July 19, 1927. 1,636,017

W. F. SMITH

MAGNETO

Filed Dec. 5, 1924 3 Sheets-Sheet 1

Fig. 1.

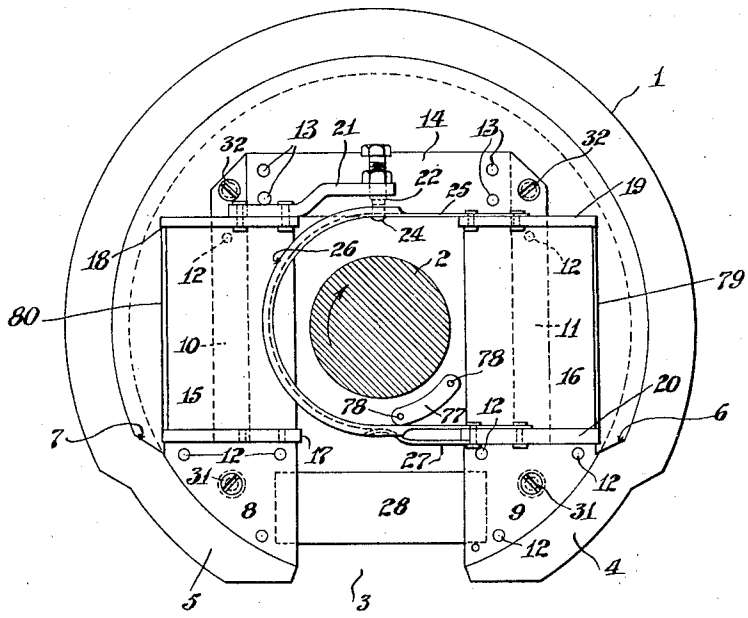
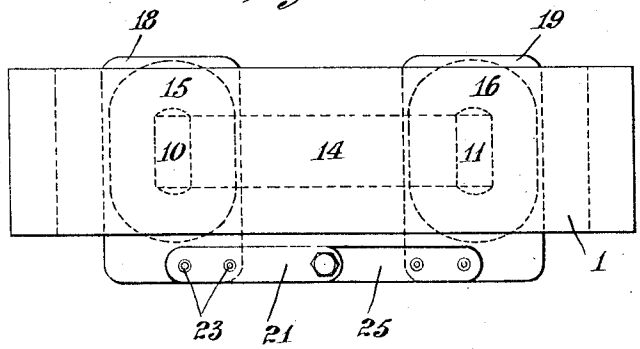


Fig. 2.



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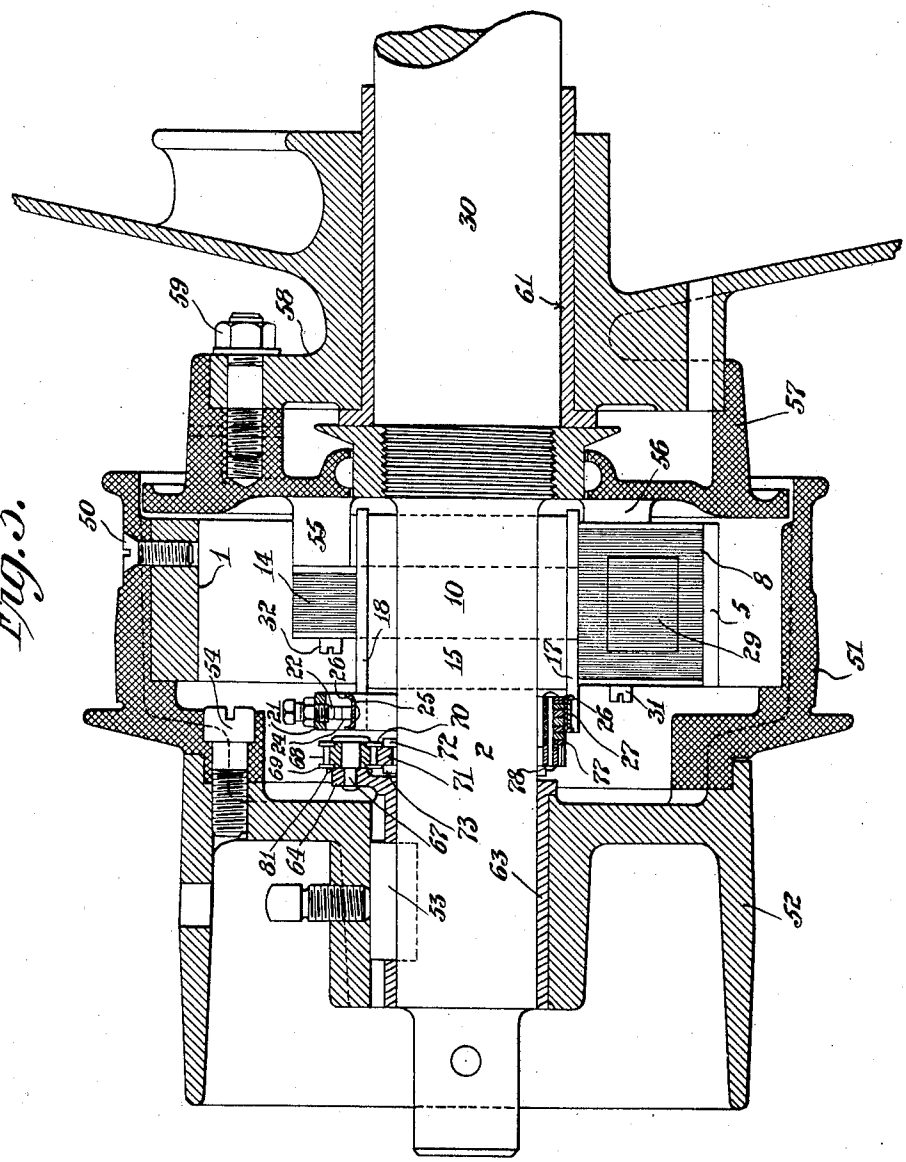
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Fig. 3.



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Fig. 4.

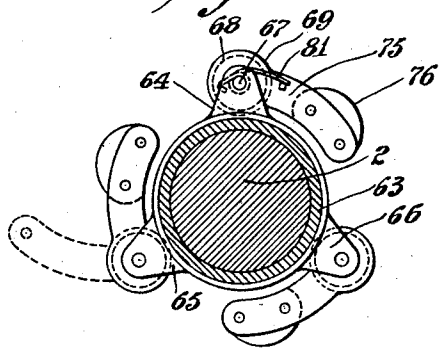


Fig. 5.

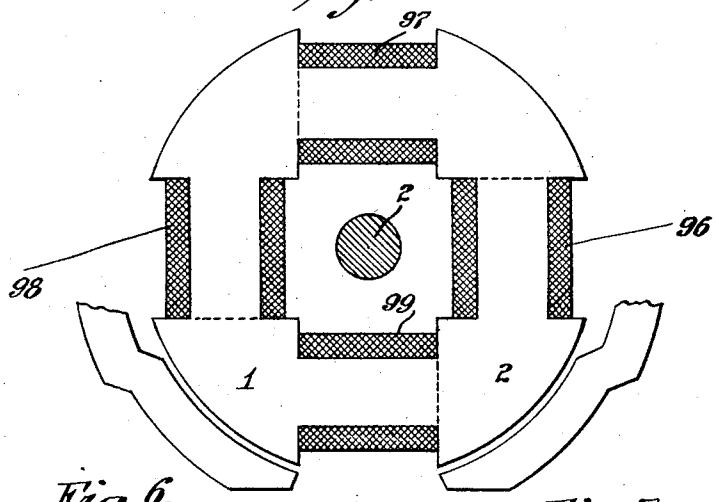


Fig. 6.

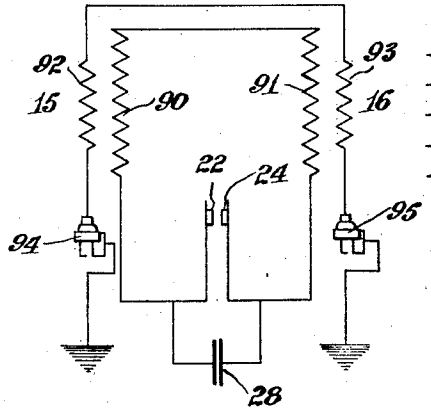
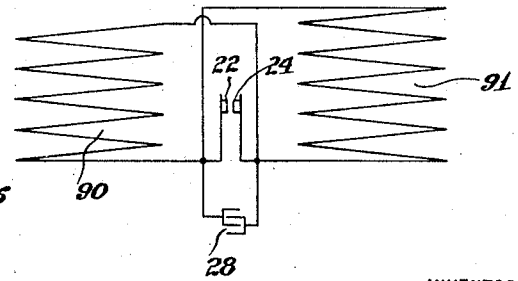


Fig. 7.



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UNITED STATES PATENT OFFICE.

WILLIAM F. SMITH, OF POUGHKEEPSIE, NEW YORK, ASSIGNOR OF ONE-HALF TO HERMAN A. SCHATZ, OF POUGHKEEPSIE, NEW YORK.

MAGNETO.

Application filed December 5, 1924. Serial No. 754,114.

This invention relates to improvements in magneto-electric generators adapted for a variety of uses, though more particularly constructed to be employed in conjunction with internal combustion engines.

The purpose of the present invention is to provide a magneto of compact and sturdy construction and adapted to operate as an efficient ignition apparatus for internal combustion engines. The various features of the invention have to do with the construction of the magnet and armature structures and their mounting on a crank-shaft extension of an internal combustion engine, an improved automatic ignition timing means, and other features described in the following detailed description and the appended claims. The invention is disclosed as applied to the crank-shaft of a single cylinder internal combustion engine and a tractor propelled by it described and claimed in my copending applications, Serial Nos. 722,580 and 715,338, filed June 26, 1924 and May 23, 1924, respectively. It will be obvious, however, to those skilled in the art that the various features of the invention are capable of a wide variety of different uses without departing from its spirit.

The preferred embodiment of the invention is illustrated in the drawings in which Fig. 1 is a plan view of the magneto structure; Fig. 2 is a sectional view along lines 2—2 of Fig. 1; Fig. 3 illustrates in vertical cross-section the magneto mounted on an extension of the crank-shaft of an internal combusiton engine; Fig. 4 is an enlarged view of the spark advance controlling mechanism; Fig. 5 illustrates in plan view a modified structure; and Figs. 6 and 7 are illustrations of two circuit diagrams adapted for use in conjunction with the magneto.

Referring now to Figs. 1 and 2 of the drawings, a substantially circular permanent magnet 1 mounted on an extension 2 of the crank-shaft is arranged to rotate therewith in the direction of the arrow. The ends of the permanent magnet 1 are separated by an air-gap 3, these ends being formed into polepieces 4 and 5. Instead of attaching separate polepieces to the permanent magnet 1, the ends of the magnet are upset at 6 and 7, raising the inner faces of the polepieces 4 and 5 into close proximity with pole heads 8 and 9 of the armature cores 10 and 11. The laminated pole heads 8 and 9 form a unitary structure with the cores which are built up of iron laminations in the form of stampings of a contour clearly illustrated in Fig. 1. The laminations are held together by means of rivets 12, and the upper ends of the core laminations are dove-tailed into the ends of a laminated yoke 14. The laminations of the yoke are riveted together at 13.

Coils 15 and 16, each comprising primary and secondary windings, surround the cores 10 and 11. The coils are provided with spool heads 17, 18 and 19, 20 of insulating material. A bracket 21 carrying an adjustable contact point 22 is riveted to the spool head 18 at 23. The contact 22 cooperates with contact 24 carried by a leaf spring 25, the two ends of which are riveted respectively, to the spool heads 19 and 20. The spring 25 has two upturned flanges 26 to give it rigidity, the spring being normally pressed with its contact 24 into engagement with the contact 22 by means of a leaf spring 27 riveted to the under side of the spool head 20. A condenser 28 is held between the pole heads 8 and 9 within recesses such as 29 provided by cutting away portions of some of the laminations that go to make up the pole heads 8 and 9.

Referring now to Fig. 3, the manner in which the magneto is mounted on an extension 2 of the crank-shaft 30 of an internal combustion engine will be explained. The permanent magnet 1 is held by means of screws like 50 against a casting 51 of aluminum or other non-magnetic material which in turn is secured by means of screws like 54 to a casting 52 keyed to the shaft 2 at 53. The castings 51 and 52 (the outside surface of the latter serving as a belt-drive) rotate therefore with the shaft 2. The armature core is fastened by means of screws 31 and 32 into bushings 55 and 56 projecting from a casting 57 of non-magnetic material. The screws project through the pole heads 8 and 9 and the ends of yoke 14. The casting 57 is rigidly held against the crank-shaft casing 58 by means of bolts like 59. The casing 58 is stationary with respect to shaft 30 which is free to rotate within a sleeve bearing 61 provided in the casing. It should be noted in this connection that the whole magneto structure is made accessible for inspection or repair simply by removing casting 52 without dismantling the internal combustion engine.

The key 53 serves also to fasten to the

shaft 2 a sleeve 63 from the end of which project three brackets 64, 65 and 66 (see Fig. 4). Each bracket carries a pin 67 on which is mounted between two guides 69 and 70 a pinion 68. The guides project beyond the teeth of the pinions 68 and hold against lateral displacement a gear 71 provided around the shaft 2. The gear 71 is provided with shoulders 72 and 73 against which the ends of the guides 69 and 70 abut. There is a clearance between the shaft 2 and the gear 71 and the latter is supported only by the three pinions 68 intermeshing therewith. Each guard of the pinions 68 is provided with an arm 75, and a weight 76 is carried between the ends of each pair of arms. A cam 77, built up of fibre or other insulating laminations and adapted to engage the spring 25 is fastened to the gear 71 by means of rivets 78.

During the rotation of the shaft 2 the casting 51 is caused to rotate with the permanent magnet 1, the polepieces 4 and 5 of which, in passing by the pole heads 8 and 9 of the armature cause, in the well-known manner, the magnetic flux to pass through the core 10, 11 and yoke 14, and this in turn results in the generation of alternating current fluctuations in the secondary windings, and by induction, with primary windings of coils 15 and 16. The pole pieces 4 and 5 are so dimensioned that they span the gap 3 between the pole heads 8 and 9, whereby the magnetic flux is short-circuited twice during each revolution of the permanent magnet 1. Inasmuch as the electrical characteristics of such magneto structures are well known in the art, their description will be dispensed with. It should be noted, however, that owing to the type of magnet structure used, losses which result from interruptions in the magnetic circuit when separate polepieces are fastened to the ends of the permanent magnet are entirely avoided by forming the polepieces 4 and 5 homogeneously with the magnet 1. The magnet 1 and the armature structure being rigidly mounted on heavy castings, the maintenance of a very narrow air-gap between the polepieces and the pole heads is insured. In order to prevent the setting up of an opposing flux through the cores 10 and 11 when one polepiece of the permanent magnet 1 passes by a pole head and the other polepiece by the upper end of the core (see Fig. 1 in which the path of the polepieces is indicated in a dotted circle), iron shields 79 and 80 are provided. These shields are in the form of strips, the ends of which are fastened to the spool heads 17, 18 and 19, 20, respectively, and serve to afford a shunt path for the magnetic flux when the polepieces 4 and 5 pass near the ends of such shields.

The sleeve 63 being also rotated with the shaft 2 will drive the gear 71, through the agency of the three pinions 68, at the same rate of speed as the shaft is rotated, and each time that the cam 77 engages the spring 25 at or near the point where it is pressed upward by the leaf spring 27, it will force these springs down, causing the opening of the primary circuit in contacts 22 and 24.

The arms 75 are normally held down by means of springs 81 wound around the heads of the brackets 64, 65 and 66 and having their ends attached to the arms 75 and brackets 64, 65 and 66, respectively. When the speed of rotation of shaft 2 is increased then owing to the centrifugal action of the weight 76, the arms 75 will be moved into or towards the positions indicated in dotted lines in Fig. 4. Such movement of an arm 75 will cause the associated pinion 68 to rotate, which movement is transmitted to the gear 71. The gear 71 is thus caused to advance in addition to the above described rotary motion normally imparted by the pinions, whereby the cam 77 will engage the spring 25 at a point to the left of the one indicated in Fig. 1. Depending, therefore, on the speed at which the shaft 2 is rotated, i. e., on the speed of the internal combustion engine the opening of the primary circuit is automatically timed to occur at more or less advanced positions of the crank-shaft and therefore of the piston or pistons carried by this shaft.

The automatic spark advance arrangement is provided in a manner to make possible a simple and compact arrangement. The gear 71 being out of contact with shaft 2, oiling of the parts which would detrimentally affect the electrical contacts is avoided. Furthermore, the predetermined setting of gear 71 and the pinions 68 is not disturbed by wear, as would be the case if some solid coupling were provided between the shaft and the gear. Another important feature of this arrangement consists in that the relative adjustments of the armature and magnet are not interfered with by its operation.

The electrical circuit connections may be provided in any one of a plurality of suitable combinations. Fig. 6 illustrates a circuit in which the primary coils 90, 91 are connected in series with the interrupter springs 22, 24, the latter being shunted by means of condenser 28 to eliminate sparking. The secondary coils 92, 93 are also connected in series and each with one electrode of spark plugs 94 and 95 the other electrodes of these plugs being grounded.

In the circuit diagram illustrated in Fig. 7, the primary coils 90 and 91 are connected in parallel with each other and with the contacts 22 and 24.

Fig. 5 illustrates the manner in which four coils 96, 97, 98 and 99 may be mounted in the structure herein disclosed, the dotted lines indicating where the cores and pole

heads of adjacent coils come in contact with each other.

What I claim is:

1. In a magneto, a shaft, means for rotating said shaft at varying speeds, a magnet carried by said shaft, a stationary armature, contacts in the armature circuit, and means comprising a gear and pinion responsive to the speed at which said shaft rotates for opening said contacts in different rotary positions of said shaft.

2. In a magneto, a shaft, means for rotating said shaft at varying speeds, a stationary armature, contacts in the armature circuit, a gear rotating at the speed of said shaft but free to revolve with respect thereto, a cam carried by said gear for opening said contacts, and means responsive to the speed at which said shaft rotates for causing said gear to revolve independently of said shaft.

3. In a magneto, a shaft, means for rotating said shaft at varying speeds, a stationary armature, contacts in the armature circuit, a pinion carried by said shaft and revolving therewith, means responsive to the speed of said shaft for rotating said pinion relative to said shaft, a gear intermeshing with said pinion, and a cam carried by said gear for actuating said contacts.

4. In a magneto, a shaft, means for rotating said shaft at varying speeds, a stationary armature, contacts in the armature circuit, a rotating element, a cam carried thereby for actuating said contacts, another element fastened to said shaft and in operative contact with said rotating element, and means responsive to the speed of said shaft for rotating said other element to displace said rotating element.

5. In a magneto, a rotating shaft, a magnet carried thereby, an armature including a primary and a secondary winding, contacts in the circuit of said primary winding three pinions fastened to said shaft, a gear supported by and intermeshing with said pinions, and means carried by said gear for actuating said contacts.

6. In a magneto, a rotating shaft, a substantially circular permanent magnet surrounding said shaft and carried thereby, a stationary armature including a primary and a secondary winding surrounded by said magnet, contacts in the circuit of said primary winding, a sleeve fastened to said shaft, three brackets radially projecting from said sleeve, a pinion carried by each bracket, two guard plates of larger diameter than said pinions mounted on each pinion, eccentric weights carried by said guard plates, springs normally forcing said weights towards said shaft, a gear provided with lateral shoulders surrounding said shaft but free thereof, the teeth of said gear being in mesh with the teeth of said three pinions and said gear being held against lateral and vertical displacements by the edges of the guard plates engaging the shoulders on said gear, a leaf spring bent in a semi-circle and held at both ends carrying one of said contacts, and a cam fastened to said gear and adapted to engage said spring at any one of a plurality of points to cause the separating of said contacts.

7. In a magneto, an operating shaft, means for rotating said shaft at varying speeds, an armature circuit, contacts in said circuit, a cam arranged to open said contacts during each revolution of said shaft, and means comprising a gear and pinion responsive to the speed at which said shaft rotates for causing said cam to actuate said contacts in varying angular positions of said shaft.

8. In a magneto, a magnet, an armature comprising a core and a coil mounted thereon, insulating spool heads for said coil, a contact in the armature circuit, and a spring carrying said contact fastened with its two ends to said spool heads.

9. In a magneto, a magnet, an armature comprising two coils, spool heads for said coils, two cooperating contacts in the armature circuit, a bent leaf spring carrying one of said contacts fastened with its two ends to two spool heads, and a bracket carrying the other contact fastened to another spool head.

10. In a magneto, a substantially circular permanent magnet the ends of which are upset to form polepieces, a laminated armature core having laminated pole heads in close proximity to said polepieces, two coils each comprising a primary and a secondary winding mounted on said core, spool heads of insulating material for said coils, a leaf spring bent in a semi-circle and having its ends riveted to the spool heads of one of said coils, a contact point carried by said leaf spring, an adjustable contact point cooperating with said first mentioned contact and mounted on a spool head of the other coil, and a cam for actuating said leaf spring.

11. In a magneto, a shaft, a magnet carried thereby, an armature comprising two cores straddling said shaft and surrounded by said magnet, contacts in the armature circuit, a spring carrying one of said contacts partially encircling said shaft, and a cam between said shaft and spring for actuating the latter.

12. In a magneto, a shaft, a magnet carried thereby, an armature comprising two cores straddling said shaft and surrounded by said magnet, contacts in the armature circuit, a leaf spring carrying one of said contacts and partially encircling said shaft beyond the plane of said magnet, a cam between said shaft and spring for actuating

the latter, and means for causing said cam to rotate around said shaft.

13. In a magneto, a substantially circular permanent magnet the ends of which are upset to form polepieces separated from each other, two laminated cores parallel with each other, a laminated yoke interconnecting the cores at one end, laminated pole heads on the other ends of said cores and projecting in close proximity to said polepieces, the distance between said pole heads being such that they may be spanned by a polepiece, a coil on each core comprising a primary and a secondary winding, spool heads of insulating material for said coils, a magnetic shield for each core mounted on the spool heads of the associated coil, a leaf spring bent in a semi-circle and having its ends riveted to the spool heads of one of said coils, a contact point in circuit with said primary windings carried by said spring, an adjustable contact point cooperating with said first mentioned contact, a bracket carrying said adjustable contact fastened to one of the spool heads of the other coil, and a cam for actuating said spring.

14. In a magneto, a rotating shaft, a casing through which said shaft projects, a non-magnetic casting fastened to said casing, two parallel armature cores straddling said shaft mounted on said casting, a second non-magnetic casting overlapping said first mentioned casting and fastened to said shaft, and a permanent magnet attached to said second casting.

15. In a magneto, a magnet, an armature core, a pole head for said core, a recess in said pole head, and a condenser held in said recess.

16. In a magneto, a magnet having two polepieces, an armature comprising two pole heads cooperating with said polepieces, and a condenser held between said pole heads.

17. In a magneto, a magnet having polepieces, an armature comprising two opposite pole heads cooperating with said polepieces, recesses in opposite faces of said pole heads, and a condenser fitted with its two ends in said recesses.

18. In a magneto, a rotating shaft, a casing through which said shaft projects, a disc of non-magnetic material mounted on said casing, armature core mounted on said disc, a second disc of non-magnetic material overlapping said first mentioned disc and fastened to said shaft, and a permanent magnet attached to said second disc.

In testimony whereof, I have signed my name to this specification this 3rd day of December 1924.

WILLIAM F. SMITH.