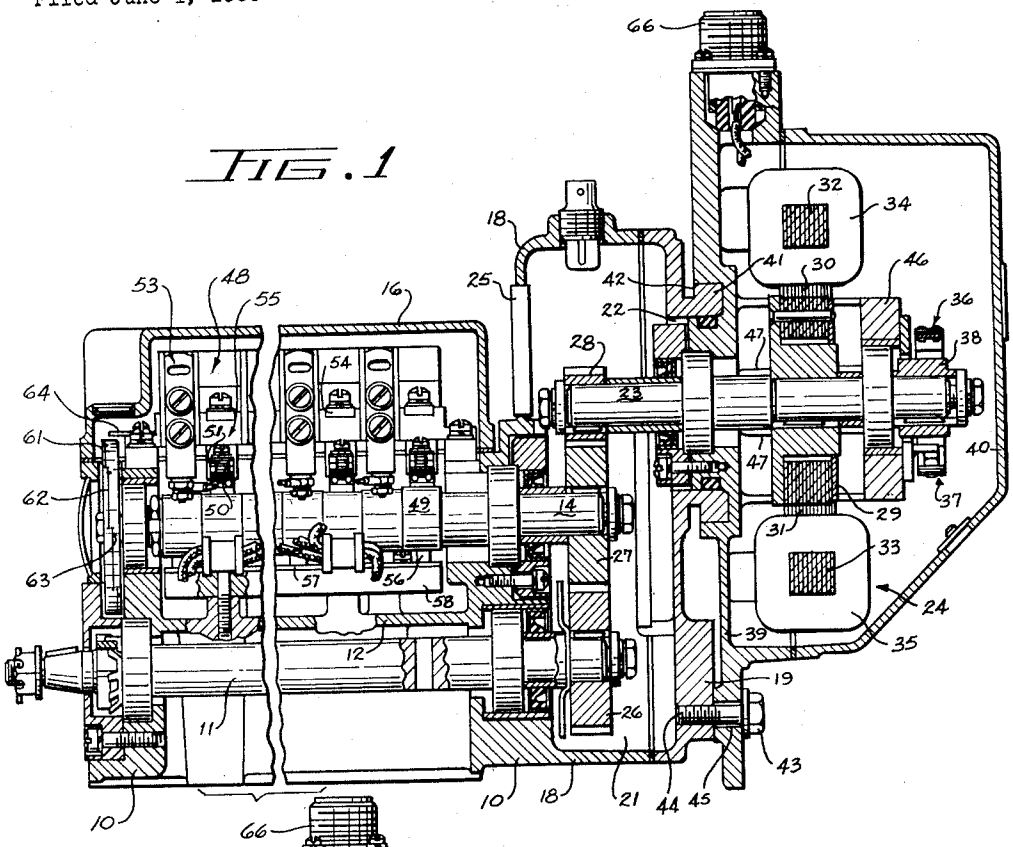
Aug. 12, 1958 R. B. CLARK ET AL 2,847,590

ELECTRICAL IGNITION GENERATOR

Filed June 1, 1955 2 Sheets-Sheet 1

FIG. 1



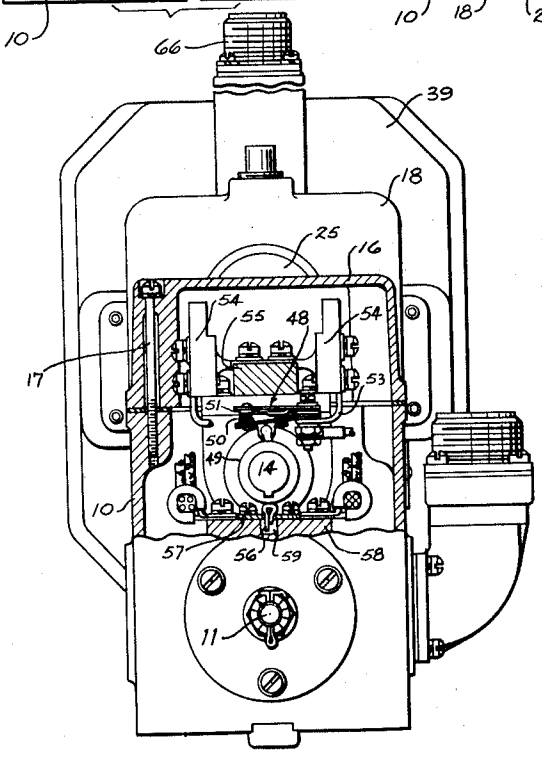


FIG. 2

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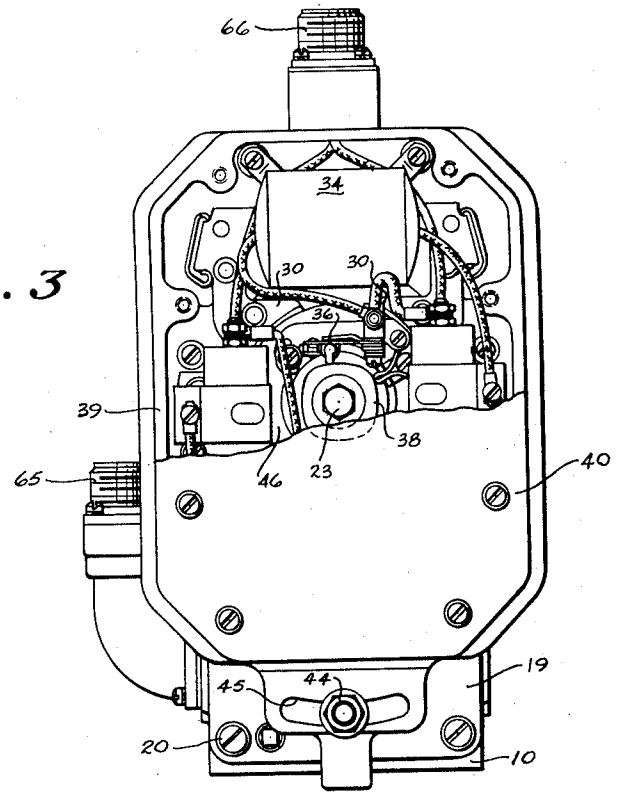
FIG. 3



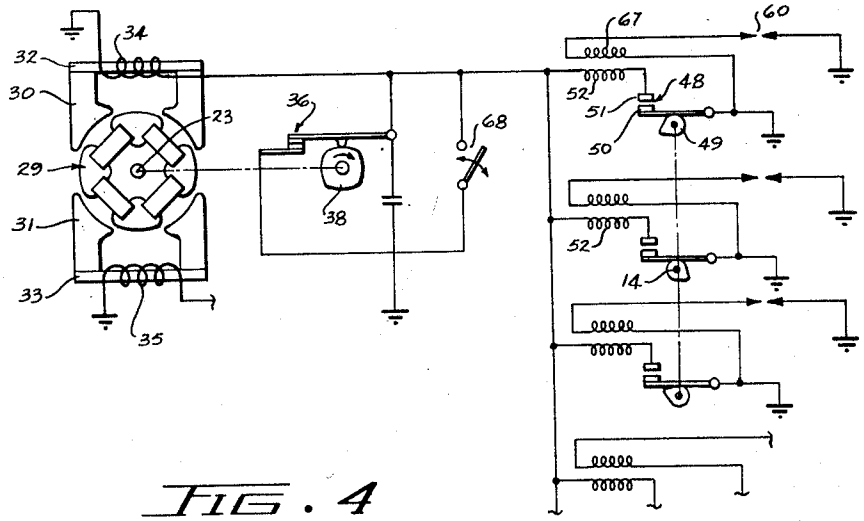


FIG. 4

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ELECTRICAL IGNITION GENERATOR

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Application June 1, 1955, Serial No. 512,540

8 Claims. (Cl. 310—70)

This invention relates to electrical apparatus and more particularly to means for generating electrical energy and distributing the same to a plurality of circuits in sequence.

One of the objects of the present invention is to provide novel apparatus for supplying electrical energy to the sparking plugs of a multi-cylinder combustion engine or the like in sequence and in timed relation to the rotation of the engine crankshaft.

Another object is to provide electrical energy generating and distributing means in novel combination with a prime mover.

Still another object of the invention is to provide novel apparatus of the above character which is so constructed as to facilitate adaptation of the same to a large number of different engines with but a minimum of modification or adjustment.

A further object is to provide novelly constructed electrical current generating and distributing apparatus which may be readily adapted to the ignition systems of a variety of different types of internal combustion engines.

A still further object is to provide novel ignition apparatus of the above character which may be readily adjusted on and timed to an engine without reducing the efficient operation thereof, and which is so constructed that the vital parts thereof are readily accessible for adjustment and repair or replacement.

The above and further objects and novel features of the present invention will more fully appear from the following detail description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not intended as a definition of the limits of the invention.

In the drawings, wherein like reference characters refer to like parts throughout the several views,

Fig. 1 is a side elevation view, partly in section and with parts broken away, illustrating one form of magneto generator-distributor unit embodying the present invention;

Fig. 2 is an end view looking from the left in Fig. 1, partly in section and with parts broken away;

Fig. 3 is an end view looking from the right of Fig. 1 with a portion of the magneto casing cover broken away; and,

Fig. 4 is a circuit diagram showing an ignition circuit served by one coil of the dual magneto illustrated in Fig. 1.

The single embodiment of the invention illustrated in the drawings by way of example is in the form of a magneto generator-distributor combination adapted for use in a low voltage distribution type of ignition system for a multi-cylinder internal combustion engine. As shown, the unit comprises a casing member **10** which may be mounted in any suitable manner on or adjacent to an engine. A drive shaft **11** adapted to be drivably connected at its left end to the engine through suitable

gearing or a clutch (not shown) is supported near its ends by bearings, preferably roller bearings, in casing member **10**. Said shaft may extend through the hollow lower part of the casing member below the transverse wall **12**. Above the latter is a cam shaft **14** which extends parallel to drive shaft **11** and is supported at its ends by bearings in the end walls of casing member **10**. Said casing member is provided with a removable cover **16** secured in place by a plurality of stud bolts, such as bolt **17** (Fig. 2).

Casing member **10** has an enlarged extension **18** at the right hand end thereof, which extension, together with a cover **19** secured thereto by a plurality of stud bolts **20**, forms a gear compartment **21**. Cover **19** is provided with an opening **22** for receiving the bearing supported shaft **23** of a magneto generator **24**, to be more fully hereinafter described, and with a transparent window **25** to facilitate checking the supply of lubricant in the gear chamber **21**.

Drive shaft **11** projects into compartment **21** and is fitted with a gear **26** which meshes with a gear **27** secured to the projecting end of cam shaft **14**. Gear **27** also meshes with a gear **28** secured to magneto shaft **23**. These three gears may be varied in diameter for the purpose of varying the relative rotational speeds of the shafts on which the same are mounted, thus facilitating the adaptation of the invention without material modification to the ignition systems of engines of different sizes and kinds.

Although the detail construction of the magneto generator may take any of many known forms, the illustrated embodiment comprises a dual magneto which does not differ essentially from the dual magneto disclosed in Dingman Patent No. 2,569,460, except that the present structure embodies a four-pole magnetic rotor **29** of any suitable known construction, such as the one shown in Tognola U. S. Patent No. 2,255,477. The rotor is secured to shaft **23** for rotation therewith and cooperates in a known manner with two pairs of stator pole shoes **30** and **31** which complete a magnetic circuit through coil cores **32** and **33**, respectively, on which coils **34** and **35** are wound. The circuits through said coil windings are normally completed through circuit breakers **36** and **37** which are periodically actuated to open position by a four-lobe cam **38** mounted on shaft **23** for rotation therewith. The coils are contained in identical circuits, one of which is shown in the diagram of Fig. 4.

The magneto is housed in a casing comprising the plate **39** and a removable cover **40**. The stator assemblies, including pole shoes **30** and **31** and the coils **34** and **35**, are secured to plate **39**, and the latter is mounted for angular adjustment on casing member **19** about the axis of rotation of shaft **23**. Plate **39** is piloted on cover **19** by a circular flange **41**, the latter of which surrounds opening **22** and has a close sliding fit in a groove in the outer face of plate **39**. Spring clips (not shown) of the type disclosed in the above-mentioned Patent Number 2,569,460 may be secured to plate **39** and engage the radial face **42** of an external groove in flange **41** for holding the magneto casing **39**, **40** against axial movement while permitting angular movement thereof relative to shaft **23** and rotor **29**. A lock nut **43** threaded onto a stud bolt **44** which extends from casing member **19** through an arcuate slot **45** in casing plate **39** is provided for locking the magneto casing and stator assembly in angularly adjusted position. In this manner, the magneto may be accurately timed to the engine while maintaining the most efficient E gap setting therefor, inasmuch as the circuit breakers **36** and **37** are also mounted for angular adjustment with casing plate **39**. These breakers are independently adjustably mounted on a disc

or bar 46 which is in turn supported by arms 47 that extend from plate 39 between the stator pole shoes. Shaft 23 is rotatably supported by bearings in casing plate 39 and in disc 46, and cam 38 is mounted on said shaft between the two circuit breakers.

Distribution of the electrical energy generated by the magneto generator is accomplished by a plurality of normally open contactors 48 mounted in casing 10, 16 above shaft 14 in position for actuation by a plurality of cams 49 which rotate with said shaft, there being a separate single lobe cam for each contactor. The cams 49 are so cut that the contactors 48 are closed in succession in predetermined sequence in accordance with the firing order of the engine cylinders and in timed relation with the magneto circuit breakers 36 and 37. Although only a few of the contactors 48 and cams 49 are shown in Fig. 1, it will be understood that there is a contactor and cam set 48, 49 for each spark plug 60 of the engine. For dual ignition engines, one spark plug in each cylinder is supplied by coil 34 and the other by coil 35.

In the form shown, each contactor 48 comprises two spring mounted contacts 50 and 51, the former of which is actuated against the spring pressure by a cam 49 to close a spark plug supply circuit. Movable contact 50 is connected to ground through its mounting, and contact 51 is connected through a lead to the primary winding 52 (Fig. 4) of a transformer coil outside of the unit. The spring supports for the contacts 50 and 51 are mounted on an angle bar 53, the vertical leg of which is slotted (Fig. 1) and thereby adjustably secured to a supporting T bracket 54. The latter is secured for horizontal adjustment transversely of shaft 14 to a bar 55 supported at its ends on the end walls of casing member 10.

Cams 49 are keyed to shaft 14 and are lubricated by oil soaked wicks 56 which are mounted in a plate 57 that is in turn mounted on a bar 58 supported by bosses projecting from transverse wall 12. The ends of wicks 56 extend into a groove 59 in bar 58 which may be used as a reservoir for a lubricant to be carried by the wicks to the cams.

Mounted on the left end of cam shaft 14 is a timing disc 61 which has lines or marks 62 inscribed on the periphery thereof to facilitate adjustment of the contactors 48 and the magneto circuit breakers 36 and 37. Each line 62 represents the length of time, measured in degrees of rotation of the cam shaft, during which the corresponding contactor 50, 51 is closed. Thus, by employing a straight edge or pointer 64, secured to the casing 10, in conjunction with the marks 62, the contactors may be adjusted to close and open at the desired times. On each line 62, is a mark 63 which, when opposite the pointer 64, represents the correct position of the cam shaft at the instant that magneto circuit breakers 36 and 37 should be opened by cam 38. A ready guide is thus provided for properly adjusting the magneto circuit breakers in relation to the distributor contactors 50, 51.

In the interest of clarity, the electrical leads have for the most part been partially broken away in Figs. 1 to 3 of the drawings, but typical circuits are illustrated diagrammatically in Fig. 4. The electrical leads into casing 10 and out of magneto casing 39, 40 are preferably made readily separable by means of plug and socket connectors, portions of which are illustrated at 65 and 66, respectively.

The operation of the above described unit in an ignition system of a multi-cylinder internal combustion engine may be best understood by reference to the circuit diagram of Fig. 4. During rotation of magneto rotor 29, a relatively low alternating voltage is generated in coil 34 while circuit breaker 36 is closed, thus providing a closed circuit through the coil. Shortly before the breaker 36 opens, a contactor 50, 51 is closed by a cam 49. Thus, when breaker 36 opens, a surge of energy flows through the closed contactor 50, 51 to a primary winding 52. This surge induces a relatively high voltage in secondary winding 67 and across the electrodes of a spark plug 60 connected thereto. Each time circuit breaker 36 opens, a different distributor contactor is in closed position so that the transformer coils 52, 67 and spark plugs 60 are energized in sequence. For rendering the above described electrical system ineffective to supply energy to the sparking plugs, a switch 68 is provided for connecting coil 34 to ground. The circuit supplied by coil 35 may be identical with that shown for coil 34.

There is thus provided novel apparatus adapted for use with a multi-cylinder internal combustion engine as means for generating and distributing electrical energy to the sparking plugs, the energy generating means and distributing means being novelly associated and combined with each other and with the engine to facilitate the use thereof on a variety of engines having different operating characteristics. The combination of the generating and distributing units is such that failure of the drive to the distributor will also result in failure of the magneto generator drive, so that damage to the engine is avoided. Additionally, the parts are uniquely designed and combined to facilitate adjustment and to facilitate examination and repair of the vital operating parts.

Although only a single embodiment of the invention is illustrated in the accompanying drawings and described in detail in the foregoing specification, it is to be expressly understood that the invention is not limited to the details of construction thus illustrated and described. For example, the magneto may have a single coil as distinguished from the dual construction illustrated, and in some applications, the magneto coils may embody both primary and secondary windings. Although alternate contactors 48 have been shown as being mounted to extend in opposite directions for ease of adjustment and to take best advantage of available space, the same could all be similarly or identically mounted. Various other modifications, including changes in the design and arrangement of the parts illustrated, will now be apparent to those skilled in the art and may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. Apparatus of the class described comprising a first casing, a drive shaft supported by said casing, current distributing means comprising a cam shaft supported in said casing with its axis parallel to the axis of said drive shaft, gear means drivably connecting said shafts, means encasing said gear means, and a current generating unit removably supported by said encasing means and comprising rotor means drivably connected with said cam shaft within said encasing means and stator means angularly adjustable about the axis of said rotor means.

2. In electrical apparatus of the class described, current generating means comprising a rotor shaft, current distributing means comprising a cam shaft, a drive shaft, said shafts being parallel and none of said shafts being concentric with another of said shafts, gear means on said rotor shaft, gear means on said drive shaft, gear means on said cam shaft drivably associated with each of said two first-named gear means, a casing for said current generating means, a casing for said current distributing means, and means intermediate said casings for encasing said gear means, the casing for said current generating means being mounted on said gear encasing means for angular adjustment about the axis of said rotor shaft.

3. Electrical apparatus as defined in claim 2 wherein said gear encasing means forms a liquid-tight compartment for a lubricant.

4. Electrical apparatus as defined in claim 2 comprising a plurality of cams mounted on said cam shaft for rotation therewith and a plurality of contactors, each mounted for actuation by one of said cams.

5. Electrical apparatus as defined in claim 4 comprising cam means on said rotor shaft, circuit breaker means mounted for actuation by said cam means, and means in-

cluding a marked disc on said cam shaft and fixed pointer means for indicating the opening and closing positions of said contactors and the opening position of said circuit breaker.

6. In electrical apparatus of the class described, current generating means comprising a rotor shaft, current distributing means comprising a cam shaft, a drive shaft, said shafts being parallel and none of said shafts being concentric with another of said shafts, gear means on said rotor shaft, gear means on said drive shaft, gear means on said cam shaft drivably associated with each of said two first-named gear means, a plurality of cams mounted on said cam shaft for rotation therewith, a plurality of contactors each mounted for actuation to closed position by one of said cams, cam means on said rotor shaft, circuit breaker means mounted for actuation to open position by said cam means, and means including a marked disc on said cam shaft and fixed pointer means for indicating the opening and closing positions for said contactors and the opening position for said circuit breaker.

7. Apparatus of the class described comprising an electrical current generating unit including a casing and a rotor, an electrical current distributing unit including a casing and a rotatable cam shaft, means drivably connecting said rotor to said cam shaft, a plurality of contactors, a plurality of cams on said cam shaft for actuating said contactors, cam means on said rotor, circuit breaker means mounted for actuation by said cam means, and means including a marked disc on said cam shaft and fixed pointer means for indicating the opening and closing positions for said contactors and the opening position for said circuit breaker means.

8. Apparatus as defined in claim 1 comprising a plurality of cams mounted on said cam shaft for rotation therewith, and a plurality of normally open contactors each mounted for actuation by one of said cams during each revolution of the latter, each of said contactors being adjustable as a unit relative to the actuating cam therefor in two directions at right angles to each other for adjusting the time of closing and the duration of closure thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 14,060	Swift	Feb. 8, 1916
1,221,208	Neuland	Apr. 3, 1917
1,389,801	Whaley	Sept. 6, 1921
1,473,255	Schwarzmann	Nov. 6, 1923
1,866,492	Shoemaker	July 5, 1932
2,272,675	Spengler	Feb. 10, 1942
2,308,973	Crocker	Jan. 19, 1943