V. G. APPLE.
STARTING AND LIGHTING APPARATUS.
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5 SHEETS-SHEET 1.

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Witnesses:
Sone's Rain, May

Blind
To all whom it may concern:

Be it known that I, Vincent G. Apple, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Starting and Lighting Apparatus, of which the following is a specification.

My invention relates to starting and lighting apparatus for self-propelled vehicles.

One of the objects of my invention is generally to improve devices of this character and the manner of association of the various parts thereof.

A more specific object of my invention is to provide an improved coupling for the shaft of a dynamo electric machine, and associate parts, whereby the armature of said machine may be directly but impositively connected to the propelling engine to increase the effect of its starting torque without impairing its operative efficiency, and by the use of which the machine may be supported on a standard automobile without the necessity of materially changing or disturbing any of the parts of said vehicle.

My invention furthermore relates to association of improved devices, most of which are to form subject matter of applications to be hereafter filed and more specifically described and claimed.

Other, further and more specific objects of my invention will become readily apparent to persons skilled in the art, from a consideration of the following description when taken in conjunction with the drawings, wherein:

Figure 1 is an elevation of the front end of a standard automobile, with parts in section, showing my starting and lighting system applied thereto.

Figure 2 is an elevation of the dynamo-electric machine showing parts of the connecting mechanism and of the vehicle in section.

Figure 3 is an end view of the dynamo-electric machine, as it appears when mounted on the vehicle.

Figure 4 is a central longitudinal section of the dynamo-electric machine taken in a horizontal plane on line 4—4 of Figure 3.

Figure 5 is a transverse section through the removable end plate of the dynamo electric machine, taken on line 5—5 of Figure 6.

Figure 6 is a rear view of the end plate looking at the inside portion thereof.

Figure 7 is a transverse section through a part of the end plate, taken on line 7—7 of Figure 6.

Figure 8 is an end view of a portion of the armature spider and the engine shaft with the end plate removed.

In starting and lighting systems, as heretofore made, so far as I am aware, a train of speed-reducing gearing is invariably employed to connect the armature of the dynamo to the power shaft of the engine and automatically operable mechanism has been, heretofore, employed to change the speed relation of the dynamo and engine when the engine becomes the driver or vice versa. In some instances, relatively large dynamos have been mounted on the automobiles with their armatures directly and rigidly connected to the power shaft of the engine, but these have been cumbersome machines, necessarily, in order to produce the required initial starting torque and by reason of their low efficiency coefficients are undesirable.

In my present invention the dynamo possesses almost unheard of efficiency; it may therefore be small, light and compact and may readily be carried on the front end of the automobile with its armature mounted yieldingly but directly on the crank shaft of the engine so as to permit some initial movement of the armature shaft before the engine shaft is moved, when the dynamo is the driver. The efficiency of an electric motor, in starting a load is greater if the armature be permitted to preliminarily move, even though the extent of movement be very small, before the load is imposed upon it. If the armature be rigidly connected to the least effect of its torque is not maximum when the armature makes its initial movement, in its effort to overcome the inertia of the static load.

While I directly connect the armature, of a dynamo electric machine, to the power shaft of the engine I do not rigidly secure it thereto but provide a yielding connection that permits some relative movement of the armature, with reference to the power shaft, so that the armature may move at least a part of a revolution before the load is picked up. The subject matter of these preliminary statements and other features of the invention will be sufficiently pointed out in the drawings and more clearly referred to in the following description.
The specific structures of several of the devices will be fully described and claimed in the applications to be hereafter filed.

In the exemplification, depicted in the drawings, wherein I have shown one form of my invention may take, 15 is an automobile of the standard type. 16 is an internal combustion engine. 17 is a power or crank shaft—shown in Fig. 4.

The dynamo electric machine 18, for starting the engine and for charging the storage battery or batteries to be associated therewith, is secured to and supported on the cross member or beam 19. The field frame 20 of the dynamo is provided with rearwardly extending perforated lugs 21 and 22, spaced apart so that the perforations in the lugs will register with the bolts 23 and 24 that extend through the clip-plate 25, of the machine, used to hold the cross member or beam 19 and the front spring 26 together.

The front support 27 is secured in the trunnion block 28, which is secured to the clip plate 25 by bolts 29 and 30. The support 27 is provided with a rearward extension 31 which is semi-conical in form and which is secured to the bottom plate 32, as by rivets, or otherwise.

An armature shaft 33 is supported on ball bearings 34 and 35 within the hub 36 of the field magnet frame 20. The shaft 33 is secured to the armature hub 30 of the spider 37 by a key 28. The front end 39 of the shaft 33 is eccentric to the main portion and is screwed threaded externally, as at 40, to receive a threaded nut 41. This nut is provided with radially-projecting lugs 42 and 43, for engagement with the hand-crank starting-lever 44. The shaft 33 is provided with an integral collar 45 which engages the member 46 of the ball bearing 34, and which member is suitably secured to the shaft. Between the member 46 and a similar member 47, is a spacing sleeve 48, to hold the ball-bearing members 46 and 47 in spaced relation in proper positions with respect to similar cooperating members 49 and 49', respectively, that are secured in the hub 36. When the nut 41 is screwed home on the reduced threaded end 39 of the shaft 33 the hub 30, of the spider 37, is forced into contact with the ball bearing member 47 which in turn is brought into contact with the sleeve 48 and that with the ball-bearing member 46 which latter is forced into contact with the collar 45, thereby tightening these members together and holding them in spaced relation in a substantial manner. A disk or plate 51 closes the end of the hub 30 and is in substantial contact with the hub 30 so as to prevent oil or grease from the bearing from leaking into the interior of the armature structure. Projecting rearwardly of the shaft 33 and, an integral part thereof, is an extension 53. The extension 53 is provided near its outward end with a transversely extending bolt 54 and is connected to the engine shaft 17, by means of a double coil spring coupling 55 and 56. The spring 55 is provided with an eye 57 which surrounds one end 58 of a transversely extending bolt 17' that passes through the shaft 17. The coil spring 56 is provided with another eye 60 that surrounds the end of the bolt 54, on the opposite side of the axis of the main and armature shaft. The coil spring 56 is provided with an eye 61 which surrounds the end 62, of the transverse bolt 17' that passes through the engine shaft 17, and at its other end is provided with another eye 63 that surrounds the opposite end of the bolt 54. By having a double spring, each with its eyes on the opposite sides of the axis, when stress or torque is applied to the springs, the shafts 17 and 53 do not receive any stress or strain that tends to throw them out of their normal coaxial positions. The flexible connection, provided by the transmitting springs 55 and 56, will, however, permit some axial displacement of the shaft members without imposing a great deal of frictional resistance to their rotation. This flexible connection also permits the armature shaft to be rotated, to some extent, before the maximum rotating torque is transmitted from the armature shaft to the engine shaft. A fan pulley 64 is provided with an inturned hub 65, that fits over the shaft 17, and a crowning face 66. The face of the pulley is perforated, as at 67 and 68 for insertion of the transverse pin 17' in the shaft 17. Into the ends of the transverse pin 17' are driven taper pins 69 and 70 to hold the major pin in place.

Upon the armature spider 37 is mounted an armature core 72 provided with the usual armature conductors 73 and 74, which extend through the core, or are included in slots therein, and which are connected to 110 commutator segments 75 as usual in such structures.

Extending inwardly from the magnetic frame 20, is a series of magnetic poles 76, of which there may be any desired number, 115 (there being 12 in the structure illustrated) which are surrounded with shunt field windings 77 and preferably with a differential compound field winding 78.

A front plate 80, for closing the front end of the field frame, is preferably molded of insulating material, such as bakelite, or the like. The plate 80 is provided with a series of elongated metal bushings 81 and 82 for attaching the plate to the front end of the field frame 20, as by cap screws 84 and 85 to permit rotary adjustment, and another elongated perforation 86 for a screw 87. The plate 80 is also provided with an inwardly projecting axial hub 88 which is preferably 120.
an integral part thereof. This hub 88 is radially slit to provide guideways 89 and 90 for the commutator brushes 91—91'. The guide ways 89 and 90 are divided by a radially extending slot 92 in which the brush connecting wires 93 and 93' may freely move to compensate for the wear of the brushes which are in contact with the inner surface 75' of the commutator 75. In the same radial plane with each of the brushes 91, 91' is a depression or a cylindrical cavity 94, each to contain an open helical spring 95 that yieldingly holds the respective brushes in contact with the inner surface 75' of the commutator 75.

Embedded in the plate 80, or contained in an angular groove 96 is a conducting ring 97. The flexible conducting wires 93', one for each of the brushes 91', are connected to the ring 97, as by use of a screw 98, or the like. Another ring, 100, concentric with the ring 97, is contained in a groove 101 in the plate 80, and projecting inwardly in planes parallel to the armature axis, from the ring 100 are a series of studs 102 each of which a flexible brush connected wire 93, is connected, as by a screw 103. A strip 105 extends from or is a part of the ring 97 and is embedded in the plate 80. This forms one terminal for the series-field of the dynamo and also one terminal for the shunt-field of the dynamo and is a terminal to which the negative end of the battery or batteries to be charged may be connected, as will be more clearly shown when the circuits are described. The connecting strip 103 is enlarged, as at 104, and is provided with an oblong perforation 105. Another strip 106 is provided with a similar terminal end 107, having an oblong perforation 108 overlapping a similar perforation in the plate 80 and is embedded therein and in connection with the binding screw 108 is the terminal for the other end of the shunt field winding.

The plate 80 is provided with an axial perforation for containing a current regulator 106. The regulator 106 is of the vibrating type operable by an electric coil 207 contained therein in connection with an eccentrically rotatable contact 208 in the end of shaft 33 and yieldingly pressed outwardly by a spring 109 for cooperation with the contact that is moved by the vibrating regulator element. I will not describe in detail the operation of this regulator as that will form subject matter for another application to be filed in which it will be more specifically described and claimed.

A binding post or bolt 110 extends rearwardly of the dynamo and is insulatedly supported in a bracket 111 that is attached to the cross member 19. A wire or cable 112 is connected to the screw threaded bolt 110, which forms the battery connection, through the switch, as by a nut 113. The cable 112 extends to and is connected with, preferably, a controlling switch and thereby to the negative terminal of the battery, the front end of the screw threaded binding bolt 110, to which the controlling switch is connected, is 70 connected to the binding post 108. A non-inductive resistance element 115, which is adapted to be connected in series with a controller, or regulator coil 207, is provided with two terminals, 116 and 117. The terminal 116 is connected to a binding post 108 and the terminal 117 is grounded to the frame, as at 118. A bracket 120 is supported on the front end of the dynamo, by the cap screws 84 and 85, and is intended for supporting a license plate 121, which is secured thereto by the screws 123, 124. The bracket 120, is provided with downwardly projecting legs 125 and 126 which serve as means for supporting the resistance element 115.

Having described my invention, what I claim is:

1. In combination with an automobile chassis having an engine and an engine shaft, of a dynamo electric machine having its shaft coaxially arranged with the engine shaft and having its frame connected to and supported on the chassis by lugs extending from the back of the dynamo frame and a flexible driving coupling inseparably connecting the two shafts to permit initial rotation of the driving shaft before the driven shaft is rotated.

2. In combination with a chassis of an automobile having an engine and an engine shaft, of a dynamo electric machine having its shaft coaxially arranged with respect to said engine shaft and a rearwardly extending ears for securing the dynamo to the cross sill of the chassis.

3. In combination with a chassis of an automobile having an engine and an engine shaft, of a dynamo electric machine having its shaft coaxially arranged with respect to the engine shaft, means for securing the dynamo to the chassis comprising a cross sill of a chassis overlapping the front vehicle spring; clips for holding the beam and spring together: bolts passing through the clips and ears extending rearwardly from the dynamo casing through which the clip bolts pass to hold the dynamo in place and means below the cross sill to secure the lower portion of the casing to the cross sill.

4. In combination with a chassis of an automobile having an engine and an engine shaft, of a dynamo electric machine having its shaft coaxially arranged with respect to the engine shaft; means for securing the dynamo to the chassis comprising a cross sill of the chassis overlapping the front vehicle spring; clips for holding the sill and spring together: bolts passing through the clips; ears extending rearwardly from the dynamo casing through which the clip bolts pass to
sé was hold the dynamo in place; a bracket secured to the cross sill; and an insulated stud projecting rearwardly from the lower portion of the dynamo casing through said bracket forming one terminal of the dynamo and means for securing it to the sill.

5. In combination with a chassis having an inverted channel bar forming a cross sill and a spring partly encompassed by said sill; clips having ears provided with holes to receive attaching bolts to hold the spring and sill together, one on each side of a longitudinal median line of the chassis; of a dynamo electric machine casing having rearwardly projecting ears registering with the perforations in the said clips to receive said bolts to hold the dynamo in place and means below the cross sill to engage the lower portion of the dynamo casing to maintain said casing in place.

6. In combination with a chassis, of a dynamo electric machine having an insulated stud projecting rearwardly from the bottom portion of the casing and serving as means to secure the casing to the chassis and as one electric terminal for the dynamo and other means projecting rearwardly from the said casing above said insulated stud for securing the upper portion of the casing to said chassis.

7. In combination with a chassis of an automobile having an engine located thereon, of a dynamo electric machine having its shaft in alignment with the engine shaft; projections from the rear portion of the dynamo casing, one on each side of its axis to secure the dynamo to the chassis and an insulated terminal stud in a vertical plane with the axis of the dynamo and projecting rearwardly from the casing as an additional means to secure the dynamo to the chassis.

8. In combination with a chassis of an automobile, of an engine mounted thereon; a dynamo electric machine mounted on the chassis with its shaft coaxially arranged with the engine shaft and a yielding spring connection between said shafts.

9. In combination with a chassis of an automobile, of an engine mounted thereon; a dynamo electric machine mounted on the chassis having a single shaft bearing; a shaft in said bearing; an armature on the inner end of said shaft and a yielding spring connection between the outer end of said shaft and the engine shaft.

10. In combination with a chassis of an automobile, having a front cross sill, of a dynamo electric machine provided with supporting parts engaging the upper part of the sill and an insulated support engaging the lower part of the sill and rearwardly extending shaft for connection with an engine shaft.

In testimony whereof I hereunto set my hand in the presence of two subscribing witnesses.

VINCENT G. APPLE.

In the presence of—
E. V. MARTIN,
R. E. FLEMING.