

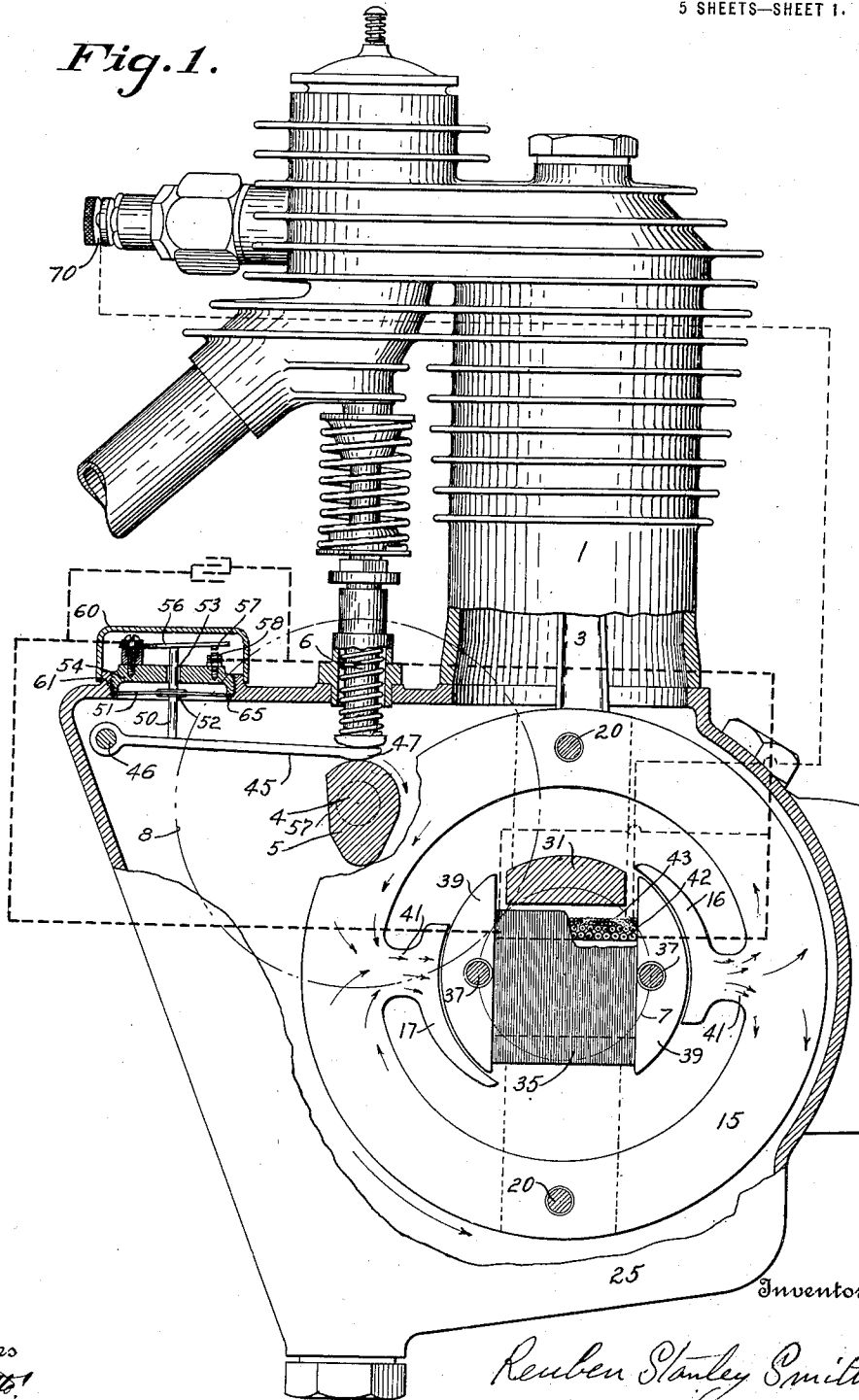
R. S. SMITH.
MAGNETO GENERATOR.
APPLICATION FILED SEPT. 2, 1916.

1,291,216.

Patented Jan. 14, 1919.

5 SHEETS—SHEET 1.

Fig. 1.



Witnesses
James

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By

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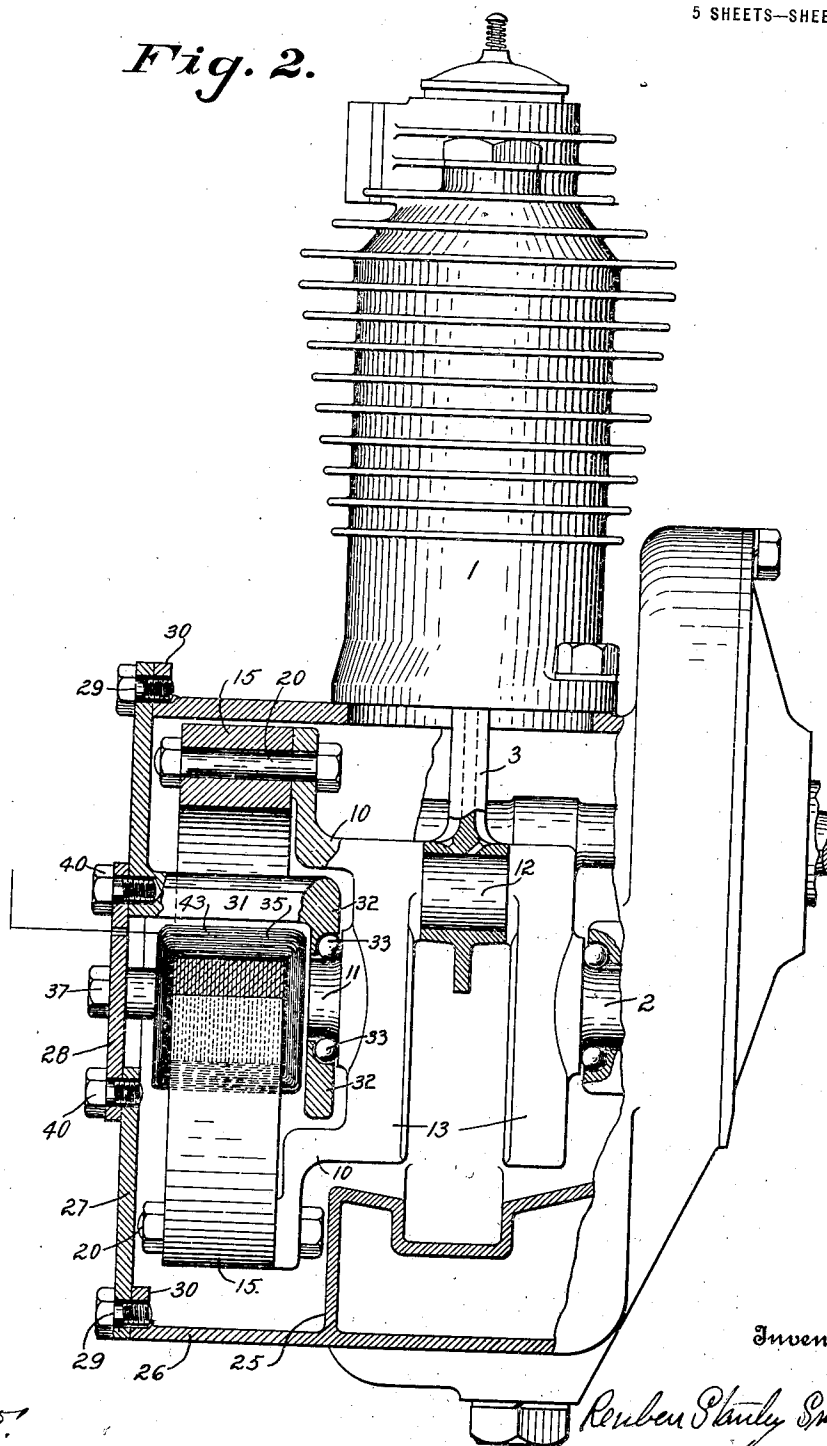
Attorney

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5 SHEETS—SHEET 2.

Fig. 2.



Witnesses

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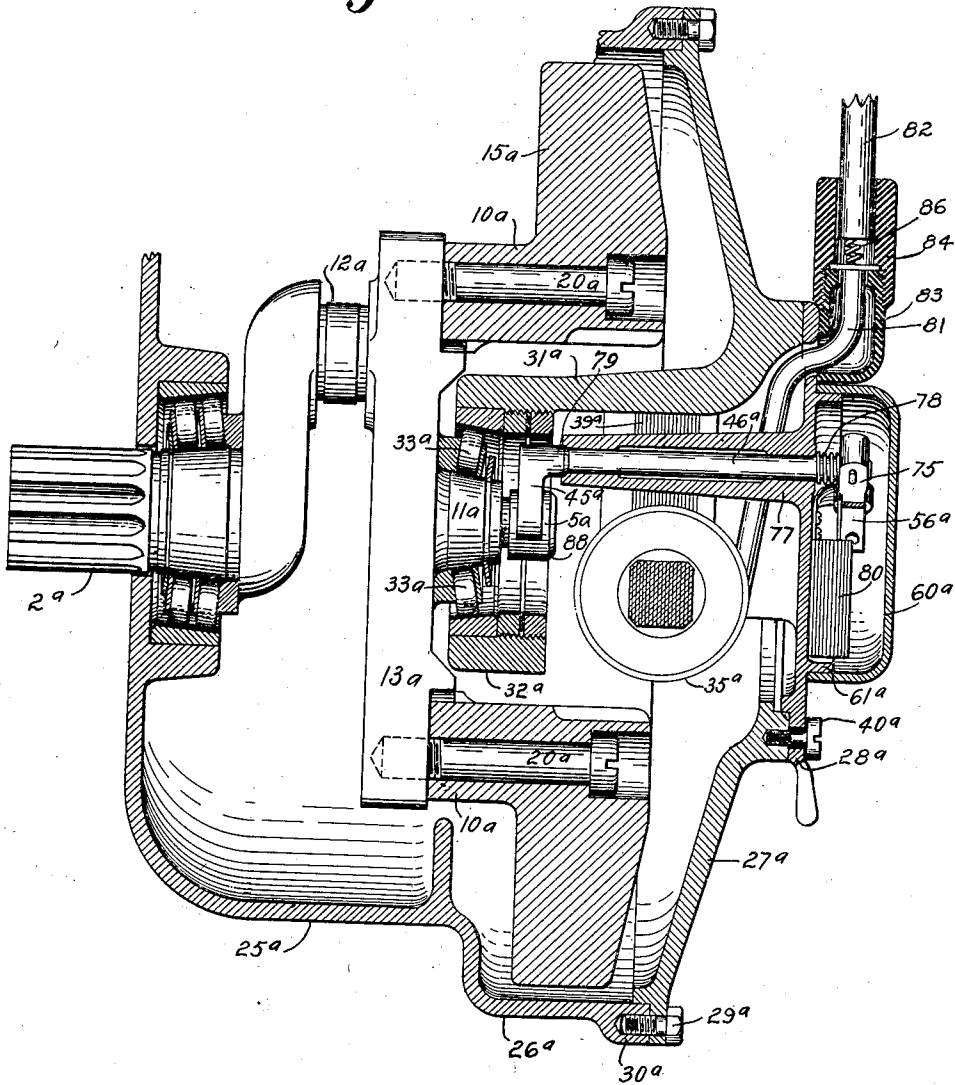
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5 SHEETS—SHEET 3.

Fig. 3.



Inventor

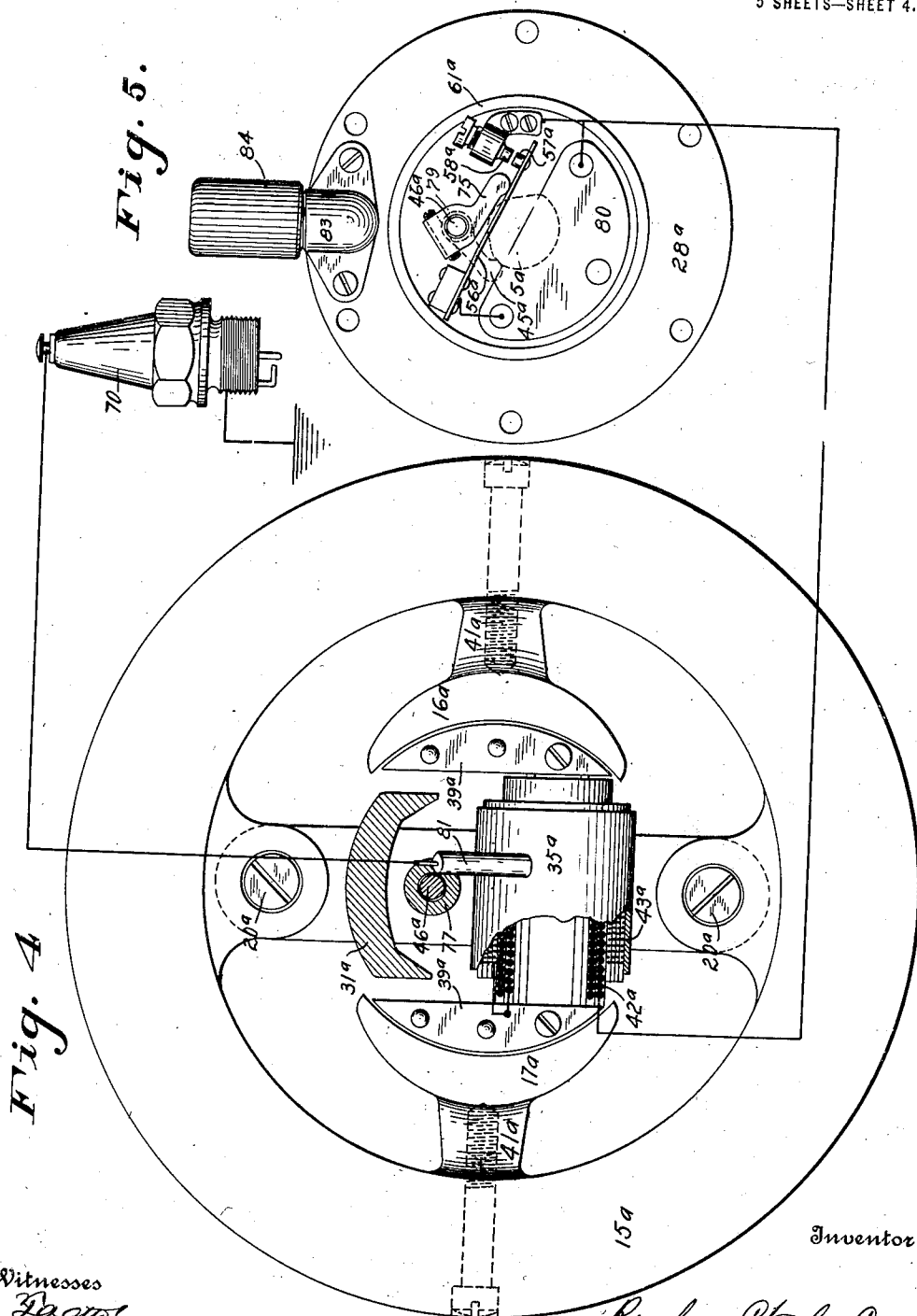
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5 SHEETS—SHEET 4.



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5 SHEETS—SHEET 5.

Fig. 6.

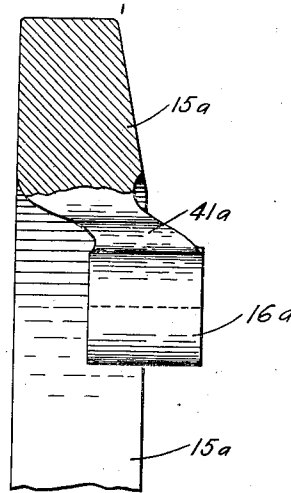
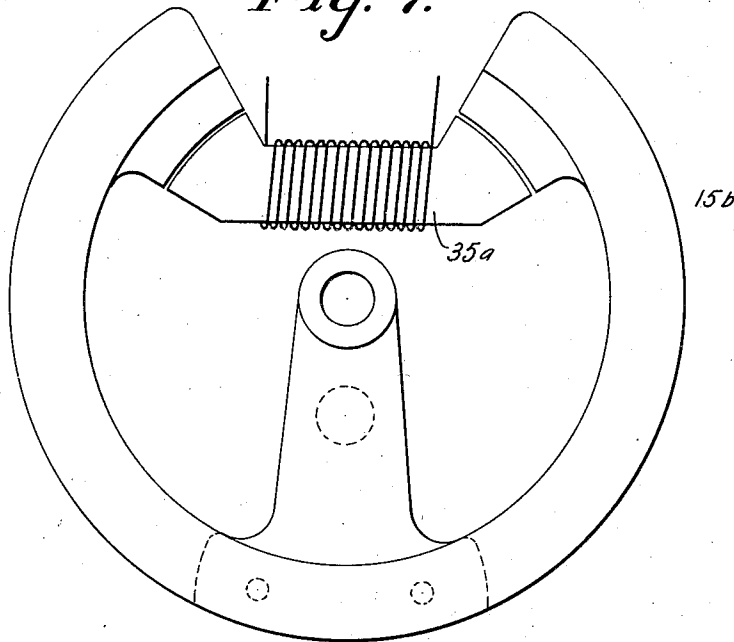


Fig. 7.



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UNITED STATES PATENT OFFICE.

REUBEN STANLEY SMITH, OF MILWAUKEE, WISCONSIN.

MAGNETO-GENERATOR.

1,291,216.

Specification of Letters Patent.

Patented Jan. 14, 1919.

Application filed September 2, 1916. Serial No. 118,177.

To all whom it may concern:

Be it known that I, REUBEN STANLEY SMITH, citizen of the United States, residing at Milwaukee, county of Milwaukee, and State of Wisconsin, have invented new and useful Improvements in Magneto-Generators, of which the following is a specification.

My invention relates to improvements in magneto generators, with particular reference to generators of that type in which the field revolves about a stationary armature.

Magneto generators of this type are usually embodied in small units in which it is greatly desirable that all of the parts should be compact, durable, and inexpensive. The object of my invention is therefore to not only secure these characteristics to the fullest possible extent but to also eliminate all unnecessary weight and to secure increased reliability in operation.

I propose to attain these objects in part by employing a circular field magnet composed of a continuous ring of permanently magnetic material, having interior polar projections on diametrically opposite sides thereof, (either integrally formed or otherwise), and supporting this ring directly from a set of fork arms connected with the crank shaft of the driving motor, with the arms secured to the ring substantially midway between the polar projections. The ring is magnetized to establish or constitute these projections as the poles and therefore the middle points between these projections are the neutral points to which the supporting arms may be secured without disturbing or weakening the magnetic field. By employing an integral continuous ring, the rotary member is better able to resist the strains developed by centrifugal force, and I therefore prefer it, although my invention contemplates also the use of a ring divided into segments having their ends secured to the pole pieces if desired. The continuous ring is also less expensive, particularly if the polar projections are integral.

I also propose to provide a form of construction in which a stationary armature may be supported from the engine frame and this support utilized to provide an end bearing for the crank shaft, said support extending through the rotary field ring in such a manner as to leave room for a stationary armature and so arranged as to avoid any impairment of energy such as might re-

sult from diversion of the lines of force, or the development of electrical currents in the support. By providing an extension of the crank casing with a bracket arm projecting around the rotating field and through the ring from the side opposite that at which the crank is located, I am enabled to bring the generator into close proximity to the crank and to produce a compact, well balanced and durable structure, reducing the number of parts and cost of manufacture to a minimum.

I also propose to secure increased reliability by providing a circuit breaking mechanism which is located and operated within an inclosure which not only excludes dust, oil, or other foreign matter from the contacts, but also protects the parts from injury. This feature is important for large units but it is also of especial importance for small units and particularly so where my invention is applied to motor driven vehicles or other portable devices.

In the drawings—

Figure 1 is a side elevation of an internal combustion engine structure with portions of the casing broken away in vertical section to expose the operating parts of my improved magneto generator.

Fig. 2 is a front elevation, partly in vertical section, drawn generally to a plane which includes the longitudinal axis of the crank shaft, the latter, however, being illustrated in full.

Fig. 3 is a detail view in vertical section exposing the crank shaft, and the connecting bolts of the field ring, and showing a modified form of construction.

Fig. 4 is a diagram of the same showing the relation of the armature to the field ring and spark plug and also showing the supporting arm of the crank shaft bearing ring in cross section.

Fig. 5 is a detail view of the outer face of the armature supporting cap showing the circuit breaker.

Fig. 6 is a fragmentary view of the field and one polar projection showing the latter in its offset relation to the ring.

Fig. 7 is a detail showing a modified field magnet.

Like parts are identified by the same reference characters throughout the several views.

Figs. 1 and 2 show my invention as applied to a four cycle internal combustion en-

gine of which 1 is the cylinder, 2 the crank shaft, 3 the pitman rod, 4 and 5 the cam shaft and cam, respectively, for actuating the exhaust valve, 6 the valve actuating rod and 7 and 8 the gear members for transmitting motion from the crank shaft to the cam shaft.

The crank shaft 2 is provided with a set of arms 10 to support the magnetic field ring. These arms are preferably elbowed and comprise integral extensions of the crank 12 and the oppositely disposed balancing arm 13. Being formed of steel, they are adapted to rigidly support a magnetic ring 15 in close proximity to the crank, but slightly offset longitudinally. The ring 15 is continuous and is provided with interior polar projections 16 and 17. The magnetic circuit is indicated by the arrows. I have discovered that it is not necessary to employ brass rings or other non-magnetic supports with segmental magnets mounted therein as has heretofore been customary, for if the continuous ring is so magnetized as to establish the poles in the projections 16 and 17, the portions of the ring midway between these poles are magnetically neutral, and the bolts 20 may be passed through these neutral points and the ring secured directly to the steel shaft arms without affecting the magnetic field. The ring being integral, it is also adapted, in itself, to perform the function of a fly wheel.

The crank case 25 has a cylindrical extension 26 provided with a removable disk shaped end wall 27, the latter being preferably centrally apertured and provided with a removable cap 28. The end wall 27 is directly bolted at 29 to an annular flange 30 on the extension 26. An arm 31 extends from the end wall 27 inwardly toward the crank shaft and supports a ring 32 at its inner end which provides a bearing for the tapered end 11 of the crank shaft, anti-friction balls or rollers 33 being preferably employed. A single arm is preferably employed in order to avoid the development of induced currents in the support or a diversion of the lines of magnetic force.

A stationary armature 35 is supported from the cap 28 by bolts or rivets 37 which are threaded or secured into the armature heads 39 as shown. The armature core is preferably offset from the center line between the head pieces 39 whereby space is provided at one side of the core and its winding to allow the arm 31 to pass between these parts and the circular path of the field pole pieces or projections 16 and 17. The armature being wholly supported from the cap 28, it is obvious that by removing the bolts 40, which connect this cap to end wall 27, the armature may be removed with the cap without disturbing any other portion of the mechanism.

It will be observed that the segmental portions of the polar projections 16 and 17 are connected with the ring 15 by neck portions 41. But the neck portions are located near the rear ends of the segments, *i. e.* near that end which is last to leave the armature head, whereby the magnetic field will be intensified and the lines of force will be concentrated in the shortest possible path at the time of breaking the circuit.

The general arrangement of the circuit conductors including the primary and secondary armature windings 42 and 43, is similar to that adopted in ordinary practice, but the circuit breaker is constructed and operated as follows. The circuit breaker operating lever 45 is pivoted to the casing at 46 and has an arm provided with head 47 interposed between the cam 5 and valve actuating rod 6 which operates the exhaust valve of the engine. The other end of this lever 45 is in a position to engage and actuate a circuit breaking pin 50 supported from the crank casing by a resilient diaphragm 51. The pin 50 extends through and is clamped to this diaphragm at 52. The upper end of the pin also projects through aperture 53 in a removable cap nut 54 forming a part of the wall of the casing, the upper end of the pin being in position to engage and actuate a resilient circuit closing arm 57 and thereby raise its terminal electrode 57 out of normal position of contact with the fixed terminal 58, thereby breaking the primary circuit of the armature. A dust tight casing 60, preferably having the form of an inverted cup, is secured to a projecting tubular boss 61 on the crank casing, the cap nut 54 being screwed to the interior wall of said boss. The casing 60, the boss 61, and the diaphragm 51 form an oil tight chamber in which cap nut 54, the upper end of the circuit breaking pin 50, the resilient arm 56, and contact members 57 and 58 are located. It will be observed that the diaphragm 51 is clamped between cap nut 54 and the interior annular shoulder 65 formed on the wall of the crank casing at the base of the boss 60. Therefore, by removing casing member 61, access may be had to the contact terminals, after which cap nut 54 may be removed to permit removal of diaphragm 51 and pin 50.

The head 47 of lever 45 is held to the cam 5 by the spring actuated valve rod 6. The cam holds the lever 45 in actuating relation to the pin 50 during all stages of cam revolution except during the short interval when head 47 registers with and enters cam depression 57, at which time the lever head 47 is depressed sufficiently under downward pressure exerted by valve rod 6 to allow pin 50 to move downwardly until arm 56 reaches circuit closing position, with members 57 and 58 in contact. This closes the primary circuit of the magneto, and this circuit is

again broken by the cam preparatory to a reversal of the magnetic flux. Sufficient current will thus be induced in the secondary winding to operate a jump spark igniter in the usual manner, the engine cylinder being provided with an ordinary igniter plug at 70.

In the modification shown in Figs. 3, 4, and 5, the same reference characters are applied to the corresponding parts as in Figs. 1 and 2 but with the letter a added. In this construction, it will be observed that a balancing arm 13^a is employed on only one leg of the crank 12^a; also that instead of the elbowed arms 10, shown in Fig. 2, I have provided the magnetic ring 15^a with projecting spacing studs 10^a located at the neutral points and through which the connecting bolts 20^a may pass. The ends of the spacing studs abut directly against the crank and the spacing arm 13^a, respectively.

The magnetic ring 15^a is a complete or continuous ring and, as in Figs. 1 and 2, it requires no brass or other nonmagnetic mounting either to support it against centrifugal force, or to connect it with the actuating shaft. The polar projections 16^a and 17^a have necks 41^a detachably connected with the ring. The polar projections are segmental and the neck portions 41^a are centrally located instead of being located near one end of the segment as illustrated in Fig. 1.

The principal distinction, however, between the construction illustrated in Figs. 3, 4, and 5 and that illustrated in Figs. 1 and 2, is in the structure and arrangement of the circuit breaker. It will be observed that a cam 5^a is mounted upon the inclosed end of the crank shaft shown in Fig. 3, this cam being mounted upon the axial projecting portion of the shaft extending beyond the tapered portion 11^a which forms a cone having bearing rollers 33^a. A circuit breaking arm 56^a (Fig. 5) is mounted upon the outer face of the cap plate 28^a and carries a contact member 57^a in position for contact with the terminal electrode 58^a. Motion is transmitted periodically from the cam 5^a to actuate the resilient circuit breaking arm 56^a through the arm 45^a rocking shaft or rod 46^a and arm 75, the latter being located on the outer end of the rocking shaft 46^a in a position to engage and actuate a circuit breaking arm 56^a as best illustrated in Fig. 5. The rocking shaft 46^a has its bearings in arm 77 which projects inwardly from the cap 28^a underneath arm 31^a. The coiled spring 78 (Fig. 3) is arranged to oscillate the shaft 46^a in a direction to retract arm 75 from the circuit breaking arm 56^a and also in a direction to hold the shaft arm 45^a in contact with the cam surface. It also holds rock shaft 46^a with its conically tapered shoulder 79 against the correspondingly tapered seat at the inner end of arm

77. The cam projection will periodically actuate the arm 45^a in the opposite direction, this motion being transmitted to cause arm 75 to swing into contact with and actuate arm 56^a to circuit breaking position. 80 is a condenser also mounted upon the cap plate 28^a, this being inclosed with circuit breaker and arm 75 by housing 60^a screwed to the projecting flange 61^a to form an oil tight, dust-excluding casing. The secondary armature coil 43^a has one end connected with the spark plug 70 by contacting wire extending through the conduit members 81 and 82. This conduit passes through supporting sleeve members 83 and 84, having screw threaded connection with each other and adapted to contain coupling fuse at 86.

The principle of operation of the modified structure is the same as that of the structure shown in Figs. 1 and 2, but in the construction illustrated in Figs. 3, 4, and 5, only the alternate igniting sparks will be utilized when connected with a four-cycle engine, since the circuit will be broken once for each revolution of the crank shaft, but this involves merely the waste of the intermediate sparks and the loss of energy is negligible. It will also be observed that in the structure shown in Fig. 3, the circuit breaker, together with the rocking shaft 46^a and its arms 45^a and 75, may be removed with the cap 28^a which also supports the armature. By removing the housing 60^a, access may be readily had to all portions of the circuit breaker and also to the armature when the cap 28^a is removed. The bearing ring 32^a together with the cam 5^a, the bearing rollers 33^a, etc., will all be exposed through the opening in the casing which is normally covered by said cap 28^a, but owing to the fact that the armature and the circuit breaking mechanism are removed with the cap, it is obvious that this portion of the crank chamber will be unobstructed and access to the crank shaft bearing will therefore be facilitated. The outer face of the cam number 5^a is beveled or conically tapered as shown at 88, whereby when the cap 28^a is replaced, arm 45^a will be pushed outwardly until it moves upon the curved outer surface of the cam.

In Fig. 3, the cap 28^a is shown adjustably mounted on the casing wall and held by a set screw 40^a. This allows a turning adjustment of the armature. Comparing Fig. 3 with Fig. 6, it will be observed that the segmental polar projections 16^a and 17^a are offset from the ring 15^a, whereby they travel a circular path concentric with the circle which includes the armature heads.

Referring to Fig. 7, it will be observed that I have illustrated a field ring 15^b of what may be called the horse-shoe type, the ring being a split ring with polar projections on opposite sides of the gap, adapted

for simultaneous registry with the respective armature heads during the rotation of the ring. In this construction, the neutral point is diametrically opposite the gap in the ring and therefore the ring will be attached at this point to the crank. In this form of construction, the ring will have only one point of support instead of two, as illustrated in the other views, and this connection may be made either with the crank or the balancing arm.

I claim—

1. A magneto generator including the combination with a rotary shaft, of a ring composed of magnetic material provided with oppositely disposed polar projections and adapted by its continuity to resist centrifugal strains and to perform the function of a fly wheel, arms on the shaft directly connecting the shaft with the ring at points substantially midway between the polar projections, and adapted to support and actuate the ring, and an armature located in current generating relation to the ring.

2. The combination with a driving motor crank shaft, of a fly wheel wholly composed of magnetic material and having its peripheral portion connected at its magnetically neutral points with the crank shaft, segmental pole pieces connected with the wheel rim substantially midway between said neutral points, and a relatively stationary current generating armature having its heads in proximity to the circle described by said pole pieces.

3. The combination with a driving motor crank shaft, of a rotary annular field magnet supported from one end portion thereof, a stationary support, a bearing member for the crank shaft, an arm connected with said support and projecting inwardly through the space encircled by the field magnet and connected with the bearing member to support the latter, and a current generating armature in operative relation to the field magnet.

4. In a magneto generator the combination with an armature, of a unitary homogeneous rotor, comprising a shaft, shaft arms, and a field magnet, all of magnetizable material, the field magnet having permanently established magnetic poles, and being secured directly to the shaft arms at its magnetically neutral points and supported thereby in current generating relation to the armature.

5. A magneto generator including a rotor wholly composed of magnetizable material and comprising a shaft and a field magnet having permanently established magnetic poles, and wholly supported from the shaft through a magnetically neutral point in the field.

6. The combination with a driving motor crank shaft, of a rotary annular field mag-

net secured to one end portion thereof, an inclosing housing provided with an end cap and a current generating armature secured to said cap and supported thereby within the circle described by the field magnet.

7. The combination with a driving motor crank shaft, of a rotary annular field magnet secured to one end portion thereof, of an inclosing housing therefor having a removable end wall provided with an aperture, an arm secured to said wall and projecting inwardly through the annular field magnet, a bearing member for the crank shaft, carried by said arm, a removable cap for the end wall aperture and an armature supported by said cap within the rotary field.

8. In a magneto generator the combination with a permanently magnetic rotary field having definitely fixed poles, of a relatively stationary armature in current generating relation to the field, and a magnetizable support adapted to actuate the field through a neutral point substantially midway between its poles.

9. In a magneto generator, the combination with an actuating shaft, of a rotary annular field ring provided with interiorly projecting pole pieces, an armature having segmental heads in proximity to the circle described by said pole pieces at diametrically opposite points and having the axis of its core and winding therefor offset from the center of said ring, and a bearing for said shaft having a supporting arm connected with a relatively stationary support and projecting through the space between the armature winding and the ring and between the armature heads.

10. In a magneto generator, the combination of a rotary annular field ring having interiorly projecting segmental pole pieces, a current generating armature located within the circle described by the pole pieces, each pole piece being supported from the field ring by a neck portion located near the rear end of the segment, and a circuit breaker arranged to break the circuit of the armature when the magnetic field is substantially at maximum intensity.

11. The combination with an internal combustion engine provided with an igniter plug and crank shaft, of a permanently magnetic field ring secured by an arm of magnetizable material at a magnetically neutral point to the crank shaft, and an armature supported from the engine frame within the magnetic field of said ring and having a winding operatively connected to the igniter plug.

12. The combination with an internal combustion engine provided with an igniter and a crank shaft provided with a crank and an oppositely projecting balancing side arm, of a permanently magnetic field ring secured to said balancing arm and one side

arm of the crank, interior polar projections on said ring substantially mid-way between said points of connection, and a relatively stationary armature within the magnetic field of the ring and operatively connected with the igniter.

and a relatively stationary armature supported by the cap. 40

16. In a magneto generator, provided with an inclosing casing, the combination with such casing of a removable wall portion and an armature secured thereto. 45

17. In a magneto generator provided with an inclosing casing, having a removable portion, an armature secured to said removable portion of the casing and circuit breaking mechanism also secured thereto and removable therewith. 50

18. In a magneto generator the combination with a field magnet, of a support composed of magnetizable material directly connected with the field magnet at a magnetically neutral point. 55

19. An integrally continuous ring connected with a rotary support and adapted to serve as a fly wheel, said ring being magnetized to constitute poles on opposite sides of the connection with the support, said point of connection constituting a magnetically neutral point. 60

20. The combination with a driving motor crank shaft and supports therefor, of an annular field magnet having permanently established magnetic poles and carried by and rotating with the crank shaft, the crank shaft and the magnet being connected at a neutral point of the latter, and a current generating armature in operative relation to the field magnet. 70

In testimony whereof I affix my signature in the presence of two witnesses.

REUBEN STANLEY SMITH.

Witnesses:

LEVERETT C. WHEELER,
J. J. STAMM.

13. The combination with an internal combustion engine provided with an igniter and a crank shaft provided with a crank and an oppositely projecting balancing side arm, of a permanently magnetic field ring secured to said balancing arm and one side arm of the crank, interior polar projections on said ring substantially mid-way between said points of connection, and a relatively stationary armature within the magnetic field of the ring and operatively connected with the igniter, said armature having a plurality of windings, one being in circuit with the igniter, and the other constituting a primary circuit and provided with means controlled by the engine for periodically breaking such circuit.

14. The combination with an internal combustion engine, having a crank shaft provided with a balancing arm, of a magnetic field ring secured at its neutral points to said arm and one arm of the crank respectively, a housing for said ring, having a projection extending therethrough, a bearing for the crank shaft carried by said housing projection, an armature detachably supported from the housing within the ring, and an igniter and a circuit breaker each in circuit with said armature.

15. The combination with a driving shaft, of a magnetic field ring supported therefrom, an inclosing casing for the ring and shaft provided with a removable end cap,