

Feb. 13, 1940.

V. E. McCARTY

2,189,913

IGNITION SYSTEM

Filed Aug. 31, 1938

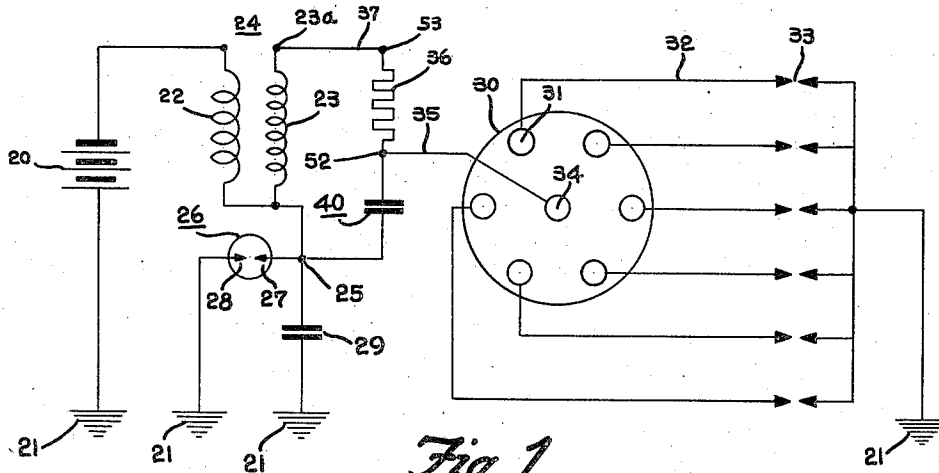


Fig. 1

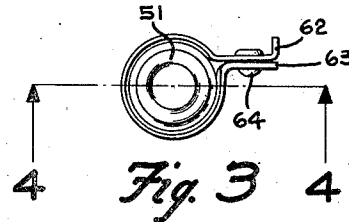


Fig. 3

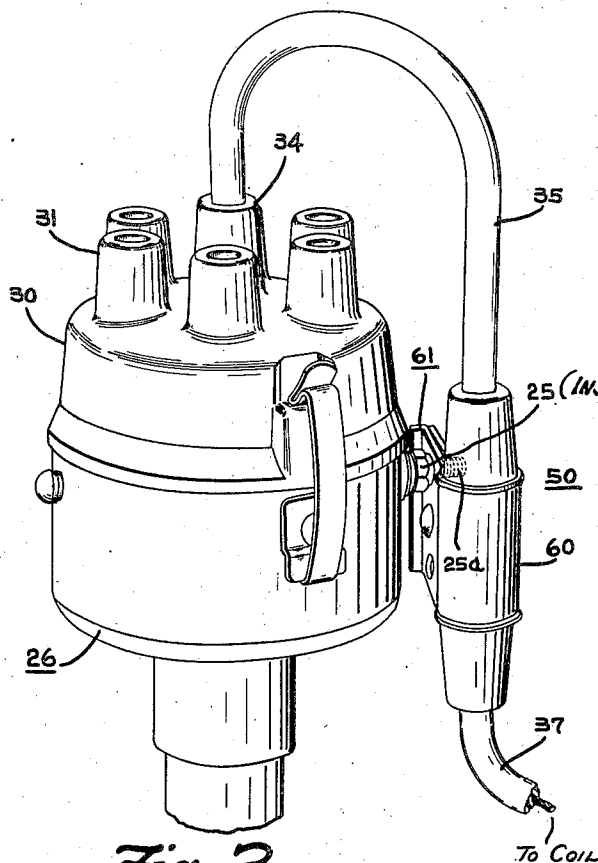


Fig. 2

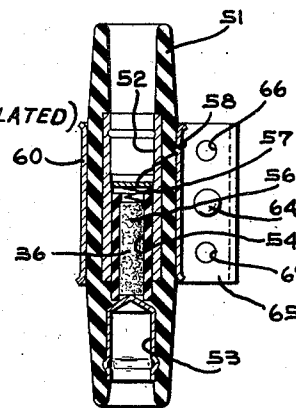


Fig. 4

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UNITED STATES PATENT OFFICE

2,189,913

IGNITION SYSTEM

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Application August 31, 1938, Serial No. 227,657

8 Claims. (Cl. 123—148)

This invention relates to method and apparatus for reducing pitting of ignition timer contact points and more particularly to the methods and apparatuses disclosed in the copending application of Herman L. Hartzell, Serial No. 276,396 filed May 29, 1939, which is a continuation in part of abandoned application S. N. 227,775 filed August 31, 1938.

The Hartzell application discloses that during ignition timer contact separation two kinds of pitting may occur. When the contact separation is .0003" or less, there is a transfer of material from the positive contact to the negative contact due to electronic bombardment of the positive contact, thereby causing the surface of the positive contact to be heated and material thereof to pass therefrom as a metallic vapor which condenses on the negative contact. This is called transfer to the negative. The second kind of pitting is due to transfer of material from the negative contact to the positive contact. This occurs at a contact separation greater than .0003" and is due to ionic bombardment of the negative contact causing the material thereof to pass as a metallic vapor to the positive contact where it condenses. This is called transfer to the positive. In order that transfer of material from the positive contact may occur some time during contact separation exceeding .0003", the voltage applied across the contacts should be at least 340 volts. According to the Hartzell application this voltage may be reached by combining, at the time of secondary discharge, the primary induced voltage with a transient voltage derived from a high frequency oscillation accompanying secondary discharge in order to produce an arc at the timer contacts which will transfer material from the negative timer contact to the positive timer contact. This transient voltage is derived by means of a capacity coupling between the insulated terminal of the timer and the secondary circuit. By a proper selection of the value of this capacity, the arc at the contacts produced by the combined induced primary voltage and voltage derived from the high frequency oscillation will be such that the transfer of material to the positive contact will compensate for the transfer of material to the negative contact. In this way flat contact operation is obtained.

When providing ignition for the modern automobile equipped with a radio receiver, it is necessary to place in the circuit between the ignition coil secondary terminal and the center terminal of the ignition distributor cap, a radio inter-

ference suppressor in the form of a resistor or choke. While this resistor or choke suppresses objectionable interference by the ignition system with the radio receiver, it also suppresses the effect of the high frequency transient upon the timer contacts and, therefore, materially decreases transfer to the positive contact. The radio suppressor is useful in an ignition system which is naturally disposed to transfer more material to the positive contact than to the negative. In such systems the radio interference suppressor would tend to correct transfer to the positive. But in most ignition systems used on relative high speed automobile engines, the tendency is to transfer to the negative rather than to the positive. The Hartzell application discloses how to correct transfer to the negative in an ignition system in which it is necessary to use a radio interference suppressor. This is accomplished by the capacity-coupling of one or more of the spark plug leads to the insulated timer terminal. The number of capacity-couplings used depends on the amount of correction required to compensate for transfer of the material to the negative contact.

I have discovered that, with some installations of ignition equipment for passenger automobiles, it is safe to take advantage of all of the high frequency transients which occur and, therefore, to use capacity-couplings between the timer contacts and all of the spark plug leads. Instead of providing a separate coupling with each lead, I provide one coupling between the insulated timer terminal and the center terminal of the distributor cap. In case a radio interference suppressor is used in the connection between the ignition coil secondary terminal and the center terminal of the distributor cap, I connect the capacity in between the suppressor and the center terminal.

In order to facilitate making the connection between the center terminal of the distributor cap and with the radio suppressor and with the capacity-coupling as well as the connection between the radio suppressor and the ignition coil secondary terminal, I provide a unitary structure which can be economically constructed and conveniently mounted upon the ignition timer. This structure comprises a high tension cable connector having sockets for making connections with plug terminal attached to cables leading respectively to the ignition distributor cap and to the ignition coil. This connector houses the resistance which provides the radio suppressor and the structure itself comprises

the condenser which provides the capacity-coupling between the insulated terminal of the timer and a point between the radio suppressor and the center terminal of the distributor cap.

- 5 The mounting of this unit upon the ignition timer provides the connection between the capacity-coupling, condenser and the insulated terminal of the ignition timer.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing wherein a preferred embodiment of the present invention is clearly shown.

In the drawing:

- 15 Figure 1 is a wiring diagram illustrating an ignition system embodying the present invention;

Figure 2 is a fragmentary perspective view of an ignition timer equipped with the unitary structure which provides a cable connector between the ignition coil secondary terminal and the center terminal of the distributor cap, which houses the radio interference suppressor and which provides the condenser for effecting a capacity-coupling between the insulated terminal of the ignition timer and some point between the radio interference suppressor and the center terminal of the distributor cap;

Figure 3 is a top plan view of the unit shown in Figure 2; and

- 30 Figure 4 is a sectional view taken on the line 4-4 of Figure 3.

Referring to Figure 1, the ignition system comprises a battery 20 grounded at 21 and connected with the primary winding 22 of ignition coil 24 having a secondary winding 23 connected with the primary and with the insulated terminal 25 of the ignition timer 26 having contacts 27 and 28. These contacts are shunted by the usual ignition condenser 29.

- 40 Numeral 30 designates the ignition distributor cap having distributor posts or terminals 31, each connected by wire 32 with a spark plug 33 grounded at 21. Sparking impulses are distributed to the post 31 by an engine distributor rotor (not shown) connected in well known manner with the center terminal 34 of the ignition distributor cap 30. The connections between the cap terminal 34 and the high tension terminal 23a of the coil 24 comprises a wire 35, a resistance 36 providing the radio interference suppressor and a wire 37.

In order to obtain flat contact operation in the manner which has been pointed out, a condenser 40 or capacity-coupling is provided between the insulated or non-grounded terminal 25 of the timer 26 and a point between the radio interference suppressor 36 and the center terminal 34 of the distributor cap 30. In order to facilitate making connections between the units 36 and 40 and other parts of the apparatus, I provide a unitary structure 50, shown in Figures 2, 3 and 4, which is supported by the ignition timer 26 in the manner shown in Figure 2.

- The unit 50 comprises a sleeve 51 made of Bakelite or other moldable insulating material. Sleeve 50 carries a tubular metallic insert 52 and a thimble-like metallic insert 53. Within the insert 52 is located a non-conducting tube 54 made of material having a high dielectric strength. As a material for this tube "Isolantite" has been found satisfactory. The isolantite tube 54 receives a carbon resistance element 56 which provides the resistor shown at 36 in Figure 1. Resistance 56 is urged by a spring 57 against the insert 53, said spring 57 being confined by a

metal disk 58 which has a press fit within the insert 52. As indicated diagrammatically in Figure 1, the insert 52 provides a terminal socket for receiving a metallic plug, thimble or ferrule fixed to one end of the cable 35 which, as shown structurally in Figure 2 as well as diagrammatically in Figure 1, makes connection between the insert 52 and the center terminal 34 of the distributor cap 30. Insert 52 is electrically connected with the resistor 56 through the disk 58 and the spring 57. The insert 53 provides a terminal socket which receives a ferrule on the end of wire 37 for making connection between the resistor and the high tension terminal 23a of the ignition coil 24.

The manner in which the unit 50 provides the condenser 40 will now be described. The two plates of the condenser 40 are provided, respectively, by the tubular metal sleeve 52 within the insulating sleeve 51 and an outer tubular sleeve 60 which is provided by the bracket 61 by which the unit 50 is mounted. The bracket 61 is formed of sheet metal so as to provide the tubular part 60 which surrounds the sleeve 51 and to provide the end portions 62 and 63 which are riveted together by a single rivet 64 to provide a mounting pad 65. The pad has two holes 66 and 67 either of which are large enough to receive the usual terminal screw or stud with which the ignition timer terminal 25 is provided. The unit 50 is therefore mounted upon the screw 25a of the insulated terminal 25 and is secured in position by a nut. Hence, the condenser 40 is provided by concentric cylindrical tubes 52 and 60 with a dielectric between them provided by the insulating sleeve 51.

From the foregoing, it is apparent that the present invention relates to an ignition system which provides for flat contact operation by the use of a capacity coupling between the non-grounded or insulated terminal of the ignition timer and some point in the connection between the high tension terminal of the ignition coil and the center terminal of the distributor cap. This connection is such that the coupling condenser is effective regardless of the use of a radio interference suppressor. In its preferred form, the present invention embraces a unitary structure which can be attached to the conventional form of ignition timer-distributor and which provides the capacity-coupling, the radio interference suppressor and the facilities for conveniently connecting the unit with other units of the system.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. An ignition system for internal combustion engines comprising, in combination, a current source, an ignition coil having a primary winding and a secondary winding, a timer having contacts for controlling connection of the current source to the ignition coil primary, an insulated terminal provided by the timer and connected with one of the timer contacts, a wire connecting said timer insulated terminal with the ignition coil primary winding, a timer condenser connected with the timer contact which is connected with said insulated timer terminal, a distributor including a center terminal for distributing sparking impulses generated in the secondary winding to the spark plugs of the engine, and a

condenser having one electrode directly attached to the insulated timer terminal and its other electrode connected electrically with the center terminal of the distributor for the purpose of supplementing the primary induced voltage, at the time of secondary discharge, with a transient voltage derived from a high frequency oscillation which accompanies the discharge of the secondary circuit across the spark gap, whereby to produce an arc at the timer contacts which will produce transfer of material to the positive timer contact to compensate for transfer of material to the negative contact.

2. An ignition system for internal combustion engines comprising, in combination, a current source, an ignition coil having a primary winding and a secondary winding, a timer having contacts for controlling connection of the current source to the ignition coil primary, an insulated terminal provided by the timer and connected with one of the timer contacts, a wire connecting said timer insulated terminal with the ignition coil primary winding, a timer condenser connected with the timer contact which is connected with said insulated timer terminal, a distributor including a center terminal for distributing sparking impulses generated in the secondary winding to the spark plugs of the engine, and a condenser having concentric tubular electrodes, the outer one being mounted upon the insulated timer terminal and the inner one providing a wire-connector-socket, a wire connected with the center terminal of the distributor and provided with a connector-plug received by said socket, said last named condenser operating for the purpose of supplementing the primary induced voltage, at the time of secondary discharge, with a transient voltage derived from a high frequency oscillation which accompanies the discharge of the secondary circuit across the spark gap, whereby to produce an arc at the timer contacts which will produce transfer of material to the positive timer contact to compensate for transfer of material to the negative contact.

3. An ignition system for internal combustion engines comprising, in combination, a current source, an ignition coil having a primary winding and a secondary winding, a timer having contacts for controlling connection of the current source to the ignition coil primary, an insulated terminal provided by the timer and connected with one of the timer contacts, a wire connecting said timer insulated terminal with the ignition coil primary winding, a timer condenser connected with the timer contact which is connected with said insulated timer terminal, a distributor including a center terminal for distributing sparking impulses generated in the secondary winding to the spark plugs of the engine, and a condenser having concentric tubular electrodes separated by a non-conducting sleeve, the outer electrode being mounted upon the insulated timer terminal and the inner one providing a wire-connector-socket, a wire connected with the center terminal of the distributor and provided with a connector-plug received by said socket, a second wire-connector-socket provided by said sleeve, a wire connected with the ignition coil secondary winding and provided with a connector-plug received by said second socket, means for connecting the second socket with said inner electrode, said last named condenser operating for the purpose of supplementing the primary induced voltage, at the time of secondary discharge, with a transient voltage derived from a high frequency

oscillation which accompanies the discharge of the secondary circuit across the spark gap, whereby to produce an arc at the timer contacts which will produce transfer of material to the positive timer contact to compensate for transfer of material to the negative contact.

4. An ignition system for internal combustion engines comprising, in combination, a current source, an ignition coil having a primary winding and a secondary winding, a timer having contacts for controlling connection of the current source to the ignition coil primary, an insulated terminal provided by the timer and connected with one of the timer contacts, a wire connecting said timer insulated terminal with the ignition coil primary winding, a timer condenser connected with the timer contact which is connected with said insulated timer terminal, a distributor including a center terminal for distributing sparking impulses generated in the secondary winding to the spark plugs of the engine, and a condenser having concentric tubular electrodes separated by a non-conducting sleeve, the outer electrode being mounted upon the insulated timer terminal and the inner one providing a wire-connector-socket, a wire connected with the center terminal of the distributor and provided with a connector-plug received by said socket, a second wire-connector-socket provided by said sleeve, a wire connected with the ignition coil secondary winding and provided with a connector-plug received by said second socket, means including a radio-interference-suppressor-resistance housed within said sleeve for electrically connecting the second socket with said inner electrode, said last named condenser operating for the purpose of supplementing the primary induced voltage, at the time of secondary discharge, with a transient voltage derived from a high frequency oscillation which accompanies the discharge of the secondary circuit across the spark gap, whereby to produce an arc at the timer contacts which will produce transfer of material to the positive timer contact to compensate for transfer of material to the negative contact.

5. For use with an internal-combustion-engine ignition system comprising a current source, an ignition coil having a primary winding and a secondary winding, a timer having contacts for controlling connection of the current source to the ignition coil primary and having an insulated terminal connected with one of the contacts and a distributor including a center terminal for distributing sparking impulses generated in the secondary winding to the spark plugs of the engine, a unitary structure providing a condenser having electrodes separated by a dielectric body, a mounting bracket provided by one of the electrodes for attaching the structure to the insulated timer terminal, and wire connecting devices electrically connected with the other electrode for making connections with wires leading, respectively, to the center terminal of the distributor and to the ignition coil secondary winding.

6. For use with an internal-combustion-engine ignition system comprising a current source, an ignition coil having a primary winding and a secondary winding, a timer having contacts for controlling connection of the current source to the ignition coil primary and having an insulated terminal connected with one of the contacts and a distributor including a center terminal for distributing sparking impulses generated in the secondary winding to the spark plugs of the engine, a unitary structure providing a condenser having

concentric tubular electrodes separated by a dielectric sleeve, a mounting bracket provided by the outer electrode for attaching the structure to the insulated timer terminal, a wire-connector-socket provided by the inner electrode for receiving an attachment plug on a wire connected with the center terminal of the distributor, and wire attaching means connected with the inner electrode of the condenser for making connection with the ignition coil secondary winding.

7. For use with an internal-combustion-engine ignition system comprising a current source, an ignition coil having a primary winding and a secondary winding, a timer having contacts for controlling connection of the current source to the ignition coil primary and having an insulated terminal connected with one of the contacts and a distributor including a center terminal for distributing sparking impulses generated in the secondary winding to the spark plugs of the engine, a unitary structure providing a condenser having electrodes separated by a dielectric body, a mounting bracket provided by one of the electrodes for attaching the structure to the insulated timer terminal, a radio-interference-suppressor-resistance carried by the structure and electrically connected with the other electrode, and wire connecting devices respectively connected electrically with said other electrode and said resistance for making

connections with wires leading, respectively, to the center terminal of the distributor and to the ignition coil secondary winding.

8. For use with an internal-combustion-engine ignition system comprising a current source, an ignition coil having a primary winding and a secondary winding, a timer having contacts for controlling connection of the current source to the ignition coil primary and having an insulated terminal connected with one of the contacts and a distributor including a center terminal for distributing sparking impulses generated in the secondary winding to the spark plugs of the engine, a unitary structure providing a condenser having concentric tubular electrodes separated by a dielectric sleeve, a mounting bracket provided by the outer electrode for attaching the structure to the insulated timer terminal, a wire-connector-socket provided by the inner electrode for receiving an attachment plug on a wire connected with the center terminal of the distributor, a radio-interference-suppressor-resistance carried by the structure and electrically connected with the inner electrode, and a wire-attaching-socket carried by the sleeve for receiving a plug on a wire connected with the ignition coil secondary winding, said second-mentioned socket being electrically connected with said resistance.

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