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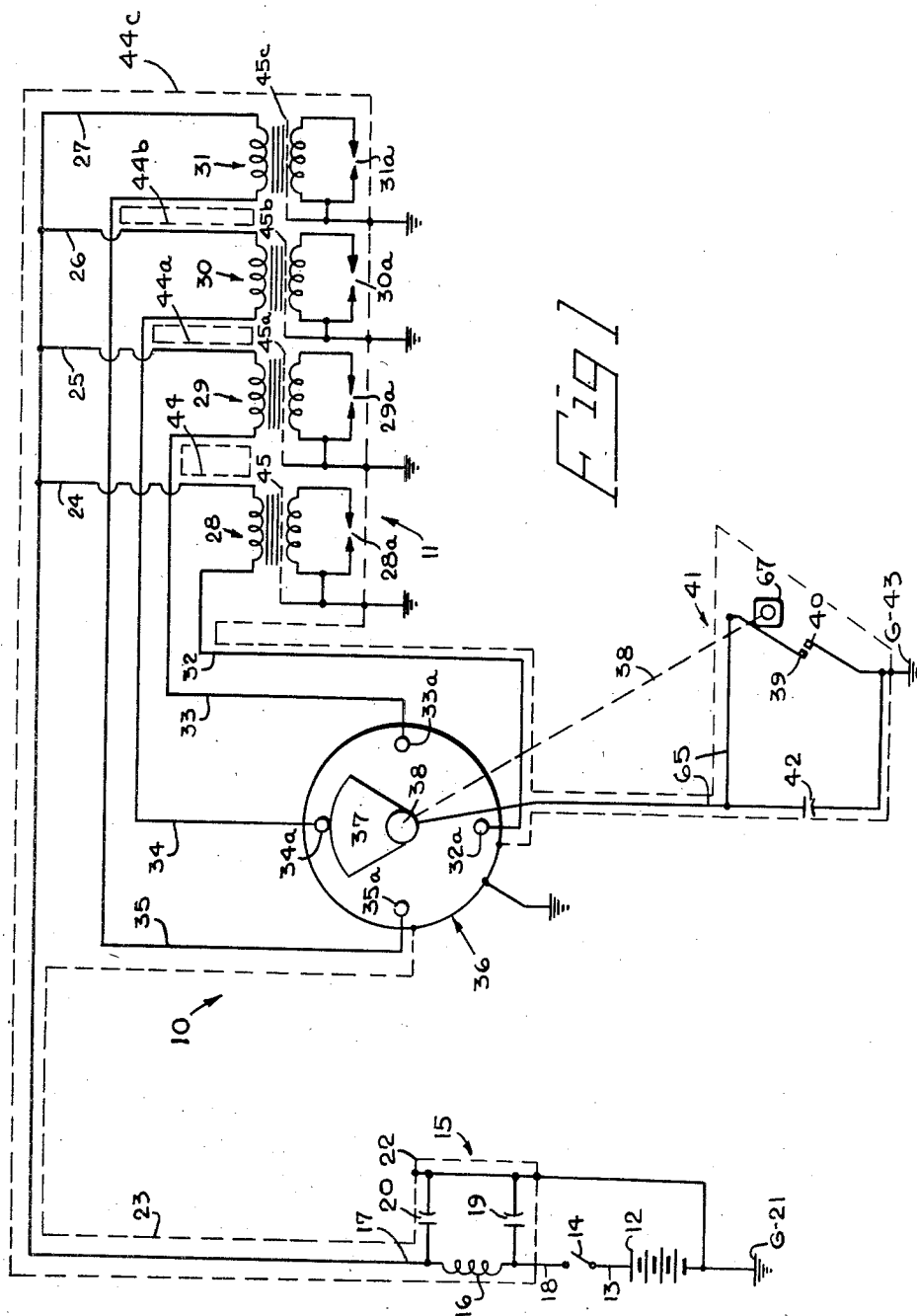
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LOW TENSION IGNITION SYSTEMS

Filed March 6, 1952

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

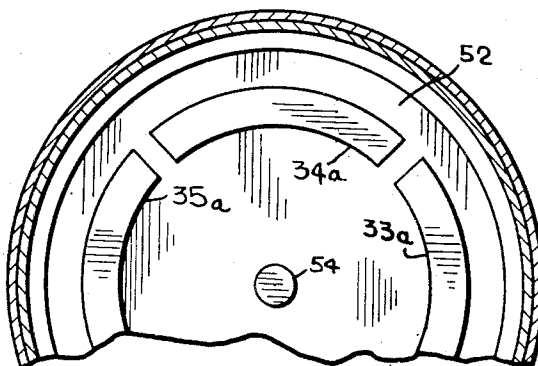
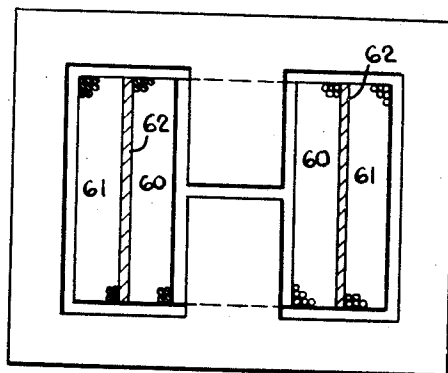
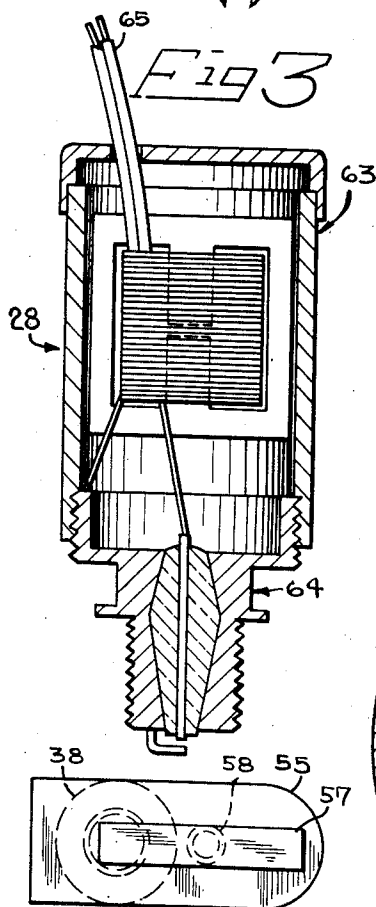
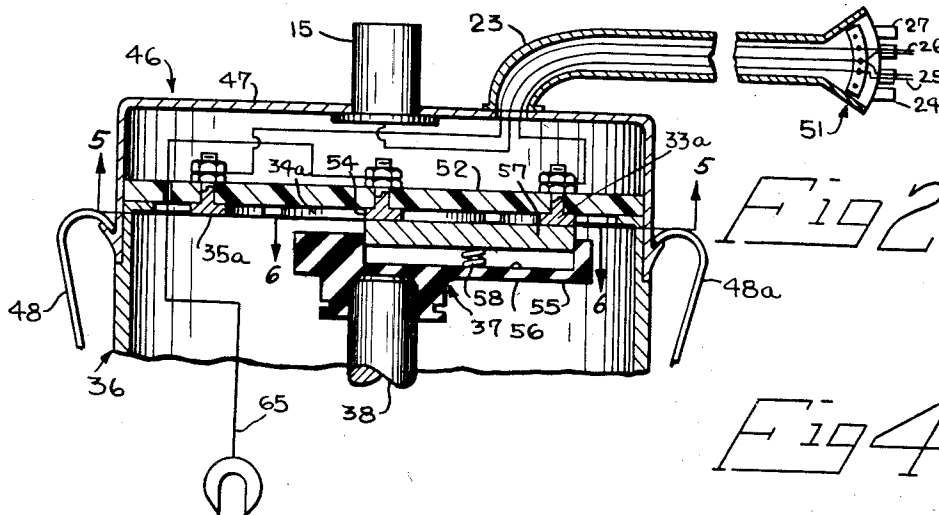


Fig 5

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LOW TENSION IGNITION SYSTEMS

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5 Claims. (Cl. 123—148)

This invention relates to low tension ignition systems, and more particularly to low tension ignition systems for internal combustion engines.

It is an object of the present invention to provide a low cost shielded ignition system for internal combustion engines.

It is another object of the present invention to provide a low cost ignition system especially adapted for quick and easy installation in conventional internal combustion engines to suppress radiations of radio frequency.

It is still another object of the present invention to provide a simple, inexpensive ignition system for converting a high tension ignition system to a shielded, noise suppressed low tension ignition system.

It is a further object of the present invention to provide a low cost, low tension shielded ignition system which substantially eliminates the condenser effect of high tension shielding in ignition systems thereby substantially increasing spark plug life and eliminating pre-ignition caused by premature spark discharge in high tension distributors at high altitudes.

Still another object of the present invention is to provide distributor means in a noise suppressed low tension system having a plurality of conventionally mounted contacts on an insulated stator, an operable rotor, a filter device in connection with said means, and shielded low tension leads extending from the filter and the means to each of the coil primaries in said system.

Other objects and features of my invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a diagrammatic view of a preferred embodiment of the invention;

Fig. 2 is a fragmental detail sectional view of a portion of my invention and taken from part of Fig. 1;

Fig. 3 is a detailed sectional view of a part of my invention showing a special type shielded ignition coil mounted on a shielded spark plug;

Fig. 4 is a detail enlarged view of coil in coil plug, shown in Fig. 3;

Fig. 5 is a fragmental plan view taken on line 5—5 of Fig. 2; and,

Fig. 6 is a view taken on line 6—6 of Fig. 2.

Referring now to the drawings, wherein like numerals refer to like parts throughout, it will be noted that a preferred embodiment of the invention is illustrated in Figure 1 by way of example, in the form of a radio shielded ignition system 10 adapted to a standard four cylinder, four cycle, internal combustion engine 11, from which the conventional plugs, coil, and high tension distributor head and rotor of the distributor have been removed. In the form shown, the source of low tension electrical energy is a standard 6 volt battery 12, having a terminal 13 connected with an ignition switch 14 to a filter 15 consisting of an inductance 16, lead terminals 17 and 18, condensers 19 and 20, mounted in a grounded shielded container 22 connected in series between switch 14 and primary lead 17. Said lead 17 is connected to

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condenser 20 and to primary coils 24—27 inclusive. The filter is designed to operate on all frequencies from 15 kc. to 1,000 mc., then through a shielded conductor 23 to the respective primary low voltage leads 24, 25, 26 and 27 of each of the four ignition coils 28, 29, 30 and 31, respectively.

One primary lead of each ignition coil is connected through a shielded conductor 32, 33, 34 and 35 respectively to a segment 32a, 33a, 34a and 35a, of a low tension commutator or "selector switch" 36. A low tension rotor 37 driven by distributor shaft 38 is connected to one side of a pair of standard distributor points 39 and 40 in the base of the distributor 41. The other distributor point 40 is connected to the battery 12 through the "ground" G—43 of the engine 11. A condenser 42 is connected across contact points 39 and 40. Each ignition coil is mounted in a shielded case 44, 44a, 44b, 44c on top of shielded spark plugs 28a, 29a, 30a and 31a. One side of the high voltage secondary of the coil is grounded while the other side of said secondary is connected to the high tension terminal of said spark plugs, respectively, as shown in Fig. 1. An electrostatic shield 45, 45a, 45b and 45c between the primary and secondary of each coil is provided and grounded, also as shown. According to the invention, engines with any number of cylinders can be so equipped by placing one coil and plug at each cylinder and using a low tension cap with a corresponding number of contacts.

Referring now more particularly to Figures 2, 5 and 6 of the drawings, there is shown a low tension distributor head 46 consisting of a metal housing 47 which snaps onto the distributor case 36 in the same manner that the high tension cap is held on by clips 48 and 48a. As shown, filter 15 is attached to the low tension cap 47. A shielded cable 23 carries all wires contained therein from switch 36 to a shielded junction box 51 from which shielded wires go to the primaries of the various ignition coils as shown in said Figure 1. Mounted inside the low tension cap is an insulated plate 52 as shown in Fig. 5, on which four contact segments 32a, 33a, 34a and 35a are mounted in a circle around the shaft 38. A center contact 54 is connected by an insulated connector 65 to the breaker point 39. The low tension rotor 37 is placed on the end of shaft 38 in the same manner as the high tension rotor is normally used. This rotor consists of an insulated arm 55 in which a recess 56 is moulded. This recess carries a contact brush 57 supported by spring member 58 in such a way that when assembled, the brush is held firmly against center contact 54 and one of the segments 32a, 33a, 34a and 35a, and being in a recess the brush is rotated by the rotor arm 55 so that it can move up and down to make good contact with the segments 32a, 33a, 34a and 35a and center contact 54.

Referring now to Figures 3 and 4, I show details of one of the ignition coils 28 containing primary and secondary windings. Said coil is of novel design in that it is wound on a special type core in which the center leg has an air gap to store the energy for the spark discharge. This core electromagnetically encloses both primary winding 60 and secondary winding 61. Said windings 60 and 61 are electrostatically shield from each other by an unshorted turn of copper foil 52 that is grounded. This feature is more clearly shown in Fig. 4. Further, said electrostatic shield is used to isolate the radio frequency set up by the discharge of the spark at the cylinder and to prevent electrostatic coupling back into the primary winding. Each ignition coil is encased in a metal shielded container 63 which is grounded to a shielded spark plug 64 and to the shield of the conductor connecting the primary at terminals 65.

It should be noted in accordance with my invention, that all wires, coils and contacts are shielded and the

shields grounded with the exception of the wire running from the filter to the battery. This does not need to be shielded due to the fact that all radio frequency currents set up within the system by either the sparking of the spark plug points or the primary breaker points are filtered and conveyed to ground by this filter, as hereinafter explained.

The operation of my system disclosed herein as applied to an internal combustion engine is as follows:

Ignition switch 14 is turned on and the engine cranked in the usual manner. The breaker points 39 and 40 are opened and closed by cam 67 in shaft 38 and these points being in series with the low tension selector switch rotor 37 and contacts 32a to 35a operate in proper sequence to the ignition coil primaries. The timing is so arranged that the standard breaker points do all the coil firing. The selector switch 36 in the low tension head 46 merely selects the primary to be energized. No current is ever made or broken by the selector switch. Its contacts are always closed while the standard breaker points are opening and closing. Said timing is further so arranged that contacts 39 and 40 are always open while rotor brush 57 is travelling from one segment of the selector switch to another. While brush 57 is connected to a segment of the selector switch, breaker points 39 and 40 close. They then open, allowing condenser 42 to discharge energizing spark coil 28 and plug 28a to which it is connected at that time. Breaker points 39 and 40 then open and the selector switch rotor 37 moves to another position connecting another spark coil primary 29 into circuit. Breaker points 39 and 40 then open and close firing spark plug 29a. This operation continues, firing plugs 30a and 31a in proper sequence.

From the foregoing, it is apparent that there is thus provided a novel noise suppressed ignition system in which a single standard set of distributor breaker points is used to time the primaries of various ignition coils in proper sequence thereby eliminating the need of timing each primary separately as in other low tension systems. There is also provided, according to my invention, a simple method whereby this system can easily and quickly be installed on engines designed for high tension systems with the minimum of effort so that said engine can be efficiently shielded from emitting radio interference. Furthermore, the distributor cap, and the ignition coils are so designed that they can be supplied completely wired together by a shielded low tension conductor. The installation as indicated comprises detaching high tension cap and removing old plugs and ignition coils. The new cap is snapped onto the distributor base with new distributor rotor, new plugs are screwed into cylinders, ignition coils attached to the plugs and the battery lead connected to the filter. The engine is then ready to operate and is efficiently shielded against any radio interference.

The advantages of my system over high tension shielded systems will be apparent in that it is much less costly than properly shielded high tension system. This is very important, for my system makes it possible for its use on installations where the cost of high tension shielded systems would be economically impractical. Also, my system can be easily installed since it requires no special knowledge of tools. It can be installed in a matter of minutes and no changes in the timing or setting of the breaker points is required. Other types of shielding and suppression equipment take skill and hours of time to install. It will fit any conventional engine now using a high tension system.

When shielding is placed over long high tension wires, a condenser effect caused by the wire and the shield causes excessive sparking at the plug thereby greatly reducing plug life. This condition is not found in my present invention because all shielded wires are at low tension.

At high altitudes, the sparking of the high tension rotor often occurs "early" due to the fact that the spark jumps

from the rotor to the contacts on the distributor cap before the rotor is opposite the contacts, thus causing "pre-ignition" which is highly objectionable. This condition is eliminated in my system due to the fact that all switching is done at low tension.

A most important feature of my system is its very high efficiency to confine all interfering radio frequency fields within the system. In other words, where most systems create RF and then means have to be taken to eliminate it, my system is designed to produce no interference. Noise tests have been conducted on vehicles using this system and "conducted" interference and "radiated" interference recorded following instructions outlined in JAN-1-225 joint Army and Navy specifications. Conducted interference tests consisted of attaching a wire from the output of the filter 15, Figure 1, to the antenna of a radio noise meter and readings taken at pre-determined frequencies from 15 kc. to 1,000 mc. Both conducted and radiated interferences were found to be negligible over the range tested.

While the foregoing description of my system and method of eliminating radio frequency interference have been illustrated with the use of ignition coils and battery power, they can also be used to control radio frequency ignition systems incorporating an oscillator and radio frequency step up transformers at each plug. In this case, instead of points 39 and 40 breaking the battery current as in Fig. 1, they "key" the output of the oscillator so that radio frequency energy at low tension is distributed to the primaries of radio frequency step up transformers mounted at the plugs instead of ignition coils. The selector switch is connected in the same way as shown in Fig. 1.

While a preferred embodiment of my invention has been described and illustrated herein, it is to be noted that modifications as to form, arrangement of parts and use of materials may be made without departing from the spirit and scope of the invention as claimed.

I claim:

1. In a low tension ignition system for internal combustion engines that may have a standard high tension unshielded system, the improvement comprising a source of electrical power, a low tension selector switch, a set of breaker points in electrical circuit with said selector switch, means for driving said switch, a plug for each cylinder of the engine, an ignition coil mounted at each plug adjacent to the cylinder which it fires, shielding means for isolating the radio frequency of the plug and secondary at the cylinder, and two wire ungrounded primary circuit means for selecting and firing each plug in a predetermined sequence, said improvement being R. F. noise free and adapted for easy installation on said engines.

2. In an ignition system for multiple cylinder internal combustion engines, a low tension ignition harness comprising a unidirectional source of power, means for mounting a spark plug in close relationship with an ignition coil at each cylinder, said coils being provided with electrostatic shields between their primary and secondary circuits to isolate radiated radio frequency of the secondary in each cylinder, low tension means for selecting the primary of the coil to be used for firing a selected plug at a given instant, breaker point means electrically in circuit with the selecting means and mechanically connected to said selecting means, a primary filter in circuit with said breaker point means to isolate the radio frequency of breaker points, and a primary filter circuit, said last circuit being connected between the battery in the engine and the common wire leading to each primary through the shielded harness.

3. Means for suppressing radio frequency interference caused by ignition systems of internal combustion engines, comprising a battery having a grounded terminal and an ungrounded terminal, a high tension distributor base normally installed in an engine, shielded spark plugs, a metal

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distributor cap, a distributor shaft, a low tension selector switch, said switch having segments mounted in said cap, and a rotor slidable on and rotatable by the distributor shaft, a plurality of ignition coils mounted adjacent said spark plugs, and connected thereto by a short shielded high tension conduit, shielded cables connecting the primaries of said coils to the segments of the selector switch, an electrical filter connected between the primaries and ungrounded battery terminal, means whereby as the rotor engages a given segment of the selector switch the breaker points will fire a pre-selected spark plug through a coil attached to said plug and segment in correct firing order, said points remaining open until the rotor engages another segment of said selector switch for the firing of another plug in like manner and in proper firing order.

4. Means for suppressing radio frequency interference caused by ignition systems of internal combustion engines, comprising a battery having a grounded terminal and an ungrounded terminal, a high tension distributor base normally installed in an engine, shielded spark plugs, a metal distributor cap, a distributor shaft, a low tension selector switch, said switch having segments mounted in said cap, and a rotor slidable on and rotatable by the distributor shaft, a plurality of ignition coils mounted adjacent said spark plugs, and connected thereto by a short shielded high tension conduit, shielded cables connecting the primaries of said coils to the segments of the selector switch, an electrical filter connected between the primaries and ungrounded battery terminal, means whereby as the rotor engages a given segment of the selector switch the breaker points will fire a pre-selected spark plug through a coil attached to said plug and segment in correct firing order, said points remaining open until the rotor engages another segment of said selector switch for the firing of another plug in like manner and in proper firing order, and means for adapting said assembly to suppress radio frequency in

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an engine upon which an unshielded ignition system has been installed without changing the timing and adjustment of the distributor base and breaker points.

5. Compact easily replaceable and removable noise suppressing means for shielding an ignition system that may formerly have had a standard unshielded system comprising a source of electrical power, the combination of a selector switch assembly, a plurality of ignition coils and spark plugs each mounted on a cylinder of an internal combustion engine, said coils being connected to the switch assembly, the secondary of each coil being electrically isolated at each cylinder, a grounded electrostatic shield between the primary and secondary of each coil, shielded primary leads and shielded secondary leads, a high tension distributor base, a low tension selector switch mounted on said base, a cam shaft in said internal combustion engine for operating the switch, said switch being connected to the primary leads, a two-way ungrounded electrical circuit for one set of breaker points for timing the firing of each ignition coil primary as it is connected in circuit by said selector switch, and primary filter circuit means connected between the battery and common wire means for isolating the spark of said breaker point.

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