R. H. HASSLER.

SELF STARTER FOR ENGINES.

APPLICATION FILED NOV. 23, 1912.

1,171,948.

Patented Feb. 15, 1916.

3 SHEETS—SHEET 1.

Fig. 1.

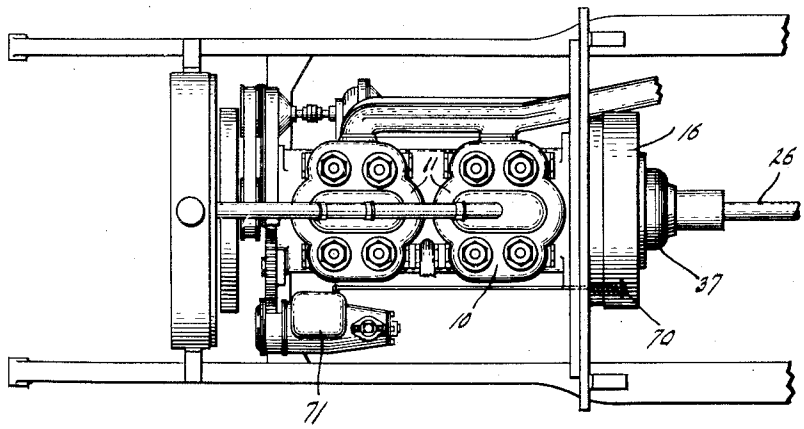
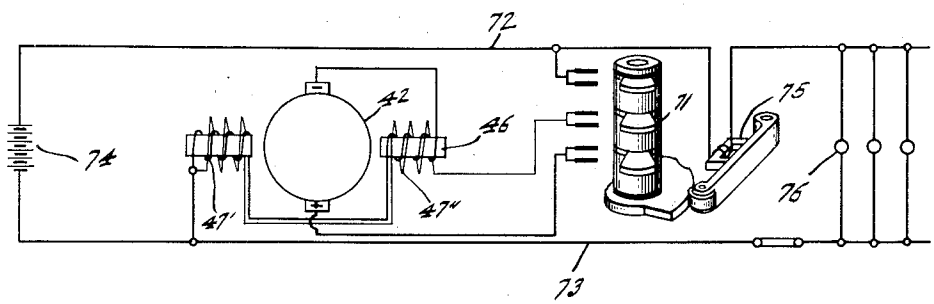


Fig. 2.



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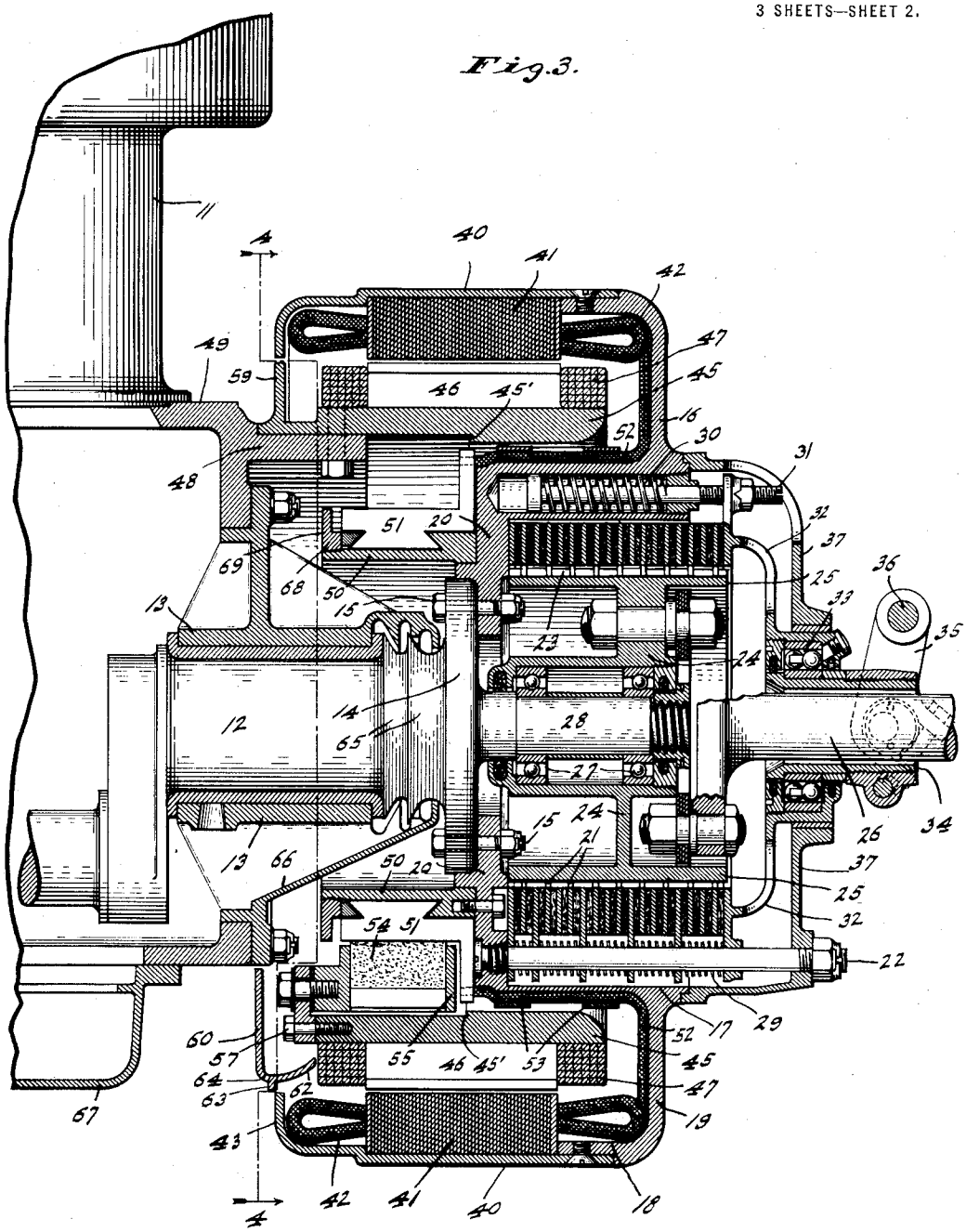
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3 SHEETS—SHEET 2.

Fig. 3.



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3 SHEETS—SHEET 3.

Fig. 4.

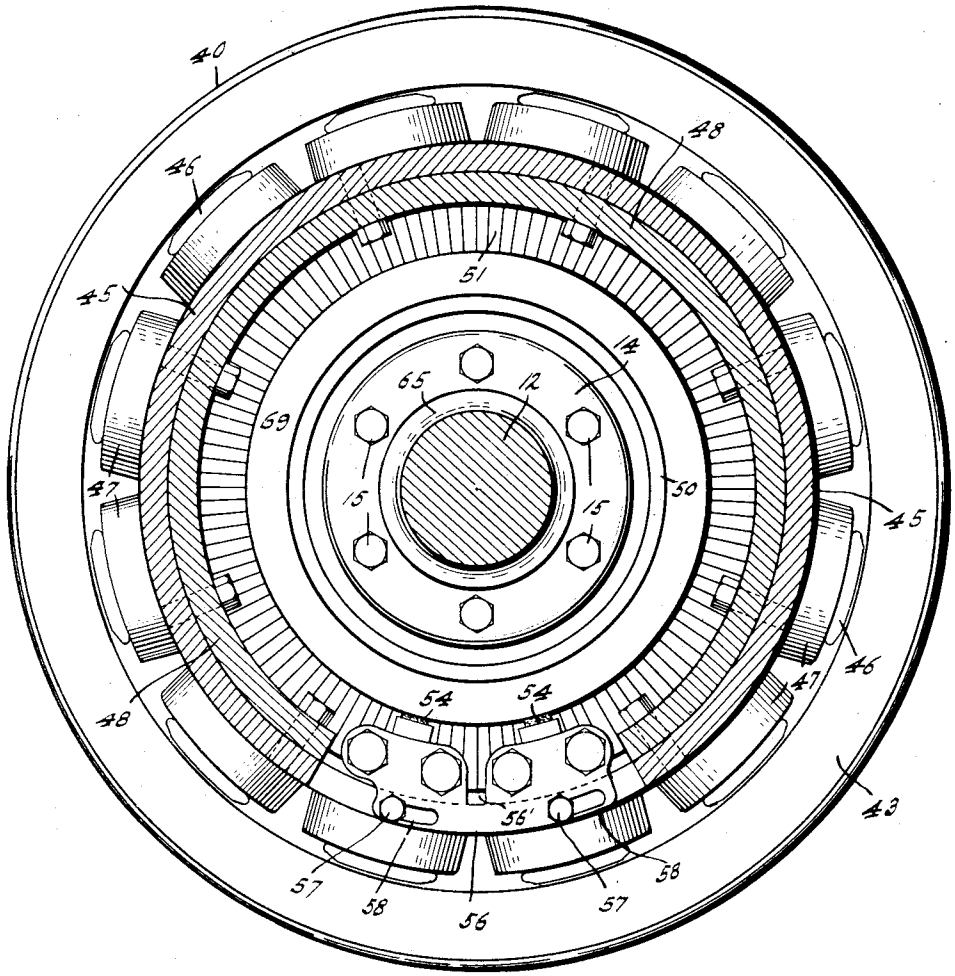
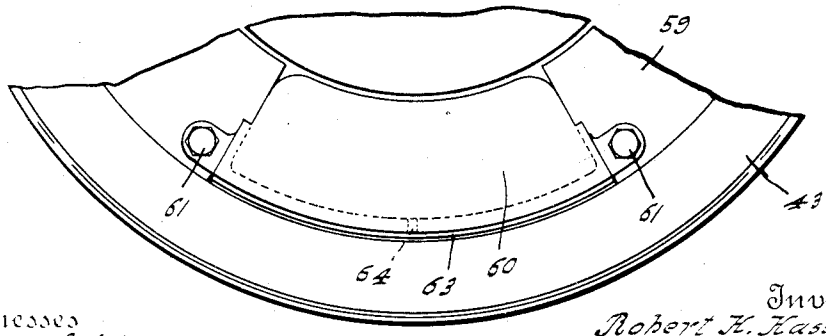


Fig. 5.



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UNITED STATES PATENT OFFICE.

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SELF-STARTER FOR ENGINES.

1,171,948. Specification of Letters Patent. Patented Feb. 15, 1916.

Application filed November 23, 1912. Serial No. 733,056.

To all whom it may concern:

Be it known that I, ROBERT H. HASSLER, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Self-Starter for Engines, of which the following is a specification.

It is the object of this invention to provide internal combustion engines especially automobile engines, with a dynamo-electric starter which is simple in construction and operation, which does not require any additional space over that which would be necessary without it, and which may be used as a motor for starting and as a generator for battery charging. To this end I have provided a novel form of dynamo-electric machine which may be mounted on the engine shaft so that it surrounds one of the engine shaft bearings and the clutch between the engine shaft and the transmission shaft. The commutator of the dynamo-electric machine, in the preferred form of my invention, is within the stationary field magnet, which is of annular form, and the armature is outside of such stationary field magnet.

The accompanying drawings illustrate my invention.

Figure 1 is a plan view of an engine equipped with a starter embodying my invention and mounted on the front end of an automobile chassis; Fig. 2 is a diagram illustrating the electrical connections; Fig. 3 is a vertical longitudinal section through the starter, showing its relation to the engine and the clutch; Fig. 4 is a section on the line 4—4 of Fig. 3; and Fig. 5 is a fragmentary end view of the lower part of the starter structure, looking in the same direction as in Fig. 4.

The engine 10 may have any number of cylinders 11, four being illustrated, the engine crank shaft 12 being suitably mounted in bearings 13 and extending rearward from the engine. Near its rearward end, the shaft 12 is provided with an annular flange 14 to which is fixed, as by bolts 15, a frame or clutch case 16. This frame has inner and outer tubular portions 17 and 18, connected by a web 19, the inner tubular portion being connected by an inwardly projecting flange 20 to the flange 14 on the shaft 12. Within the tubular portion 17 is mounted any usual form of clutch; that shown comprises a friction clutch composed of metal disks 21 with friction material between them, some of these disks being mounted on bolts 22 in the clutch case 16 and some on outwardly projecting teeth 23 on a ring 24 fixed to a flange 25 on the end of transmission shaft 26 and running on ball bearings 27 supported by and surrounding a reduced extension 28 on the shaft 12. Springs 29 surrounding the bolt 22 tend to separate the disks 21 mounted on such bolts, but stronger springs 30 on adjustable bolts 31 act on a clamping plate 32 and thereby tend to press said disks 21 together to clutch the shaft 12 and 26 together so that they rotate in unison. The clamping plate 32 is rotatably mounted, as by ball bearings 33, on a sleeve 34, which is shiftable endwise along the shaft 26 by a clutch-operating arm 35 pivoted at 36 and operated in any suitable manner. A cap 37 closes the open end of the tubular portion 17, being clamped in place by nuts on the bolts 22.

Mounted on the tubular part 18 of the frame 16 is a ring 40 within which is suitably clamped a laminated armature core 41 internally slotted to receive an armature winding 42. The end turns of the armature winding rest in the curves formed between the tubular part 18 and the web 19 and between the body of the ring 14 and an inwardly extending flange 43 on the end thereof toward the engine. These pockets firmly support the armature end turns against centrifugal force, so that no binding wires are necessary. Located within the armature core 41, and spaced therefrom by a suitable air gap, is a field magnet ring 45 having salient poles 46 provided with field magnet windings 47; which, as shown in Fig. 2, preferably comprises series windings 47′ and shunt windings 47″. The field magnet ring is suitably mounted, as by bolts, on an annular extension 48 from the supporting frame 49 for the engine cylinders 11, such annular extension being cut away at the bottom for a purpose hereinafter explained. This field magnet ring extends into the pocket formed between the armature core 41 and the tubular part 17 of the clutch case 16. A commutator ring 50 is suitably mounted on the part 20 of the frame 16, and supports the commutator 51 the radial end projections of the commutator segments being connected by wires 52 to the armature

windings 42 and the wires 52 extending around the inside of the pocket formed by the tubular part 17, the web 19 and the tubular part 18 being held against centrifugal force by bindings 53.

The armature winding 42 is preferably a series winding, so that the entire current may be collected by two brushes 54 spaced apart an angular distance equal to the distance between two field poles. These brushes 54 are conveniently mounted in brush holders 55, which are suitably supported on a segmental brush holder frame 56 attached by bolts 57 to the field magnet frame 45, the brush holder frame 56 conveniently being slotted at 58 to receive the bolts 57 and to allow circumferential adjustment. The brush holder frame 56 is preferably located at the bottom of the circle of the field magnet ring 45, which ring throughout the rest of its circumference has an outwardly projecting flange 59 which nearly meets the inwardly projecting flange 43 on the armature ring 40. The flange 59 is cut away, however, opposite the brush holder frame 56, as is also the flange 48 as aforesaid, so that such brush holder frame, with the brush holders and brushes carried thereby, may readily be removed. This gap in the flange 59 may be closed by a removable segment 60, conveniently held to the ends of the flange 59 by bolts 61. The segment 60 is provided with a shelf or flange 62 which projects toward the field magnets and slightly upward as shown in Fig. 3, and with a downwardly projecting ridge 63 slightly outside of the flange 43. At the very bottom of the pocket formed by the segment 60 and shelf 62 is a hole 64, which opens exteriorly outside (or to the left in Fig 3) of the ridge 63.

The shaft 12 is provided with oil slingers 65 which throw outward the main part of any oil which exudes from the bearings 13 toward the right in Fig. 3, the oil thus thrown out being conveyed by an inclined trough 66 into the oil pan 67 below the crank shaft 12 of the engine. If any oil succeeds in getting past the oil slingers 64, it is conveyed outward along the flange 14 to the inside of the commutator ring 50, thence around the edge of such ring, avoiding the commutator segments, to the inside of the annular flange 48 and field magnet ring the annular flange 48 and field magnet ring 45, collecting by gravity in the bottom of the field ring 45, whence it passes out through the slot 56′ in the brush holder frame 56, to which slot it may be led by a transverse groove 45′ in the lowest part of the inside surface of the field magnet ring 45, and drops into the pocket formed by the segment 60 and shelf 62, and finally drops out through the hole 64; the ridge 63 prevents this oil from dripping upon the armature winding 42. In order to insure that none of this oil gets on the commutator, the clamping ring 68 for such commutator is preferably provided with a circumferential projection 69 which is spaced from the armature segments, as illustrated in Fig. 3. To make certain that the oil which collects in the bottom of the field ring 45 passes therefrom to the left and not to the right (Fig. 3), and also to provide room for the brush holders and brush holder frame and to have as much flux-carrying iron in the field magnet ring as possible, the internal diameter of such ring is made smaller at the right hand end, or the end toward the web 19 than at the left hand end, or the end toward the engine.

The frame or clutch case 16, with the flange 14, provides an imperforate barrier between the clutch and the dynamo-electric machine, so that no oil can pass from one to the other, either by seepage or by centrifugal action. The clutch and the dynamo-electric machine are mounted, independently of each other, on opposite sides of such barrier, and parts of either can be removed, for inspection or repair, without interfering with the other in any way.

To start the engine, a push-button 70 on the dash board of the automobile is pushed, as by the operator's foot, to close a control switch 71, which when closed connects one side of the shunt field winding and one side of the armature and series field circuit to one side 72 of a distributing circuit 72—73 supplied by a storage battery 74, the other side of such shunt field and circuit and series field and armature circuit conveniently being permanently connected to the other side 73 of such distributing circuit. The control switch 71 is preferably of the form set forth in Patent No. 1,111,150, granted Sept. 22, 1914, on my co-pending application, Serial No. 733,055, of even filing date herewith, and operates to maintain the dynamo-electric machine connected across the circuit 72—73 as long as the speed of the engine remains within predetermined limits but to disconnect said dynamo-electric machine from such circuit when the speed departs from such limits. By closing the switch 71, by the push-button 70, current is drawn from the battery 74 to cause the operation of the dynamo-electric machine as a motor, to start the engine. As soon as the engine begins to operate under its own power, it increases in speed and drives the dynamo-electric machine as a generator, the direction of current through the armature and series field windings of the dynamo-electric machine changes from motor to generator. The series and shunt field windings of the dynamo-electric machine act cumulatively when the machine is acting as a motor and differentially when it is acting

as a generator, this differential action serving to maintain the generator voltage nearly constant for all speeds. The action of the control switch 71 may be varied by an electromagnet 75 responsive to the current taken by the lights 76 connected to the circuit 72—73 so that the limits within which the dynamo-electric machine is connected across the circuit 72—73 are widened as the current required for the lighting circuit is increased.

I claim as my invention:

1. A dynamo-electric machine, comprising a fixed field magnet structure of annular form, an armature structure surrounding said field magnet structure, a commutator surrounded by said field magnet structure, said armature and commutator being fixed relatively to each other and mounted to rotate together, said field magnet structure having a smaller internal diameter at one end than at the other, and brushes cooperating with said commutator and carried by and within said field magnet structure at the end having the larger internal diameter.

2. A dynamo-electric machine, comprising a field magnet structure of annular form, an armature structure surrounding said field magnet structure, a commutator surrounded by said field magnet structure, said armature and commutator being fixed relatively to each other and rotatable relatively to the field magnet structure, and brushes carried by and within said field magnet structure to coöperate with the circumference of said commutator, said field magnet structure having a larger internal diameter at one end than at the other and said commutator and brushes being located within the field magnet structure at said end having the largest internal diameter.

3. A dynamo-electric machine, comprising an annular field magnet structure, an armature structure surrounding said field magnet structure, a commutator surrounded by said field magnet structure and located toward one axial end thereof, a shaft on which said armature and commutator are carried, a second shaft co-axial with the first shaft, and a clutch for connecting said two shafts, said clutch being surrounded by said field magnet structure and located toward the other end thereof from that toward which said commutator is located.

4. A dynamo-electric machine, comprising an annular field magnet structure, an armature structure surrounding said field magnet structure, a commutator surrounded by said field magnet structure and located toward one axial end thereof, a shaft on which said armature and commutator are carried, a second shaft co-axial with the first shaft, and a clutch for connecting said two shafts, said clutch being surrounded by said field magnet structure and located toward the other end thereof from that toward which said commutator is located, said field magnet structure having a larger internal diameter at the end toward which the commutator is located than at the end toward which said clutch is located.

5. A dynamo-electric machine, comprising an annular field magnet structure, an armature structure surrounding said field magnet structure, a commutator surrounded by said field magnet structure and located toward one axial end thereof, a shaft on which said armature and commutator are carried, a second shaft co-axial with the first shaft, a clutch for connecting said two shafts, said clutch being surrounded by said field magnet structure and located toward the other end thereof from that toward which said commutator is located, and a web which separates said clutch from said commutator and armature.

6. A dynamo-electric machine, comprising an annular field magnet structure, an armature structure surrounding said field magnet structure, a commutator surrounded by said field magnet structure and located toward one axial end thereof, a shaft on which said armature and commutator are carried, a second shaft co-axial with the first shaft, a clutch for connecting said two shafts, said clutch being surrounded by said field magnet structure and located toward the other end thereof from that toward which said commutator is located, said field magnet structure having a larger internal diameter at the end toward which the commutator is located than at the end toward which said clutch is located, and a web which separates said clutch from said commutator.

7. In combination, a driving shaft, a clutch case fixed thereon, a clutch within said clutch case for connecting said driving shaft to a part to be driven, an armature of a dynamo-electric machine fixed on said clutch case, a commutator also fixed on said clutch case, and a fixed field magnet structure extending annularly between the armature and commutator and surrounding the clutch case.

8. In combination, a driving shaft, a clutch case fixed thereon, a clutch within said clutch case for connecting said driving shaft to a part to be driven, an armature of a dynamo-electric machine fixed on said clutch case, and a fixed field magnet structure within said armature and surrounding said clutch case.

9. In combination, a driving shaft, a clutch case fixed thereon, a clutch for connecting said driving shaft to a part to be driven, an armature of a dynamo-electric machine fixed on said clutch case, a commutator fixed on said clutch case, connections between said commutator and the winding

of said armature, said connections being mounted on said clutch case, and a fixed field magnet structure coöperating with said armature surrounding the commutator and clutch case and being surrounded by the armature.

10. In combination, a driving shaft, a bearing therefor, a commutator fixed on said driving shaft on one side of said bearing, said commutator extending over the bearing, a clamping ring for the commutator located at the end of the commutator over the bearing and provided with a circumferential extension spaced from the commutator segments, and a field magnet structure and an armature structure coöperating with said commutator.

11. In combination, a driving shaft, a bearing therefor, a commutator mounted on said driving shaft at one side of the bearing, said commutator extending over the bearing, a field magnet structure of annular form surrounding said commutator, an armature surrounding the field magnet structure, a brush holder frame mounted within said field magnet structure at one part thereof, said field magnet structure having an outwardly projecting flange to coöperate with the armature to form a substantially closed housing, and said flange being cut away opposite said brush holder frame, and a removable segment for closing said cut-away portion, said segment being provided with an upwardly and inwardly projecting shelf for forming an oil-collecting pocket.

12. In combination, a driving shaft, a bearing therefor, a commutator mounted on said driving shaft at one side of the bearing, said commutator extending over the bearing, a field magnet structure of annular form surrounding said commutator, an armature surrounding the field magnet structure, a brush holder frame mounted within said field magnet structure at one part thereof, said field magnet structure having an outwardly projecting flange to coöperate with the armature to form a substantially closed housing, and said flange being cut away opposite said brush holder frame, and a removable segment for closing said cutaway portion.

13. In combination, a driving shaft, a clutch case fixed thereon, a clutch within said clutch case for connecting said driving shaft to a part to be driven, an armature of a dynamo-electric machine fixed on said clutch case, a commutator also fixed on said clutch case, and a fixed field magnet structure surrounding said clutch case, said clutch case forming a barrier between the clutch and the dynamo-electric machine.

14. In combination, a driving shaft, a clutch case fixed thereon, a clutch within said clutch case for connecting said driving shaft to a part to be driven, an armature of a dynamo-electric machine fixed on said clutch case, a commutator also fixed on said clutch case, and a fixed field magnet structure surrounding said clutch case, parts of said clutch and said dynamo electric machine being separately removable of without requiring the removal of the other.

15. A dynamo-electric machine, comprising a commutator having a substantially horizontal axis, a field magnet structure of annular form surrounding said commutator, an armature coöperating with said annular field magnet structure, said annular field magnet structure being higher internally at the bottom at one end than at the other, and a brush holder frame mounted in said field magnet structure at the bottom at the lower end thereof, said brush holder frame being notched to allow any oil collecting in the bottom of said field magnet structure to pass through.

In witness whereof, I have hereunto set my hand and seal at Indianapolis, Indiana, this 21st day of November, A. D. one thousand nine hundred and twelve.

ROBERT H. HASSLER. [L. S.]

Witnesses:
ARTHUR M. HOOD,
FRANK A. FAHLE.