Aug. 17, 1954 J. B. PLATNER 2,686,510

SPARK PLUG AND IGNITION LEAD WIRE PROTECTIVE SYSTEM

Filed Dec. 20, 1951 2 Sheets-Sheet 1

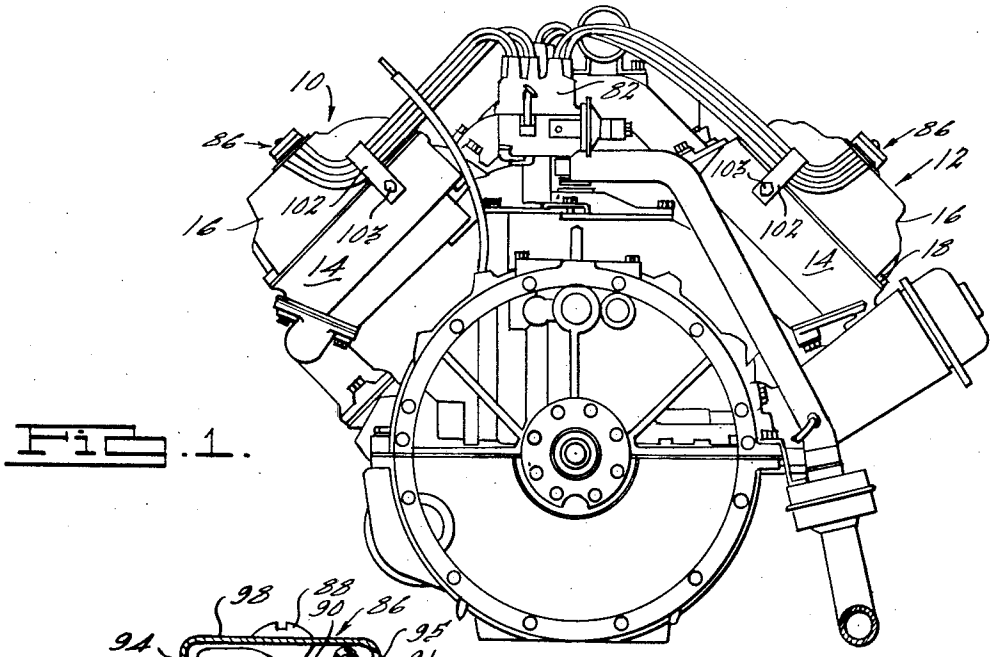


Fig. 1.

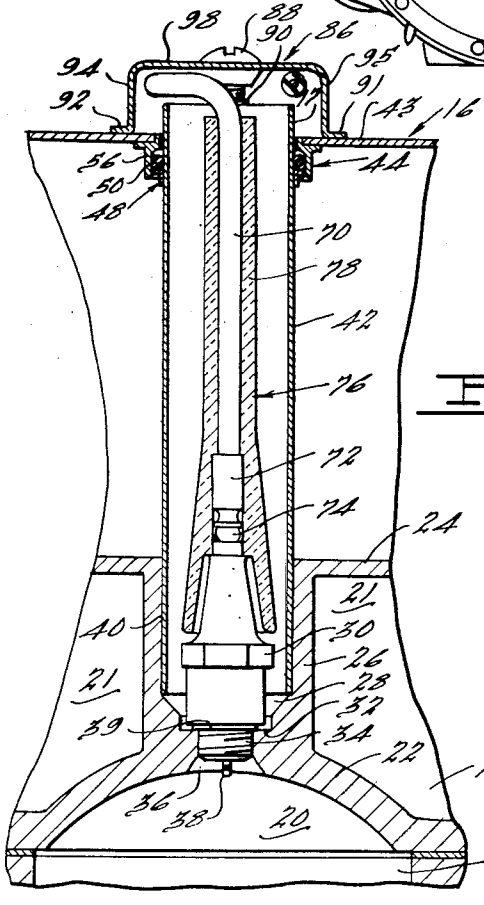


Fig. 4.

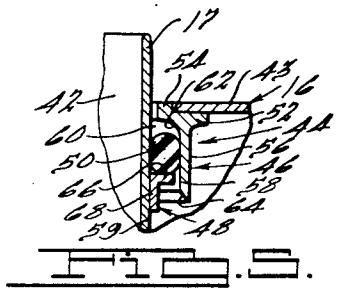


Fig. 5.

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SPARK PLUG AND IGNITION LEAD WIRE PROTECTIVE SYSTEM

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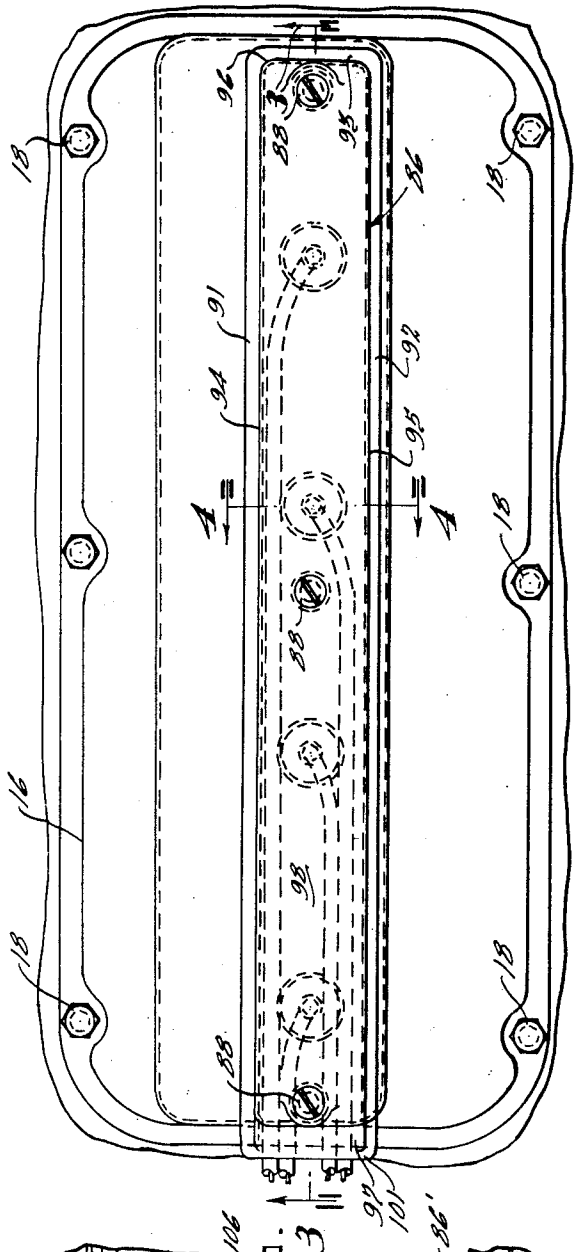


FIG. 2.

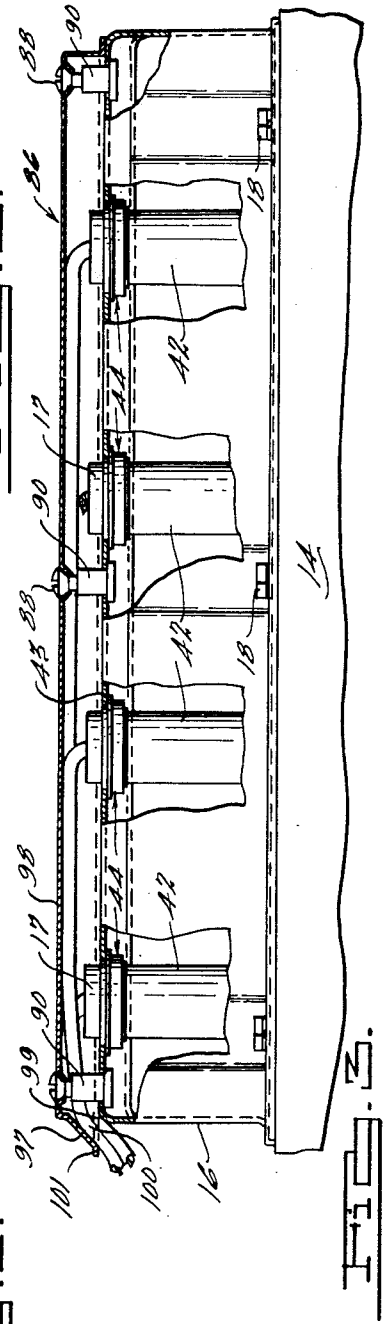


FIG. 3.

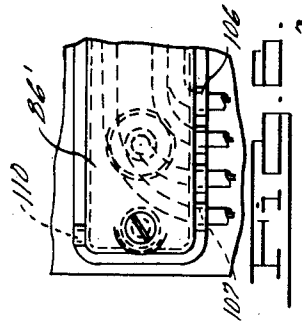


FIG. 4.

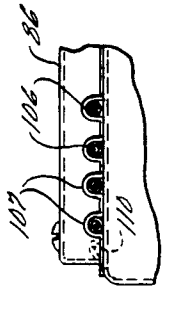


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SPARK PLUG AND IGNITION LEAD WIRE PROTECTIVE SYSTEM

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Application December 20, 1951, Serial No. 262,627

14 Claims. (Cl. 123—143)

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This invention relates to protective or shielding systems for protecting the spark plugs and connecting ignition wires or leads of internal combustion engines from oil, dust, moisture, and gases, and more particularly to a combination spark plug and ignition lead protective housing structure for V-type engines requiring submerged spark plugs.

Various devices have been suggested to protect the exterior portions of installed spark plugs and their immediate ignition wire connectors from moisture, dust, and oil. These have generally taken the form of plastic or flexible jackets confined to the spark plugs and the immediate wire connectors. They have not been entirely successful as protective media since the lead wires constitute conducting paths for water and/or oil to the plugs within the shield and oil-laden gases emanating from the interior structure of the spark plugs or the mounting openings therefor have often caused the shields and connecting leads to be blown off the plugs. Moreover, shields of this character have been difficult to handle especially where the spark plug was necessarily mounted in a well formed in the cylinder head of the engine.

The present invention provides a composite structure believed to better protect the plugs and lead wires of the ignition system.

An object of my invention is to provide a protective system for spark plugs and ignition lead wires wherein these parts are sealed from the oil-laden vapors emanating from the valve mechanism compartments of the engine.

A further object is to provide a protective system as aforesaid, wherein the spark plug is ventilated so that blow-by gases from the combustion chamber leaking through the spark plug interior or through the spark plug mounting joint may get out to the atmosphere without blowing off any flashover shields provided on the spark plug and the lead wire connectors and wherein the ventilation provided in the system avoids any build up of condensation from blowby gases.

Another object is to provide a protective system as aforesaid which inhibits the condensation of external water vapor within the system especially during periods of high humidity and low temperatures and wherein the ignition lead wires emanate from the protective covering at a location permitting external water drainage away from the plug side of the leads.

Still another object is to provide a protective system for spark plugs mounted in a well of the engine cylinder head whereby drainage water cannot get into the spark plug well.

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These and other objects of my invention will become apparent from the following description and from the accompanying drawings wherein:

Figure 1 is an end elevational view of the rear or flywheel end of a V-8 engine showing the ignition wire cover of my invention applied to each bank of cylinders and showing the manner of connecting the wires to the distributor mounted on the engine;

Figure 2 is a top plan view of one of the lead wire covers of Figure 1;

Figure 3 is an elevational view partly in section of the structure of my invention, the section being taken on the line 3—3 of Figure 2;

Figure 4 is a sectional elevation through the spark plug and lead wire protective structure of my invention taken at 4—4 of Figure 2;

Figure 5 is an enlarged fragmentary cross sectional view of the oil and water seal of my invention between the spark plug protective structure and the cylinder head cover of Figure 4;

Figure 6 is a top plan view showing a portion of a modified lead wire cover of my invention for use on the left hand engine bank of the engine looking forwardly of Figure 1; and

Figure 7 is a side elevational view of the cover of Figure 6 showing the lead wire apertures.

In the drawings in which like reference numerals designate corresponding parts of the structure of my invention, I have illustrated, as seen in Figure 1, an 8-cylinder V-type engine of current manufacture to which my invention has been applied, which engine has overhead valves.

The engine, as seen in Figure 1, has right and left cylinder banks 10 and 12 respectively. The cylinder banks are arranged in a V relationship, each having a cylinder head 14, the valve operating mechanism for which is enclosed beneath a cover 16 secured to the cylinder head, as seen in Figures 1, 2 and 3 by bolts 18.

Each cylinder head has a plurality of spaced cylinders 19 each provided with a combustion chamber 20 above which is a liquid cooling space 21 defined, among others, by the chamber wall 22 and a top wall 24.

Connecting the walls 22 and 24 on approximately one axis of the cylinders are walls 26 of circular formation which define pockets, wells or depressions 28 for receiving and substantially submerging spark plugs 30 of conventional character. The spark plug 30 is mounted upon a seat 32 by a threaded base portion 34 which is threadedly received in a threaded bore 36 at the bottom of the well which extends into the chamber 20 to permit the electrode 38 of the

spark plug to be exposed to the fuel-air mixture in the chamber 20. A suitable washer or gasket 39 is provided between the spark plug and the seat 32.

Each depression 28 has a machined bore 40 concentric with the axis of the spark plug in which is securely pressed a cylindrical, rigid spark plug shield or tube 42 of suitable heat-resisting and shape-retaining material, preferably steel, which surrounds the spark plug and extends vertically above the top wall 43 of the cylinder head cover 16 as seen at 17 in Figure 4, the said tube passing through a seal generally designated by the numeral 44. The tube 42 is of sufficient size such that the spark plugs may easily be removed and replaced by a suitable wrench provided with a cupped extension having a plug gripping device. The upper end of the tube is, moreover, preferably rounded or flared and all sharp corners removed therefrom.

The seal 44 is shown in enlarged section in Figure 5. It comprises a metallic annular gland ring or structure 46 suitably formed integral with the cover 16 or separately mounted in the cylinder head cover 16 as by soldering to obtain an oil-tight connection; a metallic stop ring 48 suitably located and mounted on the tube 42 adjacent the projecting end 17 and secured by press fitting, soldering or spot welding; and a pliable sealing ring 50 of natural or synthetic plastic material, for example, rubber or "neoprene" and which is preferably a shaped pre-formed ring having an O section.

As seen in Figure 4, the gland ring 46 when separately formed has an annular flange 52 in face-to-face contact with the under side of the wall 43 of the cover 16 by which it is secured to the cover 16 preferably together with an annular shouldered projection 54 which preferably tightly fits an aperture in the wall 43 of the cover 16 formed to receive the same. The ring 46 moreover, has an elongated tubular or annular axial extension 56 projecting from the flange 52 and which is of larger diameter than the projection 54 and is concentric with the tube 42. The extension 56 has its internal cylindric surface 58 spaced from the external surface 59 of the tube 42 to form a space 60 therewith to receive the seal ring 50, the extension 56 also forming a concave-shaped shoulder 62 with the projection 54 thereof. The lower end of the extension 56 is moreover, formed with an outwardly flaring or angular face 64 providing a tapered tip for this end of the extension 56.

The stop ring 48, as seen in Figure 4, has an annular flanged portion 66 against which the seal ring 50 may abut and seal and includes an annular or cylindrical portion 68 by which the stop ring is tightly fitted to the tube 42 as above described.

In assembling the seal, the O ring which is of slightly larger external diameter than the internal diameter of the extension 46 and of an internal dimension which is slightly smaller than the external diameter of the tube 42, is slipped or forced over the upper end of tube 42 adjacent the portion 17. The cylinder head cover 16 is then brought into position with the gland rings 46 over the tubes 42 and the cover is lowered into position. In this process the angular face 64 at the lower end of the extension 56 of the gland ring 46 will come into abutting contact with the O ring 50 and push it downwardly on the tube 42 until this ring 50 seats against the flange 66 of the stop ring 48, whereupon continued downward movement of the cover will cause the angular face 64 to cam the ring 50 inwardly to compress the same and slip over its outer surface so that the O ring 50 now assumes a flattened elliptical section, as seen in Figure 4, and tightly fits between the external surface 59 of the tube 42 and the internal surface 59 of the gland ring 46 and tightly against the flange 66 of the stop ring 48 to thus produce in conjunction with the tight seal 40 between the tube 42 and the cylinder head 14 an oil and vapor-tight seal between the cylinder head cover 16 and the tube 42 and between the cylinder head 14 and the tube 42 so that oil-laden vapor arising in the valve mechanism space cannot reach the spark plug or the ignition lead wires of the engine.

As seen in Figure 4, the insulated ignition lead 70 is provided with a spring contact clip 72 which snaps over the terminal end 74 of the spark plug 30 and is protected from flashover by a suitable tubular shield 76 forming no part of this invention which may be of ceramic or other suitable insulating material and comprises an elongated tubular portion 78 embracing the lead wire 70 and extending above the spark plug tube 42 and a lower outwardly flaring lip or portion 80 which extends over the terminal connection and over a portion of the insulating wall of the spark plug.

The lead wires 70 from the individual spark plugs are turned downwardly as they emanate from the shield 76 and are arranged, as seen in Figures 2 and 3, to extend longitudinally of the cylinder head cover in the direction of the rearward end of the engine where they connect with the distributor generally designated by the numeral 82.

Protecting the ignition lead wires 70 is a dished cover generally designated by the numeral 86 which may be of heat-resisting and shape-retaining material, for example, a metal such as aluminum and which is seated on the cylinder head cover 16 and secured thereto by countersunk head screws 88 threaded into suitable shouldered posts 90 of which three are illustrated, the latter being suitably held as by riveting, soldering, or spot welding to the cylinder head cover 16.

The cover 86 is relatively shallow in character and is of a width and length to extend over the spark plug tubes 42 and provide adequate space to neatly confine the ignition wire leads without causing damage to them. A width slightly greater than the diameter of the posts 90 plus four lead wire diameters would generally suffice for an 8-cylinder engine, there being four wires confined under each of the two covers provided on such an engine as is disclosed in Figure 1.

As further seen in Figures 2 and 3, the cover 86 has a continuous right angled flange 91, 92, 93 which connects with the side walls 94, 95 and end wall 96 of the cover 86. This flanged portion seats against the top wall 43 of the cylinder cover 16 forming a face-to-face contact requiring no gasket. The end of the cover 86 opposite the end wall 96 is provided with a sloping wall 97 projecting downwardly and outwardly from the top wall 98 of the cover 86 so as to project over the end portion of the cylinder head cover 16 and provide between this wall 97 and the rounded corner 99 of the cylinder head cover 16, an ignition lead outlet 100. The outer edge of the wall 100 has an additional outward flare to provide a rounded lip 101 to protect the lead wires from contact with any sharp corners.

Suitable clips or tubular confining members may be provided at the posts 90 or at other points between the adjacent spark plug tubes to hold the adjacent lead wires together in a compact group such that the lead wires will stay in position after the cover 86 is removed and moreover, to avoid sharp bends in the lead wires. These clips or tubular members may be of suitable heat-resistant insulating material and if made of metal are preferably coated and have all edges rounded. If desired, the inner surface of the cover 86 may be coated with a suitable insulating and/or rust-resisting material such as a phenolic resin coating.

Between the outlet 100 of the cover 86 and the distributor 82, the ignition lead wires may be clamped at one or more places against the cylinder head cover 16 by suitable straps 102, shown in Figure 1, which are secured by bolts 103 to the cylinder head 14.

It will be observed that by providing a further metallic enclosure for the exposed portions of the lead wires in Figure 1, a fully shielded enclosed ignition system to prevent radio interference from the ignition and other sources may be secured.

It will be observed that the ignition lead wire outlet 100 is at the rearward end of the engine which end is generally lower than the front end when the engine is mounted on the vehicle chassis. Hence any splash water getting under the cover 86 or on the ignition lead wires under the cover can readily run or drain off away from the spark plug chambers. Moreover, it has been previously noted that the spark plug tubes 42 project upwardly at 17 in Figure 4 above the cylinder head cover wall 43. By reason thereof it will be apparent that any splash water getting under the cover 86 and on the wall 43 of the cylinder head cover 16 cannot get into the spark plug compartment 42 and cannot get into the valve mechanism compartment by reason of the seal 44. All this is true regardless of whether or not the flange portion of the cover 86 makes a water-tight fit with the wall 43 of the cylinder head cover 16.

It will also be noted that any vapor emanating from the internal structure of the spark plugs 30 or through the threaded connection 34 between the spark plug well 28 and the combustion chamber 20 can find escape through the lead wire opening 100. Moreover, fresh air can get under the cover throughout its periphery to ventilate the spark plug compartments and the under portion of the cover 86. The described structure moreover, is of a character wherein it has been observed in actual use that practically no condensation forms on the under side of the lead cover 86, even under conditions providing low ambient temperatures with high humidity.

In Figures 6 and 7 I have illustrated a modified form of cover 86' which may be employed in instances where the ignition lead wires must emanate from the side of the ignition lead cover by reason of a more forward location of the distributor unit 82. It will be understood that except for the distinctions hereinafter pointed out, this cover is similar to the cover 86 of Figures 1 and 2 and is to be employed in conjunction with the other structure of the protective system described above. In the cover of Figures 6 and 7, both end portions are formed with a flange such as the flange 93 of the cover 86 and in place of the opening 100 of the cover 86, there

is provided in one of the side flanges 91, 92 and at the rearward end of the engine, a scalloped edge portion 105 to provide individual ignition lead wire apertures 107. By preference this scalloped portion will be provided in the cover flange that is to be located at the inner side of the engine that is between the cylinder banks. A cover of Figure 6, for example, being located on the cylinder bank 10 of Figure 1 such that the ignition lead wires emanate from the upper side of the cylinder head cover. In addition to the scalloped portion 106, the cover 86' is provided in the wall opposite the scalloped portion with a water drainage and ventilation opening 110 which may be a scalloped flange portion or the like adjacent the endmost portion of the cover such that any water getting under the cover may drain off through this opening, this being possible because of the natural downward longitudinal and lateral pitch of the covers 16 and 86'. Inasmuch as it is necessary that the drainage port 110 be at the proper side of the cylinder bank, left and right hand covers 86' will be required for use on a V-type engine, whereas the covers of Figures 1 and 2 require only a single type of construction for both banks.

Although it will be apparent that the illustrated embodiments of my invention are well calculated to adequately fulfill the objects and advantages of my invention described above, it will be understood that my invention is susceptible of variations, modifications and changes within the spirit and scope of the appended claims.

I claim:

1. In an internal combustion engine having a cylinder head, a spark plug on said head, valve mechanism carried by said head and a dished cover enclosing said valve mechanism; a protective structure for said spark plug and the ignition lead therefor comprising a tubular member surrounding said plug and having one end secured on said head, the other end of said member being open and extending through the top of said valve mechanism cover, means forming a seal between said member and said valve mechanism cover and an ignition lead cover straddling said open end of said member and mounted on said valve mechanism cover.

2. In an internal combustion engine having a cylinder head, a spark plug relatively submerged in a well in said head, valve mechanism carried by said head, and a dished cover enclosing said valve mechanism and said well; a protective structure for said spark plug and the ignition lead therefor comprising an elongated tubular member entirely open at both ends and having one of its ends telescopically sealed in said well and its other open end extending through the top of said valve mechanism cover, means forming a seal between said member and valve mechanism cover adjacent said other end of said member and an ignition lead cover straddling said member at its said other open end and carried by said valve mechanism cover.

3. In an internal combustion engine having a cylinder head, a spark plug relatively submerged in a well in said head, valve mechanism carried by said head, and a dished cover enclosing said valve mechanism and said well; a protective structure for said spark plug and the ignition lead therefor comprising an elongated rigid tubular member surrounding said plug and open at both its ends, one end of said tube tightly interfitting with said well and the other open

end projecting outwardly from said well through said valve mechanism cover, means forming a seal between said member and valve mechanism cover adjacent said other end of said member, a dished ignition lead cover straddling said member at its said other open end and means securing said lead cover to said valve mechanism cover.

4. In an internal combustion engine having a cylinder head, a spark plug relatively submerged in a well in said head, valve mechanism carried by said head, and a dished cover enclosing said valve mechanism and said well; a protective structure for said spark plug and the ignition lead therefor comprising an elongated tubular member surrounding said plug and having one end secured in said well and the other end being open and extending through the top of said valve mechanism cover, means forming a seal between said member and said valve mechanism cover, and a rectangular pan-shaped ignition lead cover straddling said member at its said open end and secured to said valve mechanism cover, one end of said cover being provided with a lead wire aperture bounded on one side by said valve mechanism cover.

5. In an internal combustion engine having a cylinder head, a spark plug relatively submerged in a well in said head, valve mechanism carried by said head, and a dished cover enclosing said valve mechanism and said well; a protective structure for said spark plug and the ignition lead therefor comprising an elongated tubular member surrounding said plug and having one end secured in said well, and the other end extending through the top of said valve mechanism cover, a seal gland forming part of said valve mechanism cover and having a cylindrical extension coaxial with said member, a seal stop ring on said member, a pliable preformed seal ring on said member and in said gland, said ring being in sealing contact with said member and said extension, a cam-shaped seal pusher portion on said extension, and a dished lead wire cover straddling said member and secured to said valve mechanism cover.

6. In an oil and vapor seal for an internal combustion engine spark plug and ignition lead wire protective structure, a stationary tubular member, an annular stop shoulder on said member, a second tubular member surrounding and spaced from said first member and extending beyond said stop shoulder, a preformed pliable seal ring of O section arranged in the space between said members in sealing relation thereto and relative to said stop shoulder, said ring having a normal internal dimension under that of the external dimension of said first member and having a normal external dimension greater than the internal dimension of said second member, and a ring pushing and camming end on said second member for positioning said seal ring against said shoulder in assembling said structure and for effecting a compression of said ring to effect said seal.

7. In an internal combustion engine having a cylinder head, a spark plug relatively submerged in a well in said head, valve mechanism carried by said head, and a dished cover enclosing said valve mechanism and said well; a protective structure for said spark plug and the ignition lead therefor comprising an elongated tubular member surrounding said plug, said member being open at both ends and having one open end telescopically sealed in said well and having its other end open and extending through the top of said valve mechanism cover, means forming a seal between this cover and said member at a position within this cover, an ignition lead connected to said plug and extending over said member, an ignition lead cover straddling said other end of said member and said lead and means securing said ignition lead cover to said valve mechanism cover.

8. In an internal combustion engine having a cylinder head, a spark plug relatively submerged in a well in said head, valve mechanism carried by said head, and a dished cover enclosing said valve mechanism and said well; a protective structure for said spark plug and the ignition lead therefor comprising an elongated rigid cylindrical member surrounding said plug, said member having an internal transverse dimension sufficient to enable insertion therein of a socket wrench for removing said plug, said member having its external surface adjacent one end of said member forming a bond with said well, the other end of said member being open and extending through the top well of said valve mechanism cover to a predetermined point adjacent thereto, means forming a seal between said member and said valve mechanism cover adjacent the under side of said top wall, an ignition lead wire within said member having a terminal clip engaged with the terminal of said spark plug, a flashover shield surrounding said lead in said member and adapted for facilitating connection and disconnection of said lead terminal clip with said plug terminal, said lead wire having a portion thereof extending over said member and arranged to lie adjacent said valve mechanism cover, a shallow ignition lead cover straddling said member and ignition lead and in face-to-face contact with said top wall of said valve mechanism cover, and an aperture at one end of said ignition lead cover providing a lead outlet and ventilation port.

9. In an internal combustion engine having a pair of cylinder banks forming a V with each other, said banks being pitched downwardly longitudinally from the fan end of the engine when the latter is assembled in a vehicle, a plurality of longitudinally spaced cylinders in each bank, a cylinder head over the cylinders of each bank, valve mechanism carried by each head, a plurality of spark plugs relatively submerged in wells in said heads, one being over each cylinder, and a dished cover secured to each head and covering the valve mechanism of that head; a protective structure for said spark plugs and the ignition lead wires thereof comprising an elongated tubular member surrounding each spark plug and mounted in each well, said member having one of its ends secured in the well in which it is mounted and having its opposite end open and projecting through the top wall of said valve mechanism cover, means providing an elastic seal between each said member and said valve mechanism cover at a position within the latter cover, a detachable ignition lead wire connected to each said spark plug and extending over the tube in which it is connected, said lead wires being arranged to extend toward the low end of the cylinder bank in which they are connected, an elongated ignition lead cover straddling all said members and the lead wires emanating from the spark plugs therein, means securing said lead cover to said valve mechanism cover and a lead wire aperture at the longitudinal end of said lead wire cover which is at the

low end of the cylinder bank one side of said aperture being bounded by said valve mechanism cover.

10. A protective structure as claimed in claim 9 wherein the apertured end of the ignition lead cover is located at the end of the dished portion of said valve mechanism cover and has a downwardly sloping wall extending over the lead wires and over the end of said dished portion.

11. In an internal combustion engine having a pair of cylinder banks forming a V with each other, said banks being pitched downwardly longitudinally from the fan end of the engine when the latter is assembled in a vehicle, a plurality of longitudinally spaced cylinders in each bank, a cylinder head over the cylinders of each bank, valve mechanism carried by each head, a plurality of spark plugs relatively submerged in wells in said heads, one being over each cylinder, and a dished cover secured to each head and covering the valve mechanism of that head; a protective structure for said spark plugs and the ignition lead wires thereof comprising an elongated tubular member surrounding each spark plug and mounted in each well, said member having one of its ends secured in the well in which it is mounted and having its opposite end open and projecting through the top wall of said valve mechanism cover, means providing an elastic seal between each said member and said valve mechanism cover at a position within the latter cover, a detachable ignition lead wire connected to each said spark plug and extending over the tube in which it is connected, said lead wires being arranged to extend toward the low end of the cylinder bank in which they are connected, an elongated ignition lead cover straddling all said members and the lead wires emanating from the spark plugs therein and lead wire aperture means in a side wall of said lead wire cover facing the inner side of said V and in a portion of said side wall which is adjacent the end of the ignition lead cover corresponding to the low end of the cylinder bank.

12. A protective structure as claimed in claim 11 wherein there is a further aperture means in the opposite side wall of said ignition lead cover and adjacent the same end thereof as said first mentioned aperture means.

13. In an internal combustion engine having a cylinder head and a plurality of spark plugs mounted on said head in spaced relationship, each plug including a body portion and an ignition lead; a protective structure for said plugs and leads comprising tubular members surrounding the body portions of said plugs, one end of each of said tubular members being open and there being cover means carried by said head in spaced relationship to said members and straddling the said open ends of said members and said leads.

14. In an internal combustion engine having a cylinder head, a spark plug mounted on said head, valve mechanism carried by said head and a dished cover over said valve mechanism and plug; a protective structure for said plug and the ignition lead therefor comprising an elongated tubular member surrounding said plug and having one end projecting through an opening in said cover, a seal gland surrounding said member and forming part of said cover at said opening, said gland having a cylindrical extension coaxial with said member, a seal stop ring on said member, a pliable preformed seal ring on said member and in said gland, said seal ring being in sealing contact with said member and said extension, and a cam-shaped seal pusher portion on said extension.

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