Feb. 28, 1939. R. L. MEREDITH 2,149,027

SPARK PLUG SHIELD

Filed Aug. 2, 1929

Fig. 1.

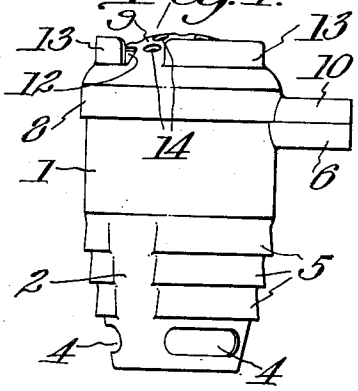


Fig. 2.

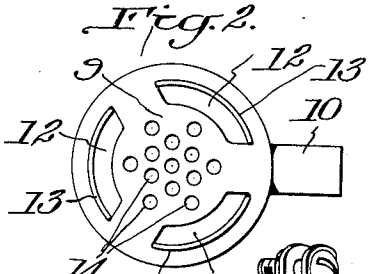


Fig. 3.

Fig. 4.

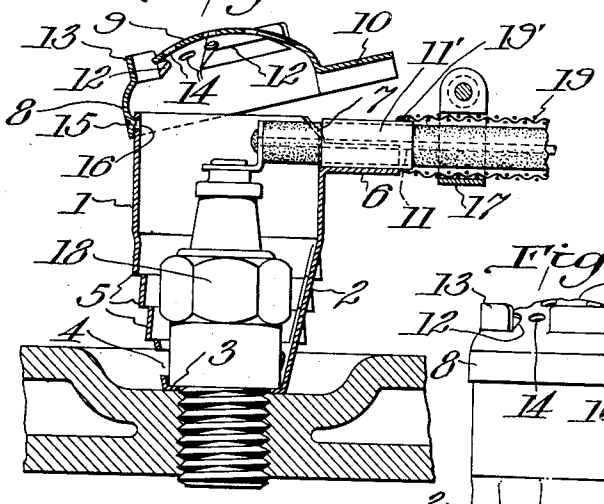


Fig. 5.

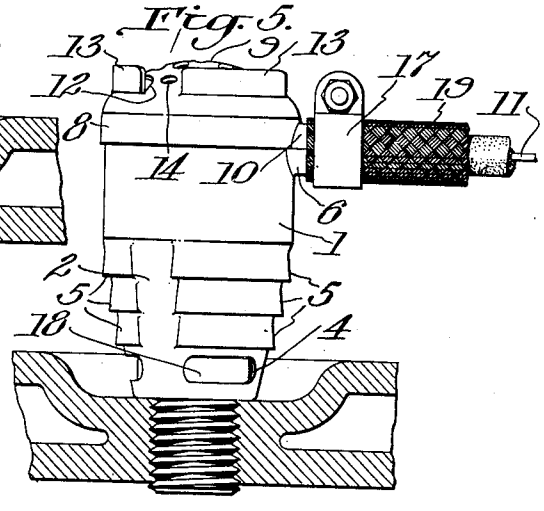
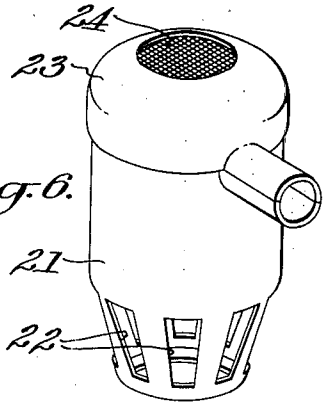


Fig. 6.



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Attorneys.

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UNITED STATES PATENT OFFICE

2,149,027

SPARK PLUG SHIELD

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Application August 2, 1929, Serial No. 383,019

26 Claims. (Cl. 123—169)

This invention relates to the mechanical construction of shields for reducing or eliminating the radiation of high-frequency waves from the spark plugs of motors employed with or adjacent a radio receiver or transmitter.

The invention is particularly useful in connection with the ignition systems of aeroplane engines but may of course be employed on marine or automobile engines when the radiation of electrical energy from such engines interferes with the operation of a receiver or transmitter carried by the boat or vehicle.

Due to the extreme sensitivity customarily required in aeroplane receivers and the location of the collector system near the engine, the ignition system must be carefully and completely shielded if weak signals are to be received; see "Proceedings of the Institute of Radio Engineers", Feb., 1929, pages 318–19. Although the shielding of the spark plugs in an otherwise completely shielded ignition system may result in a 40 to 1 reduction in the ignition noise level, it is a fact that up to the present time no large transport company has equipped its passenger carrying planes with shields for the spark plugs.

Spark plug shields and specially constructed shielded spark plugs have been proposed during the past few years, but such devices have been open to the objections that they did not satisfy all of the essential requirements, i. e., (*a*) provide adequate electrical shielding; (*b*) not affect engine reliability; (*c*) be of rugged mechanical construction and easily installed.

An object of the present invention is to provide a spark plug shield which satisfies all of the above requirements. A further object is to provide a sectional shield including a shell which is secured in place by the spark plug, and a cover which may be quickly and securely attached to the shell. More specifically, an object is to provide a ventilated shield composed of two or more parts, one part having the form of a shell which is clamped in place by the spark plug, and the other part or parts being secured to the shell by the clamp which serves to connect the shielding braid of the ignition wire to the shield.

These and other objects of the invention will be apparent from the following specification when taken with the accompanying drawing in which:

Fig. 1 is a side elevation of one embodiment of the invention,

Fig. 2 is a plan view of the same,

Fig. 3 is a perspective view of the shield clamp,

Fig. 4 is a vertical longitudinal section through a shield, the main shell being shown as clamped in place by the plug and the cap being somewhat removed from its final position,

Fig. 5 is a side elevation of the shield and a part of the associated ignition wire, and

Fig. 6 is a perspective view of another form of shield which embodies the invention.

In the drawing, the reference numeral 1 indicates the upper cylindrical portion of the main shell, the cylindrical portion merging into a conical lower portion 2 which terminates in an internal flange 3. The lower end of the conical portion 2 is provided with a series of apertures 4, and between the cylindrical part 1 and the row of apertures, additional apertures are provided by the louvers 5.

A flange 6 of semi-circular cross section projects from the cylindrical shell, the longitudinal axis of the semi-cylindrical flange being spaced from the upper edge of the shell, and the material of the shell being cut away, as indicated at 7.

The cap or cover for the shell comprises a short cylindrical portion 8 for telescoping engagement with the shell, a domed end 9, and a flange 10 of semi-circular cross section which cooperates with the flange 6 of the shell to form a tubular passage for the insulated ignition wire 11. The cap is ventilated by a series of openings 12 formed by stamping the flanges or louvers 13 from the end 9 of the cap, and by a plurality of smaller openings 14.

At points diametrically opposite the respective flanges, the cap and shell are provided with a pin or projection 15 and an aperture 16, which cooperate to form a separable or loose hinge connection between the parts of the shield. When the cap is positioned upon the shell, the parts are maintained in position by a clamp 17 which surrounds the semi-cylindrical flanges 6, 10.

The method of installing the shield will be apparent from Fig. 4. The spark plug 18 is inserted in the main shell and the plug is screwed into the cylinder head. The conical shape of the lower end of the shell provides clearance for the application of the usual socket wrench to the plug, and the plug seats against the inturned flange 3 to clamp the shell against the cylinder head.

The ignition wire 11 is preferably provided with a metal sleeve 11' to which the metallic shielding braid 19 is secured by solder 19'.

The clamp 17 is passed over the end of the ignition wire 11 and the metallic braid 19, and the terminal of the wire is attached to the spark plug in the usual manner. The cap is then applied to the shell, as shown in Fig. 4, and the clamp 17 is moved back over the flanges 6, 10 and adjusted to lock the cap in position upon the end of the shell.

It will be noted that the application of the clamp 17 to the shield accomplishes several important results. In addition to its primary function of completing the shield assembly, the clamp grounds the shielding braid 19 to the shell and, by pressure applied to the sleeve 11', it prevents the inadvertent displacement of the ignition wire.

The use of the metal sleeve 11' as the terminal section of the shielding on the ignition wire is to be preferred, but is not essential. When the sleeve 11' is omitted, the braid 19 is slipped over the flanges 6, 10 and the clamp 17 is then applied over the braid, as shown in Fig. 5.

Since the shell and cap must be ventilated to facilitate cooling of the plug, there is a finite leakage through the shield but the suppression of the interference may be substantially complete when the antenna is spaced from the engine by at least five feet. For example, in one particular test, no leakage through the ventilated shield was apparent on a receiver having a sensitivity of 5 microvolts per meter.

As shown in Fig. 6, portions of the shell 21 may be removed to provide a plurality of approximately rectangular openings 22 in the conical portion of the shell. The central portion of the cap 23 comprises a wire screen 24 which permits air currents to enter the shell but which substantially eliminates the leakage of high frequency currents through the top of the shield.

While the shape of and method of forming the ventilating openings are subject to considerable variation, I believe that the full advantages of the invention are attained when the openings are so located that the air currents within the shield are constrained to move axially of the plug. With such an arrangement, adequate cooling may be provided and the shield is satisfactory from the standpoint of moisture collection, as for example when flying through a rain storm, since the water is blown through the shield by the longitudinal air current and the small amount which reaches the terminals is quickly evaporated.

It is therefore unnecessary to employ the moisture-proof fillings which have been proposed in other types of shields, and which prevent cooling of the plugs.

The shields may be readily and economically manufactured from plates or tubes of a metal or alloy of low electrical resistance, such as, for example, soft copper. The shields may be installed without difficulty, and the additional time required for their installation is negligible.

The use of a main shell which is clamped between the plug and cylinder, and the arrangement of cooperating flanges which provide a tubular passage for the ignition wire and over which a single clamp may be placed to secure the parts to each other, are important features of the invention but it is to be understood that the invention is not limited to the particular constructions which I have illustrated and described. The main shell, may be attached to the plug by other means, for example, screws or clamps, but I prefer to employ the described construction in which the shell is clamped in place by the insertion of the plug.

It will be apparent that the shields constructed in accordance with this invention, do not impose any limitations upon the use of plugs of standard or accepted design. Plugs of special design and incorporating shielding elements in the plug structure have been proposed, but the present invention permits an operator to continue the use of the type of plug which, from his past experience, he believes to be best suited for his particular needs.

I claim:

1. A spark plug shield of the type including a plurality of separable parts for enclosing the plug and having a tubular passage for the introduction of the ignition wire, characterized by the fact that two of said parts separate substantially along a plane through the longitudinal axis of said passage, and a clamp surrounds said tubular passage for retaining the said parts in operative position.

2. A spark plug shield of the type including a plurality of separable parts for enclosing the plug and having a tubular passage for the introduction of a shielded ignition wire, characterized by the fact that two of said parts separate substantially along a plane through the longitudinal axis of said passage, and a clamp surrounds said tubular passage for retaining the said parts in operative position, said clamp also serving to hold the ignition wire against accidental displacement, and to ground the ignition wire shield to said plug shield.

3. A spark plug shield comprising a ventilated shell, a cap separable from and having a loose hinge connection to said shell, flanges projecting from said shell and cap, respectively, to define a passage through which the ignition wire may be led into said shell, and clamping means cooperating with said flanges to secure said cap to said shell.

4. A spark plug shield comprising a ventilated shell having a portion projecting inwardly from the lower end thereof for seating between a plug and the engine, a cap separable from and having a loose hinge connection to said shell, flanges projecting from said shell and cap, respectively, to define a passage through which the ignition wire may be led into said shell, and clamping means cooperating with said flanges to secure said cap to said shell.

5. A spark plug shield for use with a shielded ignition wire, said shield comprising a substantially tubular shell, an inwardly projecting flange at one end of said shell, said flange being adapted to seat upon a cylinder head and to be clamped thereto by the spark plug, a detachable cap for closing the other end of said shell, means providing an ignition wire passage through the wall of said shield, and means for securing the said cap to said shell.

6. A ventilated spark plug shield of the type stated comprising a substantially tubular shell having an internal flange at its lower end, a cap for closing the upper end of said shell, members carried by said cap and shell and cooperating to form a tubular passage for an ignition wire, and clamping means engaging said members to secure said cap to said shell.

7. A spark plug shield of the type stated comprising a ventilated shell having an inturned flange at its lower end for seating between a plug and the cylinder head, a cap for closing the upper end of said shell, and means for securing said cap to said shell, said securing means including elements providing a support for the ignition wire adjacent the point where it enters said shield.

8. A spark plug shield of the type stated, comprising a ventilated shell for enclosing the exposed portion of a plug, an inturned flange at the lower end of said shell, said flange being adapted to be clamped between the engine and plug when the plug is secured to the engine, a ventilated cap for said shell, flanges projecting from said shell and cap, respectively, and cooperating to form a tubular passage through which the ignition wire may pass, cooperating parts on said shell and cap connecting the same to each other at a point spaced from said flanges.

and clamping means surrounding said flanges for locking said cap to said shell.

9. A spark plug shield comprising a shell having an internal flange at the lower end thereof, the wall of said shell flaring outwardly from said flanged end to provide a clearance space between the upper portion of the shell wall and a plug housed within the shield, said flaring wall being apertured for ventilation of the shield, a flange extending laterally from the shell at a point below the upper edge thereof, said shell being cut away above said flange, a cap having a telescoping engagement with said shell, a flange projecting from said cap and cooperating with said shell flange to provide a passage through which the ignition wire may pass, and locking means engageable with said flanges for retaining the shell and cap in operative relationship.

10. The invention as set forth in claim 9, in combination with cooperating pin and slot elements on said cap and shell at points diametrically opposed to said flanges, said pin and slot elements providing a loose hinge connection between said cap and shell.

11. A spark plug shield for overcoming electrical radiation from a spark plug comprising a ventilated shell having an open top, a ventilated cap for closing said open top, and means for securing said cap to said shell, the ventilating openings in said shell being restricted to the lower portion thereof, said openings being so constructed and arranged that the air current established within said shield is constrained to move axially thereof.

12. A spark plug shield for overcoming electrical radiation from a spark plug comprising a shell for attachment to a plug, a cap, and means for securing said cap to said shell, said cap and only the lower portion of said shell being provided with ventilating openings, said openings being so constructed and arranged that the air current established within said shield is constrained to move axially thereof.

13. A spark plug shield for overcoming electrical radiation from a spark plug, of the type including separable elements defining a housing substantially enclosing the exposed portion of a plug, characterized by the fact that the lower position of said shield is conical shaped and provided at its extremities with ventilating openings positioned and arranged to establish an air current movable within and axially of said shield.

14. The invention as set forth in claim 13, wherein the intermediate portion of said shield is imperforate, and the ventilating openings are restricted in location to the top and bottom portions thereof.

15. A shield for a spark plug comprising a conical shaped lower shielding member, an upper shielding member detachably connected to said lower member, and an insulating member passing through the upper portion of the shield.

16. A device for shielding a spark plug to prevent the radiation of electrical energy therefrom comprising a casing formed of complementary sections, and means for pivotally connecting said sections to each other.

17. A device for shielding a spark plug to prevent the radiation of electrical energy therefrom comprising a casing formed of complementary sections, means for pivotally connecting said sections to each other, and means adapted to hold said sections in closed position in contact with each other.

18. In combination with a spark plug including a metal shell, and a shielded conductor therefor, a device for preventing radiation of electrical energy therefrom comprising a casing formed of complementary sections, and means adapted to hold said sections in contact with each other and in contact with the shielded conductor, and at least one of said sections in contact with the shell, said last section having a plurality of ventilating openings positioned to establish an air current movable within and axially of said shield.

19. A device for shielding a spark plug to prevent the radiation of electrical energy therefrom comprising a metallic casing formed of upper and lower complementary sections, means pivotly connecting said sections to each other, and means mechanically linking the adjacent edges of said sections and adapted to hold said sections in electrical contact with each other and in fixed position surrounding the spark plug.

20. In combination with a cylinder of an internal combustion engine, a spark plug therefor, a two-part electrical shield surrounding said plug and having an opening at the adjacent edges of said two parts for the reception of an ignition cable disposed with its longitudinal axis substantially perpendicular to the longitudinal axis of the plug, one of said parts being arranged for receiving the sparking end of the plug so that said end extends into said cylinder, and means for securing the two parts together.

21. In combination with a spark plug including a metal shell, and a shielded conductor therefor, a device for preventing radiation of electrical energy therefrom comprising a casing formed of complementary sections, and means adapted to hold said sections in contact with each other over an area which includes a plane passing through said conductor, and with one of the sections in contact with the shell.

22. As an article of manufacture for use with spark plugs, an upwardly flaring metallic ventilated, electrical shield surrounding a spark plug and a flange-like portion arranged to be in contact with a portion of a cylinder casing, into which the spark plug is fitted and with which the shell of the plug is in contact, said shield having a plurality of ventilating openings therein surrounding said plug.

23. A shield for an ignition device, and ventilating means for affording circulation of air around said device, said means including a plurality of louvers formed on the surface of the shield.

24. A shield for an ignition device, said shield comprising a plurality of sections which when assembled enclose a spark plug, and ventilating means for affording circulation of air around the plug, said means including a plurality of louvers formed on the surface of the lower part of the shield, the louvers being shaped to prevent decrease of the shielding action and to prevent injury when handling the shield.

25. An electrical shield having means for affording circulation of air within the shield, said means including a plurality of louvers formed on the surface of the shield.

26. In combination with a cylinder of a combustion engine, a spark plug therefor, a two-part electrical shield surrounding said plug and having an opening at the adjacent edges of said two parts for the reception of an ignition cable disposed at the juncture thereof, and means for securing the two parts together.

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