

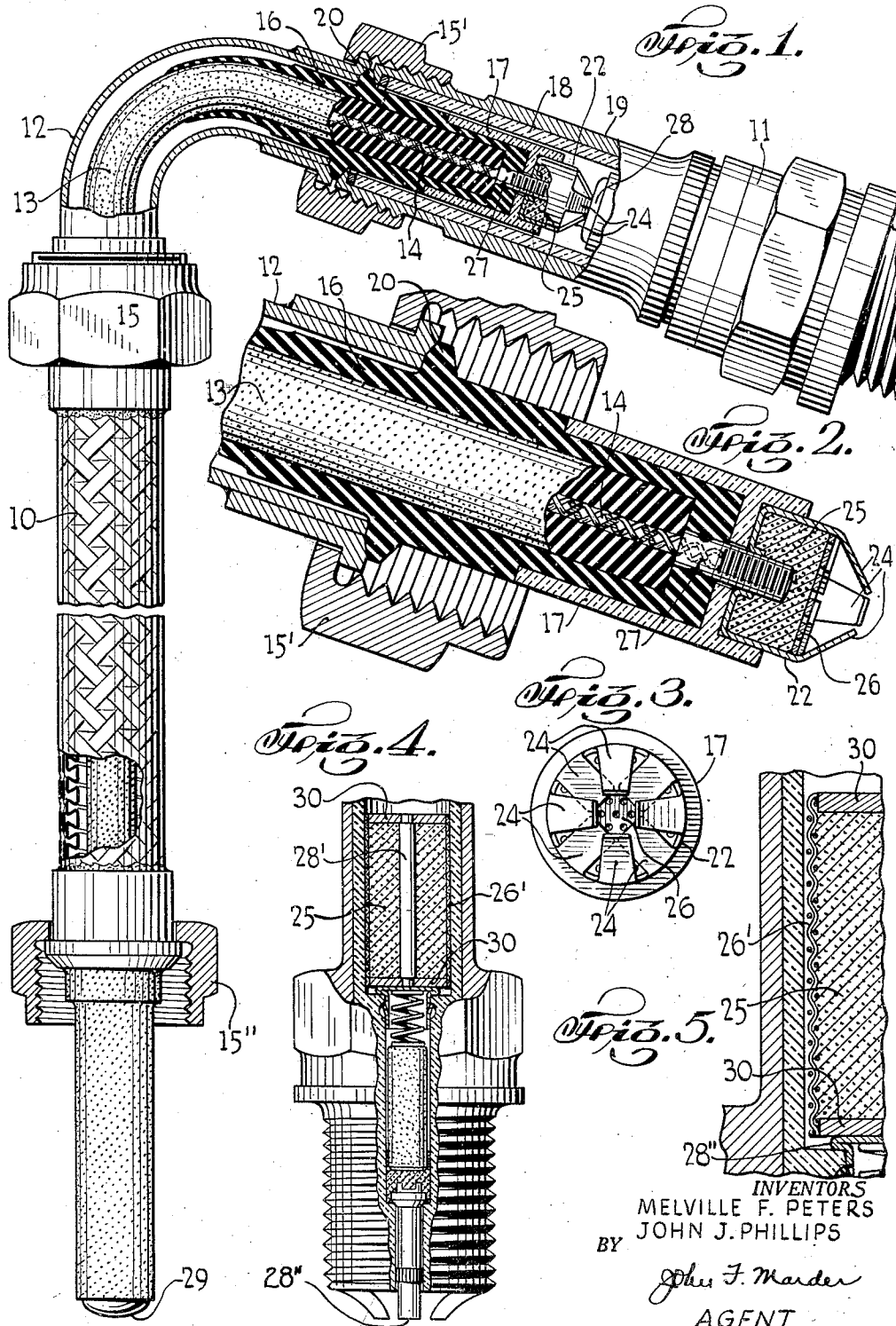
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DEHYDRATOR FOR IGNITION SYSTEMS

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DEHYDRATOR FOR IGNITION SYSTEMS

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5 Claims. (Cl. 315—85)

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This invention relates to improvements in ignition equipment for internal combustion engines and particularly to the devices used with a radio shielded spark plug of the style employed with aircraft power plants where it is required that complete metal jacketing be provided to cover the high tension current supply for the purpose of avoiding interference in the reception of radio communications.

Shielded spark plugs are well known in the aircraft industry. The types of electrical connection to the plugs from magnetos or from other current supply sources have been more or less standardized to meet operating and service conditions and usually comprise a spring-type connector of some description which is mechanically and electrically fastened to a shielded ignition cable. It is necessary to provide adequate insulation to preclude the possibility of "flash-over" from the open spring connection within the plug at magneto current potential to the metal barrel shielding the plug and to shielding fittings and devices at ground potential which are employed to jacket the cable conducting the current to the plug.

Even with the customary precautions of insulation, electrical "flash-over" is occasionally experienced between the open connection at the electrode in the plug and the shielding spark plug barrel. The tendency to flashover is aggravated by an accumulation of moisture within the barrel resulting either from plug leakage or from condensation. In the case of plug leakage, liquids from the products of combustion within the engine cylinder may pass the insulation adjacent to central electrode and find their way into the shielding barrel. This condition may be eliminated by the use of sealed electrode plug design as in the patent to Rabezzana, Number 2,336,569.

On the other hand, the condensation within the spark plug barrel resulting from cooling off of the engine is troublesome despite the use of sealed spark plugs. Such conditions of moisture and water vapor and the compounds formed by the potential gradients in the spark plug cause difficulties in starting aircraft engines.

Various expedients have been employed for overcoming difficulties of this sort due to moisture in the plug. Jelly-like compounds of petroleum and other oils have been inserted within the spark plug barrel so that air is excluded when the connection devices are assembled in the plug permitting no possible condensation. Also, for the same purpose, entire harnesses have been dehydrated using mechanical devices and controls.

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It is a principal object of this invention to provide a means by which an accumulation of water vapor can be absorbed before condensation on the elements of the plugs or on the electrical connecting devices. A further object of the invention is to provide a means for this purpose which is replaceable, inexpensive, and which may be adapted to standard shielded aircraft spark plugs.

Other and ancillary objects will be noted as the description proceeds. The novelty resides in the construction, combination, and arrangement of parts substantially as shown in the specification following, and as defined in the appended claims.

The invention contemplates solutions designed in the form of accessories to the spark plug connection and which are integral with the elements of the connection although such construction may not necessarily be considered the only solution for the purpose.

In the drawings,

Figure 1 is a side elevation partially sectioned, showing a flexible detachable style aircraft ignition lead assembled to a spark plug and employing our invention;

Figure 2 is an enlarged fragmentary section view of the connecting element employing the invention which is used within the spark plug barrel;

Figure 3 is an end view of the connecting element of Figure 2;

Figure 4 is a cut-away side view of the spark plug showing a modified form of the invention; and

Figure 5 is a fragmentary section of the cut-away in Figure 4.

Referring now to the drawings, wherein like numerals are used to designate like parts throughout the several views, numeral 11 refers to a shielded aircraft spark plug which in service is associated with a cylinder of an internal combustion engine, not shown, in a conventional manner.

A supply of current to the spark plug is provided through a flexible detachable shielded spark plug lead; parts of the lead include a flexible metal conduit 10 to shield and protect the ignition cable between relatively moveable parts and an elbow attached to the flexible conduit for directing the ignition cable at a pre-determined angle to the spark plug. An insulated cable 13 is disposed within the assembly of flexible conduit and elbow and terminates at one end in the flexible electrical connection element 29 for establishing contact with suitable elements of an ignition shielding harness, not shown. Projecting

from the other end of the lead are certain parts to be described later forming an electrical connection to the spark plug electrode 23. Conventional threaded connecting devices 15, 15' and 15'' provide mechanical connections between conduit 10 and elbow 12; elbow 12 and spark plug barrel 19; and conduit 10 and a suitable connector; not shown, at the ignition manifold, respectively.

Referring now to Figure 2, the electrical connection which is constructed to fit within the spark plug barrel to provide contact with the spark plug electrode 23 is shown separated from the spark plug 11. The conductor cable 13 forming a part of this connection includes a metallic conducting element 14 suitably insulated which is directed from connection 29 and which projects from within the shielding elbow 12. A flexible rubber sheath 16 is disposed in gas tight association over the projecting end of cable 13 and serves to position the cable centrally within the elbow and within the spark plug barrel and also insulates cable 13. It will be noted here that this sheath 16 extends slightly beyond the end of the conducting cable, and that a circumferential ledge 26 is disposed about the sheath 16 at the location of the abutment of spark plug 11 and elbow 12. The purpose of this ledge is to provide a moisture seal at this joint where the spark plug nut forming a part of connection 15' is drawn up on the male threads provided on spark plug barrel 19. A relatively rigid insulating member 17 is disposed over the end of the flexible sheath 16 providing a terminal to the insulation which is less destructible physically and electrically than the flexible insulating material of sheath 16. The material chosen for the rigid insulator 17 may be ceramic or other insulation which is not likely to "carbon track" if a flash-over should occur at the open connection within the spark plug barrel at the spark plug electrode. In an actual occurrence of electrical flashover, it would be necessary for a spark to jump the gap between the connection at the spark plug electrode 23 and the spark plug barrel at its junction with spark plug elbow 12. This is the case since the inner cylindrical surface of the spark plug barrel is insulated by a ceramic or mica sleeve 18 which has less tendency to break down than the air gap from electrode 23 to the barrel 19 at its junction with an elbow 12.

A threaded stud connection 27 is provided at the termination of the conductor 14 of cable 13. This stud may be fastened to conductor 14 mechanically and electrically by means of a crimped connection or by soldering. Stud 27 may be hollow if it is desirable to supercharge the spark plug barrel by directing a flow of air under pressure through the conductor 14. As shown in the drawings, a circular bore is provided in the end of flexible sheath 16 and in the web of the relatively rigid insulating element 17 permitting passage therethrough of stud 27 so that the threaded portion of stud 27 projects out beyond the assembly.

A cylindrical shell 22 preferably constructed of beryllium copper or stainless steel is fastened to the stud 27 so that its base abuts the web of the insulator 17 holding it in place over the flexible insulating sheath 16. Four spring fingers 24 are suitably formed on the end of shell 22 to serve as a spring-type connector when associated with the spark plug electrode 23.

It will be noted here that the assembly of rigid insulator 17 and flexible insulator 16 form a sub-

stantially cylindrical projection which projects from the spark plug elbow 12 and which has approximately the same outside measurement as has the inside diameter of the insulating lining 18. This construction permits assembly with a minimum amount of precluded air within the spark plug barrel.

Within the shell 22 is disposed a quantity of dehydrating material 25 such as silica gel or activated alumina. A perforated disk 26 retained in place by four additional fingers 24 formed integrally with the shell 22 and bent at right angles to the walls of the shell, shown more clearly in Figure 3, is used to provide mechanical support for the dehydrating material and still permit any gas surrounding the shell to penetrate the dehydrating material. The quantity of dehydrating material used may be varied with the design of the connector assembly and should be sufficient to meet average operating conditions. Such an assembly of parts provides for an electrical connection to the spark plug by the association of the metal conducting elements comprising conductor 14, stud 27, and shell 22, and also would provide for removing moisture or water vapor which collects within the spark plug barrel.

As an alternative to the use of a shell of this description, a cylindrical container, as shown assembled within a spark plug in Figure 4, may be used. Figure 5 is an enlarged fragmentary detail of part of the construction of Figure 4. This container comprises a central conducting core 28' at the ends of which are rigidly fastened metal washers 30. The dehydrating material 25 is retained in place about core 28' by a loosely woven metal wrapper 23' which terminates at, and is attached to, the washers 30 as by soldering. In the use of such an assembly it is necessary to increase the length of the spark plug barrel beyond that which is conventionally used in order to accommodate the increased length of the open connection extending upwardly toward the non-insulated portions of the shielding assembly.

The lower washer 30 serves to contact the central spark plug electrode 23'', which in this modification is shown as a leakproof style electrode similar to that of United States Patent 2,336,569, and the upper washer 29 provides a suitable element against which a conventional spring contactor for carrying high tension current may be resiliently attached. Intermediate of the two washers 30, the metal core 28' and retaining screen 29' will conduct current to the electrode 28'' during the interval of ignition current supply. As in the case of the previous description of Figs. 1 and 2, a seal 28 may be provided at the abutment of the shielding barrel top and the shielding conduit 12 associated therewith to prevent moisture entering the barrel.

The quantity of material in the liquid state which condenses within the barrel of a shielded spark plug when an aircraft engine has cooled depends upon the dew point of the vapor in a gaseous state within the plug during operation. An extremely fine film of this liquid is sufficient to cause misfiring, particularly inasmuch as the impurities in the condensed vapor are usually both nitrogen-oxygen compounds and carbon dioxide, and perhaps some oxides of sulfur all of which impart relative conductivity to water.

In operation of the engine, the dehydrating material used either as in shell 22 of Figure 2 or cylindrical container 28' of Figure 4, serves to absorb vapors during engine cooling before they condense on the walls of the spark plug sleeve and

the connector assembly, and hence insures efficient starting. During operation, and as the engine temperature increases, the water vapor will be driven off from the dehydrating agent. However, this causes no harmful electrical effects since it is then in a gaseous state. If after a period of time the effectiveness of the dehydrating agent has been affected by gases, a replacement dehydrating container may be substituted for the defective unit.

While the invention has been illustrated in what is considered to be its best application, it may have other embodiments without departing from its spirit and is not therefore limited to the structure shown in the drawing.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A terminal assembly for connecting a flexible radio-shielded spark plug lead with a spark plug that has a shielding barrel and an electrode located in the lower portion of the barrel, said assembly including an insulated cable for conducting current, a flexible metallic shield surrounding the insulated cable, a shoulder on the sleeve, a nut that threads on the upper end of the barrel and that abuts against the shoulder on the shield for connecting the shield with the barrel, means to seal the shielding barrel from the atmosphere including a sheath that surrounds the insulated cable in the region of said shoulder and that has a portion which is clamped between the end of the metallic shield and the end of the barrel, a relatively rigid insulating element that surrounds the end of the insulated cable beyond the metallic shield, said element being of substantially the same diameter as the inside diameter of the barrel so as to fill a substantial volume of the interior of the barrel and thus reduce the amount of air or gas within the barrel, a metal dehydrant container at the lower end of said insulating element and detachably connected to the end of the cable, a perforated closure for the lower end of the container, and a plurality of axially-spaced fingers comprising integral extensions of sides of said container, some of said fingers being bent over to retain the closure in place and other of the fingers converging toward one another and comprising resilient contacts that bear against the electrode in the barrel to complete the ignition circuit.

2. A terminal assembly for connecting a flexible radio-shielded spark plug lead with a spark plug that has a shielding barrel and an electrode located in the lower portion of the barrel, said assembly including an insulated cable for conducting current, a flexible metallic shield surrounding the insulated cable, means for connecting the shield to the upper end of the barrel, means to seal the shielding barrel from the atmosphere, structure on the end of the cable beyond the end of said shield and filling a substantial part of the volume within the barrel to reduce the volume of gas within the barrel, and a perforated container for dehydrating material within the barrel for absorbing moisture contained in any air or gas that leaks into the sealed interior of the barrel, said container including

metal contact means that bear against the electrode and at least a portion of said container comprising a conductor for completing the ignition circuit between the end of the cable and said electrode.

3. In a radio-shielded ignition system having a spark plug with a shielding barrel, an electrode at the lower end of the barrel, an insulated ignition cable, a flexible metallic shield around the ignition cable, and means for sealing the barrel from the atmosphere, the combination with said cable of a perforated container for dehydrant material, detachable fastening means connecting the container to the end of the cable within the barrel and comprising the conductor for the ignition circuit between the end of the cable and the electrode, the container having resilient fingers at its lower end for contact with the electrode.

4. An ignition system including in combination a spark plug having a shielding barrel, an electrode having a surface exposed to the interior of said barrel, a lead having a shield connected with the barrel and an insulated cable that extends into the barrel for supplying current to the electrode, means sealing the barrel from the atmosphere, and a container positioned within the barrel and filled with dehydrating material.

5. The combination with a spark plug having an electrode and a shielding barrel extending for a substantial distance above the electrode, of a spark plug lead including an insulated cable that extends into the barrel and that is electrically connected with the electrode, and a shield connected with the upper end of the barrel and covering the insulated cable beyond the barrel, a container filled with dehydrating material, said container being perforated for communication of its interior with the air or gas within the barrel, and said container being located in the lower end of the barrel and in heat conducting relation with the lower portion of the plug so that the material in the container becomes hot enough for moisture to be driven off when the plug is in use and in preparation for absorbing moisture in the barrel as the plug cools after use and before the plug has cooled enough for water vapor to condense within the barrel.

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