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V. W. THOMAS

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APPARATUS FOR TESTING IGNITION SYSTEMS

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Fig. 1

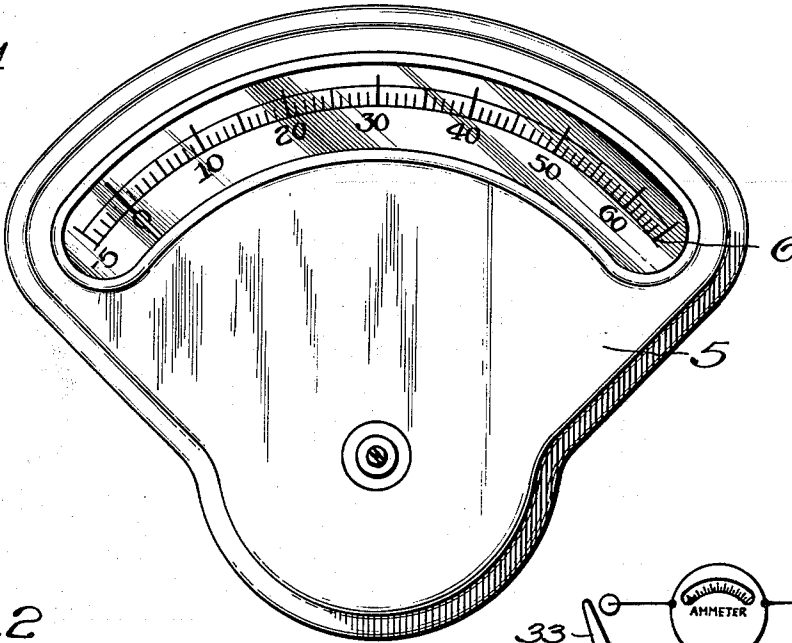
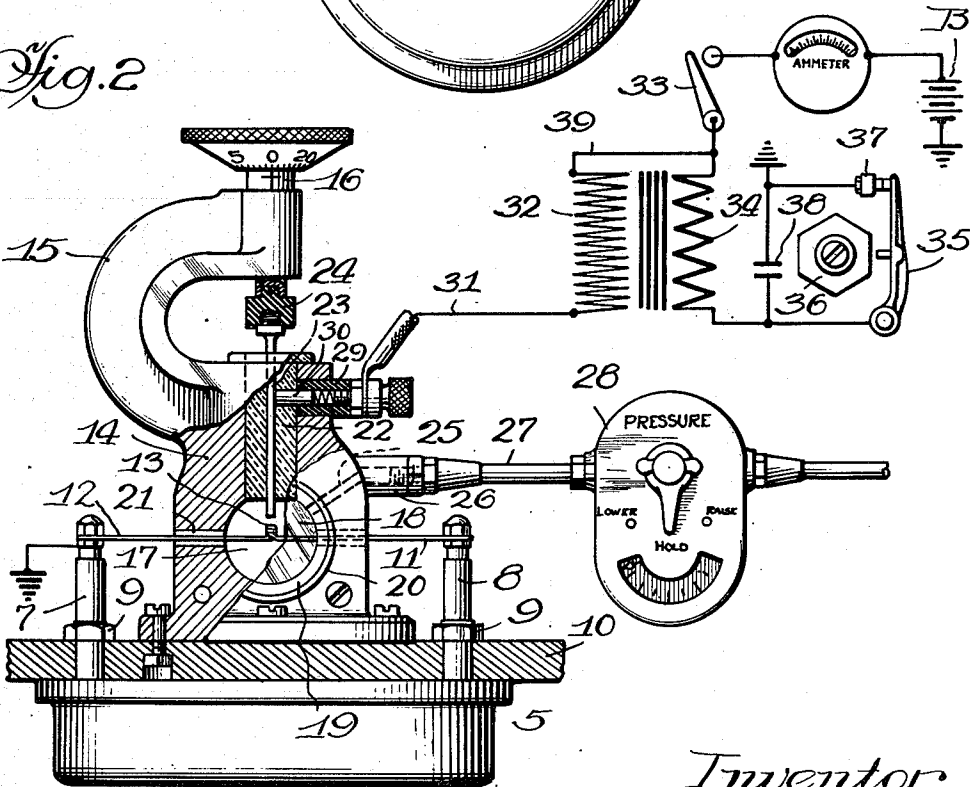


Fig. 2



Witness:
Chas. L. Kousch.

Inventor,
Victor W. Thomas,
By J. J. Gordonson Atty.

UNITED STATES PATENT OFFICE

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APPARATUS FOR TESTING IGNITION SYSTEMS

Victor W. Thomas, Waukegan, Ill., assignor to
Shurhit Products, Inc., Waukegan, Ill., a corporation of Illinois

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6 Claims. (Cl. 73—51)

My present invention relates to the provision of apparatus for testing ignition systems. The final and ultimate object of the operation of ignition systems and the operation of the divers elements necessary in such systems is the production at the spark plug in the cylinder of the engine of a spark of adequate heat producing quality to ignite the charge. Every element going into an ignition system, as well as the speed of its operation, and the setting of the breaker points for opening and closing the primary circuit and the spacing of the sparking points in the spark plug contributes to a greater or less extent to the generation of the spark between the sparking points of the plug and the heat producing capabilities of the spark produced.

So far as I am at present aware the makers of ignition equipment design and proportion the same in accordance with their previous experience and there are at present no means for dependably determining the proper adjustment of the respective elements for securing a spark of the best heating quality or for comparing the relative efficiency of different makes of elements from the point of view of the heat of the spark produced.

I have had as my object the provision of a relatively simple arrangement of equipment by means of which may be measured the relative efficiency of the igniting spark when generated with different known spark gaps in the spark plugs and in connection with different known adjustments of a breaker and with different spark coils and condensers, and when produced at divers engine speeds and under different cylinder compressions.

I have attained the foregoing objects by means of the mechanism illustrated in the accompanying drawing, in which—

Fig. 1 is a front elevation of a temperature meter, and

Fig. 2 is a side view, partially in section, of a spark gap measuring apparatus in association with the temperature meter, a pressure gauge, and other requisite elements of an ignition system.

Similar reference characters refer to similar parts in the respective views.

The apparatus which I employ for actually measuring the temperature of the igniting spark, a front view of which is shown in Fig. 1, and a top plan of which is shown in Fig. 2, and which is designated by the reference numeral 5, is, in all respects, a milliammeter of a standard type, such as a Weston, reorganized, however, by cutting down the resistance to about, or something less than, 9 ohms.

I have also arranged the scale of the instrument to read in heat units instead of electrical units. The usual terminal posts 7 and 8 of such an instrument are secured by nuts 9 in the usual way to a panel 10. Connecting the ends of the terminal posts 7 and 8 is a thermo-couple consisting of a piece of copper wire 11 connected with the positive terminal 8 and a piece of nickel wire 12 connected to the negative terminal 7, the meeting ends of which wires are twisted together and soldered, at 13.

Mounted upon the panel 10 between the terminal posts 7 and 8 is a block of metal 14, the upper end whereof is developed to provide a bracket 15 for mounting a micrometer 16 directly over the center of the block 14. One end of the block 14 is bored to provide a chamber 17, the outer end of which is closed by a glass panel 18 secured in place with suitable packing 19 with a bezel 20. The block 14 is bored horizontally to provide a passage centrally of the chamber 17 extending between the tops of the terminal posts 7 and 8. The wires of the thermocouple are run through the horizontal bores before being attached to the terminal posts and sealing and insulating bushings 21 are employed in the bores to insulate the couple from the block 14. Block 14 is also bored from the top to receive a porcelain or other suitable insulating bushing or thimble 22 which, in its turn, is provided with a central bore for the passage of a sparking terminal rod 23. The lower end of the rod 23 aligns with the upstanding connected ends of the wires 11 and 12, and the upper end of the rod 23 is connected with an insulating block 24 connected, in its turn, with the micrometer 16.

It will be seen from the foregoing description, taken in connection with the drawing, that the spacing between the rod 23 and the connected portion 13 of the wires 11 and 12 may be adjusted and measured with any desired degree of accuracy. The block 14 is also bored to provide an air passage 25 connecting with a hollow stud 26 which connects by means of suitable connections 27 with a pressure and control gauge 28, which, in its turn, is connected with any suitable apparatus (not shown) for compressing air. The block 24 is also laterally bored near its top for the receipt of an insulating stud 29 which is bored for the receipt of a spring pressed contact 30 extending through a suitable bore in the bushing or thimble 22 to make contact with the rod 23. The outer end of the stud 29 is provided with a terminal connection for conductor 31 leading to the end of the secondary winding 32 of the spark coil.

The battery B, which energizes the spark coil, has one terminal grounded in accordance with the usual practice, and the other terminal is connected through an ammeter and a switch 33 with one end of the primary winding 34 of the spark coil. The other end of the primary winding is connected with the ordinary breaker bar 35 operated by a cam 36. The stationary contact 37, co-operating with the breaker bar 35, is grounded, and the breaker mechanism is shunted by a condenser 38, all in accordance with the usual practice. The end of the secondary winding of the spark coil, which is not connected with the conductor 31, is grounded by a conductor 39 through battery B. Also I have shown the terminal post 7 of the heat meter grounded to complete the secondary or sparking circuit.

When switch, 33 is closed and cam 36 is set in rotation and micrometer 16 is manipulated, there will be found an adjustment of the rod 23 which will give the highest reading on the scale 6 at a particular rate of revolution of the cam 36. Such an adjustment is, generally speaking, the best spark gap for the spark plug with that particular organization of ignition elements at the speed employed, but when the rate of revolution of the cam 36 is increased, it will be found from the ammeter that the current in the primary coil 34 drops, and it will also be found from the reading of the heat meter 5 that the heat produced at the spark also decreases and the amount of such decrease.

Too much current in the primary circuit of the coil at low speeds is objectionable for several reasons, but the critical conditions are usually developed at high speeds when the heating quality of the spark decreases to an extent when it will not dependably ignite the charge. At high rates of revolution of the cam 36 my instrument will not only show the most desirable extent of spark gap to be employed in the spark plug, but by watching the heat meter 5 and the ammeter the proper adjustment of the fixed contact 37 of the breaker may be ascertained and the complete functioning of all the elements of the ignition system checked.

A change in the compression in the cylinders at high speeds is capable of changing satisfactory to unsatisfactory operation, but it should be noted that my instrument is capable of providing highly desirable information when operated without any compression chamber.

It should be borne in mind that it is the change in temperature which establishes the E. M. F. in the thermocouple and operates the heat meter 5 and that the temperature of the elements of the thermo-couple as it may be effected by the flow of the secondary current is not reflected in the reading of the heat meter which shows only the heat produced by the spark. This is so because the sparking current is read in thousandths of an ampere and the conductors are relatively large.

Having described my invention what I claim is new and desire to secure by Letters Patent is:

1. Apparatus for studying the characteristics of an ignition system of an internal combustion engine consisting of a thermo-couple comprising the juncture of conductors of different metals, a meter responsive to the electro-motive force developed by a change of temperature in the thermo-couple, an electrode, means for advancing and withdrawing said electrode known dis-

tances to and from said thermo-couple, an induction coil, the secondary circuit whereof includes said electrode and one of the conductors of said thermo-couple, a breaker and an ammeter and a battery included in the primary circuit of said induction coil.

2. Apparatus for studying the characteristics of an ignition system of an internal combustion engine consisting of a thermo-couple comprising the juncture of conductors of different metals, a meter responsive to the electro-motive force developed by a change of temperature in the thermo-couple, an electrode, means for advancing and withdrawing said electrode known distances to and from said thermo-couple and means for producing a succession of high voltage currents in a circuit including said electrode and one of the conductors of said thermo-couple.

3. Apparatus for studying the characteristics of an ignition system of an internal combustion engine consisting of a thermo-couple comprising the juncture of conductors of different metals, a meter responsive to the electro-motive force developed by a change of temperature in the thermo-couple, an electrode, means for advancing and withdrawing said electrode known distances to and from said thermo-couple and means for producing a succession of high voltage currents in a circuit including said electrode and one of the conductors of said thermo-couple, a casing having a compartment surrounding the thermo-couple and the approximating end of the electrode and means for changing the pressure in said compartment.

4. Apparatus for studying the characteristics of an ignition system of an internal combustion engine consisting of a thermo-couple comprising the juncture of a copper and a nickel conductor, a meter responsive to the electro-motive force developed by a change of temperature in the thermo-couple, an electrode, means for advancing and withdrawing said electrode known distances to and from said thermo-couple and means for producing a succession of high voltage currents in a circuit including said electrode and one of the conductors of said thermo-couple.

5. Apparatus for studying the characteristics of an ignition system of an internal combustion engine consisting of a thermo-couple comprising the juncture of conductors of different metals, a meter graduated in heat units responsive to the electro-motive force developed by a change of temperature in the thermo-couple, an electrode, means for advancing and withdrawing said electrode known distances to and from said thermo-couple and means for producing a succession of high voltage currents in a circuit including said electrode and one of the conductors of said thermo-couple.

6. Apparatus for studying the characteristics of an ignition system of an internal combustion engine consisting of a thermo-couple comprising the juncture of conductors of different metals, a meter responsive to the electromotive force developed by change of temperature in the thermo-couple, an electrode, means for changing the relation between said thermo-couple and said electrode known distances, and means for producing a succession of high voltage currents in a circuit including said electrode and one of the conductors of said thermo-couple.

VICTOR W. THOMAS.