Oct. 16, 1934. E. L. GRANGIER ET AL 1,976,988

ARRANGEMENT FOR TESTING SPARK PLUGS

Filed Dec. 22, 1933

Fig. 1

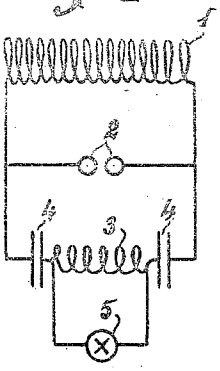


Fig. 2

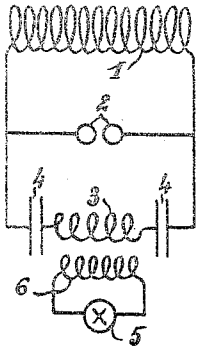


Fig. 3

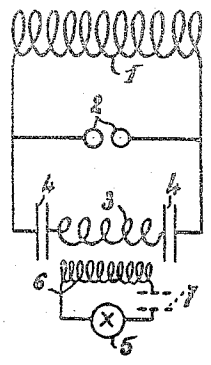


Fig. 4

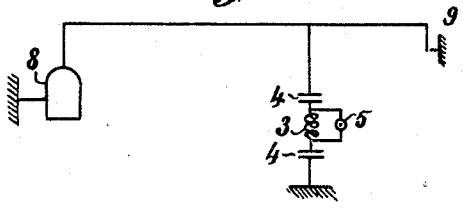
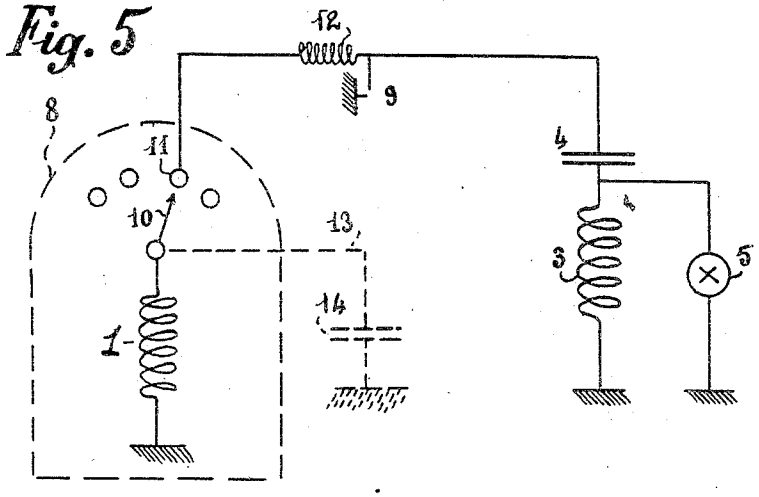


Fig. 5



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ARRANGEMENT FOR TESTING SPARK PLUGS

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4 Claims. (Cl. 173—183)

This invention relates to an arrangement for testing spark plugs for internal combustion engines or the like

Spark plugs are liable to many sorts of failures. The sparking terminals may become short-circuited with each other; they may be insulated from each other by an oily layer; they may become abnormally spaced from each other owing to corrosion of the metal. It also happens that the sparking terminals are connected by a poorly conductive layer of carbon which, while not properly short-circuiting the spark gap, weakens the spark and perturbs the correct ignition.

The arrangement which is the object of this invention permits an easy test of a spark plug in any case. It consists in connecting an oscillating circuit across the plug to be tested and in detecting the high-frequency current resulting therein from the spark by means responsive only to such a current.

In the annexed drawing:

Figs. 1 to 4 are diagrams adapted to explain the basis of the invention.

Fig. 5 illustrates an arrangement suitable according to the invention.

In Fig. 1, 1 is a coil adapted to deliver high-tension currents of relatively low frequency to a spark gap 2. An oscillating circuit is connected across spark gap 2, said circuit comprising a coil 3 in series with two condensers 4. Coil 1 comprises a great number of turns of fine wire and has an iron core so that it acts as an arrester or choke coil for high-frequency currents. Coil 3 is on the contrary void of any iron core and comprises a small number of turns of wire of large diameter.

In operation the condensers 4 are charged by coil 1 and when the voltage is sufficient the spark flashes at 2. Condensers 4 are then discharged through the spark gap, thus generating an oscillating current of very high frequency.

This high-frequency current may be detected by means of a lamp 5 connected across coil 3. The frequency of the current generated by coil 1 being low, the charging current does not light lamp 5 since the resistance and self-induction of coil 3 are negligible with low-frequency currents. But the discharge current having a very high frequency, the voltage difference between the terminals of coil 3 is sufficient to light lamp 5.

In the arrangement of Fig. 2 lamp 5 is fed by a separate coil 6 which is inductively coupled with coil 3. The operation is the same as in Fig. 1.

When this secondary coil 6 comprises a number of turns large enough with respect to coil 3, lamp 5 is operated even if there is interposed in its circuit a small condenser 7. The unavoidable capacities between coil 6, the metallic surrounding parts and the electrodes or terminals of lamp 5 are often sufficient to form a path for the high-frequency current in the absence of any condenser 7.

These arrangements permit of easily testing spark gap 2. When the latter is short-circuited condensers 4 are not charged and lamp 5 is not lighted. When the spark does not take place owing to insulation between the electrodes or otherwise, condensers 4 are charged and then discharged at the low frequency of coil 1 and no high-frequency current is generated; lamp 5 is not lighted. When the electrodes of spark gap 2 are connected by a resistance which weakens the spark, condensers 4 are not charged at the normal voltage and their discharge is damped so that no high-frequency is generated; lamp 5 is not lighted.

In automobile engines and the like the ignition magneto or coil 8 (Fig. 4) generates a current of relatively low frequency. The spark plug 9 is the spark gap to be tested. The oscillating circuit 3—4 is therefore connected in parallel with plug 9. Lamp 5 is preferably a small neon glow-discharge tube or bulb. It may be connected according to any one of the diagrams of Figs. 1 to 3.

As it has been explained lamp 5 will be lighted only as long as plug will work properly. Thus any sort of failure will be easily detected.

It is of course necessary that there exists no other source of high-frequency currents than the spark plug 9, otherwise lamp 5 would be lighted even when the ignition fails. With some igniting devices the spark distributor includes itself a small spark gap and not a sliding brush. This spark gap may generate high-frequency currents which perturb the operation of the plug testing device. This may be remedied by inserting an arresting filter or choke-coil between the spark distributor and the spark plug.

As illustrated, Fig. 5, the magneto or ignition coil 8 comprises the fixed or movable high-voltage generating coil 1 and a spark distributor embodying a rotating electrode 10 connected with the high-voltage terminal of coil 1, in cooperation with fixed electrodes 11 which are somewhat spaced from the path of electrode 10. Electrodes 11 are respectively connected with the individual spark plugs of the engine. For the sake of simplicity there is shown but one plug 9 and the corresponding oscillating circuit 3—4 (which in this

instance comprises but one condenser) provided with the detecting lamp 5. 12 designates a filtering coil which will be described later on.

Coil 1 having a large number of turns of fine wire and therefore a large ohmic resistance and a high self-induction, acts as an arrester for high-frequency currents; but in fact such a coil is inclosed within a metallic container and embodies an iron core, so that capacities are present which form a path 13—14 for high-frequency currents across coil 1 itself. Under such circumstances, the charging current of condenser 4 through the spark between electrodes 10 and 11 may be a high-frequency oscillating current capable of illuminating lamp 5, even if spark plug 9 has failed through mutual insulation of its electrodes by oil, for instance.

This is remedied by means of coil 12. The latter is a coil having an ohmic resistance and a self-induction sufficient to form choke coil for high-frequency currents, any capacity between its terminals being carefully avoided. Thus, even if distributor 10—11 generates high-frequency currents, the latter do not pass through oscillating circuit 3—4 and do not perturb the operation of the latter.

Another solution of this difficulty would consist in arranging lamp 5 in a separate oscillating circuit 6—7, Fig. 3, of low ohmic resistance, and in adjusting the wave length of the latter in accordance with the wave length of circuit 3—4. This tuned circuit 6—7 would then be responsive to the oscillations of circuit 3—4 and not to other high-frequency currents.

We claim:

1. In combination, a high-voltage ignition current generator; a spark plug fed by said generator; a filtering coil inserted between said generator and said plug, said coil being adapted to form a choke-coil for high-frequency currents; an oscillating circuit connected across said plug; and means to detect high-frequency currents in said circuit, said means being irresponsive to low-frequency currents.

2. In combination, a high-voltage ignition current generator; a spark plug fed by said generator; a filtering coil inserted between said generator and said plug, said coil being adapted to form a choke-coil for high-frequency currents; an oscillating circuit connected across said plug, said circuit embodying at least one coil and at least one condenser; and an electric lamp connected across said coil.

3. An arrangement as claimed in claim 2, wherein the electric lamp is a neon glow-discharge tube.

4. In combination, a high-voltage current generator; a spark plug fed by said generator; an oscillating circuit connected across said plug; an oscillating circuit inductively coupled with said first-named oscillating circuit, said second-named oscillating circuit having the same wave length as said first-named oscillating circuit when the discharge takes place through said spark plug; and means to detect high-frequency currents in said second-named oscillating circuit.

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