

J. P. NIKONOW.
 STARTING SYSTEM FOR AUTOMOBILES.
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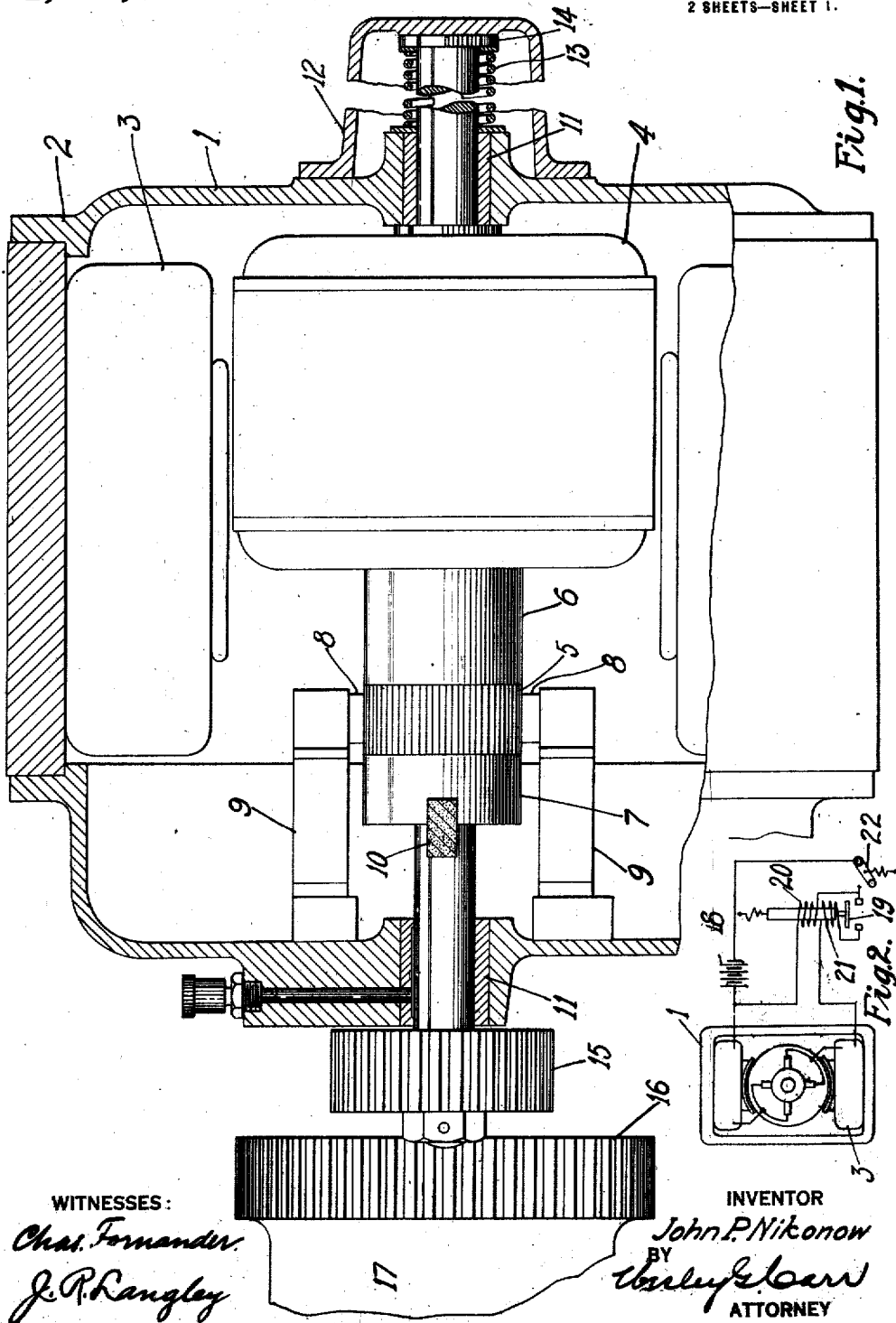


Fig. 1.

Fig. 2. 19 22

WITNESSES:

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Fig. 3.

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STARTING SYSTEM FOR AUTOMOBILES.

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To all whom it may concern:

Be it known that I, JOHN P. NIKONOW, a subject of the Czar of Russia, and a resident of Wilksburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Starting Systems for Automobiles, of which the following is a specification.

My invention relates to starting systems for automobiles, and it has particular reference to such systems as embody motors that have longitudinally movable armatures for controlling the engagement of coacting gear wheels.

My invention has for its object to provide a motor of the character indicated above which possesses the characteristics of exerting a low torque in the displaced position of the armature and a strong magnetic force to return the armature to its central position.

Motors having displaced armatures have been proposed heretofore but they possess certain disadvantages in that they require the use of auxiliary switching mechanisms and resistors to prevent rotation of the armatures until the gear wheels are 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 their 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 coacting teeth to retard their relative slidable movements.

I provide an electric motor by means of which the results above described are accomplished without the employment of auxiliary switching mechanism or resistors.

In the preferred form of my invention, the motor is provided with two sets of brushes displaced from each other by approximately 90 electrical degrees. An auxiliary set of brushes engages the commutator cylinder in its displaced position and the main or

working brushes are in contact with the commutator cylinder in the central position of the armature. Since the auxiliary brushes are displaced by approximately 90° from the neutral axis of the motor, the direction of current through substantially half of the armature coils is reversed. The result is that the magnetic force produced by the armature coils which reacts upon the field flux to produce rotation of the armature tends to rotate the armature in both directions with substantially equal and opposite forces. Accordingly, when the motor circuit is closed, the armature does not rotate. In practice, however, the brushes are so arranged that a very small torque is produced in order to facilitate the meshing of the gear wheels. In a modified form of my invention, the circuits through the respective sets of brushes are controlled by an automatic switching mechanism that is controlled in accordance with the position of 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 dynamo-electric machine constructed in accordance with my invention and a pair of coacting gear wheels. Fig. 2 is a diagrammatic view of circuits and apparatus embodying my invention. Fig. 3 is a diagrammatic view of circuits and apparatus embodying a modification.

A motor 1 has a field magnet frame 2 which is secured to any suitable stationary part of the automobile (not shown). The motor has any convenient number of poles which are provided with series field windings 3. The rotatable portion of the motor comprises an armature 4, a commutator cylinder 5, and sleeves 6 and 7 of insulating material which are disposed at the respective ends of the commutator cylinder 5.

The diameter of the insulating sleeves 6 and 7 is equal to that of the commutator cylinder 5 so that these members present a continuous surface along the axis of the shaft. A pair of auxiliary brushes 8, which engage the commutator cylinder in the displaced position of the armature, are supported by brush holders 9 that are secured to an end bell of the motor. A pair of

main or working brushes 10, only one of which is shown, are displaced longitudinally from the auxiliary brushes by a distance substantially equal to the longitudinal movement of the armature. The respective sets of brushes are also angularly displaced by approximately 90 electrical degrees. The main brushes 10 are supported by brush holders (not shown) similar to the brush holders 9 which support the auxiliary brushes 8.

The armature shaft is arranged for slidable movement in bearings 11. A tubular cap 12 incloses the rear end of the armature shaft. A spring 13, which bears, at one end, against the bearing 11 and, at the other end, against the collar 14 on the armature shaft, tends to maintain the armature in a displaced position relatively to the pole pieces, as illustrated. A pinion 15, which is mounted on the opposite end of the armature shaft, coacts with gear teeth 16 on the engine fly wheel 17.

Referring to Fig. 2, in which the circuits and apparatus employed in connection with my invention are diagrammatically shown, the motor circuit comprises a storage battery 18 and an electromagnetic switch 19 which is provided with a shunt actuating coil 20 and a series holding coil 21. A manually operable switch 22 controls the circuit of the shunt coil 20.

It may be assumed that the various parts occupy their respective illustrated positions, with the armature in its displaced position and the pinion 15 out of engagement with the gear teeth 16. When it is desired to start the engine, the switch 22 is actuated to close the circuit of the shunt coil 20. The switch 19 then closes and the series coil 21 is energized to maintain the closure of the switch 19 after the switch 22 has been released by the operator. Current then traverses a circuit comprising the series field winding 3, the auxiliary brushes 8, the armature winding, series coil 21, and the switch 19. Since the resistance of the motor circuit is very low, a heavy current traverses the motor windings. The field windings 3 energize the field magnet poles to exert a strong magnetic force to shift the armature longitudinally to its central position.

Since the auxiliary brushes are displaced from the neutral axis by substantially 90 electrical degrees, and substantially equal and opposite forces tend to rotate the armature, the armature will rotate very slowly, if at all, while the pinion 15 is being meshed with the gear teeth 16. Before the armature has reached its extreme position, and before the auxiliary brushes 8 are out of engagement with the commutator cylinder 5, the working brushes 10, which are in engagement with the insulating sleeve 7, engage the commutator cylinder 5. At this period,

current traverses the armature through the parallel circuits established by the two sets of brushes.

Further movement of the armature operates to shift the commutator cylinder 5 out of engagement with the auxiliary brushes 8 and into complete engagement with the main brushes 10. Current then traverses the armature winding through the normal circuit, and the normal torque is applied to the pinion 15 to drive the fly wheel 17. When the motor is driving the engine, a very heavy current traverses its windings and the poles are sufficiently energized to retain the armature in its central position against the force of the compression spring 13.

The operator may release the switch 22 at any time after the switch 19 has closed. When the engine starts under its own power, it accelerates rapidly, and the motor is driven at a correspondingly increased 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 poles is less than the force of the spring 11. The armature is then shifted to its displaced position by the spring 13, and the pinion 15 is disengaged from the gear teeth 16. The series coil 21 may be so designed as to release the switch 19 at a predetermined value of the counter electromotive force of the motor. The opening of the switch may occur simultaneously with, or before, the return of the armature to its displaced position.

A modification of my invention is illustrated in Fig. 3 in which like numerals designate corresponding parts. The principle of operation is similar to that of the arrangement illustrated in Figs. 1 and 2. A set of auxiliary brushes 8 and a set of main brushes 10, which are in constant engagement with the commutator cylinder 23, are connected in circuit with the motor windings alternately, according to the position of the armature.

The electrical connections of the two sets of brushes are controlled by a switching mechanism 24 which connects the auxiliary brushes 8 in circuit when the armature is in its displaced position and connects the main brushes 10 in circuit when the armature has been shifted to its central position to mesh the pinion 15 with the gear teeth 16. The motor circuit comprises a storage battery 18 and an electromagnetic relay switch 25 which is provided with a coil 26. The relay switch 25 is controlled by a manually operable switch 27 which may be located within convenient reach of the operator.

A charging circuit for the battery 18 comprises a generator 28 and a cut-out mechanism 29 which controls the connection of the generator to the battery. The cut out 29 is provided with a series coil 30 and a shunt

coil 31 which normally assist each other to control the position of a movable armature member 32. A contact member 33, which is mounted upon, and connected to, the armature 32, coacts with a stationary contact member 34.

Assuming that the various parts occupy their respective illustrated positions and that it is desired to start the engine, the operator closes the switch 27 to complete the circuit of the magnet coil 26. The switch 25 then closes to complete the motor circuit which extends from the battery through the switch 25, series field winding 3, switch member 35, auxiliary brushes 8 and armature winding and switch member 36 to the opposite side of the battery. As in the arrangement above described in connection with Figs. 1 and 2, the armature will be moved longitudinally by a strong magnetic force but will be rotated by a very low torque. When the pinion 15 is in mesh with the gear teeth 16, the switch mechanism 24 will be moved to the left, as shown, to complete the motor circuit through the main brushes 10 and to break the circuit of the auxiliary brushes 8. The normal torque is then applied to the pinion 15 to rotate the engine fly wheel 17.

When the engine starts under its own power, the operator releases the switch 27 to open the circuit of the magnet coil 26, and the switch 25 opens the motor circuit. The spring 13 then returns the armature to its displaced position, with the pinion 25 out of engagement with the gear wheel 16.

If the operator fails to release the switch 27 at the proper time, the motor circuit will be opened automatically. The generator 28, which is connected to the engine shaft in any suitable manner (not shown), is operated at an increase in speed. When the electromotive force of the generator reaches a predetermined value, the coils 30 and 31 of the cut-out 29 are energized to draw the armature member 32 downwardly to effect the engagement of the contact members 33 and 34. Both terminals of the magnet coil 26 are then grounded and the coil is deenergized, thus permitting the switch 25 to open. The operation of the cut-out also closes the charging circuit of the battery which extends from the positive terminal of the generator, through a series field winding 37, series coil 30, contact members 34 and 33, armature 32 to ground, and thence through the battery, the positive terminal of which is grounded to the negative terminal of the generator.

I provide a starting motor which operates automatically to effect the operative connection of its rotating part to the engine shaft of an automobile and to rotate the latter after the connection has been established. I provide also means for automatically disengag-

ing the coacting gear wheels which connect the motor to the engine when the engine starts under its own power. These and other advantages will be apparent to those skilled in the art to which my invention appertains.

My invention may be modified in various ways, and it is understood that such changes may be made, without departing from the spirit of my invention, as fall within the scope of the appended claims.

I claim as my invention:

1. In a starting system, the combination with a dynamo-electric machine having a longitudinally movable armature, of means for supplying current to the armature at points varying in angular relation thereto in accordance with its longitudinal position, said means comprising auxiliary brushes that are angularly displaced from the main brushes.

2. In a starting system, the combination with a dynamo-electric machine having a longitudinally movable armature, of means for supplying current to the armature at points varying in angular relation thereto in accordance with its longitudinal position, said means comprising auxiliary brushes that are angularly and longitudinally displaced from the main brushes.

3. In a starting system, the combination with a dynamo-electric machine having a longitudinally movable armature, a pinion on the armature shaft, and a gear wheel for meshing with said pinion in one position of said armature, of means comprising auxiliary brushes for supplying current to the armature windings at points varying in angular relation thereto according to the relative positions of said pinion and said gear wheel.

4. In a starting system, the combination with a dynamo-electric machine having a longitudinally movable armature, a pinion on the armature shaft, and a gear wheel for meshing with said pinion in one position of said armature, of means for supplying current to the armature windings at points varying in angular relation thereto according to the relative positions of said pinion and said gear wheel, said means comprising auxiliary brushes that are angularly and longitudinally displaced from the main brushes.

5. In a starting system, the combination with an electric motor having an armature that is longitudinally movable from a central position, of means for decreasing the torque of said armature in its displaced position, said means comprising an auxiliary set of commutator brushes that are angularly displaced from the main brushes.

6. In a starting system, the combination with an electric motor having an armature that is longitudinally movable from a central position, of means for decreasing the

torque of said armature in its displaced position, said means comprising an auxiliary set of commutator brushes that are angularly and longitudinally displaced from the main brushes.

7. In a starting system, the combination with an electric motor having an armature that is longitudinally movable from a central position, and two sets of commutator brushes, of a source of current and means comprising said brushes for connecting said source to the armature windings at points varying in angular relation thereto according to the position of said armature.

8. In a starting system, the combination with an electric motor having an armature that is longitudinally movable from a central position, of a source of current, means comprising two sets of commutator brushes for connecting said source to the armature winding, and means for rendering one or the other of said sets of brushes inoperative according to the position of said armature.

9. In a starting system, the combination with an electric motor having an armature that is longitudinally movable from its normal position and having also main and auxiliary sets of commutator brushes, of means for rendering the main brushes inoperative when the armature is in its displaced position and for rendering the auxiliary brushes inoperative when the armature is in its normal position.

10. In a starting system, the combination with an electric motor having an armature that is longitudinally movable from its normal position and having also main and auxiliary sets of commutator brushes, of means for rendering the main brushes inoperative when the armature is in its displaced position and for rendering the auxiliary brushes inoperative when the armature is in its normal position, said means comprising a pair of insulating members on the armature shaft.

11. In apparatus of the class described, in combination, a dynamo having an armature which is slidable endwise with respect to its field magnets, an internal combustion engine, a gear driven from said engine, a gear upon the armature shaft of said dynamo positioned to come into operative relation to said first gear as said armature slides, and means adapted to lead current to the commutator of said dynamo at one point to effect said sliding movement and subsequently to lead current thereto at another point to effect starting of the engine.

12. In a starting system, the combination with a dynamo-electric machine having a longitudinally movable armature, of means

for supplying current to the armature at points varying in angular relation thereto in accordance with the longitudinal position of said armature.

13. In a starting system, the combination with a dynamo-electric machine having a longitudinally movable armature, a pinion on the armature shaft, and a gear wheel coacting with said pinion, of means for supplying current to the armature winding at points varying in angular relation thereto in accordance with the relative positions of said pinion and gear wheel.

14. In a starting system, the combination with an electric motor having an armature that is longitudinally movable from a central position, of means for decreasing the torque of said armature in its displaced position by supplying current to it at points angularly displaced from the points at which current is normally supplied.

15. In a starting system, the combination with a field magnet frame, and a longitudinally movable armature therein, of means for supplying current to said armature in its displaced position at points angularly displaced from the points of normal supply.

16. In a starting system, the combination with a dynamo-electric machine having a field-magnet winding and a longitudinally movable armature, of means for decreasing the torque of said armature in one of its positions by varying the angular relations of the magnetic fields produced by said field-magnet winding and said armature.

17. In a starting system, the combination with a pair of relatively movable members, of means for controlling the operative connection of said members, said means comprising a dynamo-electric machine having a longitudinally shiftable armature and means for controlling the angular relations of the magnetic fields in said dynamo-electric machine.

18. In a starting system, the combination with a pair of relatively movable members, of means for controlling the operative connection of said members, said means comprising a dynamo-electric machine having a longitudinally shiftable armature and means for automatically controlling the angular relations of the magnetic fields of said dynamo-electric machine in accordance with the longitudinal position of said armature.

In testimony whereof, I have hereunto subscribed my name this 2nd day of October, 1914.

JOHN P. NIKONOW.

Witnesses:

B. B. HINES,
M. C. MERZ.