

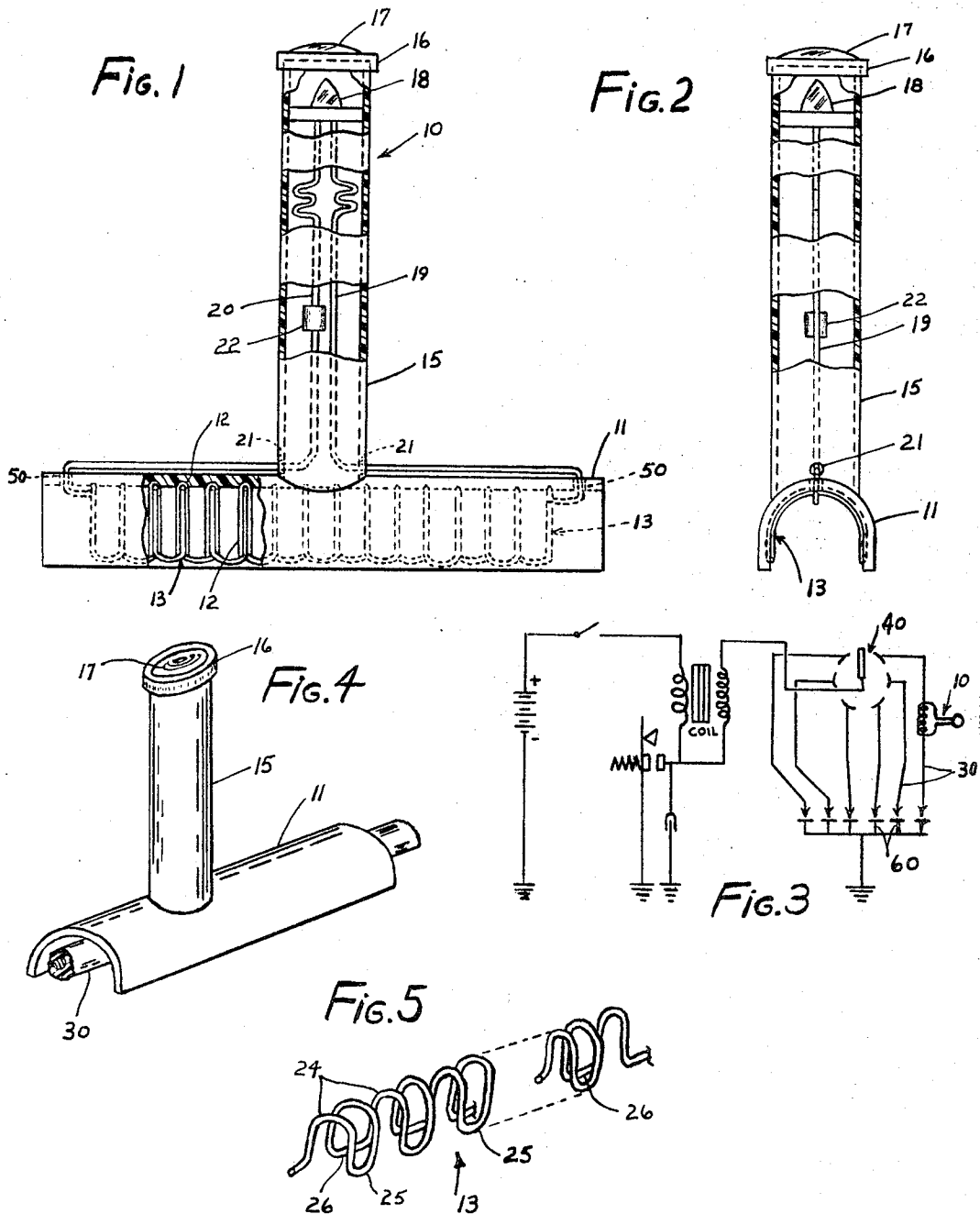
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DEVICE FOR DETERMINING FIRING CONDITION OF SPARK PLUGS

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DEVICE FOR DETERMINING FIRING CONDITION OF SPARK PLUGS

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4 Claims

ABSTRACT OF THE DISCLOSURE

A device with which the operating condition of a spark plug in an internal combustion engine ignition circuit can be determined is disclosed. The device includes an open coil form of a single continuous winding carried in a shroud which can be positioned over the ignition wire to which the spark plug being tested is connected. The coil form has an E.M.F. induced therein by the change in the magnetic field established around the ignition wire when current flows therethrough, the change in the field being produced by the pulsating nature of the current flow in the ignition wire. A signal lamp is connected to the coil form and is carried in a handle connected to the shroud. The lamp is lighted by the induced E.M.F. and flashes to indicate that the spark plug is firing properly.

This invention relates to a testing device with which the operating condition of the spark plugs in an internal combustion engine may be determined, the testing being effected rapidly and safely by merely inserting the device over the ignition wires connected to the spark plugs, the presence of a current flow in the ignition wires as when the spark plug is operating properly, being utilized to operate a suitable indicator means carried in the device.

In spark ignition internal combustion engines, the spark to each cylinder is supplied by a distributor and ignition coil circuit arrangement which transmits from a very high potential electric power source, a series of pulsating or interrupted surges of current of extremely low order. In the case of most internal combustion engines, the current is of the order of several milliamperes only, whereas, the potential is very high, i.e., 12,000–15,000 volts. A common problem associated with spark plugs is that carbon and other solid fuel residue deposits on the electrodes of the plugs tending to act as insulators thereby preventing a current flow from across the gap separating the electrodes which is necessary to create the ignition spark. Testing plugs with prior art devices is cumbersome, time consuming and sometimes dangerous.

It is, therefore, an important object of the present invention to provide a testing device for determining the operating condition of internal combustion engine spark plugs, the testing device being characterized by its simplicity of construction and operation, and dependability for the service intended.

Another object is to provide a testing device for determining the operating or firing condition of spark plugs which is safe to use in that it does not involve directly contacting any conductor in the ignition circuit means with any other conductor member thus eliminating recourse by the mechanic to testing practices heretofore recognized as being unsafe.

Other objects of the present invention will in part be obvious and will in part appear hereinafter.

According to the present invention, the testing device generally comprises a conductor member which has been shaped into a suitable coil form so as to adapt it for positioning it girdingly around or substantially embracing an ignition wire in the engine ignition circuit. The coil form

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is preferably supported in a housing of insulated material, the housing generally conforming to the shape of the coil form. Also located in the housing and in circuit with the coil form is a suitable indicator means, as for example, a neon glow tube. To use the device, the coil form is inserted over and extending around a portion only of the periphery of an ignition wire. If the spark plug is operating or firing in normal manner, there will be a pulsating current flow through its associated ignition wire. This flow of current will establish a magnetic field about the ignition wire, the field emanations crossing the coil form conductor. The field emanations which are of a raising and collapsing nature corresponding to the pulsating current flow will induce an E.M.F. in the coil form, the E.M.F. being of sufficient magnitude to light the neon glow tube. Thus, by observing the flashing of the neon glow tube, the mechanic may readily determine that the plug is operating properly since the neon glow tube will flash only in response to current flow in the ignition wire and the latter will occur only when the spark plug is operating properly.

The invention will appear more clearly from the following detailed description when taken in conjunction with the accompanying drawing showing by way of example a preferred embodiment of the inventive concept.

In the drawing:

FIGURE 1 is a front elevational view of a testing device constructed in accordance with the principles of the present invention, some parts of the device being broken away for purposes of illustrating with clarity the constructional details thereof.

FIGURE 2 is an end elevational view of the testing device shown in FIGURE 1.

FIGURE 3 is a schematic wiring diagram of an internal combustion engine wiring circuit showing the manner in which the device of the present invention is used therein to determine spark plug operating conditions.

FIGURE 4 is a perspective view on reduced scale illustrating the manner in which the device of the present invention is inserted over an ignition wire.

FIGURE 5 is a perspective view of the coil form used in the testing device of the present invention.

Throughout the description like reference numerals are used to denote like parts in the drawings.

Referring now in detail to FIGURES 1 and 2, the testing device comprises a hollow, parti-cylindrical shroud 11, the inner surface of which is grooved as at 12 for receiving a coil form 13, the construction and special configuration of which will be described in greater detail later on in the description. The shroud 11 is preferably made of an insulator material such as a plastic. Connected with the shroud 11 and located at approximately mid-length thereon is a hollow cylindrical handle 15, which to facilitate assembly, preferably is made of the same material as the shroud. As those skilled in the art may readily discern, it is also possible to mold the shroud-handle assembly as a unitary construction.

Mounted on the top of handle 15 is a collar 16 preferably secured thereto with a snap-fit and adapted to hold a lens piece 17 or other magnifying means. A neon glow tube 18 or similar signal means is supported within handle 15 just below lens piece 17, being connected with the end leads 19 and 20 of the coil form 13 and the end leads having a section of folds therein to provide sufficient lead length for assembling the device and for replacing the neon glow tube. The end leads 19 and 20 of the coil form extend downwardly from the neon glow tube 18 within the handle 15 and outwardly therefrom through suitable openings 21 located in the handle adjacent the shroud. A resistor 22 is series connected in end lead 19 and serves a function which will be described later. The end leads 19 and 20

each also extend along the outside of the shroud 11 to a point adjacent the ends thereof, passing into the shroud through openings 50 at which point the coil form starts to assume the special configuration now described.

Referring to FIGURE 5, the coil form 13 which is the most important element in the device is formed from a soft conductor member preferably a continuous length of wire and has a generally parti but preferably semi-cylindrical overall profile so that it may be positioned girdingly over a peripheral portion only of an internal combustion engine ignition wire 30 in the manner shown in FIGURE 4. The coil form comprises a plurality of substantially parti or semi-circular open loops 24 extending generally perpendicular to the longitudinal axis of the coil form and connected each to another by an integral arcuate branch extending substantially parallel with the coil form longitudinal axis, the arcuate branches being located alternately on opposite sides of said axis as at 25 and 26, respectively. In practice it was found convenient to shape the coil form by winding a length of wire on a jig in the path of a sine wave, thereafter positioning the sinuous-shaped length on a rod symmetrically thereabout and bending it into a generally parti or semi-cylindrical profile. The coil form 13 is adapted to be supported in the shroud in groove 12 and to that end the groove 12 is shaped to correspond with the coil form shape.

In using the testing device 10 of the present invention to test the operating condition of a spark plug, the user positions it over each ignition wire 30 connecting the internal combustion engine distributor 40 and the spark plugs 60, with the shroud 11 and coil form 13 girding or embracing a portion of the periphery only of the wire in the manner shown in FIGURE 4, neither the coil form or the shroud, however, actually having to contact the ignition wire. If a spark plug 60 is operating properly, a current will flow through its associated ignition wire 30, the current flow being of a uniformly intermittent character. This current flow in the ignition wire 30 establishes a magnetic field flux thereabout which is constant raising and collapsing due to the intermittent nature of the current flow. The effect of the raising and collapsing field is to induce a pulsating E.M.F. in the coil form which is believed to result from the rapidly raising and lowering field cutting the conductor material in the coil form 13. This induced E.M.F. in the coil form will provide a potential so as to cause the neon glow tube 18 to flash, the tube flashing with the same intermittent frequency as the current flow in the ignition wire 30. Thus, the observer will note the uniformly intermittent flashing indicating a properly functioning spark plug. On the other hand, if a spark plug 60 is not operating at all, there will be no flow of current in its associated ignition wire 30 without which no E.M.F. can be induced in the coil form. Hence, the neon glow tube will not flash, the absence of flashing denoting a nonfunctioning condition. If the spark plug is partly fouled only so as to operate intermittently, the observer will note an erratic flashing denoting a spark plug which is operating, but operating abnormally.

A neon glow tube 18 is utilized in the testing device inasmuch as the current flow associated with the induced E.M.F. in the testing device is of the order of a few milliamperes only and insufficient to light an incandescent type lamp. The resistor 22 in series with the coil form 13 and the neon glow tube provides a circuit load therein.

It is thus believed it will be apparent from the above description that the spark plug tester of the present inven-

tion offers a number of positive advantages associated with testing spark plugs. There is no hazard to the user in that no actual contact with a "hot" conductor is made when using the device. The neon glow tube indicator means is readily visible in both day and night conditions. Further, the mechanic testing plugs can check the operating condition of all the spark plugs in the ignition circuit in less than 10 seconds time as use of the device does not require positioning a coil around the entire periphery of the ignition wire. The coil form of the device of the present invention is easily and quickly positioned over a portion only of the ignition wire.

What is claimed is:

1. A device for detecting the existence of a current flow in a wire conductor comprising a coil form of a single continuous winding having a plurality of aligned open loops and branches connecting the loops alternately at opposite sides of the coil form, means including a handle portion for supporting the coil form whereby it may be positioned girdingly around a portion of said wire conductor and lie in the field established therearound when current flows therethrough, and a visual signal means supported in said handle portion and connected with said coil form, said signal means being operable by the E.M.F. produced in said coil form by a change in said field caused by a corresponding change in said current flow.

2. A device for determining the operating condition of a spark plug connected to an ignition wire in an ignition circuit, said device comprising a coil form of a single continuous winding having a plurality of aligned, open loops and branches connecting the loops alternately at opposite sides of the coil form, a shroud for supportingly receiving said coil form and conforming in configuration to the overall profile of said coil form, a handle connected with said shroud whereby the coil form may be positioned girdingly around a portion of the ignition wire and lie in the field established therearound when a current flows therethrough to the spark plug, and a visual signal means supported in said handle portion and connected with said coil form, said visual signal means being operable by the E.M.F. produced in said coil by a change in said field caused by a corresponding change in said current flow.

3. A device in accordance with claim 2 wherein said open loops are parti-circular in shape, said shroud having a parti-circular cross section, the inner surface thereof being grooved conformingly to the winding of said coil form for receiving said coil form.

4. A device in accordance with claim 2 wherein said visual signal means is a neon glow tube, and further comprises a lens magnifying means supported in said handle to magnify the signals from said neon glow tube.

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