

J. L. MILTON.
ELECTRICAL EQUIPMENT FOR AUTOMOBILES.
APPLICATION FILED MAR. 23, 1908.

1,015,275.

Patented Jan. 16, 1912.

2 SHEETS—SHEET 1.

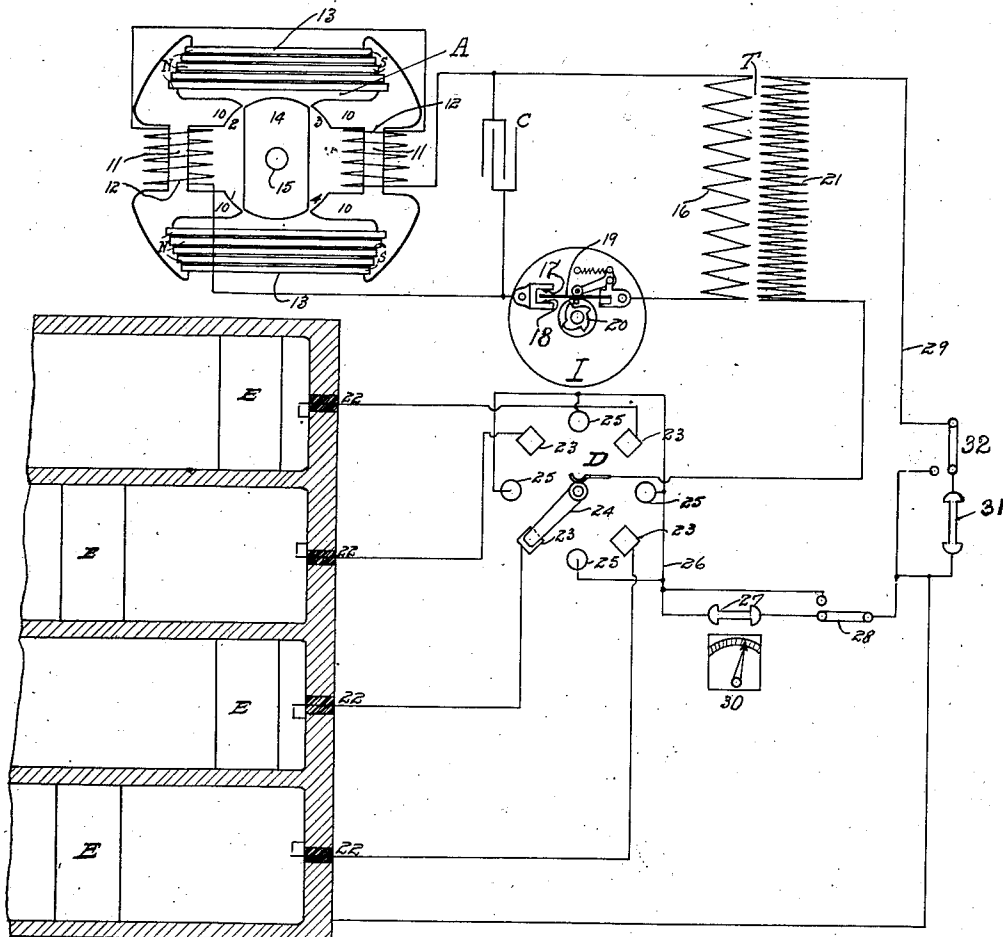


FIG. 1.

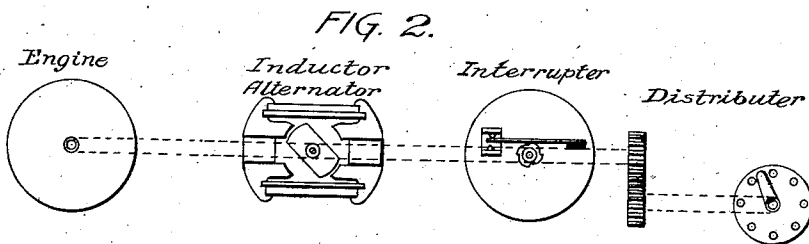


FIG. 2.

WITNESSES:
Frank J. Thelen
Albert Mc Caleb

INVENTOR
John L. Milton
By Brown & Williams
ATTORNEYS

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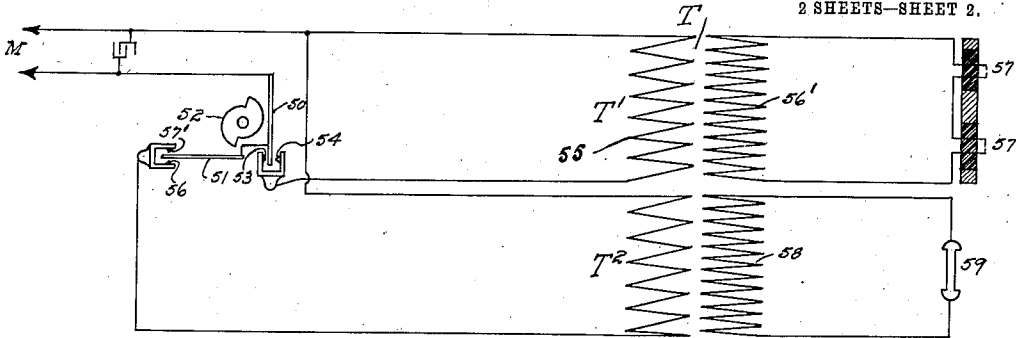


FIG. 3

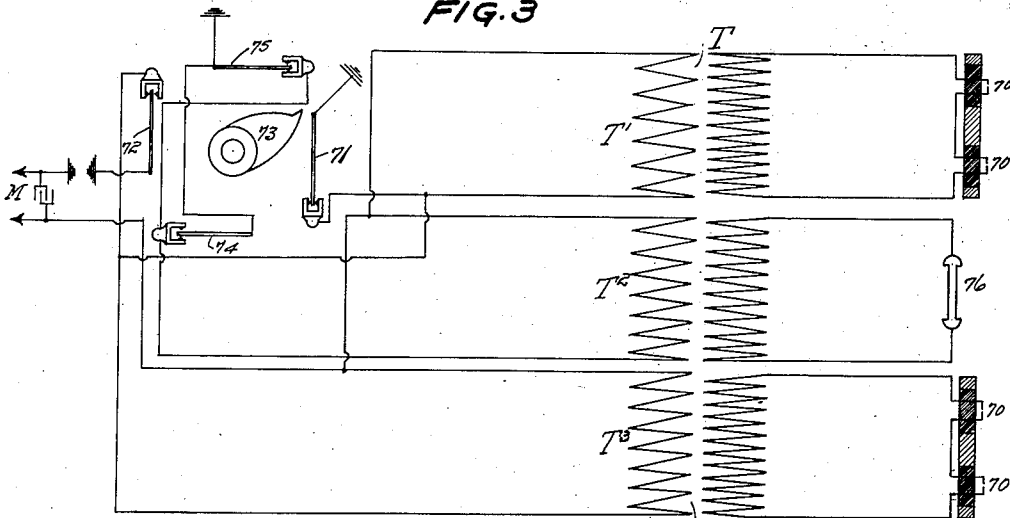


FIG. 5

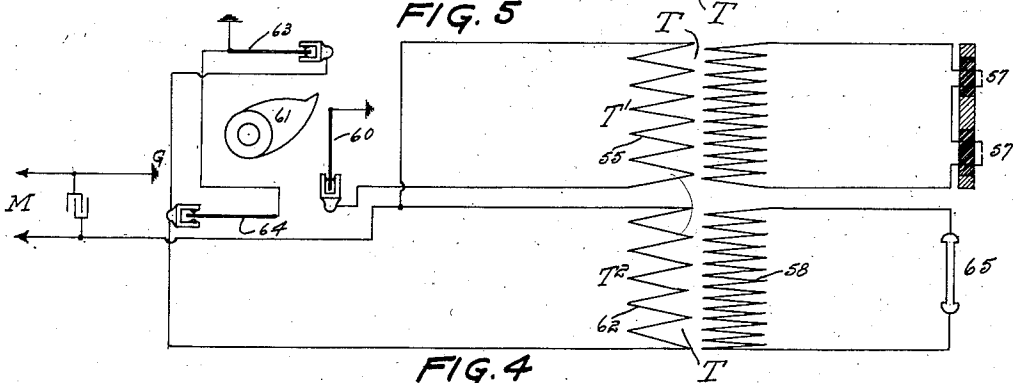


FIG. 4

WITNESSES:

Frank J. Thelen
Albert Mc Caleb

INVENTOR

John L. Milton
By Brown & Williams

ATTORNEYS

UNITED STATES PATENT OFFICE.

JOHN L. MILTON, OF CHICAGO, ILLINOIS.

ELECTRICAL EQUIPMENT FOR AUTOMOBILES.

1,015,275.

Specification of Letters Patent.

Patented Jan. 16, 1912.

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To all whom it may concern:

Be it known that I, JOHN L. MILTON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Electrical Equipment for Automobiles, (Case 6,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to electrical equipments for automobiles, and comprises means for the electrical ignition of the combustible in the internal combustion engine, and means for the illumination of the car or various instruments or attachments used upon the car.

In an internal combustion engine such as is used in an automobile, it is customary to ignite the explosive mixture in the engine cylinders by means of an electrical spark passing between the contacts of spark plugs. It is desirable also to equip automobiles with speedometers, clocks, automatic oiling devices, etc. In order that the dials of such instruments or devices may be read at night it is necessary in some way to illuminate them.

In accordance with my present invention I combine an electric lighting system with the electrical equipment which is required for ignition purposes.

It is a special object of my invention to provide for the illumination of such instruments, or, in fact, the interior of a limousine car, without materially increasing the cost or complication of the equipment and without materially increasing the load upon the engine.

In the preferred form of my invention an inductor generator of alternating currents is geared to the engine in a ratio such that a positive half wave of current will be generated in synchronism with each compression stroke of the engine. The spark plugs of the engine are connected with the secondary winding of a transformer or induction coil whose primary winding is adapted to be included in circuit with the generator coils. A circuit breaker driven from the engine shaft periodically interrupts the flow of current through the primary winding of the transformer, thus causing high pressure currents to be induced in the secondary circuit of the transformer in synchronism

with the compression strokes of the engine. The high tension currents are directed to the appropriate spark plugs in the engine cylinders by means of a distributor, which is also driven in synchronism with the engine shaft. In accordance with the preferred form of my invention the negative half waves of current generated in the coils of the alternator are not utilized in the production of jump sparks for ignition purposes. These negative half waves are used for illuminating purposes. The distributor is provided with contacts intermediate of those connected with the spark plugs, and the rotating wiper makes connection with these intermediate contacts during the flow of the negative half waves of current. Leading from these intermediate contacts there is a circuit which includes the secondary winding of a separate transformer and one or more vacuum tubes, such, for instance, as Geissler tubes of a form adapted to emit the most light upon the passage of high tension electrical currents there-through. Such a vacuum tube or lamp is placed in proximity to the dial of each of the instruments which it may be desired to read. So also, the interior of the body of an automobile may be equipped with one or more of these glow lamps. I have found that when the engine runs at even a comparatively slow speed the discharges through the tubes or lamps will be of sufficient frequency to cause the emission of a very satisfactory and apparently constant light amply sufficient for purposes of dial illumination. I have found that the light which is emitted by a lamp of this character is sufficient to enable one to read a paper observed at a distance of two or three feet from a Geissler tube of ordinary construction.

The details of the various embodiments of my invention will be more fully understood by reference to the accompanying drawings, in which—

Figure 1 illustrates diagrammatically the equipment for an automobile arranged in accordance with my invention; Fig. 2 illustrates more or less diagrammatically the connection between the engine and the inductor-alternator, the interrupter and the distributor; Fig. 3 illustrates a modification in which two transformers or induction coils are used, one for ignition and the other for illuminating purposes; Fig. 4 illustrates a similar modification adapted for application

to a two-cylinder engine, and Fig. 5 illustrates a modification containing three separate transformers and four circuit breakers adapted for the ignition of a four-cylinder engine and the illumination of the car in accordance with my invention.

In so far as they are applicable, like characters of reference are applied to corresponding parts in all of the figures.

Referring first in detail to Fig. 1, the inductor alternator is shown at A. It comprises the bifurcated pole pieces 10, 10 upon the connecting yokes 11, 11 on which are wound the inductor coils 12, 12. The magnetic circuit of the pole pieces is completed by the permanent bar magnets 13, 13 whose polarity is indicated by the letters N, S. The rotor or inductor 14 of soft iron is mounted to rotate with the shaft 15, this shaft being geared to the automobile engine at a ratio such that one revolution of a four-cycle engine will be accompanied by one revolution of the rotor. The angular relationship in which the rotor is geared to the engine shaft is such that the maximum pressure of the positive half waves will synchronize approximately with the completion of the compression strokes of the pistons of the engine. The induction windings 12 are connected in circuit with the primary winding 16 of the transformer or induction coil T, this connecting circuit including, however, the interrupter or circuit breaker I. This circuit breaker preferably includes contacts 17 and 18 and also a vibrating member 19 which is actuated by the rotating cam 20. The cam 20 is geared to the engine shaft in a ratio such that the circuit through the contacts 17 and 19 will be made shortly before the maximum pressure is attained in the generation of the half waves of alternating current. A condenser C is connected in bridge of the circuit leading from the coils of the inductor generator to the primary winding of the transformer. The operation of this portion of the mechanism is as follows: The circuit is closed from the inductor coils through the vibrator 19 and the front contact 17, preferably just about as the maximum instantaneous value in each current wave is reached. Current therefore flows through the primary winding of the transformer upon its return to the opposite side of the generator. The flow of current through this circuit is suddenly interrupted by the disengagement of a projection upon the cam 20 from the toe of the vibrator 19, thus causing the charge of the condenser C. Almost instantly after the circuit through the primary winding is opened at 17 it is again closed through the contact 18. The condenser having had time to become charged during this very short interval of time, is now afforded an opportunity to discharge itself through the primary wind-

ing of the induction coil. The sudden demagnetization of the transformer, followed by the discharge of the condenser through the primary winding, causes a very high tension current to be induced in the secondary winding 21 of the transformer. These high tension waves are used for ignition purposes in the spark plugs and for illuminating purposes in the vacuum tubes of the system of my invention.

The cylinders of a four-cylinder engine are indicated at E, E. Each cylinder is equipped, as shown, with a spark plug 22, these spark plugs being connected, respectively, with the main contacts 23, 23 of the distributor D. The rotating wiper 24 of the distributor is geared to the engine shaft in a ratio such that the wiper will make connection with the contact for each cylinder during the time at which the combustible mixture in that cylinder is at the compression stage of its cycle. The angular adjustment of the gears is such, also, that each spark plug will be connected with the secondary of the transformer during generation of a positive half wave of current. The interruption of the primary circuit of the transformer, accompanied by the closure of a circuit for the discharge of the condenser therethrough, causes a spark to jump between the contacts of the plug which is at that time connected in circuit with the secondary of the transformer. This part of the system provides the means for the ignition of the mixture in the engine cylinders.

The distributor D is provided with a set of intermediate contacts 25, 25, these contacts occupying a position such that the wiper will close circuit through them during the generation of the negative half waves of current. That is to say, while the wiper 24 makes connection with one of the intermediate contacts 25, the interrupter cam 20 causes the circuit to be broken at the contact 17 and immediately thereafter to be closed through the contact 18, thus causing an energization of the primary winding of the transformer, due to the interruption and subsequent condenser discharge during the generation of a negative half wave in the coils of the inductor generator. The high tension current which is induced in the secondary winding of the transformer follows a path from one end of the secondary winding 21, through the wiper 24, the intermediate contact 25, the conducting wire 26 and the Geissler tube or glow lamp 27, the manual switch 28 and the conductor 29 which leads to the other side of the secondary winding 21.

At 30 there is represented the dial of a speedometer whose indications can clearly be read by the glow or illumination afforded by the tube 27. There is, of course, a discharge of high tension current through this

lamp whenever the wiper makes connection with one of the intermediate contacts 25. Even when the engine is run at a very moderate speed these discharges take place with sufficient rapidity to give what appears to be a substantially constant light, and the illumination is amply sufficient for the purposes required. At 31 there is shown a second tube or lamp with its manual switch 32. When this switch is closed the discharge will take place through both lamps, thus affording illumination at two places upon the car.

It will be apparent that my invention provides means for securing the required illumination without placing upon the engine any substantial load in addition to that which is required for ignition purposes. Furthermore, the equipment is not greatly complicated or increased in cost in order that the desired results may be accomplished.

Various modifications of the fundamental features of my invention are possible.

In Fig. 3 I have shown the conductors leading from the generator to a pair of interrupter vibrators 50 and 51. A single interrupter cam 52 is arranged to actuate both of the vibrators. The vibrator 50, co-operating with the contacts 53 and 54 in a manner already described, controls the circuit through the primary winding 55 of the transformer T^1 , the secondary 56' of this transformer being connected with the spark plug 57 of a two-cylinder engine. In this case the spark plugs are connected in series, so that each discharge will take place in series through both plugs. The ratio of gearing between the cam 52 and the engine shaft is such that the engine will make two revolutions for each revolution of the cam. This will cause the passage of a spark through the spark plugs once during each revolution of the engine, and the sparks are timed to synchronize with the compression strokes of the engine. Here again the positive half waves are utilized for ignition purposes, the negative half waves occurring during the time when the interrupter vibrator 51 is actuated to coöperate with its contacts 56 and 57' to cause the induction of a high tension current in the secondary 58 of the transformer T^2 . These high tension currents are discharged through the vacuum tube or glow lamp 59 which is connected with the secondary 58 in the manner shown in the diagram. It will, of course, be understood that when the spark plugs are connected in series, as here shown, only one spark will be effective at a time to cause the ignition of an explosive mixture. The spark which simultaneously occurs between the contacts of the other plug will cause no harm, however, since when the explosive mixture reaches the end of its compression

stroke in one of the two cylinders, the piston of the other cylinder will be at the end of its exhaust stroke. There will therefore be nothing to be ignited in that cylinder.

Still another modification of my invention is illustrated in Fig. 4. Here again the conductors leading from the generator are shown connected on one side with the primary windings of transformers T^1 and T^2 and on the other side with the ground or engine frame G. The secondary of the transformer T^1 is connected in series with the two spark plugs 57, 57' of the two-cylinder engine. The interruption of the positive waves of current through the primary winding 55 of the transformer T^1 is controlled by the vibrator 60 which is operated by the cam 61, the cam in this instance having but a single projection. This cam is geared to the engine shaft in a one-to-one ratio, so that an interruption of the current through the transformer winding 55 occurs once during each revolution of the engine. Here again the high tension sparks pass between the contacts of the spark plugs 57, 57' in series, although the sparks are alternately effective in causing ignition. In the modification shown in this Fig. 4 the generator will be run at a speed such as to cause the generation of two positive half waves and two intervening negative half waves during each revolution of the cam 61. While it is only the alternate positive waves which are utilized in causing a spark to pass between the contacts of the plugs, all of the negative waves are utilized in causing the induction of high tension currents in the secondary 58 of the transformer T^2 . It will be noted that the primary winding 62 of this transformer is connected with the contacts of two vibrator arms 63 and 64, these arms having an angular disposition about the axis of rotation of the cam 61 such that one of the blades will be actuated during the generation of each negative half wave of alternating current. The result is that a high tension current will be induced in the secondary winding of the transformer T^2 during each negative half wave, and these currents are, in the manner already described, conveyed to the lamp 65. One or more of these lamps may be placed at any convenient point to give the required illumination.

In Fig. 5 I have illustrated a similar embodiment of my invention, except that a four-cylinder engine is diagrammatically indicated by the four spark plugs 70, 70. These spark plugs are connected together serially in pairs, each pair being connected with the terminals of an induction coil T^1 or T^2 , as the case may be. The primaries of these induction coils are connected, respectively, with the contacts of diametrically opposite vibrator blades 71 and 72. These blades are actuated by the rotating

cam 73, this cam being geared to the engine in a one-to-one ratio, the generator being driven at a speed such that a positive impulse of current will synchronize with the actuation of each of the vibrator blades 71 and 72. The cam 73 is arranged to actuate one or the other of the intermediate vibrator blades 74 or 75, during the negative half waves of current. The interruptions of these negative half waves and the accompanying condenser discharges are effective in causing the induction of high tension currents in the secondary winding of the transformer T², the secondary of this transformer being connected with the glow lamp 76. In this modification of my invention the spark plugs are connected serially in pairs, so that the passage of a spark through any plug will be accompanied by the passage of a spark between the contacts of the serially connected plug. As in the case of the arrangements illustrated in Figs. 3 and 4, however, only one of the sparks will be effective at a time to cause ignition in an engine cylinder. In this embodiment of my invention each positive wave of current is utilized in one or the other ignition circuit, and all of the negative half waves of high tension current are passed through the vacuum tube or lamp for illuminating purposes in the manner previously described.

While I have thus shown and described the preferred embodiment of my invention, together with certain modifications thereof, it will be apparent that still other adaptations may be made without departing from the spirit of my invention. I do not wish, therefore, to limit myself except as expressed in the terms of the following claims.

I desire to secure by Letters Patent—

1. In an automobile, the combination with an internal combustion engine, of an inductor generator of alternating current geared to said engine in a fixed relation such that the generation of the positive current half-waves shall synchronize with the compression strokes of the engine, a transformer having its primary winding included in a circuit with the generator, a circuit breaker driven by the engine and adapted periodically to close and open the primary circuit in synchronism with the compression strokes of the engine, a condenser in bridge of the circuit from the generator, spark plugs associated with the engine cylinders, a distributor geared to the engine and having a contact connected with each spark plug, the secondary winding of the transformer being connected with the spark plugs through said distributor contacts during the positive current half-waves, an instrument having a suitable dial, a vacuum tube mounted to light said dial, and intermediate contacts on said distributor con-

nected with said vacuum tube and adapted to include said vacuum tube in circuit with the secondary winding of the transformer during the negative current half-waves.

2. In an automobile, the combination with an internal combustion engine, of a generator of alternating current driven by said engine in a relation such that the positive current half-waves shall synchronize with the compression strokes of the engine, a transformer having its primary winding included in circuit with the generator, a circuit breaker driven by the engine and adapted periodically to close and open the primary circuit of the transformer in synchronism with the current waves, a condenser in bridge of the circuit from the generator, spark plugs associated with the engine cylinders, an instrument having a suitable dial, a vacuum tube glow lamp mounted to light said dial, means for connecting the spark plugs with the secondary of the transformer during the generation of alternate current half-waves, and means for connecting the glow lamp with the secondary of the transformer during the generation of the intervening current half-waves.

3. In an automobile, the combination with an internal combustion engine, of a generator of alternating current driven by the engine, a transformer having its primary winding adapted for connection with the generator, spark plugs associated with the engine cylinders, a vacuum tube glow lamp, and means for alternately connecting the spark plugs and the glow lamp with the secondary of said transformer.

4. In an automobile, the combination with an internal combustion engine, of spark plugs therefor, a source of single-phase alternating currents controlled by said engine and adapted to cause the passage of current between the electrodes of the spark plugs, an instrument, an electric glow lamp mounted to light the dial of said instrument, and means for supplying current from said source alternately to said lamp and to said spark plugs.

5. In an automobile, the combination with an internal combustion engine, of spark plugs therefor, a source of single-phase alternating currents controlled by said engine and adapted to cause the passage of current between the electrodes of the spark plugs, an electric lamp, and means for supplying current from said source alternately to said lamp and to said spark plugs.

6. In an automobile, the combination of an internal combustion engine, an alternating current generator driven thereby, spark plugs associated with the engine cylinders, an electric lamp, suitable circuit-connections for the spark plugs and the lamp, and a distributor controlled by the engine for

causing the current to pass alternately between the spark plugs and through the lamp.

7. In an automobile, the combination of an internal combustion engine, an alternating current generator driven thereby, spark plugs associated with the engine cylinders, a vacuum-tube lamp, suitable circuit-connections for the spark plugs and the lamp, and a distributor controlled by the engine for causing the current to pass alternately between the spark plugs and through the lamp.

8. In an electric equipment for automobiles, the combination of an internal combustion engine, an alternating current generator driven thereby, a transformer having its primary winding included in circuit with the generator, a circuit-breaker driven by the engine and adapted periodically to close and open the primary circuit of the transformer in synchronism with the current waves, spark plugs associated with the engine cylinders, a vacuum-tube lamp, and means for alternately connecting the spark plugs and the lamp with the secondary of the transformer.

9. In combination, an internal combustion engine, a source of high tension alternating currents controlled by the engine, a spark plug associated with the engine cylinder, a vacuum tube glow lamp carried with the engine, and means for causing the passage of high-tension current from said source alternately through said lamp and between the electrodes of the spark plug.

10. In an electrical equipment for automobiles, the combination of an internal-combustion engine, a generator of single-phase alternating currents connected to said engine in a suitable gear-ratio, spark-plugs associated with the engine-cylinders, an electric lamp, and means whereby certain alter-

nate half-waves from said generator are caused to pass between the electrodes of the spark-plugs for ignition-purposes, while the other alternate half-waves are caused to pass through the lamp for illuminating purposes.

11. In an electrical equipment for automobiles, the combination of an internal-combustion engine, a generator of single-phase alternating currents connected to said engine in a suitable gear-ratio, spark-plugs associated with the engine-cylinders, an electric lamp, and means whereby the single-phase currents from said generator are caused to pass alternately between the electrodes of the spark-plugs for ignition-purposes, and through the lamp for illuminating purposes.

12. The combination of an internal-combustion engine, an alternating current generator driven thereby, spark-plugs associated with the engine cylinders, an electric lamp, suitable circuit connections for the spark-plugs, separate circuit connections for the lamp, and a circuit-controlling device governed by the engine for causing current to pass between the spark-plugs and through the lamp at different intervals.

13. The combination of an internal combustion engine, spark plugs associated with the engine cylinders, an electrical lamp, an alternating current generator, and circuit changing mechanism operated simultaneously with the engine and the generator for causing current to pass between the spark plugs and through the lamp at different intervals.

In witness whereof, I hereunto subscribe my name this 20th day of March A. D. 1908.

JOHN L. MILTON.

Witnesses:

HENRY J. PODLESÁK,
HARVEY L. HANSON.