

Dec. 26, 1967

L. W. WILLIAMS

3,350,718

SPARK PLUG TESTER

Filed Aug. 15, 1967

FIG. 1.

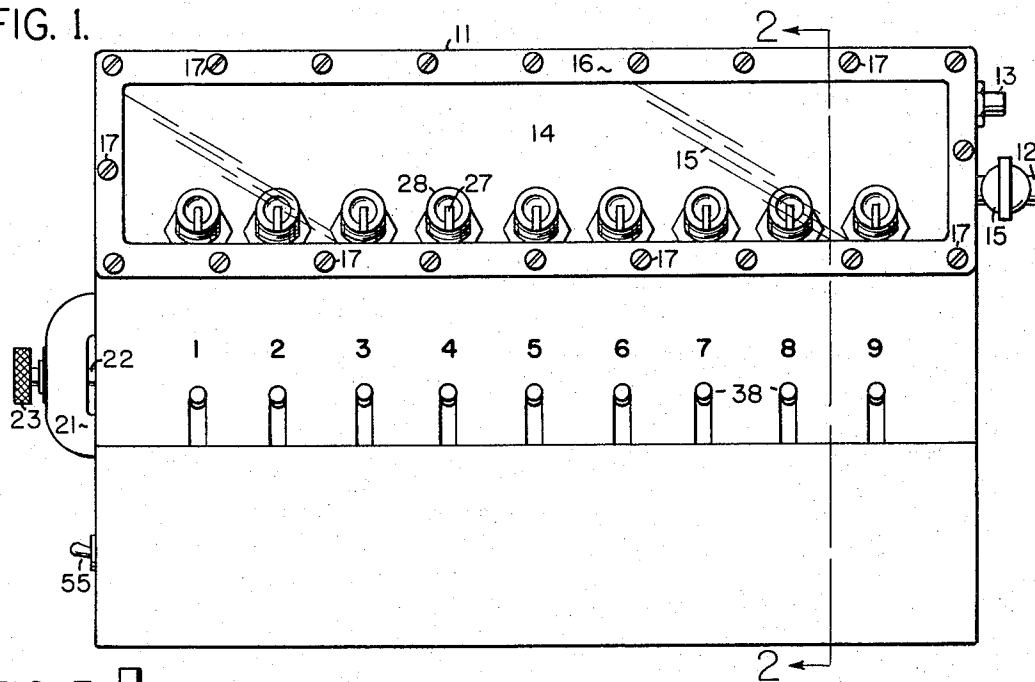


FIG. 3.

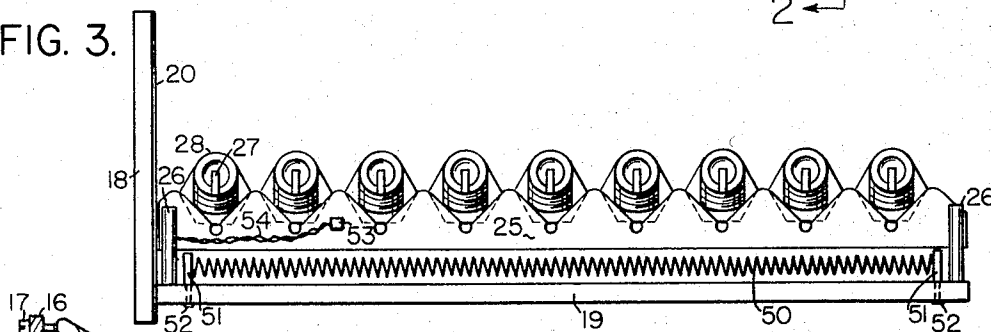
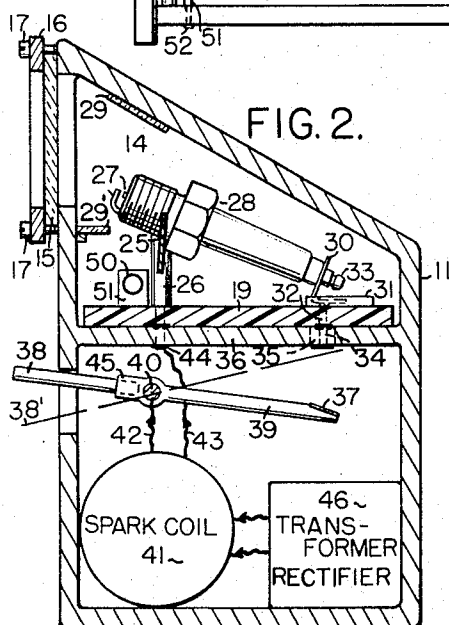


FIG. 2.



INVENTOR.

LESTER W. WILLIAMS

BY *Harry K. Lubcke*
AGENT

1

3,360,718

SPARK PLUG TESTER

Lester W. Williams, 3665 S. Victoria Ave.,
Los Angeles, Calif. 90016

Filed Aug. 15, 1967, Ser. No. 660,679

6 Claims. (Cl. 324—15)

ABSTRACT OF THE DISCLOSURE

A spark plug tester in which all of the plugs for an internal combustion engine can be simultaneously laid in an up-ended inclined position upon contacts on a tray for selective electrical testing within a pressurized housing. Individual, gravity-restored, normally-open electrical switches allow one or more plugs to be sequentially or simultaneously tested with high voltage. An electrical heating coil extends under all plugs to enable testing while hot. The housing has transparent means to allow visual inspection of the spark at any plug and two strip mirrors to allow observation between the points of the gap of any plug. A pressure-resisting closure allows insertion and removal of the tray within the housing.

Background of the invention

The invention pertains to a spark plug test fixture.

The prior art has invariably provided a test fixture into which spark plugs must be screwed, usually one at a time. The time required to thus test the usual engine complement of eight plugs is so long that it is frequently less expensive to install a new set of plugs without ever testing the old ones. Other testers have not provided means for heating the plugs so that the conditions of use within an engine can be simulated; nor have some testers provided for pressurizing the portion of the housing in which sparking takes place, which is also necessary for a representative test.

Also, prior testers have often been formed in complicated shapes and have required extensive precision machine work in manufacture. Additionally, the electrical switching system has frequently been either elemental and require too much time for operation, or complicated and likely to become defective in use.

Summary of the invention

The present structure departs completely from that of the prior art in providing a tray into which typically nine spark plugs are simply laid in an up-ended inclined position upon metallic contacts. This allows all of the plugs from an engine and one new or standard one to be installed for testing in less than one minute. The loaded tray is inserted in a housing, which is then pressurized and the plugs heated. Directly below each spark plug is a gravity-restored switch with an insulated external handle. By pressing this down electrical contact is completed between a high voltage (spark coil) source and the two points of the plug. Any plug can be tested repeatedly, and two or more can be tested together by depressing the appropriate handles at the same time. A whole set of plugs can be tested for uniformity of performance in rapid sequence or simultaneously. Such uniformity is important in securing even engine operation.

Brief description of the drawings

FIG. 1 is a front elevation view of the assembled tester.

FIG. 2 is a sectional end elevation view of the same, taken along line 2—2 in FIG. 1.

FIG. 3 is a front elevation view of the tray only, with spark plugs in place.

2

Description of the preferred embodiment

In FIG. 1 numeral 11 indicates an elongated housing. This is preferably gas-tight in the portion holding the spark plugs, being capable of withstanding an internal pressure of the order of 180 pounds per square inch. The housing may be cast of aluminum, or of an equivalent metal, in an alloy having superior tensile strength. While a particular shape has been shown, this can be modified to partake of the characteristics of pressure vessels, such as quasi-spherical surfaces. An inlet 12 for gas (air) pressure is provided for the upper portion 14 of the housing. Known pipe fittings are employed, and these may include an indicating pressure gauge (not shown). Also included is two-way valve 15, connected between inlet 12 and housing portion 14, so that air can be admitted to portion 14 for raising the pressure therein, this portion can be sealed off, or the air can be exhausted to the atmosphere after testing the plugs has been accomplished. A safety-valve 13 is provided in communication with portion 14 for usual safety purposes. It may be of the known ball and spring type. This provision for pressure testing is desirable for simulating the condition of operation of spark plugs in an internal combustion engine, but it may be eliminated for a low cost embodiment. On the other hand, a mechanical extension may be provided for valve 15 which automatically starts pressurization of portion 14 upon tray 19, carrying the spark plugs, being fully inserted.

Transparent means 15, such as high-strength glass or plastic, is provided so that the spark passing between the points of a plug can be observed by the operator. This is shown as a one-piece panel fastened to housing 11 under retaining frame 16 and suitable gaskets. A number of screws 17 pass through the frame and into the housing to provide a pressure-tight structure. Alternately, a series of portholes, one for each spark plug to be tested, are provided in housing 11, instead of the single large aperture. Accordingly, a single piece transparent means 15 may be used over the portholes and secured as has been described, or a series of small transparent elements may be fastened by individual circular clamping rings, or by epoxy cement.

A closure to allow the tray to be inserted and removed from the housing is shown at the left of FIGS. 1 and 3. An end 18 is provided, rigidly attached to tray proper 19. The end is constructed of metal to withstand pressure and is provided with a gasket seal 20. Tray 19 is formed of an insulator, such as a phenol plastic, having good mechanical and high voltage electrical insulating properties, so that a number of electrical contacts can be fastened to it and remain insulated one from the other.

A clamp 21 is arranged to be rotatable on stud 22. Threads at the end of the stud allow the clamp to be strongly forced against both the end of housing 11 at the bottom of the clamp and at end 18 of the tray at the top of the clamp by screwing down thumbscrew 23. Of course, tray 19 may be formed to fit entirely within housing 11 and a pressure port type cover provided with a number of thumbscrews and a gasket to fit over the end of the housing.

Tray 19 carries a serrated metal ground contact 25 having a depression for receiving each spark plug to be tested. Contact 25 is supported by two end posts 26. See FIG. 3. The height of this structure is sufficient to allow the operator to directly view points 27 of spark plug 28 through transparent means 15. A first strip mirror 29 is provided fastened to the under side of the top of housing 11, and a second strip mirror 29' is provided fastened to housing 11 just below transparent means 15. The mirrors enable viewing the gap between points 27. The general nature of the spark can be discerned by direct viewing

despite the fact that the ground point extends over the inner point in essentially all of the spark plugs in use today. However, more careful viewing of the spark between the points by means of one or both mirrors is desirable in certain instances.

A plurality of insulated separate contacts 30 are provided away from window 15 with respect to ground contact 25 and at a lower elevation than the depressions in that contact, thereby up-ending each spark plug in an inclined position, as seen in FIG. 2. Since an eight cylinder engine is the maximum number of cylinders now generally in use, it is preferred to provide nine test positions for plugs. This allows one new or standard plug to also be tested under the same conditions as the rest of the plugs, so that proper performance can be determined by comparison. The several plug positions are preferably numbered for identification, as from 1 through 9, with plug number nine being the new plug.

Each contact 30 is attached to insulating material tray 19 by a metallic U-shaped trough 31, in which it may be slid left and right as shown in FIG. 2 by an operator exercising a nominal force with his fingers. This allows spark plugs of different lengths, as foreign vs. domestic brands, to be properly seated. Each contact 30 has a central V opening of the equivalent, into which the top metallic contact 33 of the spark plug rests. Contact 30 may be formed of flexible material, such as spring bronze, which tends to provide positional stability and firm electrical contact.

A metallic rivet or equivalent fastening 32 secures trough 31 to tray 19. The bottom of the rivet is formed to project slightly below the tray, so that when the latter is in position in the housing the bottom of rivet 32 contacts an equivalent upper projection of rivet-like contact 34, which passes through insulating bushing 35 secured in horizontal partition 36 of housing 11.

The lower surface of contact 34 may be large, such as 1/4" in diameter, so that contact is established with contact 37 each time insulated lever-handle 38 of the gravity-restored switch is depressed by the operator. The right-hand portion 39 of the lever is of metal or other electrically conductive material, so that electrical contact will be made to longitudinally extending rod 40. This rod extends the length of the housing and is insulatingly supported at each end thereof. The rod forms the mechanical fulcrum for each of the nine levers 38, 39 and also is the bus bar for the high voltage electricity produced in a known manner by spark coil 41. Insulated conductor 42 connects the high voltage terminal of the spark coil to rod 40. Conductor 43 connects the ground terminal of the spark coil to ground support 25 for the spark plugs through one end support 26 and a rivet contact 44, similar to that described in connection with rivet 32. Since the output voltage of spark coil 41 is of the order of 10,000 volts, it is not necessary that any of these contacts be of low electrical resistance, as would be required if a voltage of only a few volts was involved. Thus, resting mechanical contact of one upon the other is sufficient.

It will be understood that lever portion 38 of the individual switches must be of insulating material, since this is depressed by the finger of the operator and shock from rod 40 must be avoided. This is arranged by forming conductive portion 39 of the lever with tubular section 45 extending a short distance to the left of the rod 40 fulcrum, and by screwing or cementing insulating portion 38 thereinto.

Dashed line 38' signifies the position of lever 38, 45, 39, 37 when portion 38 has been depressed by the operator to make electrical contact to a particular spark plug for testing the same. Since the right-hand portion of this lever is heavier than the left-hand portion, it will assume the position shown in full lines when the downward pressure upon portion 38 is removed. This arrangement of testing several plugs is simple, rugged and inexpensive. Also, two or more plugs can be connected to spark coil

41 at one time, to check the comparative resistance of such plugs.

Spark coil 41 is electrically energized by a battery, or by a transformer-rectifier combination 46, in which the usual 117 volt alternating current power is transformed and rectified to a direct current of approximately twelve volts, and this is employed to operate the spark coil via leads 47.

In order to test spark plugs while they are reasonably hot, such as the average temperature within a four cycle internal combustion engine, a coil of resistance wire 50 is strung between two connection terminals 51, which have lower rivet or screw fastenings 52 to tray 19. This coil is typically capable of converting a few hundred watts of 117 volt (A.C.) electrical energy to heat, thereby to rather quickly heat the several aligned plugs which are positioned above it. A thermocouple 53 is preferably attached to ground contact 25. With the electrical leads 54 shown and an external electrical indicating milliammeter (not shown) the approximate temperature of the plugs is indicated.

A typical mode of operation entails placing eight spark plugs to be tested in the first eight contact positions on tray 19; placing a reference plug in position 9; inserting the tray into pressure portion 14 of the housing; and securing it therein by clamp 21. Heating coil 50 is then energized, valve 15 is rotated to raise the pressure to a fraction of the full value, and valve 15 is then rotated to exhaust the pressure portion 14. This operation may be repeated, for the purpose of removing gasoline or oil vapors, which could be explosive upon a spark being created within the enclosed space. By this time the plugs will be warm.

The spark producing elements 41, 46 are then energized by closing switch 55 and testing individual plugs is started; by depressing lever portion 38 located below the plug involved. Comparison is made with the sparking of reference plug 9. All this time the plugs are becoming hotter and changes, if any, in the performance of individual plugs can be noted from the cold to hot conditions. The operator notes the performance of the several plugs for later determination of what to do with them.

The pressure within portions 14 is then reduced to atmospheric by rotating valve 15 to its exhaust position, clamp 21 is loosened, and the tray with the plugs is removed from the housing.

Certain modifications can be made in the structure of this tester, such as providing another switch in series with manually operated switch 55, which closes the electrical circuit automatically upon tray 19 being fully inserted within housing 11. Switch 55 then becomes an over-all control switch. Still other modifications may be made in the arrangement, size, proportions and shape of the illustrative embodiment without departing from the scope of this invention.

I claim:

1. A tester for simultaneously enclosing a plurality of more than two spark plugs for testing comprising;

(a) a tray (19),

(b) pairs of spaced contacts (25, 30) upon said tray for electrically contacting respective spark plug electrodes and for supporting each spark plug of said plurality in an up-ended inclined position.

(c) an elongated housing (11) to receive and enclose said tray,

(d) means (15) forming a part of said housing to allow observation directly of the spark gaps of the spark plugs,

(e) high voltage source means (41), and

(f) individual normally open-circuit electrical switches (37, 38, 39, 45) to selectively connect said source means through said pairs of contacts (25, 30) to selected spark plugs (28) for enabling observation of the sparks produced thereby.

5

2. The tester of claim 1 in which each of said pair of spaced contacts comprises;

(a) a common ground contact (25) having a depression to engage the shank of each said spark plug, and

(b) an individual contact (30) having a V-slot to engage the metallic top of said spark plug at an elevation lower than that of said depression.

3. The tester of claim 1 in which each said normally open-circuit electrical switch comprises;

(a) a metallic portion (39) carrying an electrical contact (37) and electrically and mechanically engaging a common rod (40) acting as a fulcrum, and

(b) an insulated portion (38) on the side of said fulcrum opposite to said metallic portion, said insulated portion having a smaller turning moment than said metallic portion, whereby said metallic portion is normally inclined downward by the force of gravity and thus away from the individual contact (30, 34) for each spark plug.

4. The tester of claim 1 which additionally includes; (a) a first strip mirror (29) extending the length of the assembly of said plurality of spark plugs, and attached to said housing above said plugs, and

(b) a second strip mirror (29') similarly extending,

6

and attached to said housing below said plugs, whereby the spark in the spark gap of any plug may be observed.

5. The tester of claim 1 which additionally includes; (a) electrical means (50) mounted on said tray linearly disposed beneath said spark plugs to heat said spark plugs for testing.

6. The tester of claim 1 which additionally includes; (a) means (12, 15) to increase and subsequently decrease the gaseous pressure within that portion (14) of said housing enclosing said spark plugs, whereby said spark plugs are subjected to gaseous pressure during testing.

References Cited

UNITED STATES PATENTS

1,834,990	12/1931	Zeller	324—15
2,505,422	4/1950	Michaels	324—15
2,801,384	7/1957	Pierce	324—16
2,892,149	6/1959	Persak	324—16
2,899,634	8/1959	Carbonneau	324—15

RUDOLPH V. ROLINEC, *Primary Examiner*.

M. J. LYNCH, *Assistant Examiner*.