C. CUNO.
DUAL IGNITION SYSTEM.
APPLICATION FILED NOV. 10, 1910.

1,026,077. Patented May 14, 1912.

3 SHEETS—SHEET 1.

Fig. 1.

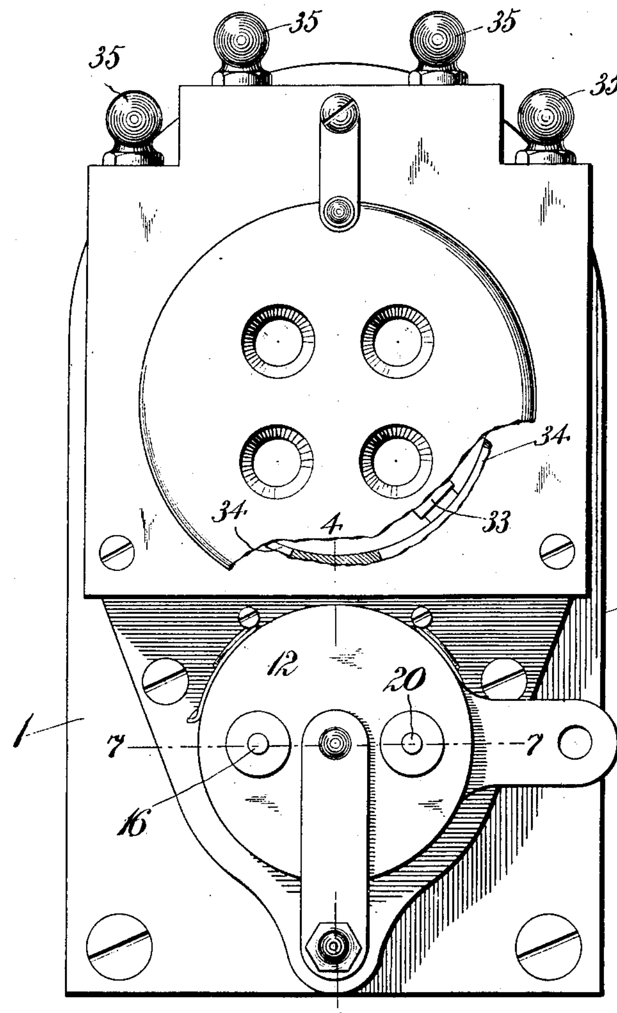
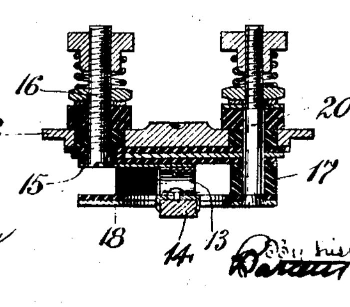


Fig. 7.



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3 SHEETS—SHEET 2.

Fig. 2.

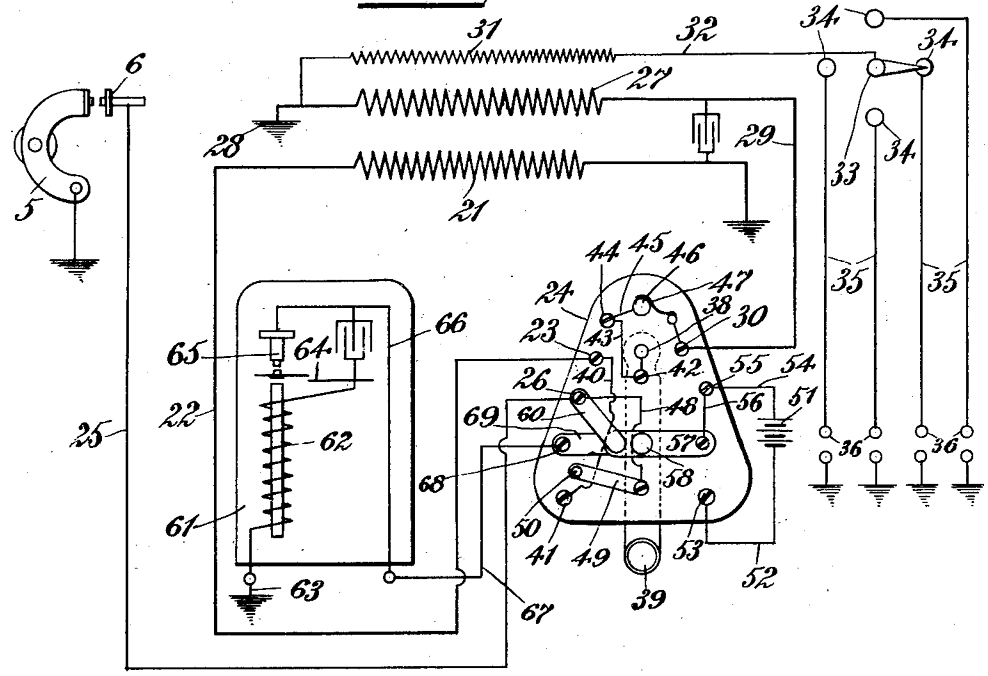
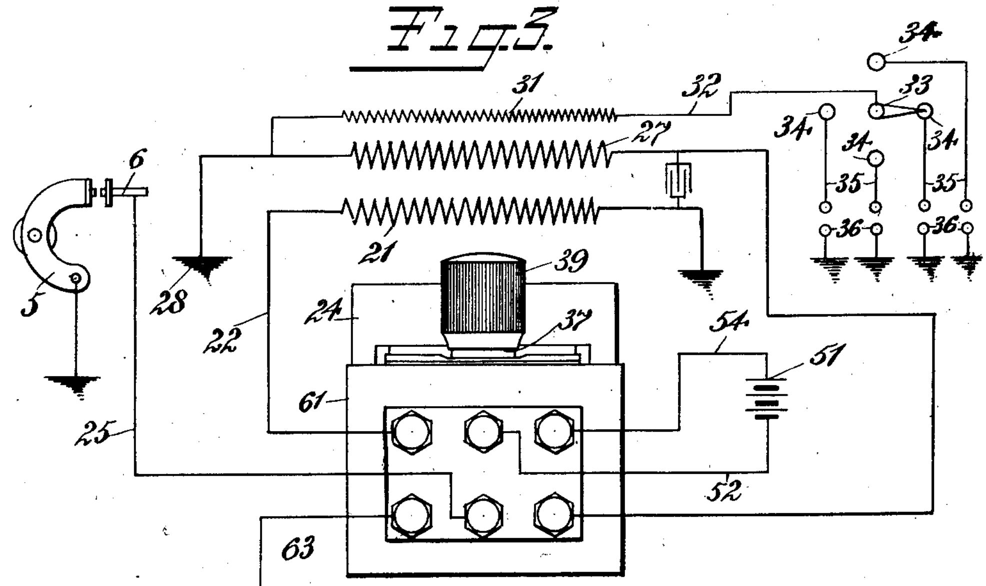


Fig. 3.



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3 SHEETS—SHEET 3.

Fig. 4.

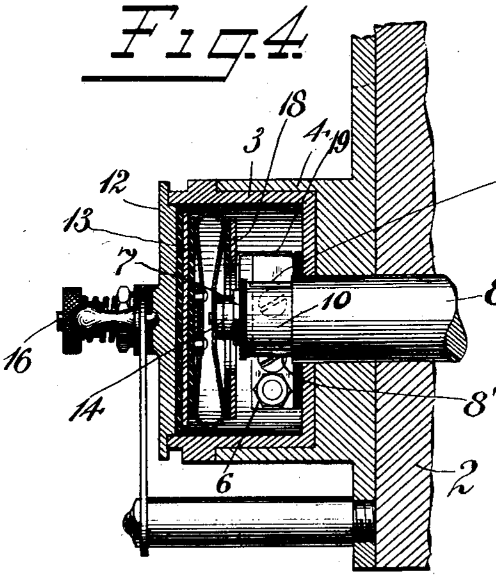


Fig. 8.

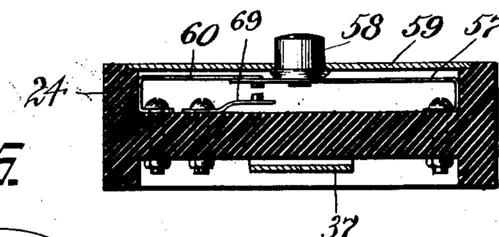


Fig. 5.

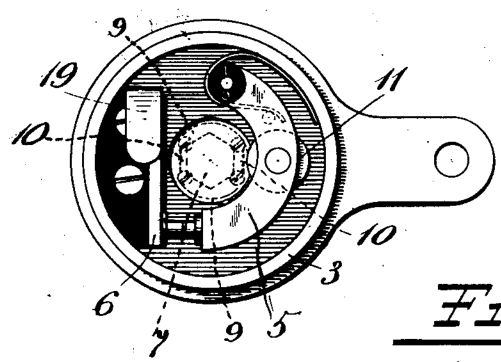


Fig. 6.

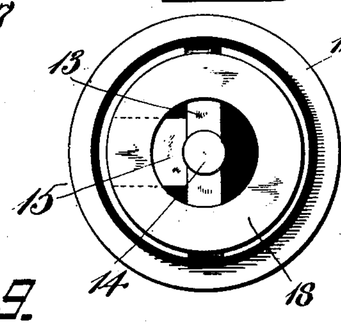
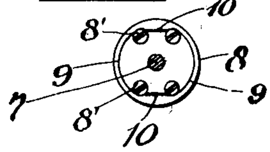


Fig. 9.



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UNITED STATES PATENT OFFICE.

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DUAL IGNITION SYSTEM.

1,026,077. Specification of Letters Patent. Patented May 14, 1912.

Application filed November 10, 1910. Serial No. 591,584.

To all whom it may concern:

Be it known that I, CHARLES CUNO, a citizen of the United States, residing at Meriden, county of New Haven, State of Connecticut, have invented certain new and useful Improvements in Dual Ignition Systems, of which the following is a full, clear, and exact description.

My invention relates to an improved electrical apparatus and system for ignition purposes, particularly, though not exclusively, for hydrocarbon engines.

The object of the invention is to combine in one apparatus and system means whereby the ignition devices, such as the spark plugs, may be operated either from a generator such as a magneto or from an external source of current such as a battery.

A further object of the invention is to provide means whereby both the magneto circuit and battery circuit may be operated through a single interrupter or timer mechanism.

A further object is to provide means in conjunction with the battery circuit whereby the engine with which the ignition apparatus is used may be started from the battery and independently of the interrupter or timer mechanism and in any position of the engine in which a charge of combustible in one of the cylinders could be effectively ignited.

The invention also contemplates mechanism whereby the low tension current either of the magneto or of the battery may each be so directed as to perform the several functions above set forth.

A further object of the invention is to provide an improved interrupter or timer mechanism whereby when the battery current is operating through the interrupter, the necessary contact through the interrupter will be maintained for a sufficient length of time to permit the battery current to develop to a proper degree in the primary coil of the high tension mechanism or transformer, while at the same time the interrupter mechanism is so constructed as to maintain the interruption of the battery circuit during the greater portion of the time between successive ignition operations, in order to economize the battery current to the greatest possible extent.

A further object is to provide an improved form of distributer mechanism which shall so coöperate with the interrupter or timer mechanism as to produce the most effective results.

With these objects in view, the invention consists in the construction and arrangement of parts, a preferred embodiment of which is illustrated in the accompanying drawings, in which—

Figure 1 is an end view of the magneto embodying certain features of the invention, certain parts being broken away to show a portion of the interior of the distributer mechanism. Fig. 2 is a diagrammatic view of the circuit connections of the system, including a conventional showing of the magneto armature winding, the interrupter, the transformer, distributer mechanism and sparking plugs, a vibrator coil, and an improved form of switch for properly directing the several circuits. Fig. 3 is a view similar to Fig. 2, showing the switch conveniently mounted upon the case of the vibrator unit. Fig. 4 is a vertical sectional view on the line 4—4 Fig. 1, of the interrupter mechanism. Fig. 5 is a view of the interior of the interrupter carrier detached from the magneto, showing the armature shaft in its relative position to the movable member of the interrupter. Fig. 6 is an inside face view of the cap for the interrupter carrier, showing certain contact members for the interrupter members. Fig. 7 is a sectional view on the line 7—7 Fig. 1, of said cap. Fig. 8 is a sectional view on the line 8—8 Fig. 2, of the switch, showing the relative position of certain spring contact members, and Fig. 9 is a detail of the interrupter cam.

In the embodiment of my invention herein selected for illustration, 1 indicates the magneto, which may be of substantially the form shown in my copending application Serial No. 539,059, filed on the 20th day of January, 1910, and comprising a suitable frame 2, the usual field magnets, armature and transformer, as shown in said application. The interrupter mechanism is mounted in a carrier 3 (Fig. 4) in the bearing 4 and comprises the usual movable member 5 and fixed member 6. One terminal of the armature winding is connected with a headed stud or pin 7 extended through but insulated from the armature shaft 8, (Fig.

4) as described in said application. The outer end of the armature shaft is formed with the arc shaped raised portions 9—9, between which are the flattened cam portions 10—10, all of which portions coöperate with the cam roll 11 on the movable interrupter member 5 to effect the necessary make and break of circuits, as hereinafter described. Adjustable wear pins 8' are provided at each end of the flattened surfaces 10—10. The cap 12 for the interrupter carrier has secured thereto but insulated therefrom a contact spring 13 (Figs. 4, 6 and 7) having a contact stud 14, which, when the cap is in position on the carrier, makes connection with the terminal pin 7 in the armature shaft. The spring 13 is connected by plate 15 (Figs. 6 and 7) with the binding post 16 extending through but insulated from the cap. Also mounted on the cap but insulated therefrom by supporting blocks 17 (Fig. 7) is a contact ring 18 adapted to make connection with the spring 19 (Fig. 5) on the fixed interrupter contact member. The ring 18 is connected with a second binding post 20, also extending through the cap. When the parts of the interrupter mechanism are assembled, the current from the magneto armature winding 21 (Figs. 2 and 3) passes through the spring 13, plate 15 and binding post 16, and is thence led by wire 22 to binding screw 23 of a switch 24, hereinafter described. The fixed interrupter member 6 is also connected by means of spring 19 contact ring 18, binding post 20 and a suitable conductor wire 25, with a binding screw 26 of the switch.

The transformer may, as described in the above mentioned application, be mounted in the bow of the field magnets of the magneto, and comprises the primary winding 27 (Figs. 2 and 3) having one terminal grounded at 28, and the opposite terminal connected by wire 29 with binding screw 30 of the switch. The secondary 31 of the transformer likewise has one terminal grounded at 28, and the opposite terminal connected by wire 32 with a rotary arm 33 of the distributer, said distributer comprising also the usual contact segments 34 connected by wires 35 with the spark plugs 36 of the several cylinders of the engine.

The switch 24 is provided with a movable switch arm 37 pivoted at 38 and provided with a convenient operating handle 39. The binding screw 23 for the armature circuit is connected by wire 40 to the contact pin 41 arranged to coöperate with the switch blade 37. The switch blade is also in electrical connection through the binding screw 42, connector 43, screw 44, connector 45, with a plug socket 46. Adjacent this socket is mounted a spring contact arm 47, which is electrically connected with the binding screw 30 of the transformer primary connection 29. The binding screw 26 connected with the interrupter member 6 is connected by wire 48 with a spring plate 49 having a stud 50, which projects to the rear of the switch body and into the path of the switch blade. When the switch blade is moved to the left, as shown in Fig. 2, into contact with the contact pin 41 and with the usual switch plug in the plug socket 46, the magneto circuit is completed through wire 22, screw 23, wire 40, contact 41, switch blade 37, contact 42, connector 43, contact 44, connector 45, spring 47, contact 30, wire 29, transformer primary 27 to ground 28. The course of the current just described assumes that the interrupter members are separated. When the interrupter members are closed or in contact, the current takes the following course: wire 22, contact 23, connector 40, contact 41, switch blade 37, spring contact pin 50, spring plate 49, connector 48, contact 26, wire 25, interrupter member 6, interrupter member 5 to ground.

The operation of the ignition mechanism through an external or battery circuit may be effected under different conditions and arrangement of parts dependent upon whether it is desired to continue the operation of the engine on the battery, or simply to start the engine from the battery. Under the first condition of operation, the battery current operates through the interrupter mechanism of the magneto; under the second, through a vibrator unit hereinafter described. To this end the battery 51 is connected by wire 52 to contact screw 53, with which screw the switch blade 37 is adapted to coöperate when moved to the right, as shown in Fig. 2. The opposite terminal of the battery is connected by wire 54, contact screw 55, wire 56, with spring contact arm 57. This arm is secured to the switch body and is provided with a button 58 (Fig. 8) arranged to project through the cover plate 59 of the switch. A second spring arm 60 also mounted in the switch body in electrical connection with the contact screw 26 of the interrupter connection lies normally in contact with the spring arm 57 (Fig. 8). When, therefore, the switch blade is moved to the right in contact with contact pin 53, the battery current is completed through wire 52, screw 53, blade 37, connector 43, contact 44, connector 45, contact spring 47, contact 30, wire 29, and through the primary 27 of the transformer to ground 28. When the interrupter members 5 and 6 are in contact, as when the cam roll 11 (Fig. 5) engages one of the flattened portions 10 of the cam surface on the armature shaft, this battery circuit will be completed through interrupter members 5 and 6, wire 25, contact 26, contact spring 60, contact spring 57,

connector 56, contact 55, wire 54, back to the battery 51. The flattened cam surfaces 10 of the armature shaft are made of sufficient length, preferably about 60°, to correspond with the distance of separation of the pole pieces of the magnetic field whereby the magneto may operate in either direction without the necessity of changing the position of the interrupter contacts or of the housing therefor and to permit a certain amount of dwell of the interrupter members in contact in order that the battery current may have time to build up to the required degree in the transformer primary. As this circuit is broken by the interrupter cam, the necessary high tension current will be induced in the transformer secondary and conducted to the proper spark plug by the distributer.

In order that the engine may be started by means of the battery circuit, a vibrator coil unit 61 is provided to effect the necessary induction in the transformer secondary independently of the interrupter or timer. This unit comprises the usual electromagnet 62, the coil of which is grounded at 63, the opposite end of said coil being connected to the vibrator armature 64 coöperating with the fixed contact 65, which contact is connected by a conductor 66 and wire 67 to contact pin 68 on the switch body, with which pin also is connected a conductor plate 69, the outer end of which lies immediately beneath the spring arm 57 (Fig. 8) whereby said arms may be brought into contact by means of the push-button 58 when desired.

In order that the engine may be started from the battery, irrespective of whether or not the interrupter members of the magneto are in contact, it is necessary that all connection between the battery and the interrupter be broken when the battery is used for starting purposes. To this end, the contact arm 57 is so arranged relatively to the contact arms 60 and 69 that when in contact with one, connection with the other is broken, as will be seen in Fig. 8. To start from the battery, the operator presses the push-button 58, bringing arm 57 into contact with arm 69. The battery current then takes the following course: wire 52, contact 53, switch blade 37, contact 42, connector 43, contact 44, connector 45, spring contact 47, contact 30, wire 29, transformer primary 27, to ground 28; thence through vibrator unit 61, wire 67, contact 68, contact arm 69, contact arm 57, connector 56, contact 55, wire 54, to battery. By reason of the simultaneous breaking of the connection between contact arm 57 and arm 60, when arm 57 is brought into contact with arm 69, it will be seen that all connection with the interrupter mechanism is broken during the starting operation; hence it is immaterial whether or not the interrupter members are in contact. If this connection were not broken, it would be clear from an examination of the circuits that the battery current through the transformer primary would pass continuously through the interrupter rather than through the vibrator unit, owing to the lower degree of resistance of the former.

The flattened cam surfaces 10 on the magneto shaft are provided for the purpose of permitting a considerable dwell of the interrupter members in contact to permit the battery current to build up to the necessary degree in the transformer primary. The contact segments 34 of the distributer are extended somewhat angularly to maintain the necessary connection with the distributer arm 33 to provide for the starting operation on the battery through the manually operable contact spring 57, which operation may under some conditions take place after the piston has passed the usual firing point.

In order to adapt the magneto for right or left drive, the distributer arm 33 is adjustably mounted upon its operating gear in a manner similar to that illustrated in my copending application No. 537,412, filed January 11th, 1910. In this case, however, the two positions of the positioning pin upon the operating gear are approximately diametrically opposite each other. The flattened cam surfaces 10 of the magneto shaft and the arc-like cam surfaces 9, as well as the extension in length of the distributer segments 34, are so proportioned that these parts will coöperate properly for right or left drive when the distributer arm is angularly adjusted on its gear, as above described, it being understood that the construction and arrangement of the interrupter contacts is such as to properly coöperate with the distributer arm in each of its adjusted positions.

In Fig. 2, the vibrator unit is shown as separate from the switch, and in such case may be conveniently mounted in the casing with the battery, whereas the switch will be mounted as usual upon the dashboard of the vehicle. In Fig. 3, the switch is shown as mounted upon the vibrator casing, in which case these members will be mounted together upon the dashboard.

What I claim is:

1. In electric ignition apparatus, the combination with a generator and an interrupter therefor, a transformer having sparking mechanism connected therewith, a switch having a single switch arm, and means, when said arm is in one position, to connect said generator and said transformer in series when said interrupter is open, and to short circuit said generator through said interrupter when the latter is closed, an external source of current connected with said switch, and means, when said switch arm is in an-

other position, to connect said external source, said transformer and said interrupter in series when the latter is closed, said circuit being broken by the opening of said interrupter.

2. In electric ignition apparatus, the combination with a magneto and an interrupter therefor, of a switch having a switch arm and means when said arm is in one position to connect said magneto armature and said transformer in series when the interrupter is open, and to short circuit said magneto through said interrupter when the latter is closed, an external source of current and a vibrator unit, and means, when said switch arm is in another position, to connect said external source, said transformer and said interrupter in series when the latter is closed, said circuit being broken by the opening of said interrupter, and means, when the switch arm is in the same position to break said interrupter connection and connect said external source, said transformer and said vibrator unit in series.

3. In electric ignition apparatus, the combination with a magneto and an interrupter therefor, of a switch having a switch arm and means, when said arm is in one position, to connect said magneto armature and said transformer in series when the interrupter is open, and to short circuit said magneto armature through said interrupter when the latter is closed, an external source of current and a vibrator unit, and means on said switch, when the switch arm is in another position, to connect said external source, said transformer and said interrupter in series when the latter is closed, said circuit being broken by the opening of the interrupter, and means on said switch to connect said external source, said transformer and said vibrator unit in series irrespective of the position of said interrupter.

4. In electric ignition apparatus, the combination with an inductive coil and a mechanically operated circuit breaker, with a source of current and a vibrator, a switch having means to connect said source of current, inductive coil and circuit breaker in series, exclusive of said vibrator, and having means to connect said source of current, said coil and said vibrator in series exclusive of said circuit breaker.

5. In electric ignition apparatus, the combination with a generator of an inductive coil having sparking mechanism connected with the secondary thereof, a mechanically operated circuit breaker and an external source of current, of a switch having a single switch arm and means, when said arm is in one position, to connect said generator and said coil in series when said circuit breaker is open, and to short circuit said generator current through said circuit breaker when the latter is closed, and when in another position to break said generator circuit and connect said external source, said coil and said circuit breaker in series.

6. In electric ignition apparatus, the combination with a generator and an inductive coil, a mechanically operated circuit breaker, an external source of current and an electro-magnetic vibrator, of a switch having a switch arm and means, when said arm is in one position, to connect said generator and said coil in series when said circuit breaker is open, and to short circuit said generator current through said circuit breaker when the latter is closed and means, when said switch arm is in another position, to connect said external source, said coil and said circuit breaker in series and means, when said switch arm is in the same position, to connect said external source, said coil and said vibrator in series exclusive of said circuit breaker.

7. In electric ignition apparatus, the combination with a generator and an inductive coil having sparking mechanism connected with the secondary thereof, a mechanically operated circuit breaker, an external source of current and an electro-magnetic vibrator, a switch having a switch arm and means, when said switch arm is in one position, to connect said generator and said coil in series when said circuit breaker is open and to short circuit said generator through said circuit breaker when the latter is closed and means on said switch, when said switch arm is in another position, to connect said external source, said coil and said circuit breaker in series, and means on said switch to break said connection of said external source with said circuit breaker and simultaneously connect said external source, said coil and said vibrator in series.

8. In electric ignition apparatus, the combination with a magneto, an interrupter therefor comprising fixed and movable members, of a cam on the armature shaft cooperating with said movable member and having a cam face to permit said movable member to dwell periodically in contact with said fixed member, a transformer, an external source of current and a switch having a single switch arm and means to connect said magneto and said transformer in series when said interrupter is open, and means to short circuit said magneto through said interrupter when the latter is closed, and means, when the switch arm is in another position, to connect said external source, said transformer and said interrupter in series, the dwell of said interrupter members being sufficient to permit the current of said external source to build up in said transformer.

9. In electric ignition apparatus, the combination with an inductive coil having sparking mechanism connected therewith, a

source of current and a mechanically operated circuit breaker having means to permit the members of said circuit breaker to dwell in contact periodically, of a switch to connect said source of current, said coil and said circuit breaker in series, the dwell of said circuit breaker permitting said current to build in said coil, an electro-magnetic vibrator and means on said switch to connect said source of current, said coil and said vibrator in series and to simultaneously cut out said circuit breaker.

10. In electric ignition apparatus, the combination with a magneto and an interrupter therefor, a transformer having sparking mechanism connected therewith, an external source of current and an electro-magnetic vibrator, of means to connect said magneto and said transformer in series when said interrupter is open and to short circuit said magneto through said interrupter when the latter is closed, said connecting means being adapted also to connect said external source, said transformer and said interrupter in series, and means coöperating with said connecting means to cut out said interrupter and simultaneously connect said external source, said transformer and said vibrator in series.

11. In electric ignition apparatus, the combination with a magneto and an interrupter therefor, of a transformer, an external source of current and an electro-magnetic vibrator, of a switch having a switch arm adapted, when in one position, to connect said magneto and said transformer in series when said interrupter is open and to short circuit said magneto through said interrupter when the latter is closed, and when in another position, to connect said external source, said transformer and said interrupter in series, and manually operable means on said switch, when the arm is in the same position to cut out said interrupter and simultaneously connect said external source, said transformer and said vibrator in series.

12. In electric ignition apparatus, the combination with a magneto of interrupter mechanism comprising a fixed and a movable member, a cam on the shaft of said magneto armature coöperating with said movable member having a cam surface to maintain said members out of contact for a portion of the revolution of said shaft, and having a second cam surface of a length proportioned to the distance of separation of the pole pieces of the magnetic field whereby said magneto may operate in either direction and to permit said members to dwell in contact for a portion of each revolution.

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