O. E. HUNT.

STARTING APPARATUS.

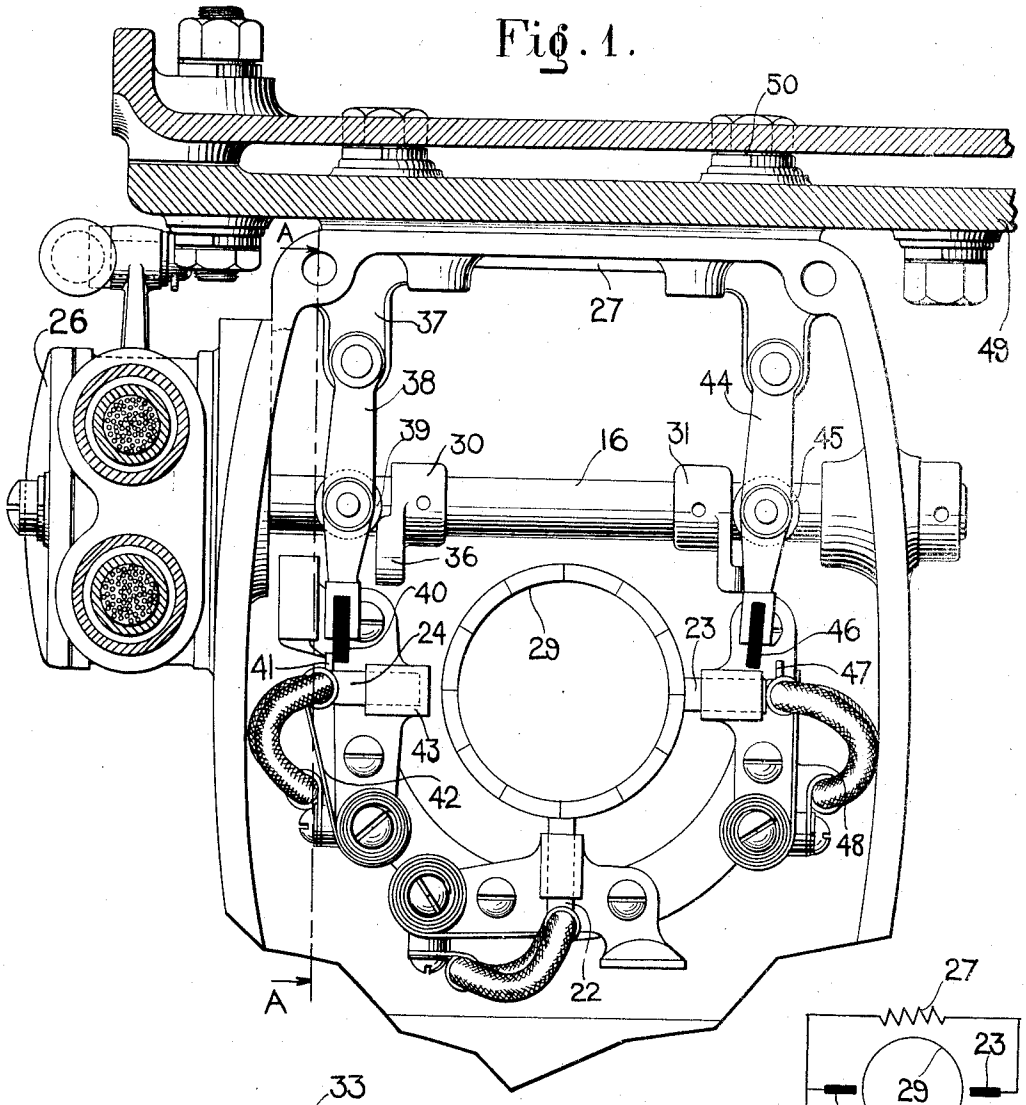
APPLICATION FILED MAR. 5, 1915.

1,278,151.

Patented Sept. 10, 1918.

2 SHEETS—SHEET 1.

Fig. 1.



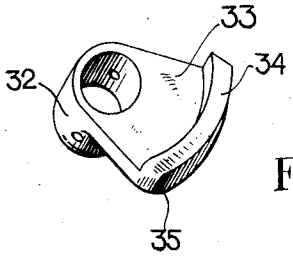


Fig. 5.

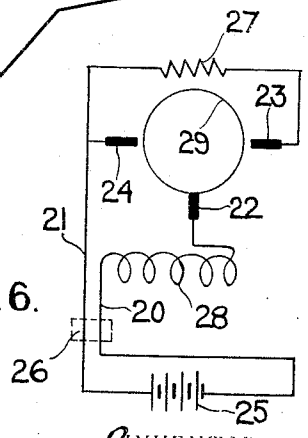


Fig. 6.

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2 SHEETS—SHEET 2.

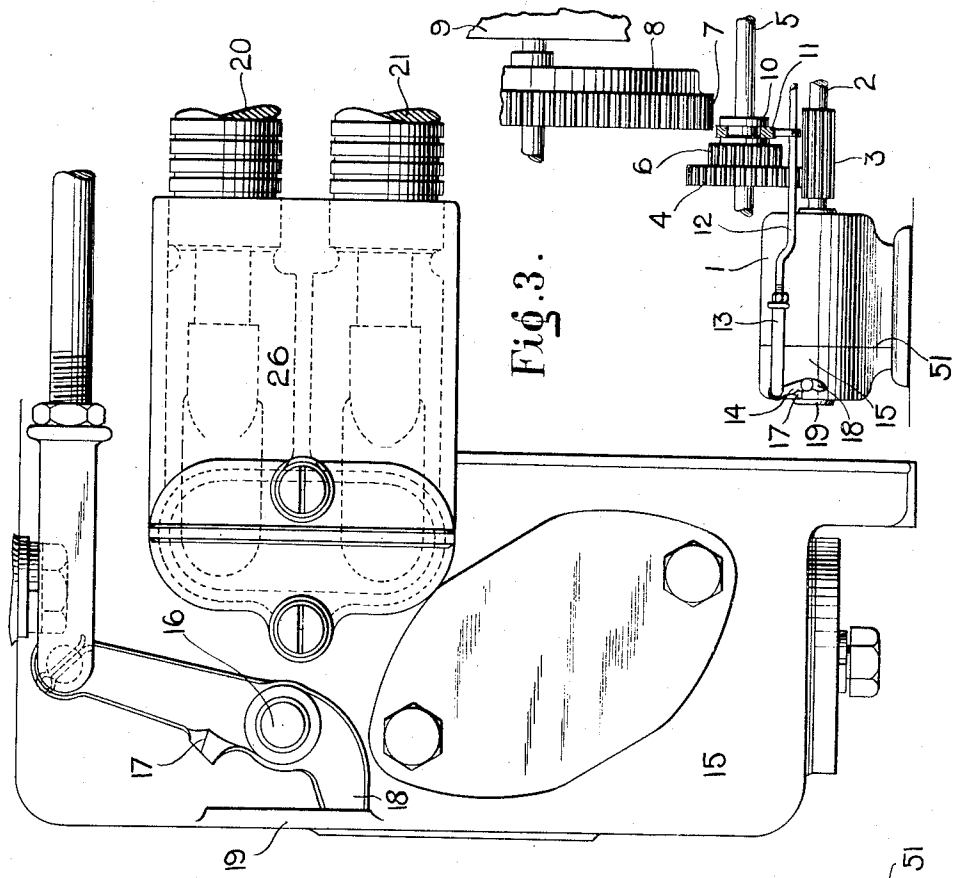

Fig. 3.

Fig. 4.

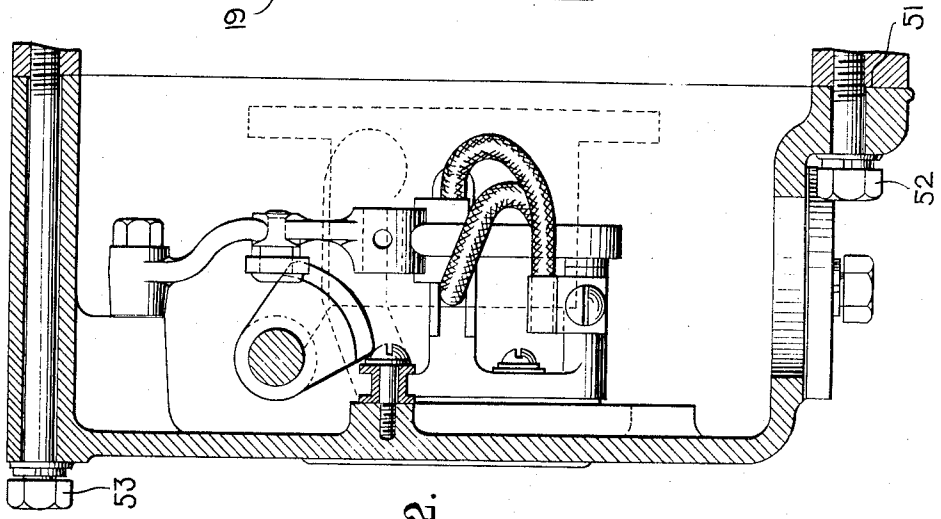

Fig. 2.

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UNITED STATES PATENT OFFICE.

ORMOND E. HUNT, OF DETROIT, MICHIGAN, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

STARTING APPARATUS.

1,278,151. Specification of Letters Patent. Patented Sept. 10, 1918.

Application filed March 5, 1915. Serial No. 12,254.

To all whom it may concern:

Be it known that I, ORMOND E. HUNT, a citizen of the United States, and residing at Detroit, in the county of Wayne and State of Michigan, have invented a new and Improved Starting Apparatus, of which the following specification is a full disclosure.

This invention relates to the starting of dynamos, and with regard to certain more specific features thereof to the starting of internal combustion engines by means of a dynamo.

One of the objects thereof is to provide practical and efficient apparatus of the above nature of simple construction and efficient action. Another object is to provide apparatus of the above nature in which the parts are positively actuated and are adapted to withstand all conditions of use without injury or derangement.

Other objects will be in part obvious from the annexed drawings and in part indicated in connection therewith by the following analysis of this invention.

This invention accordingly consists in the features of construction, combinations of parts, and in the unique relations of the members and in the relative proportioning and disposition thereof; all as more completely outlined herein.

To enable others skilled in the art so fully to comprehend the underlying features thereof that they may embody the same by the numerous modifications in structure and relation contemplated by this invention, drawings depicting a preferred form have been annexed as a part of this disclosure, and in such drawings, like characters of reference denote corresponding parts throughout all the views of which:—

Figure 1 is an inside end view of a dynamo head with parts mounted thereon.

Fig. 2 is a sectional elevation taken substantially on the line A—A of Fig. 1, certain parts being omitted and certain parts being indicated by dotted lines in order to avoid obscuring the showing.

Fig. 3 is a side elevation of the apparatus shown in Fig. 1 in different position.

Fig. 4 is a diagrammatic view indicating the connection of the dynamo with certain gearing.

Fig. 5 is a detail perspective view of a cam member.

Fig. 6 is a diagrammatic electrical plan.

Referring now to Fig. 4 of the drawings, there is shown at 1 a dynamo, which here takes the form of an electric motor, and the armature shaft 2 of which is provided with a pinion 3 meshing with an idle gear 4 which slides upon the shaft 5. Secured to gear 4 is a pinion 6 adapted upon sliding with the former to come into mesh with the gear 7 upon the fly wheel 8 of an internal combustion engine 9. The member comprising gears 4 and 6 is shifted by apparatus here diagrammatically indicated as the grooved collar 10 engaged by the fork 11 and the position of which is controlled by an endwise slidable link 12. This link is connected by thread and lock nut with a fork or yoke 13 pivotally joined to a lever 14 mounted upon the casing of the dynamo 1, as hereinafter described.

It will thus be seen that with the parts in the position indicated in Fig. 4, if the link or rod 12 be drawn toward the right, as by the pedal of an automobile, the gear 4 will remain in mesh with the pinion 3 which is fast upon shaft 2 and turning with the motor armature, and that gear 6 will come into mesh with gear 7 and turn over the engine. A reverse movement of the link 12 will throw this gearing out of mesh and break the connection between the engine and the dynamo. It may here be noted that the term "gearing" is used throughout in a broad sense to cover power transmitting mechanism either of the positive or frictional type.

Turning now to Fig. 3 of the drawings, there is shown a dynamo head or end casing 15 upon which the lever 14 is mounted by means of the rock shaft 16 journaled in the walls of the casing as shown in Fig. 1. The movement of the link 12, as above described, swings this lever throughout an arc limited by the engagement of the abutments 17 and 18 with the stop 19 formed upon the dynamo casing. The parts are so proportioned that this swing is sufficient to bring the gears 6 and 7 into and out of mesh and also properly to actuate the devices hereinafter described.

Current is led through the dynamo by the cables 20 and 21 and suitable electrical connections are made between one of these cables and the brush 22, shown in Fig. 1 of the drawings. The remaining cable is connected with brushes 23 and 24 in parallel.

Referring to Fig. 6 of the drawings, there

is given a general plan of electrical connections and in this figure there is shown at 25 a storage battery or other source of current from which the cables 20 and 21 lead through the connection box indicated in dotted lines at 26. The circuit of one of these conductors then passes directly to brush 24 and through the resistance element 27 to the brush 23. Cable 20 is connected through the series field 28 of the dynamo directly to the brush 22. It may here be noted that the dynamo is preferably of the four-pole type, the commutator 29 consequently having four neutral points, but the opposite commutator segments are cross-connected so as to permit of the operation of the machine with a single pair of brushes spaced ninety degrees apart.

As best shown in Fig. 1 of the drawings, the rock shaft 16 is provided with a pair of cam parts 30 and 31, here shown as separate members although they might, if desired, be formed as a single member. The member 31, as shown in Fig. 5 of the drawings, comprises a hub portion 32 which may be pinned to the shaft or secured thereto by a set-screw to permit of angular adjustment. Formed on this hub is a web 33 having a flange 34, rounded at 35, but the outer surface of which is otherwise substantially in a plane transverse to the axis of shaft 16. The cam member 30 is of substantially identical construction except that the flange 36 is faced in the opposite direction. Pivoted to the lug 37 formed on the inner surface of the dynamo casing, is a lever 38 having a roller 39 co-acting with the cam flange 36. The parts are shown in Fig. 2 with the shaft turned throughout a portion of its angular range such that the cam member 30 is substantially active whereas the cam member 31 is inoperative. The lower portion of lever 38 is provided with a tongue 40 of insulating material which co-acts with a lug 41 upon the brush 24 and with the parts in the position shown is holding the brush away from the commutator in opposition to the force of the brush feeding spring 42, which tends to urge the brush toward the commutator through the guide 43. Likewise co-acting with cam member 31 is a lever 44 provided with a roller 45 and a lug 46 which, with the parts as shown, is free from a lug 47 upon the brush 23. This spacing apart of these lugs with the levers in inoperative position permits free feeding of the brush by the brush springs 42 and 48 and thus the wearing away of the brush may be compensated for without the adjustment of the springs. If desired, separate springs may be employed to urge the levers 38 and 44 toward their respective cams.

The dynamo casing may be bolted to the support 49 as at 50, this construction not being shown in detail as it forms in itself no part of the present invention. It may also be noted that the head on which the above described parts are mounted is separable from the main dynamo casing 51 as by means of the removal of the bolts 52 and 53.

The action of the above described apparatus is substantially as follows:—

The rock shaft 16 normally occupies such angular position that not only lever 38 but lever 44 hold the corresponding brushes away from the commutator, as diagrammatically indicated in Fig. 6 of the drawings. With the parts in this position, the stop 17 is resting against the stop 19 and the gears 6 and 7 are out of mesh. If now the link 12 be drawn slightly to the right, referring to Fig. 4 of the drawings, the cam 31 permits lever 44 to swing to the left and brush 23 is moved by its spring against the commutator at one of the neutral points, it being understood that brush 22 is constantly in engagement with the commutator. The armature is thus rotated at a slow rate due to the passage of the current through the resistance element 27 which may take the form of a flat metallic plate mounted on the upper surface of the dynamo head. As the movement of the link 12 progresses, the gears 6 and 7 come into mesh and further movement, with a consequent further turning of the shaft 16, causes the cam flange 36 to pass from beneath the roller 39 and permits the engagement of brush 24 with the commutator at the neutral point opposite brush 23. A circuit is thus complete through the armature independent of the resistance element and the full torque of the latter is exercised. This acts to turn over and start the internal combustion engine 9 and upon the latter being started the link 12 is manually moved toward the left, referring to Fig. 4 of the drawings, and stop 18 swung away from stop 19. The first effect of this reverse movement is to withdraw the brush 24 from the commutator. This materally cuts down the current of the motor and upon the movement of the member 12 being completed, the brush 23 is withdrawn, stopping the motor, and inasmuch as the current is small due to the effect of resistance 27 and the counter-electromotive force of the motor, which has risen with its speed, there is no tendency to burn the commutator segments. It may be noted that the actuation of the member 12 is preferably manual, the term being used, of course, in a broad sense to cover any non-automatic method of applying power.

It will thus be seen that there is provided simple and compact apparatus in which the objects of this invention are achieved, and this apparatus is of the most reliable and efficient action.

As many changes might be made in the

above construction, and as many apparently different embodiments might be made of this invention without departing from the scope thereof, it is intended that all features herein described or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus revealed this invention, I claim as new and desire to secure the following combinations of elements, or equivalents thereof, by Letters Patent of the United States:—

1. In starting apparatus, in combination, a dynamo having a commutator, means adapted to lead current through a resistance element to one neutral point of said commutator, and means adapted to lead current independently of said resistance element to another neutral point of the same polarity, the said means being operable successively by a single actuation.

2. In starting apparatus, in combination, a dynamo having a commutator, a resistance element, means adapted to lead current through said resistance element to one neutral point of said commutator, means adapted to lead current independently of said resistance element to another neutral point, and a device adapted upon a single actuation to render said first and second means operative in the above order.

3. In starting apparatus, in combination, a dynamo having brushes and a commutator, a resistance element, a brush adapted to lead current through said resistance element to one neutral point of said commutator, a second brush adapted to lead current independently of said resistance element to another neutral point, and a device adapted upon actuation to move the brushes at said neutral points against said commutator in the above order.

4. In starting apparatus, in combination, a dynamo comprising a commutator and a pair of brushes, and a device adapted upon actuation in one direction to move said brushes successively against the commutator of said dynamo and adapted upon actuation in the opposite direction to withdraw said brushes in the reverse order, said brushes each being positioned to engage the commutator at a neutral point.

5. In starting apparatus, in combination, a dynamo comprising a commutator and a pair of brushes, a movable member, a pair of cam parts controlled by said member, connections respectively between said cam parts and said brushes, and means adapted to actuate said movable member, said parts being proportioned to move said brushes successively into contact or out of contact with the commutator of said dynamo according as said movable member is moved in one or the other direction.

6. In starting apparatus, in combination, a dynamo comprising a commutator and a pair of brushes, a movable member, a pair of cam parts controlled by said member, connections respectively between said cam parts and said brushes, means adapted to actuate said movable member, said parts being proportioned to move said brushes successively into contact or out of contact with the commutator of said dynamo according as said movable member is moved in one or the other direction, and means resiliently urging said brushes against said commutator with said brushes in operative position thereon.

7. In starting apparatus, in combination, a dynamo comprising a commutator and a pair of brushes, a rock shaft mounted on said dynamo, a pair of cams upon said rock shaft, a pair of levers respectively controlled by said cams, connections between said levers and said brushes whereby as said shaft is rocked in one direction said brushes are successively permitted to move against the commutator and as said shaft is rocked in the other direction said brushes are removed from said commutator in the reverse order, and brush feeding springs respectively urging said brushes against said commutator with a resilient force when said brushes are in operative position thereon.

8. In starting apparatus, in combination, a dynamo comprising a commutator and a pair of brushes, a rock shaft mounted on said dynamo, a pair of cams upon said rock shaft, a pair of levers respectively controlled by said cam, connections between said levers and said brushes whereby as said shaft is rocked in one direction said brushes are successively permitted to move against the commutator and as said shaft is rocked in the other direction said brushes are removed from said commutator in the reverse order, brush feeding springs respectively urging said brushes against said commutator with a resilient force when said brushes are in operative position thereon, a source of current, means connecting one of said brushes directly with said source of current, a resistance element, and means connecting the other of said brushes with said source of current through said resistance element.

9. In starting apparatus, in combination, an internal combustion engine, a dynamo, gearing adapted to connect said engine and said dynamo, said dynamo being provided with cross-connected commutator segments, a resistance element, means adapted to lead current through said resistance element to one neutral point of said commutator, means adapted to lead current independently of said resistance element to an opposite neutral point thereof, and a device adapted successively to actuate said first means, connect said gearing, and actuate said second means.

10. In starting apparatus, in combination, an internal combustion engine, a gear connected with said engine, a dynamo, a gear driven from said dynamo, a pair of brushes, a source of current, means connecting one of said brushes with said source of current, a resistance element, means connecting the other of said brushes with said source of current through said resistance element, and means adapted upon actuation to move said second brush against the commutator of said dynamo, mesh said gears, and then move said first brush against said commutator, said last means comprising a rock shaft mounted upon said dynamo and having thereon cam parts connected with said brushes.

11. In starting apparatus, in combination, a dynamo having cross-connected commutator segments, a resistance element stationary with respect to the non-rotatable parts of said dynamo, a brush adapted to lead current through said resistance element to one neutral point of said commutator, a second brush adapted to lead current independently of said resistance element to an opposite neutral point, both said brushes being biased toward said commutator, and means to release said brushes in succession to permit them to contact said commutator.

In witness whereof, I hereunto subscribe my name, as attested by the two subscribing witnesses.

ORMOND E. HUNT.

Witnesses:
ELSIE E. INSLEE,
LE ROI J. WILLIAMS.