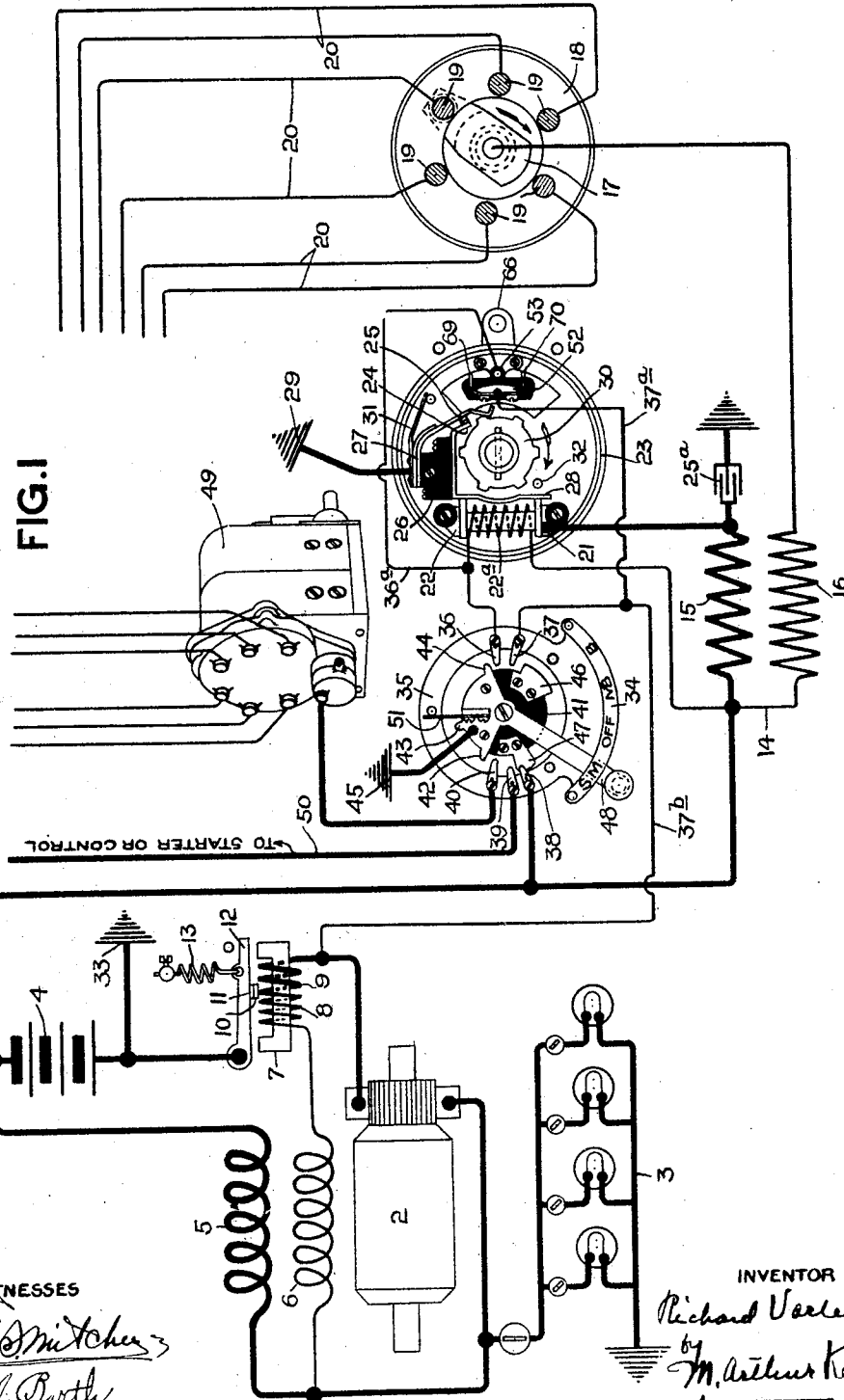


R. VARLEY.
IGNITION SYSTEM AND APPARATUS.
APPLICATION FILED SEPT. 11, 1914.

1,225,533.

Patented May 8, 1917.
5 SHEETS—SHEET 1.



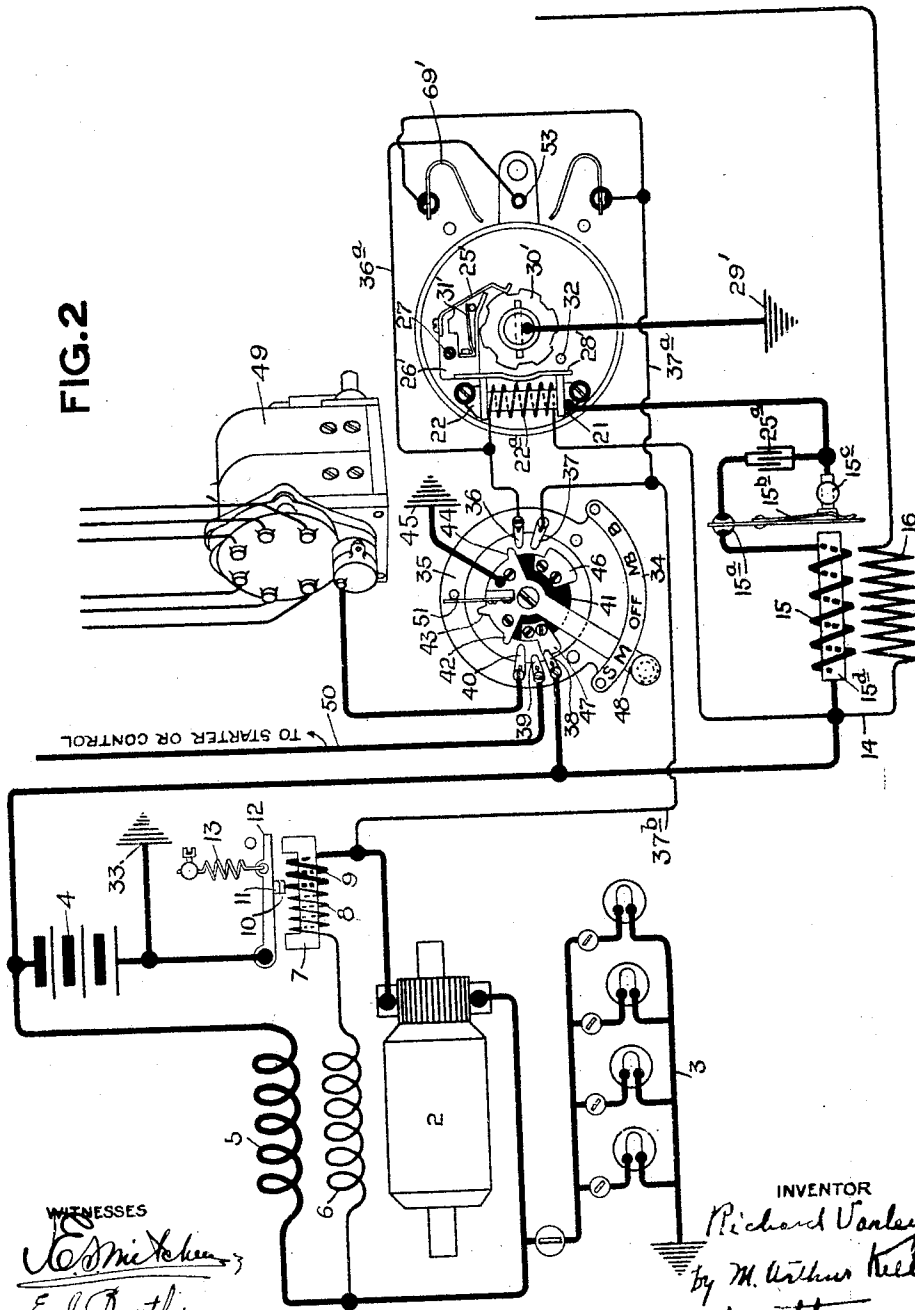
WITNESSES

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R. VARLEY.
IGNITION SYSTEM AND APPARATUS.
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Patented May 8, 1917.
5 SHEETS—SHEET 2.

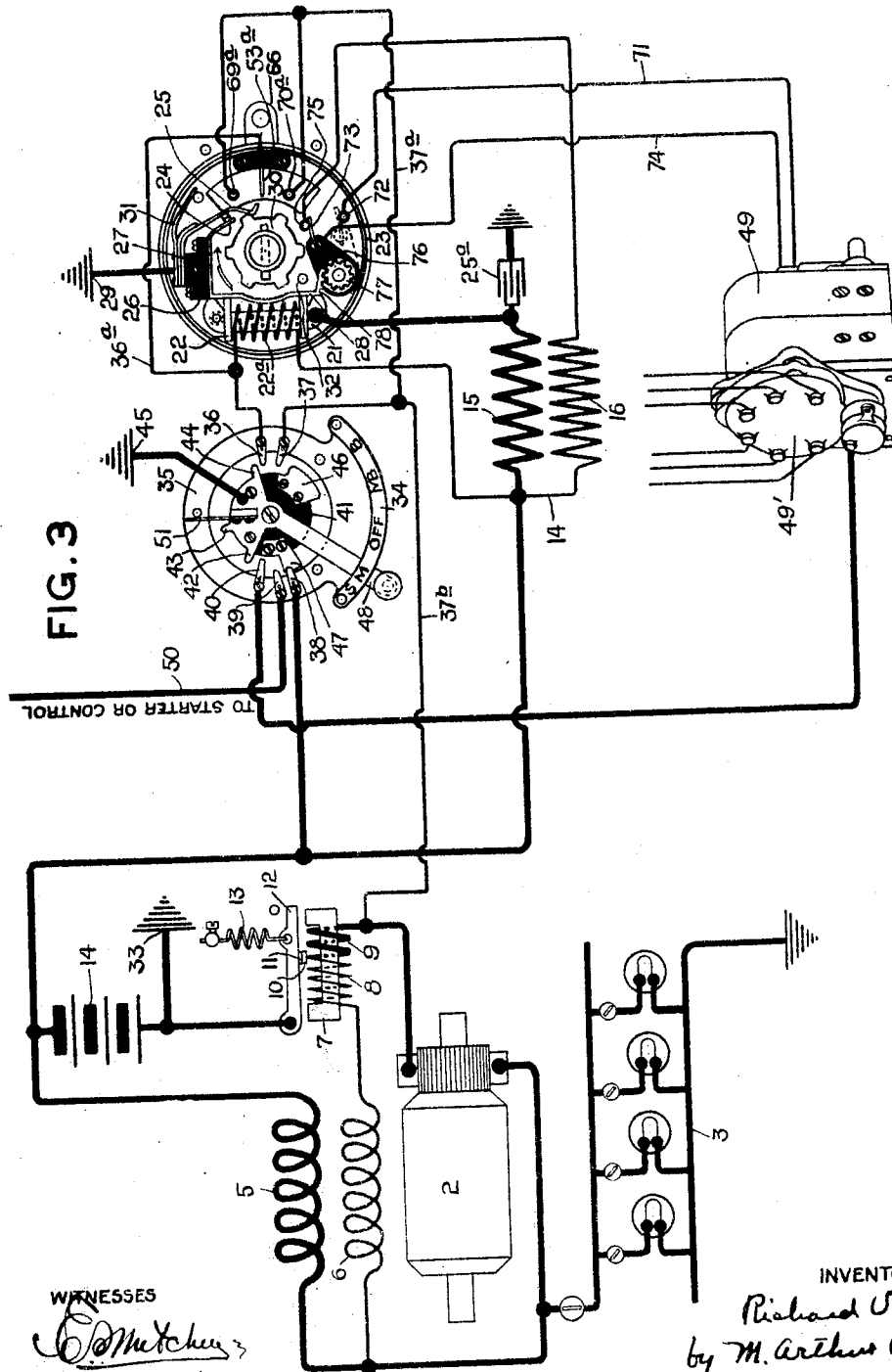
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5 SHEETS—SHEET 4.

1,225,533.

FIG. 5

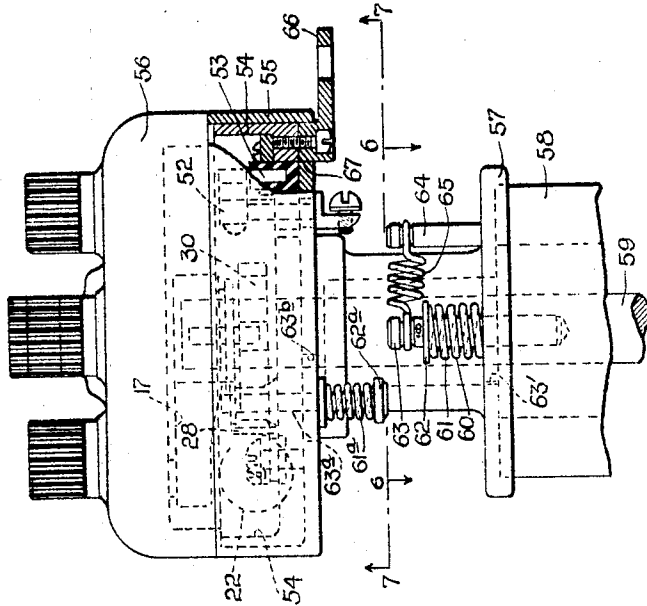


FIG. 4

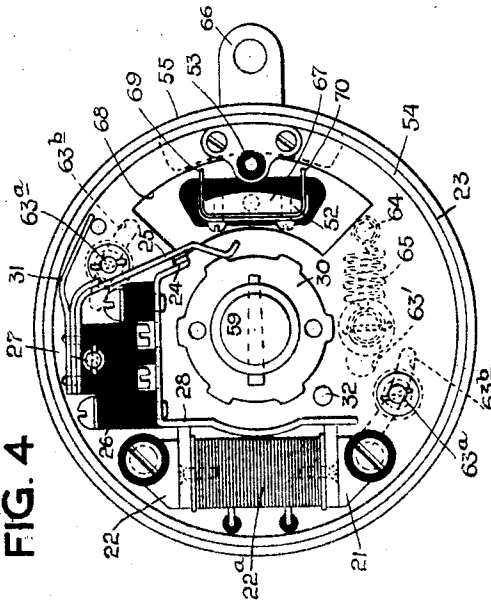
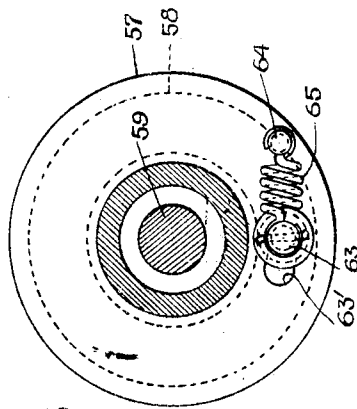


FIG. 6



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5 SHEETS—SHEET 5.

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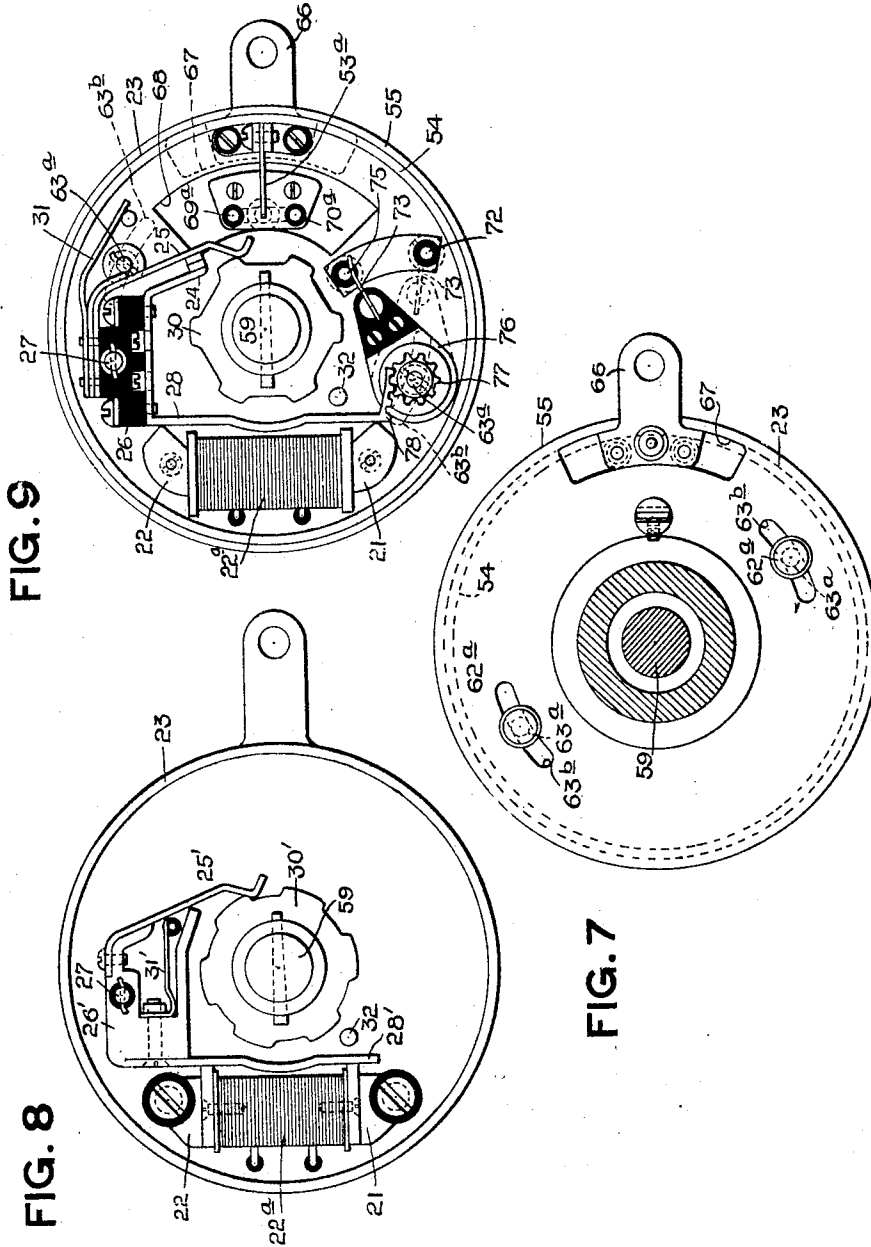


FIG. 9

FIG. 8

FIG. 7

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UNITED STATES PATENT OFFICE.

RICHARD VARLEY, OF ENGLEWOOD, NEW JERSEY.

IGNITION SYSTEM AND APPARATUS.

1,225,533.

Specification of Letters Patent.

Patented May 8, 1917.

Original application filed August 29, 1914, Serial No. 859,160. Divided and this application filed September 11, 1914. Serial No. 861,230.

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 Ignition Systems and Apparatus, 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 relates to electrical systems, more particularly to the provision of means for exploding the combustible mixture in the cylinders of an engine.

The general object of this invention is to provide a new and improved form of ignition system and apparatus which shall be effectively responsive to the requirements of the modern internal combustion engine of the equipment of autovehicles. The attainment of this end and other advantages, hereinafter apparent, are afforded by the provision of a system and apparatus employing interrupter or timer mechanism, the contact elements of which are relieved from contactual activity by occupying a non-operative position, during non-use of the ignition circuit of which said mechanism is an element and when the spark plugs are energized by another ignition circuit, as that of a magneto generator.

The present application comprises a division of my application for Letters Patent filed August 29, 1914, Serial No. 859,160.

The above mentioned and other advantages will more fully appear in the following description of my invention, which I will now make in connection with the accompanying drawings, 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 various structures shown and circuit arrangements therein largely diagrammatically illustrated, without departing from my invention.

Figure 1 is a diagrammatic view of an ignition system and apparatus embodying my invention; Fig. 2 is a similar view, showing modified form of timer mechanism and a vibrator spark coil; Fig. 3 is a diagrammatic view corresponding generally to the arrangement shown in Fig. 1 but showing means for connecting the high tension

winding of a spark coil or of a magneto generator to common distributor mechanism; Fig. 4 is a plan view showing interrupter mechanism diagrammatically indicated in Fig. 1; Fig. 5 is an elevational view, partly broken away, of the same; Fig. 6 is a transverse sectional view on the line 6-6 of Fig. 5; Fig. 7 is a similar sectional view on the line 7-7 of Fig. 5; Fig. 8 is a plan view of timer mechanism diagrammatically illustrated in Fig. 2; and Fig. 9 is a plan view of interrupter or timer mechanism diagrammatically illustrated in Fig. 3.

Referring to Fig. 1 of the drawings, I have shown my invention in connection with an electric generator 2 adapted to supply current to a light or work circuit 3 and to charge a battery (accumulator) 4. This generator has series and shunt field windings 5 and 6 respectively, that are connected to oppose each other. The numeral 7 indicates the core of a magnetic cut out or relay, having winding in circuit with shunt field winding of the generator and consisting, preferably, of a fine wire coil 8 and a heavy series coil 9 which have a common terminal contact connection at 10, with which contact is adapted to co-act a contact member 11 carried by and electrically connected to a pivotally mounted armature 12 connected in the battery circuit. Connected to the armature 12 is a suitable spring 13 which operates to separate the contacts 10 and 11 at low engine speeds.

The spark coil or transformer of a continuous or battery ignition circuit, as contrasted from a magneto or alternating current circuit, is indicated at 14 and comprises a usual primary winding 15 and a high tension or secondary winding 16 which connects with a revoluble arm 17 of suitable distributor mechanism 18 the symmetrically disposed segments or contacts 19 of which connect with spark plugs of the engine (not shown), in the usual manner, as by leads 20. One end of the primary winding 15 connects with the battery 4 while the other end is connected to a core 21 of an electromagnet 22, having energizing winding 22^a. Said magnet in this particular instance is mounted in and its core insulated from the casing or housing 23 of circuit interrupter or timer mechanism (clearly shown in Fig. 4) comprising essentially a fixed contact 24, a relatively yieldable contact or movable lever 25

and contact actuating means. Connected across said contacts is a usual condenser 25^a. The contact 24 and lever 25, normally in contactual union, are carried by an insulated mounting 26 pivoted in the casing 23, as at 27, and the contact 24 is mounted on an extension of or electrically connected to an arm 28 of the pivotal member 26, while the contact lever 25 is grounded, as at 29. The arm 28 constitutes an armature for the magnet 22, attraction by which of the arm, pivotally moves the member 26 to such position as to present the contact lever 25 to an actuating cam 30 (properly synchronously driven by the engine through suitable gear connection, not shown), against the action of a spring 31 which serves upon and during demagnetization of the magnet 22, to return and normally hold the armature 28 against a stop 32 and the contact lever 25 out of the path of the projecting noses of the actuating cam. With the magnet core 21 connected in the circuit of the primary winding of the spark coil, attraction of the armature 28 and contact thereof with the core completes, from the battery, through the primary winding 15 of the spark coil, contacts 24 and 25, and ground 29 and battery ground 33, a primary ignition circuit subject to periodical interruption by operative separation of the contacts 24 and 25 by the action of the cam 30 on the latter yieldable contact or lever 25, for the production of a high potential sparking current in the secondary winding of the spark coil, as is understood.

By means of switch mechanism 34, control of the battery ignition circuit is effected and also, as hereinafter set forth, the control of certain more or less interdependently related elements of the equipment of an automobile. This switch mechanism 34 which may be mounted at any convenient place on the vehicle, comprises an insulated base or support 35 that carries contact blades 36, 37, 38, 39 and 40 grouped about a pivotal switch block 41 carrying contact fingers 42, 43 and 44, grounded, as at 45, and insulated bridging contact blades 46 and 47. The pivotal switch member 41 is provided with a suitable manipulating handle 48. The movable contacts 42 and 43 are adapted to co-act with contact finger or blade 40 for grounding a magneto generator 49 of the equipment when it is desired to cut out that element, as hereinafter set forth. The movable contact member 44 is adapted, by engagement with the contact 36, to connect the winding of the interrupter magnet 22 in grounded circuit with the battery, while contact 46 when shifted to bridge the contacts 36 and 37 also connects, as hereinafter more fully described, the magnet winding 22^a with the battery and in circuit with winding 9 of the generator relay or cut

out above described. Bridging of contacts 38 and 39 by the contact member 47 brings the battery into energizing connection with engine starting mechanism or controlling apparatus for such starting mechanism (not shown), as by lead 50.

When it is desired to start the engine the switch arm 48 is shifted to move switch body or block 41 against the tension of a spring 51, to a position where contact 47 will bridge or connect contacts 38 and 39. This position for the arm 48, is indicated by "S" on the index plate of the switch structure shown in the drawing. Bridging of the contacts 38 and 39 connects in battery circuit, and sets up operation of, the engine starting apparatus, or its control, for turning over or initial driving of the engine. Movement of the switch to "S" or engine starting position, brings contact 44 into engagement with the contact 36 of the switch with the result that the winding 22^a of the interrupter magnet 22 is connected in the battery circuit, resulting in attractive pull of the armature 28 into contact with the magnet core 21, shifting of the interrupter contact lever 25 into operative juxtaposition to the actuating cam 30, and the establishment of a battery primary ignition circuit for utilization during starting of the engine.

Upon picking up or assumption of self-propulsion of the engine, the switch arm 48 is released and the spring 51 returns the switch member 41 to "M" or magneto position, breaking the connection between contacts 39 and 47 and causing contact 44 to pass from contact finger 36. It will be assumed that the interrupter or timer casing 23 has been so shifted as to obtain the usual desirable spark retard during starting of the engine, and that generative driving of the generator 2 by the engine, causes energizing of the coils 8 and 9 of the aforesaid magnetic cut out or relay and resultant attraction of the relay armature 12 in such manner as to effect engagement of the relay contacts 10 and 11. By the provision of switch means, as hereinafter fully set forth, occupation of the interrupter of "spark retard" position brings or maintains, as through leads 36^a, 37^a and 37^b and coil 9 of the magnetic cut out or relay, the magnet winding 22^a in closed circuit with the battery, so that when switch contact 44 passes from contact finger 36 in the breaking of engine starting connection, in the manner above set forth, the interrupter or timer mechanism of the battery or continuous current ignition circuit remains operative. It therefore will be seen that initial driving of the engine may be made on battery ignition and until such time as the magneto generator delivers effective sparking current. When it is desired to discontinue use of the magneto generator 49, the switch

arm 48 may be shifted to a position to bring the contact finger 42 into engagement with the contact blade 40 or to "off" position with resultant short circuiting grounding of the magneto.

Shifting of the switch arm 48 so as to cause bridging of the contacts 36 and 37 by the contact 46 or to "MB" of magneto-battery position, moves the contact finger 42 from the contact 40, restoring the magneto to operative condition by ungrounding thereof, and connects the interrupter magnet 22 into energizing relationship with the battery, which, it will be assumed, is now in circuit with the active lighting generator and the coil 9 of the battery or generator cut-out or relay. In this condition both the magneto and the battery ignition circuit are operative, so that the battery or continuous current ignition circuit operates in supplementary capacity. Thus if the magneto current grows inefficient, as hereafter stated, or for any other reason, the battery or continuous current ignition circuit will continue to supply effective sparks.

Should the operator desire to run solely on battery or continuous current ignition, shifting of the switch arm 48 to "B" or battery position causes the switch contact 46 to continue to bridge the magnet contacts or terminals 36 and 37 and brings the contact 43 into engagement with contact finger 40, resulting in the establishment of operative conditions in the battery or continuous current circuit, above described, and grounding of the magneto.

As stated above, a magneto generator is usually ineffective at low speeds of the engine, and for many reasons which are well understood and need not be here stated, alternating current, supplied by the magneto generator, for ignition purpose, is desirable during normal running of the engine. However, increase in speed of the engine, and resultant driving of the magneto at correspondingly advanced speed, sets up shifting of the magnetic flux or field of the magneto to a degree greater than the normal or possible angular advance adjustment of the circuit interrupting means, such shifting resulting in movement of the current wave peak to a position materially out of synchronism or coincidence with the desired moment of ignition.

As stated above, I have provided switch mechanism whereby occupation of the interrupter or timer mechanism of the battery circuit of "spark retard" position, as incident to starting of the engine, completes a circuit for the controlling magnet coil 22^a when the primary winding 15 of the spark coil is connected in the battery circuit through cut out or relay winding 9. Such switch mechanism, however, is not limited in function to the establishment of a bat-

tery ignition circuit during initial operation of the engine, but is designed to "cut in" the battery or continuous current primary ignition circuit when the magneto generator develops weakness at high speed or at low speed of the engine and accordingly by merely making adjustment of the interrupter or timer mechanism in the direction of spark advance or retard. This mechanism includes, essentially, insulated double contact mechanism 52 and an insulated relatively movable contact 53, carried, as indicated, by a movable element of spark adjusting means. Shifting of the contact 53, upon advance or retard movement in adjustment of the interrupter mechanism, establishes a short circuit around the switch contacts 36 and 37, through leads 36^a and 37^a, bringing the winding 22^a into circuit with the generator 2, and consequently establishing operative conditions in the continuous current circuit. It thus will be seen that should the magneto generator develop such weakness or become ineffective during driving thereof at high speed, shifting of the interrupter mechanism to a spark advance position not only completes or establishes the continuous current circuit from generator 2, but simultaneously adjusts the interrupter mechanism for substantial continuity of the moment of ignition. The same is true where weakness of the magneto is developed upon the assumption of lower speed, it being necessary to shift the interrupter mechanism to spark retard position before the continuous current ignition circuit can be established. Furthermore, it will be seen that these connections are made without disturbing the magneto switch connections, so that there need be no manipulation of the switch member 41 preparatory to natural restoration or recovery of the magneto to normal condition.

The degree of "advance" or "retard" at which the continuous current ignition circuit may be cut in by spark adjustment of the interrupter or timer mechanism, is preferably such in each case as to establish the continuous current ignition circuit at a suitable point intermediate full advance and retard not only so as to be effectively responsive to initial development of weakness in the magneto, but to permit of the use of said continuous current in flexible manner through proper spark adjustment. This implies the maintenance of the closed shunt circuit of the magnet winding 22^a during further spark adjustment of the interrupter or timer after the establishment of such circuit, by the provision of a yieldable switch arrangement, and I provide such means by the employment of the interrupter or timer construction indicated in Fig. 1 and more clearly set forth in Figs. 4, 5, 6 and 7. Referring more particularly to these latter

views, the contact elements in the casing 23 are more directly carried or housed by a shell member 54 nesting in an outer casing or housing 55 which supports or to which is connected the usual distributor casing 56 of distributor mechanism, such as distributor mechanism 18, indicated in Fig. 1. The casing 55 is provided with a usual base 57 (see Figs. 5 and 6) recessed to pivotally fit the top of a support or bearing 58 through which passes the actuating shaft 59 of the interrupter or contact cam 30. A friction clamp or anti-rattling device 60 urges the base 57 to its seat. This means comprises a spring 61 interposed between the top face of the base 57 and a washer or abutment 62 on a pin or stud 63 fixedly carried by the support 58 and extending up through an opening 63' in the base or platform 57. This opening 63 is elongated to permit of limited pivotal movement of the timer casing 55 relatively to the shaft 59, and carried by the base is a post or stud 64 connected to which and the fixed stud 63 is a contractile spring 65 which tends to hold the timer casing 55 in fixed (preferably full retard) position so that the inner timer shell 54 may be pivotally shifted for rotative adjustment of the contact lever relatively to the cam for limited or normal spark advance and retard without attending shifting of the outer casing 55 carrying the distributor casing 56. The inner casing 54 is yieldably clamped to the base of the outer casing by suitable friction devices, comprising a pin 63^a depending from the shell 54 through elongated concentric slots 63^b (see Fig. 4) formed in the bottom of the outer casing 55, and a spring 61^a interposed between the bottom of the outer casing and a head or abutment 62^a on the pin 63^a; it being understood that the slots are sufficiently elongated and the clamping members are under such tension as will permit of movement of the shell 54 within the outer casing 55, as stated, without resultant moving of the latter casing, which shifting of the inner casing may be effected in any desired manner, as by means of a radial arm 66 which connects with the inner casing, as clearly shown in Figs. 5 and 7, through a slot concentrically formed in the bottom of the outer casing 55.

The insulated switch contact or finger 53 of the interrupter mechanism is so carried by the timer or interrupter as to be movable with movement of the inner casing 54 while the double contact 52 is shown as comprising an insulated post 67 carried by the floor or bottom wall of the outer casing 55 and extending up through an arcuate opening 68 in the bottom of the inner shell 54 and provided with spaced resilient contact fingers 69 and 70.

It will be readily seen that pivotal shift-

ing of the inner casing or shell 54 will bring the contact finger or post 53 into engagement with either yieldable finger 69 or 70 according to whether the arm 66 is shifted in the direction of spark advance or retard.

As stated above the degree of rotative adjustable movement (which may be controlled by the length of the slots 63^b or the opening 67) of the inner casing 54 should be sufficient to obtain spark adjustment within the range of normal running speed. As a result, the distributor 56 remains stationary during the greater part of the time of operation of the engine, and thus there is no extended "working" back and forth of the spark plug leads or cores at their juncture with the distributor box or casing with attending wear and liability to disturbance of terminal connections. When the independent movement of the inner shell 54, in spark-advancing, has reached its termination, and further advance is desired, continual movement of the shell 54 sets up movement of the outer casing 55 under the tension of the contractile spring 65. Such further movement of the two casings in unison preserves contractual engagement between contacts 53 and 52 (finger 69) so that when the engine is on "M" the continuous current ignition circuit is available for assistive or supplementary ignition. As the spark is retarded from this higher advance position, the outer casing (with the inner shell) returns, under the action of the spring 65, to normal position.

The system and mechanism described above concerns that type of system wherein the spark is formed, in the battery ignition circuit, by the interruption of a primary circuit and resultant building up of a high potential sparking current in the secondary winding or coil to which is connected the distributor mechanism. It will be apparent that the principle of my invention will not be departed from but may be readily embodied in a system in which the spark is formed by the closing of a primary circuit intercalated in which may be suitable buzzer or vibrator mechanism for the purpose of trembling the current and causing the formation of a cascade of sparks at the terminals of the plugs. I have indicated such a system in Fig. 2 which diagrammatically is the same as Fig. 1, with the exception that a modified form of timer apparatus and vibrator mechanism is shown in connection with the primary circuit. To obviate repetition of description of the essential parts and operations thereof, except as hereinafter set forth, like reference numerals are used to indicate like or similar parts.

In this Fig. 2 (also see Fig. 8) the timer contact mechanism comprises a yieldable contact lever 25' carried by a pivotal sup-

port 26' properly insulated, and provided with an arm 28' which corresponds in function with the arm 28 described above. Energizing of the timer magnet 22 attracts the arm 28' against the action of spring 31', moving the timer contact blade or finger 25' into position for contactual engagement thereof by a positively driven contact cam 30', grounded at 29'. This contact 25' and the cam 30' constitute the means by which the circuit of the primary coil or winding of the spark coil is periodically closed in proper synchronism with the engine, and included in this primary circuit or connected across the contact lever 25' and the contact cam 30' is the condenser 25^a and vibrator mechanism 15^a comprising vibrator blade 15^b, contact 15^c and a magnetic core 15^d which may form part of the spark coil 15.

In this modified arrangement shown in Fig. 2, the closing of the circuit of the timer magnet coil 22^a by shiftable adjustable movement for spark advance or retard is effected by coactive engagement of the contact post or finger 53 with the yieldable contact blades 69' and 70' which correspond in function to the yieldable fingers 69 and 70 described above. In this arrangement it is assumed that the distributor mechanism 18 or the distributor casing 56 is carried by or connected to the timer casing 23. On account of the instantaneous formation of the spark upon interruption of the primary circuit it is possible, as disclosed above in connection with description of Fig. 1, to advance and retard the spark within normal range or operation of the engine without at the same time correspondingly advancing or retarding the distributor, the angular degree of contactual movement of the distributor arm 17 over each segment 19 of the distributor being such as to complete (without shiftable adjustment of the distributor) at any point within the normal range of spark adjustment of the interrupter or timer, a spark plug circuit. In systems employing a vibrator primary circuit in which the spark is formed by closing the circuit, the incidental lag of the current and the necessity for extending contact dwell requires, in obtaining desired spark advance and retard, simultaneous movement of the timer or distributor mechanism through the whole angular range of adjustment. Therefore, it will be seen that if in the use of the system disclosed in Fig. 2, it is desired to use a timer or circuit controlling device, the movable contact or contacts of which are more directly carried by an inner adjustable shell, and in which the switch elements for establishing the shunt circuit of the magnet 22 are housed, the distributor casing 56 must be so mounted or connected to the inner casing

or shell 54 of said previously described interrupter or timer construction or must be so otherwise connected as to be shiftablely adjustable in unison with adjustable movement of said inner shell or casing.

It will of course be apparent that my invention is not limited to the employment of directly connected interrupter or timer and distributor mechanism. These elements may be separately formed and separately driven. Furthermore, the distributor mechanism of the usual magneto generator may act in the capacity of distributor in the battery or continuous current ignition circuit. I have indicated such an arrangement in Fig. 3 which otherwise discloses a system corresponding with that illustrated in Fig. 1, and in which like parts accordingly bear like reference numerals, so that it is unnecessary to here repeat the description and operation otherwise than to disclose the feature of utilizing a common distributor element. As stated, this common distributor element, shown in Fig. 3, may comprise the distributor 49' of a magneto generator 49. It is well understood that this distributor of the magneto is operatively associated with the high tension winding of the magneto generator. I have indicated this high tension winding (not shown) as being connected, as by lead 71, to an insulated switch contact or post 72, carried by the interrupter casing 23, while to a movable insulated switch member 73 I connect, as through lead 74, the usual rotating arm or distributor element (not shown) of the magneto generator. The high tension winding 16 of the battery circuit spark coil or transformer 14 connects with an insulated switch contact 75. Referring more particularly to Fig. 9, which illustrates in larger view the interrupter mechanism of the battery ignition circuit of Fig. 3, it will be seen that the movable switch element 73 is operatively carried by an oscillating or pivotal switch block 76 which is adapted to be actuated by movement of the arm or armature 28 carried by the pivotal interrupter contact mounting mechanism 76. This movement in the particular construction, is effected by means of a pinion 77 carried by the switch block 76 and which meshes with a short rack or toothed foot 78 formed on the arm or armature 28.

The adjustment between the armature 28 and the switch block 76 is such that when the interrupter or timer mechanism of the battery or continuous current ignition circuit is in operative condition, the high tension winding 16 of the spark coil 14 will be connected to the magneto distributor mechanism 49' via contacts 75 and 73 and lead 74, and when the interrupter mechanism of the battery ignition circuit is inoperative, the high tension winding of the

magneto generator connects with its own distributor mechanism 49' via lead 71, switch contacts 72 and 73 and lead 74. This is brought about by the fact that movement of the armature 28, in either direction, whether by attraction of the interrupter or timer magnet 22 or by the returning action of the spring 31, alternately shifts the yieldable switch blade 73 into engagement with the switch posts or contacts 75 and 72 respectively.

From the foregoing description of the system and mechanism set forth in views 1, 2 and 3, and as mentioned above, it will be readily seen that after the engine has been started and the switch arm 48 occupies any of the positions when the battery connections are established in the various manners above set forth, including "M" or magneto position of the switch arm 48, maintenance of closed circuit condition of the winding 22^a of the interrupter or timer mechanism obtains by reason of the fact that the magnetic cut out or relay of the main generator 2, remains closed during self-propulsion of the engine and generative driving of the generator 2. Dropping of the speed of the engine below self-propulsion or stopping thereof weakens the magnetic attraction in the cut out core 7 so that a counter flow of current from the battery 4 through the relay or cut out winding 9 neutralizes the magnetic attraction, releasing the armature 12 to the pull of the spring 13, separating the contacts 10 and 11 and interrupting the circuit of the coil 9 and therefore the circuit of the coil of the interrupter or timer magnet 22 which in turn causes the shiftable contact element of said mechanism to move to an inoperative position as already described. As a result, the spark coil 14 is brought out of connection with the battery, through breaking of the primary circuit upon contact separation of the interrupter or timer arm or armature 28 or 28' and the core 21 of the magnet 22, the advantage of which is that the spark coil can not effect a dissipating pull on the battery when the engine is idle. This would be otherwise were all connections of the magnet winding 22 established with the battery through grounds 29 and 30 or in such other manner as to preclude the cut-out effect of the magnetic cut-out or relay operation of which is controlled or influenced by the generator 2, which, it will be presumed, is constantly driven when the engine is in operation.

It will be apparent that many changes may be made in the various circuit arrangements and mechanism described. Any desired switch arrangement may be used for making the various circuit connections outlined.

The advantages of my invention will be

found to reside in an arrangement whereby interrupter and timer contact elements are shifted to an inoperative position upon non-use, electrically of that element, and in the employment of an ignition system of extended capacities under the control of means largely automatic in operation.

The general system above described is not claimed herein, as the same forms subject matter of my application Serial No. 859,160.

The broad idea of rendering inoperative the ignition controller or timer means forms subject matter of Letters Patent No. 1,071,373, granted to me August 26, 1913, and is not therefore claimed herein.

What I claim and desire to secure by Letters Patent is:

1. In ignition systems and apparatus, circuit controlling means comprising a yieldable contact, a shiftable support therefor and actuating means, and means, comprising said support, for bringing the contact into and out of operative association with said actuating means.

2. In ignition systems and apparatus, circuit controlling means comprising a yieldable contact, a pivotal support therefor, and actuating means, and means, including said support, for bringing the contact into and out of operative association with said actuating means.

3. In ignition systems and apparatus, circuit controlling means comprising a resilient contact blade, a support therefor, and actuating means, and means, including said support, for shifting the contact blade into and out of operative association with the actuating means.

4. In ignition systems and apparatus, circuit controlling means comprising a resilient blade, a pivotal support therefor, and rotatory cam means, and means including said support, for swinging the contact blade into and out of operative association with the cam means.

5. In ignition systems and apparatus, circuit controlling means comprising a contact lever carried by a support, an actuating cam, and means for varying the position of the support, whereby the contact lever may be brought into and out of operative association with the cam.

6. In ignition systems and apparatus, circuit controlling mechanism comprising a plurality of contacts normally in engagement with one another, a yieldable lever carrying one of said contacts, a support for the lever, actuating means, and means for moving the support, for bringing the lever into and out of operative association with the actuating means.

7. In ignition systems and apparatus, circuit controlling mechanism comprising a contact lever and actuating means; a movable support for the lever, and means for

moving the support, for rendering the controlling mechanism operative and non-operative.

8. In ignition systems and apparatus, circuit controlling mechanism comprising a plurality of coactive contacts, a support for said contacts, actuating means, and means for shifting said support, for bringing the contacts into and out of operative association with said actuating means.

9. In ignition systems and apparatus, circuit controlling mechanism comprising a plurality of coactive contacts, a support for said contacts, means for bringing one contact into and out of engagement with another contact, and means for shifting the support, for rendering the contacts operative and non-operative.

10. In ignition systems and apparatus, circuit controlling mechanism comprising a contact lever, a pivotal support therefor, actuating means, and means for pivotally adjusting the support, for bringing the lever into and out of operative association with the actuating means.

11. In ignition systems and apparatus, circuit controlling mechanism comprising contact devices and a pivotal support therefor, and means for pivotally adjusting the support, for rendering said contact devices operative and non-operative.

12. In ignition systems and apparatus, circuit controlling mechanism comprising a contact lever mounted on a pivotal support, cam means for engaging the lever, and means for pivotally adjusting the support, to bring the lever into and out of operative juxtaposition to the cam means.

13. In ignition systems and apparatus, circuit controlling mechanism comprising a fixed contact, a yieldable member constituting contactual means normally engaging the fixed contact, a pivotal support for the yieldable member, cam means for intermittently engaging the yieldable member, and means for bringing the yieldable member into and out of operative association with the cam means.

14. In ignition systems and apparatus, circuit controlling mechanism comprising a contact lever and actuating means, a pivotal support for the lever, and means, including an electromagnet, for moving the support, for rendering the controlling mechanism operative and non-operative.

15. In ignition systems and apparatus, circuit controlling mechanism comprising a plurality of contacts, a movable support for the contacts, and means including an electromagnet, for moving the support, for controlling operation of the contacts.

16. In ignition systems and apparatus, circuit controlling mechanism comprising a contact lever, a pivotal support therefor, cooperative cam means, and means, including an electromagnet, for adjusting the support, for bringing the lever into and out of operative association with said cam means.

17. In ignition systems and apparatus, circuit controlling mechanism comprising contact devices and a pivotal support therefor and means, including an electromagnet, for pivotally adjusting said support, for rendering the controlling mechanism operative and non-operative.

18. In ignition systems and apparatus, circuit controlling mechanism comprising a fixed contact, a yieldable contact normally engaging the fixed contact, actuating means for separating the contacts, and means for bringing the contact lever into and out of operative association with the actuating means and without varying the functional relationship of the contacts.

19. In ignition systems and apparatus, circuit controlling mechanism comprising a plurality of contacts, an electromagnet, and a support for the contacts, having an arm constituting an armature for the magnet.

In testimony whereof I have hereunto set my hand.

RICHARD VARLEY.

Witnesses:

M. A. KELLER,
HENRY WOOG.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."