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2,447,727

FLYWHEEL MAGNETO

Filed Sept. 21, 1945

2 Sheets-Sheet 1

Fig. 1.

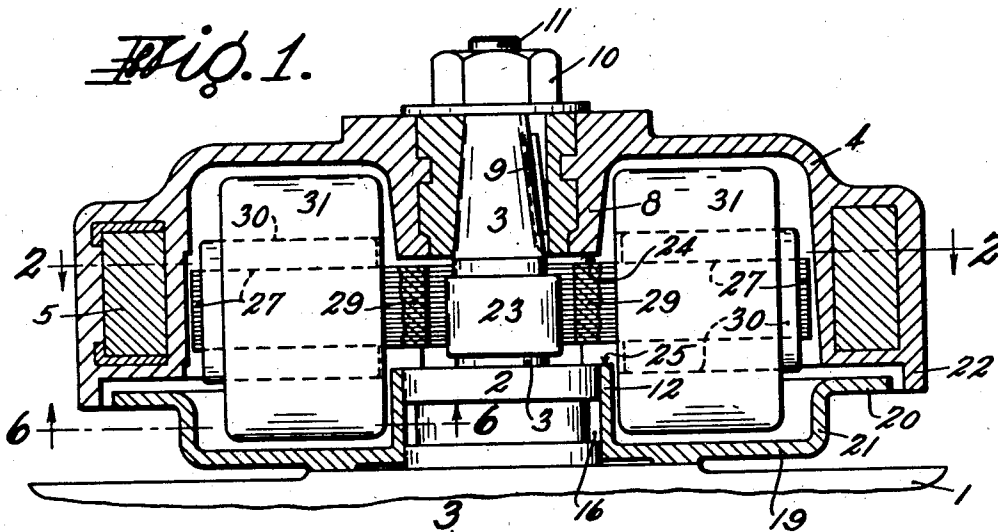
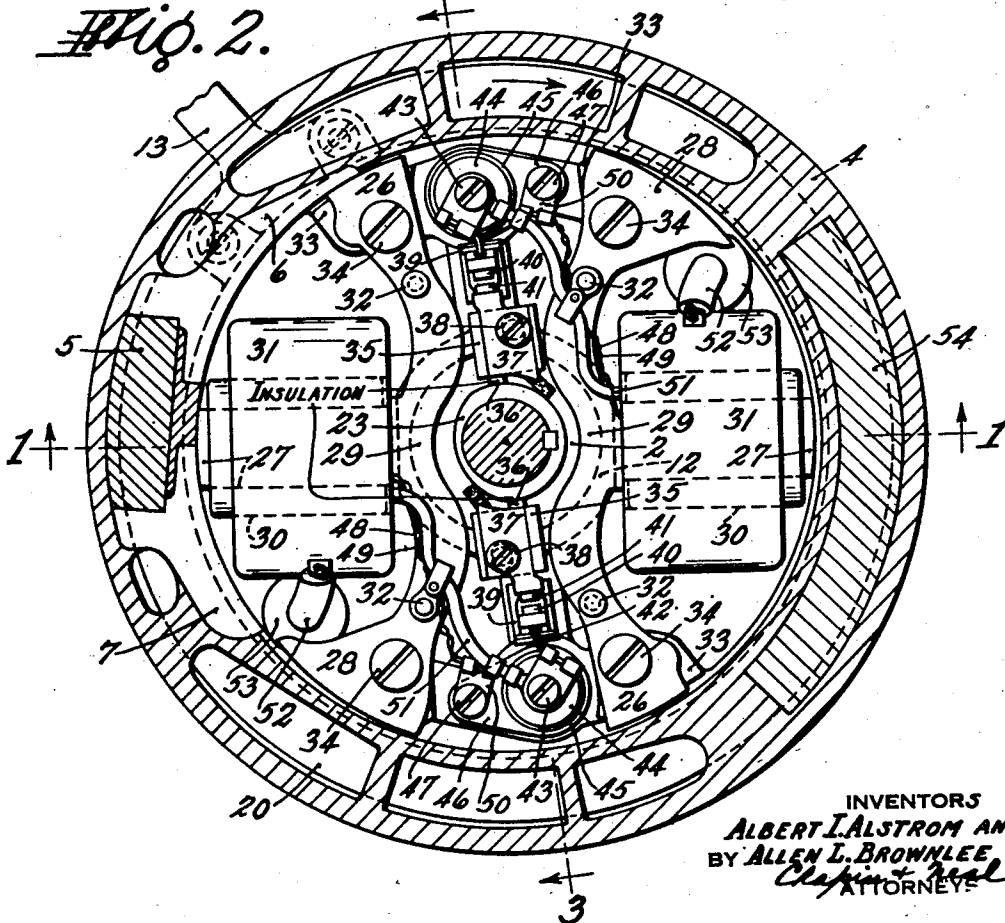


Fig. 2.



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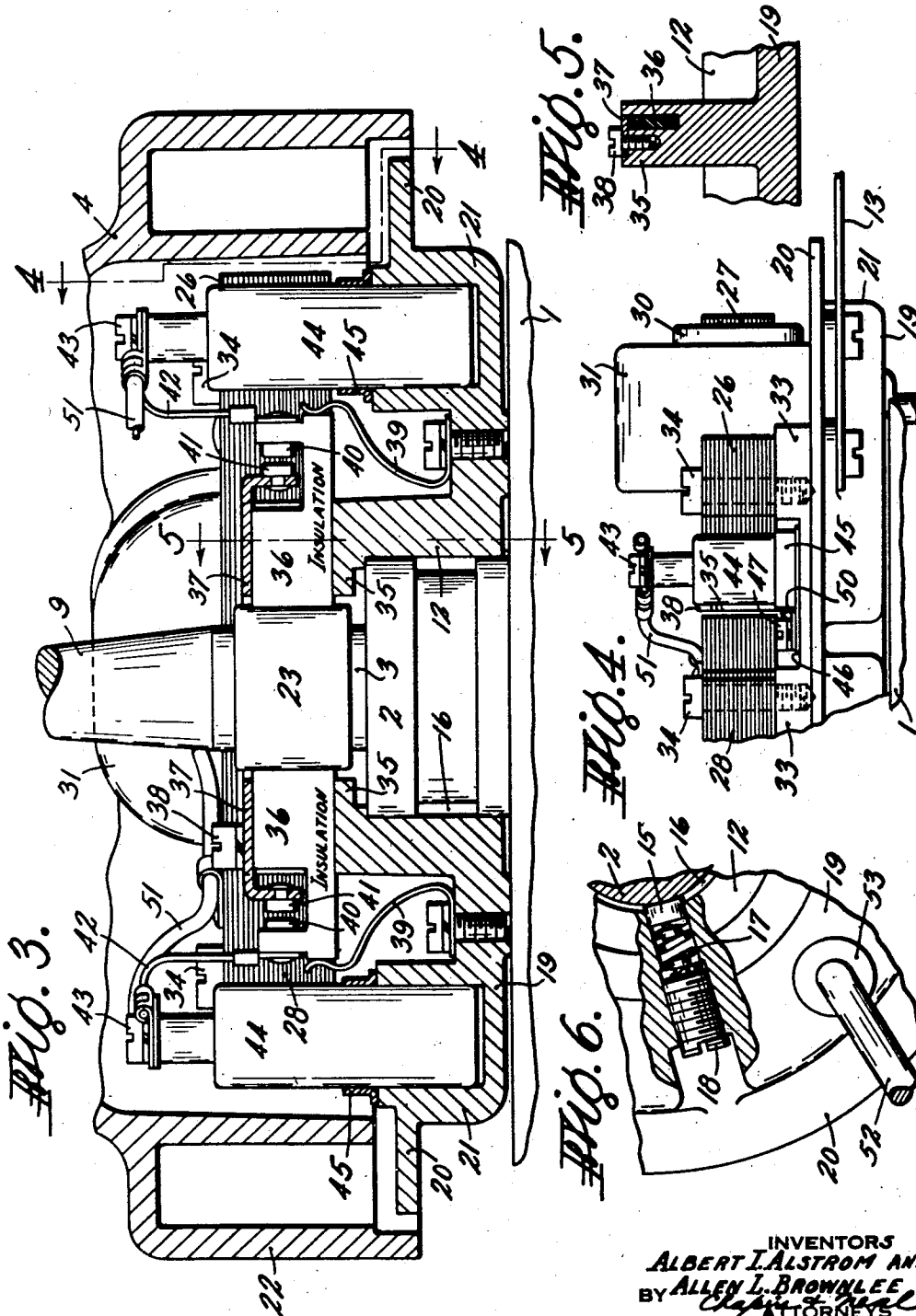
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FLYWHEEL MAGNETO

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5 Claims. (Cl. 171-209)

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This invention relates generally to improvements in flywheel magnetos. More particularly, the invention is concerned with improvements in the stator element of a magneto of the type in which the field magnet is carried by the flywheel and two or more coil-bearing core structures are carried by the stator plate.

Magnetos of this type are commonly used with the relatively small internal combustion engines which serve as outboard motors for boats. In some cases, such engines are of the two-cylinder, two-cycle, alternately-firing type and it is desirable that the magneto for such an engine should have two separate ignition units—that is two separate coil-bearing core structures—for cooperation with the magnetic rotor formed by the flywheel. In such a case, two breaker mechanisms and two condensers are required, one for each ignition unit. In other cases, one core structure may bear a low tension coil for generating lighting current, while the other core structure or structures may bear an ignition coil or coils. In every case, there will be at least two coil-bearing core structures and at least one breaker mechanism. The problem is to mount all the necessary elements on a stator plate, which is adapted for use with small flywheels (frequently no more than six and one half inches in diameter), without adding to the overall dimensions of the magneto so as to require changes in the flywheel.

This invention provides an improved arrangement of a plurality of coil-bearing core structures with one or more breaker mechanisms and condensers on a stator plate of a flywheel magneto, characterized in that each breaker point mechanism is located in a narrow radial gap between two adjacent core structures and between the adjacent end faces of the hubs of the flywheel and stator and in that each such mechanism has its breaker-point bearing members relatively reciprocable in a straight line path lengthwise of the gap in which it is mounted.

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

Fig. 1 is a full-size sectional elevational view of a flywheel magneto embodying the invention taken on the line 1—1 of Fig. 2;

Fig. 2 is a full-size sectional plan view thereof taken on the line 2—2 of Fig. 1;

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Fig. 3 is an enlarged cross sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a fragmentary full-size end view taken on the line 4—4 of Fig. 3;

Fig. 5 is a full-size fragmentary cross sectional view taken on the line 5—5 of Fig. 3; and

Fig. 6 is a fragmentary full-size sectional plan view taken on the line 6—6 of Fig. 1.

Referring to these drawings; there is shown at 1 in Fig. 1 a portion of the upper end of the crankcase of an internal combustion engine, such for example, as that used as an outboard motor for boats. The engine crankcase is provided with an external hub 2, through and beyond which one end of the engine crankshaft 3 extends. From this hub 2, the stator of the magneto is supported. The rotor of the magneto is the flywheel 4, which bears the permanent magnet 5, and its pole shoes 6 and 7 (Fig. 2). The flywheel has an internal hub 8, which is keyed to the tapered end 9 of the crankshaft and held axially in place thereon by a nut 10 screwed onto the threaded outer end 11 of the crankshaft.

The stator of the magneto is mounted on a so-called stator plate which has a central hollow hub 12. This hub telescopes over the crankcase hub 2 and closely fits the same to support the stator, and particularly its pole pieces, in true coaxial relation with the crankshaft 3. The hub 12 is, however, capable of being turned on the hub, as by an arm 13 (shown in part in Figs. 2 and 4) fixed to the stator plate for the purpose of advancing or retarding the spark in the usual manner. The hub 12 is held in the various positions to which it may be moved by arm 13, by means of a leather plug 15 (Fig. 6) which is mounted for radial sliding movement in the stator plate and is pressed inwardly against the bottom of an annular groove 16 in the crankcase hub 2 by means of a spring 17, which is adjustable by means of a screw 18 threaded into the outer end of the hole in which the plug and spring are mounted. The engagement of the plug 15 in groove 16 is such as to hold the stator plate 45 against axial displacement. The stator plate, in the particular form illustrated, includes a bottom wall 19 (Figs. 1 and 3), which lies substantially flush with the bottom face of hub 12, an annular flange 20, and a connecting wall 21. The circular rim of flange 20 cooperates with the rim 22 of the

flywheel 4 to complete an enclosure for the magneto parts. The bottom wall 19 is offset from flange 20 to provide space for the generating coils to be described and, in this case, the hub 12 is an internal one. However, where, as is sometimes the case, the generating coils can protrude through the bottom wall of the stator plate this wall may be raised, say to the level of flange 20, in which case hub 12 would be largely an external one.

The hubs 8 and 12 (Fig. 1) are space apart just about sufficiently to receive between them a cam 23, which actuates the breaker mechanisms to be described. This cam is suitably fixed to the crankshaft 3. It will be noted that the cam is substantially less in external diameter than either of the hubs 8 and 12. It would not be feasible to form the cam on the hub of the flywheel. For one reason, the hub would have to be made so small that it would not have the necessary strength. For another reason, the replacement of a worn cam would mean replacement of the entire flywheel. For all practical purposes, the cam must be located between the hubs 8 and 12 and this means that the breaker mechanisms, operated by the cam, must also be located between the two transverse planes which pass through the adjacent end faces 24 and 25 of the hubs 8 and 12 respectively.

The stator plate supports a plurality of core structures, in this case two, which are angularly spaced about hub 12. These core structures may vary considerably in form. As herein shown, each core structure includes three more or less radial legs 26, 27 and 28 (Fig. 2), the inner ends of which are interconnected as at 29. The outer ends of the legs 26 and 28 of each core structure form pole pieces for cooperation with the pole shoes 6 and 7, respectively, of the magnetic rotor. The intermediate leg 27 of each core structure bears suitable windings, in this case primary and secondary coils 30 and 31, respectively, since two high tension ignition units are desired. But in some cases one core structure might equally well bear a single low tension winding to be used for lighting purposes. Each core structure is made up of iron laminations, held together by rivets 32 and clamped to supporting pads 33 (Fig. 2) which project upwardly from the bottom wall 18 of the stator plate, by cap screws 34. The core structures are located between two transverse planes which pass through the end faces 24 and 25 (Fig. 1) of the hubs 8 and 12, respectively. The two core structures are located in opposed relation. The legs 26 and 28 and the connecting part 29 of each core structure are arranged in adjacent relation and are separated by narrow gaps which extend radially of the stator plate. The space between the central portions of the two parts 29 is substantially less than the diameter of either hub 8 or 12.

The space limitations are such as to preclude the use of the common type of breaker mechanism, that is the type having a pivoted bellcrank with the outer end of one arm carrying a breaker point and the outer end of the other arm riding on the cam. Such a breaker mechanism could not be used if located between the two transverse planes described and if otherwise located, it would mean an increase in the axial dimensions of the magneto which is undesired because it would force the flywheel to be located farther away from its bearing in hub 2 or if the cam were formed on the hub of the flywheel, then the disadvantages above set forth would be incurred.

To keep the breaker mechanisms within the limiting transverse planes, referred to, they are made of the reciprocating type and are located one in each of the above described narrow radial gaps and on opposite sides of shaft 3 and cam 23. In the present case, where both stators are used for ignition, two breakers are necessary but if one stator is used for a purpose which does not require a breaker mechanism, one of the mechanisms shown may of course be omitted.

The breaker mechanisms are mounted one in each of two supports 35 which are integral up-standing parts of hub 12 and are arranged at diametrically opposite points thereon. Since both breaker mechanisms are alike a description of one will suffice. The support 35 (Fig. 5) is grooved to slidably receive a plunger 36, which is retained in its groove by a member 37. Member 37 slidably fits in a groove in the top of support 35 and is held thereto by a screw 38 threaded into the support and passing through a slot (Fig. 2) in the member which allows the latter to be adjusted in the path of reciprocation of the plunger 36. The plunger reciprocates in a path radially of the axis of cam 23, and its inner end rides on the periphery of the latter. A flat spring 39 (Fig. 3) fixed at one end to wall 19 bears at its other end on the outer end of plunger 36 and tends to move it radially inward. The plunger is made of insulating material and carries near its outer end a breaker point 40 for cooperation with a breaker point 41 carried by the plunger-retaining member 37. As best shown in Fig. 3, the plunger near its outer end is notched to receive the down-turned and breaker-point-carrying end of the member 37 and the breaker point 40 is carried by the inner face of the outer wall of such recess. The breaker point 40 is connected by a flexible conductor 42 to the upper and insulated terminal 43 of a suitable condenser mounted in a cylindrical casing 44 which forms the other terminal of the condenser. The axis of this condenser parallels that of the shaft and both these axes are located in a vertical plane passing through the radial center line of the plunger 36. The lower end of the condenser sets into a socket (Fig. 3) in the stator plate. Intermediate the ends of casing 44 is fixed a metallic band 45, having fixed thereto an ear 46 which is secured to and grounded to the stator plate by a screw 47. The condenser is thus bridged across the breaker points in the usual way.

The remaining electrical connections will be described. These connections are the same for each stator unit so the connections for one unit only will be described. One terminal of the primary coil 30 and one terminal of the secondary coil 31 are connected to bare wires 48 and 49 (Fig. 2) which are twisted together and connected to a lug 50, held to the stator plate by the described screw 47. The other terminal of the primary coil 30 is connected by an insulated wire 51 to the condenser terminal 43. The other terminal of the secondary coil 31 is connected to an insulated wire 52 which passes out through the lower wall 19 of the stator plate through an insulator 53 and is adapted for connection to a spark plug of the engine.

The magnet 5 and laminated pole shoes 6 and 7 are constructed in the same general manner and held in place in the flywheel 4 in the same general way as disclosed in the patent to Harmon No. 2,101,392, dated December 7, 1937. This field magnet assembly is held in place by imbedding it in the non-magnetic metal of the

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flywheel during the process of casting the same. A counterweight 54 (Fig. 2) is mounted in the flywheel at a point diametrically opposite the field magnet assembly and is held in place in the same manner. The invention is not, however, limited to the use of this exact form of magnetic rotor although it is desirable. The invention, being more particularly concerned with the stator of the magneto and the relative locations of the core structures and breaker mechanisms, any suitable form of magnetic rotor may be used as desired.

The particular magneto illustrated being for a two-cylinder, two-cycle, alternately-firing small outboard motor, an ignition spark is produced by each ignition unit once each revolution, one spark serving one cylinder of the engine and the other spark serving the other cylinder. As the flywheel 4 revolves in the direction of the arrow, a magnetic circuit from the magnet 5 is established first in one direction through a core 27 and then in an opposite direction. The parts as shown in Fig. 2 are in the positions which they occupy just after the first-named magnetic circuit through the left hand core 27, and the coil unit thereon, has been broken and the second-named magnetic circuit has been established. The breaker points 40 and 41 for said coil unit separate at this time and the ignition spark is produced. Shortly before the flywheel reached the Fig. 2 position, the pole shoe 6 connected with the outer end of core 27 while the shoe 7 connected with the outer end of leg 28. A magnetic circuit from magnet 5 through core 27 and leg 28 was established. Then the breaker points were closed to hold the flux while the rotor turned further into position to connect the shoe 6 with leg 26 and the shoe 7 with core 27. The breaker points then open and a reversal of flux through core 27 ensues and the ignition spark is generated.

In the particular example shown herein, the pole shoe 6 is substantially greater in arcuate extent than the pole shoe 7 and the outer end of leg 28 is substantially greater in angular extent than the outer end of leg 26. This unsymmetrical arrangement of shoes and core ends is employed to prevent the occurrence of a spark at the wrong time while the breaker points are open. While this arrangement is desirable, important and preferred, it is nevertheless not essential to the present invention which is primarily concerned with the stator plate parts of the magneto.

The invention, in particular, provides an arrangement of parts on the stator plate that enables the use of a plurality of core structures with breaker mechanisms and condensers for each such structure, all mounted within the narrow space limits of diameter and axial length that are available inside a small flywheel of the kind described. The necessary additional parts are provided without relocation of the breaker cam and without increase in diameter of the flywheel or in the axial length of the same. The breaker mechanisms are entirely located between two planes passing through the adjacent end faces of the hubs 12 and 24, as is necessary if relocation of the cam is to be avoided. This is made possible by the use of breaker-point-bearing members which can be located in and which are reciprocable in a straight line path lengthwise of the narrow radial gaps between adjacent core structures. The compactness of the arrangement will best be appreciated from an inspection

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of Fig. 2 which shows all the parts full-size and in their closely packed relation.

It will also be noted that each of the breakers is readily accessible when the flywheel 4 is removed. The breaker points are completely exposed in such positions that the usual feeler gauge may be easily inserted between the points by the operator with one hand while with the other hand he moves the member 37, after screw 38 has been loosened, to engage the gauge and press it into engagement with breaker point 40. The entire breaker mechanism is readily accessible for inspection, adjustment, repair or replacement. Servicing of the breaker mechanisms is thus made simple, easy and convenient.

We claim:

1. In combination, a stator plate for a flywheel magneto, said plate having a hollow hub adapted to be mounted on that hub of an engine crankcase through and beyond which the engine crankshaft extends, a plurality of coil-bearing core structures fixed to said plate in angularly-spaced relation around the axis of said hub and separated one from another by narrow radial gaps, said core structures being located between two planes transverse to said axis one of which includes the outer end face of said hub and the other of which lies beyond said outer end face, and a breaker mechanism located between two adjacent core structures in one of said radial gaps, said mechanism including a plunger located between said planes and reciprocable in a straight line path lengthwise of said gap, a breaker point carried by said plunger, and a cooperating breaker point carried by said plate.

2. In combination, a stator plate for a flywheel magneto, said plate having a hollow hub adapted to be mounted on that hub of an engine crankcase through and beyond which the engine crankshaft extends, a plurality of coil-bearing core structures fixed to said plate in angularly-spaced relation around the axis of said hub and separated one from another by narrow radial gaps, said core structures being located between two planes transverse to said axis one of which includes the outer end face of said hub and the other of which lies beyond said outer end face, and a plurality of breaker mechanisms one for each core structure and located one in each of said radial gaps, each said mechanism including a plunger located between said planes and reciprocable in a straight line path lengthwise of its gap, a breaker point carried by said plunger, and a cooperating breaker point carried by said plate.

3. In combination, a stator plate for a flywheel magneto, said plate having a hollow hub adapted to be mounted on that hub of an engine crankcase through and beyond which the engine crankshaft extends, a plurality of coil-bearing core structures fixed to said plate in angularly-spaced relation around the axis of said hub and separated one from another by narrow radial gaps, said core structures being located between two planes transverse to said axis one of which includes the outer end face of said hub and the other of which lies beyond said outer end face, and a breaker mechanism located between two adjacent core structures in one of said radial gaps, said mechanism including a plunger located between said planes and reciprocable in a straight line path lengthwise of said gap, a breaker point carried by said plunger, and a condenser fixed to said plate and located radially beyond the last-named

breaker point with its long dimension parallel with the axis of said hub.

4. In combination, a stator plate for a flywheel magneto, said plate having a hollow hub adapted to be mounted on that hub of an engine crankcase through and beyond which the engine crankshaft extends, a plurality of coil-bearing core structures fixed to said plate in angularly-spaced relation around the axis of said hub and separated one from another by narrow radial gaps, less in width than the internal diameter of said hub, said core structures being located between two planes transverse to said axis one of which includes the outer end face of said hub and the other of which lies beyond said outer end face, and a breaker mechanism located between two adjacent core structures in one of said radial gaps, said mechanism including a plunger located between said planes and reciprocable in a straight line path lengthwise of said gap, a breaker point carried by said plunger, and a cooperating breaker point carried by said plate.

5. In combination, a stator plate for a flywheel magneto, said plate having a hollow hub adapted to be mounted on that hub of an engine crankcase through and beyond which the engine crankshaft extends, a pair of coil-bearing core structures fixed to said plate on opposite sides of the axis of said hub, each said structure including three legs interconnected at their inner ends and extending outwardly from said axis in angularly spaced relation and terminating with curved polar

surfaces coaxial with said hub, said core structures mounted in opposed relation with their inner walls in adjacent relation and separated by narrow radial gaps and the central parts of the inner portions separated by a distance less than the internal diameter of said hub, said core structures being located between two planes transverse to said axis one of which includes the outer end face of said hub and the other of which lies beyond said outer end face, and a breaker mechanism located between two adjacent core structures in one of said radial gaps, said mechanism including a plunger located between said planes and reciprocable in a straight line path lengthwise of said gap, a breaker point carried by said plunger, and a cooperating breaker point carried by said plate.

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