E. S. LINCOLN.

POLE REVERSING TIMER OR DISTRIBUTER.

APPLICATION FILED MAY 13, 1911.

1,019,061.

Patented Mar. 5, 1912.

2 SHEETS—SHEET 1.

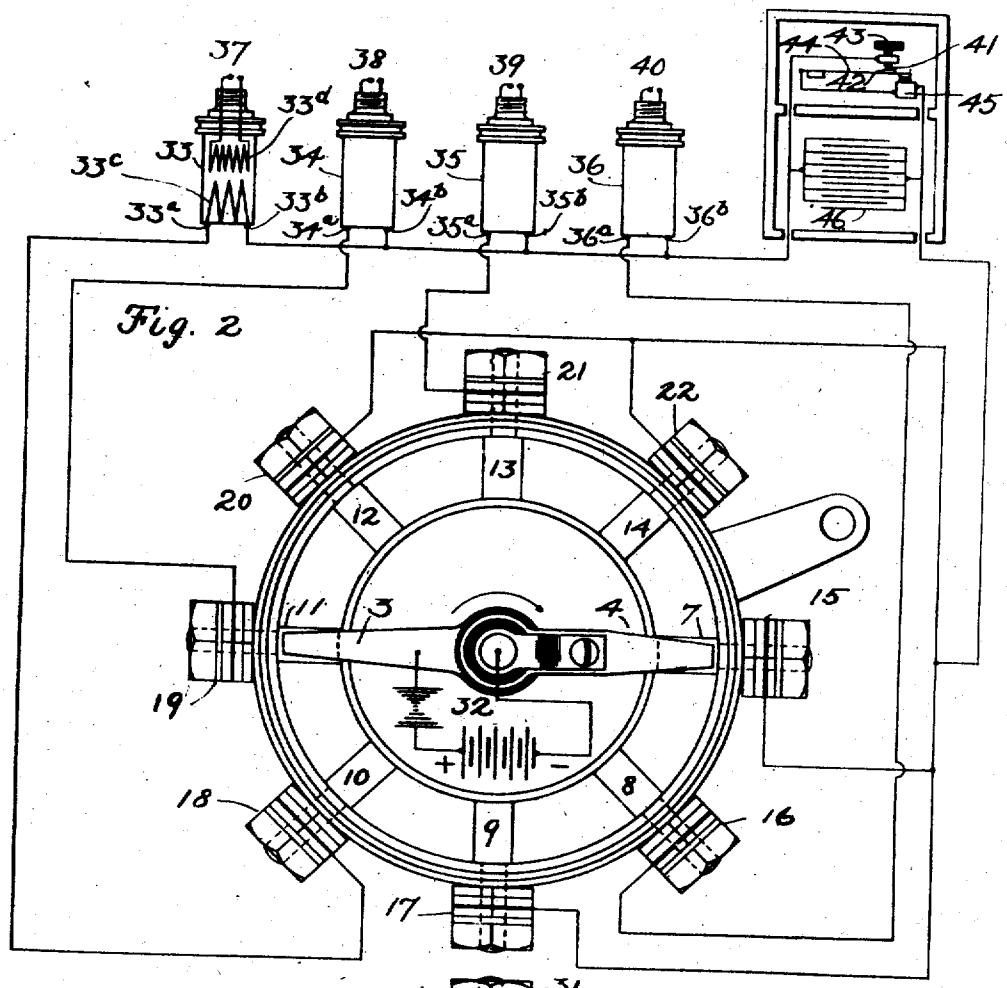

Fig. 2

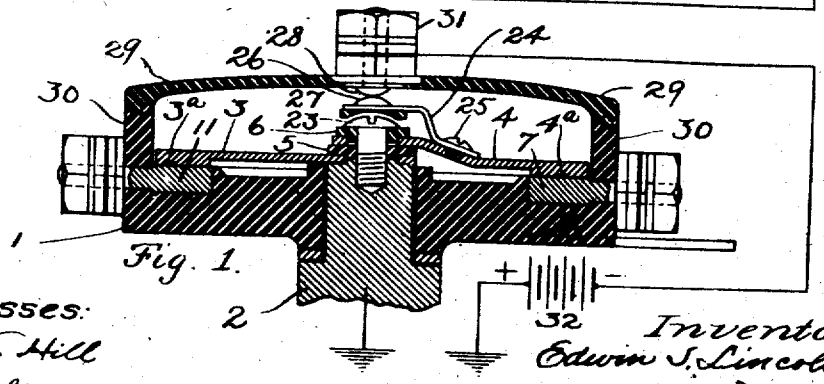

Fig. 1.

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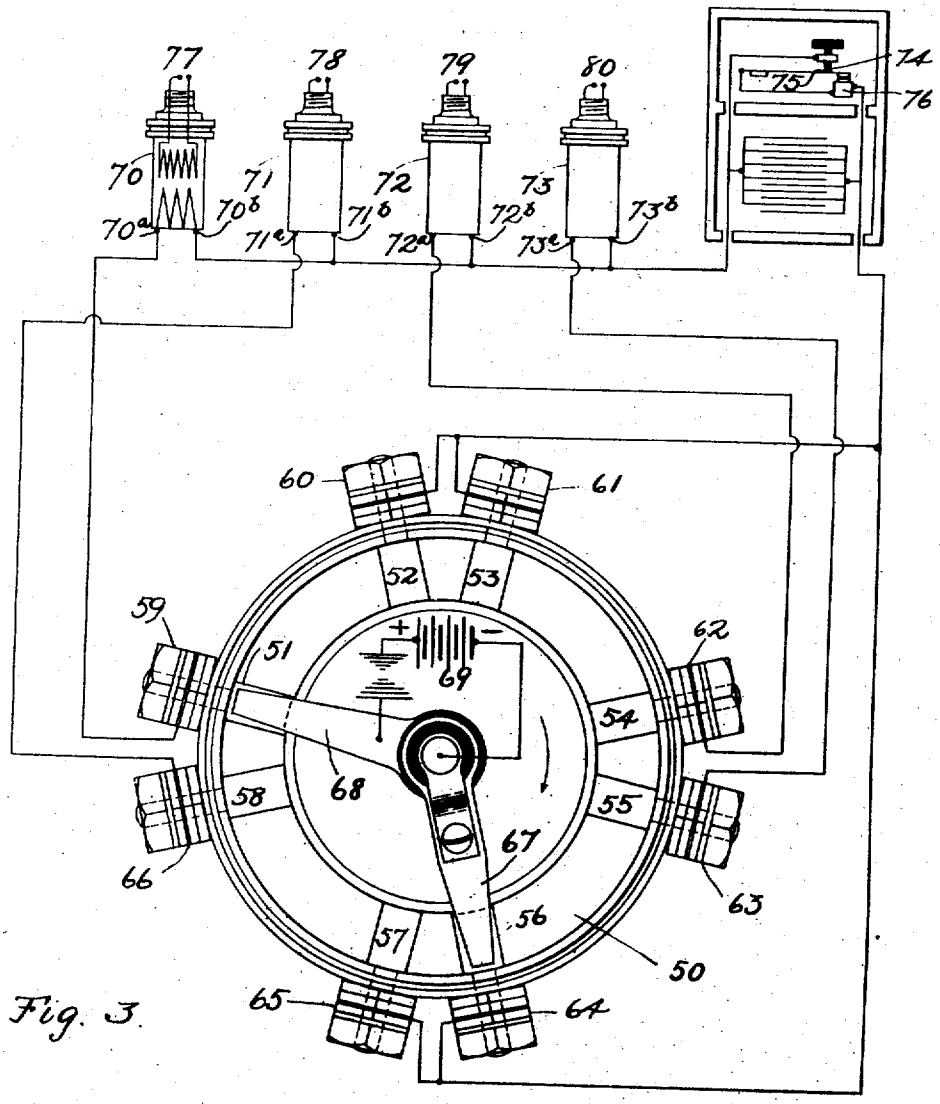

Fig. 3.

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UNITED STATES PATENT OFFICE.

EDWIN S. LINCOLN, OF BROOKLINE, MASSACHUSETTS, ASSIGNOR TO ELECTRIC GOODS MANUFACTURING COMPANY, A CORPORATION OF MAINE.

POLE-REVERSING TIMER OR DISTRIBUTER.

1,019,061. Specification of Letters Patent. Patented Mar. 5, 1912.

Application filed May 13, 1911. Serial No. 627,010.

To all whom it may concern:

Be it known that I, EDWIN S. LINCOLN, citizen of the United States, residing at Brookline, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Pole-Reversing Timers or Distributers, of which the following is a specification.

My invention relates to ignition systems having a battery or other source of energy which at the desired moment is connected in energizing relation with an induction coil through a circuit interrupter preferably of the vibrating type; the said vibrator then operating to interrupt the flow of current energizing the primary winding of the induction coil and thereby to induce in the secondary winding of the coil, a high tension electric current available for igniting purposes.

More especially my invention relates to the circuit closing device which is designed to connect the battery at the proper instant through the vibrator in energizing relation with the induction coil, assuming but one coil to be employed, or with a selected induction coil where several coils are included in the ignition system. Where but a single coil is used the circuit closing device is hereinafter termed a timer, and where several coils are employed it is termed a distributer. Inasmuch as my invention is hereinafter described as embodied in an ignition system having several induction coils, I will refer to said device under the term distributer.

The object of the invention is to devise a means, preferably in the form of a distributer, for use in connection with an ignition system whereby the source of energy is connected, in the different operative positions of the distributer, with the induction coil through the vibrator in such relation that in certain of such positions the poles of the battery are electrically connected to the vibrator points in a reversed relation as compared with the relation in which said battery poles are connected with said vibrator points in other operative positions of the distributer, in order that the direction of flow of the energizing current through the vibrator may be periodically reversed so as to prevent the disintegration of one of the vibrator points and the building up of the other point and consequently to equalize the wear of both of the said vibrator points.

My invention is shown and described in the accompanying drawings which form a part of this application, in one of its preferred embodiments.

Referring to the drawings,—Figure 1 is a side elevation, principally in section, showing a distributer more especially designed to control the ignition system of a four-cylinder, four-cycle internal combustion engine, and embodying a moving member arranged to rotate at one-fourth of the speed of the shaft of said engine. Fig. 2 shows a plan view of said distributer, and also includes a diagrammatic representation of the other apparatus forming the ignition system which said distributer is designed to control. Fig. 3 is a plan view of a distributer more especially adapted to control the ignition system of a four-cylinder four-cycle motor and having a moving member adapted to rotate in unison with the cam shaft or at one-half the speed of the engine shaft; said figure also showing diagrammatically the other apparatus forming the ignition system which said distributer is designed to control.

Referring to Figs. 1 and 2 of the drawings, 1 is the body of the distributer, preferably composed of insulating material. Centrally located in the body 1 of the distributer and having a capacity for free rotation with respect thereto is a driving shaft 2 connected preferably through gearing not shown with the shaft of the engine or motor to which ignition is to be supplied so as to be positively driven thereby at a speed of rotation one-fourth that of the shaft speed. On the end of said shaft 2 is carried the moving member of the distributer; said moving member embodying the two arms 3 and 4 arranged as follows: The arm 3 is in electrical connection with said shaft 2, preferably by direct contact therewith. Arm 4 is electrically insulated with respect to said shaft 2 and said arm 3 in any approved manner as by the insulating washer 5 and bushing 6. Both said arms 3 and 4 are, in the embodiment of the invention now being described, secured upon said shaft 2 as by a screw 23 in such manner as to occupy diametrically opposite positions with respect to each other. On the end of each of said

arms is provided a contact face 3^a and 4^a, which faces are located so as to be substantially radially equidistant from the center of the shaft 2.

In the upper surface of the distributer are embedded the contact segments 7, 8, 9, 10, 11, 12, 13 and 14, having contact faces which are flush with the upper surface of the distributer body and so placed as to be successively engaged by each of said contact faces 3^a and 4^a as the arms 3 and 4 rotate. Said contact segments 7, 8, 9, 10, 11, 12, 13 and 14 respectively connect with the binding posts 15, 16, 17, 18, 19, 20, 21 and 22. In the type of the distributer now being described said contact segments are spaced at angular equidistant intervals and are arranged in diametrically opposite sets 7 and 11, 8 and 12, and so on, so that the members of each such set of diametrically opposite contact segments will be contemporaneously engaged in each of the operative positions of the distributer by the contact faces 3^a and 4^a of the arms 3 and 4 successively as the rotating member of the distributer revolves.

On the arm 4 is carried a preferably resilient strip 24 secured to the arm, as by a screw 25, and carrying a bearing button 26 located concentrically with shaft 2. Preferably an insulating washer 27 is provided to prevent electrical leakage from arm 4 into the shaft 2 by way of the strip 24 and the screw 23. Said bearing button 26 is held preferably by the resiliency of strip 24, in electrical engagement with a coöperating contact button 28 carried on the cover 29 of the distributer, said cover being preferably of insulating material and being secured in any convenient manner to the timer body, as through a tongue and groove engagement with a peripheral wall 30 forming a part of the distributer body. A binding post 31 is electrically connected with said contact button 28.

The distributer just described is combined with other electrical apparatus in forming an ignition system, as follows. One pole, as for example the negative pole, of a source of electricity, preferably a battery 32, is connected with the arm 4 through the binding post 31, the bearing buttons 28 and 26, and the strip 24. The other, or positive pole, of the battery 32 is connected with the arm 3, as by grounding through shaft 2. At 33, 34, 35 and 36 are four igniters, each preferably comprising an induction coil which is carried directly upon the spark plug in a manner well known to those familiar with electrical ignition, the primary and secondary windings of the induction coil of igniter 33 being shown respectively at 33^c and 33^d, the secondary windings of the induction coils embodied in the said igniters having their terminals connected without external wiring with the spark points of the igniter of which it forms a part. Thus the terminals of the secondary windings included in the igniters 33, 34, 35 and 36 are respectively connected to the spark points 37, 38, 39 and 40. The terminals of the primary windings comprised in each of the induction coils embodied in the igniters 33, 34, 35 and 36 are indicated respectively at 33^a and 33^b, 34^a and 34^b, 35^a and 35^b, 36^a and 36^b.

The vibrator embodied in the ignition system is of any approved type. As shown it comprises the separable points 41 and 42, the former being carried on the tip of the adjustable screw 43, and the latter on a resilient conducting strip 44 which is adapted to be actuated by the electro-magnet 45 so as to cause the separation of said vibrator points. An electrical circuit extends in usual manner through the screw 43, the vibrator points 41 and 42, and the strip 44, through the winding of the electro-magnet 45. A condenser 46, is preferably connected around the vibrator points 41 and 42 in any approved manner.

Electrical connections between the vibrator points and the primary terminals of the igniters and the binding posts of the distributer are provided as follows. Binding posts 15, 17, 20 and 22 are collectively connected by a circuit extending through the winding of the electro-magnet 45, with the vibrator point 42. The other vibrator point 41 is connected by a branching circuit to one of the primary terminals of each of the igniters, namely, to the terminals 33^b, 34^b, 35^b and 36^b. The primary terminal 33^a of the igniter 33 is connected to the binding post 18, the primary terminal 34^a of igniter 34 to binding post 19, the primary terminal 35^a of igniter 35 to the binding post 21 and the primary terminal 36^a of igniter 36 to the binding post 16. It is thus evident that in the position of the rotating member of the distributer shown in Fig. 2, hereinafter referred to as the first operative position of the distributer, in which arms 3 and 4 respectively engage the contact segments 7 and 11, the battery 32 is connected through the vibrator points 41 and 42 in energizing relation with the igniter 34, and further, it will be seen that in such position, the vibrator point 42 is connected with the negative pole of said battery and the vibrator point 41 is connected through the igniter with the positive pole of said battery. Such connection through the distributer is established at the instant when a contemporaneous engagement between the contact faces 3^a and 4^a on the arms 3 and 4, and the contact segments 7 and 11, is completed, and at such instant the igniting sparks will begin to pass between the spark points 38.

Assuming now the rotating member of the distributer to revolve in a clockwise direction for one-eighth of a turn, corresponding

to one-half a revolution of the engine shaft, from the position of the same when igniting sparks were first produced at the igniter 34, it will be evident that the arm 4 will come into engagement with the contact segment 8 and arm 3 will come into engagement with the contact segment 12, and in such second operative position the battery 32 will be connected in energizing relation with the igniter 36 through the vibrator and sparks will be produced at the spark points 40. It will be seen however, that in such second position the vibrator point 41 is now connected with the negative pole of the battery 32 and that vibrator point 42 is connected with the positive pole of the same, the polarity of said points being consequently reversed as compared with the polarity of the same when the distributer was in its first position shown in Fig. 2. Similarly, a further one-half revolution of the engine will carry the rotating member into its third position, wherein arm 4 will engage segment 9 and arm 3 segment 13; in which third position the battery 32 will be connected through the vibrator in energizing relation with the igniter 35. However, the vibrator point 41 will now be seen to be again connected with the positive pole of the battery, giving a reversal of polarity at the vibrator points as compared with that in the previous position. Finally the igniter 33 is energized by the contemporaneous engagement of arm 4 with segment 10, and arm 3 with segment 14; in which fourth position the battery 32 is connected through the vibrator with the igniter 33. The polarity at the vibrator points in such position is again reversed, the vibrator point 41 now being negative and vibrator point 42, positive. It is thus apparent that in the successive operative positions of the distributer a recurring reversal of polarity at the vibrator points will be produced, and in consequence of the change of the direction of current flow through the vibrator points, the excessive wearing or pitting of any one point will be avoided, and by equalizing the wear on the same the life of the vibrator will be prolonged and necessity for frequent adjustment of the same avoided. Continuing its rotation with the next half turn of the motor, to its fifth position, the arm 4 of the distributer will next engage the contact segment 11 and arm 3 will contemporaneously engage contact segment 7, thereby again placing battery 32 in energizing relation with the igniter 34, although the rotating member of the timer is in a position diametrically opposite from that in which it is shown in Fig. 2. The battery 32 is also connected to said igniter 34 so as to reverse the polarity at the vibrator points, as compared with the polarity of the same shown in Fig. 1, although such polarity will not in this position be reversed as compared with that of the vibrator points in the previous or fourth position. In similar manner at each one-eighth further rotation of the rotating member of the distributer the battery will be placed in energizing relation through the vibrator points in turn with igniters 36, 35 and 33 and a reversal of polarity at the vibrator points will take place in each of the next succeeding three positions. After the completion of a full turn of the rotating member of the distributer the cycle of operations above described of the distributer in controlling the ignition system will be repeated.

It is evident that in the form of distributer just described the revolving member rotates at a relatively slow rate as compared with that of the engine shaft. In some cases it may be desirable to have the rotating member of the distributer or timer geared directly to the cam shaft of the engine so that the same will rotate at one-half of the engine speed. In such case a slight modification in the arrangement of the arms of the rotating timer and of the contact segments will be necessary. A distributer more especially adapted for use in such a situation is shown in Fig. 3. The said distributer is essentially the same as that shown and described in connection with Fig. 2, embodying the base 50 having the contact segments 51, 52, 53, 54, 55, 56, 57 and 58 embedded therein, and respectively connected with the binding posts 59, 60, 61, 62, 63, 64, 65 and 66. The rotating member of the timer as before consists of the two relatively insulated contact arms 67 and 68 which are in electrical connection in the manner shown in Fig. 1, or in any other approved manner, with the poles of a battery 69, and which are provided with contact faces through which each of said arms engages in turn with each of said contact segments 51, 52, 53, 54, 55, 56, 67 and 68 as said rotating member revolves. In the case of a four-cylinder engine one set of contact segments, 51, 53, 55 and 57 are placed at 0° apart, and are spaced at such an angular distance with respect to the first set comprising the contact segments 51, 53, 55 and 57 that the contact face of either of said arms in their rotation will preferably disengage a segment of one set before engaging an adjacent segment of the other set. The arms 67 and 68 are secured upon the moving member of the distributer substantially in the same manner as described in Figs. 1 and 2, but in such angular relation that said arms contemporaneously engage in their operative positions with one of the set of segments comprising segments 51, 53, 55 and 57 and with one of the segments in the other set comprising 52, 54, 56 and 58. As shown in Fig. 3, said arms contemporaneously engage in the first operative position of the

distributer with the segments 51 and 56. Assuming said arm 67 to rotate in a clockwise direction although the arm 67 will immediately come into engagement with contact 57, the arm 68 will be out of engagement with contact 51 and not yet in engagement with contact 52, and in consequence the distributer will be inoperative. The moving member of the distributer will not come into the second operative position until it arrives at a position 90° removed from that shown in Fig. 3, in which position arm 67 will engage contact 58 and arm 68 will engage contact 53. The third operative position will be that 180° removed from the position shown in Fig. 3, wherein arm 67 will engage contact 32 and arm 68, contact 55. In the third operative position the arm 67 will engage segment 54, and arm 68, contact 57.

The distributer before described is adapted to control an ignition system in which a battery 69 is designed to selectively energize the igniters 70, 71, 72 and 73 through a vibrator in which, as before, is embodied the vibrator points 74 and 75, and the electro-magnet 76 designed to cause the separation of said points, and thereby to cause an interruption in the primary winding of induction coils forming a part of the igniters adapted to cause igniting sparks at the spark points 77, 78, 79 and 80 to which the secondary windings of said induction coils are connected.

Electrical connections are provided between the battery 69, the arms 67 and 68 of distributer, the binding posts of the distributer, the vibrator points, and the primary terminals 70^a, 70^b, of igniter 70, 71^a, 71^b of igniter 71, 72^a, 72^b of igniter 72, and 73^a, 73^b of igniter 73, as follows. One pole of battery 69, for example the negative pole, is in connection with the arm 67, the other or positive pole of said battery, being connected preferably by grounding with the arm 68 of the distributer. The binding posts 60, 61, 64 and 65 are connected through the electro-magnet 76 with the vibrator point 75. One of each of the primary terminals of the igniters, for example the terminals 70^b, 71^b, 72^b and 73^b is connected with the vibrator points 74. The second primary terminals 70^a of igniter 70 is connected to the binding post 59, the second primary terminal 71^a of igniter 71 is connected to binding post 66. The terminal 72^a is connected to binding post 62 and the terminal 73^a is connected to binding post 63.

My invention operates in the following manner. In the first operative position of the distributer, as shown in Fig. 3, the negative pole of the battery 69 is connected through the arm 67, the contact segment 56 and the binding post 64 through the electro-magnet 76 with the vibrator point 75, said vibrator point 75 consequently being of negative polarity in such first position. In such position also the positive pole of said battery 69 is connected through the arm 68, the contact segment 51 and the binding post 59 through the primary winding of igniter 70 with the vibrator point 74, said point 74 being of positive polarity because of such first position. In the second position the negative pole of said battery 69 is connected through the arm 67, the segment 58 and the binding post 66 through the primary winding of the igniter 71 with the vibrator point 74, so that said point 74 is of negative polarity and in such position the positive pole of said battery 69 is connected through segment 53 and binding post 61 by way of the winding of the electro-magnet 76, with the vibrator point 75, said vibrator point 75 being of positive polarity in such position. It will be observed therefore that the polarity at the vibrator points is reversed in the second position as compared with the polarity of the same in the first position. As the rotation of the rotating member of the distributer proceeds to its third operative position, the negative pole of battery 69 will be connected through the binding post 60 with the vibrator point 75, and the positive pole will be connected through the binding post 63 with the vibrator point 74, said points being respectively of negative and positive polarity. In the fourth position the negative pole of battery 69 is connected through the binding post 62 and through the igniter 72 with the vibrator point 74, and the positive pole of said battery will be connected through binding post 65 and through the electro-magnet 76 with the vibrator point 75, said points being therefore respectively of the negative and positive polarity, giving a reversal of polarity at said vibrator points as compared with the polarity of the same in the third position. It will therefore be noted that in two of the operative positions the polarity at the vibratory points is relatively reversed with respect to the polarity of the same during the other two positions and consequently the advantages above mentioned as incident to such reversal of polarity will be secured. It is not necessary that the polarity at the vibrator points reverse in the alternate positions of the distributer, but the ignition system may if desired be so arranged that the polarity is the same in two successive distributer positions, and be then reversed for the next two successive positions.

In case the motor to which my timer is applied is of the two-cycle type, the rotating member of the timer should be arranged to rotate at the same speed as the motor shaft, where the timer is of the form shown in Fig. 3, or at one-half such motor

speed in the case of the timer shown in Figs. 1 and 2. Further where my invention is applied to a motor having a number of cylinders other than four, modifications in the number of contact segments and in the spacing of the same, and also in the speed at which said rotating member is driven may be necessary. Such modifications, however, can be easily effected in the light of the explanation of the principles controlling my invention hereinbefore disclosed and any necessary changes can be readily effected by any electrician conversant with the art of electrical ignition.

Having described my invention, I claim:—

1. In an ignition system, the combination with an induction coil, a circuit interrupter having separable contacts, and a source of electric energy; of means including a timer adapted, in the operative timer positions, to connect said source of energy in energizing relation with the coil through said separable contacts, the poles of said source of energy being connected with said separable contacts in reversed polarity relation in the different operative positions of the timer.

2. In an ignition system, the combination with an induction coil, a vibrator having vibrator points, and a source of electric energy; of means including a timer adapted, in the operative timer positions, to connect said source of energy in energizing relation with the coil through the vibrator points, the poles of said source of energy being connected with said vibrator points in reversed polarity relation in different operative positions of the timer.

3. In an ignition system, the combination with an induction coil, a vibrator having vibrator points, and a source of electric energy; of means including a timer connecting the source of energy in energizing relation with the coil through the vibrator points, said source of energy being connected with said points in one relation of polarity in one operative position of the timer, and in the reversed polarity relation as to said points in another operative position of the timer.

4. In an ignition system, the combination with an induction coil, a vibrator having vibrator points, and a source of electric energy, of means adapted to connect said source of energy in energizing relation with the induction coil through the vibrator points, said means including a timer, comprising a moving member embodying a plurality of relatively insulated arms, one arm being in electrical connection with one pole of the source of energy and another arm with the other pole, and contact segments contemporaneously engaged by said arms in the operative positions of the timer, the segment engaged by one arm in one of the operative timer positions being in electrical connection with one vibrator point, and the segment contemporaneously engaged in such position by another arm being in electrical connection with the other vibrator point, the segment engaged by the first arm in another operative timer position being in electrical connection with the second above mentioned vibrator point and the segment engaged by the second arm in such other position being in electrical connection with the first mentioned vibrator point.

5. In an ignition system, the combination with an induction coil, a vibrator having vibrator points, and a source of electric energy; of means adapted to connect said battery in energizing relation with the induction coil through the vibrator points, said means including a timer comprising a rotating member embodying relatively insulated arms in electrical connection one with the positive pole and another with the negative pole of the battery, and contact segments contemporaneously engaged in sets by the said timer arms in the operative positions of the timer, the poles of said battery being electrically connected through the said arms and through the set of segments engaged by the same in one operative timer position with the vibrator points in one relation as to polarity, and through the said arms and through the set of segments engaged by the same in another operative position, with said vibrator points in the reversed relation.

In testimony whereof I affix my signature in the presence of two witnesses.

EDWIN S. LINCOLN.

Witnesses:
NATHAN B. DAY,
CHAS. F. RANDALL.