Aug. 18, 1925. 1,549,953

F. W. ANDREW

IGNITION MAGNETO

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Fig. 1.

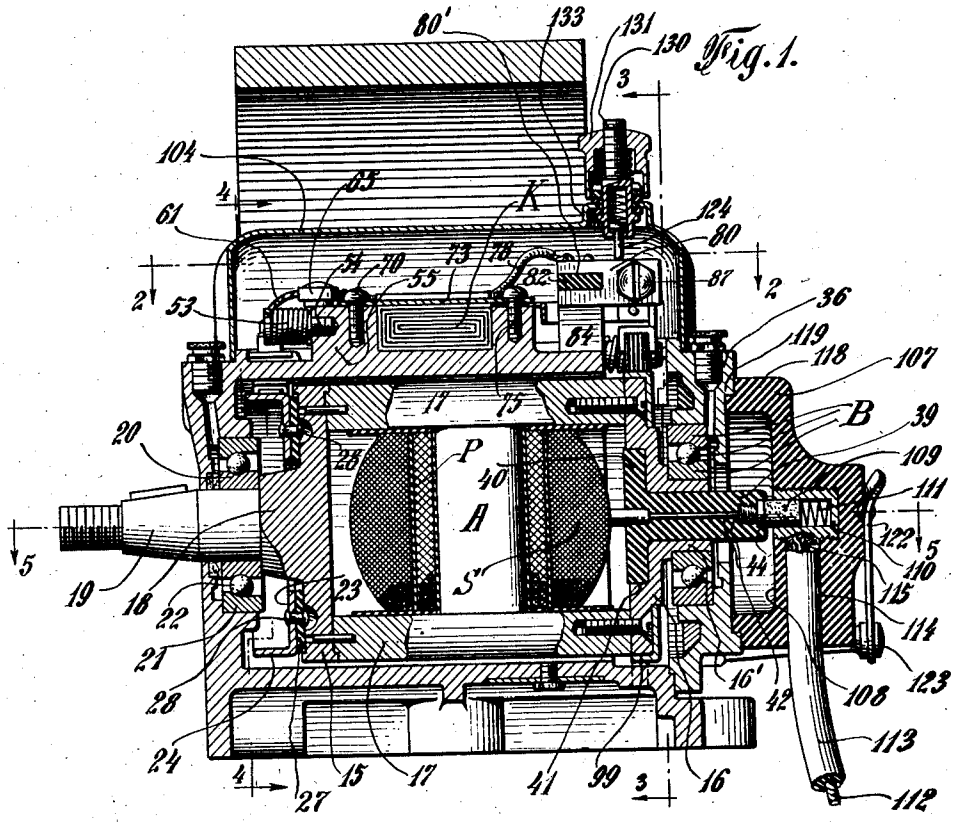
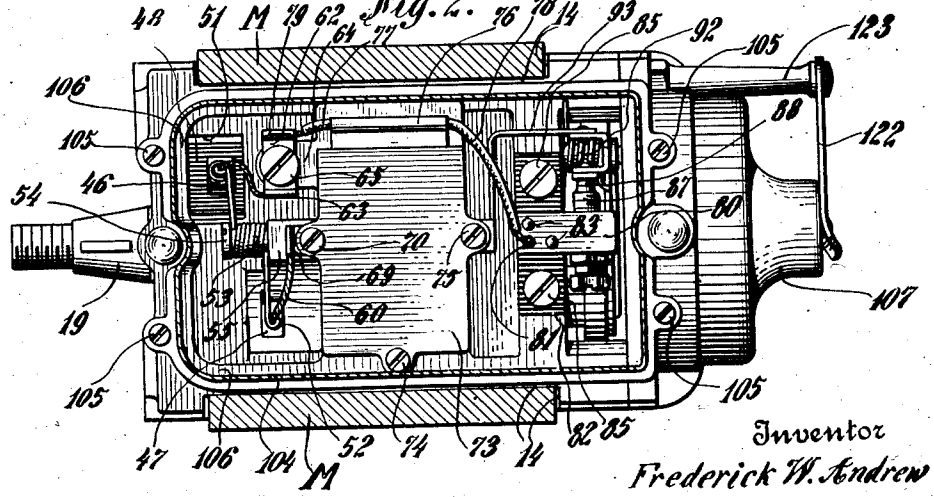


Fig. 2.



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Fig. 3.

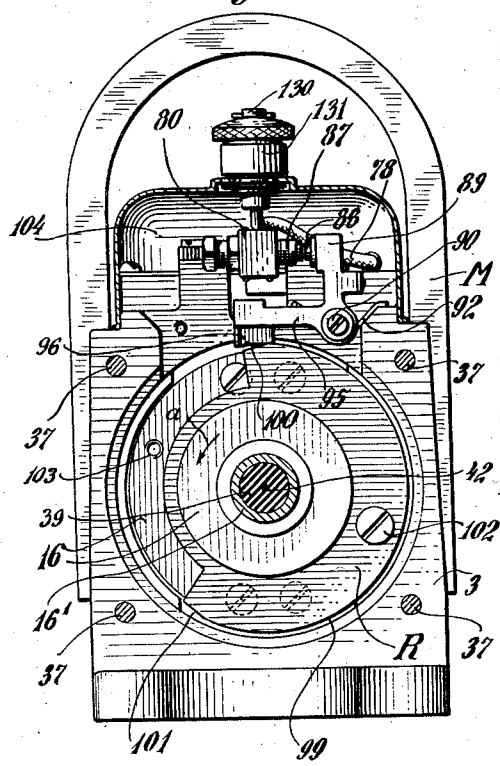


Fig. 4.

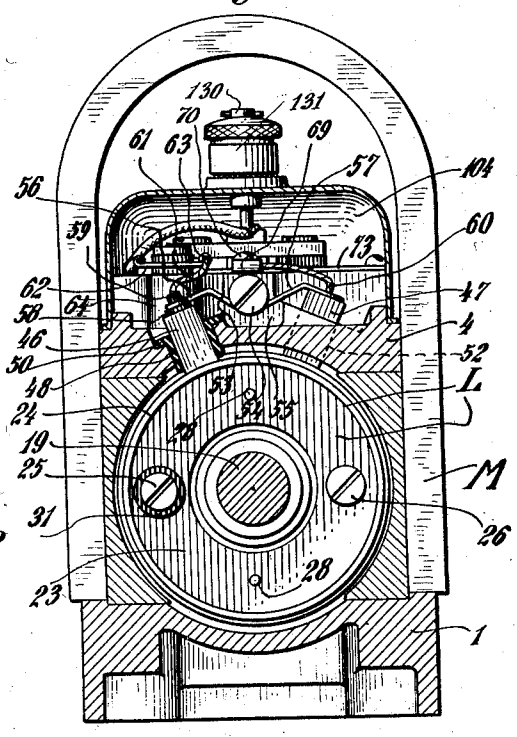
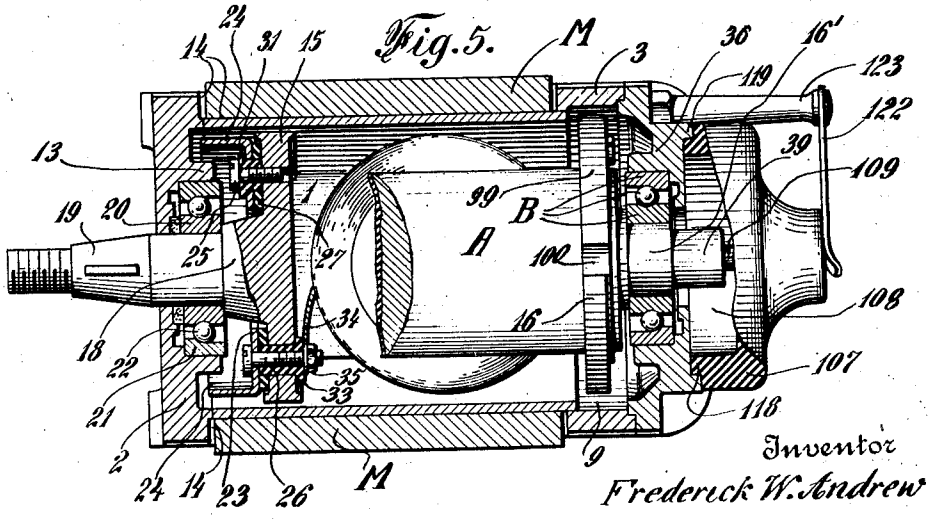


Fig. 5.



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Fig. 6.

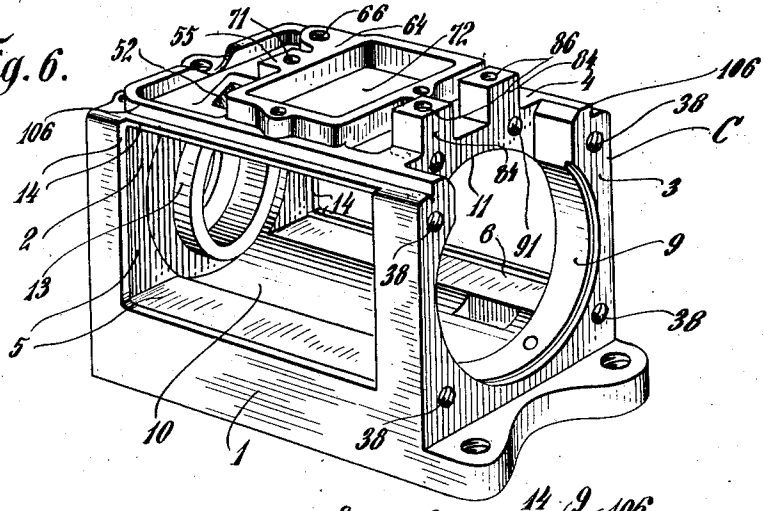


Fig. 7.

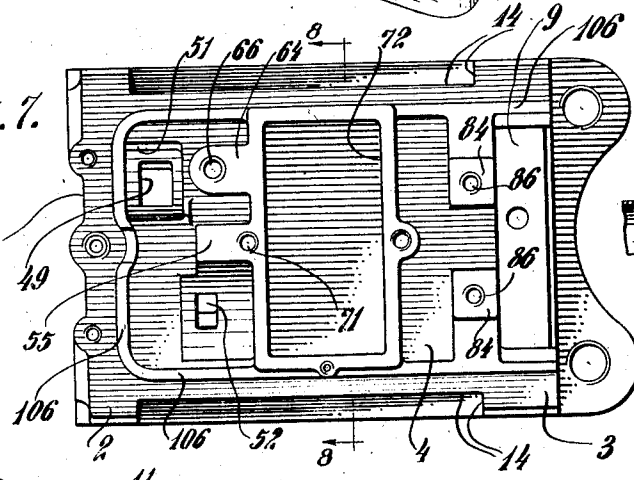
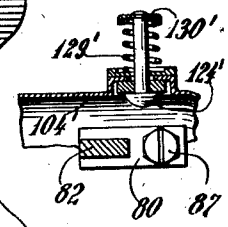


Fig. 8b.



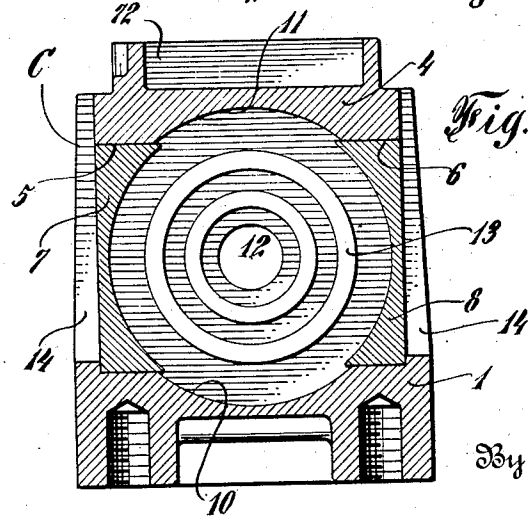
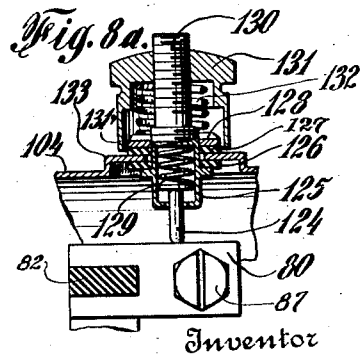


Fig. 8.

Fig. 8a.



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Fig. 9.

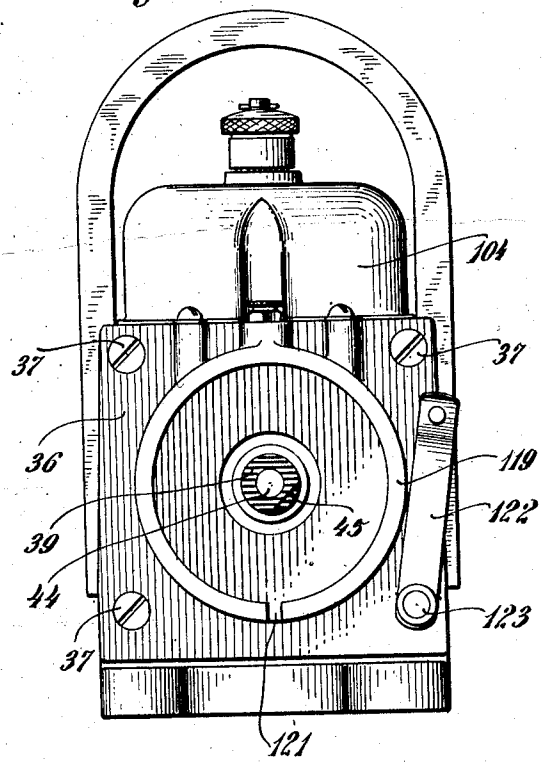


Fig. 10.

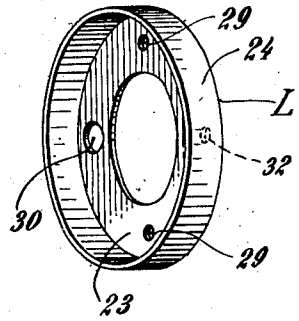


Fig. 11.

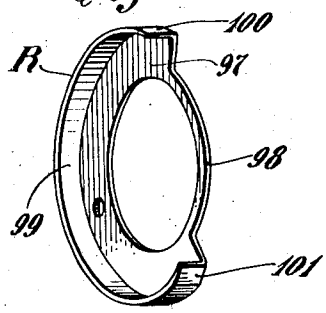


Fig. 12.

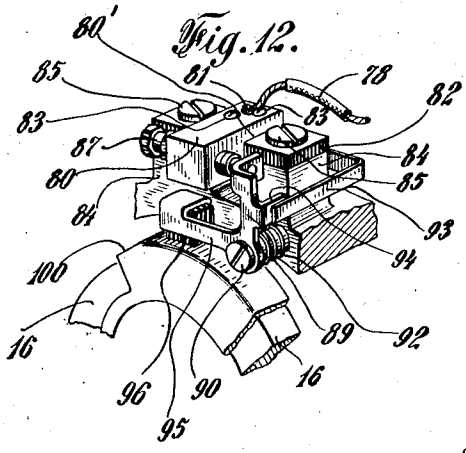
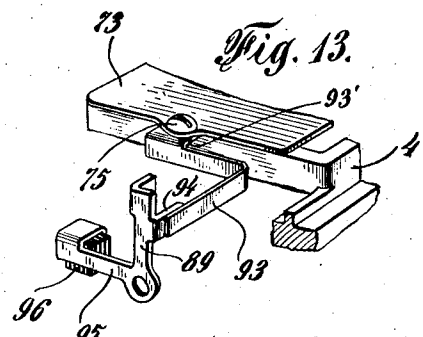


Fig. 13.



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IGNITION MAGNETO

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Fig. 14.

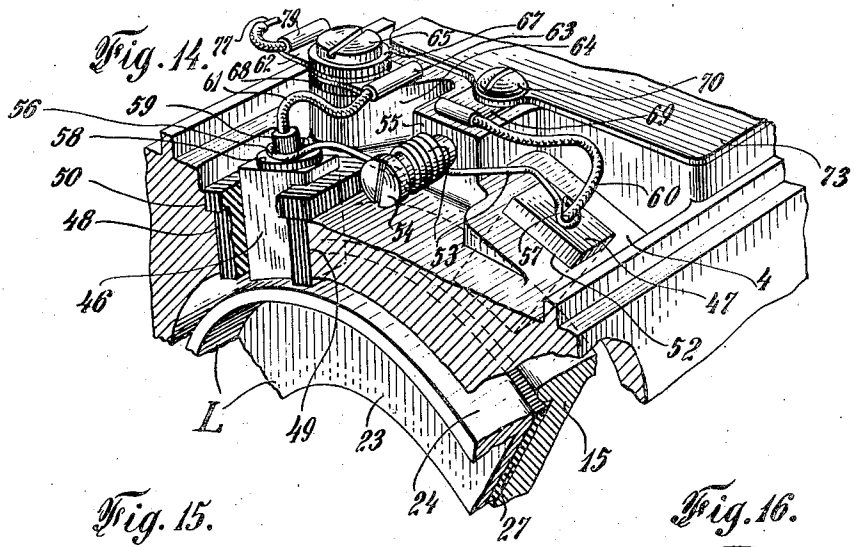


Fig. 15.

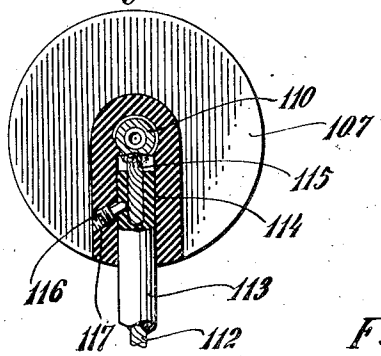


Fig. 16.

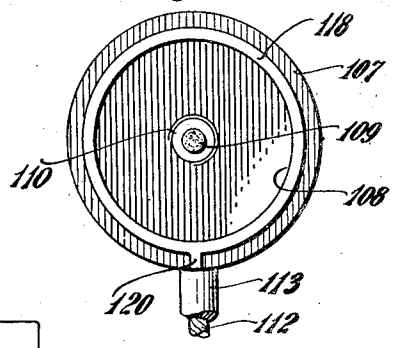
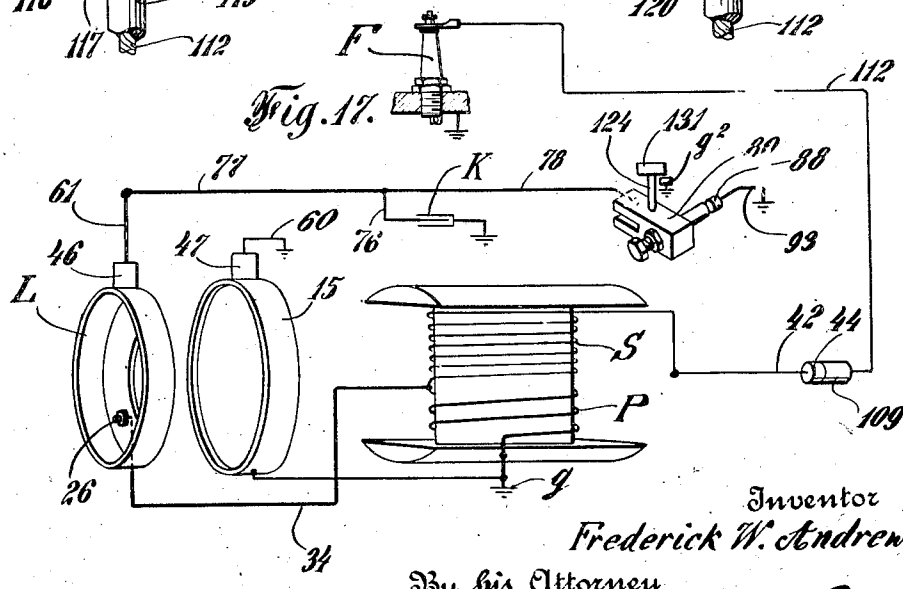


Fig. 17.



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IGNITION MAGNETO

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Fig. 18.

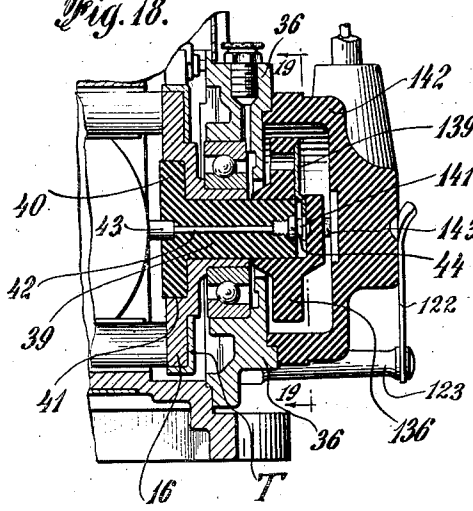


Fig. 19.

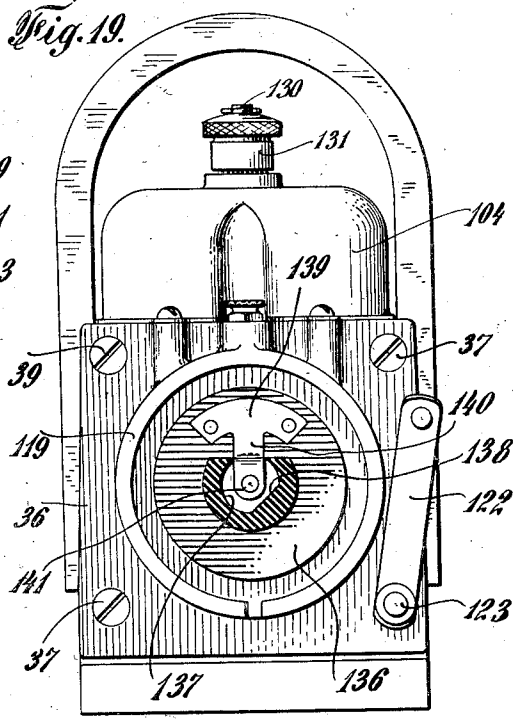


Fig. 20.

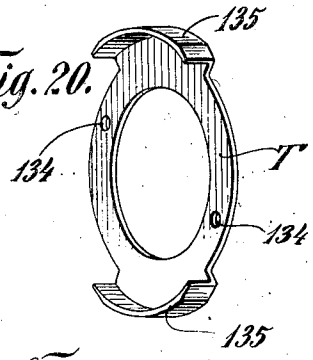


Fig. 21.

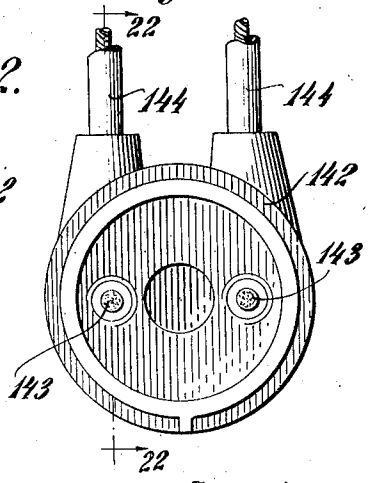


Fig. 22.

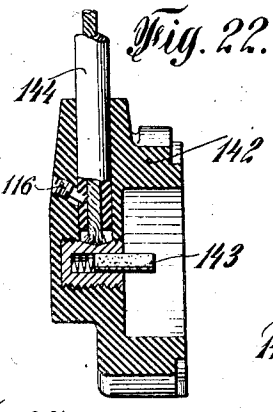


Fig. 23.

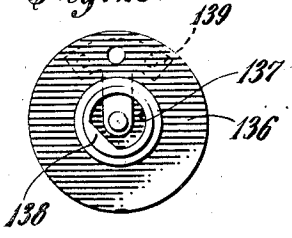


Fig. 24.

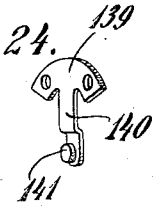
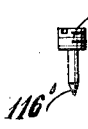


Fig. 25.



Inventor
Frederick W. Andrew
By his Attorney
A. Alexander Thomas

Patented Aug. 18, 1925. 1,549,953

UNITED STATES PATENT OFFICE.

FREDERICK W. ANDREW, OF BROOKLYN, NEW YORK, ASSIGNOR TO EISENMANN MAGNETO CORPORATION, OF BROOKLYN, NEW YORK, A CORPORATION OF NEW YORK.

IGNITION MAGNETO.

Application filed October 3, 1921. Serial No. 504,934.

To all whom it may concern:

Be it known that I, FREDERICK W. ANDREW, a citizen of the United States, and a resident of the city of New York, borough of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Ignition Magnetos, of which the following is a specification.

My invention relates to that type of magnetos which are adapted to produce electric sparks sufficient to ignite the explosive mixture in the cylinder or cylinders of internal combustion engines, more commonly called gas engines. The magneto of my invention differs in several material respects from the magnetos heretofore constructed and possesses advantages not inherent in prior devices.

One of the principal objects of my invention is to construct a magneto powerful enough to fire large gas engines and yet sufficiently small and compact to permit of installation in places where but little space is available.

Another general object of my invention is to provide a magneto which can be manufactured at less cost than prior machines of this class, without impairing its durability and efficiency of operation. Furthermore, a magneto constructed according to my invention is easily changed from a one-cylinder to a multi-cylinder machine, as will later appear.

The above and other objects and advantages of my invention will become apparent from a detailed description of the embodiment illustrated in the accompanying drawings, in which—

Fig. 1 is a longitudinal cross-section of an ignition magneto constructed in accordance with my invention;

Fig. 2 is a plan view approximately on line 2—2 of Fig. 1;

Fig. 3 is a transverse cross-section at the distributor end of the magneto, approximately on line 3—3 of Fig. 1;

Fig. 4 is a transverse cross-section of the drive end of the magneto, approximately on line 4—4 of Fig. 1;

Fig. 5 is a sectional plan view taken approximately on line 5—5 of Fig. 1;

Fig. 6 is a perspective view of the non-magnetic unit casting which forms the supporting framework of the magneto, this figure being on a slightly reduced scale as compared with the other figures;

Fig. 7 is a plan view of the casting shown in Fig. 6;

Fig. 8 shows a transverse cross-section on line 8—8 of Fig. 7;

Fig 8[a] is a fragmentary enlarged view of my new short-circuiting device;

Fig. 8[b] is a fragmentary view of a modified form of short-circuiting device;

Fig. 9 shows the magneto in end view looking from right to left of Fig. 1 and with the distributor block removed;

Fig. 10 is a detached perspective view of the low-tension collector ring mounted on one of the armature end plates;

Fig. 11 is a detached perspective view of the cam which controls the movable arm of the circuit breaker;

Fig. 12 is a fragmentary perspective view of the circuit breaker;

Fig. 13 is a fragmentary perspective view showing how the movable breaker arm is grounded through a flexible conducting strip;

Fig. 14 is a fragmentary perspective view showing my new primary brush construction, this view being enlarged for the sake of clearness;

Fig. 15 shows my new method of fastening the cable or conductor in the distributor block, a portion of the figure being in cross-section;

Fig. 16 is an inside face view of the distributor block shown in Fig. 15;

Fig. 17 is a wiring diagram showing how the magneto is connected in circuit with the spark plug of a gas engine;

Fig. 18 shows a longitudinal cross-section of the distributing end of a two-cylinder magneto changed from the one-cylinder magneto shown in Fig. 1;

Fig. 19 is an end view of the magneto shown in Fig. 18, with the distributor block

removed and with the distributor disk shown in section at the line 19—19 of Fig. 18;

Fig. 20 is a detached perspective view of the circuit breaker cam used in the machine of Fig. 18;

Fig. 21 is an inside face view of the two-cylinder distributor block embodied in the magneto of Fig. 18;

Fig. 22 is a cross-section approximately on line 22—22 of Fig. 21;

Fig. 23 is a face view of the distributor disk embodied in Fig. 18;

Fig. 24 is a detached perspective view of the metallic contact member embedded in the distributor disk of Fig. 23; and

Fig. 25 is an enlarged view of the pointed screw shown in Figs. 15 and 22 for fastening the cable or conductor in the distributor block.

As one of the novel features of my invention resides in the construction by which a one-cylinder magneto can readily and quickly be changed into a multi-cylinder magneto, and vice versa, I have shown a one-cylinder magneto in Figs. 1 to 5 and a two-cylinder magneto in Figs. 18 to 24, inclusive. I will first describe the single cylinder magneto and then explain how the same can be easily changed into a two-cylinder magneto by the mere substitution of a few parts.

The main supporting framework of my new magneto preferably consists of a single casting of non-magnetic material, such as aluminum. The general form and outline of this non-magnetic casting, indicated as a whole by C, is best shown in Figs. 6, 7 and 8, from which it will be seen that the casting comprises, roughly speaking, a base 1, a pair of end plates or pieces 2 and 3, and a top 4. Between the end plates the casting has rectangular openings 5 and 6, in which are secured the iron pole pieces 7 and 8, as best shown in Fig. 8. The end piece 3 has a circular opening 9 sufficiently large to permit insertion of the armature as a whole, as may be seen from Fig. 5. The base 1 of the casting is formed with a cylindrical recess 10 and the top 4 has a similar recess or cutaway portion 11 for the purpose of accommodating the cylindrical armature, as will be understood. The end plate 2 has a central opening 12, through which projects the drive end of the armature shaft, as will be explained later, and is further provided with an inwardly extending cylindrical flange or shoulder 13, as best shown in Fig. 6. Between the end pieces 2 and 3 the casting is formed with a recess 14 to receive the legs of the permanent magnet or magnets M. The other structural details of the main casting or framework C will be referred to as the description of the drawings progresses.

Between the pole pieces 7 and 8 is mounted a rotary or oscillatory armature, indicated as a whole by A, which has the usual arrangement of primary and secondary coils. It will be understood that when I speak of a rotatable armature in the description or in the claims, I mean either an armature that rotates continuously in the same direction or one that oscillates. The low-tension primary coil is shown at P and the high-tension secondary coil at S in Fig. 1. The armature A has an end plate or disk 15 at the drive end and an end plate or disk 16 at the other end, these plates being of non-magnetic material. These end plates, which are preferably of bronze or brass, are rigidly secured to the iron poles 17 of the armature core in any suitable way.

The end disk 15 has a hub 18 to which is secured the shaft 19 adapted to be driven from the engine either direct or through a suitable oscillator or impulse starter. This will be clear to those who are acquainted with apparatus of this kind. The shaft 19, which may be called the drive shaft, is rotatably supported in the casting C, through a suitable bearing which, in the present instance, comprises an inner ring 20, an outer ring 21 and ball bearings 22. The ring 21 is secured in the recess formed by the cylindrical flange or shoulder 13 of the casting C. The bearing 20—21—22 is such as to permit the ready withdrawal and insertion of the armature in the magneto housing. To the outer face of the end disk 15 is secured a low-tension collector ring, indicated as a whole by L in Fig. 10. This ring, which is preferably made from a cut-punching of a suitable conducting material, consists of a disk or body portion 23 and a cylindrical contact flange 24. The collector ring L is secured to the end plate or disk 15 of the armature by suitable fastening devices, such as the screws 25 and 26, as shown in Fig. 5, and is electrically insulated from the disk 15 and the grounded framework of the magneto. In the present instance, this insulation is accomplished as follows, reference being had to Figs. 1 and 5: A ring 27 of suitable insulating material is interposed between the collector ring L and the end disk 15 of the armature. Preferably, the ring or washer 27 is attached to the ring L by rivets 28 or otherwise, these rivets passing openings 29 (see Fig. 10) in the disk 23 of the collector ring L. The screw 25 passes through an opening 30 (see Fig. 10) in the collector ring L and is insulated from this ring by an insulating bushing 31, as clearly shown in Fig. 5. The screw 26, which passes through a hole 32 (see Fig. 10) in the collector ring L, is in electrical contact with the collector ring, but is insulated from the end disk 15 by an insulating bushing 33, as illustrated

in Fig. 5. The screw 26 serves as a connecting terminal for the conductor 34, which is connected to the armature coils P and S, as indicated in the wiring diagram of Fig. 17. The end of the conductor 34 is rigidly clamped to the screw 26 in any suitable way, as by a nut 35 or otherwise. As seen from Fig. 17, the conductor 34 forms a common lead from the primary and secondary coils. The other terminal of the primary or low-tension coil P is connected to the metal of the armature and is therefore "grounded", as it is technically termed. This grounding of the coil P is diagrammatically indicated at *g* in Fig. 17. The end disk 15 of the armature is also grounded as diagrammatically indicated at *g* in Fig. 17.

It will be evident that the mounting of the low-tension collector ring L on the end disk 15 of the armature saves end space on the magneto, thereby contributing to the compactness of the machine. Also, a collector ring made from a cut punching is materially cheaper than the cast or molded slip-rings used in prior machines and which were mounted directly on the armature shaft, thereby adding to the length of the magneto.

The opposite end of the armature—the end which I may call the distributor end—is supported in the end plate 36 secured to the casting C by screws 37 or otherwise. The end plate 36 is shown in cross-section in Figs. 1, 5 and 18; the end views of Figs. 9 and 19 show the plate 36 in elevation. The plate 36 is secured against the end piece 3 of the casting C, as best indicated in Fig. 6, the screws or fastening device 37 passing into holes 38 in the end piece 3. A suitable bearing, indicated as a whole by B, rotatably supports the distributor end of the armature in the end plate 36. The bearing B is preferably similar to the bearing 20—21—22 which supports the drive end of the rotary armature shaft. In the hub 16′ of the end disk 16 is mounted a shaft 39 of suitable insulating material, as best shown in Figs. 1 and 18. The inner end of the insulated shaft 39 has a disk-like enlargement 40 which is firmly seated in a correspondingly shaped recess 41 in the end member 16 of the armature. Through an axial opening in the shaft 39 extends the leading-out wire 42 of the high-tension secondary coil S. This connection is shown in Figs. 1 and 17 and is diagrammatically indicated in Fig. 17. The wire 42 terminates in or contacts with a button or bushing 44, which is substantially flush with the outer end of shaft 39.

Speaking in a practical way, it may be said that the armature shaft of my new magneto consists of the driving end 19 and the insulated distributor end 39, these ends being arranged in axial alignment and constituting in effect a single rotary shaft. The complete embedding of the high-tension conductor 42 between the secondary coil and the button 44 in an insulated portion of the rotary armature shaft removes the danger to which exposed conductors are usually subject in devices of this kind. Furthermore, since the contact button 44 is concentric with the axis of the rotation of the armature, it is, in fact, practically a stationary contact and requires simpler mechanism for collecting the current therefrom than in the case of collector ring contacts. Attention is called to the fact that the insulating shaft 39 projects axially a considerable distance beyond the hub 16′ of end disk 16. Consequently, the brush (to be described later) that engages the high-tension contact 44 at the outer end of shaft 39 is separated from the nearest point of end disk 16 by considerable surface insulation. This arrangement thus insures a safe insulation of the high-tension contact brush—an important feature in high-tension ignition magnetos, as any ignition engineer will understand. The armature as above described may be removed as a unit from the casting or frame C after the end plate 36 has been taken off. It will be noticed in Fig. 9 that the outer end of the shaft 39 is formed with a straight shoulder 45 by cutting away a segment of the material. The purpose of the shoulder 45 will be apparent later when I explain how a one-cylinder magneto may be readily changed into a multi-cylinder magneto, or vice versa.

I will now describe the primary brush construction, by means of which the low-tension current is collected from the rotary armature. In the top 4 of the casting C is mounted a pair of brushes 46 and 47, made of a good conducting material possessing inherent lubricating qualities and a low contact drop—such as copper-graphite. The angle at which these brushes are preferably mounted is such that the center line or axis of each brush passes through the axis of the armature shaft, or as nearly so as mechanical conditions permit. This angular arrangement of the brushes is clearly seen from Fig. 4. The brush 46 is arranged to bear upon the flange 24 of the collector ring L, as illustrated in Figs. 4 and 14, and is completely insulated from the framework of the machine by an insulating bushing 48 lining an opening 49 in the top 4 of the casting C (see Figs. 7 and 14). The insulating bushing 48 has a flange 50 adapted to fit into the recess 51 which surrounds the top of the opening 49, as best shown in Fig. 7. The brush 47 passes through an opening 52 in the top 4 of the casting C (see Fig. 7) and is arranged in alignment with the grounded disk 15, which is one of the end members of the armature, as previously de-

scribed. The brush 47 is not insulated from the framework of the machine. The brushes 46 and 47 are pressed against their respective rotary members L and 15 by a single torsional spring 53 coiled about a pin 54 which may conveniently be in the form of a screw fastened into a projection 55 on the top 4 of the casting C, as best shown in Figs. 1 and 14. The hooked or looped end 56 of the spring 53 presses down on the brush 46, while the other looped end 57 of the spring bears down on the brush 47, as clearly shown in Fig. 14. An insulating washer or bushing 58 is interposed between the brush 46 and the end 56 of the torsional spring 53. The washer 58 is preferably provided with a collar 59 around which the end 56 of the spring is coiled. This insures the electrical insulation of the brush 46 and at the same time prevents displacement of the spring end 56. The insulating bushing 58—59 may be formed as an integral part from fiber or other suitable insulating material. The other end 57 of the spring 53 is looped around the conductor 60, which is connected to the brush 47. As the brush 47 is grounded, there is no necessity for interposing any insulation between the brush and the spring. The normal set of the coiled torsional spring 53 is such that it holds the brushes yieldably against the rotary members L and 15 respectively.

Through the insulating bushing 58—59 on top of the brush 46 extends a conductor 61, the inner end of which is secured to the brush in any well known manner. The other end of the conductor 61 is fastened to a metal clip 62 at the point 63, as shown in Figs. 2 and 14. The clip 62 is secured on the projection 64 on the top 4 of the frame or casting C by means of a screw 65 or otherwise. The screw 65 passes into a hole 66 in the projections 64, as shown in Figs. 6 and 7. The clip 62 is insulated by means of a pair of insulating washers 67 and 68 between which the clip is clamped. This is illustrated in Figs. 4 and 14.

The conductor 60, which leads from the brush 47, is at its other end connected to a metal clip 69 secured to the top of the casting by a screw 70, or otherwise. The screw 70 passes into an opening 71 in the projection 55 on top of the casting C, as shown in Figs. 1, 6 and 7.

The top 4 of the casting C is provided with a recess or chamber 72 (see Figs. 6 and 7) for receiving a condenser K (see Fig. 1) of suitable construction. I prefer to use a paper condenser, because of its lower cost than the mica condensers, and I can safely use a paper condenser for reasons which I will now state. There are special advantages in placing the condenser on top of the magneto frame. In prior magneto constructions using a rotating winding, the condenser has ordinarily been mounted on the rotating element of the machine. It is a matter of common knowledge and experience that the rotating element of a magneto develops considerable heat during operation and on that account it has heretofore been necessary to use a condenser with a dielectric of mica which is not easily affected by heat. Condensers of this type are considerably more expensive than the so-called paper condensers in which sheets of paper are used to separate the tinfoil, the whole being impregnated with paraffin or a similar substance. If a paper condenser were mounted on the rotating element of a magneto, the heat developed in operation would melt or soften the paraffin, which would then be thrown out by centrifugal force, with the result that the action of the condenser would be destroyed or impaired. Now, this objection is entirely overcome in my construction by mounting the condenser K within the chamber 72 on top of the casting. As the condenser is separated from the rotating armature by the wall 4 of the casting, it is out of the heat zone caused by the operation of the machine—at least, out of the most intense heat. But even if, for any reason, the temperature of the condenser should mount so high as to soften the paraffin, that material could not escape from the chamber and the condenser would continue to function. By being thus able to use a paper condenser in absolute safety, I bring down the manufacturing cost of the machine.

The condenser chamber 72 is covered with a plate 73, which is held in place by the screw 70 and additional screws 74 and 75 (see Fig. 2), or by any other suitable means. As shown in Fig. 2, the plate 73 does not entirely cover the chamber 72 but leaves a space sufficient to bring out the insulated condenser terminal 76. The plate 73 has the advantage that it keeps the condenser compressed, thus insuring a practically constant capacity. To the terminal 76 are connected the conductors 77 and 78 (see Fig 2), while the other terminal of the condenser is grounded under screw 74, these condenser connections being well understood by those familiar with ignition apparatus. The conductor 77 is electrically connected at 79 to the insulated clip 62, to which the brush 64 is connected, as previously described. The conductor 78 is suitably connected to the fixed terminal 80 at the point 81. The terminal 80, which is a block of good conducting material, has an opening or slot 80′ (see Figs. 1 and 12) for receiving a rigid insulating strip 82. The terminal 80 is secured at right angles to the insulating strip 82 by rivets 83, or otherwise, as indicated in Fig. 12. The strip 82 is made of an insulating material possessing sufficient rigidity and strength, such as bake-

lite canvas, and is mounted on a pair of posts 84 by screws 85 or otherwise. The posts 84 are preferably an integral part of the top 4 of the casting, as best shown in Fig. 6. The fastening devices 85 enter holes 86 in the posts 84. It will be seen that I have provided a very simple insulated mounting for the terminal 80, which is easily put in place and removed when required. The terminal 80 carries an adjustable contact screw 87, which co-operates with a movable contact 88 to form the circuit breaker of the magneto for controlling the primary circuit, as will be understood by those skilled in the art. The movable contact 88 is carried at the outer end of the breaker arm 89, pivoted to the casting by means of a screw or pin 90, which enters an opening 91 in the top of the casting (see Fig. 6). The contact 88 is normally pressed against the fixed contact 87 by a spring 92 coiled about the pin or screw 90, as shown in Figs. 2 and 12. The fixed contact 87 is insulated and the movable contact 88 is grounded. As the movable pivot of the breaker arm 89 acts like a high resistance contact, and as it is important in any high-tension magneto to keep down the resistance of the primary circuit, I provide a flexible strip 93 of good conducting material for grounding the breaker arm 89. As best shown in Figs. 2 and 13, the strip 93 is at one end removably secured to the top 4 of the casting by the screw 75, and at the other end is suitably connected to a lateral extension 94 on the breaker arm 89. Preferably the connection between the breaker arm 89 and strip 93 is permanent, as a riveted or soldered joint. The strip 93, being easily flexible, does not interfere with the movements of the breaker arm. The screw 75 clamps the strip 93 firmly between the top of the casting and the cover plate 73. The conductor 93 thus provides a fixed circuit connection of low resistance for the movable contact 88. The strip 93, which is very thin, is bent substantially at right angles to provide an arm of great effective length in a small space, and the connecting clip 93′ is bent at right angles to the strip, to provide a flexible hinge for the entire strip during the operation of the breaker arm 89. In this way the strains of operation, instead of being localized, are distributed throughout the strip, thereby considerably prolonging its life.

The breaker arm 89 is formed with a right-angled extension 95, which carries at its free end a block 96 of suitable wearing material, such as fiber. The block 96 is in vertical alignment with an actuating cam mounted on the end member 16 of the armature. The form of this cam is best shown in Fig. 11, where it is indicated as a whole by R. It will be seen that the cam R consists of a disk or ring 97 having a section cut away at 98 and provided with a cylindrical flange 99. The ends of the flange 99 are bevelled to form cam surfaces 100 and 101. The cam R, like the collector ring L, is preferably made from a cut punching. It will be understood that the form of the cam R shown in Fig. 11 is for a one-cylinder magneto and that the shape of the cam will naturally depend upon the number of cylinders in the engine to which the magneto is connected. The cam R, which is preferably of hard steel, is secured to the end disk 16 of the armature by a screw 102, or otherwise (see Fig. 3). When the cam is in place on the disk 16, the flange 99 overlaps the periphery of the disk, as shown in Figs. 1 and 5. In other words, the cam R forms in effect a removable section of the disk 16. It will be clear from Fig. 3 that, as long as the block 96 of the breaker arm 89 engages the cylindrical flange 99 of the cam R, the contacts 87 and 88 are held apart and the primary circuit of the magneto is open. As the cam surface 100 passes under the block 96 in the direction of the arrow *a* in Fig. 3, the contacts are allowed to open under the action of the spring 92 and they remain open until the opposite cam surface 101 rides under the block 96 and rocks the breaker arm 89 into closed position. During the intervals that the contacts 87—88 remain closed, current passes through the primary circuit P. The angular position of the circuit breaker cam R is such that it interrupts the primary circuit at approximately the moment of maximum voltage, thereby inducing a current of sufficiently high voltage in the secondary circuit S to produce a spark at the spark plug F (see Fig. 17). This operation is well understood and nothing further need be said about it.

To change the magneto from a right-hand to a left-hand rotation, or vice versa, it is only necessary to change the position of the cam R on the disk 16. For this purpose the disk 16 is provided with a pair or diametrically opposite screw holes 103, one of which is shown in Fig. 3; the other screw hole being covered by the screw 102. The cam R is readily accessible upon removal of the end plate or cover 36.

By mounting the primary brushes 46 and 47, the condenser K and the breaker contacts 87 and 89, all on top of the magneto frame C, they are in an easily accessible position and may thus be readily replaced or inspected when desired. This is an advantage, because it is well known that these parts are liable to get out of order. To protect the parts referred to against dust and moisture, I provide a cover 104 which fits tightly on top of the casting and is secured in place by suitable means, such as screws 105 or bails. The lower edge of the

cover 104 closely surrounds the flange or shoulder 106 formed on the top of the casting, as best shown in Figs. 6 and 7. In this way the cover is easily centered on the casting and fits snugly in place, producing practically a dust-proof and moisture-proof casing for the brushes, the condenser and the circuit breaker.

In a single-cylinder magneto—that is to say, a magneto connected to a single-cylinder engine—the distributor through which the current is led to the spark plug need have but a single contact. Such a distributor is shown in Figs. 1, 15 and 16. This distributor consists of a properly shaped block 107 of insulating material provided with a chamber 108, into which projects a brush or contact 109. This brush is usually a piece of carbon and is mounted in a hollow metal plug 110 embedded in the block 107, as best shown in Fig. 1. A light spring 111 presses the brush 109 against the contact 44 when the block 107 is in place on the magneto. A cable or conductor 112, encased in suitable insulation 113, is electrically connected to the metal plug 110. The cable 112 passes through an opening 114 in the distributor block 107 and the frayed ends 115 of the wires which constitute the conductor 112 are pushed tight against the metal plug (see Figs. 1 and 15), thereby producing a firm electrical connection between the collector brush 109 and the cable 112. As diagrammatically indicated in Fig. 17, the cable 112 leads to the insulated terminal of the spark plug F. I provide very simple and efficient means for securely fastening the cable in the insulator block, and yet permitting easy removal thereof when necessary. This means comprises a set screw 116 having a pointed end 116′ (see Fig. 25), which enters the insulation 113 surrounding the high-tension cable 112, as illustrated in Fig. 15. It will be noticed that the screw 116 pierces the insulation of the cable at an angle in a direction to oppose a force tending to pull the cable out of its socket. It will also be seen that tightening of the screw tends to push the inner end of the cable against the metal plug 110. The screw 116 may be entirely concealed in the opening 117 in the insulator block, as shown in Fig. 15. The screw 116 is not a current-carrying member, and its sole function is to hold the high-tension cable in electrical contact with the distributor brush 109. For this reason the screw 116 may be made of metal or of insulating material. I prefer to make the screw 116 of fiber or other hard insulating material suitable for that purpose. This prevents the danger of a possible short-circuit between the high-tension circuit and the grounded parts through moisture.

The insulator block 107 is provided with a circular flange or shoulder 118 (see Figs. 5 and 16) adapted to fit against a corresponding flange or shoulder 119 on the end plate 36, whereby the insulator block is readily centered on the end plate 36, as may be seen from Figs. 1 and 5. If desired, the distributor block 107 may also be provided with a lug 120 (see Fig. 16) adapted to enter a notch or recess 121 in the plate 36 (see Figs. 9 and 19), when the distributor block is properly positioned on the magneto. The lug 120 and notch 121 thus insure a correct positioning of the distributor block. The distributor block is held in place on the magneto by any suitable means, such as a spring arm 122 pivoted on the stud 123 carried by the end plate 36. When the spring arm 122 is in locking position, it engages the block 107 substantially at the center, as shown in Figs. 1, 2 and 5. To release the distributor block it is only necessary to swing the arm 122 into the position shown in Figs. 9 and 19.

In ignition magnetos it is frequently desirable to short-circuit the primary coil in order to stop the ignition. I provide a short-circuiting device in an easily accessible position on the cover 104. As best shown in the enlarged view of Fig. 8ª, this device comprises a contact pin 124 projecting from a hollow plug 125, which is rigidly secured to the cover 104 and insulated therefrom by insulating washers 126 and 127. A nut 128 holds the plug 125 firmly in place on the cover 104. A spring 129 within the plug 125 pushes the pin 124 against the terminal 80. The plug 125 has a screw-threaded extension 130 on which is mounted a nut 131. If desired, a spring 132 may be placed around the screw 130 to hold the nut firmly in adjusted position. The nut 131 is thus electrically connected with the terminal 80 through pin 124, plug 125 and screw 130. As long as the nut 131 is out of contact with the grounded cover 104, the primary circuit is completed through the contacts 87 and 88 of the circuit breaker, as previously explained. However, when the nut 131 is screwed down until the flange or skirt 131′ thereof contacts with the raised shoulder 133 of the cover 104, the primary current is short-circuited through pin 124, nut 131 and the grounded cover 104. In the wiring diagram of Fig. 17, the grounded connection of the nut 131 is diagrammatically indicated at g^2.

If it is desired to control the short-circuiting device above described from a distant point, it is only necessary to clamp one end of a conductor between the nut 131 and the shoulder 133 in the cover; the other end of the conductor being fastened to a switch mounted on the dashboard or other part of the motor vehicle. The other terminal of the switch would, of course, be grounded. As long as the switch was open, the primary current would operate in the usual

way, but upon closing the switch the primary current would be short-circuited in the same way as above described. In using a short-circuiting switch it would not be necessary to use a nut with a flange or skirt like the nut 131, but an ordinary nut would be sufficient.

A modified and simpler form of short-circuiting device is illustrated in Fig. 8ᵇ, where a spring-pressed plunger or pin 130′ is mounted in the cover 104 without being insulated therefrom. A spring 129′ normally holds the lower end 124′ of the plunger out of contact with the terminal 80. To short-circuit the magneto windings, it is only necessary to push against the pin 130′ until the lower end 124′ thereof contacts with the terminal 80.

A one-cylinder magneto constructed in accordance with my invention is readily changed into a multi-cylinder magneto by the substitution of a few parts. For the sake of explaining this feature of my invention, I will assume that a one-cylinder magneto is to be changed into a two-cylinder magneto. This is accomplished by simply removing the cam R and substituting a cam T, as shown in Fig. 20. The cam T is mounted on the end plate 16 of the armature in the same way as the cam R. The cam T is provided with a pair of screw holes 134, adapted to register with the screw holes 103 in the disk 16, so that, by inserting screws into these aligned openings, the cam T is rigidly mounted on the disk 16 in a predetermined position. For a two-cylinder magneto the cam T has two oppositely arranged cam-sections, since the circuit must be interrupted twice during every revolution of the armature. On the projecting end of the insulated shaft 39 is mounted a distributor disk 136, as shown in Figs. 18, 19 and 23. This disk, which is of hard rubber or other insulating material, has an opening 137 formed with a shoulder 138. When the disk 136 is inserted on the shaft 39, the shoulder 138 fits against the correspondingly arranged shoulder 45 on the shaft 39 (see Fig. 9), whereby the disk 136 is locked to the shaft 39 so as to rotate therewith, at the same time being free to be removed. The distributor disk 136 has embedded therein a segmental or arc-shaped contact 139 (see Fig. 24), which has an extension 140 terminating in a contact button 141. When the distributor disk is in place on the magneto shaft, the button 141 is in firm contact with the button 44 of the magneto shaft, as shown in Fig. 18.

In the case of a two-cylinder magneto, the distributor block 107 is replaced by a distributor block 142, as shown in Figs. 18, 21 and 22. The general contour of the distributor block 142 is the same as that of the block 107, so that both blocks fit equally well against the end plate 36 and are held in place by the same spring arm 122. The only difference between the distributor blocks 107 and 142 is that the latter has two collector brushes 143, to which are connected the end of cables 144, each cable leading to one of the spark plugs of the engine. The cables 144 are held in electric contact with the brushes 143 in the same manner as the cable 112 in the one-cylinder distributor block 107.

In the operation of the two-cylinder magneto, the segment 139 of the rotating distributor disk 136 sweeps over the brushes 143 in succession, thereby closing the circuit through the spark plugs at the proper intervals, as will be understood by those skilled in the art. It will be evident that the shape of the circuit breaker cam and the number of contacts in the distributor will vary with the number of cylinders in the engine to which the magneto is attached.

From the foregoing description of an illustrative embodiment of my invention, it will be seen that I have provided an ignition magneto of small and compact dimensions, particularly as to length, without impairing or diminishing its electrical efficiency. In fact, to give an idea of the compactness of my machine, the original drawings herewith filed show a full-size magneto which has been successfully operated. The manufacturing cost of such a magneto is cut down by making certain parts from a cut punching (as, for instance, the low-tension collector ring and the circuit breaker cam), and by using a paper condenser instead of the more expensive mica condenser heretofore employed. Those parts which are liable to require most care and inspection—such as the primary brushes, the condenser, and the breaker contacts—are mounted in a readily accessible position on top of the magneto frame and completely enclosed, so as to be water-proof and dust-proof. Furthermore, as pointed out, a one-cylinder magneto is easily changed into a multi-cylinder magneto by the mere substitution of a few parts.

While I have herein shown and described a specific construction, I do not intend to be limited to the details set forth. It is obvious that changes and modifications may be resorted to and yet be within the scope of my invention as defined in the appended claims.

What I claim as my invention is:

1. In a rotatable armature for ignition magnetos, a pair of end plates between which the usual coils are supported, an insulated collector ring mounted on one of said end plates, said collector ring having a cylindrical contact section and a disk section, fastening devices passing through said disk section into the adjacent end plate, and a

circuit-breaker cam mounted on the other end plate.

2. In an rotatable armature for ignition magnetos, a pair of end plates between which the usual coils are supported, an insulated collector ring secured to the face of one of said end plates, said collector ring having a cylindrical contact section and a disk section, fastening devices passing through said disk section into the adjacent end plate, and a circuit-breaker cam adjustably secured to the face of the other end plate.

3. In an ignition magneto, a non-magnetic frame or housing provided with a top, an armature rotatably mounted in said frame and having a pair of end plates, an insulated collector ring secured to one of said end plates, said collector ring having a disk section and a cylindrical contact section extending axially beyond said disk section, fastening devices passing through said disk section into the adjacent end plate, a cam adjustably secured to the other end plate, an insulated brush mounted in the top of said frame and extending through a hole in said top into contact with said cylindrical section, and a circuit-breaker mounted on said top so as to be controlled by said cam.

4. In an ignition magneto, a non-magnetic frame or housing provided with a top which has an opening near one end thereof, an insulated brush yieldably held in said opening, a circuit-breaker mounted on said top at the other end thereof, an armature journalled in said frame, an insulated collector ring mounted at the driving end of said armature and engaged by said brush, said collector ring having a cylindrical contact section and a disk section, fastening devices passing through said disk section into the adjacent end plate, and a cam secured to the other end of said armature to actuate said circuit-breaker.

5. In an ignition magneto, a non-magnetic frame having a pair of end plates, one of which is readily removable, an armature having a pair of end disks between which the primary and secondary coils are supported, a drive shaft projecting from one of said end disks, an insulated collector ring mounted near said last-mentioned disk, an insulated distributor shaft projecting from the other end disk, means for journalling said shafts in the end plates of said frame, said distributor shaft being supported in the removable end plate and projecting beyond the same, a contact at the outer end of said distributor shaft, the leading out wire of the secondary coil being inserted longitudinally in said distributor shaft and engaging said contact, a distributor block mounted on said removable end plate so as to be readily removable therefrom, and a brush carried by said block in position to engage said contact.

6. In an ignition magneto, a non-magnetic frame having a pair of end plates, one of which is readily removable, an armature having a pair of end disks between which the primary and secondary coils are supported, a drive shaft projecting from one of said end disks, an insulated collector ring mounted near said last-mentioned disk, an insulated distributor shaft projecting from the other end disk, means for journalling said shafts in the end plates of said frame, said distributor shaft being supported in the removable end plate and projecting beyond the same, a contact at the outer end of said distributor shaft, the leading-out wire of the secondary coil being inserted longitudinally in said distributor shaft and engaging said contact, in combination with a distributor disk adapted to be mounted on the projecting end of said distributor shaft so as to rotate therewith, said distributor disk being readily inserted upon and removable from said distributor shaft, a current-conducting member carried by said distributor disk in position to engage said contact when the disk is in place on the distributor shaft, and a distributor block adapted to be mounted on said removable end plate in operative relation to said distributor disk.

7. In an ignition magneto, a non-magnetic frame provided with a pair of end plates, and armature journalled in said end plates, one of said end plates being readily removable to permit mounting and dismounting of said armature in and from said frame, said armature having a pair of end disks, a circuit-breaker cam adjustably mounted on that end disk which is adjacent to the removable end plate of said frame, whereby the removal of said last-mentioned end plate renders said cam accessible, a collector ring at the other end disk of the armature, and a brush engaging said cylindrical section of the collector ring, said cylindrical section automatically sliding out of engagement with said brush when the armature is removed.

8. In an ignition magneto, a non-magnetic frame provided with a pair of end plates, an armature journalled in said end plates, one of said end plates being readily removable to permit mounting and dismounting of said armature in and from said frame, a circuit-breaker cam adjustably and removably mounted on said armature at that end thereof which is adjacent to the removable end plate of said frame, whereby the removal of said last-mentioned end plate renders said cam accessible, said cam comprising a cylindrical section and a disk section, said cylindrical section being provided with a cam surface, and fastening devices passing through said disk section into the adjacent end of the armature.

9. In an ignition magneto, an armature construction insertable into and removable from the magneto frame as a unit, said con-

struction including a pair of end disks between which the usual coils are supported, a drive shaft projecting from one of said disks, an insulated collector ring supported adjacent said last-mentioned disk and electrically connected with one end of the armature coils, an insulated shaft projecting from the other end disk, a contact at the outer end of said insulated shaft, the leading-out wire of the secondary coil being inserted in said insulated shaft and engaging said contact, and a circuit-breaker cam mounted on said armature adjacent to said other end disk.

10. In an ignition magneto, an armature construction insertable into and removable from the magneto frame as a unit, said construction including a pair of end disks between which the usual coils are supported, a drive shaft projecting from one of said disks, an insulated collector ring removably secured to said last-mentioned disk and electrically connected with one end of the armature coils, an insulated shaft projecting from the other end disk, a contact at the outer end of said insulated shaft, the leading-out wire of the secondary coil being inserted in said insulated shaft and engaging said contact, and a circuit-breaker cam removably mounted on said other end disk.

11. In an ignition magneto, a non-magnetic frame in which the armature is rotatably mounted, the top of said frame being integral with the sides thereof and having a recess or chamber, a condenser mounted in said chamber, and circuit connections for said condenser.

12. In an ignition magneto, a non-magnetic frame in which the armature is rotatably mounted, the top of said frame being integral with the sides thereof and having a recess or chamber, a condenser mounted in said chamber and having an insulated terminal projecting out of said chamber, a cover for closing the top of said chamber and leaving said terminal exposed, and conductors connected to said terminal, the other terminal of the condenser being grounded to said frame.

13. In an ignition magneto, a non-magnetic frame having a top provided with an opening near one end, a brush mounted in said opening, a circuit breaker mounted on said top at the other end thereof, said top being provided with a chamber between said brush and said circuit breaker, a condenser within said chamber, circuit connections from said brush and circuit breaker to said condenser, and a cover removably secured to said top for enclosing the parts mounted thereon.

14. In an ignition magneto, a non-magnetic frame having a top provided with a peripheral flange or shoulder, a brush mounted in an opening near one end of said top, a circuit breaker supported on said top at the other end thereof, said top being provided with a chamber between said brush and said circuit breaker, a condenser within said chamber, circuit connections from said brush and circuit breaker to said condenser, a cover fitting around said flange for enclosing the parts mounted on said top, and means for removably securing said cover in place.

15. In an ignition magneto, a non-magnetic frame having a top provided with an opening near one end, a brush mounted in said opening, a circuit breaker mounted on said top at the other end thereof, said top being provided with a chamber between said brush and said circuit breaker, a condenser within said chamber, circuit connections from said brush and circuit breaker to said condenser, a cover removably secured to said top for enclosing the parts mounted thereon, and an adjustable short-circuiting device on said cover, said device having a part extending into contact with said circuit breaker.

16. In ignition magnetos, a non-magnetic frame consisting of a single casting which comprises a base, a top, sides and a plate at one end, the other end of the casting being open to permit insertion and removal of the armature into and from the frame, said top having an opening near the first-mentioned end of the casting and a recess at the other end, a pair of posts on said top near said recess, a rectangular flange formed on said top between said opening and said posts to provide a recess or chamber, and a peripheral flange formed on said top along the two sides and the closed end of the casting, substantially as and for the purposes specified.

17. In an ignition magneto, a non-magnetic frame in which the armature is mounted, the top of said frame having a recess or chamber, a condenser in said chamber, and a cover secured over said chamber, said cover holding the condenser compressed to a predetermined degree, whereby said condenser remains at practically constant capacity.

18. In an ignition magneto, a non-magnetic frame in which the armature is mounted, the top of said frame having a recess or chamber, a condenser in said chamber and having a terminal projecting out of said chamber, a cover for said chamber, said cover leaving said terminal exposed, and fastening devices for holding said cover in place, whereby said cover holds the condenser compressed, one of said fastening devices holding the other terminal grounded to said frame.

19. In an ignition magneto, a non-magnetic frame in which the armature is mounted, the top of said frame having a recess or chamber, a condenser in said cham-

ber, one terminal of said condenser projecting out of said chamber, said cover leaving said terminal exposed, a plurality of fastening devices for holding said cover in place, one of said fastening devices holding the other terminal of the condenser grounded to said frame, a circuit breaker mounted on top of said frame, said circuit breaker consisting of a stationary terminal and a movable terminal, a pivoted arm carrying said movable terminal, and a flexible conductor connected at one end to said pivoted arm, the other end of said flexible conductor passes under said cover and is held grounded to the frame by another of said fastening devices.

20. In an ignition magneto, a non-magnetic supporting frame having a recess or chamber, a paper condenser in said chamber, and a cover secured over said chamber to hold said condenser compressed and to prevent the escape of the paper-impregnating substance if this should melt or soften under heat, whereby said paper condenser remains at practically constant capacity.

FREDERICK W. ANDREW.

Certificate of Correction.

It is hereby certified that the name of the assignee in Letters Patent No. 1,549,953, granted August 18, 1925, upon the application of Frederick W. Andrew, of Brooklyn, New York, for an improvement in "Ignition Magnetos," was erroneously written and printed as "Eisenmann Magneto Corporation," whereas said name should have been written and printed as *Eisemann Magneto Corporation*, as shown by the records of assignments in this office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 22d day of September, A. D. 1925.

[SEAL.]

KARL FENNING,
Acting Commissioner of Patents.