

Jan. 8, 1946.

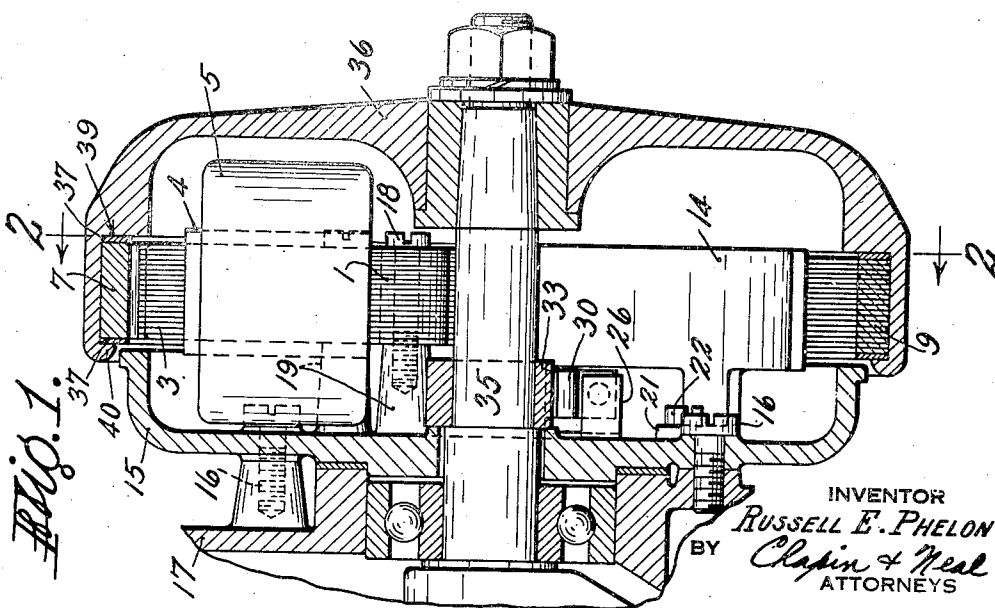
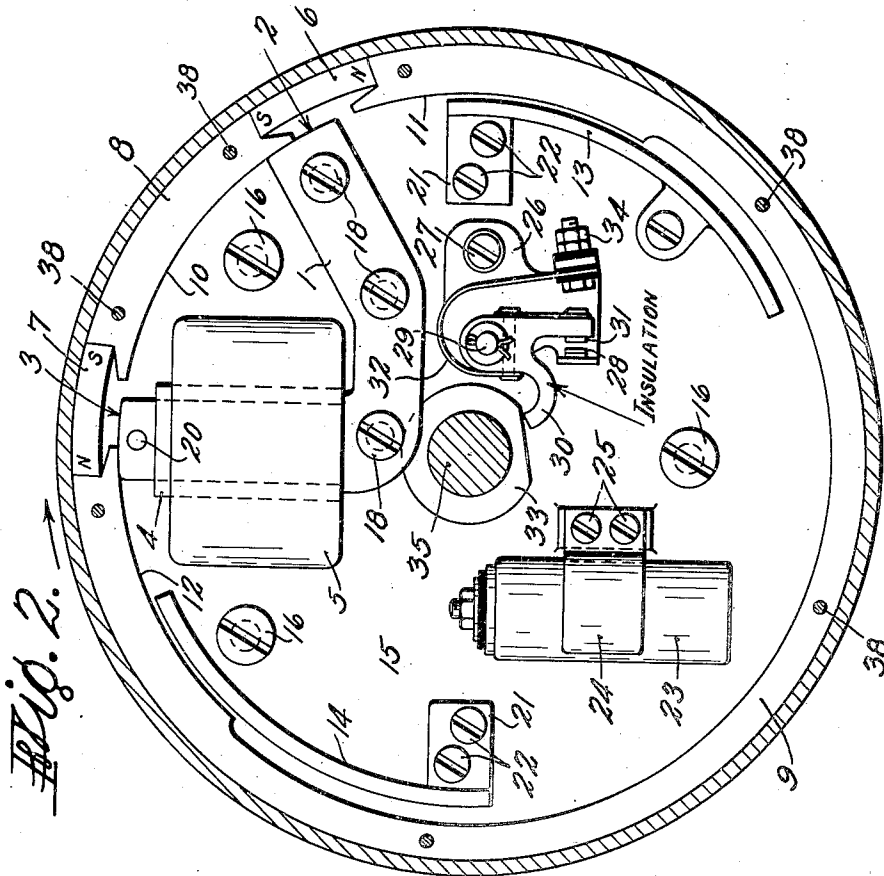
R. E. PHELOM

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MAGNETO

Filed July 10, 1944

5 Sheets-Sheet 1



Jan. 8, 1946.

R. E. PHELON

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5 Sheets-Sheet 2

Fig. 4.

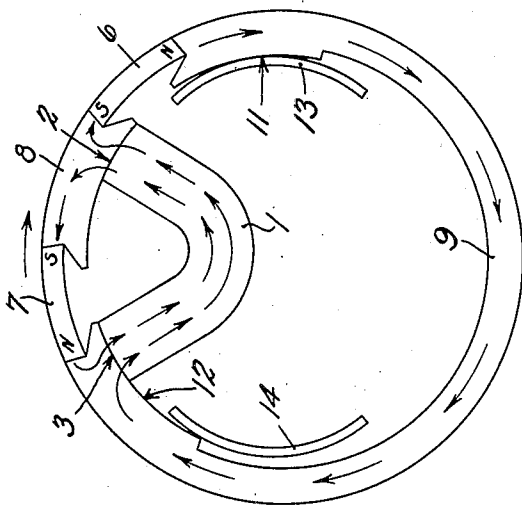


Fig. 5.

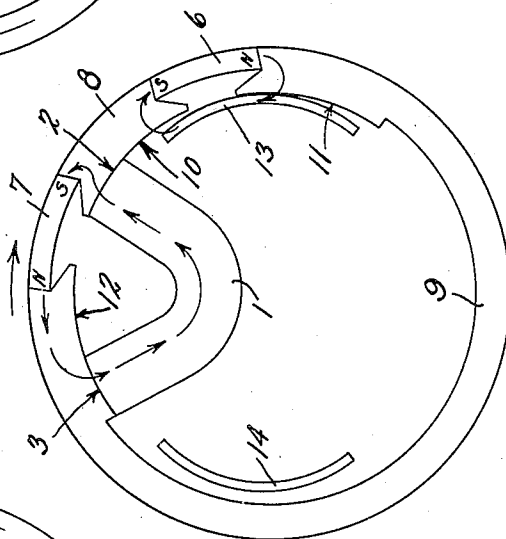
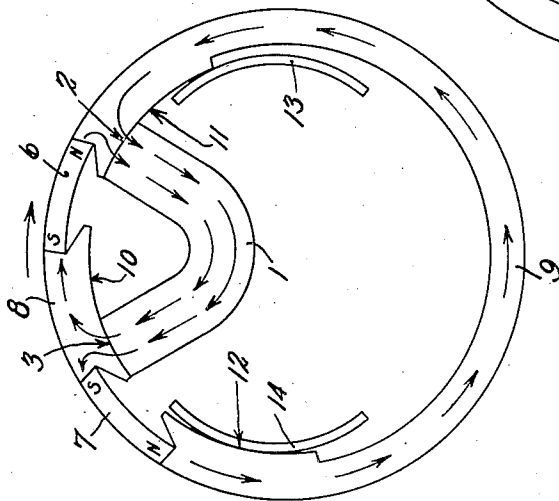


Fig. 3.



INVENTOR
RUSSELL E. PHELON
BY *Chapin & Neal*
ATTORNEYS

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R. E. PHELON

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5 Sheets-Sheet 4

Fig. 10.

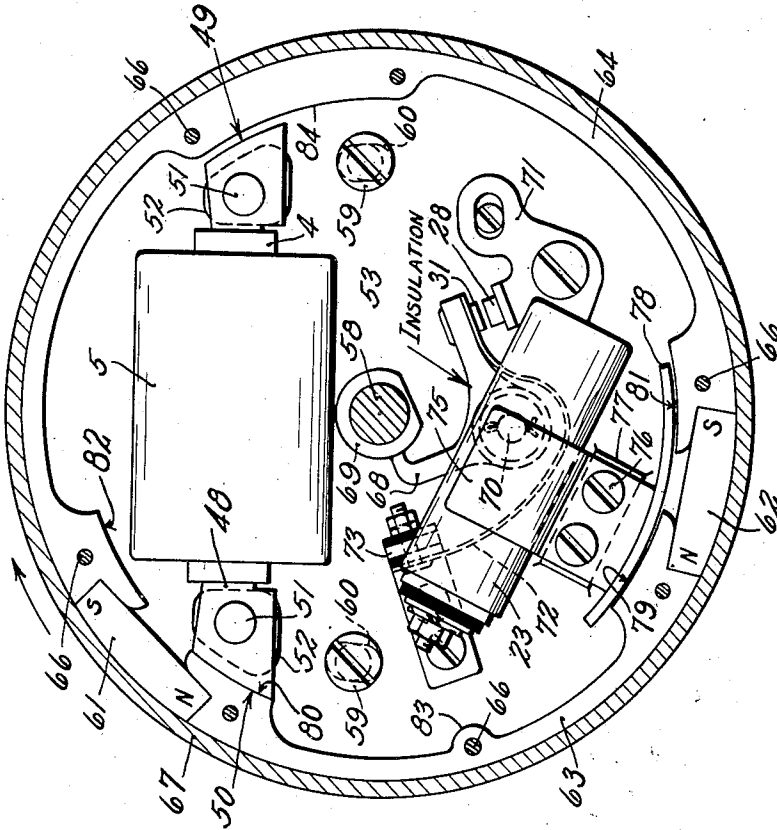
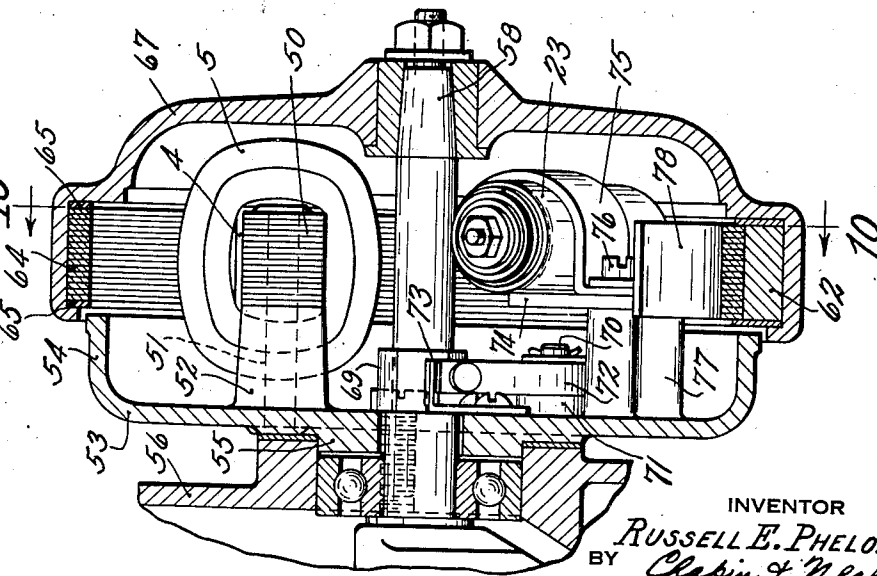


Fig. 9.



INVENTOR
RUSSELL E. PHELON
BY *Chapin & Neal*
ATTORNEYS

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R. E. PHELON

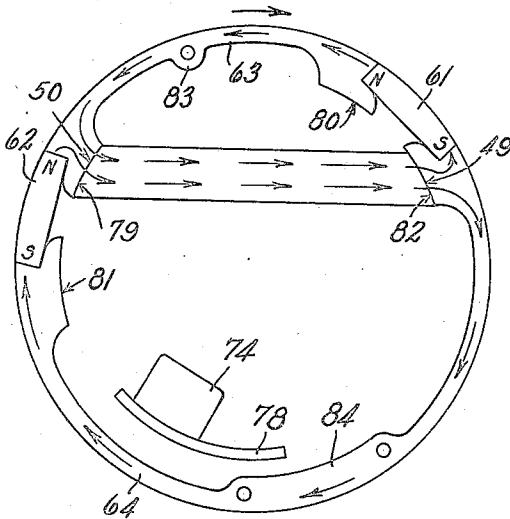
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5 Sheets-Sheet 5

Fig. 11.



Exhib. 12.

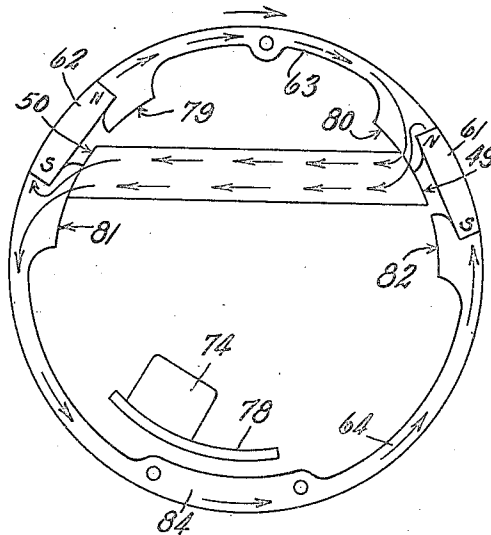
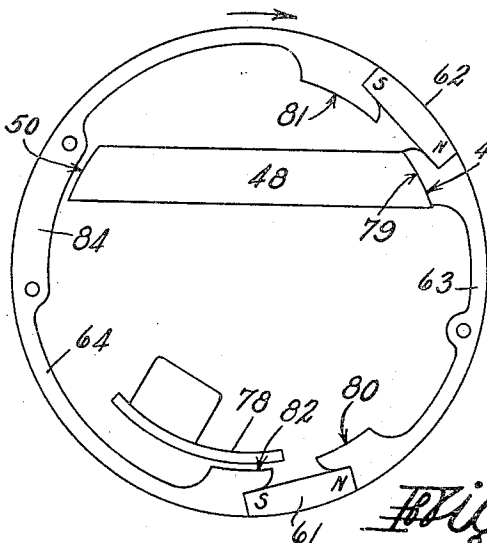


Fig. 13.



Exo. 14.

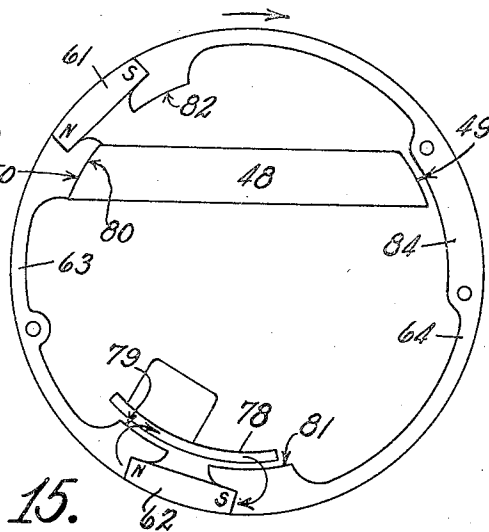
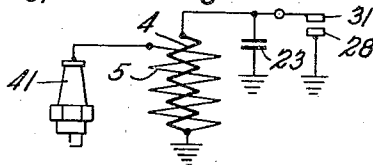


Fig. 15.



INVENTOR
BY *RUSSELL E. PHELON*
Chapin & Neal
ATTORNEYS

UNITED STATES PATENT OFFICE

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MAGNETO

Russell E. Phelon, West Springfield, Mass., assignor to Wico Electric Company, West Springfield, Mass., a corporation of Massachusetts

Application July 10, 1944, Serial No. 544,293

10 Claims. (Cl. 171-209)

This invention relates to improvements in magnetos.

More particularly, the invention has to do with the prevention of the production of sparks at undesired times from a magneto which is operated at relatively high speed. Magnetic flux changes, which in a magneto that is operated at relatively low speed, occur so gradually as not to produce a spark, will at the relatively-high speeds, referred to, cause the production of a spark and this may occur independently of the operation of the breaker mechanism.

The invention has for an object to provide in a magneto of the type described, wherein a spark is produced by a reversal of flux through the armature member occurring on relative movement from a first to a second position, means operable during relative movement of said members from the second to the first position to first decrease the flux flow through the armature member in one direction in a plurality of stages and to then build up flux flow through the armature member in an opposite direction in a plurality of stages.

This invention has for another object the provision, in a magneto of the type wherein a field member having two magnets and a cooperating armature member having two poles are relatively rotatable, of magnetic shunt means operable during relative rotation of said members to interconnect the poles of first one and then the other of said magnets to diminish the flux flow through said armature member at times when an undesired spark might otherwise occur.

These and other objects will best be understood as the detailed description proceeds.

The invention will be disclosed with reference to the accompanying drawings, in which,

Fig. 1 is a sectional elevational view showing a flywheel magneto embodying the invention;

Fig. 2 is a cross sectional view taken on the line 2-2 of Fig. 1;

Figs. 3 to 7 are diagrammatical views showing the stator and rotor in several successive relative positions and illustrating the operation of the magneto;

Fig. 8 is a chart showing the magnetic flux changes which occur during one revolution of the rotor;

Fig. 9 is a sectional elevational view showing another form of flywheel magneto embodying the invention;

Fig. 10 is a cross sectional view taken on the line 10-10 of Fig. 9;

Figs. 11 to 14 are diagrammatical views showing the stator and rotor in several successive relative

positions and illustrating the operation of the form of magneto shown in Figs. 9 and 10; and

Fig. 15 is a wiring diagram showing the electrical connections of both forms of magneto.

Referring to these drawings, the magneto includes a stator, (Fig. 2) comprising a laminated core 1, made in approximately V-shape with two outwardly-diverging branches, terminating with pole pieces 2 and 3, spaced one from the other by an angle of sixty degrees. On at least one branch of the core are generating windings, such as the usual primary and secondary coils 4 and 5, respectively.

Cooperating with this stator is a magnetic rotor having a source of magnetic flux which in the form herein shown, includes two permanent magnets 6 and 7 of relatively short, bar form and of high coercive force and two laminated, magnetic connecting members 8 and 9, of unequal length. The rotor, in this case, has three pole shoes of equal arcuate extent, one shoe 10 being on the short magnetic member 8 and the other two shoes 11 and 12 being on the long magnetic member 9. The spacing of the center of the shoe 10 from the center of the adjacent shoes 11 and 12 is equal to the center to center spacing of the pole pieces 2 and 3. The pole shoe 10 is connected to the adjacent ends of magnets 6 and 7, which ends are of like polarity, say for example south polarity. The pole shoe 11 is connected to the other end of magnet 6 and is, for example, of north polarity. The pole shoe 12 is connected to the other end of magnet 7 and is, for example, of north polarity.

Cooperating with the pole shoes of the magnetic rotor is a suitable magnetic-shunting means. In this case, there are two stationary, shunt-forming, magnetic members 13 and 14, located one on each side of the stator. The spacing between the center of each shunt and the center of the adjacent pole piece is substantially the same as the spacing between the centers of the pole pieces 2 and 3. These shunt members may have their curved surfaces coaxial with the shoes of the rotor as shown in Fig. 2. They may also be made as shown in Figs. 3 to 7. In the latter case the outer surface of each shunt is closer to the axis of the rotor at its ends than at its intermediate portion. Because of this construction, a more gradual change of flux is effected when a pole shoe approaches and leaves a shunt than would otherwise be possible. The air gap between the leading end of a pole shoe and one end of the shunt gradually diminishes as such shoe and end approach each other. Likewise, the air gap between the trailing end of a pole shoe and the

other end of a shunt gradually increases as such shoe and end move away from one another.

The stator and shunt members are suitably supported from a dish-shaped, non-magnetic casing 15, (Fig. 1), suitably fixed, as by screws 16 to a wall of the engine crankcase, shown in part at 17. The core 1 is suitably secured, as by screws 18, to bosses, such as 19, extending outwardly from member 15. The laminations of core 1 may also be suitably riveted together, as indicated at 20 in Fig. 2. The shunt members 13 and 14 are each provided with a right-angularly turned lug 21, which is secured by screws 22 to member 15.

Also mounted on the casing member 15 are a suitable breaker-point mechanism and a condenser 23. The latter is held by a clip 24 and screws 25 to member 15. The breaker-point mechanism includes a bracket 26, suitably secured, as by means shown in part by the screw 27, to member 15. Fixed to this bracket is a stationary breaker point 28, which through the bracket and member 15 is electrically grounded to the crankcase 17 of the engine. Pivotaly mounted on a stud 29 on bracket 26 is an arm 30 which is of insulating material and carries a breaker point 31 to co-operate with point 28. A spring 32 fixed at one end to arm 30 is fixed at its other end to, and insulated from, the bracket 26. The spring urges the arm 30 into engagement with its actuating cam 33 and also serves as an electrical connection between breaker point 31 and the terminal 34 which is insulated from bracket 26.

One end of the engine crankshaft 35 extends freely through casing 15 and has fixed thereto, as indicated in Fig. 1, the engine flywheel 36. The cam 33 is also fixed to shaft 35, as indicated. This flywheel is approximately bowl-shaped and cooperates with the stationary dish-shaped casing member 15 to provide an enclosure for all the described elements of the magneto. The magnetic rotor is fixed in any suitable way to the flywheel. In the particular example herein shown, the annular assembly of the rotor members 6, 7, 8 and 9 is held together between two annular, non-magnetic rings 37 by a series of rivets 38. The flywheel is bored out to receive this assembly which is then pressed into the flywheel bore with one ring 37 abutting the shoulder 39 and held therein by a press fit or by shrinking. The outer edge of the flywheel is then spun over against the other ring 37, as shown at 40 in Fig. 1.

The electrical connections of the magneto are the usual ones and are diagrammatically shown in Fig. 15, in which 41 represents a spark plug of the engine.

The operation of the magneto will be described with particular reference to the diagrammatical views of Figs. 3 to 7 and the chart of Fig. 8. With the rotor in the position of Fig. 2, wherein the pole shoes 10 and 11 respectively connect with the pole pieces 3 and 2, the flux from both magnets 6 and 7 is passing in one direction through the core 1, entering the pole piece 2 and leaving by the pole piece 3. The breaker points 28 and 31 are now closed to hold the flux while the rotor moves clockwise from the Fig. 3 toward the Fig. 4 position. After the rotor has moved far enough to cause the pole shoes 10 and 12 to respectively engage pole pieces 2 and 3 and to create a sufficient air gap between the trailing end of shoe 11 and pole piece 2 and between the trailing end of pole shoe 10 and pole piece 3, the breaker points open. This relative positioning of the parts is shown in Fig. 2. The flux previously established in the core is released and a flow of flux in the

opposite direction established. The flux from both magnets enters by pole piece 3 and leaves by pole piece 2 as indicated in Fig. 4. This large change of flux is indicated on the chart of Fig. 8 by the curve 42. In this diagram, the ordinates indicate flux intensity and the abscissae indicate degrees of rotation of the rotor. This large flux change occurs in no more than a 35° movement of the rotor and extends from a maximum in one direction to zero and then beyond to a maximum in the opposite direction. The electro-motive force produced by this change of flux is the one utilized for the ignition spark.

Only one ignition spark per revolution of the rotor is desired. The problem of this invention is to prevent the occurrence of other sparks during the remainder of the revolution of the rotor while the breaker points 28 and 31 are open. Generally speaking, the result is accomplished by effecting the other half wave of flux change in a series of steps so that there are several small non-concurrent flux changes instead of a single large flux change and so that these changes occur relatively slowly instead of rapidly. These changes are indicated in Fig. 8 in full lines as a series of four steps 43, 44, 45 and 46.

In particular, as the rotor moves clockwise from the Fig. 4 to the Fig. 5 position, the pole shoes 10 and 12 remain engaged with the same pole pieces 2 and 3, respectively, but the shunt 13 comes into play with respect to magnet 6. The pole shoes 10 and 11 are interconnected by the shunt 13 and substantially all the flux from magnet 6 flows through the short shunt path and is thus diverted from the longer path through core 1. The result is that the flux flow through the core is substantially cut in half. This flux change is represented by the curve 43 in the chart of Fig. 8. As will be evident from this chart, this change is gradually effected. This flux change occurs during a 24° movement of the rotor and it is of only one quarter of the value of the flux change 42. The electro-motive force produced by this flux change is too small to produce a spark.

As the rotor continues its clockwise movement and passes from the Fig. 5 to the Fig. 6 position, the pole shoe 10 leaves the pole piece 2 and the pole shoe 12 leaves the pole piece 3. Substantially, all flow of flux through core 1 ceases. This change of flux is represented by the line 44 in Fig. 8. It will be seen that this change is of only one-quarter the value of flux change 42 and is affected in about the same time as the flux change 43. The electro-motive force produced by this flux change will be too small to produce a spark. The flux flow through core 1 in one direction has thus been diminished to zero in a plurality of stages. Except for the shunts the flux flow would be diminished in one stage as indicated by the dotted line a.

During the next 205° of movement of the rotor in its clockwise direction there will be substantially no flux flow in core 1. This condition is represented by the horizontal line 47 in Fig. 8.

During the next 36° movement of the rotor, flux is built up in core 1 in the direction indicated in Fig. 7. The leading ends of the pole shoes 11 and 10 respectively connect with the pole pieces 2 and 3. The flux from magnet 6 passes through the core 1, entering by pole piece 2 and leaving by pole piece 3. The result is that the flux flow through the cores is substantially cut in half. Hence, the flux can build up in core 1 only to half the maximum value. This change is represented by the line 45 in Fig. 8. It occurs gradu-

ally as indicated, and during a 36° movement of the rotor.

Further clockwise movement of the rotor will release the magnet 7 from shunt 14 and enable full flow of flux to be established in core 1 in the same direction as shown in Fig. 7. As the rotor moves from the Fig. 7 to the Fig. 1 position, the pole shoes 11 and 10 remain engaged with the same pole pieces 2 and 3 and the only change is an increase in flux without change in direction of flow. This flux change is indicated at 46 in Fig. 8. It occurs during a 24° movement of the rotor, is gradually affected and is of about one-quarter the value of flux change 42. The electromotive force produced by this flux change 46 is not sufficient to produce a spark. The flux flow through core 1 is thus built up from zero to a maximum in a plurality of stages. Without the shunt means, the flux flow would be built up in a single stage represented by the dotted line b.

If the shunt members 13 and 14 are constructed as shown in Figs. 3 to 7 inclusive instead of as shown in Fig. 2, this will contribute to somewhat more gradual changes of flux, represented by the rounded termini of the curves 43, 44, 45 and 46 in Fig. 8. The shunt means 13 and 14 may be made to move as closely as desired to the pole shoes 10, 11 and 12 with no more clearance than exists between the pole pieces 2 and 3 and said shoes. This is indicated in Figs. 3 to 7 inclusive.

The invention is not necessarily confined to use with two magnets although that arrangement is a convenient and desirable one and the one at present preferred. The two permanent magnets are the component parts of a single magnetic source and the invention, in its broadest aspect, is directed to shunting part of the flux from the source, at certain times. The part shunted out need not all come from one magnet. The important thing is to shunt out the desired part from the source, considered in its entirety, irrespective of how the division is made between the component parts. Actually, each shunt, when it interconnects a pair of pole shoes, forms a second circuit from the magnetic source in parallel with the first circuit from the source through the coil core. The reluctance of these two circuits is not greatly different and the flux from the source will divide and flow substantially half in one circuit and substantially half in the other circuit.

Referring now to the form of the invention shown in Figs. 9 and 10, the stator includes a substantially straight and laminated core 48, having at its ends pole pieces 49 and 50. This core is secured at its ends, as by rivets 51, to a pair of bosses 52, formed on the back plate 53 of a substantially dish-shaped housing 54, made of any suitable non-magnetic material. Plate 53 has a hub 55 (Fig. 9) which is mounted in a wall 56 of the engine crank-case to turn about the axis of the engine crankshaft 58 and is suitably held in various positions of angular adjustment, as by two cap screws 59 (Fig. 10), passing through elongated arcuate slots 60 in plate 53 and threading into the wall 56 of the engine crankcase.

The rotor of the magneto comprises a pair of relatively-short, permanent bar magnets 61 and 62. Like poles of these magnets are interconnected by laminated, soft-iron, arcuate members 63 and 64 which are relatively long but of unequal angular extent. These members 63 and 64 and the interposed magnets 61 and 62 form a complete annulus, which encompasses the stator and is located coaxially of the crankshaft. The annular assembly of members 61, 62, 63 and 64 is

held together between two annular non-magnetic rings 65 by a series of rivets 66. This assembly is suitably fixed in place in, and coaxially of, the engine flywheel 67, carried on the outer end of the crankshaft 58.

On the core 48 are mounted the primary and secondary coils 4 and 5, respectively, and these together with the breaker points 28 and 31 and condenser 23 are connected as before and in the manner shown in Fig. 15. The breaker point mechanism includes an arm 68, carrying point 29 and actuated by a cam 69 on shaft 58. This arm is pivoted on a stud 70 on a bracket 71 fixed to plate 53, as indicated. The point 28 is grounded to the bracket. A spring 72, fixed at one end to arm 68 and electrically connected to point 29, is fixed at its other end to, and insulated from, a bracket 73 fixed to plate 53. The condenser 23 and breaker point mechanism are in different planes as will be clear from Fig. 9. The condenser is held between a plate 74 and a clip 75, both being secured by screws 76 to a boss 77, outstanding from plate 53. The plate 74 serves to carry a shunt-forming member 78 of suitable magnetic material.

Referring again to the magnetic rotor, it is provided with four pole shoes of equal angular extent. These shoes are designated 79, 80, 81 and 82, the first two shoes being formed on the laminated member 63 and the last two on the laminated member 64. The radius of each shoe is only slightly greater than that of the pole pieces 49 and 50 on the stator so that the shoes will successively move into close proximity with the stator pole pieces and magnetically connect therewith, as indicated for example in Figs. 11 and 12, being separated by air gaps equal to the running clearance between the parts. Intermediate the pole shoes, the members 63 and 64 are of relatively narrow radial width with their inner arcuate walls of much greater radius than the radius of the stator pole pieces 49 and 50, whereby, when these narrow portions move past the stator pole pieces 49 and 50, no magnetic effect of any substantial amount occurs because of the large air gaps therebetween. Intermediate these narrow portions of the members 63 and 64 are other portions 83 and 84, respectively, which are of greater width but which are also separated from the pole pieces 49 and 50 by substantial air gaps. The portion 84 is not intended to have any functional effect magnetically and its purpose is simply to counterbalance the magnets 61 and 62. The sole purpose of the portion 83 is to receive one of the rivets 66.

The operation of this second form of magneto will next be described. Assuming that the rotor is travelling in the direction of the arrow and has reached the position shown in Fig. 11, magnetic flux from both magnets 61 and 62 will flow through core 48 in one direction, say from left to right as viewed in Fig. 11. The breaker points 28 and 31 will now be closed to hold the flux while the rotor moves clockwise from the Fig. 11 to the Fig. 12 position. The breaker points now open and the flux, previously established in the core, is released and a flow of flux from both magnets through the core in an opposite direction is established. This large change of flux is utilized to produce the ignition spark.

On continued movement of the rotor from the Fig. 12 position, the pole shoe 79 will become connected with the end 49 of core 48 and, shortly afterward the shoe 81 will become connected with the end 49. During the same interval the part 84 of the rotor will be moving past the end 50

of the core and, while there is a substantial gap between the end 50 and part 84, there is a chance for some flux flow through core 48 first in one and then in an opposite direction as the shoe 79 leaves the core end 49 and shoe 81 becomes engaged with such end. While the breaker points 28 and 31 are open during the interval described and a substantial gap exists between end 50 and part 84—factors which tend to prevent production of a spark at this time—the possibility of such a spark is made still more remote by the shunt 78, which, during the interval described, interconnects the pole shoes 80 and 82 of magnet 61, thus substantially short circuiting the magnets.

On continued movement of the rotor from the Fig. 13 position, the shoe 82 will become connected with the end 50 of core 48 and, shortly afterward, shoe 80 will become connected with such end as shown in Fig. 14. During this same interval, the part 84 will be moving past the core end 49 and the shunt 78 will come into play to interconnect the shoes 79 and 81 of magnet 62, thus substantially short circuiting the magnets.

The invention thus provides shunt means for cooperation successively with the shoes of the magnetic rotor for reducing the amount of the flux changes which occur while the breaker points are open and while the rotor is moving through that part of its rotation where no spark is desired.

I claim:

1. In a magneto, a field member and an armature member, said members being relatively rotatable about an axis, said field member comprising two relatively-short permanent magnets separated by an angle less than 180 degrees and magnetic members interconnecting like poles of said magnets and having pole shoes adjacent the polar ends of the magnets, said armature including a core having two pole pieces for cooperation with said shoes, said shoes and pole pieces being so spaced that during rotation of the rotatable member the two pole pieces simultaneously connect with two pole shoes one at one polar end of one magnet and the other at the opposite polar end of the other magnet and as the pole pieces disengage from said shoes they simultaneously engage with the other two shoes, whereby a magnetic circuit from both magnets first in one and then in the opposite direction is established through said core, a generating winding associated with said core, breaker points controlling said winding, means movable with the rotatable member and operable at one position to close the breaker points before the pole pieces become disconnected from the first-named pole shoes and operable at another position to open them after the pole pieces have become connected with the second-named pole shoes, and magnetic shunt means operable during movement of the rotor from the second to the first position to successively shunt the flux from said magnets.

2. In a magneto, a field member and an armature member, said members being relatively rotatable about an axis, said field member comprising two relatively-short permanent magnets separated by an angle less than 180 degrees and magnetic members interconnecting like poles of said magnets and having pole shoes adjacent the polar ends of the magnets, said armature including a core having two pole pieces for cooperation with said shoes, said shoes and pole pieces being so spaced that during rotation of the rotatable member the two pole pieces simul-

taneously connect with two pole shoes one at one polar end of one magnet and the other at the opposite polar end of the other magnet and as the pole pieces disengage from said shoes they simultaneously engage with the other two shoes, whereby a magnetic circuit from both magnets first in one and then in the opposite direction is established through said core, a generating winding associated with said core, breaker points controlling said winding, means movable with the rotatable member and operable at one position to close the breaker points before the pole pieces become disconnected from the first-named pole shoes and operable at another position to open them after the pole pieces have become connected with the second-named pole shoes, and magnetic shunt means operable after the rotatable member has left the second position and before it reaches the first position and when either pole piece moves from one shoe to another of one magnet to interconnect the shoes of the other magnet.

3. In a magneto, relatively rotatable field and armature members, said field member comprising two relatively short permanent magnets having a center to center angular spacing of substantially less than 180 degrees and magnetic members interconnecting like poles of said magnets and having pole shoes adjacent the polar ends of the magnets, said armature including a core having two pole pieces having the same angular spacing center to center as said magnets, a non-magnetic support to which said core is fixed, and magnetic shunts fixed to said support one on each side of said core and each having its center separated from the center of the adjacent pole piece by substantially the same angular spacing as that between the pole pieces.

4. In a magneto, a field member and an armature member, said members being relatively rotatable about an axis, said field member comprising two relatively-short permanent magnets separated by an angle less than 180 degrees and magnetic members interconnecting like poles of said magnets and having pole shoes adjacent the polar ends of the magnets, said armature including a core having two pole pieces for cooperation with said shoes, said shoes and pole pieces being so spaced that during rotation of the rotatable member the two pole pieces simultaneously connect with two pole shoes one at one polar end of one magnet and the other at the opposite polar end of the other magnet and as the pole pieces disengage from said shoes they simultaneously engage with the other two shoes, whereby a magnetic circuit from both magnets first in one and then in the opposite direction is established through said core, a generating winding associated with said core, breaker points controlling said winding, means movable with the rotatable member and operable at one position to close the breaker points before the pole pieces become disconnected from the first-named pole shoes and operable at another position to open them after the pole pieces have become connected with the second-named pole shoes, and means operable during movement of the rotor from the second to the first position to first diminish the flux flow through the core in the last-named direction in a plurality of stages and then build up the flux flow through said core in the first-named direction in a plurality of stages.

5. In a magneto, a field member and an armature member, said members being relatively rotatable about an axis, said field member com-

prising two relatively-short permanent magnets separated by an angle less than 180 degrees and magnetic members interconnecting like poles of said magnets and having pole shoes adjacent the polar ends of the magnets, said armature including a core having two pole pieces for cooperation with said shoes, said shoes and pole pieces being so spaced that while the rotatable member is moving through a certain angle the two pole pieces connect with two pole shoes of opposite polarity and establish flow of flux through the core in one direction and so that after the rotatable member has moved to disconnect said shoes and pole pieces it moves through a second angle in which each pole piece engages a pole shoe of polarity opposite to that of the shoe it first engaged, whereby the flow of flux through said core is reversed, and magnetic shunt means operable as the rotatable member moves through the initial part of the first angle to connect the shoes of one of said magnets and operable as the rotatable member moves through the latter part of the second angle to connect the shoes of the other of said magnets.

6. In a magneto, an annular rotor, comprising two relatively short bar magnets and two arcuate magnetic members of unequal length interconnecting like poles of the magnets and having pole shoes adjacent each magnet, a stator having a core with pole pieces at its ends to cooperate with said shoes and at one angular position of the rotor to complete a magnetic circuit from both magnets for flux flow in one direction through the core and shortly after to complete another magnetic circuit from both magnets for flux flow in a reverse direction through the core, and means operable when the rotor is in any other position in which a circuit can be established from said magnets through said core to shunt the flux from one of the magnets thereby limiting the maximum flux change possible in the core to that of one magnet.

7. In a magneto, a field member and an armature member, said members being relatively rotatable about an axis, said field member comprising two relatively-short permanent magnets separated by an angle less than 180 degrees and magnetic members interconnecting like poles of said magnets and having pole shoes adjacent the polar ends of the magnets, said armature including a core having two pole pieces for cooperating with said shoes, said shoes and pole pieces being so spaced that during rotation of the rotatable member the two pole pieces simultaneously connect with two pole shoes one at one polar end of one magnet and the other at the opposite polar end of the other magnet and as the pole pieces disengage from said shoes they simultaneously engage with the other two shoes, whereby a magnetic circuit from both magnets first in one and then in the opposite direction is established through said core, and means oper-

able during movement of the rotatable member to connect the magnets in succession into said circuit and subsequently to disconnect the magnets in succession from said circuit.

8. In a magneto, relatively rotatable field and armature members, said field member comprising two relatively short permanent magnets having a center to center angular spacing of substantially 60 degrees and magnetic members interconnecting like poles of said magnets and provided with pole shoes adjacent the polar ends of the magnets, said armature comprising a core having two pole pieces for cooperating with said shoes on relative rotation of said members and having the same center to center angular spacing as said shoes, a non-magnetic support to which said armature is fixed, and two magnetic shunts fixed to said support, one near each pole piece, each shunt having its center separated from the center of the nearest pole piece by an angular spacing substantially equal to the spacing between the pole pieces.

9. In a magneto, an annular rotor, comprising two relatively short magnets and two arcuate magnetic members of unequal length interconnecting like poles of the magnets and having pole shoes adjacent the polar ends of the magnets, a stator including a core having two pole pieces to cooperate with said shoes and so spaced that in one position of the rotor the two pole pieces connect with two pole shoes of opposite polarity and establish flow of flux through the core in one direction and so that when the rotor moves to another position each pole piece is disconnected from the pole shoe with which it was first connected and connected with a pole shoe opposite in polarity to that of the first, whereby the flow of flux in the core is reversed, and shunt means cooperating with the pole shoes after the rotor moves out of the second position and before the rotor moves into the first position to interconnect the shoes of one magnet.

10. In a magneto, relatively rotatable field and armature members, said field member comprising two relatively short permanent magnets having a center to center angular spacing of substantially 120 degrees and magnetic members interconnecting like poles of said members and provided with pole shoes adjacent the polar ends of the magnets, said armature comprising a core having two pole pieces for cooperation with said shoes on relative rotation of said members and having the same center to center angular spacing as said shoes, a non-magnetic support to which said armature is fixed, and a magnetic shunt fixed to said support in position to cooperate with said shoes on relative rotation of said members and having the same angular spacing between its center and the center of one pole piece as that between said magnets and pole shoes.

RUSSELL E. PHELON.