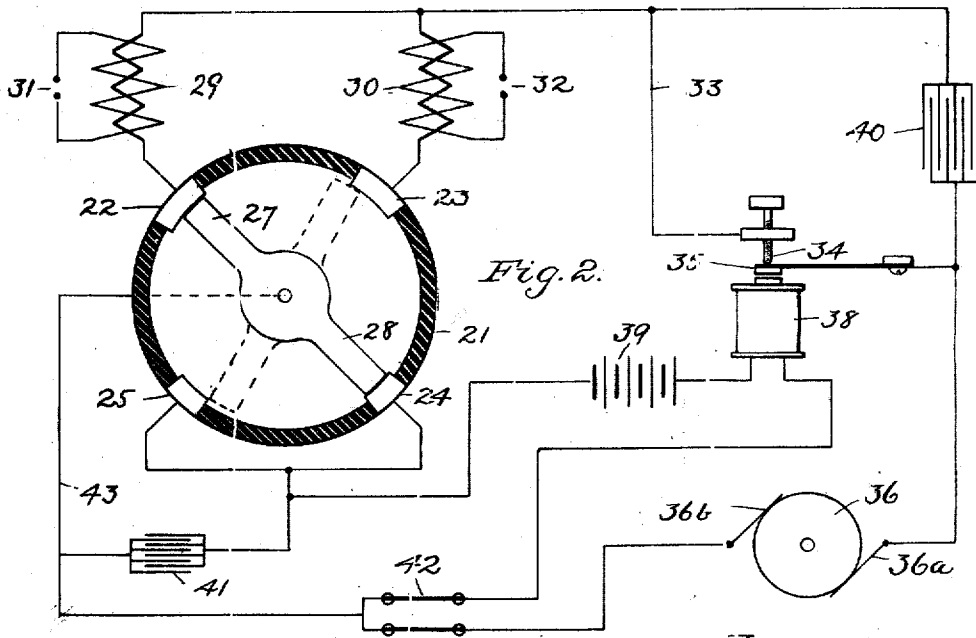
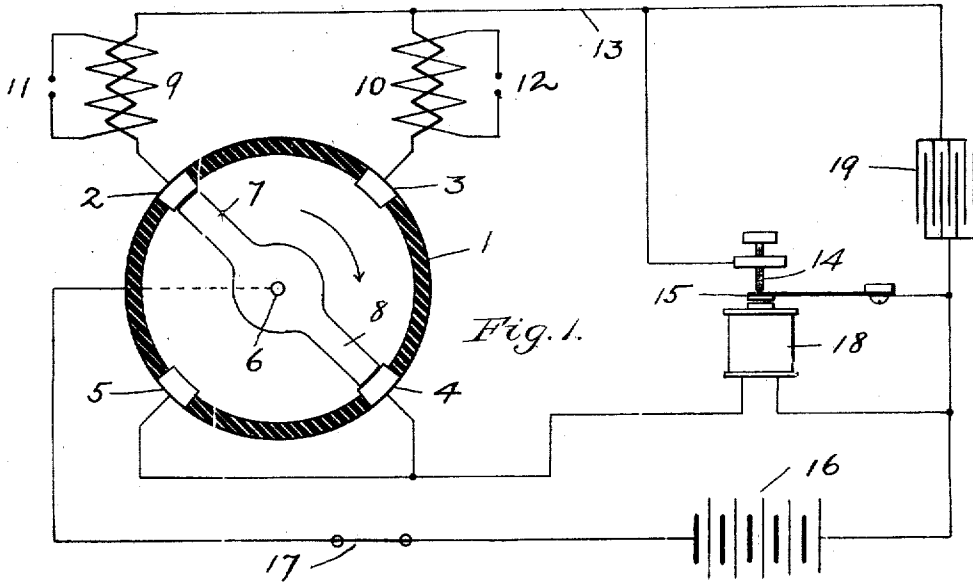


E. S. LINCOLN.
SINGLE SPARK IGNITION SYSTEM.
APPLICATION FILED DEC. 8, 1909.

1,017,300.

Patented Feb. 13, 1912.

2 SHEETS—SHEET 1.



Attest:
Aaron B. Randall
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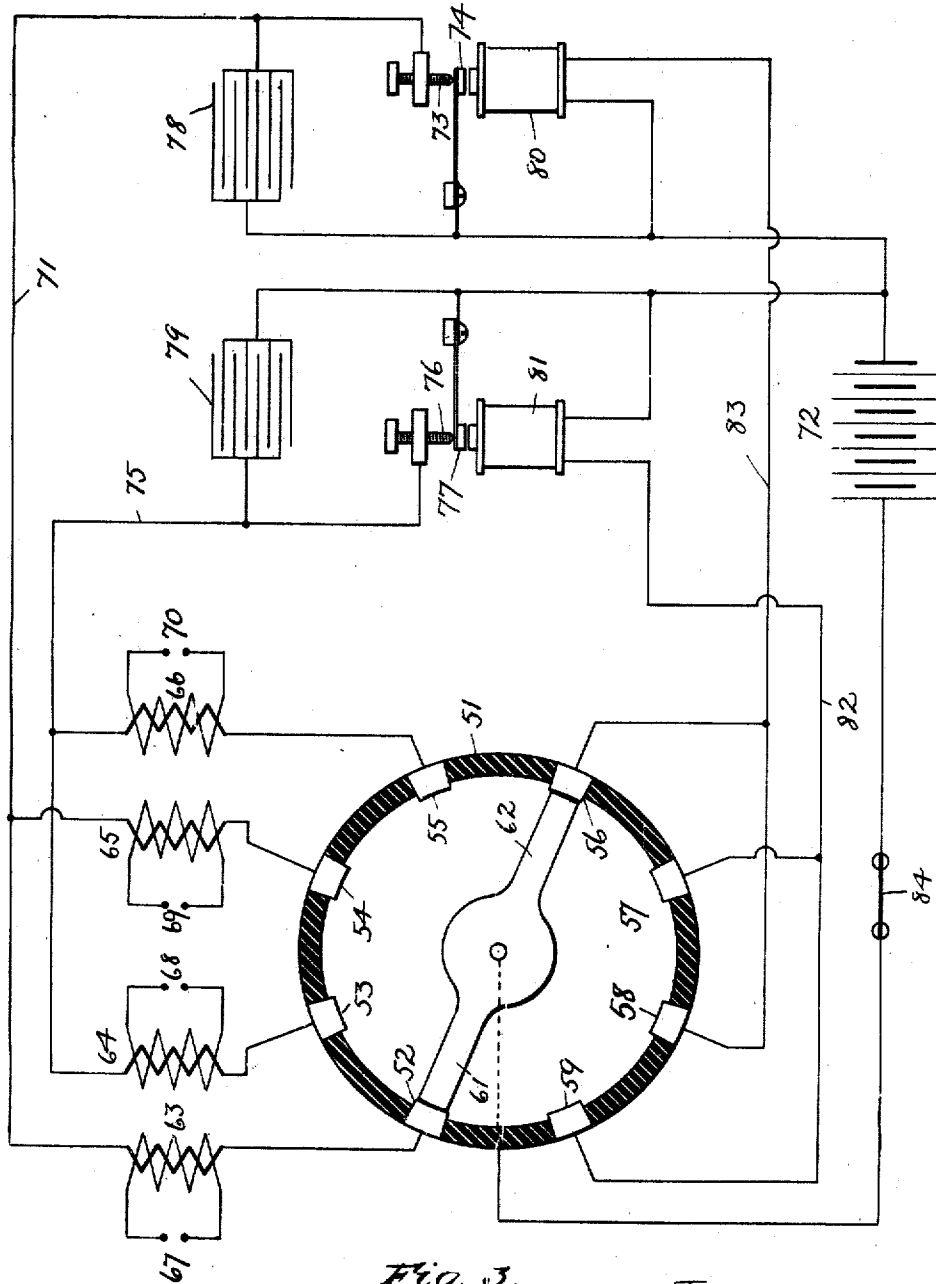


Fig. 3.

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UNITED STATES PATENT OFFICE.

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

SINGLE-SPARK IGNITION SYSTEM.

1,017,300.

Specification of Letters Patent.

Patented Feb. 13, 1912.

Application filed December 6, 1909. Serial No. 531,645.

To all whom it may concern:

Be it known that I, EDWIN S. LINCOLN, a 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 Single-Spark Ignition Systems, of which the following is a specification.

My invention relates to improvements in electrical apparatus associated and combined to form an ignition system adapted to energize the ignition devices of engines, motors, or the like, of the internal combustion type, so as to produce at the desired moment an electric discharge, which, passing between such ignition devices, or spark points, as they are commonly more specifically termed, located in a cylinder of such motor, ignites a vaporized charge of combustible in such motor cylinder.

Usually such ignition systems, where applied to a multicylindered engine or motor, embody a source of energy, a plurality of induction coils individually electrically connected in operative relation with the ignition devices of one of the cylinders of the motor which said ignition system is designed to control, selective means by which the source of energy may be placed in electrical communication with the desired induction coil, and a circuit breaker, intercalated in the energizing circuit between the primary winding of the induction coil and the source of energy, by which the circuit through such primary winding may be interrupted and current induced in the secondary winding of such coil by which an electric spark is produced at the ignition device or spark points.

My invention more especially relates to those ignition systems comprising the elements just named in which the operation of the circuit breaker is effected by magnetism produced in an electromagnet when its winding is placed in circuit with a source of electrical energy, and preferably the same source of energy as that by which the induction coils are energized; said energization being furthermore caused to occur but once during the period when the source of energy is electrically connected with a given induction coil, so that only a single spark is produced at the ignition device or spark plug.

The objects of my invention are to produce an ignition system of the nature just

described, in which a single rotating or moving member, forming a part of said selective means, performs, simultaneously both the functions of electrically connecting the source of energy with the ignition device of the desired motor cylinder, and of making the electrical connections necessary to cause the operation of the spark producing instrumentalities; said selective means furthermore being preferably so constructed and so electrically connected in operative relation with the coöperating elements of the ignition system, that the performance of such double function is repeated a plurality of times during the course of a single revolution of the rotating member of the said selective means.

With these objects in view my invention consists in the construction of the special apparatus hereinafter termed the distributor-timer, and in the assembly of such apparatus in operative relation with other electrical instrumentalities, in the manner shown in the accompanying drawings and more fully set forth and described in the following specification.

In said drawings, Figure 1 shows diagrammatically my invention as embodied in its preferred form for application to an engine or motor having two cylinders. Fig. 2 shows diagrammatically a modified form of my invention more especially adapted for use where it is desired to employ a direct current generator for the purpose of energizing the ignition system. Fig. 3 presents a further modification of my invention showing the same as preferably applied to motors having four cylinders.

Referring to Fig. 1 of the drawings, 1 represents the casing of the distributor-timer which I employ in my ignition system; the said casing being made of insulating material and having the four contact elements, as for example the blocks 2, 3, 4, and 5 mounted therein as shown. The rotating member of the ignition system forms a part of the distributor-timer, being positively driven by the engine or motor so that it revolves about a central shaft 6 concentrically located with respect to the contact surface of the said contact blocks 2, 3, 4, and 5. Said rotating member or timer arm as it is hereinafter more specifically termed embodies the two arms 7 and 8 projecting from a common hub, and preferably located dia-

metrically opposite as to each other. At the end of each of said arms 7 and 8 is carried a contact element which preferably forms an integral portion of the arm, and adapted to make electrical connection successively with each of the contact blocks 2, 3, 4, and 5 as the rotating member revolves. Said contact blocks 2 and 3, hereinafter called distributor contact blocks, are separated by such an angular distance that the interval between the engagement of contact 2 by a timer arm and the engagement of contact 3 by the same timer arm approximately corresponds to the interval between the ignition of the explosive charge in one engine cylinder and the succeeding ignition in another cylinder. The contact blocks 4 and 5 are so located with respect to the timer arms, and to the distributor contact blocks 2 and 3, that one timer arm engages the same substantially at the same instant that the other arm of the timer engages the contact block 2 or 3. That is, both said timer arms, or more accurately, the contact surfaces or elements carried by the said timer arms, engage contemporaneously with contacts, 2 and 4, or with contacts 3 and 5. In other words, the contact elements carried by the rotating member are adapted to contemporaneously interengage in the different operative positions of said rotating member, with the contact elements carried on the stationary member, so as to form two pairs; one of the timer arm contacts forming, with the distributor contact, one pair of interengaging contact elements, and the second timer arm contact forming, with the timer contact, the second pair of interengaging contact elements.

In adapting my system to a two cylinder motor, I set the contacts 2, 3, 4, and 5 substantially at 90 degrees apart as shown.

At 9 and 10 are represented induction coils, having secondary windings which lead respectively to spark points 11 and 12 located in the cylinders of an internal combustion motor. The primary winding of said induction coil 9 is electrically connected at one end to contact 2, and the primary winding of induction coil 10 is similarly connected to contact 3. The other ends of both said primary windings are joined in a common conductor 13 leading to a contact screw 14 and the movable armature 15 of a circuit breaker, which normally electrically engages the contact screw 14. The other pole of said battery 16 is in electrical connection, preferably through a switch 17 and by grounding, or in any other desired manner, with both the arms 7 and 8 of the rotating member of the distributor timer. It is therefore apparent that when either of the timer arms is in contact with either of the distributor contacts 2 or 3, an electric current from the battery will energize the

primary winding of the induction coil with which the contact engaged by such arm leads.

For the purposes of interrupting the flow of electric current through the primary winding of the induction coil so as to produce a high tension discharge at the spark points, I employ instrumentalities including separable contacts intercalated in the energizing circuit and having an actuating winding, preferably the winding of an electromagnet 18, adapted to cause the disengagement of the separable contacts by attracting the armature 15 away from the contact screw 14. One terminal of said magnet winding is connected to one pole of battery 16, the other end of the said winding being in electrical connection with both contacts 4 and 5, said contacts being hereinafter termed "timer contacts". Hence when either of the rotating timer arms is in engagement with either timer contact the other end of the actuating or magnet winding will be placed in electrical connection with the unengaged pole of battery 16 through the rotating timer arm and the switch 17, and said battery is in consequence connected by the actuating circuit with the actuating or magnet winding. Preferably a condenser 19 is connected in usual manner around the separable contacts carried on the contact screw 14 and on the movable armature 15.

My invention operates in the following manner: Assuming the timer arm to rotate in a clockwise direction, and to be so driven as to approach the position shown in Fig. 1 when it is desired to produce an igniting spark at the spark points 11, it is apparent that as the timer arm 7 first makes contact with the distributor contact block 2, current will flow from the battery 16 through the primary winding of induction coil 9 energizing the same. The other timer arm 8 will engage timer contact block 4 practically simultaneously with the engagement of arm 7 and distributor contact block 2. In consequence the electric circuit through the magnet 18 will be completed and the magnetism set up in the same will draw down the movable armature 15 and causing the separation of the same from the contact screw 14. As a result the circuit through the induction coil 9 will be broken, and current will be induced in the secondary winding of the same which will cause an igniting spark to be discharged between the spark points 11. Preferably the timer arm 8 should remain in engagement with timer contact block 4 until the contact between timer arm 7 and distributor contact 2 has ceased, so as to prevent any subsequent energization of the induction coil, with consequent waste of current. As the time for producing a spark in the other cylinder of the motor approaches, the timer arm 7 will ap-

proach the distributor contact block 3, and as it engages the same, the other timer arm 8 will engage timer contact block 5. As before, the spark producing instrumentalities will become operative to cause induction coil 10 to produce an igniting discharge between spark points 12. Further rotation of the timer shaft will bring timer arm 7 into its diametrically opposite position; that is, into the position in which timer arm 8 is shown in Fig. 1. In such position arm 7 will engage with timer contact 4, and arm 8 will be in position occupied by arm 7 in Fig. 1 and be in contact with distributor contact 2. As before, induction coil 9 will be energized by battery 16, and the magnet 18 will become operative to break the primary circuit and cause a spark at spark points 11. Still another quarter turn of the timer shaft will bring timer arm 7 into engagement with timer contact 5; timer arm 8 at the same time engaging distributor contact 3. In this position the sparking instrumentalities will again become operative to produce a spark at spark points 12. After traversing another arc of 90° the rotating member will complete its cycle of operations reaching its initial position; that is, as it appears in Fig. 1.

Fig. 2 shows a modification of my invention which is especially adapted for use where it is desired to employ a direct current generator in place of a battery as a source of energy. In such modification the distributor-timer has in general the same characteristics as that hereinabove described in the connection with Fig. 1, comprising the casing 21 carrying the distributor contacts 22 and 23, and the timer contacts 24 and 25; and a rotating member having the two arms 27 and 28 which are adapted to make contemporaneous contact with two of said contacts in two of its positions of rotation. As in the case of Fig. 1 distributor contacts 22 and 23 lead to the induction coils 29 and 30 by which the spark points 31 and 32 are energized. Said induction coils are connected through a common conductor 33 to brush 36^a of a generator 36, by a circuit which includes two separable contacts comprised in the adjustable contact screw 34 and the armature 35. As before, the separation of said separable contacts is caused by magnetism produced in a magnet 38 at the desired time.

For the purpose of magnetizing said magnet 38 an independent battery 39 is preferably employed, having one pole connected to both timer contacts 24 and 25, and its other pole connected with the timer arms 27 and 28 through the magnet 38, switch blade 42, and conductor 43. Said timer arms 27 and 28 are also connected to brush 36^b of the generator 36; a double pole switch 42 being preferably employed as shown, arranged to

simultaneously connect said timer arms with brush 36^b and the magnet 38.

Preferably the condensers 40 and 41 are employed condenser 40 being connected in shunt around the contact screw 34 and armature 35; and condenser 41 being connected in between the timer contacts 24 and 25 and the conductor 43 leading to said rotating member.

In the modification now under description the distributor contacts 22 and 23 should preferably have a somewhat longer bearing surface than those of the timer contacts 24 and 25, and be so situated upon the casing that that arm of the timer which is about to engage one of said distributor contacts will come in contact with it slightly in advance of the time when the other arm of the rotating member engages the timer contact as indicated in the dotted position shown in Fig. 2. The object of this is to permit the potential of the generator to build up to its normal operating voltage before the engagement of the rotating member with the magnet contact causes the operation of the spark producing instrumentalities.

If desired an alternating current generator or magneto may be substituted in place of either the direct current generator 36 or the battery 39. In such case the magneto armature should be arranged to rotate at such a rate and in such an angular relation to the position of the timer arm that the armature of said magneto is preferably approaching its position of maximum current generation when the timer arms are about to engage the timer and distributor contacts.

As a result of the constructions hereinbefore described it will appear that in the course of a single rotation of the rotating member there are two positions in which the same becomes effective to render the ignition device of each cylinder operative, whereas, so far as I am aware, in similar systems and apparatus used in connection therewith, as now employed, such rotating member is adapted to render the ignition device operative only in one position of rotation. Hence, the rotating member may be operated at a speed of rotation which is one-half that which would be necessary were my invention not employed.

Fig. 3 shows a modification of my invention which is more particularly adapted for motors which have four cylinders. Referring to said Fig. 3 the casing 51 of the distributor-timer formed of insulating material, carries four distributor contacts, 52, 53, 54, and 55, and it also carries, mounted in said casing at points substantially diametrically opposite to the timer contacts, the timer contacts 56, 57, 58, and 59. As before pointed out in connection with Figs. 1 and 2, the rotating member is arranged to revolve about a central shaft, and embodies

the two timer arms 61 and 62, said arms being arranged to engage with each of said distributor contacts and said magnet contacts in the course of a revolution of the rotating member. The distributor contacts 52, 53, 54, and 55 are in electrical connection, respectively, with the primary windings of the induction coils 63, 64, 65, and 66. The primary windings of induction coils 63 and 65 are electrically connected by a common conductor 71 with one pole of a source of electrical energy 72, through the contact screw 73 and the movable armature 74, which is normally in engagement therewith. Similarly induction coils 64, and 66 are connected through a common conductor 75 with said source of energy 72 through the contact screw 76 and the movable armature 77. Condensers 78 and 79 are preferably provided, the former being connected in shunt around the contact screw 73 and armature 74 and the latter around the contact screw 76 and the armature 77. As is the case with the embodiment of my invention described in Figs. 1 and 2, the actuation of the armatures 74 and 77 is effected by means of the magnets 80 and 81. The timer contacts 57 and 59 are connected by a common conductor 82 through the winding of the magnet 81 to one pole of the source of energy 72. The timer contacts 56 and 58 are connected by the common conductor 83 to the winding of magnet 80, and thence through the same to the same pole of the source of energy 72, to which the magnet 81 is connected. The other pole of the source of energy 72 is connected to the rotating member so that both of the timer arms 61 and 62 carried thereon are in electrical connection with said source of energy. Switch 84 is preferably inserted in the circuit between the source of energy and the rotating member for the purpose of disconnecting said source of energy from the ignition system when desired.

The mode of operation of the modification described in Fig. 3 is analogous to that of the embodiments of my invention described in Figs. 1 and 2. That is, the rotating member, in the position shown in Fig. 3 serves not only to establish the electrical connections necessary to energize the induction coil 63 but to cause an electrical discharge at spark points 67 through the actuation of the spark producing instrumentalities as a result of the magnetization of magnet 80. Said rotating member will also perform the same double function when said rotating member has revolved 180° so as to come into a position diametrically opposite to that in which it appears in Fig. 3. Similarly when the rotating member has advanced one eighth of one revolution in a clock-wise direction, it will establish the electrical connections necessary to energize the induction coil 64 and to cause a discharge at spark points 68

through the actuation of the circuit breaker as a result of the magnetization of magnet 81. In an analogous manner when the rotating member, in the course of its revolution, reaches a diametrically opposite position, it will operate to establish the same electrical connections as in its former position, and thereby will cause in that position, a second electrical discharge between the spark points 68. Still further rotation will cause the rotating member to separately and successively engage the distributed contacts 54 and 55 leading to induction coils 65 and 66, and also simultaneously to engage the timer contacts 58 and 59 respectively, so as to effect the operation of the spark producing instrumentalities through the successive magnetization of magnets 80 and 81. As before, said induction coils 65 and 66 and also magnets 80 and 81 are again simultaneously energized when the rotating member has advanced a half revolution beyond its original operative position.

It will be noted that in the modification now being described the magnets 80 and 81 are energized alternatively for the purpose of operating the spark producing instrumentalities. Such use of alternatively operating spark producing means has been found advisable in ignition systems where the interval between the successive magnetizations of the magnet actuating the circuit breaker, would be too brief to permit a complete demagnetization of such magnet to take place in such interval, and where for such reason a satisfactory operation of the spark producing instrumentalities, when the rotating member was revolving at a relatively rapid rate of revolution, could not be secured. In such cases by the use of a plurality of spark producing instrumentalities arranged to be alternatively operated my system may be rendered available for use in motors in which the ignition at the different cylinders occurs with such frequency as to be beyond the range of successful operation of a system of my type employing only a single set of spark producing instrumentalities.

I claim—

1. In an electric discharge producing system, in combination; a source of electric energy; an induction coil; an energizing circuit adapted to connect the source of energy with the coil; a circuit interrupter having separable contacts intercalated in said energizing circuit, said interrupter including an actuating winding for causing the separation of the said contacts; an actuating circuit adapted to connect the source of energy with the actuating winding; and means for contemporaneously closing said energizing and actuating circuits independently.

2. In an electric discharge producing sys-

tem, in combination; a source of electric energy; an induction coil; a distributor-timer having a distributor contact, a timer contact, and a rotating member having contact making surfaces adapted to contemporaneously engage both said distributor contact and said timer contact independently; an energizing circuit extending from said distributor contact through said source of energy and the coil to one of said contact making surfaces; a circuit interrupter having separable contacts intercalated in said energizing circuit, said interrupter including an actuating winding for causing the separation of said separable contacts; and an actuating circuit extending from said timer contact through the actuating winding and said source of energy to another of said contact making surfaces.

3. In an electric discharge producing system, in combination; a source of electric energy; an induction coil having a primary winding; a circuit interrupter having separable contacts, and embodying a magnetizing winding for effecting the separation of said contacts; a circuit controller having a distributor contact and a timer contact, and a rotating member carrying a plurality of contact surfaces, one of said surfaces being adapted to engage said distributor contact in the course of the rotation of the arm and another of said surfaces being adapted contemporaneously to engage said timer contact at the moment of discharge; electric connections connecting said contact surfaces collectively with one terminal of said source of energy; an electric circuit adapted to connect said distributor contact through the separable contacts and the primary winding with the second terminal of said source of energy; and an electric circuit, electri-

cally distinct from the circuit just mentioned, adapted to connect said timer contact with said second terminal of the source of energy through said magnetizing winding.

4. In an ignition system, in combination; a source of electric energy; a plurality of induction coils having primary windings; a circuit breaker having separable contacts, and embodying a magnetizing winding for effecting the separation of said contacts; a distributor-timer having a plurality of distributor contacts and a plurality of timer contacts, and a rotating member carrying a plurality of contact surfaces, one of said contact surfaces being adapted to engage said distributor contacts in succession as said arm rotates, and another of said contact surfaces being adapted, contemporaneously with such engagement and at the moment of ignition, to engage a timer contact; electric connections connecting said contact surfaces with one terminal of said source of energy; independent electric circuits adapted to separately connect said distributor contacts through the selected primary windings and through the separable contacts with the second terminal of said source of energy; and a circuit electrically distinct from the circuits just mentioned adapted to connect said timer contacts collectively with said second terminal of the source of energy through said magnetizing winding.

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

EDWIN S. LINCOLN.

Witnesses:

NATHAN B. DAY,
CHAS. F. RANDALL.