received in said pockets, enclosure means forming part of the starter housing, and two distinct supporting shafts journaled in said enclosure means, each shaft having its inner end secured to one of said end plates, said inner ends being separated by the intervening bar magnets above recited.

2. In a magneto of the type adapted to constitute part of an internal combustion engine starter mechanism, a box-like rotor frame including circular end plates and segmental connecting shoes having pockets aligned in parallelism with said end plates, a plurality of bar magnets received in said pockets, enclosure means forming part of the starter housing, and two distinct supporting shafts journaled in said enclosure means, each shaft having its inner end secured to one of said end plates, said inner ends being separated by the intervening bar magnets above recited, one of said supporting shafts being driven by the starter, and the other constituting the ignition circuit interrupting actuating means.

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