March 2, 1943. W. E. SCHWARZMANN ET AL 2,312,447

MULTICYLINDER MAGNETO

Filed March 3, 1942 2 Sheets-Sheet 1

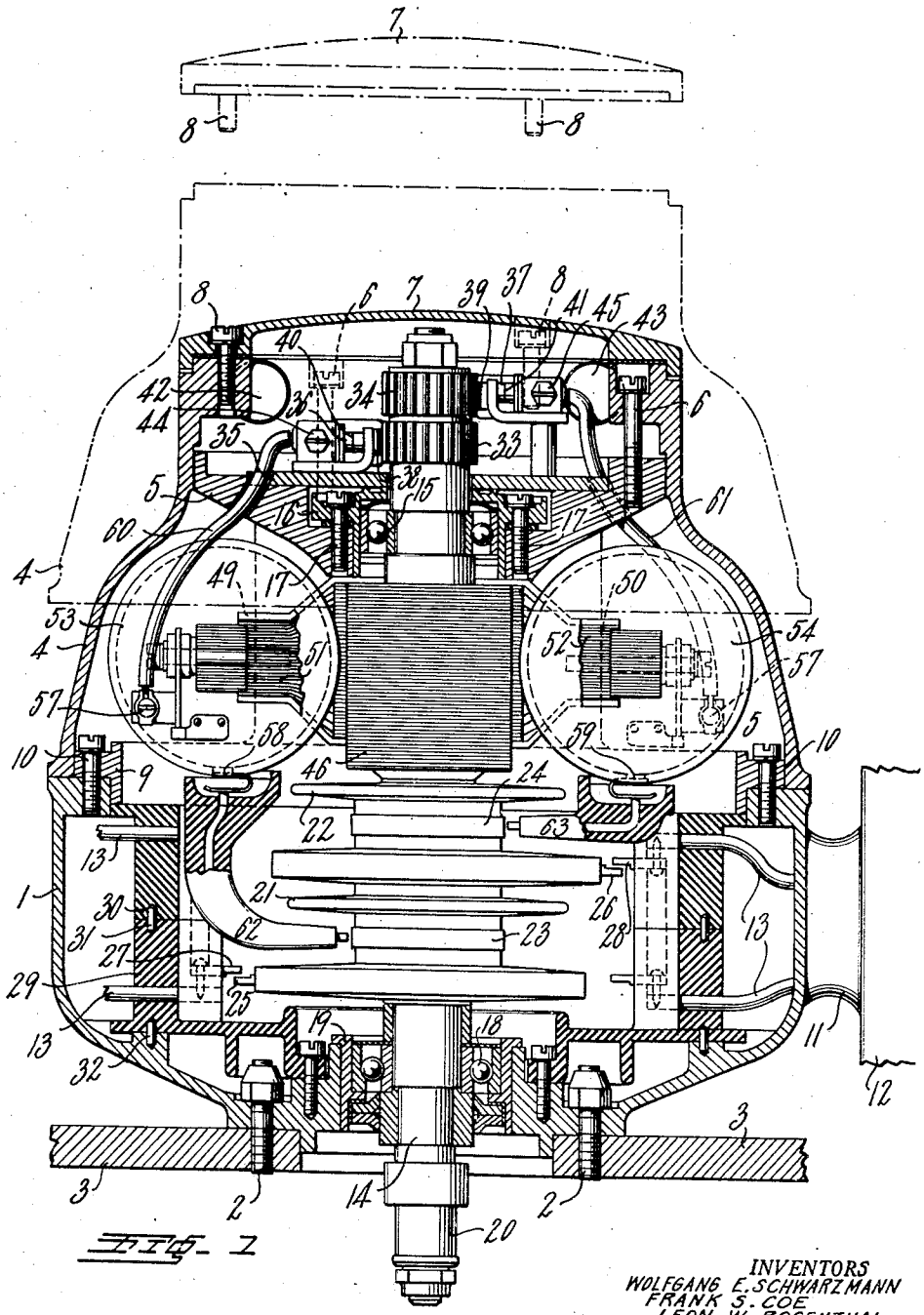


FIG. 1

INVENTORS
WOLFGANG E. SCHWARZMANN
FRANK S. COE
LEON W. ROSENTHAL

BY

ATTORNEY

March 2, 1943. W. E. SCHWARZMANN ET AL 2,312,447

MULTICYLINDER MAGNETO

Filed March 3, 1942 2 Sheets-Sheet 2

Fig. 2

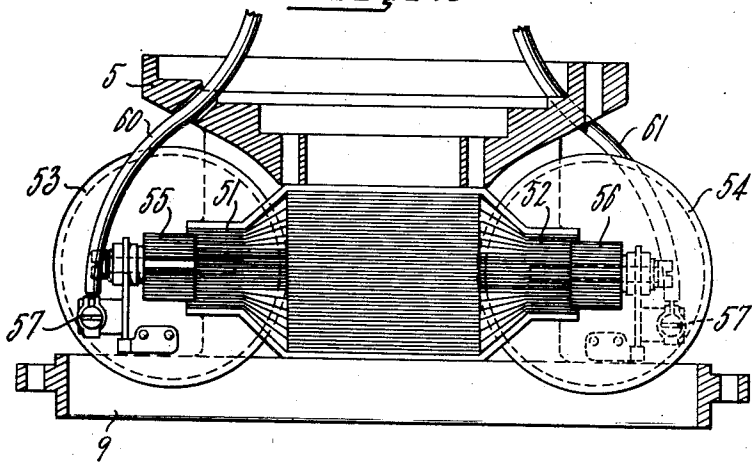
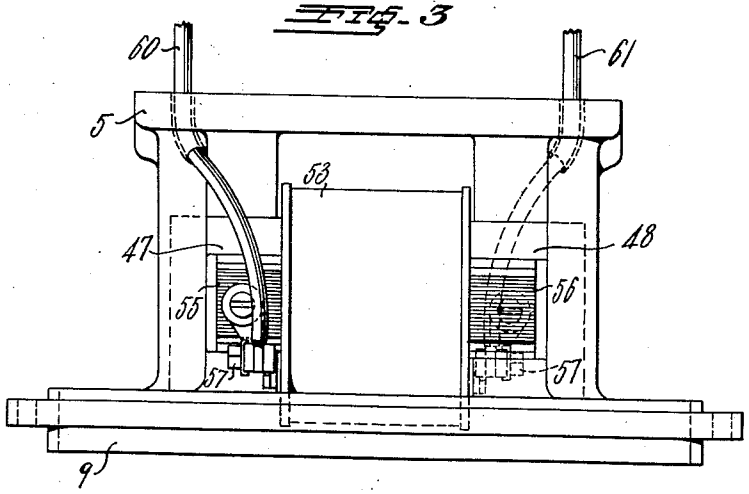


Fig. 3



INVENTORS
WOLFGANG E. SCHWARZMANN
FRANK S. COE
LEON W. ROSENTHAL
BY
ATTORNEY

Patented Mar. 2, 1943

2,312,447

UNITED STATES PATENT OFFICE

2,312,447

MULTICYLINDER MAGNETO

Wolfgang E. Schwarzmann, Longmeadow, and Frank S. Coe, Springfield, Mass., and Leon W. Rosenthal, New York, N. Y., assignors to American Bosch Corporation, Springfield, Mass., a corporation of New York

Application March 3, 1942, Serial No. 433,114

16 Claims. (Cl. 171—209)

This invention relates to multicylinder magnetos of the inductor type for electrical ignition for internal combustion engines, and more particularly to a magneto incorporating a stationary coil or coils and distributor mechanism for the sparkplugs of the engine but having no gearing between the distributor mechanism and the generator rotor, as for instance a magneto adapted to be driven at engine cam shaft speed.

In magnetos of this general type, herein termed multicylinder magnetos of the gearless inductor type, it has been customary to arrange the coil associated with the generator rotor on the same side of both the interrupter and distributor mechanisms, the generator rotor and coil being near one end of the rotor shaft as the bottom thereof, and the interrupter and distributor mechanisms being near the other end of the rotor shaft as the top thereof. For instance, in U. S. Patent 2,116,353 the distributor is arranged between the interrupter mechanism and the coil, and in U. S. Patents 1,993,824, 2,130,316 and 2,243,416, the interrupter mechanism is arranged between the distributor mechanism and the coil. In U. S. Patent 1,693,345, the generator rotor is likewise below the interrupter and distributor mechanisms but the coil is above them. In all these instances, either there is difficulty in maintaining the primary and secondary connections of the ignition coil separate from each other, and also hazards in operation due to electrical breakdown between the connections or to the grounded frame particularly in high tension magnetos of this type, or else one of the connections is relatively long and extends through a tunnel in the magneto frame or outside the magneto or as an insert through the distributor plate or cap. Furthermore, it is difficult if not impossible in these prior arrangements to fasten the stationary distributor member for the sparkplugs to the ignition manifold and/or to the engine frame and at the same time to provide for the ready removal and exposure of the rotatable and other internal parts of the magneto for purposes of inspection, adjustment, repair and replacement thereof.

In accordance with the invention, the ignition coil of the magneto is arranged between those parts of the interrupter and distributor mechanisms to which the coil is electrically connected, whereby a short primary conductor from the coil extends in one direction to the interrupter mechanism in proximity thereto and preferably near the top of the rotor shaft, and a short secondary conductor from the coil extends in the opposite direction to the distributor mechanism also in proximity thereto and preferably near the other end of the rotor shaft. In this way, the primary and secondary connecting wires, which in the case of a high tension magneto are respectively the low and high tension wires, are separated from each other and both are of minimum length, whereby the likelihood of electrical breakdown between them and to the grounded frame is reduced. Furthermore, the stationary distributor member to which the sparkplug wires are connected may then be combined with the ignition manifold and thereby considerably simplify and improve the mechanical and electrical connections between the two and to the sparkplugs, and preferably may then be arranged at that end of the generator shaft which is coupled to the engine drive shaft and in fact may be fastened to the engine frame. Preferably also, the generator rotor associated with the coil is mounted on the rotor shaft between the interrupter cam and the distributor rotor thereon, to thereby further simplify and compact the structure and the electrical connections. Also, in the manner hereinafter disclosed, this arrangement provides, as desired whenever the engine is at rest, for readily removing from the magneto frame the rotor shaft, generator rotor and coil, the interrupter mechanism, and the distributor rotor, together with the remainder of the generator stator structure, which thereby permits the servicing thereof.

Accordingly the primary object of the invention is to provide a multicylinder magneto of the gearless inductor type which is simple and compact in construction and arrangement, which is free from some of the causes of electrical breakdown in prior magnetos of this type, which also provides for readier disassembly for inspection, adjustment, repair and replacement, and which provides if desired for permanent and improved electrical and mechanical connections between the magneto and the ignition manifold and with the engine frame.

These and other objects and advantages of the invention will be obvious from the following disclosure taken in conjunction with the accompanying drawings, which, as an example, refer to a multicylinder high tension double magneto of this gearless inductor type for simultaneously firing two sparkplugs in each cylinder of a multicylinder aviation engine of the four-stroke cycle type. In the drawings,

Fig. 1 is a central vertical section, partly in elevation and partly broken away, of a magneto of this kind representing the preferred embodi-

ment of the invention with the stationary distributor member fastened to the ignition manifold and to the engine frame; Fig. 2 is a vertical section, partly in elevation, showing the mounting of the ignition coils in the stator structure; and Fig. 3 is an elevation of the stator structure of Fig. 2.

The frame of the magneto is of non-magnetic material as die cast aluminum or zinc alloy and comprises a distributor housing section 1 adapted to be fastened by screws as 2 to the engine frame 3, and a generator and interrupter housing section 4 fastened to an upper non-magnetic supporting member 5 of the magneto stator structure by screws as 6, the cap 7 of the interrupter housing being fastened in place by screws as 8. The lower part 9 of the supporting member is fastened by screws as 10 to the housing section 1, and this section has a cable outlet 11 which is coupled in the well known way to an ignition manifold 12 which contains the sparkplug cables 13 between the magneto and the engine cylinders and completes the electrostatic shield for the ignition system.

The magneto has a rotor shaft 14 mounted in an upper ball bearing 15 carried by a bearing support 16 fastened by screws as 17 to member 5 and also mounted in a lower ball bearing 18 of the separable type carried by a support 19 in frame section 1, the rotor shaft being connected to the cam shaft of the engine 3, in timed relation thereto, by an adjustable drive coupling 20 of any suitable kind. Near the lower end of shaft 14 and fastened thereon, is a multicylinder distributor mechanism comprising two distributor rotors 21, 22 having continuous metal rings 23, 24 and distributor electrodes 25, 26 which cooperate sequentially with respective circularly-disposed stationary electrodes 27, 28 in insulator rings 29, 30 dowelled together as at 31 and to the frame as at 32.

Fastened on the upper end of shaft 14 are superposed multilobe or multicylinder cams 33, 34, and fastened in adjusted angular position on member 5 is an interrupter plate 35. On the plate are mounted two interrupters 36, 37 of well known kind having cam followers 38, 39 cooperative with the respective cams to periodically and simultaneously separate the sets of contact points 40, 41. These contact points are shunted by respective condensers 42, 43 and the interrupters have respective live terminals 44, 45.

Fastened on the shaft 14, between the distributor rotors 21, 22 and the cams 33, 34 is a magnetic rotor 46 of laminated sheet steel with radial projections of the proper number and angular extent, as is well known. This magnetic rotor cooperates with the stator structure including magnets 47, 48, laminated pole shoes 49, 50, 51, 52 and the ignition coils 53, 54 with laminated cores 55, 56 fastened across respective sets of pole shoes so as to simultaneously generate ignition voltages in those coils in the well known manner. The coils have low tension windings with live terminals as 57 and high tension windings with live terminals 58, 59. The primary coil terminals are connected to the respective interrupter terminals 44, 45 by wires 60, 61 passing through the supporting member 5, and the secondary terminals 58, 59 are connected to the respective distributor rotors 21, 22 by the insulated connectors 62, 63 which are mechanically fastened to the member 9 and electrically connected to the respective rings 23, 24 by spark gaps.

The two distributor rotors 21, 22 with their respective distributor rings 29, 30 constitute a distributing mechanism arranged near the bottom of the rotor shaft 14, and the two interrupter cams 33, 34 with their cooperative interrupters 36, 37 constitute an interrupter mechanism arranged near the top end of the rotor shaft. The magnetic rotor 44 with the stator structure including the magnets, pole shoes and ignition coils constitute a generator mechanism and this is arranged between the interrupter and distributor mechanisms. By this arrangement, the primary connections 60 or 61 and the secondary connections 62 or 63, for each coil, extend in opposite directions to the interrupter and distributor mechanisms respectively, and thereby are relatively short and are kept apart from each other without any of them extending through a tunnel in the frame or on the outside of the magneto, but directly between proximate terminals with reduced likelihood of electrical breakdown at any place of any connection. Furthermore, the comparatively short primary connections 60, 61 contribute in some measure to the effective generation of ignition voltages. Also, by this arrangement, the distributor mechanism is located at the bottom end of the magneto so that the distributor rings 29, 30 may be fastened in the bottom housing section 1 which in turn is fastened to the ignition manifold 12 and to the engine frame 3, so that these parts may remain fastened to the engine without being disturbed while the other internal parts of the magneto are removed, as hereinafter described, for the purpose of inspection, adjustment, repair and replacement.

Practically all the internal and operative parts of the magneto may be removed from the housing sections without detaching or disturbing the stationary distributor members or their electrical connections to the sparkplug cables in the ignition manifold 12, or their mechanical connection to the housing section 1 or its connection to the engine frame 3 or the ignition manifold. By loosening the screws 8, the cap 7 may be removed, as indicated in broken lines in Fig. 1, for inspection, adjustment, repair and replacement of the interrupter mechanism, and also to provide access to the screws 6. Upon removing those screws 6, the housing section 4 may be removed, also as indicated in broken lines in Fig. 1, to inspect and sometimes service the coils 53, 54 and their mechanical and electrical connections in the stator structure of the magneto, and also to provide access to the screws 10. Upon removal of those screws 10, and the disconnection of the drive coupling 20, the interrupter and generating mechanisms and the distributor rotors, together with all the electrical connections therebetween, may be removed as a unit from the housing section 1 and the therein-contained stationary distributor members 29, 30, the bearing 18 being separable for this purpose. All parts of that unit may then be serviced at any time that the engine is at rest. If desired, the distributor member 29, 30 may then be mechanically and electrically disconnected from the housing section 1 and from the sparkplug cables in the ignition manifold 12, and then upon removal of the screws 2 the housing section 1 may be removed from the engine after being mechanically disconnected from the ignition manifold.

While but one embodiment is herein disclosed, it will be obvious that various parts of the invention may be applied to many forms of multicylinder magnetos of the gearless inductor type,

and that many modifications may be made. For instance, a single magneto may otherwise have some or all the features disclosed, ignition for multicylinder engines having any number of cylinders may be provided, the interrupter and distributor mechanisms may be transposed in location with respect to the ignition coil or coils between them, the stationary distributor member need not be incorporated with the ignition manifold and neither one nor both need be fastened to the engine frame, the engine with which the magneto is associated may be of the two-stroke or other suitable cycle, the magneto frame need not be physically divided into the number of parts or the arrangement disclosed, the permanent magnet may be mounted on the generator rotor instead of being incorporated in the stator structure and that rotor may be mounted on the shaft in a place other than between the interrupter cam and the distributor rotor so long as the ignition coil is between the interrupter and distributor mechanisms, the two interrupter cams for a double magneto may be replaced by a single cam for the two sets of contact points, and the interrupter and the distributor mechanisms for a single or double magneto may be of other suitable type. These and other modifications are intended to be included within the broad interpretation of the terms of the appended claims.

Having thus described the invention, what is claimed is:

1. In a multicylinder magneto of the gearless inductor type, a rotor shaft adapted to be driven by an engine, interrupter mechanism including a multicylinder cam mounted on the shaft and also electrical contacts cooperative therewith, multicylinder distributor mechanism including a distributor rotor electrode mounted on the shaft and also including a stationary member with electrodes in circular arrangement about the shaft in cooperation with the rotor electrode, and generator mechanism including a magnetic rotor mounted on the shaft and also a stationary coil which is located between the contacts of the interrupter mechanism and the rotor of the distributor mechanism and which has a primary connection extending in one direction to the interrupter contacts and a secondary connection extending in the opposite direction to the distributor rotor electrode.

2. In a multicylinder magneto of the gearless inductor type, a rotor shaft adapted to be driven by an engine, interrupter mechanism including a multicylinder cam mounted on the shaft, multicylinder distributor mechanism including a rotor electrode mounted on the shaft and also including stationary electrodes in circular arrangement about the shaft in cooperation with the rotor electrode, and generator mechanism which is located between the interrupter and distributor mechanisms and which includes a magnetic rotor mounted on the shaft and also a stationary coil having a primary connection extending in one direction to the interrupter mechanism and a secondary connection extending in the opposite direction to the distributor mechanism.

3. In a multicylinder magneto of the gearless inductor type, a rotor shaft adapted to be driven by an engine, interrupter mechanism including a multicylinder cam mounted on the shaft near one end thereof, multicylinder distributor mechanism including a rotor electrode mounted on the shaft near the other end thereof and also including stationary electrodes in circular arrangement about the shaft in cooperation with the rotor electrode, and generator mechanism which includes a magnetic rotor mounted on the shaft between the interrupter cam and the distributor rotor electrode and which also includes a stationary coil having a primary connection extending in one direction to the interrupter mechanism and a secondary connection extending in the opposite direction to the distributor mechanism.

4. In a multicylinder magneto of the gearless inductor type, a rotor shaft adapted to be driven by an engine, interrupter mechanism including a multicylinder cam mounted on the shaft and electrical contacts cooperative therewith, multicylinder distributor mechanism including a rotor electrode mounted on the shaft and a stationary member with electrodes in circular arrangement about the shaft in cooperation with the rotor electrode, and a generator mechanism which includes a magnetic rotor mounted on the shaft between the interrupter cam and the distributor rotor electrode and which also includes a stationary coil mounted between the interrupter and distributor mechanisms in cooperation with the magnetic rotor and having a primary connection extending in one direction to the interrupter contacts and a secondary connection extending in the opposite direction to the distributor rotor electrode.

5. In a multicylinder double magneto of the gearless inductor type, a rotor shaft adapted to be driven by an engine, interrupter mechanism including two sets of electrical contacts in cooperation with multicylinder cam means mounted on the shaft, multicylinder distributor mechanism including two stationary sets of electrodes each in circular arrangement about the shaft and also including two rotor electrodes mounted on the shaft in cooperation with the electrode sets respectively, and generator mechanism which includes a magnetic rotor mounted on the shaft between the cam means and the distributor rotor electrodes and which also includes two stationary coils mounted between the interrupter and distributor mechanisms in cooperation with the magnetic rotor, each coil having a primary connection extending in one direction to a respective set of interrupter contacts and a secondary connection extending in the opposite direction to a respective distributor rotor electrode.

6. In a multicylinder magneto of the gearless inductor type, a frame having an interrupter housing at its top including a removable cap, a rotor shaft adapted to be driven by an engine and terminating at one end in the interrupter housing, interrupter mechanism which is arranged in the interrupter housing and which includes a multicylinder cam mounted near that end of the shaft, multicylinder distributor mechanism which is arranged near the other end of the shaft and which includes a rotor electrode mounted on the shaft and also a stationary member mounted in the frame and having electrodes in circular arrangement about the shaft in cooperation with the distributor rotor electrode, and generating mechanism which is located between the interrupter and distributor mechanisms and which includes a magnetic rotor mounted on the shaft and also a stationary coil having a primary connection extending in one direction to the interrupter mechanism and a secondary connection extending in the opposite direction to the distributor rotor electrode.

7. In a multicylinder magneto of the gearless inductor type, a frame having an interrupter housing, a rotor shaft adapted to be driven by an engine and extending into the interrupter hous-

ing, generator mechanism which includes a magnetic rotor mounted on the shaft and which also includes a stator structure having a coil and a supporting member fastened to the frame for supporting the stator structure therefrom, interrupter mechanism which includes a multicylinder cam mounted on the shaft and electrical contacts mounted on the supporting member in cooperation with the cam, and multicylinder distributor mechanism which includes a rotor electrode mounted on the shaft and which also includes a stationary member mounted in the frame and having electrodes in circular arrangement around the shaft in cooperation with the distributor rotor electrode, the coil being arranged in the stator structure between the interrupter and distributor mechanisms and having a primary connection extending in one direction to the electrical contacts and a secondary connection extending in the opposite direction to the distributor rotor electrode.

8. In a multicylinder magneto of the gearless inductor type, a frame having an interrupter housing section at the top, a rotor shaft journaled in the frame and adapted to be driven by an engine, generator mechanism including a magnetic rotor mounted on the shaft and also including a stator structure having a coil and a supporting member which is detachably fastened to the frame for supporting the stator structure therein and in which the rotor shaft is journaled also, interrupter mechanism which is arranged in the interrupter housing and which includes a cam mounted on the shaft and electrical contacts mounted on the supporting member in cooperation with the cam, and distributor mechanism which includes a rotor mounted on the shaft and which also includes a stationary member fastened to the frame near the bottom thereof and having electrodes arranged in cooperation with the distributor rotor, the coil being arranged in the stator structure between the interrupter and distributor mechanisms and having a primary connection extending in one direction to the electrical contacts and a secondary connection extending in the opposite direction to the distributor rotor.

9. In a multicylinder magneto of the gearless inductor type, a sectionalized frame which has a lower distributor housing section adapted to be fastened to an engine and which also has an upper generator and interrupter housing section with a detachable cap on its top, a rotor shaft journaled in the lower section and adapted to be driven by the engine, generator mechanism including a magnetic rotor on the shaft and also including a stator structure having a coil and a supporting member in which the rotor shaft is journaled also, interrupter mechanism which is arranged in the interrupter housing and which includes a cam mounted on the shaft and electrical contacts mounted on the supporting member in cooperation with the cam, and distributor mechanism which includes a rotor mounted on the shaft and which also includes a stationary member fastened to the lower frame section and having electrodes arranged in cooperation with the distributor rotor, the coil being arranged in the stator structure between the interrupter and distributor mechanism and having a primary connection extending in one direction to the electrical contacts and a secondary connection extending in the opposite direction to the distributor rotor, and the supporting member being detachably fastened to both sections of the frame.

10. In a multicylinder magneto of the gearless inductor type, a rotor shaft adapted to be coupled to an engine, distributor mechanism which includes a rotor mounted on the shaft and which also includes a stationary member having electrodes arranged in cooperation with the distributor rotor, interrupter mechanism which includes a cam mounted on the shaft and which also includes interrupter contacts arranged in cooperation with the cam, generator mechanism which includes a magnetic rotor mounted on the shaft and which also includes a stator structure having a coil electrically connected to the distributor rotor and to the interrupter contacts and also having a supporting member supporting the interrupter contacts, a sectionalized frame which has one section housing the stationary distributor member and adapted to be detachably fastened to the engine and to the supporting member and which also has another section housing the generator and interrupter mechanisms and being detachably fastened to the supporting member, said shaft being journaled in the distributor housing section of the frame and also being journaled in and supported by the supporting member, whereby, upon detaching the supporting member from both sections of the frame, the rotor shaft with the parts mounted thereon together with the stator structure and interrupter mechanism may be removed as a unit from the stationary distributor member.

11. In a multicylinder magneto of the gearless inductor type, a rotor shaft adapted to be coupled to an engine, distributor mechanism which includes a rotor mounted on the shaft and which also includes a stationary member having electrodes arranged in cooperation with the distributor rotor, interrupter mechanism which includes a cam mounted on the shaft and which also includes interrupter contacts arranged in cooperation with the cam, generator mechanism which includes a magnetic rotor mounted on the shaft and which also includes a stator structure having a coil electrically connected to the distributor rotor and to the interrupter contacts and also having a supporting member supporting the interrupter contacts, a sectionalized frame which has a lower section fastened to the stationary distributor member and adapted to be fastened to the engine and which also has an upper section housing the generator and interrupter mechanisms and having a detachable cap, said shaft being journaled in the lower section of the frame and also being journaled in and supported by the supporting member, and the supporting member being detachably fastened to the upper section of the frame beneath the interrupter cap and also being detachably fastened to the lower section of the frame, whereby upon removing the cap the supporting member may be detached from the upper housing section and then from the lower housing section, so that the rotor shaft with the parts mounted thereon together with the stator structure and inerrupter mechanism may be removed as a unit from the lower section of the frame without disturbing the stationary distributor member and without detaching the lower section of the frame from the engine.

12. In a multicylinder magneto of the gearless inductor type, a frame for the magneto, a rotor shaft adapted to be coupled to an engine, distributor mechanism associated with the shaft, interrupter mechanism associated with the shaft, and generator mechanism which is arranged between the distributor and interrupter mecha-

nisms and which includes a magnetic rotor mounted on the shaft and a stator structure cooperative with the magnetic rotor, said stator structure comprising magnetic members, an ignition coil fastened to the magnetic members and electrically connected to the distributor and interrupter mechanisms, and a supporting member fastened to the magnetic members and to the frame for fastening the stator structure therein and having a bearing for the rotor shaft.

13. In a multicylinder magneto of the gearless inductor type, a rotor shaft adapted to be coupled to an engine, distributor mechanism associated with the shaft, interrupter mechanism associated with the shaft, generator mechanism which is arranged between the distributor and interrupter mechanisms and which includes a magnetic rotor mounted on the shaft and a stator structure cooperative with the magnetic rotor, and a frame for the magneto, said stator structure comprising magnetic members, an ignition coil fastened to the magnetic members and electrically connected to the distributor and interrupter mechanisms, and a supporting member fastened to the magnetic members and also to the frame for fastening the stator structure therein, and said rotor shaft being journaled in the frame and in the supporting member.

14. In a multicylinder magneto of the gearless inductor type, a frame for the magneto, a rotor shaft adapted to be coupled to an engine, distributor mechanism associated with the shaft, interrupter mechanism including a cam mounted on the shaft and also interrupter contacts, and generator mechanism which is arranged between the distributor and interrupter mechanisms and which includes a magnetic rotor mounted on the shaft and a stator structure cooperative with the magnetic rotor, said stator structure comprising magnetic members, an ignition coil fastened to the magnetic members and electrically connected to the distributor mechanism and also to the interrupter contacts, and a supporting member which is fastened to the magnetic members and to the frame for fastening the stator structure therein and which also supports the interrupter contacts in cooperation with the cam.

15. In a multicylinder magneto of the gearless inductor type; a frame for the magneto, a rotor shaft adapted to be coupled to an engine; distributor mechanism including a rotor mounted on the shaft and also a stationary member having electrodes arranged in cooperation with the distributor rotor; interrupter mechanism associated with the shaft; generator mechanism which is arranged between the distributor and interrupter mechanisms and which includes a magnetic rotor mounted on the shaft and a stator structure cooperative with the magnetic rotor; said stator structure comprising magnetic members, an ignition coil fastened to the magnetic members and electrically connected to the interrupter mechanism, and a supporting member fastened to the magnetic members and also to the frame for fastening the stator structure therein; and an electrical connector which is fastened to the supporting member and which electrically connects the ignition coil to the distributor rotor.

16. In a multicylinder magneto of the gearless inductor type; a frame for the magneto, a rotor shaft adapted to be coupled to an engine; distributor mechanism associated with the shaft, interrupter mechanism including a cam mounted on the shaft and also interrupter contacts; generator mechanism which is arranged between the distributor and interrupter mechanisms and which includes a magnetic rotor mounted on the shaft and a stator structure cooperative with the magnetic rotor; said stator structure comprising magnetic members, an ignition coil fastened to the magnetic members and electrically connected to the distributor mechanism, and a supporting member which is fastened to the magnetic members and also to the frame for fastening the stator structure therein and which supports the interrupter contacts in cooperation with the cam; and an electrical conductor passing through the supporting member and electrically connecting the ignition coil with the interrupter contacts.

WOLFGANG E. SCHWARZMANN.
FRANK S. COE.
LEON W. ROSENTHAL.