No. 865,662. PATENTED SEPT. 10, 1907.

R. VARLEY.

IGNITER SYSTEM.

APPLICATION FILED MAY 11, 1906.

2 SHEETS—SHEET 1.

Fig. 1.

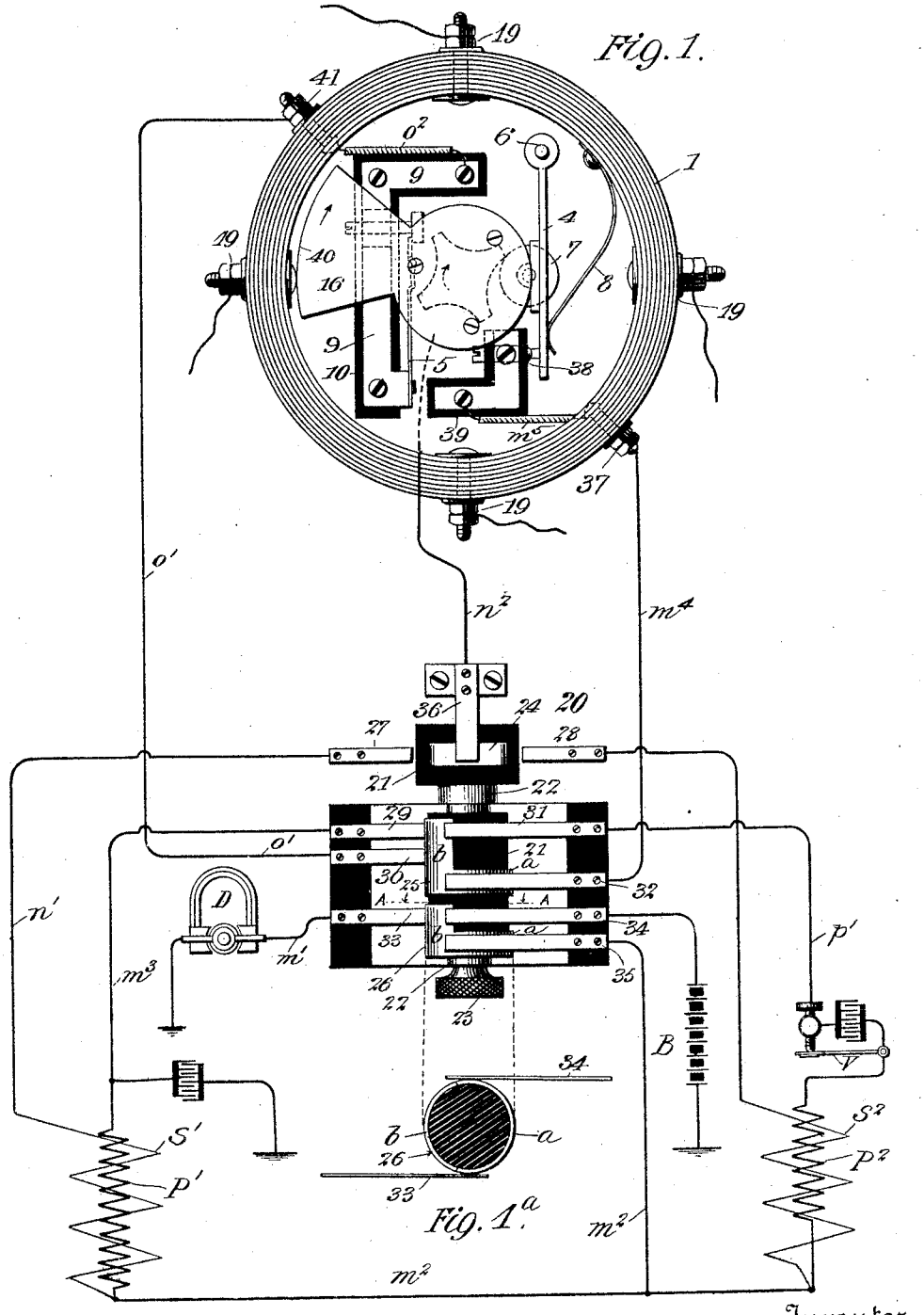

Fig. 1a.

Witnesses

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2 SHEETS—SHEET 2.

Fig. 2.

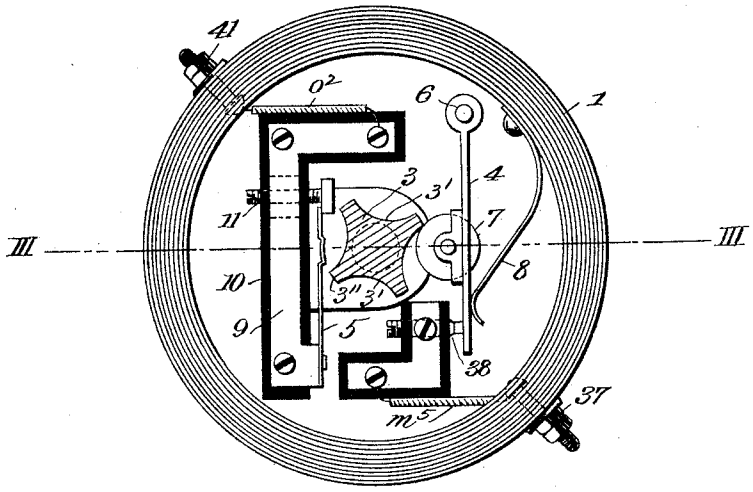
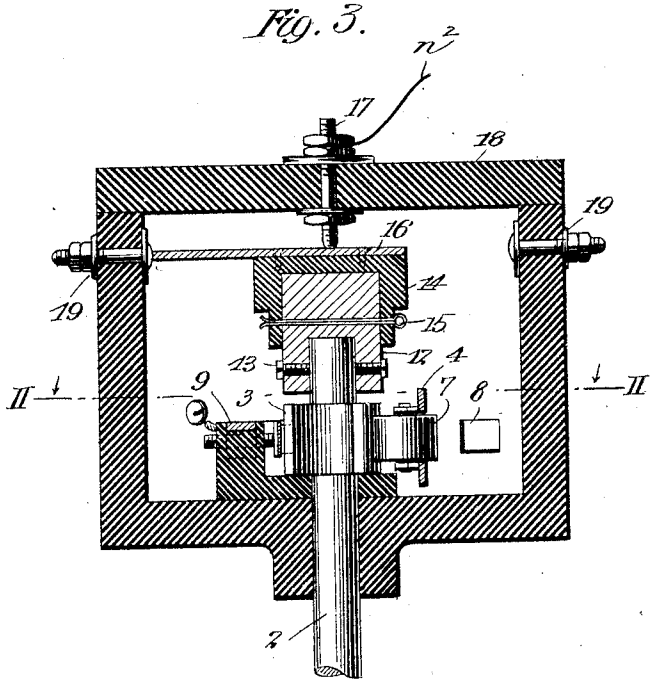


Fig. 3.



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UNITED STATES PATENT OFFICE.

RICHARD VARLEY, OF ENGLEWOOD, NEW JERSEY, ASSIGNOR TO THE AUTOCOIL COMPANY, A CORPORATION OF NEW JERSEY.

IGNITER SYSTEM.

No. 865,662. Specification of Letters Patent. Patented Sept. 10, 1907.

Application filed May 11, 1906. Serial No. 316,258.

To all whom it may concern:

Be it known that I, RICHARD VARLEY, a citizen of the United States, residing at Englewood, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Ignition Systems, of which the following is a full, clear, and exact description.

My invention relates to an ignition system for explosion engines, particularly in connection with motor vehicles where both a battery and a dynamo are provided to furnish the necessary current.

The principal object of the invention is to provide an apparatus for timing the action of the primary current, and properly distributing the secondary current, which is suitable to the nature of both the battery and the dynamo, and which is capable of utilizing either as desired.

A further object of the invention is to accomplish all the above functions in a single timing and distributing switch box, together with a single switch element or commutator, and further to render the mechanical construction and arrangement very strong, practical and efficient.

With these and other objects in view, the invention consists in the construction, combination, in the location and in the arrangement of parts, as hereinafter set forth and shown, and finally particularly pointed out in the appended claims.

In the drawings, Figure 1 is a partly diagrammatic view showing the arrangement of the circuits and apparatus which I employ, of which Fig. 1ª is a detail sectional view of the commutator on the line A, looking in the direction of the arrows; Fig. 2 is a sectional view of the timing mechanism. This section is taken on the line II—II of Fig. 3, looking in the direction of the arrows; Fig. 3 is a longitudinal sectional view on the line III—III of Fig. 2.

It will be understood that the conditions are different when a dynamo is used for ignition purposes, than when a battery is employed. A battery has substantially no self inductance, so that the full strength of current flows therefrom immediately when its circuit is closed. On the other hand, a dynamo has a large amount of self inductance, so that current does not arrive at its full strength until an appreciable interval after the circuit is closed. This is very much more the case if the dynamo is self exciting. On this account it is important to have the circuit of the dynamo closed for as long a period as possible, when the dynamo is being used for ignition purposes.

In my prior application, Serial No. 289,179, filed November 27th, 1905, I have set forth in diagrammatic form the principles of an ignition system in which a maximum period is given for the dynamo to remain in closed circuit relation, or, in other words, the period of "charging" the coil preliminary to a spark. By the present invention I secure the same arrangement, and in addition provide means by which the timing and distributing is suited to the requirements of a battery, and by which the battery may be substituted when desired.

When the battery is in circuit it is desirable to economize current, and since an interval is not necessary for the purposes of overcoming self inductance, a very much shorter "charging" period is required. In practice the interval of charging is so short that it is possible to obtain a number of sparks during the ignition period, and it is accordingly customary to use a vibrator with the induction coil when the battery is in circuit. The vibrator gives a rapid succession of sparks, in place of a single powerful spark which is secured by the dynamo, and the somewhat heavy induction coil used therewith. In carrying out my invention I, therefore, aim to secure all the desirable conditions which should accompany battery ignition, as well as those appropriate to dynamo ignition. I further aim to secure these conditions without disturbing the proper timing of the ignition in the cylinders.

Referring to the drawings in which like parts are designated by the same reference sign, 1 indicates a box or casing which is mounted to have a certain rotative adjustment. The way in which this rotative adjustment is secured, is unimportant and may be of any well known sort. This feature forms no part of the present invention.

Co-axial with the box or casing 1, is a shaft 2, which I will term the half-time shaft, it being understood that this is a shaft geared or connected to rotate at any predetermined relation to the engine speed. 3 indicates a cam upon this shaft, which I form as shown in Fig. 2, that is to say, cylindrical, with sharply incut portions 3′. The remaining cylindrical portions 3″ are equally spaced from one another, and each occupies a small angle, say 15°, of the periphery.

Mounted to vibrate in proximity to the cam 3, are two separately movable fingers or blades 4 and 5. The finger 4 is pivoted in the casing at 6, and carries a cam roller 7. 8 indicates a spring by which the finger and cam roller are normally pressed inward against the cam 3. The blade or finger 5 is conveniently a springy piece of metal, fixed to a metallic piece 9, upon an insulating support 10.

11 indicates an adjustment screw by which the resiliency impelled movement of the blade 5 toward the cam 3 is limited.

Before considering the electrical connections of the above mentioned parts, I will refer to the remaining mechanical features of the timer and distributer, and also to the switch or commutator used.

Referring particularly to Fig. 3, I have indicated a

practical method for securing the distributing blade upon the half time shaft. 12 denotes a rigid support, conveniently of steel or metal, keyed to the half-time shaft 2, by screws 13. In this way is formed a head which has a true and concentric rotation with the half-time shaft. 14 indicates an insulating sleeve or cap, which slips upon the head and is fastened in place by cotter pin, or other means, 15. 16 indicates the distributing switch blade fastened to the face of the insulating cap 14. In this way the switch blade is effectually insulated from the half-time shaft and from the primary circuits. The secondary current is admitted to the switch blade 16 by a screw 17, bolted through the insulating cover 18 of the casing, and forming a terminal for the connection of the secondary circuit wire. The connections for the various spark plugs are made by the contacts 19, suitably spaced around the casing in the path of the distributing blade 16. The switch is designated at 20, and comprises a revoluble element 21, formed of insulating material, and supported by bearings 22. 23 denotes a milled wheel, by which the rotative element is turned. Upon the periphery of the insulating material or element 21, are a number of segments 24, 25 and 26, of which 24 is a simple curved strip occupying a limited arc of say 90° on the insulating element. The segments 25 and 26 are shaped in a peculiar way, each having a narrow portion *a*, occupying rather more than a semi-circumference, and a broad portion *b*, occupying less than a semi-circumference, the relation being shown in Fig. 1ª. 27 and 28 are a pair of fixed plates in the path of the segment 24. 29, 30, 31 and 32 are fixed springs or blades in the path of the segment 25, and bearing thereon at diametrically opposite points, in the relation as shown in Fig. 1ª. The blades 29, 30 and 31 are in the path of the broad part *b* of the segment, while the blade 32 is the only one engaged by the narrow part *a*. 33, 34 and 35 denote additional springs or blades, having a relation to the segment 26 similar to the relation of the above blades to their segment 25. Of these last mentioned blades only 35 is in the path of the narrow part *a* of the segment. In addition to the above named springs and contacts, there is an additional connection provided by the spring 36, fixed to bear on the segment 24 in all relations thereof.

I will now consider the operation of the above mechanism, and the connections and effects of the various electric circuits employed. We will first suppose that it is desired to operate exclusively from the dynamo shown at D. The apparatus is shown in Fig. 1 in its neutral relation, when neither the dynamo nor the battery are connected. In order to connect the dynamo the milled wheel 23 is turned to the left until the segment 24 contacts with the plate 27, and the segments 25 and 26 engage the various blades 29, 30 and 33. By this movement the spring blades 31 and 34 are wholly disconnected, but blades 32 and 35 remain in circuit since they bear on the continuous ring portion *a* of the segments. The following circuits are completed: from dynamo D, wire m', blade 33, segment 26, blade 35, wire m^2, primary P', wire m^3, blade 29, segment 25, blade 32, wire m^4, through a connection 37, wire m^5, to the primary contact 38, which is held on an insulating support 39 in the path of the finger 4. From contact 38 the current makes a closed circuit to ground if the finger 4 happens to be resting thereagainst. The shaft 2 is, however, rotating in the direction of the arrow in Fig. 1, and at a particular point of the revolution the cam 3 abruptly engages the cam roller 7, moving the finger 4, and breaking the primary circuit at 38. This causes a spark in the secondary current as follows: from secondary S', wire n', plate 27, segment 24, blade 36, wire n^2 (shown in Fig. 3 and diagrammatically represented in Fig. 1), distributing switch blade 16. This blade has a sufficiently long peripheral edge 40 to insure a circuit to one or another of the contacts 19 which lead to the various spark plugs in a manner which is well known and need not be described.

The primary circuit being thus broken, as above described, and the ignition spark made, it is advantageous to re-close the primary circuit as speedily as may be. Since the pivoted finger 4 was given an abrupt movement to break the circuit and is necessarily heavy to stand the wear and tear, it is evident that there will be quite an interval before the inertia of this finger will permit it to return against the contact 38. In the interim a contact is, therefore, made in another way as follows: At the instant of the primary break the spring finger or blade 5 lies out of contact with the cam 3, but is in a position to engage such cam after a short movement thereof, say 20°. Accordingly 20° after the primary break at the point 38, the blade 5 engages the surface 3″, completing the primary circuit as follows: from dynamo D, through wires m', m^2 and m^3, into segment 25, as before, and from thence through a wire o' to connection 41, wire o^2, to plate 9 and blade 5, and from thence through cam 3 to ground. This gives the dynamo a chance to build up and thoroughly charge its induction coil and by the time this circuit is broken by the onward movement of the cam, the pivoted finger 4 is returned against the contact 38. The blade 5 is arranged, of course, to clear the cam before the next rupture of the primary circuit at the point 38, occurring as above described. Accordingly when the dynamo is in circuit, the dynamo induction coil has a chance to charge up during about 70° of rotative movement, which is about the maximum time possible. When the battery is thrown into circuit, however, new conditions are developed. The battery induction coil has a primary P^2 and a secondary S^2. V indicates the usual vibrator. In order to throw the battery into circuit, the knob 23 is turned to the right, so that the segment 24 is in contact with plate 28. Under these circumstances the broad parts *b* of segments 25 and 26 are disengaged from blades 29, 30 and 33, and pass into contact with blades 31 and 34. Current passes from battery B through blades 34 and 35, through coil P^2, wire p', blade 31, segment 25, blade 32, wire m^4, connection 37, wire m^5, to contact 38. As long as this contact is in the closed relation shown, a series of sparks will be produced. In Fig. 1 the parts are shown at the final instant of this succession of sparks, namely, at the instant the primary circuit is broken at the point 38. The sparks have been continuing for 20° or 30° previous, during all the time that the finger 4 has been in contact with the stop 38. But during this action the spring finger 5 is wholly out of circuit on account of the disconnection of the blade 30. The continuation of the battery current and the spark cascade is, therefore, only for a small interval before the action of the timer upon the

finger 4. This economizes battery current, which is important, and also avoids premature ignition which would occur if the battery circuit were closed during 70° or 80°, as is the case with dynamo ignition. If a battery cascade of sparks gives a slightly earlier ignition than the single spark of the dynamo ignition, the slight variation can be readily compensated for by adjusting the angular position of the casing 1. The secondary circuit is completed through plate 28, into segment 24, and through the various distributing contacts in substantially the same way with the battery as with the dynamo. With the dynamo ignition a single secondary impulse passes from the distributing blade 16 at about the position shown in Fig. 1. With the battery ignition a series of impulses pass from the blade 16, which is sufficiently long for this purpose, the last one occurring at about the position shown in Fig. 1.

By means of the above it will be seen that I am able to throw in either the dynamo ignition system or the battery ignition system, or cut out both systems, all by the motion of a single switch element, and by the use of a single combined timing and distributing box.

What I claim, is:—

1. In an ignition system, a rotating cam, a finger moving against a fixed contact and arranged to be abruptly moved by said cam, an additional blade or finger in the path of said cam, and a single switch element for directing the primary current into both of said fingers.

2. In an ignition system, a continuously rotating cam, a pair of fingers normally included in the primary circuit and arranged in the path of said cam, and means for cutting one of said fingers out of circuit.

3. In an ignition system, a continuously rotating cam, a finger moving against a fixed contact and arranged to be abruptly moved by said cam, an additional finger in the path of said cam, a battery and dynamo with induction coils, and means for directing the primary current from the dynamo into both of said fingers, and the primary current from the battery into said pivoted finger.

4. In an ignition system, a continuously rotating cam, a finger moving against a fixed contact and arranged to be abruptly moved by said cam, a second finger in the path of said cam, and means for including both or one of said fingers in the primary circuit at will.

5. In an ignition system, a continuously rotating cam, a finger in the path of said cam and arranged to abruptly break the primary circuit, a second finger in the path of said cam and arranged to complete the primary circuit a minute interval after said break, said last named finger being disengaged from the cam before the following break.

6. In an ignition system, a continuously rotating cam having sharply incut portions separated by equally spaced circumferential sections, a pivoted finger having a cam roller and moving against a fixed stop or contact, an additional finger in the path of said circumferential sections, and means for including both of said fingers in the primary circuit.

7. In an ignition system, a continuously rotating cam, a finger arranged to abruptly break the primary circuit, a battery and dynamo and induction coils therefor, and means for completing the battery circuit through a predetermined interval prior to its break by said finger, and means whereby the dynamo primary circuit is completed for a longer interval prior to said break.

8. In a distributing system, a combined timer and distributer having means for completing the primary current through a long or short interval, a switch having insulated segments with broad and narrow portions and brushes engaging the respective portions, said segements having a limited angular movement for determining the duration of the primary current.

9. In an ignition system for explosion engines, a battery and dynamo as alternative sources of current, a single point cam lever, means for interrupting the battery current at said cam lever, and a single device for changing the circuits whereby the dynamo current is interrupted at the same cam lever, said device providing means for increasing the duration of the primary circuit closure in case of the dynamo.

10. In an ignition system for explosion engines, a battery and dynamo as alternating sources of current, a single point cam lever, a single device for changing the circuit whereby the current of either said battery or said dynamo is broken at said lever, and means for establishing a special path independent of said cam lever for the dynamo current prior to the instant when the dynamo circuit is closed at said lever.

11. In an ignition system, a continuously rotating cam, a finger arranged to abruptly break the primary circuit, a battery and dynamo, and an induction coil, means for completing the primary circuit through a predetermined interval prior to its break by said finger, and means whereby the dynamo primary circuit is completed for a longer interval prior to said break.

12. In an ignition system for explosion engines, a battery and a dynamo as alternative sources of current, a single point cam lever adapted to be included in circuit with either current source, means for establishing a shunt or multiple circuit around said cam lever when the dynamo is in circuit, said shunt connection continuing for a brief interval up to the instant of the circuit closure at said cam lever and terminating before the circuit rupture at such cam lever.

In witness whereof, I subscribe my signature, in the presence of two witnesses.

RICHARD VARLEY.

Witnesses:
FRANK S. OBER,
WALDO M. CHAPIN.