June 16, 1936. R. H. DIBLEY 2,044,155

IGNITION SYSTEM FOR COMBUSTION ENGINES

Filed April 13, 1935 2 Sheets-Sheet 1

Fig. 1.

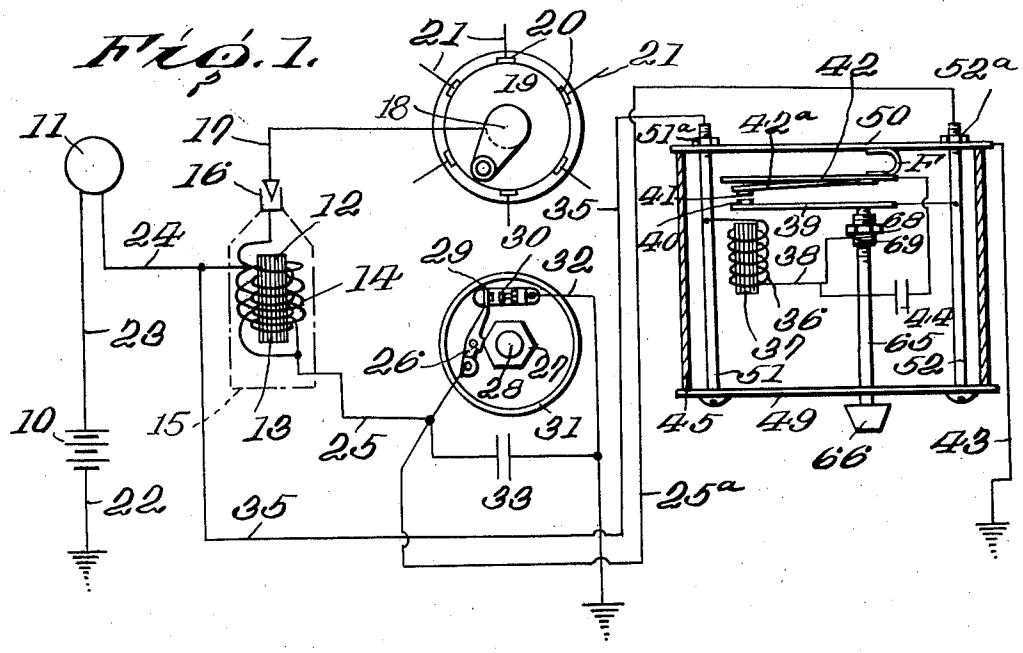


Fig. 2.

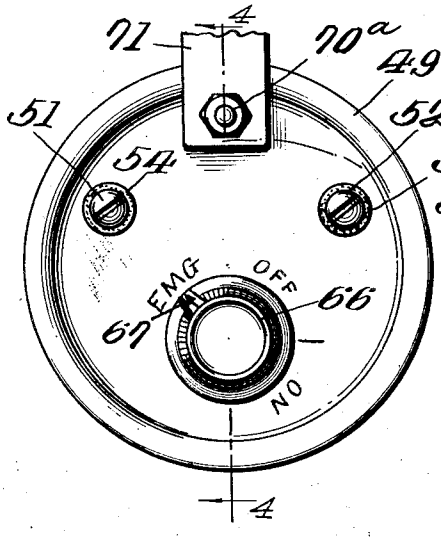
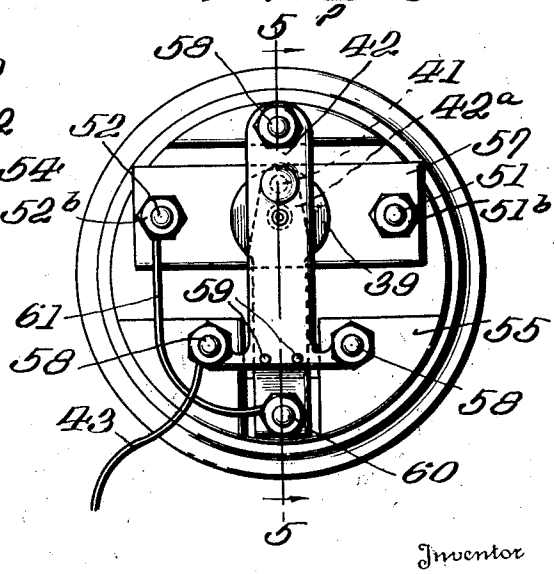


Fig. 3.



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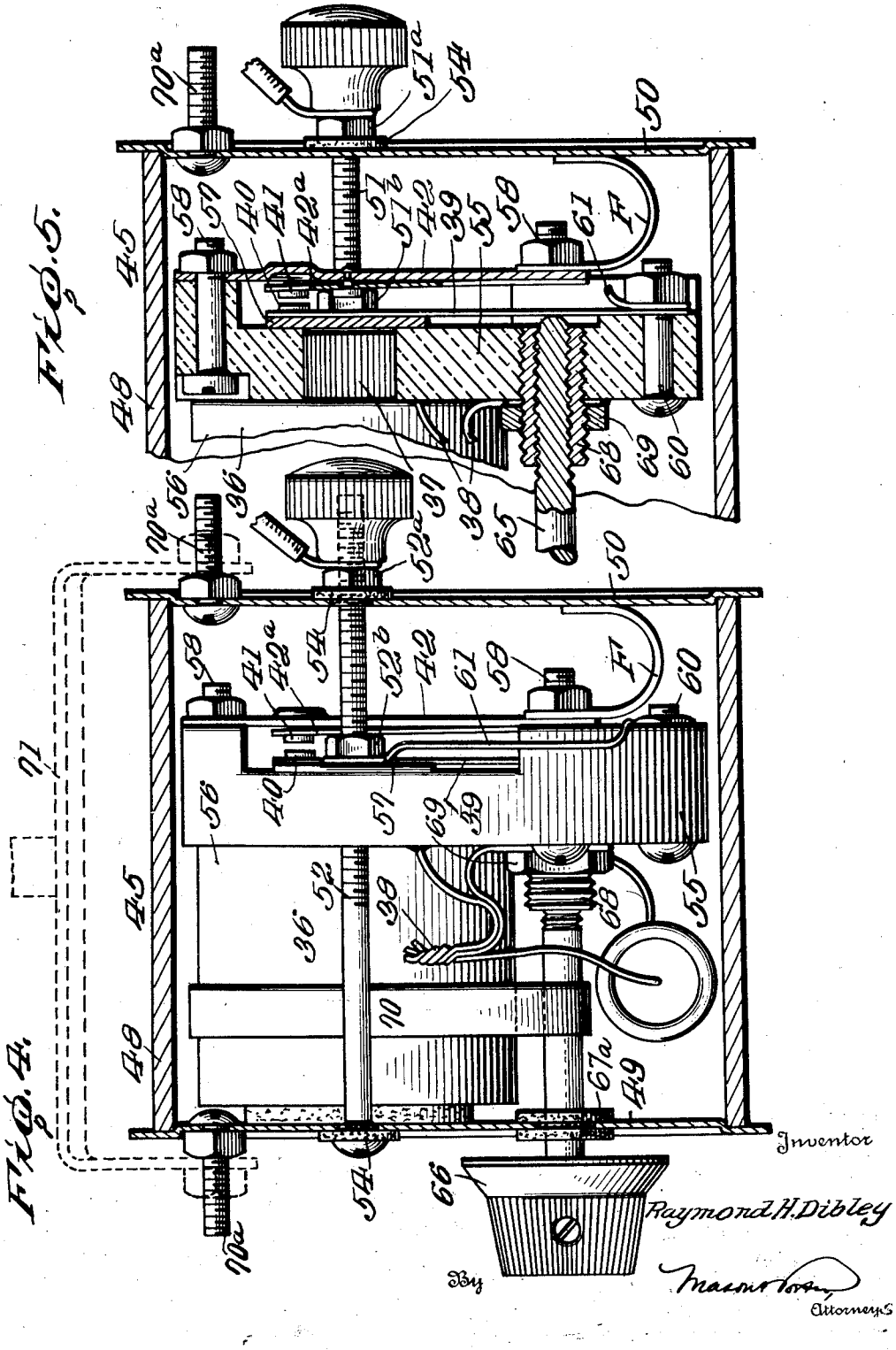
Filed April 13, 1935 2 Sheets-Sheet 2



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2,044,155

IGNITION SYSTEM FOR COMBUSTION ENGINES

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8 Claims. (Cl. 123—148)

This invention relates to improvements in an ignition system for combustion engines, and is more particularly related to means for accruing the firing and combustion of the charge within the engine cylinder.

One of the features of the present invention is the provision of devices which cooperate with an induction coil having primary and secondary windings and with the engine timer for producing a series of sparks at and following the time predetermined for the ignition at the timer.

Another feature of the present invention is the provision of such devices as an attachment for the usual ignition system for a combustion engine, for assisting the usual ignition elements under various conditions of operation.

A further feature of the present invention is the provision of such devices along with a control by which they may be rendered operative or inoperative as desired, and whereby their method of operation may be modified according to the prevailing conditions.

Still another feature of the present invention is the provision of such an assemblage of devices in a compact and convenient form for employment with the timer and distributor or usual ignition coil of a multi-cylinder internal combustion engine.

With these and other objects in view, as will appear in the course of the following specification and claims, an illustrative form of practicing the invention is set out on the accompanying drawings, in which:

Fig. 1 is a circuit diagram showing the connections of an ignition system according to the present invention.

Fig. 2 is a front view of an assembly of devices according to the present invention.

Fig. 3 is a rear view of the same.

Fig. 4 is a view substantially on line 4—4 of Fig. 2 showing the outer casing in section and the internal elements in elevation.

Fig. 5 is a sectional view substantially on line 5—5 of Fig. 3.

In these drawings, Fig. 1 shows the system as applied to a multi-cylinder combustion engine having six cylinders. This portion of the ignition system is conventionally illustrated as including parts presently common to automobile construction, comprising the battery 10, the ignition switch 11, an ignition coil having a laminated iron core 12, a primary winding 13 and a secondary winding 14. This coil includes an outer casing 15 which is conventionally shown and having a snap terminal 16 for receiving the high tension conductor 17 which leads to the rotating blade 18 of the distributor. This distributor is conventionally illustrated as having an internal casing wall 19 provided with the six spaced electrodes 20 from which the conductors 21 are extended to the several spark plugs of the engine in the usual way.

The battery 10 is connected to ground, e. g., the frame of the automobile, by a conductor 22, while the conductors 23, 24 deliver the battery current to the primary winding 13. This primary winding, at its other terminal, is connected by a conductor 25 to the rocker arm 26 of a conventionally shown timer. This timer rocker arm is driven by a cam 27 secured to the common shaft 28 which is rotated by the engine and hence is in synchronism with the crank shaft thereof in the usual way. The rocker arm 26 has a contact 29 which engages with the fixed contact 30 on the timer shell 31, and thus is joined by a conductor 32 (usually a part of the engine frame) to the ground. The customary condenser 33 is shown as shunted across the contacts 29, 30.

According to the present invention, a branch from conductor 24 extends by conductor 35 to the winding 36 of a solenoid having a magnetizable core 37: the other terminal of this solenoid winding being connected by a conductor 38 to a bushing 68 and shaft 65; and when the shaft 65 is in contact with blade 39, the winding 36 is in parallel with the primary winding 13 of the usual ignition coil. The magnetically vibratable blade 39 has a contact point 40 cooperating with a movable contact 41 carried by a conductive fixed structure 42, as will be described hereinafter. This fixed structure 42 is joined by a conductor 43 with the common ground or machine frame through a fuse F comprising a resilient element contacting the end plate 50. A condenser 44 is connected between the conductor 38 and the ground conductor 43.

Where the appliance is used as an attachment for a pre-constructed automobile, for example, it is preferred to enclose the solenoid and vibrator structure in a housing 45.

As illustratively shown in Fig. 4, this housing includes the sleeve 48 and the end plates 49 and 50. The preferred manner of construction is to assemble the devices as a sub-assembly upon the end plate 49.

For this purpose, the long bolts 51, 52 are passed through the end plate 49, inside the sleeve 48, and through the rear plate 50, being fixed in position by the nuts 51*a*, 52*a*. The bolts are insulated from the plates 49 and 50 by insulation members 54 so that these bolts 51, 52 serve with conductors 35, 25*a* for conducting current to and from the parts within the housing 45. Inside the sleeve 48, the bolts pass through a block 55 of insulating material, as for example of porcelain. The core 37 and winding 36 of the solenoid may be enclosed by a protective sleeve 56 and assembled between the end plate 49 and the block 55, being held clamped in position by the nuts 51*b*, 52*b* on bolts 51, 52. The block 55

has a transverse channel or groove on its rear face to receive a pad 57 which may be of asbestos, as a cushion for the nuts 51*b*, 52*b*. Across the groove for receiving the pad 57 extends the fixed structure 42 which is held in position by bolts 58. This fixed structure preferably includes a resilient blade 42*a* (Fig. 5) for carrying the contact 41, so that a proper engagement of the contact points 40 and 41 is assured with adequate time for saturation of both coils while the vibrator is in operation. This blade is secured to the fixed structure by the rivets 59.

Beneath the fixed structure 42 is provided the vibrator blade 39 with its contact 40, being held in position on the block 55 by the bolt 60. It is preferred to coat the pad 57 with graphite or like material to prevent adhesion or sticking of the blade 39; and to join the bolt 51 with the bolt 60 by a conductor 61.

A threaded shaft 65 extends through the face plate 49 and has a knob 66 connected fixedly thereto. This knob bears an indicator arrow 67 which by rotation of the knob may be brought into several positions designated in Fig. 2 by the indicia "EMG", "on" and "off", corresponding to axially moved positions of the shaft 65 by which the shaft places the parts in condition for the several operations possible with the system. The shaft is insulatedly supported in the front plate 49 by an insulated bearing bushing 67*a*, and is threadedly engaged in a bushing 68 which passes through the block 55 and is held fixedly to the block by the clamping nut 69 (Fig. 5). The rear end of shaft 65 has a nose which may be brought into engagement with the vibrator blade 39 as will be described hereinafter.

In order to prevent accidental movement of the shaft 65 by vibration, and to assure it a proper friction to prevent its turning loosely, a friction band 70 may be extended around the solenoid housing 56 and the shaft 65, as shown in Fig. 4.

The method of operation of this structure is as follows:

When the indicator arrow 67 of knob 66 is at the "off" position, the shaft 65 is in such an axial position that its end does not engage the vibrator blade 39. In this condition, the solenoid winding 36 is connected to the primary winding 13 of the ignition coil but no current can flow as the current is broken between the shaft 65 and blade 39 and the condenser 44 is in series between the winding 36 and the ground. In this condition, the vibrator blade 39 rests against the pad 57 and the contacts 40, 41 are separated. Energization of the core 37 therefore cannot occur. The system operates in the usual manner of an ignition system.

When the knob 66 is turned until the arrow points to "on", the shaft 65 is moved axially until its inner or rear end engages with the vibrator blade 39. The contacts 40, 41 remain open. Under these conditions, the condenser 44 is in shunt to the condenser 33, so that this condenser 44 will permit driving the machine with the condenser 33 removed; and also the condenser 44 and the winding 36 serve for boosting the normal operation of the ignition system at high speeds, and under control of the timer contacts at 29, 30.

When the knob 66 is turned so that the arrow points to "EMG", the shaft 65 is advanced axially so that the vibrator blade 39 is moved until the contacts 40, 41 are normally engaged and the resiliency of the vibrator blade tends to hold them in this condition. When the timing cam 27 closes the contacts 29, 30 preparatory to a sparking, current flows in the usual way from battery 10 through the switch 11, the primary winding 13, the contact points 29, 30, and by conductor 32, the ground, and the conductor 22 back to the battery 10. A field is thus established in the usual way in the core 12. Also, the flow of current through conductor 35 and solenoid winding 36 is possible as conductor 38 is connected to the bushing 68 and thus by shaft 65 to the vibrator 39 and thus by contacts 40, 41 and conductor 43 to the ground; and also current may flow from the vibrator 39, by the post 52 and conductor 25*a* to the rocker arm 26, contacts 29, 30, and thus to the ground. The winding 36 establishes a magnetic field in the core 37, and the vibrator blade 39 is attracted until it rests against the pad 57 and thus contacts 40, 41 are broken; but as current can still continue to flow through the conductor 25*a* and between the closed contacts 29 and 30, the winding 36 is not de-energized.

As soon as the cam 27 permits the rocker arm 26 to open, the energization of the primary winding 13 and the solenoid winding 36 is interrupted at these contacts, and the two magnetic fields collapse and produce a current in the secondary winding 14 which is led by conductor 17 to the distributor rotor 18 and thus to the proper contact plate 20, and thus to the proper spark plug, producing a properly timed and single spark in the plug. Following the collapse of the magnetic field in the core 37, however, the vibrator blade 39 is released so that the contacts 40, 41 are closed again and current may now flow from the battery 10 by conductor 23, switch 11, conductor 24, conductor 35, winding 36, conductor 38, bushing 68, shaft 65, vibrator blade 39, contacts 40, 41, fixed structure 42, and conductor 43 back to the ground. This again energizes the solenoid winding 36 so that a magnetic field is re-established and the vibrator blade 39 attracted again, producing a break of current at the contacts 40, 41. At the same time of energizing the winding 36, however, current has also been permitted to flow from conductor 24 through the primary winding 13, conductors 25 and 25*a*, to the vibrator blade 39, with a return as before through contacts 40, 41, fixed structure 42, and conductor 43. Hence, when the contacts 40, 41 are again broken, the existing field in the core 12 collapses and a further spark is produced at the spark plug. This continues according to the adjustment of the resilient effects in the vibrator blade 39 by the stress placed thereon from shaft 65, and until the distributor rotor 18 has moved a considerable distance past the corresponding plate 20 of the distributor. That is, this increase of gap between the rotor 18 and the plate 20 produces an intensifying or amplifying effect upon the spark produced at the spark plug, thus permitting the system to start even a flooded engine.

Finally, when the cam 27 again makes a contact at contacts 29, 30, the breaking of the circuit at 40, 41 no longer produces a collapse in the magnetic field of cores 12 and 37, so that no sparks are delivered into a cylinder for a time during which the rotor 18 is approaching the proper firing position for such cylinder.

The appliance is usually employed in the "EMG" position at starting or under conditions when the principal timer is out of service, and thus permits moving an automobile under its

own power, for example, when this would be impossible with the normal ignition system. The ready control of operation at the knob **66** permits disconnecting the auxiliary parts, so far as their functions are concerned, so that there is no difficulty with respect to any false operation, such as the delivery of sparks for an undue period or at an improper time with the engine turning at very high speed.

The employment of the fuse F in the ground conductor **43** prevents a burning out of the condenser, coil, or other part in the event that the apparatus is incorrectly connected to the normal ignition system, when the parts within the housing **45** are employed as an attachment to a preconstructed system.

When the device is so employed as an auxiliary or attachment, the bolts **70***a* (Figs. 2 and 5) may be employed for holding a bracket **71** which may be connected to the steering column or other desired part of the automobile, so that the knob **66** is readily accessible.

It will be noted that the auxiliary parts within the housing **45** operate without any additional battery and without the employment of high tension wiring therefrom, and that the entire system delivers a spark only when both sets of contacts **29**, **30** and **40**, **41** are open, and hence there is no change in the timing of the spark regardless of the speed of the engine.

It is obvious that the invention may be modified in many ways within the scope of the appended claims.

I claim:

1. In an ignition system, the combination of a source of energy, an induction coil having a primary winding, a circuit breaker, first circuit means for the passage of current from said source through said primary winding under control of said circuit breaker, an interrupter including a solenoid winding and contacts to be opened by energization of said solenoid winding, and further circuit means extending in series path through said solenoid winding and contacts and connecting said series path in parallel to said primary winding and circuit breaker, and conductor means connecting a point of said first circuit means between said primary winding and circuit breaker to a point between said solenoid winding and contact.

2. In an ignition system, the combination with a source of energy, an induction coil having a primary winding, a circuit connecting said source and primary winding, and a positively actuated circuit breaker arranged to open and close the circuit through said primary winding, of an interrupter having circuit breaking means and a solenoid for actuating the same, said solenoid being connected in parallel with the primary winding in the circuit, and means providing a branch circuit in parallel to said circuit breaker and including said circuit breaking means, the parallel connection of the solenoid and primary winding causing the solenoid to maintain the branch circuit open so long as the circuit breaker is closed and thus providing for operation of the interrupter only when the positively actuated circuit breaker is open.

3. In an ignition system, the combination with a source of energy, an induction coil having a primary winding, a circuit connecting said source and primary winding, and a positively actuated circuit breaker arranged to open and close the circuit through said primary winding, of a solenoid connected in parallel with the primary winding in the circuit, contact points constructed and arranged to be opened and closed in response to energization and de-energization of the solenoid, and a branch circuit from said primary winding and said solenoid through said contacts cooperative with the source for permitting current to flow with periodic interruption at said contacts when the circuit breaker is open, said solenoid being maintained energized through the circuit breaker while the latter is closed whereby then to maintain said contacts open.

4. In an ignition system, the combination with a source of energy, an induction coil having a primary winding, a circuit connecting said source and primary winding, and a positively actuated circuit breaker arranged to open and close the circuit through said primary winding, of a solenoid connected in parallel with the primary winding in the circuit, contact points arranged to be opened and closed in response to energization and de-energization of the solenoid, and further circuit means from said primary winding and said solenoid through said contacts whereby, in response to opening of the positively actuated circuit breaker, said contact points are permitted by the solenoid to close and thereby effect intermittent passage of current through the primary winding and solenoid, and means included in said further circuit means to disconnect the contacts from the primary winding.

5. In an ignition system for an internal combustion engine, the combination of first and second windings, a source of electrical energy, a timing circuit breaker driven by the engine, a vibrator actuated by said second winding when energized, normally closed contacts opened by said vibrator when actuated, first conductor means connecting the source and one terminal of said first winding with one terminal of said second winding, second conductor means connecting the other terminal of said first winding with one contact of said circuit breaker and with one of said vibrator contacts, third conductor means connecting the other terminal of said second winding with said one vibrator contact, and fourth conductor means connecting the source, the other vibrator contact and the other breaker contact.

6. A system as in claim 5, in which said third conductor means includes a circuit disconnecting element.

7. A system as in claim 5, in which said third conductor means includes a circuit disconnecting element, and in which a condenser is connected between said other terminal of the second winding and said fourth conductor means.

8. In an ignition system for an internal combustion engine, the combination of first and second windings, a source of electrical energy, a timing circuit breaker driven by the engine, a vibrator having normally closed contacts and actuated by said second winding to open said contacts upon energization of said second winding, a first condenser connected in parallel with the circuit breaker, a second condenser connected in parallel with the vibrator contacts, first conductor means connecting said source with one terminal of each of said windings, second conductor means connecting said source with one terminal of each of said condensers, and third conductor means connecting the other terminals of said condensers and the other terminals of said windings.

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