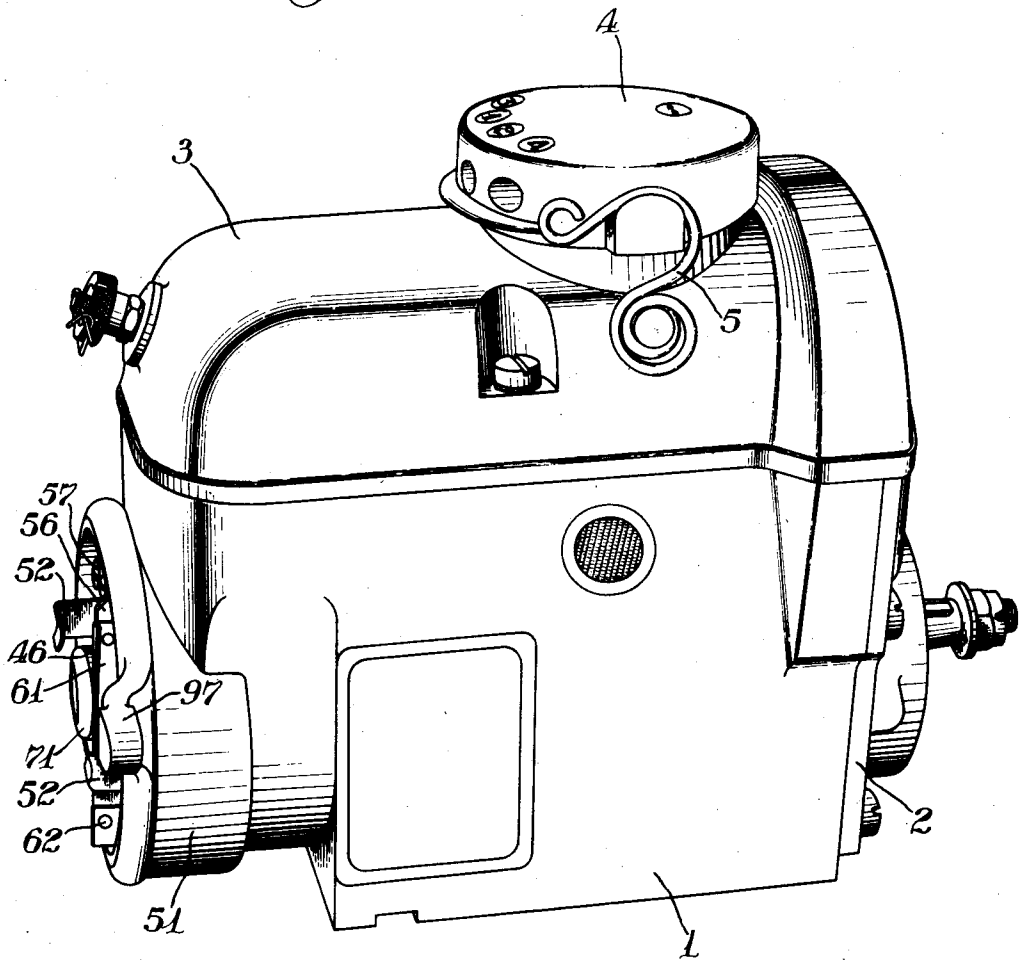
Aug. 27, 1935. W. J. SPENGLER 2,012,290

ELECTRICAL GENERATOR

Filed Feb. 25, 1933 4 Sheets-Sheet 1

Fig. 1



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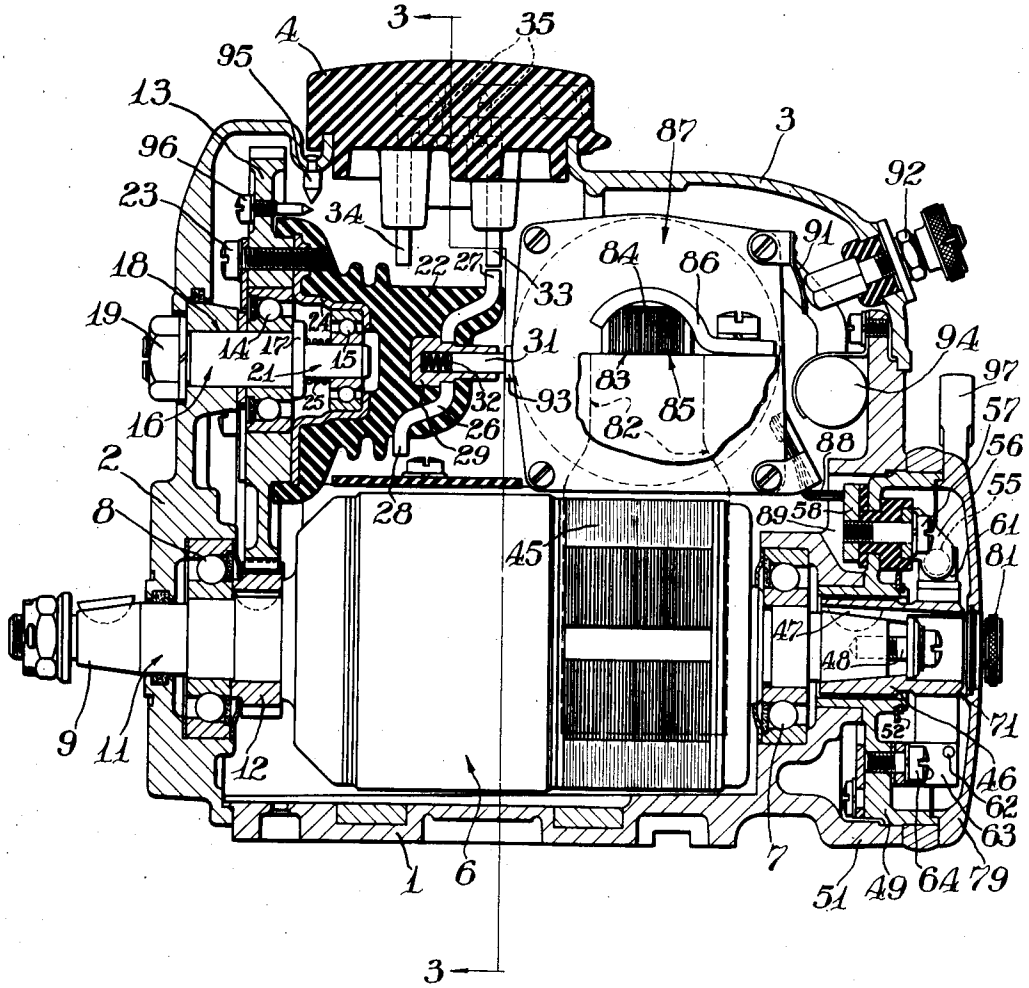
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ELECTRICAL GENERATOR

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Fig. 2



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ELECTRICAL GENERATOR

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Fig. 3

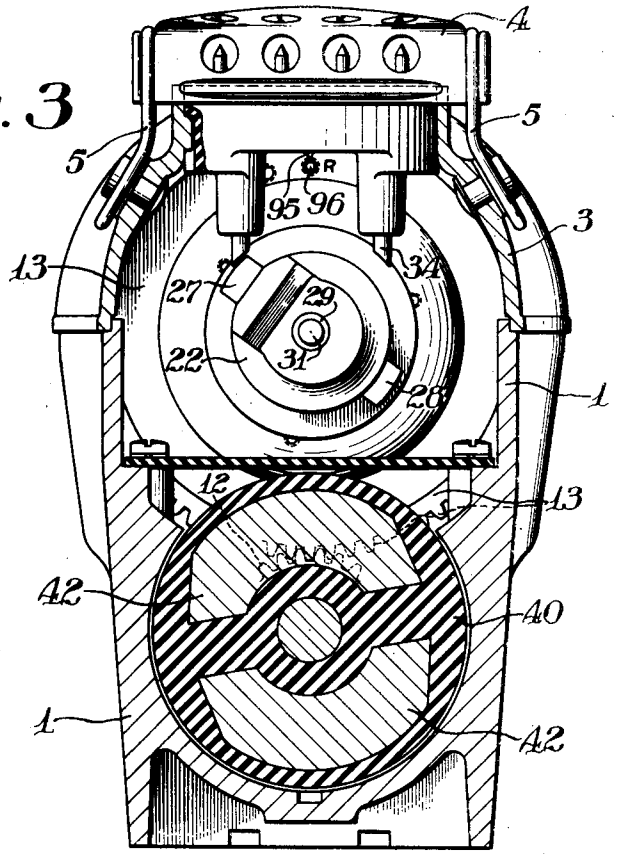
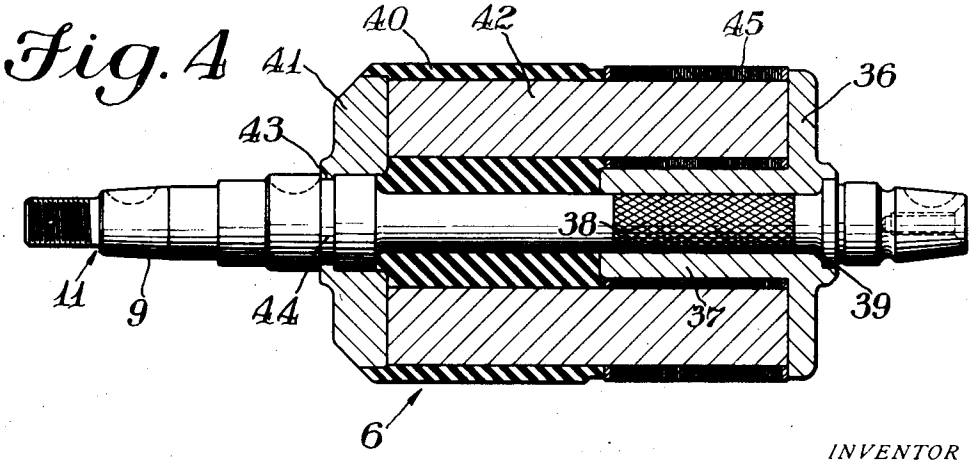


Fig. 4



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ELECTRICAL GENERATOR

Filed Feb. 25, 1933 4 Sheets-Sheet 4

Fig. 5

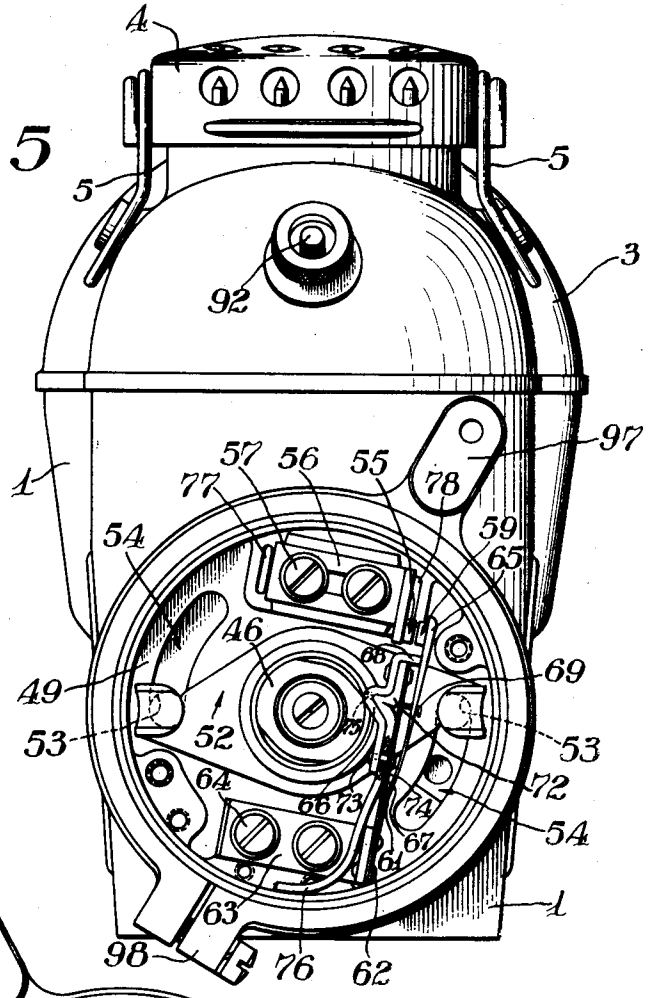
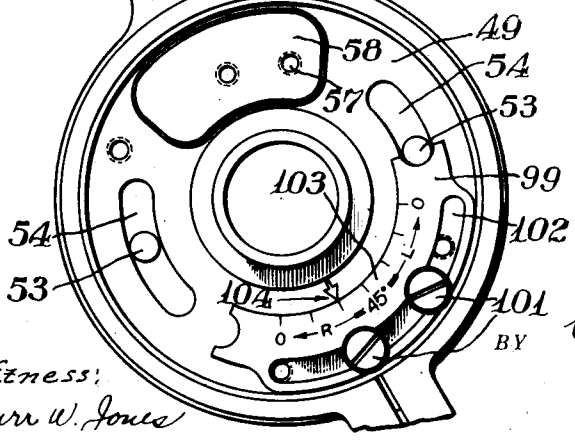


Fig. 6



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Patented Aug. 27, 1935 2,012,290

UNITED STATES PATENT OFFICE

2,012,290

ELECTRICAL GENERATOR

Walter J. Spengler, Sidney, N. Y., assignor, by mesne assignments, to Bendix Aviation Corporation, South Bend, Ind., a corporation of Delaware

Application February 25, 1933, Serial No. 658,614

10 Claims. (Cl. 171—252)

This invention relates to electrical generators and more particularly to ignition magnetos for internal combustion engines.

It is an object of the present invention to provide a novel and improved form of magneto for generating ignition current for internal combustion engines.

It is another object to provide such a device having a new and improved rotor structure.

It is another object to provide such a device embodying a new and improved form of distributor.

It is a further object to provide such a device embodying new and improved circuit breaker structure.

It is a further object to provide such a device embodying a circuit breaker which is particularly adapted for high-speed operation.

It is another object to provide such a device in which wear of the breaker parts is reduced to a minimum.

It is another object to provide such a device embodying means for the efficient and continuous lubrication of the moving parts.

It is another object to provide such a device in which the timing and adjustment of the breaker mechanism is convenient and is readily observed.

It is a further object to provide such a device embodying a convenient index for establishing a reference point for the rotor of the magneto.

It is a further object to provide such a device which is highly efficient while being capable of economical manufacture and which is readily assembled and adjusted.

Further objects and advantages will be apparent to those skilled in this art from the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a side view of the magneto showing the external arrangement including the distributor block, with the cover of the breaker assembly removed;

Fig. 2 is a vertical mid-sectional view of the magneto, the rotor and coil being shown in elevation;

Fig. 3 is a vertical section taken substantially on the line 3—3 of Fig. 2;

Fig. 4 is a detail view of the rotor partly in longitudinal mid-section;

Fig. 5 is a view of the breaker end of the magneto, the cover of the breaker being removed; and

Fig. 6 is a rear view of the carrier element for the breaker mechanism showing particularly the adjustment limiting means.

Referring first to Fig. 1 of the drawing, there is illustrated a magneto comprising a frame or casing 1 having a removable end plate 2 and a removable cover 3 provided with an opening forming a seat for a terminal block 4 which is retained therein by suitable means such as the yielding hook members 5. A rotor indicated generally at 6 (Fig. 2) is journalled in suitable bearings 7 and 8 in the frame 1 and end plate 2 respectively. The rotor 6 is adapted to be driven from and in synchronism with an internal combustion engine, not shown, by means of an adjustable coupling adapted to be mounted on the tapered end 9 of the rotor shaft 11, this coupling not being illustrated since it forms no part of the present invention. A pinion 12 is suitably keyed on the rotor shaft 11 and is arranged to mesh with and drive a distributor gear 13 mounted on a radial bearing 14 and pilot bearing 15. A stud 16 for supporting the bearings 14 and 15 is provided with a flange 17 arranged to engage the inner race of the radial bearing 14 and is arranged to be retained in an opening 18 in the end plate 2 by means of a nut 19 threaded on the outer end of the stud so as to clamp the inner race of the bearing 14 against the inner surface of the end plate. The stud 16 is provided with a reduced extension 21 for slidably receiving the pilot bearing 15.

A rotary distributor 22 comprising a block of suitable insulating material is mounted on the distributor gear 13 to rotate therewith as by means of studs 23 traversing the distributor gear and a cup-shaped metallic element 24 moulded in one end of said block of insulation and formed to receive the outer race of the pilot bearing 15. A light compression spring 25 may be provided to insure the proper seating of the bearing 15 in the cup 24. An electrode 26 is moulded in the opposite end of the distributor block 22 and is provided with off-set terminal projections 27 and 28. A conducting thimble 29 is moulded within the rotor block 22 in electrical connection with the electrode 26 and is arranged to extend axially from the distributor block. A conducting element 31 is slidably mounted in the thimble 29 and is urged outwardly therefrom by suitable means such as a light spring 32 in order to form a conducting brush for leading current to the distributor electrode 26.

The terminal block 4 is formed of suitable insulating material and is provided with conductors moulded therein and having protruding terminal portions arranged in off-set series 33 and 34 closely adjacent the path of the off-set terminal

portions 27 and 28 respectively of the distributor electrode 26. The conductors 33 and 34 are provided with suitable attaching means 35 for anchoring the terminals of the high tension cables leading to the spark plugs of the internal combustion engines whereby current supplied to the distributor electrode 26 will be transmitted to the spark plugs in proper sequence.

It will be understood that although the structure here illustrated comprises four terminal connections and is therefore adapted for a four-cylinder engine, the structure may readily be adapted for engines of different numbers of cylinders the invention not being restricted in its use to a four-cylinder engine.

Referring now to Fig. 4, it will be seen that the rotor 6 comprises a non-magnetic end plate 36 suitably fixed to the shaft 11 as by rolling, swedging or casting a hub portion 37 of said plate onto a knurled portion 38 and against a shoulder 39 on the shaft 11. A magnetic end plate 41 is mounted on the rotor shaft 11 and a plurality of parallel magnets 42 are arranged parallel to the shaft 11 spaced circumferentially thereabout, and are rigidly clamped between the end plates 36 and 41 by pressing said plates together and forcing a lip 43 of the end plate 41 into a circumferential groove 44 on the shaft 11. The magnets 42 carry adjacent one end thereof pole pieces 45 preferably formed of laminations of magnetic material pressed on the ends of said magnets. These laminations are compressed against the end plate 36 and the rotor unified by moulding suitable insulating and non-magnetic material 40 such as a phenol condensation product around the magnets 42 and the shaft 11 so as to completely fill all interstices and form a solid unit.

Referring again to Fig. 2, a cam 46 is rigidly mounted on the end of the rotor shaft 11 opposite to the driving end, by suitable means such as a key 47 and stud 48, said cam being arranged to extend outwardly from the frame 1 a considerable distance. A breaker assembly is mounted for rotary adjustment in the end of the casing 1 in position to be actuated by the cam 46. This breaker assembly comprises a cup-shaped carrier 49 arranged to seat in a circular flange 51 on the end of the casing 1 and to be retained therein by means of an elastic hook member 52 (Fig. 5) swivelled inside the carrier member 49 and adapted to engage a pair of anchorages in the form of pins 53 fixed in the end of casing 1 and projecting through slots 54 in the bottom of the carrier 49.

A fixed contact 55 is adjustably mounted in the carrier 49 as by means of sliding bracket member 56 fixed to the carrier 49 by means of studs 57 insulated from said carrier but connected to a conducting plate 58 (Fig. 2) at the back of said carrier.

A movable contact 59 (Fig. 5) is mounted on a spring contact arm 61 anchored at 62 to a bracket 63 fixed to the carrier 49 by means of studs 64. The arm 61 is normally tensioned so as to hold the movable contact 59 against the fixed contact 55 with a suitable pressure and is preferably stiffened at and adjacent to its free end as by means of flanges 65 formed thereon in order to prevent harmonic vibrations of the arm. A cam follower 66 is mounted on a spring arm 67 also anchored at 62 to the bracket 63, in position to cooperate with the cam 46, and is provided with an extension 68 arranged to engage near its free end the breaker arm 61 to move contact 59 away from contact 55 when the cam follower 66 is on a lobe of said cam. The spring arm 67 is tensioned to maintain the cam follower 66 in engagement with the cam 46 at all times, and means in the form of a hook-shaped element 69 is provided for limiting the inward motion of the follower. The primary purpose of thus limiting the inward motion of the cam follower 66 is to facilitate the assembly of the breaker unit on the frame 1, since it is merely necessary to slightly bevel the end of the cam 46 as indicated at 71 to insure that the cam follower does not interfere with the assembly operation by abutting on the end of the cam.

It will be particularly noted that the common anchorage of the breaker arm 61 and the cam follower 66 at 62 prevents any sliding action taking place between the portion 68 of the cam follower 66 and said spring arm during the actuation of the spring arm by the cam follower. This prevents wear at this point and correspondingly increases the life of the parts.

Means are provided for insuring efficient and continuous lubrication of the bearing surfaces of the cam 46 and cam follower 66 in the form of an oil wick 72 fixed to the back of the cam follower 66 as by means of the rivets 73 which hold the cam follower on the spring arm 67, suitable spacing thimbles 74 around the rivets where they traverse the wick 72 being provided to prevent undue compression of the wick at these points. The cam follower 66 is provided with an opening 75 therethrough adjacent its bearing surface, and the wick 72 is preferably compressed into the space at the rear of this opening so as to furnish a supply of lubricant through said opening. The wick may if desired be extended as indicated at 76 to the bottom portion of the carrier 49 in order to pick up lubricant therefrom.

The fixed contact 55 is readily adjustable longitudinally by loosening the studs 57 and placing an instrument such as a screw driver with its point in one or the other of the depressions 77 or 78 in the carrier 49 adjacent the ends of the bracket 56, and using such instrument as a lever to slide the bracket. Adjustment of the contact 55 axially of the rotor in order to line it up with the contact 59 may be effected by the use of shims beneath the bracket 63. The contact 59 is adjustable laterally with respect to the contact 55 to secure accurate alinement thereof forming the opening for one of the studs 64 in the bracket 63 larger than necessary so that the bracket may pivot around the other stud 64 to secure such adjustment.

It will be noted that the cam 46 and contacts 55 and 59 all extend axially beyond the carrier 49 whereby observation and adjustment of the contacts when the magneto is mounted in a confined position are greatly facilitated.

A suitable cover 79 (Fig. 2) is provided for sealing the breaker mechanism, and is preferably attached to the carrier 49 by readily detachable means such as the knurled studs 81.

The frame 1, which is of non-magnetic material, has formed therein a pair of stationary magnetic pole pieces arranged to cooperate with the pole pieces 45 of the rotor and extend upwardly as indicated at 82, terminating in flat surfaces 83. The magnetic circuit is completed by a laminated core 84 extending between the pole pieces 82 and having flat surfaces 85 maintained in engagement with the surfaces 83 of the pole pieces by suitable clamping means such as indicated at 86.

An induction coil indicated generally by nu-

meral 87 is mounted on the core 84, one terminal of the primary thereof being grounded, and the other terminal being brought out to a flexible connector 88 arranged to project through an opening 89 in the frame and bear against the conductor element 58 on the back of the carrier 49. This terminal of the primary is also connected to a flexible contactor 91 arranged to engage with an insulated binding post 92 which is connected by means of a lead not shown to a grounding switch for rendering the magneto inoperative to stop the engine. One terminal of the secondary is grounded and the opposite terminal of the secondary brought out to a terminal 93 which is arranged in juxtaposition to the connector 31 on the distributor 22 whereby secondary current is supplied to the distributor electrode 26 for transmission through the conductors 33 and 34 to the spark plugs of the engine. It will be understood that the breaker arm 61 is grounded at its anchorage 62 whereby when the contacts 55, 59 are closed the primary circuit will be completed but when said contacts are open the primary circuit is broken. A condenser 94 is connected between the second terminal of the primary and the ground whereby to bridge the breaker contacts.

In order to facilitate the proper timing of the magneto with respect to the engine, an index in the form of a pointer 95 is fixed inside the cover 3, and a second index in the form of a pointer 96 is mounted on the distributor gear 13 in position to almost touch the point of the index 95 when rotated into juxtaposition thereto. The magneto is adjusted internally so that when these indices are in juxtaposition the contacts of the fully advanced breaker are just disengaging, and one of the terminal projections of electrode 26 is in the correct position to spark No. 1 cylinder of the engine.

To time the magneto to the engine, the engine crank shaft is rotated until cylinder No. 1 is in the correct firing position at full advance. The magneto is then simply coupled to the engine with the two indices in juxtaposition. This eliminates the necessity of timing to the disengaging point of the contacts. It will be noted that these indices although within the casing are readily observable by merely removing the terminal block 4 so as to permit setting the magneto by means of its adjustable connection with the engine.

It will be noted that since the cam follower 66 always remains in engagement with the cam 46, the time of breaking of contacts 55 and 59 may be adjusted by sliding the bracket 56 back and forth irrespective of the maximum opening of said contacts or of any pitting thereof. This forms a secondary timing adjustment for the magneto. In order to adjust the timing in accordance with the running conditions of the engine, an arm 97 (Fig. 5) is adjustably clamped as indicated at 98 to the carrier 49 and is adapted to be operated by a suitable linkage to rotate the carrier in order to advance or retard the time of the breaking of the contacts. This forms a tertiary timing adjustment.

It may under certain circumstances be desirable to restrict this tertiary adjustment to a fixed amount, and for this purpose an arcuate member 99 (Fig. 6) is adjustably mounted on the back of the carrier 49 as by means of studs 101 which engage in a slot 102 in said arcuate member. The ends of the arcuate member 99 are formed to engage the anchoring studs 53 to limit the rotary adjustment of the carrier. A scale 103 is preferably provided on the arcuate member in conjunction with a pointer 104 on the carrier to indicate the maximum rotary adjustment allowed by any particular position of the arcuate member 99.

In the operation of this device, the rotor shaft 11 is driven from the engine whereby the pole pieces 45 of the rotor cause an oscillation of magnetic flux through the stationary portions of the magnetic circuit including the core 84 of the coil 87. These oscillations induce a current in the primary of the coil, the circuit of which is completed through the flexible connector 88 and the breaker mechanism to the ground. When the cam 46 is rotated sufficiently to open the breaker contacts 55 and 59 the primary circuit is interrupted, and a high tension current is thereby induced in the secondary of the coil. This current is led from the high tension terminal 93 through the conductor 26 in the rotor 22 to the electrode 33 in the terminal block 4 adjacent thereto and from thence through the usual high tension cable, not illustrated, to the corresponding spark plug of the engine. It will be understood that the timing of the cam 46 and the distributor rotor 42 is such as to cause the spark to occur at the proper time for the particular operating condition of the engine.

To secure proper timing of the magneto to the engine, the crankshaft of the latter is rotated as above set forth to the full advance firing position for cylinder No. 1. The magneto drive shaft is then rotated until the index 96 is in juxtaposition to the index 95. In this relation the magneto shaft is coupled to the engine driving shaft.

Adjustment of the spark timing during the running of the engine may be accomplished in the usual manner by rotating the breaker mechanism by means of the arm 97 to suitably retard or advance the spark. This eliminates the necessity of observing the disengaging point of the breaker contacts since they have previously been adjusted to be just disengaging when the two indices are in juxtaposition.

Although an embodiment of the invention has been illustrated which comprises certain detailed structural features, it will be understood that the structural details are not necessarily exclusive and that changes may be made in the dimensions and arrangements of the parts without departing from the spirit of the invention as defined in the claims appended hereto.

What is claimed is:

1. In an ignition magneto, a rotor comprising an axle shaft having spaced shoulders thereon, an end plate mounted on said axle in abutting relation to one shoulder, a second end plate mounted on the axle, a plurality of spaced bar magnets between said end plates, magnetic pole pieces mounted on said magnets, said second end plate having a lip swedged down into engagement with the second shoulder to clamp the magnets rigidly between said plates, and a non-magnetic filler and binder moulded around said axle and magnets and against said pole pieces to form a solid rotor.

2. In a magneto, a frame, a permanently magnetized rotor including an axle shaft journalled in said frame, a breaker cam fixed on the end of said axle to project beyond the frame, a breaker assembly unit rotatably and detachably mounted in the frame in position to be operated by said cam, said breaker including a cup-shaped mount-

ing element and a pair of contacts arranged to project axially beyond the frame and beyond the rim of the mounting element.

3. In a magneto, a frame, a permanently magnetized rotor including an axle shaft journaled in said frame, a breaker cam fixed on the end of said axle to project beyond the frame, a breaker assembly unit rotatably and detachably mounted in the frame in position to be operated by said cam, said breaker including a fixed contact, a movable contact, a swinging arm carrying said movable contact, a cam follower arranged to bear on said cam, and means operated by the cam follower to engage the arm and open the contacts, said arm and cam follower being arranged to swing about a substantially common anchorage point.

4. In a magneto, a frame, a rotor journalled therein and provided with a cam extending axially therefrom and a breaker assembly including a cam follower and a breaker arm both yieldably urged toward said cam, a fixed contact limiting such motion of the breaker arm and a lost motion connection between the cam follower and contact arm to limit such motion of the cam follower.

5. In a magneto, a frame, a rotor journalled therein and provided with a cam extending axially therefrom, a breaker assembly including a cam follower and breaker arm and a carrier therefor mounted for rotary adjustment about said cam to vary the angular relation of the cam and follower and adjustable means for limiting the angular movement of the carrier.

6. In a magneto, a frame, a rotor journalled therein and provided with a cam extending axially therefrom, a breaker assembly including a cam follower and breaker arm and a carrier therefor mounted for rotary adjustment about said cam to vary the angular relation of the cam and follower, detachable means for retaining the carrier on the frame including anchoring means rigid with said frame and an adjustable element on said carrier adapted to engage said anchoring means and limit the angular movement of the carrier.

7. In an ignition magneto for internal combustion engines, a frame, a rotor journalled therein, adjustable means for driving said rotor in synchronism with an internal combustion engine, a distributor block mounted in an opening in said frame a fixed index in said frame and an index geared to said rotor cooperating with the fixed index to indicate a zero position of the rotor said indices being so arranged as to be readily observable through the opening for said distributor block.

8. In an ignition magneto for internal combustion engines, a frame, a rotor journalled therein, adjustable means for driving said rotor in synchronism with an internal combustion engine, a distributor block mounted in an opening in said frame, a fixed index in said frame, and an index geared to said rotor cooperating with the fixed index to indicate a zero position of the rotor in combination with a breaker asembly including a pair of breaker points and means for operating said points from said rotor, said points being laterally adjustable to provide a secondary timing adjustment thereof with respect to the engine, and said breaker assembly being rotarily adjustable to provide a tertiary timing adjustment of the breaker points.

9. An ignition magneto comprising a permanently magnetized rotor, a stator including means to complete a magnetic circuit for the rotor magnets and primary and secondary coils in inductive relation to said magnetic circuit, a distributor for the secondary current including a rotary commutator driven in timed relation with said rotor, a casing completely inclosing all said parts, cooperating means on said commutator and casing for indicating a zero angular position of the rotor, and a fixed distributor block forming a closure for said casing, said indicating means being arranged to be rendered easily visible upon removal of said distributor block.

10. In a magneto, a rotor comprising an integral axle shaft having a shoulder thereon adjacent one end thereof, an end plate on said shaft having a hub formed against the shoulder, said shaft having adjacent the other end thereof, a second shoulder with a groove adjacent thereto, a second end plate mounted on said shaft adjacent the second shoulder, bar magnets held by and between said plates, said second plate having a hub so forced into engagement with the second shoulder as to form a lip entering said groove and thereby to clamp the magnets between the end plates.

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