R. VARLEY.

ELECTRICAL SYSTEM.

APPLICATION FILED DEC. 6, 191-

1,225,536.

Patented May 8, 1917.

2 SHEETS—SHEET 1.

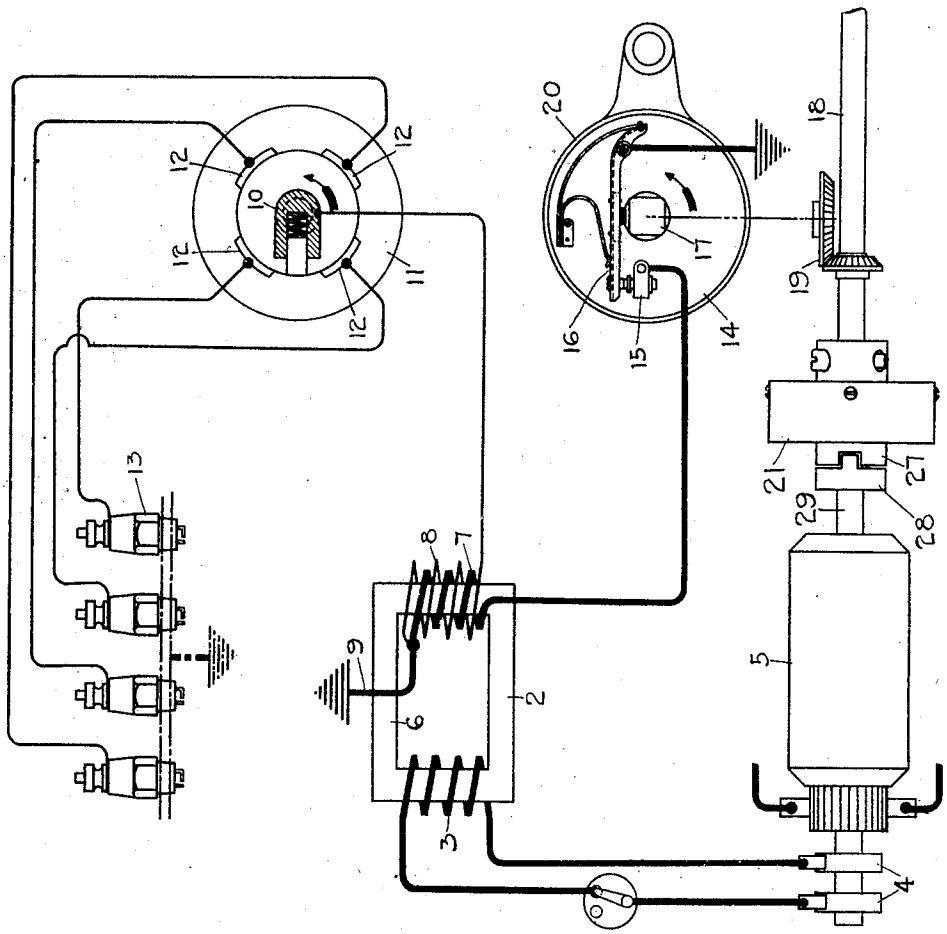


FIG. 1

INVENTOR

Richard Varley

by M. Arthur Keller

his Attorney

NORRIS PETERS, INC., LITHO., WASHINGTON, D. C.

R. VARLEY.

ELECTRICAL SYSTEM.

APPLICATION FILED DEC. 6, 1915.

1,225,536.

Patented May 8, 1917.

2 SHEETS—SHEET 2.

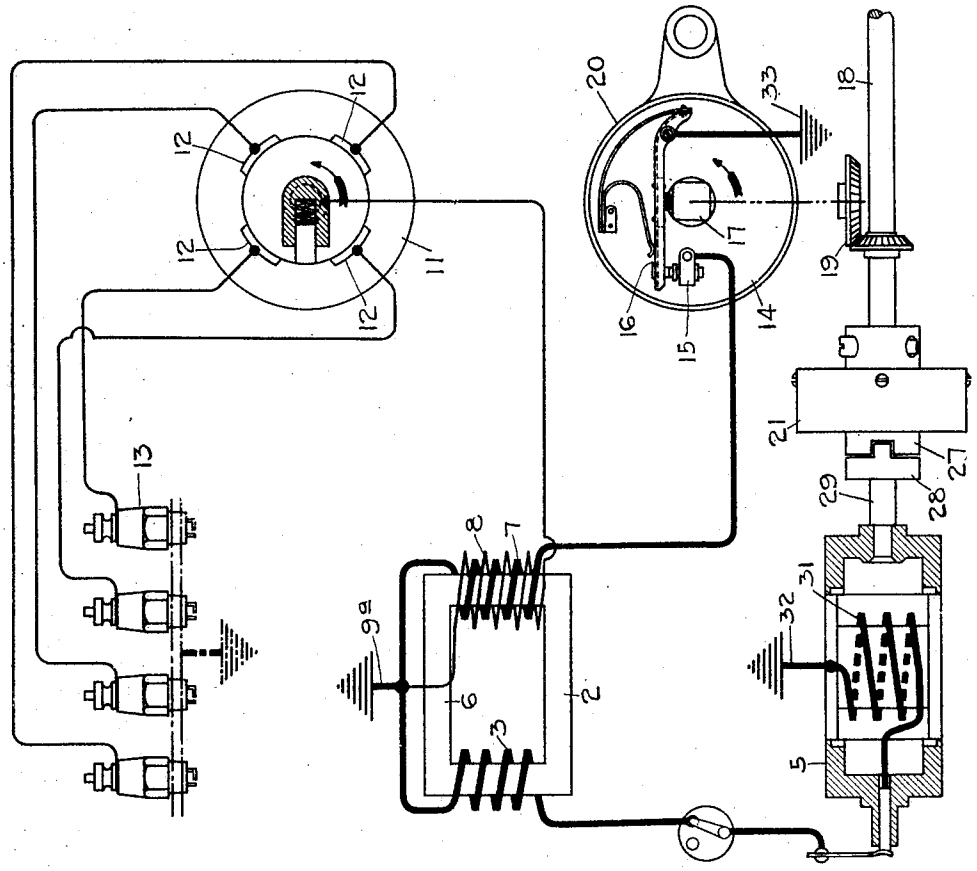


FIG. 2

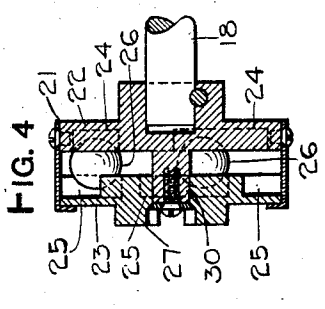


FIG. 4

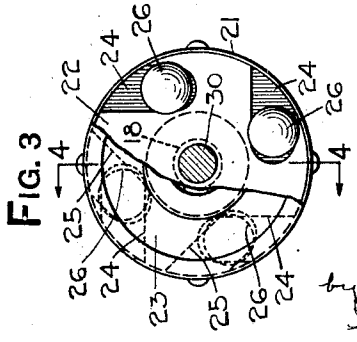


FIG. 3

INVENTOR

Richard Varley

by M. Arthur Kellett

his attorney

MORRIS PETERS, INC., LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

RICHARD VARLEY, OF ENGLEWOOD, NEW JERSEY.

ELECTRICAL SYSTEM.

1,225,536. Specification of Letters Patent. Patented May 8, 1917.

Application filed December 6, 1915. Serial No. 65,382.

To all whom it may concern:

Be it known that I, RICHARD VARLEY, a citizen of the United States of America, residing at Englewood, in the county of Bergen and State of New Jersey, have invented new and useful Improvements in Electrical Systems, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form part of this specification.

This invention is an electrical system, and it finds advantageous embodiment in an ignition system whereby the combustible charges of an explosion engine may be ignited. Furthermore, it relates to systems in which the source of energy comprises a power driven alternating current generator or a magneto machine having a primary winding interruption of which induces a high potential current in a secondary winding connecting with sparking devices.

In an ignition system, interruption of the primary circuit, to produce the spark, must occur at or near the period of maximum flux distortion in the generator, *i. e.*, at or near the peak of the current wave, and is brought about by interrupter contact mechanism which is adjustable relative to the engine piston position to vary the time of sparking. Thus it is customary to retard the spark during starting of the engine, to prevent premature explosion of the charge, after which the interrupter mechanism is adjustably advanced as the speed of the engine increases. To obtain a hot effective spark it is necessary to maintain substantial coincidence between the peak of the alternating current wave and the time of separation of the interrupter contacts. It therefore will be seen that the angle or degree within which timing adjustment of the interrupter may obtain while according operative coincidence with the wave peak, is very slight, and that full desired spark advance adjustment of the interrupter is at the expense of the spark because such adjustment results in the interrupter being shifted relatively to a position in which it operates in asynchronism or "off the wave peak" of the current.

The object of my invention is to overcome this difficulty in the provision of a system in which the current wave peak is available within an extended range of timing adjustment of the interrupter mechanism.

I will now describe my invention so that others skilled in the art to which it appertains may understand and construct the same, it being premised, however, that many changes may be made in the circuit arrangements and construction shown without departing from my invention.

Figure 1 is a diagrammatic view of an ignition system embodying my invention; Fig. 2 is a similar view showing the generator circuit grounded and a modified form of transformer means; Fig. 3 is an elevational view, partly broken away, of a centrifugally actuated device for adjustably advancing or retarding in its magnetic field the generator armature, indicated in Fig. 1; and Fig. 4 is a sectional view of said centrifugal device, taken on the line 4—4 of Fig. 3.

In Fig. 1, the numeral 2 indicates a spark coil or transformer that is energized by a winding 3 fed from slip rings 4 of the armature 5 of an alternating current generator which may form part of the lighting equipment of an autovehicle. The particular transformer shown corresponds to that disclosed in Letters Patent 1,103,385, granted to me July 14th, 1914, in that a magnetic core 6 besides carrying the energizing winding 3 is provided with a choke winding 7 for controlling inductive relationship between the winding 3 and a secondary winding 8 one end of which is grounded, as through ground 9, which also grounds the choke winding, and the other end of which connects with the arm 10 of suitable synchronously driven distributer apparatus 11, the contact segments 12 of which connect with spark plugs 13 in the usual manner. In the circuit of the winding 7 is interrupter mechanism 14 that comprises essentially a fixed contact 15, a movable contact 16 in the form of a contact lever, and a contact actuating cam 17, the contact 16 preferably being grounded in common with ground 9. It will, of course, be understood that the interrupter and distributer mechanisms are so driven as to interrupt the circuit of the winding 7 and connect the spark plugs in the secondary circuit at periods of time properly related to the engine piston phases. This synchronous driving may be effected in any suitable manner, as by the engine driven shaft 18 and gearing 19.

The generator armature 5 is driven by the engine, as by the shaft 18, so as to energize

the transformer winding 3 which thereupon sets up or induces a magnetic flux in the transformer core. The circuit of the choke coil 7 is normally closed by the interrupter contacts 15 and 16, so that as a result the lines of flux are restrained or forced back and tend to take a leakage path across the sides of the core, all as clearly set forth in my above mentioned Letters Patent, but upon opening the circuit of the choke winding 7, by operative separation of the interrupter contacts, the repressed flux assumes the magnetic path provided by the core, and immediately induces a high potential current in the secondary winding 8 as the distributer connects it in circuit with a spark plug.

The point in time of separation of the interrupter contacts accords with the peak of the current wave traversing the winding 3 and therefore with the time of maximum flux activity in the transformer or maximum flux distortion in the generator, but it is apparent that as the engine speed builds up the time of formation of the spark in the engine cylinder, must be advanced relative to the engine piston position, and this is effected by angularly advancing the interrupter contacts relatively to the engine shaft so that the point of separation of the interrupter contacts occurs sooner in the engine cycle, as is well understood by those skilled in the art; the interrupter in the instant case having its contacts carried in a casing 20 rotatively adjustably mounted about the interrupter cam shaft.

But spark advance movement of the interrupter to required limits results in destruction of desired synchronism between the wave peak and time of separation of the interrupter contacts and therefore in energizing of the secondary winding at other than maximum potential and the formation of a spark of low ignitive value. I therefore interposed between the driven member or armature 5 of the alternating current generator and the driving shaft, in this instance the shaft 18, a variable coupling 21 that is preferably centrifugally actuable to shiftably advance, relatively to and in the direction of rotation of the shaft 18, the armature 5 in its magnetic field, with resultant advance in time of development of the maximum period of flow or of the peak of the current wave to a point effectively in accord with the interruptive period of the advanced interrupter mechanism.

The above mentioned operative relationship between the coupling or automatic adjusting device for the generator and the interrupter mechanism is preferably such that when the engine assumes a speed incident to or necessitating spark advance adjustment of the interrupter, the centrifugal member will respond to adjustably shift the armature in the direction of its rotation just prior to the necessary advance adjustment of the interrupter mechanism.

Any suitable form of shifting device or coupling 21 may be employed. In Figs. 3 and 4 this variable coupling, shown in Fig. 1, comprises a plurality of disks 22 and 23 formed in the opposing faces of which are a plurality of tangential slots or grooves 24 and 25 respectively, the grooves in one disk extending in the opposite direction to and intersecting those in the other disk. Lodged in the grooves, between the disks, are ball weights 26 that, by reason of their engagement with the grooves in each disk, determine the point of intersection of the grooves. When the shaft 18 drives the coupling 21 at a high speed incident to developed propulsion of the engine, the ball members 26 will be centrifugally extended or thrown outwardly, thus varying the point of intersection of the grooves 24 and 25 and thereby rotating the disk 23 relatively to the disk 22, in the direction of rotation of the shaft 18 or generator armature. The disk 23 preferably has a clutch face or head 27 that interlocks (see Fig. 1) with a similar member 28 carried by the armature shaft 29; an axial stub extension 30 on the disk 22 serving to hold the disk 23 in alinement.

As above stated, any suitable transformer may be employed. In Fig. 2 I show a system that corresponds with that shown in Fig. 1 (and in which Fig. 2 like or similar parts and circuits bear like reference numerals,) with the exception that the generative winding 31 of the alternating current generator is grounded, as at 32, in common with grounds 9^a and 33, and the winding 7 is connected in active circuit with the generator through the interrupter mechanism 14 and ground 33. Thus when the interrupter contacts are closed the current generated in the armature 5, traverses both the windings 3 and 7 which are preferably so arranged on the transformer core that the lines of flux thereby set up or induced in the core tend to meet one another at an intermediate point in the core. When the interrupter contacts are suddenly opened or separated by the action of the cam 17, the circuit of the winding 7 is broken and that winding brought out of energizing relationship with the generator, so that the repressed flux takes the normal path provided by the core, as above described in connection with Fig. 1, surging through that part of the core carrying the secondary winding 8 and thus therein inducing a high potential sparking current which is well sustained by reason of the fact that the winding 3 remains connected in the active generator circuit.

Having thus described my invention what I claim and desire to secure by Letters Patent is:

1. In an electrical system, spark producing means including a circuit and a controller for periodically opening and closing said circuit for the production of sparks and capable of spark adjustment, an alternating current generator supplying said sparking means with energy and having a shiftable generator phase adjusting member actuable without thereby effecting adjustment of the controller, and power actuated means for shifting said phase adjusting member.

2. In an electrical system, spark producing means including a circuit and a controller for periodically opening and closing said circuit for the production of sparks and capable of spark adjustment, an alternating current generator supplying said sparking means with energy and having a shiftable generator phase adjusting member actuable without thereby effecting adjustment of the controller, and a centrifugally operated device for shifting said phase adjusting member.

3. In an electrical system, spark producing means including a circuit and a controller for periodically opening and closing said circuit for the production of sparks and capable of spark adjustment, an alternating current generator supplying said sparking means and having winding connected in said circuit and having a shiftable generator phase adjusting member actuable without thereby effecting adjustment of the controller, and power actuated means for shifting said phase adjusting member.

4. In an electrical system, spark producing means including a circuit and a controller for periodically opening and closing said circuit for the production of sparks and capable of spark adjustment, an alternating current generator supplying said sparking means with energy and having a revoluble armature shiftable for adjusting the generator phases without thereby effecting adjustment of the controller, and means for shifting the armature.

5. In an electrical system, a transformer forming part of spark producing means and having a winding, circuit controller means for said winding, capable of adjustment for varying the time of sparking, an alternating current generator supplying said transformer and having a current phase adjusting member, and means for automatically adjusting said member without thereby effecting adjustment of the controller means.

6. In an electrical system, a transformer forming part of spark producing means and having a normally closed circuit winding, circuit interrupter means for said winding, capable of adjustment for varying the time of sparking, an alternating current generator supplying said transformer and having a revoluble armature shiftable for adjusting the generator phases without thereby effecting adjustment of the interrupter, and means for shifting the armature.

7. In an electrical system, a primary winding, an inductively related secondary winding having in circuit a current using device, a controller for periodically opening and closing a circuit including said primary winding and capable of spark adjustment, an alternating current generator supplying energy to said primary winding and having a shiftable generator phase adjusting member actuable without thereby effecting adjustment of the controller, and power actuated means for shifting said phase adjusting member.

8. In an electrical system, an alternating current generator having a winding, spark producing means energized by said winding, controller means for opening and closing a circuit including said winding and capable of spark adjustment; said generator having a phase adjusting member actuable without thereby effecting adjustment of the controller means, and power actuated mechanism for operating said phase adjusting member.

9. In an electrical system, an alternating current generator having a winding, spark producing means energized by said winding, a power driven shaft for actuating the generator, controlling means actuated by said shaft, for opening and closing a circuit including said winding and capable of spark adjustment; and a generator phase adjusting member operatively associated with said shaft and actuable without thereby effecting adjustment of the controlling means.

In testimony whereof I have hereunto set my hand.

RICHARD VARLEY.