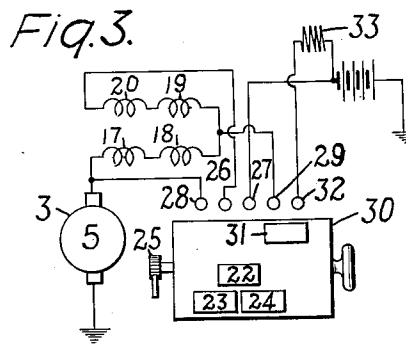
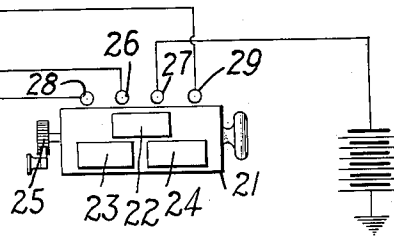
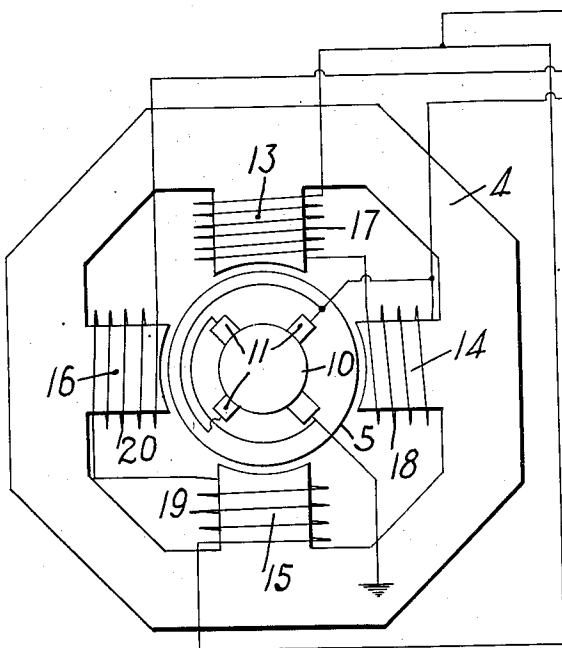
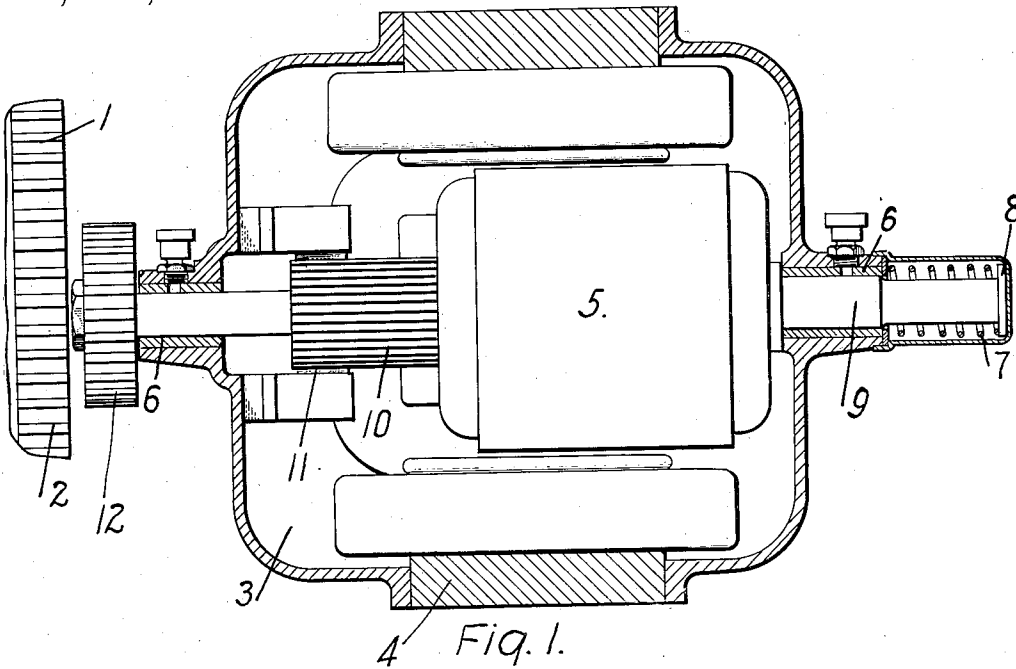


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STARTING MECHANISM FOR AUTOMOBILES.
APPLICATION FILED JAN. 5, 1915.

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Patented Feb. 8, 1916.



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STARTING MECHANISM FOR AUTOMOBILES.

1,171,375.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CHARLES E. WILSON, a citizen of the United States and a resident of Wilkesburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Starting Mechanism for Automobiles, of which the following is a specification.

My invention relates to starting mechanisms for automobiles and particularly to such mechanisms as embody dynamo-electric machines having reciprocating armatures for actuating pinions into and out of operative connection with the shafts of internal combustion engines.

My invention has for its object to provide a simple arrangement whereby the armature of the dynamo-electric machine may be reciprocated longitudinally with a strong force while little or no torque is effective to rotate the armature.

Motors having displaced armatures have heretofore been proposed, but they possess certain disadvantages in that they require the use of complicated switching mechanisms and resistors to prevent rotation of the armature until coasting gear wheels are placed in mesh. This arrangement is necessary because, in the displaced position of the armature, the torque is sufficiently high to rotate the armature at a comparatively high rate of speed before the gear wheels are completely meshed.

It is also difficult to effect the meshing of the gear wheels when there is considerable lateral pressure between the coasting teeth. When the switching mechanism above described is employed, little or no current traverses the armature winding to produce a torque for rotating the armature, and the gear wheels may be readily meshed because there is little or no lateral pressure between the coasting teeth to retard their relative slidable movements.

According to the present invention, I provide an electric motor having a plurality of field-magnet windings for producing magnetic fields in which the poles are arranged in different combinations. When the field-magnet windings are connected in series relation, the polarity of two of the field-magnet poles is reversed. The result is to produce such an arrangement of poles that substantially equal forces act upon the armature to rotate it in opposite directions. The

longitudinal pull is sufficiently strong, however, to shift the armature and thereby establish driving connections between the motor and the engine shaft. When the several field-magnet windings are connected in parallel relation, the normal arrangement of poles is produced, and full torque is applied to the armature.

The details of my invention will be described in connection with the accompanying drawings in which—

Figure 1 is a side view, partially in elevation and partially in section, of a portion of an engine fly wheel with my invention applied thereto. Fig. 2 is a diagrammatic view of circuits and apparatus embodying my invention. Fig. 3 is a view, similar to Fig. 2, of a modification.

Referring particularly to Figs. 1 and 2, a fly wheel 1, only a portion of which is shown, is provided with gear teeth 2. An electric motor 3 has a field-magnet frame 4 which may be secured to any suitable stationary part of a motor vehicle. The motor armature 5 is arranged for longitudinal movement in bearings 6. A spring 7, which is interposed between one of the bearings and a collar member 8 at the rear end of the armature shaft 9, tends to maintain the armature in a displaced position relatively to the field-magnet frame, as illustrated. The commutator cylinder 10 is of such length that it is always in engagement with coasting brushes 11 that are supported by the motor frame. The armature shaft 9 is provided with a pinion 12 which coacts with the gear teeth 2 to operatively connect the motor to the engine shaft.

Referring particularly to Fig. 2, the motor is provided with field-magnet poles 13, 14, 15 and 16. The poles 13 and 14 are energized by field-magnet coils 17 and 18 that are in series relation with the motor armature and with each other. The poles 15 and 16 are energized by field-magnet coils 19 and 20 that are similarly connected. The motor armature is provided with a suitable four-pole winding in accordance with the number of field-magnet poles. The electrical connections of the motor are controlled by a controller 21 which comprises contact segments 22, 23 and 24 to coact with the terminals of the coils 17, 18, 19 and 20. The controller 21 comprises also a pawl-and-ratchet mechanism 25 which prevents the

operation of the controller in a reverse direction and thereby insures that the cycle of operations cannot occur in reverse order. To start the engine, the controller 21 is actuated in a clockwise direction, as viewed from the right, to effect the engagement of the contact segment 22 with the contact fingers 26 and 27. A circuit is then completed which extends from the ungrounded side of the battery, through contact finger 27, contact segment 22, contact finger 26, coils 20, 19, 17 and 18 and the armature winding to ground. The several field-magnet coils are energized by the circuit just described to produce an abnormal arrangement of the polarity of the several field-magnet poles. For example, if the pole 13 is a north pole and the pole 14 is a south pole, the pole 16 is a north pole and the pole 15 is a south pole. It will be noted that, in this arrangement, the two north poles and the two south poles are adjacent to each other. Since the armature is provided with a four-pole winding to correspond to the number of field-magnet poles, the production of a magnetic field, which is substantially the equivalent of a two-pole field, operates to produce substantially equal forces for rotating the armature in opposite directions. As a result, the armature rotates slowly, if at all. In practice, however, it is desirable to insure a slight rotation to aid in meshing the coacting gear teeth and this result is accomplished by providing one of the field-magnet poles with a winding having a larger number of turns than the other poles. In the present case, the coil 17 is represented as having more turns than the other coils. The forces produced by the poles of opposite polarity will therefore be slightly unbalanced, and a slight rotation will occur. Because of the low resistance of the circuit, a heavy current traverses the motor windings, and the field-magnet poles are energized to exert a strong magnetic force to shift the armature to its central position and thereby effect the meshing of the pinion 12 with the gear teeth 2. Further movement of the controller 21 effects the engagement of the contact segments 23 and 24 with the contact fingers 26, 27, 28 and 29. The circuit thus completed extends from the ungrounded side of the battery through contact finger 27, contact segment 24, contact finger 29, through the field-magnet windings in parallel and the armature winding to ground. One branch of the parallel circuit comprises the field-magnet coils 17 and 18, and the second branch comprises the coils 19 and 20, contact finger 26, contact segment 23, and contact finger 28. In the second position of the controller, the connections of the coils 19 and 20 are reversed, and the polarity of the respective poles 15 and 16 will be opposite

that described in connection with the first position of the controller. That is, the pole 15 is now a north pole and the pole 16 is a south pole. The dynamo-electric machine now operates as a four-pole motor, under normal conditions, to crank the engine. When the engine starts under its own power, the motor circuit may be broken by the actuation of the controller 21 in a clockwise direction to disengage the contact segments 23 and 24 from the corresponding contact fingers. The armature 5 will then be returned to its displaced position by the spring 7 which has been under compression. The ratchet mechanism 25 insures that the circuit cannot be completed through the several field-magnet coils in series to again shift the armature. This action would occur if the controller were actuated to its "off" position in a counter-clockwise direction. If the operator fails to open the motor circuit immediately after the engine starts, the motor will be driven at a rapidly increasing speed. The counter-electromotive force of the motor is thereby increased to reduce the current traversing its windings to such a value that the longitudinal pulls exerted by the field magnet poles is less than the force of the spring 7, whereupon the armature is shifted to its displaced position, and the pinion 12 is disengaged from the gear teeth 2. It is obvious, therefore, that no damage may be caused by a failure to open the switch at the proper time.

A modification of my invention is illustrated in Fig. 3. An electric motor 3, the armature of which is indicated at 5, is provided with field-magnet coils 17, 18, 19 and 20 arranged in the same manner as in the motor of Fig. 2. The mechanical construction of the motor corresponds, in detail, to the motor 3 of Figs. 1 and 2. The circuits of the several windings are controlled by a controller 30 that is provided with a ratchet mechanism 25.

In the first position of the controller, a contact segment 31 engages contact fingers 29 and 32 to complete a circuit which extends from the ungrounded side of the battery, through a resistor 33, contact finger 32, contact segment 21, contact finger 29, field magnet coils 18 and 17 and the armature winding to ground. The effect of the circuit just described, which is of high resistance, is to cause the motor to rotate slowly. Since the movement of the controller 30 may be continuous, the circuit is completed for a short time only, and is then broken.

In the second position of the controller, the contact segment 22 engages contact fingers 26 and 27 to connect the several field-magnet coils in series with the motor armature and with each other. The arrangement of the poles thus produced is similar to

that described in connection with the first position of the controller 21 of Fig. 2, and the armature 5 is shifted longitudinally, while it rotates, only because of its inertia.

5 The running circuit of the motor is completed in the third position of the controller in which the connections of the coils 19 and 20 are reversed and they are connected in parallel with the coils 17 and 18.

10 It will be noted that the principal difference between the system of Fig. 3 and that of Figs. 1 and 2 is, that the motor circuit is temporarily completed in order to impart a slight rotating torque to the armature. The motor then rotates, because of its inertia, while the pinion 12 is being meshed with the gear teeth 2 but no torque is exerted by the field-magnet winding. The system of Fig. 3 differs in no other material respect from that above described.

It will be understood that the number of field-magnet poles and the effects produced by the controlling mechanism are illustrative only, and that a motor may be employed 25 which has any convenient number of poles that may be arranged in any desired combination to produce a corresponding effect. Other changes may be made within the scope of the appended claims without departing from the spirit of my invention.

30 I claim as my invention:

1. In a starting mechanism, the combination with an electric motor having field-magnet windings and a longitudinally shift- 35 able armature, of means for controlling the current in said windings to rearrange the polarity of the field-magnet poles for shifting said armature longitudinally and to cause the field-magnet poles to have their normal polarity for rotating said armature.

40 2. In a starting mechanism, the combination with an electric motor having field-magnet windings and a longitudinally shift- 45 able armature, of means for successively controlling the current in said windings to

rearrange the polarity of the field-magnet poles for shifting said armature longitudinally and to cause the field-magnet poles to have their normal polarity for rotating said armature.

3. In a starting mechanism, the combination with an electric motor having field-magnet windings and a longitudinally shift- 50 able armature, of means for energizing said windings to produce an abnormal arrangement of the field-magnet poles for shifting said armature longitudinally and to produce a normal arrangement of said field-magnet poles for rotating said armature.

4. In a starting mechanism, the combination with a pair of coacting gear wheels, of means for actuating one of said gear wheels into and out of mesh with the other, said means comprising a dynamo-electric machine having a longitudinally movable 65 armature connected to the movable gear wheel and means for changing the polarity of at least one of the field-magnet poles for shifting said armature longitudinally and simultaneously opposing its rotation.

5. In a starting mechanism, the combination with a pair of coacting gear wheels, of means for actuating one of said gear wheels into and out of mesh with the other, said means comprising a dynamo-electric machine having a longitudinally movable 75 armature and a controlling means for temporarily completing a circuit for the dynamo-electric machine, producing an abnormal arrangement of the polarity of the 80 field magnet poles and producing the normal arrangement of the polarity of the field-magnet poles.

In testimony whereof, I have hereunto subscribed my name this 23rd day of Dec. 85 1914.

CHARLES E. WILSON.

Witnesses:

BAYARD D. KUNKLE,
B. B. HINES.