

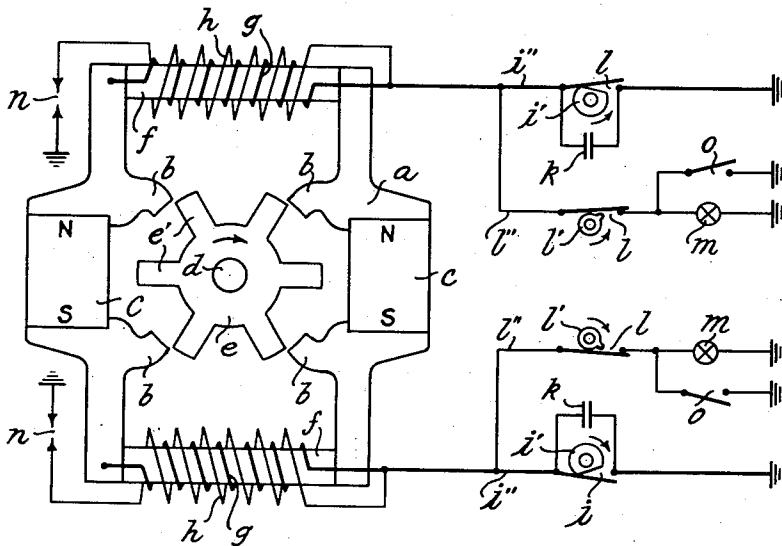
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K. BEER ET AL

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ELECTRIC IGNITION AND LIGHTING SYSTEM

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INVENTORS
KARL BEER &
GUSTAV PFROMMER
BY *Don H. Douthal*
ATTORNEY.

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ELECTRIC IGNITION AND LIGHTING
SYSTEM

Karl Beer, Stuttgart, and Gustav Pfrommer,
Stuttgart-Oberturkheim, Germany, assignors
to Robert Bosch Gesellschaft mit beschränkter
Haftung, Stuttgart, Germany

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The present invention relates to electric ignition and lighting systems, and particularly to systems in which a generator supplies ignition impulses to a sparkplug or sparkplugs of an internal combustion engine at predetermined periods and also supplies current impulses to translating devices as a lamp or lamps.

Prior arrangements of this general kind were devised to supply ignition and lighting devices from a single generator but "false" or undesired ignition sparks occurred in addition to those desired, or at undesired periods, with the result that the undesired sparks at the sparkplug or sparkplugs caused backfire or misfire of the engine, sometimes with dangerous consequences.

The primary object of this invention is to provide an ignition and lighting system in which ignition is reliably prevented at undesired periods. This is accomplished by providing a switching mechanism for the ignition and lighting circuits which connects the ignition circuit alone to the generator at the predetermined or desired periods of ignition and which connects the lighting circuit alone to the generator in intermediate periods. Preferably this is accomplished by connecting the ignition and lighting circuits in shunt relation to each other and providing an interrupter in each circuit for connecting and disconnecting the circuit to the generator, the cams of the interrupters being so arranged that the lever in the lighting circuit is opened at about the time the lever in the ignition circuit is closed and then closed at about the time the lever in the ignition circuit is opened to produce an ignition spark, the lever in the ignition circuit then remaining open and the lever in the lighting circuit then remaining closed between the predetermined desired periods of ignition.

Other objects of the invention are to provide such an arrangement in connection with a generator having a generating winding composed of primary and secondary windings, one or more sparkplugs being connected in the well known way to the secondary winding, and also to provide such an arrangement in connection with a generator having a plurality of generating windings each composed of a primary winding alone or of primary and secondary windings in inductive relation, and furthermore to provide such an arrangement in connection with single or double magnetos, of low-tension or high-tension types, introducing, at the periods of generation of ignition and lighting impulses, flux reversals or flux changes in the core of the one or the plurality of generating windings.

Still other objects will be apparent from the following description and the accompanying drawing diagrammatically illustrating the invention in application, as an example, to a generator of the magneto type in which the rotor is a flux distributor and has a plurality of arms cooperating with a multipolar stator structure including permanent magnets and also including generating coils each with a primary and a secondary winding for the simultaneous generation of ignition impulses at two sparkplugs at predetermined periods of flux reversal and for the simultaneous generation of lighting impulses in two lighting circuits at other periods of flux reversal.

In the drawing, the reference *a* represents a laminated or sheet steel stator structure having four poles *b* magnetically connected to two permanent magnets *c*, and also having two laminated coil cores *f* in the arrangement as shown. A generating winding, comprising a primary or low-tension winding *g* and a secondary or high-tension winding *h* in inductive relation thereto, is mounted on each coil core *f*. The rotor comprises a shaft *d* on which is fastened a flux distributor *e* of laminated or sheet steel with six equally spaced radial projections *e'* so as to produce with the four-pole stator twelve flux reversals in the two coil cores *f*, and therefore twelve current impulses in the two primary windings *g*, at 30° intervals in each rotation of the rotor.

If, for example, this generator driven at crank shaft or engine speed is used for igniting a four-cycle internal combustion engine having two cylinders at 90° with quartered cranks, of the twelve flux reversals through each coil core *f* effected during each rotation of the engine and the flux distributor *e*, only one of the flux reversals is necessary for the generation of an ignition impulse in each ignition circuit. The remaining periods of generation in the primary windings *g* may then be utilized as current impulses in each lighting circuit for lighting the lamps therein.

The switching mechanism preferably used for this purpose includes a spring-pressed interrupter lever *i* of well known kind, operated by a cam *i'* on the rotor shaft *d* and shunted by a condenser *k* in each of the two grounded ignition circuits *i''*. The switching mechanism also includes, in each of the two grounded lighting circuits *i'''*, a spring-pressed interrupter lever *l* of well known kind operated by a cam *l'* on the rotor shaft *d* and connected to respective primary windings *g* in shunt relation to the corresponding ignition cir-

cuits i'' . Each lighting circuit also includes one or more incandescent lamps m shunted by a manual controlling switch o . A sparkplug n in a cylinder of the engine is connected to the high voltage terminal of each secondary winding h . The cams i' are so constructed and arranged that levers i operate simultaneously and have a long open period with a short closure once in each rotation during that period of flux reversal in the coil cores f when the flats on the cams of those interrupters are opposite the levers. The cams i' are so constructed and arranged that the levers i operate simultaneously and have a long closed period with a short opening once in each rotation during the same period of flux reversal when the lobes on the cams of those interrupters engage the levers.

Considering now the levers i and l connected to the upper winding g of the drawing, the arrangement is such that just preceding the generation of the desired ignition spark at sparkplug n , at which instant the parts have the position shown in the drawing, the flux from the N. pole of the right hand magnet c flows through upper coil core f and thence through the flux distributor e to the S. pole of that magnet, whereas the flux from the N. pole of the left hand magnet c flows through the flux distributor e and thence lower coil core f . At this instant the lever i starts to close and the lever l starts to open. In a few degrees of rotation thereafter when the flux starts to reverse through the coil cores as a result of the new alignment of other extensions e' with poles b , the lever i which had just closed now suddenly opens while the lever l which had just opened now starts to close. The sudden opening of the ignition circuit i'' at the time the lighting circuit l'' is open effects a decay of the circuit in the primary winding g which decreases the time period of flux reversal and therefore increases the rate of flux change, so that a sufficiently high voltage is generated in the secondary winding h to produce a spark at the sparkplug n , this representing the predetermined or desired period of ignition of the engine. Shortly thereafter, and before the next flux reversal in the coil core f , the lever i is opened and the lever l is closed, the current impulses generated in the winding g until the next desired period of ignition then flowing to the lamp m so long as the switch o is open. This cycle of operation is repeated in each rotation of the rotor and occurs simultaneously in the lower ignition and lighting circuits connected to the lower generating windings g in the drawing.

It will be observed in the operation of the ignition and lighting system that for each generating winding one or the other of the two levers i and l is closed at all times except for the short intervals including the desired instants of ignition when the ignition lever i opens soon after it closes, and that throughout all the periods of flux reversal except the one at which ignition occurs, the lever l remains closed. The result is that the lever i is closed for a sufficient period just preceding the period of ignition, and the lever l is open for a sufficient time during that period, to allow current to build up in the primary winding g to sufficiently increase the rate of the flux reversal, upon the decay of that current when the circuit is opened by lever i , to generate such a voltage in coil h as will produce an ignition spark at the sparkplug n . Another result is that throughout each of the other periods of flux reversal, the continued closure of the lever

l and the continued opening of the lever i prevent the rate of flux reversal ever becoming so rapid that a sufficiently high voltage for an ignition spark is generated in the winding h even at high speeds of rotation of the rotor. In this way, ignition sparks are produced at the desired periods and no "false" or undesired ignition spark is ever produced at either sparkplug n .

It will be obvious that the lever l may be opened at any time after lever i closes provided that the final interruption of both the ignition and the lighting circuits occurs at the predetermined or desired period of ignition to bring about the decay of the current in the primary winding g and thereby the rapid rate of flux reversal in coil core f . Also the lever l may subsequently close at the time the lever i opens at the desired period of ignition, or at any time thereafter, provided that the lighting circuit l'' is closed during those periods of flux reversal between the desired periods of ignition, for otherwise the flux reversal without the interruption of the circuit of the generating winding g may be sufficiently rapid at high speed of the rotor to produce ignition sparks at those undesired periods. Furthermore, it will be obvious that the lever l should never be opened while the lever i is open at any period of flux reversal other than at the desired periods of ignition because undesired ignition sparks would be caused thereby, and that preferably the lever i should not be closed at any period between the desired periods of ignition since the current impulses that would otherwise flow to the lamps will pass to the ground through the ignition circuit. Thus by the arrangement described, an ignition spark occurs at each and every period that is predetermined or desired, and never at any other period, and lighting current impulses flow to the lamps at all intermediate periods of generation. When a range of ignition timing is provided, as is desirable for some engines, the desired relation of operation of the ignition and lighting interrupters may be maintained by simultaneously advancing and retarding all cams, or all levers, or both.

It will now be obvious that a generator of this kind may have one or any suitable number of generating coils in accordance with the invention, and may have in each rotation any suitable number of flux reversals, or other flux changes if not reversed. Also more than one current impulse per rotation may be utilized for ignition, and provision may be made whereby only some of the intermediate impulses may be utilized for lighting. Also it will be obvious that the generator may be driven at cam shaft or other desired speed relative to that of the engine and may be used for ignition of any desired number or arrangement of cylinders, or any desired number of sparkplugs in each cylinder, and for two-cycle or other desired cycle of operation of the engine. Furthermore, the arrangement of the stator and rotor and of the interrupters may be such that the ignition impulses, and also the lighting impulses, may be generated successively instead of simultaneously in the plurality of generating windings. Furthermore, it will be obvious that translating devices other than lamps may be supplied and therefore the term "lighting" as used herein and in the appended claims is intended to broadly cover within its meaning all translating devices and circuits therefor. Still other changes may occur within the intended scope of the appended claims.

Having thus described the invention, what is claimed is:

1. In an ignition and lighting system, an electric generator having a generating winding, ignition and lighting circuits, and switching mechanism arranged to connect the ignition circuit alone to said winding at predetermined periods of generation therein and to connect the lighting circuit alone to said winding at other periods of generation therein, whereby ignition is prevented at undesired periods.

2. In an ignition and lighting system, an electric generator having a generating winding, ignition and lighting circuits, and switching mechanism arranged to connect the ignition circuit to and disconnect the lighting circuit from said winding during predetermined periods of generation therein and to maintain the lighting circuit connected to said winding and the ignition circuit disconnected therefrom between said predetermined periods, whereby ignition is prevented at undesired periods.

3. In an ignition and lighting system, an electric generator having a generating winding, ignition and lighting circuits, and switching mechanism arranged to connect the ignition circuit to said winding only at predetermined periods of generation therein and to maintain a connection between the lighting circuit and said winding between the predetermined periods, said switching mechanism also being arranged to disconnect the lighting circuit from said winding at substantially the time it connects the ignition circuit thereto and to connect the lighting circuit to said winding directly after each of said predetermined periods, whereby ignition is prevented at undesired periods.

4. In an ignition and lighting system, a magnet having a generating winding in which current impulses are generated at periods of flux change therein, ignition and lighting circuits, and switching mechanism arranged to connect the ignition circuit alone to said winding at predetermined ones of said current impulses and to connect the lighting circuit alone to said winding at other of said current impulses, whereby ignition is prevented at undesired periods.

5. In an ignition and lighting system, a magnet having a generating winding in which current impulses are generated at periods of flux change therein, ignition and lighting circuits, and switching mechanism arranged to maintain the ignition circuit disconnected from and the lighting circuit connected to said winding between predetermined ones of the current impulses and also arranged at the predetermined ones of the current impulses to connect the ignition circuit to and disconnect the lighting circuit from said winding and then to disconnect the ignition circuit from and connect the lighting circuit to said winding, whereby ignition is prevented as undesired periods.

6. In an ignition and lighting system, an electric generator having a plurality of generating windings, ignition and lighting circuits for each generating winding, and switching mechanism arranged to simultaneously connect the ignition circuits alone to their respective windings at predetermined periods of generation therein and to simultaneously connect the lighting circuits alone to their respective windings at other periods of generation therein, whereby ignition in all ignition circuits is prevented at undesired periods.

7. In an ignition and lighting system, an elec-

tric generator having a generating winding, an ignition circuit connected to said winding, a lighting circuit connected to said winding in shunt relation to the ignition circuit, an interrupter in the ignition circuit arranged to close at predetermined periods of generation in said winding and to be open at periods of generation between said predetermined periods, and an interrupter in the lighting circuit arranged to open at said predetermined periods and to be closed at periods of generation between said predetermined periods, whereby ignition is prevented at undesired periods.

8. In an ignition and lighting system, an electric generator having a generating winding, an ignition circuit connected to said winding, a lighting circuit connected to said winding in shunt relation to the ignition circuit, an interrupter in the ignition circuit arranged to remain open between predetermined periods of generation in said winding, an interrupter in the lighting circuit arranged to remain closed between said predetermined periods, the interrupter in the ignition circuit also being arranged to close shortly before each of said predetermined periods and thereafter to open at said period, and the interrupter in the lighting circuit also being arranged to open substantially at the time of each closure of the interrupter in the ignition circuit and to close at substantially the time of the next opening thereof, whereby ignition is prevented at undesired periods.

9. In an ignition and lighting system, an electric generator having primary and secondary generating windings, a sparkplug connected to the secondary winding, ignition and lighting circuits connected to the primary winding in shunt relation to each other, and an interrupter in each of the ignition and lighting circuits, the interrupter in the lighting circuit being arranged to open at substantially the time of closure of the interrupter in the ignition circuit and to close at substantially the time of next opening thereof, whereby undesired ignition impulses are prevented at the sparkplug.

10. In an ignition and lighting system, an electric generator having two generating windings, an ignition circuit connected to each of said windings, a lighting circuit connected to each of said windings in shunt relation to the ignition circuit of the same winding, an interrupter in each ignition circuit for causing the simultaneous generation of ignition impulses in said windings at predetermined periods, and an interrupter in each lighting circuit for causing the simultaneous generation of lighting impulses in said windings at periods other than the periods of the ignition impulses, said interrupters in the lighting circuits being arranged to open at substantially the time of closure of the interrupters in the ignition circuits and to close at substantially the time of the next opening thereof, whereby undesired ignition impulses are prevented in the ignition circuits.

11. In an ignition and lighting system, a magnet having a generating winding and means for causing periodic flux changes therein, an ignition circuit connected to said winding, a lighting circuit connected to said winding in shunt relation to the ignition circuit, an interrupter in the ignition circuit for causing the generation of ignition impulses in said winding at certain of said flux changes, and an interrupter in the lighting circuit for causing generation of the lighting impulses in said winding at other pe-

riods, said interrupter in the lighting circuit being arranged to open at substantially the time of closure of the interrupter in the ignition circuit and to close at substantially the time of the next opening thereof, whereby undesired ignition impulses are prevented in the ignition circuit.

12. In an ignition and lighting system, a magneto having a plurality of generating windings each with a primary and a secondary winding and also having means for causing periodic flux changes therein, a sparkplug connected to each secondary winding, an ignition circuit connected to each primary winding, a lighting circuit connected to each primary winding in shunt rela-

tion to the ignition circuit, interrupters in the ignition circuits for causing the simultaneous generation of ignition sparks at the sparkplugs at certain of said flux changes, and interrupters in the lighting circuits for causing generation of lighting impulses in said windings at other periods, said interrupters in the lighting circuit being arranged to open simultaneously at substantially the time of closure of the interrupters in the ignition circuits and to close simultaneously at substantially the time of the next opening thereof, whereby ignition at the sparkplugs is prevented at undesired periods.

KARL BEER.

GUSTAV PFROMMER. 15