

C. E. WILSON.
 STARTING MECHANISM FOR AUTOMOBILES.
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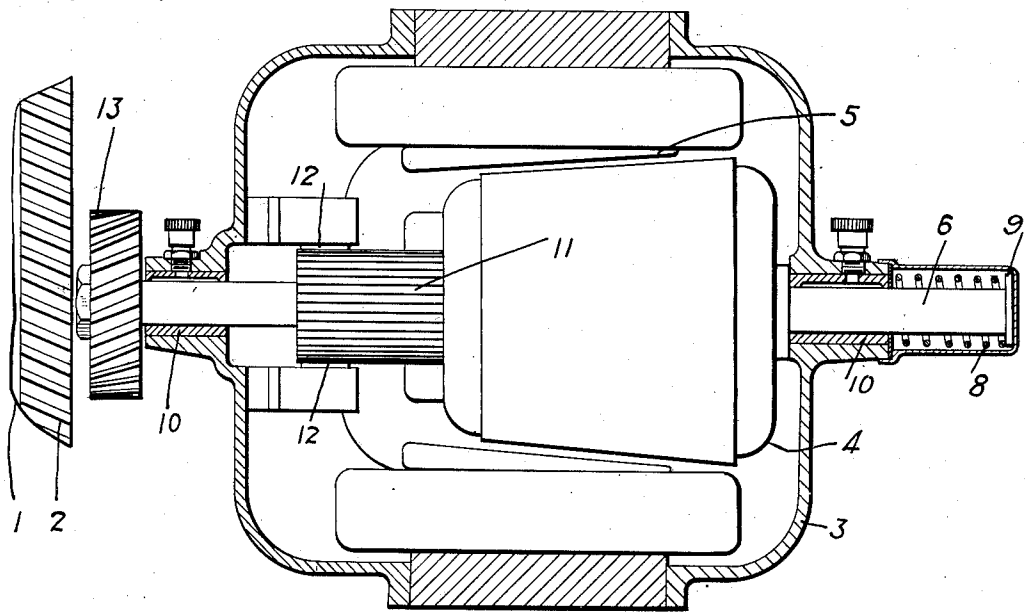


Fig. 1.

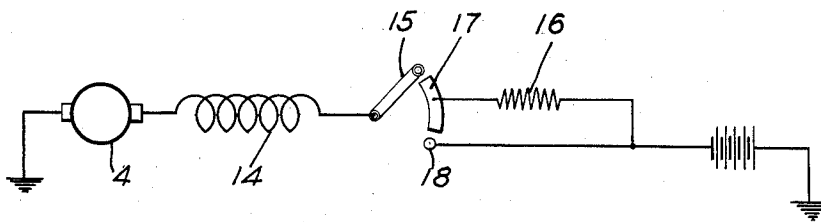


Fig. 2

WITNESSES:

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STARTING MECHANISM FOR AUTOMOBILES.

1,246,207.

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 Wilksburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Starting Mechanisms 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 and efficient arrangement whereby the armature of a dynamo-electric machine may be reciprocated longitudinally with a strong force while the torque effective for rotating the armature is relatively small.

It has been proposed, heretofore, to provide electric starting motors with displaced armatures, but such arrangements possess certain disadvantages, in that it is necessary to employ switching mechanisms of a complicated nature for temporarily short circuiting the armature or for inserting resistance in the armature circuit. If such an arrangement is not employed, the torque is sufficiently high, when the armature is in its displaced position, 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 coacting teeth. When little torque is effective to rotate the armature during its longitudinal movement, the gear wheels may be readily meshed because there is little or no lateral pressure between their respective teeth to retard their relative slidable movements.

I provide a dynamo-electric machine in which the above described desirable results are obtained by a novel construction of certain parts of the dynamo-electric machine. A dynamo-electric machine constructed in accordance with my invention has a longitudinally shiftable armature that is tapered to form substantially the frustum of a cone, the shape of the pole pieces corresponding to

that of the armature in order that the air gap may be of uniform width in the various positions of the armature. The width of the air gap is a minimum when the armature is in its central position and is materially increased when the armature is in its displaced position, the armature being displaced toward its end having the larger diameter.

The effect of the increased air gap, when the armature is in its displaced position, is to diminish the flux traversing the magnetic circuit of the dynamo-electric machine when the field magnet poles are energized. Under these conditions, the torque applied to the armature is correspondingly diminished, since the torque varies directly with the total flux traversing the magnetic circuit.

The longitudinal pull that is exerted upon the armature by the field-magnet poles is not diminished in the same proportion for the reason that the maximum pull exerted upon the movable core of a solenoid occurs when the core is displaced from its central position. The increased pull, because of the displacement of the armature, compensates, at least in part, for the decreased amount of flux traversing the magnetic circuit and the diminished pull resulting therefrom.

The longitudinal pull is also augmented by the inclination of the periphery of the armature and the faces of the pole pieces to the axis of the armature. This construction causes the flux to traverse a path across the air gap that is inclined to the axis of the armature, and the component of force along the axis of the armature is correspondingly increased. It is clear, therefore, that, in the displaced position of the armature, the torque tending to rotate the armature has been materially diminished, while the longitudinal pull exerted upon the armature by the pole pieces is decreased in a much lesser degree.

The details of my invention will be described in connection with the accompanying drawing in which Figure 1 is a view, partially in section and partially in elevation, of an engine fly wheel with my invention applied thereto. Fig. 2 is a diagrammatic view of circuits and apparatus embodying my invention.

A fly wheel 1, only a portion of which is shown, is provided with gear teeth 2. An

electric motor 3 is provided with an armature 4, the core structure of which is tapered to form substantially the frustum of a cone. The field magnet pole pieces 5 are shaped to correspond to the armature in order that the air gap between the armature and the pole pieces may always be uniform.

The armature 4 and the motor shaft 6 are arranged for longitudinal movement relatively to the motor frame. A spring 8, which is interposed between a collar member 9 on the armature shaft and one of the motor bearings 10, tends to maintain the armature in a displaced position relatively to the core structure, as illustrated. The commutator cylinder 11 is of such length that it is always in engagement with coacting brushes 12 that are secured to the motor frame. The armature shaft 6 is provided with a pinion 13 which coacts with the gear teeth 2 in the fly wheel 1.

Referring particularly to Fig. 2, in which the circuits and apparatus embodying my invention are diagrammatically illustrated, the motor armature 4 and the series field winding 14 are in circuit with a switch 15 which operates to connect the motor in circuit with the battery, either directly or through the resistor 16, according to the position of the switch. The switch 15 comprises a curved contact segment 17 which is connected to the resistor 16 and a contact member 18 which is connected directly to the battery.

It may be assumed that the various parts are in their respective illustrated positions, with the pinion 13 out of engagement with the gear teeth 2 and the switch 15 in its open position. To start the motor, the switch 15 is closed through the contact segment 17, and a circuit is completed which extends from the battery through the resistor 16, contact segment 17, series field winding 14 and motor armature to ground and thence to the grounded side of the battery. Because of the relatively low resistance of the circuit a heavy current traverses the motor windings, and the field magnet poles exert a strong magnetic force to shift the armature 4 to its central position and thereby effect the meshing of the pinion 13 with the gear teeth 2. As above set forth, the torque applied to the armature is materially reduced when the armature is in its displaced position because of the increased air gap. The armature may be shifted toward its central position a sufficient distance to effect the meshing of the pinion 13 and the gear teeth 2 before the torque effective to rotate the armature has increased to such a degree that the meshing is rendered difficult.

When the armature is in its central position, the air gap between the armature and field-magnet poles is diminished to its normal width and full torque is effective to

rotate the armature. The movable member of the switch 15, which has been operated with a continuous movement, engages the contact member 18 substantially simultaneously with the return of the armature to its central position. The resistor 16 is thereby excluded from the motor circuit, and the full voltage of the battery is applied to the motor.

When the engine starts under its own power, the switch 15 will be opened by the operator, and the spring 8 will then operate to return the armature to its displaced position. 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 value that the longitudinal pulls exerted by the field-magnet poles is less than the force of the spring 8, whereupon the armature is shifted to its displaced position, and the pinion 13 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.

Many changes would occur to those skilled in the art to which my invention appertains and it is to be understood that such modifications may be made as fall within the scope of the appended claims without departing from the spirit of my invention.

I claim as my invention:

1. In a starting mechanism, the combination with a pair of coacting gear wheels, of a dynamo-electric machine having a rotor of substantially frusto-conical shape that is longitudinally movable from its normal position for shifting one of said gear wheels into and out of mesh with the other and a correspondingly shaped stator whereby the torque of said dynamo-electric machine is materially decreased when the rotor is in a displaced position and the gear wheels are out of mesh.

2. In a starting mechanism, the combination with a dynamo-electric machine having an armature of substantially frusto-conical shape that is longitudinally movable from its normal position and coacting pole pieces shaped to correspond to said armature, whereby the torque of said dynamo-electric machine is materially diminished when the rotor is in a displaced position, of an engine member and a pair of coacting gear wheels, one of which is shifted into and out of mesh with the other by said rotor, for operatively connecting said dynamo-electric machine to said member.

3. In a starting mechanism, the combination with a pair of 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 hav-

ing a longitudinally movable armature and coacting pole pieces so shaped that the air gap between the coacting parts is increased when the armature is in its displaced position.

4. In a starting mechanism, the combination with a pair of 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 armature and pole pieces having coacting surfaces so inclined to the axis of said armature that the torque tending to rotate said armature is diminished at a greater rate than the longitudinal pull exerted upon it by the pole pieces as the armature approaches its displaced position.

5. In a starting mechanism, the combination with an engine shaft, and a gear wheel operatively connected thereto, of a dynamo-electric machine having an armature of substantially frusto-conical shape that is longi-

tudinally movable from its normal position, and field-magnet poles provided with faces shaped to correspond to said armature, and a gear wheel on the shaft of said dynamo-electric machine.

6. In a starting mechanism, the combination with a pair of coacting gear wheels, of a dynamo-electric machine having a longitudinally shiftable armature for shifting one of said gear wheels into and out of mesh with the other and pole pieces, said armature and said pole pieces having coacting surfaces so related to the axis of the armature that the respective forces tending to rotate said armature and to return it to its central position are varied at different rates as the armature moves longitudinally to effect the meshing of said gear wheels.

In testimony whereof, I have hereunto subscribed my name this 20th day of Sept., 1915.

CHARLES E. WILSON.