Jan. 17, 1950 G. F. WETZEL 2,494,788

DEMONSTRATING DEVICE FOR SPARK PLUGS

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Fig.1

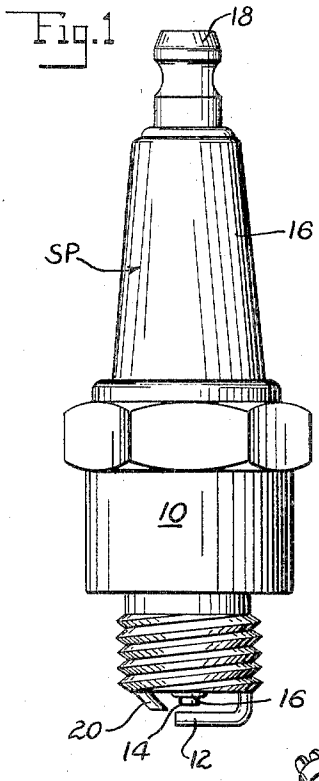


Fig.2

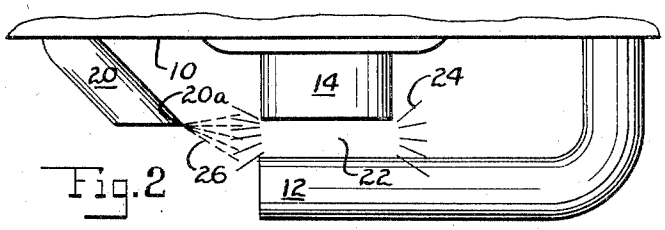


Fig.3

Fig.4

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DEMONSTRATING DEVICE FOR SPARK PLUGS

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4 Claims. (Cl. 35—13)

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This invention relates to a demonstrating device to show spark plug action of those types of spark plugs made in accordance with my copending application, Serial No. 22,157, filed April 20, 1948, now abandoned.

In said application a spark plug of increased efficiency is illustrated in which the increased efficiency results from the addition of non-sparking grounded electrodes to the usual type of spark plug. Spark plugs equipped with these non-sparking electrodes (which produce high frequency or corona discharges within the combustion chamber of an engine in addition to the usual ignition spark that occurs in a standard spark plug) perform in a manner superior to a standard spark plug. The corona discharge may be considered as auxiliary to the usual spark discharge and has the effect of extending the time that ignition of the fuel occurs as a result of turbulence created in the air-gas mixture by the non-sparking discharge. This auxiliary or non-sparking discharge has the same effect as stirring up the embers of a fire; thus bringing a greater percentage of the combustible material into the firing range and extending the flame front to bring about a more complete and rapid combustion of the fuel within the engine cylinder so that combustion is completed before the exhaust valve opens; thus minimizing the discharge of unburned fuel which results in extending the life of the exhaust valves.

In connection with the sale of spark plugs having the additional non-sparking grounded electrodes, I have devised a demonstrating device which visually demonstrates the action of the non-sparking electrodes and the main object of the present invention is to provide such a demonstrator which is comparatively simple and inexpensive as well as being simple to operate and of considerable value as a means for salesmen to demonstrate the action of the spark plug to a dealer or prospective customer.

Another object is to provide a demonstrator which includes sparking electrodes and one or more non-sparking electrodes, with the non-sparking electrodes acting on a few drops of engine oil or other non-conducting liquid in a shallow pan in such manner that the non-sparking discharge causes a disturbances of the liquid which is readily visible by giving the appearance of a tiny jet of compressed air being discharged against the surface of the liquid.

Still another object is to provide a demonstrating device which is readily portable and capable of operation on either A. C. or D. C. house current or on storage battery current usually available at automobile accessory houses, service stations, and the like.

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A further object is to provide a flexible arrangement of non-sparking electrodes whereby one or any number of them may be selectively brought into position for operation.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my demonstrating device for spark plugs whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims and illustrated in the accompanying drawings, wherein:

Figure 1 is an enlarged side elevation of a spark plug with my improvement added thereto, this being the type of spark plug shown in my copending application above referred to.

Figure 2 is a further enlargement to graphically illustrate the probable action that takes place in a spark provided with one of my auxiliary or non-sparking electrodes.

Figure 3 is a perspective view of a demonstrating device made in accordance with my present invention, and

Figure 4 is an electro-diagrammatic view of my demonstrating device showing the several circuits necessary for its operation from a selected or available source of current supply.

On the accompanying drawing I have used the reference character SP to indicate in general a spark plug. This is any of the well-known types and its construction need not be explained in detail except to refer to a metal shell 10 which is screwed into the spark plug opening and thereby grounded to the engine. Grounded and insulated electrodes 12 and 14 are provided in the usual manner. The electrode 14 is supported by an insulator 16 which insulates it from the grounded shell of the spark plug and this electrode has the usual terminal 18 for connection to the high tension lead of the distributor of the engine.

One of my auxiliary electrodes is shown at 20 and it is grounded to the metal shell 10 by attaching it thereto with a good mechanical and electrical connection of any suitable type. The electrode 20 is pointed as at 20*a* and the point is directed toward the spark gap 22 between the electrodes 12 and 14. Either one or a plurality of the auxiliary non-sparking electrodes 20 may be provided although I have found that one operates almost as efficiently as a number of them, there being a slight difference due prob-

ably to greater turbulence of the combustible fuel mixture adjacent the spark gap caused by additional high-tension, non-sparking discharges from the additional auxiliary electrodes.

The spacing from the point 20*a* to the electrode 14 must be greater than the spacing between the electrodes 12 and 14, otherwise sparking will occur across 14 and 20 as it is a well-known fact that high-tension sparks cannot occur at each of a number of spark gaps connected in parallel with each other but will occur across the shortest gap only. In general I have found the gap across 14 and 20 should be approximately .015" (plus or minus .005") greater than the ignition spark gap 22.

The pointed end 20*a* of the non-sparking electrode 20 is directed in the general direction of the ignition spark gap 22, this being illustrated in Figure 2 wherein the spark is indicated by the solid lines 24 and on a theoretical high-tension or corona discharge by the dotted lines 26. I have found that an automobile equipped with spark plugs of the type disclosed operates with improved combustion efficiency giving far better performance and more rapid acceleration with less fuel used or more mileage with the same amount of fuel. Spark plugs foul less from excess oil and carbon formation on the cylinder and the plug itself. Improved combustion is especially noticeable with a cold engine which starts much quicker and easier in cold weather and storage battery drain is considerably less than with the usual type of plug not equipped with the auxiliary electrodes 20. Quicker and easier starting is also experienced when the engine is warm.

All of these facts can be demonstrated by installing the plugs in an automobile or truck engine and checking gasoline consumption, mileage, etc. It is somewhat difficult to get prospective customers to "try every new thing that comes along" however, but if they can see a visual demonstration that some additional action takes place, it usually helps to "sell them" much quicker. Accordingly, I have provided a demonstrating device which may consist of a suitable case 28 having a hinged cover 30 within which the following described apparatus is mounted.

A partition 32 of insulating material is provided on which a shallow pan 34 (corresponding to the electrode 14 of the spark plug SP in Figure 1) is mounted. A high-tension bus bar 36 extends over the pan, is supported by a post 37 of insulating material and has a plurality of electrodes 38 corresponding to the auxiliary electrodes 20 of the spark plug SP. The electrodes 38 are slidably mounted on the bus bar 36 so as to be selectively positioned over the pan 34 or over the partition 32 as illustrated by the right-hand three electrodes and the left-hand two electrodes in Figures 3 and 4. A sixth electrode 40 corresponding to the electrode 12 is provided, it being fixed to the bus bar 36 in a position opposite an electrode 42 also corresponding to the electrode 14 of the spark plug by being the end of an extension 44 from the pan 34. Between the last two electrodes a gap 46 is provided which corresponds to the spark gap 22.

High tension current is supplied to the bus bar 36 and to the pan 34 by high-tension leads 48 and 50, respectively. The lead 48 preferably has a ground wire 52 connected therewith and leading to a clamp type clip 53 that may be connected with a suitable ground 59 such as a radiator or the like to prevent the possibility of anyone being shocked by the high-tension current. A plug 55 and jack 57 may be provided for convenience in detachably connecting the lead 52 to the demonstrator so that the lead can be removed and placed inside the casing 28 when the demonstrator is not being used.

For supplying high-tension current to the leads 48 and 50 I provide a spark coil SC having a high-tension secondary 54 and a low-tension primary 56 wound preferably for six volts.

It is desirable to provide the demonstrator with a circuit arrangement so that it can be plugged in for operation from either A. C. or D. C. house current, or connected with a six volt storage battery, and for this purpose I provide a circuit which will now be described.

For battery current I provide a pair of battery clips 58 on leads 60 with a plug and jack at 62—63 connected with wires 64 and 66. The wire 66 is connected by a switch blade 68 to one end of the low-tension coil 56 and the wire 64 is connected to contacts 70 and 72 of A. C. and D. C. switches ACS and DCS, respectively. These switches are of the push-button type having switch blades 74 and 76, the blade 74 being connected directly to the other end of the coil 56 and the blade 76 being connected thereto through an electromagnetic vibrator, the vibrating blade of which is indicated at 78 and the stationary contact thereof at 80. The core 82 of the spark coil SC furnishes the electromagnetism for operating the vibrator 78 similar to any standard vibrating type of spark plug. A condensor 82 shunts the switches ACS and DCS and the vibrator 78—80 to reduce sparking at their contacts in the usual manner.

Another source of direct current may be supplied by a supply cord 84 having a plug 86 at one end to plug into a 110-volt D. C. service outlet and a jack 88 at the other end to plug on to a D. C. plug 90 connected by wires 92 and 94 to the wires 64 and 66. The cords 60 and 84 are thus detachable for storing in the casing 28 as already described for the lead 52. A resistor 96 cuts down the 110-volt D. C. current to a proper value for operating the six volt coil 56.

For operation on 110 volt A. C. current the jack 88 of the supply cord 84 is transferred to an A. C. plug 98 similar to the plug 90 but connected to the A. C. side of the switch blade 68 and the wire 64 through a step-down transformer T. The 110 volt primary of the transformer is shown at 100 and the six volt secondary thereof at 102. The plug 86 of course is plugged into an A. C. service outlet and the switch blade 68 swung from the D. C. position to the A. C. position (dotted) when operating on 110 volts A. C. When operating on either 110 volts D. C. or 6 volts D. C. this switch blade is swung to the D. C. position shown by full lines in Figure 4.

Practical operation

In the operation of my demonstrating device any number of the auxiliary electrodes 38 may be adjusted to a position over the pan 34 and the pan is provided with a few drops of engine oil or other non-conducting liquid 106. The gaps from the lower ends of the electrodes 38 to the pan 34 are greater than the sparking gap 46 so that sparking occurs only in the spark gap 46, whereas the non-sparking corona discharges occur across from the lower ends of the electrodes 38 to the pan 34. The operation is illustrated in Figure 4, the spark across the gap 46 by solid lines and the non-sparking discharges from 38

to 34 at 104 by dotted lines (corresponding to the discharge 26 in Figure 2) which causes the surface of the oil to be disturbed, the agitation being easily visible and approximately as illustrated in Figure 4. The oil, at the closest points to the electrodes 38, produces a visible effect as though a tiny jet of compressed air was being discharged downwardly from each electrode 38. This causes the oil to spread away from the point in alignment with the electrode and pile up between the electrodes as illustrated by the uneven surfaces of the oil. The action can be observed clearly even though no discharge can be visually detected even in a dark room.

An ordinary ignition circuit of an engine could be used but each closure of the switch such as 74 would produce but a single spark at 46 and a single discharge against the surface of the oil. It is therefore preferable to use a vibrator type spark coil on direct current in order (by means of the circuit interruptions at the vibrator) to provide continuous discharges long enough for the action of the non-sparking electrodes to be fully observed. On A. C. current, of course, the vibrator is not necessary and accordingly the second push-button switch 74 is provided which eliminates the vibrator 78—80. The circuits disclosed or other such as high-tension current from a Tesla coil or the like may be used for operating the demonstrator.

From the foregoing specification it will be obvious that I have provided a demonstrator which is readily portable and operable to visually demonstrate the action that takes place with a spark plug of the kind disclosed in my copending application. The turbulence caused by the non-sparking gaps is shown by the agitation on the surface of the oil 106 whenever the demonstrator is operated. This turbulence always occurs simultaneously with the spark at 46 and is the phenomenon that makes the spark plug more effective as an ignition agent and expedites the combustion of fuel in the combustion cylinder.

Some changes may be made in the construction and arrangement of the parts of my demonstrator device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

I claim as my invention:

1. A demonstrating device for spark plug action comprising, a source of high-tension current, a pair of electrodes spaced from each other to provide a high-tension spark gap and other electrodes spaced from each other to provide at least one non-sparking gap in parallel with said first pair of electrodes and of greater spacing than said first pair, one electrode of the non-sparking gap comprising an element adapted to contain non-conducting liquid to be impinged by the discharge from the other non-sparking electrode to demonstrate the presence of a corona discharge by disturbing the surface of said liquid in addition to a visible spark across said first pair of electrodes.

2. A demonstrating device for spark plugs of the character disclosed comprising a source of high-tension current, two pairs of electrodes in parallel, the spacing between the electrodes of one pair being greater than the spacing between the electrodes of the other pair to provide non-sparking and sparking gaps respectively, one electrode of said non-sparking gap comprising an element adapted to contain oil or the like, the discharge from the other non-sparking electrode disturbing the surface of said oil to demonstrate the presence of said discharge.

3. In a demonstrating device of the character disclosed, a shallow pan adapted to contain a small quantity of non-conducting liquid, a non-sparking electrode in opposition thereto, a pair of spark gap electrodes in parallel with said pan and non-sparking electrode, the distance between said spark gap electrodes being less than the distance from said non-sparking electrode to said pan, and means for supplying high-tension current to said electrodes, spark gap and pan, said means comprising a spark coil, a plural source of current supply therefor, and means for selectively energizing said spark coil from the desired source of current supply.

4. In a demonstrating device, an electrode adapted to contain a small quantity of oil or the like, a plurality of non-sparking electrodes in opposition thereto and a pair of spark gap electrodes in parallel with said first electrode and said non-sparking electrodes, the distance between said spark gap electrodes being less than the distance between said first electrode and any of said non-sparking electrodes, and means for supplying high-tension current to said electrodes.

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REFERENCES CITED

The following references are of record in the file of this patent:

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