June 22, 1943. C. J. JOHNSON 2,322,448

IGNITION DISTRIBUTION SYSTEM

Filed Aug. 21, 1941 2 Sheets-Sheet 1

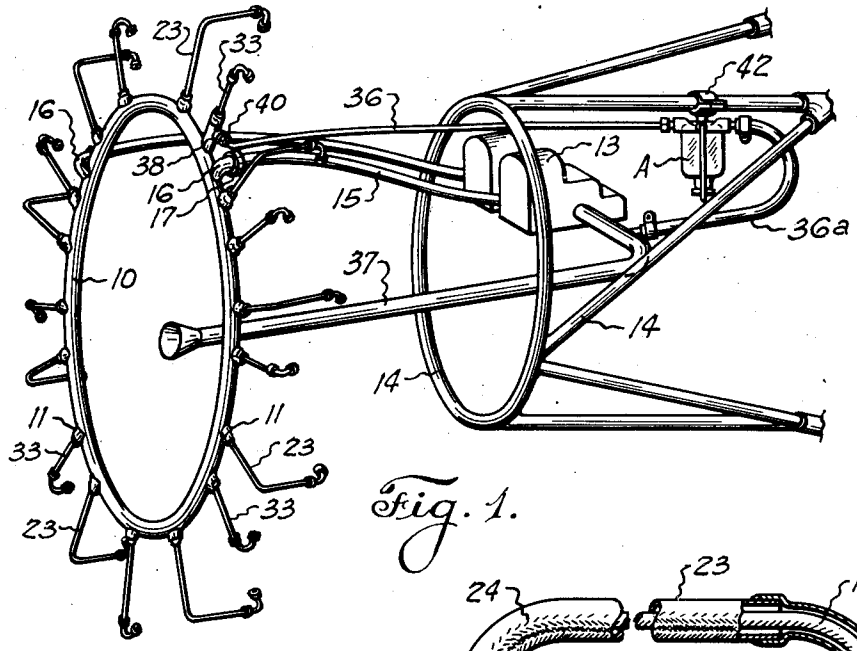


Fig. 1.

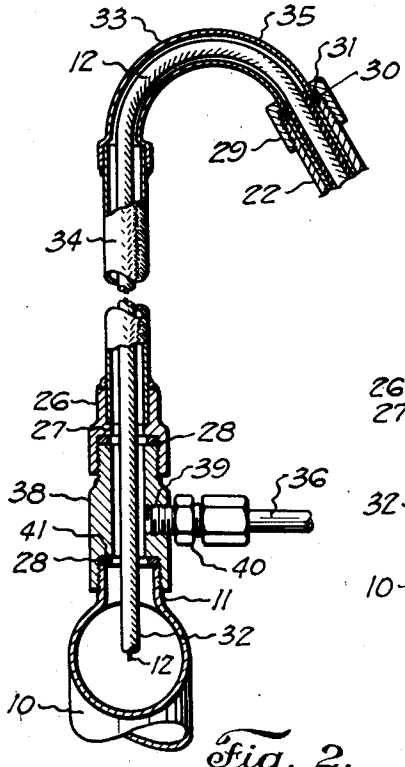


Fig. 2.

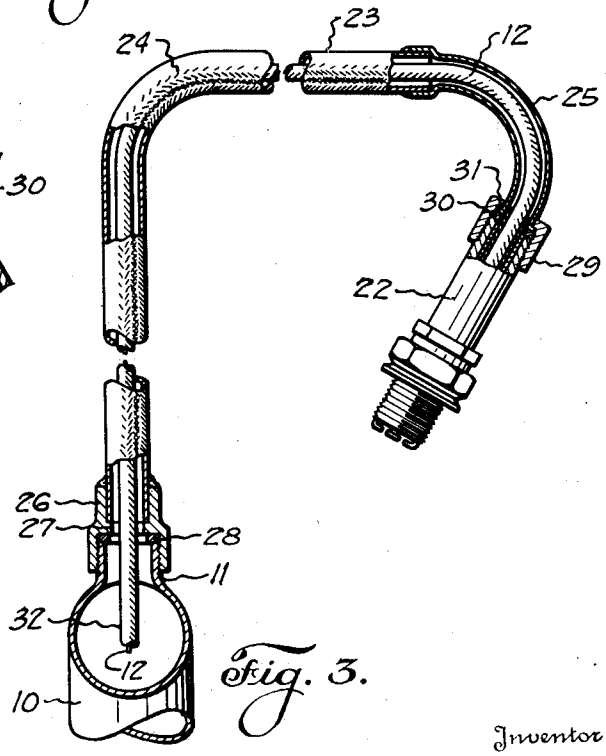


Fig. 3.

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IGNITION DISTRIBUTION SYSTEM

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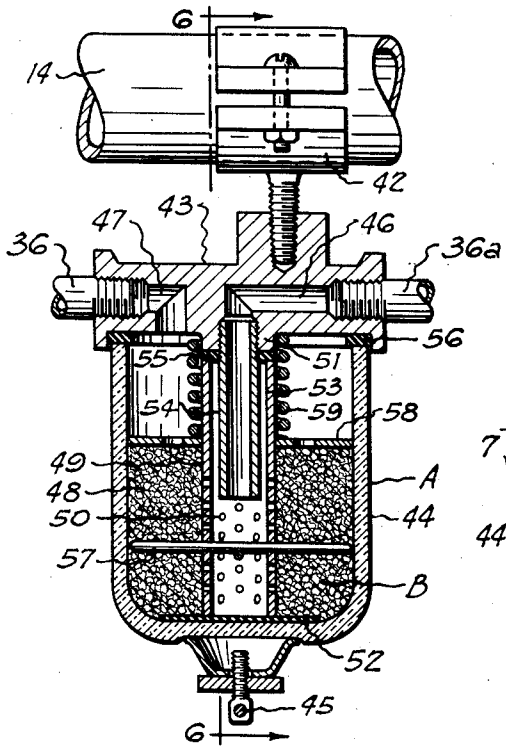


Fig. 5.

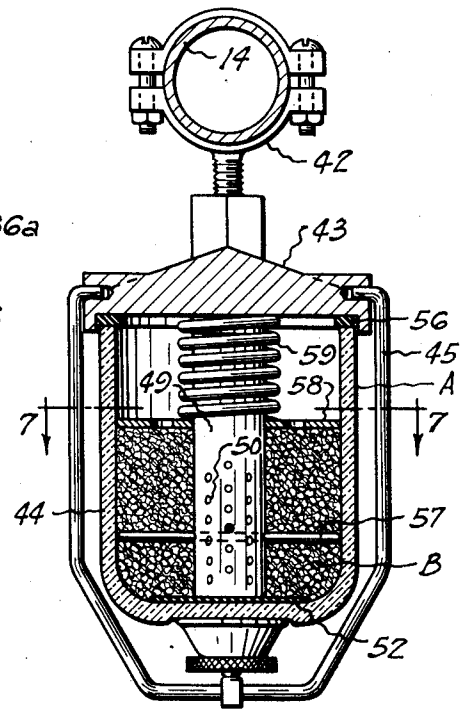


Fig. 6.

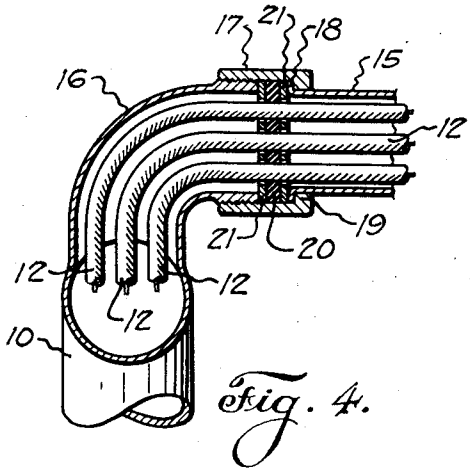


Fig. 4.

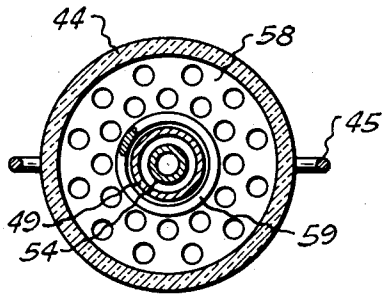


Fig. 7.

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UNITED STATES PATENT OFFICE

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IGNITION DISTRIBUTION SYSTEM

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8 Claims. (Cl. 123—148)

This invention relates to new and useful improvements in ignition distribution systems.

One object of the invention is to provide improved means for dehydrating the air present within an airplane or other aircraft ignition distribution system which is so constructed as to eliminate moisture from the air in the system, which moisture is highly detrimental to said system due to the fact that it is the primary cause of ignition failure or flash-over.

An important object of the invention is to provide an improved ignition distribution system, wherein the interior of the system communicates with atmosphere to automatically equalize the internal and external pressures of said system, thereby obviating the leakage of air through the joints thereof, together with means for dehydrating the air which is admitted to the system, whereby the air within said system is maintained substantially moisture-free.

Another object of the invention is to provide an improved ignition distribution system, of the character described, wherein a suitable dehydrating unit is provided for absorbing the moisture entrained in the admitted air prior to its passage into the system, whereby a substantially dry, moisture-free air is delivered to said system; the system being so constructed that a reduced volume of air flows through the system, with the result that a minimum quantity of absorbent may be employed to obtain efficient dehydration.

A particular object of the invention is to provide an improved ignition distribution system which is electrically shielded and which includes a dehydrator, containing a suitable indicative absorbent, such as activated alumina or silica gel, connected in the fresh air, pressure-equalizing line, whereby only dry air is admitted to the system and whereby the dehydrating or absorbing capacities of the absorbent may be readily and visibly determined at all times.

A further object of the invention is to provide an improved ignition system, of the character described, which is of relatively simple, economical construction and maintenance and which may be constructed by merely converting the standard shielded ignition system to accomplish the improved results.

Still another object of the invention is to provide an improved method of maintaining an electrical ignition system free from detrimental extraneous matter which includes establishing communication between the interior and exterior of the system so as to maintain an air pressure within said system substantially equal to the surrounding atmospheric pressure and dehydrating the air within the interior of the system to remove moisture therefrom.

The construction designed to carry out the invention will be hereinafter described together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, as an example of the invention is shown, and wherein:

Figure 1 is an isometric view of an ignition distribution system, constructed in accordance with the invention,

Figure 2 is an enlarged view, partly in section and partly in elevation, showing the connection between the pressure-equalizing line and one of the forward spark plug conduits of the manifold,

Figure 3 is a view, similar to Figure 2, showing the details of construction of one of the rear spark plug conduits and its connection to the manifold as well as the spark plug,

Figure 4 is an enlarged, vertical, sectional view of the connection between the manifold and the conduit from one of the magnetos,

Figure 5 is an enlarged, transverse, vertical, sectional view of the dehydrator,

Figure 6 is a similar view taken on the line 6—6 of Figure 5, and

Figure 7 is a horizontal, cross-sectional view, taken on the line 7—7 of Figure 6.

In the drawings, the numeral 10 designates the usual annular, tubular ignition manifold, having radially-disposed nipples or bosses 11, which is adapted to be mounted on the forward portion or surface of an airplane engine of the radial type. The manifold contains the conventional ignition wires 12 (Figures 2 and 3) and is provided for the purpose of electrically shielding said ignition wires from the highly sensitive radio receivers which might be mounted within the airplane. One or more magnetos 13 are mounted behind the engine support or frame 14 and are connected to the manifold 10 by means of a metallic tube 15 and a suitable elbow 16 which is made integral with said manifold. It is preferable to provide a detachable connection between the tube 15 and the elbow 16, such as the flanged coupling collar 17 which is telescopically mounted on said tube and which is adapted to be screw-threaded onto said elbow, as shown in Figure 4. An annular, outwardly-directed flange 18 is formed on the forward end of the tube 15 and coacts with the complementary internal flange 19 of the collar 17 to fasten said tube to the elbow 16. For sealing off around the ignition wires 12 which extend

through the tube 15 from the magnetos to the manifold so as to prevent the passage of air from said manifold to said tube and magneto, a circular gasket 20, of neoprene, rubber or other suitable material, is clamped within the collar 17 between the flange 18 and the end of the elbow 16. Metallic reinforcing disks 21 are preferably disposed on each side of the gasket 20 so as to prevent undue distortion thereof. As is clearly shown in Figure 4, the ignition wires 12 extend through openings formed in the gasket and disks, said gasket snugly engaging the wires to pack or seal off therearound so as to prevent the passage of air or other extraneous matter from the tube 15 to the elbow 16.

The ignition wires 12 project outwardly from the manifold through the bosses or nipples 11 and have their outer ends individually connected to the forward and rear spark plugs 22 of the engine as shown in Figures 2 and 3. For electrically shielding the portion of each rear ignition wire between the manifold and its respective spark plug, a metallic conduit 23 is provided and includes a flexible tube 24 and a rigid tubular elbow 25 (Figure 3). The tube 24 is preferably constructed of a metallic braided casing or armor and has a coupling collar 26 secured to its inner end by means of soldering, welding, or other suitable means, which collar is screw-threaded onto one of the nipples or bosses 11. The inner end of the tube 24 abuts an internal, annular flange 27 formed within the bore of the collar 26 so as to strengthen the connection between said tube and said collar. For sealing off the joint between the nipple 11 and the collar 26, an annular gasket or washer 28, of copper or other suitable distortable metal or material, is interposed between the end of the nipple and the shoulder formed by the flange 27 of the said collar. It is pointed out that the gasket 28 preferably has substantially the same diameter as the flange 27, which is spaced from the ignition wire 12, so as to permit the free passage of air between the manifold and the conduit 23. The outer end of the tube 24 is soldered, welded or otherwise secured to the elbow 25 which, in turn, has a flanged coupling collar 29, similar to the collar 17, telescopically mounted on its outer end. The collar 29 is adapted to screw-thread onto the spark plug 22 and provides a removable connection between the conduit 23 and said spark plug. An annular copper gasket 30, similar to the gasket 28, is confined within the collar and is clamped between the outer end of said spark plug and the flanged end 31 of the elbow 25 and seals the screw-threaded joint, the internal diameter of said gasket being greater than the outer diameter of the wire 12, which is enclosed in the usual insulation 32, whereby an annular air space establishing communication between the conduit and spark plug is had.

The conduits 33 for the forward spark plugs are substantially the same in construction as the conduits 23, the only differences being that the flexible tube 34 of each conduit 33 is of less length than the tube 24 while the angle of the rigid elbow 35 is greater than that of the elbow 25. Since the connections between each conduit 33 and its spark plug and the manifold are exactly the same as that hereinbefore described and illustrated in Figure 3, a detailed description and illustration of the same is thought to be unnecessary. However, it is noted that such connection includes the coupling collars 26 and 29 and the gaskets 28 and 30. The foregoing is a description of a typical installation of an ignition system or harness for airplane or other aircraft engines of the radial type which in itself forms no part of the present invention, with the exception of the provision of the copper washers or gaskets which tend to prevent leakage at the joints of said system but do not interfere with the circulation of air through the system as do the usual rubber grommets for which said gaskets have been substituted. However, it is pointed out that to date no absolutely air-tight, leak-proof ignition system or harness has been devised and no claim to such ignition system is made herein.

Since it is virtually impossible to construct an air-tight, leak-proof ignition distribution system or harness, it has been found desirable to equalize the internal and external pressures of said system so as to prevent leakage of the joints or connections thereof. Of course, the surrounding external or atmospheric pressure is subject to variation in accordance with the altitude and the air speed or rate of movement of the aircraft upon which the system is installed. Also, the pressure of the air within the system varies in accordance with the altitude.

To accomplish this equalization of pressures, improved means has been provided and such means includes a pipe or line 36 which establishes communication between the manifold 10 and the conventional air-blast or induction tube 37 of the magneto 13. For connecting the line 36 to the manifold, a swedged coupling collar or adapter 38 is interposed between the collar 26 of one of the forward spark plug conduits 33 and one of the nipples 11 of said manifold and is provided with an internally screw-threaded, radial port or opening 39 which communicates with its bore. The inner end of the line 36 is detachably fastened to the adapter by a suitable union 40 which is screw-threaded into the port 39, whereby air may be admitted to and released from the manifold and the ignition conduit by means of said line so as to maintain a pressure within the ignition system substantially equal to that of atmospheric pressure at all times.

As is clearly shown in Figure 2, the bore of the adapter is provided with a counterbore to form an internal, annular shoulder 41 at its lower end for receiving one of the copper gaskets 28 which is clamped between the shoulder and the end of the nipple 11. Of course, another one of the gaskets is disposed between the outer end of the adapter and the flange 27 of the collar 26. Since all of the screw-threaded joints of the ignition system are sealed by means of gaskets and since air is freely admitted to and released from said system, it is obvious that said joints are substantially air-tight and leak-proof and that the pressure within said system is equalized with the surrounding atmospheric pressure.

For controlling the moisture content of the air admitted to the ignition system, a dehydrating unit A is connected to the outer end of the line 36 and is preferably supported by a clamp 42 which is attached to one of the legs of the engine support or frame 14 as shown in Figures 1, 5 and 6. The dehydrating unit includes a circular head or cap member 43, of metal or other suitable material, from which a transparent filter bowl 44, of glass or other suitable material, is suspended by means of the usual U-shaped bail or clamp 45. An angular inlet port 46, for receiving the inner end of the hose 36a which is connected to the tube 37, is formed within the cap member 43, while the

outer end of the line 36 communicates with a diametrically-opposed angular outlet port 47 whereby air passing through the hose and line must flow through the chamber 48 of the bowl 44.

A cylindrical sleeve 49, having its lower portion perforated as shown at 50, is axially-disposed within the chamber 48 between the bottom thereof and an annular, depending boss 51 which is made integral with the cap member 43. The sleeve 49 is supported on a circular gasket 52, of neoprene, rubber or other suitable material, and is of a sufficient length to have its upper end engaging the boss 51, which surrounds the inner end of the inlet port 46, when the bowl 44 is fastened in position by the bail or clamp 45. Although the external diameter of the sleeve is substantially equal to the external diameter of the boss, said sleeve is provided with an enlarged bore 53 for receiving an axially-depending tube 54 which is screw-threaded within the inner end of the inlet port 46.

For sealing off between the sleeve 49, boss 51 and tube 54, an annular packing ring 55, of sponge rubber or other suitable material, surrounds said tube and is confined between the upper end of said sleeve and the lower end of said boss. A similar packing ring 56 may be interposed between the upper end of the bowl 44 and the lower surface of the cap member 43. It is pointed out that the sleeve 49 is positioned axially within the bowl 44 by means of diametric spacer rods or bars 57 which extend through the perforated portion of said sleeve.

Although the tube 54 is of considerably less length than the sleeve 49, the lower end of said tube extends into the perforated portion of said sleeve whereby air passing through the hose 36a into the port 46 is directed into the perforated portion by the tube. The air then flows through the perforations into the chamber 48 and upwardly and outwardly through the port 47 which is in direct communication with said chamber. For dehydrating this air, the lower portion of the chamber 48 exteriorly of the sleeve 49 is filled with a suitable indicative absorbent B, such as silica gel or activated alumina. Sufficient absorbent is employed to cover the perforations 50 of the sleeve 49 and said absorbent is confined within the lower portion of the chamber 48 by means of an annular perforated plate 58 and a coil or helical spring 59 which surrounds the boss 51 and said sleeve.

The plate 58 has an external diameter substantially equal to the internal diameter of the bowl 44 and has an internal diameter substantially the same as the external diameter of the sleeve 49, whereby the outer and inner peripheries of said plate have a snug sliding engagement with said bowl and sleeve. Due to the fact that the spring 59 is confined between the cap member 43 and the plate 58, said spring is constantly exerting its force to urge said sleeve downwardly so as to compress the absorbent and prevent agitation and consequent disintegration thereof.

From the foregoing, it will be obvious that by the herein described method the air present within the ignition system is always of a pressure substantially equal to that of atmospheric pressure, that is, the surrounding or external air pressure. Due to the provision of the pressure equalizing line and hose, the joints and/or connections of the ignition system are substantially air-tight and leak-proof because of the elimination of pressure-differential thereacross; while the provision of the dehydrator A assures the delivery of a dry, moisture-free air to said system. Air admitted to the hose 36a from the tube 37, flows through the inlet port 46 of the dehydrator A, through the tube 54 into the perforated portion 50 of the sleeve 49, and then outwardly into the absorbent-filled portion of the chamber 48 of the bowl 44. Due to the nature of the absorbent, the air is dehydrated as it passes upwardly through said absorbent into the upper portion of the chamber and is substantially dry and moisture-free when it reaches the outlet port 47. From the outlet port, the air flows through the line 36, through the union 40 and into the counterbore of the adapter 38, from which it is distributed through the ignition system including the manifold 10 and the rear and forward spark plug conduits 23 and 33.

Of course, during ascension of an aircraft equipped with the hereinbefore described improved ignition distribution system, the air within the system expands and escapes through the adapter 38, pipe 36, dehydrator A and blast tube 37. However, upon descension of the aircraft, the air within the system contracts so that additional dry air may enter to said system as has been hereinbefore fully explained.

It is pointed out that the provision of the dehydrator A not only dehydrates the air admitted to the ignition system but also the introduction of such dehydrated air within said system causes the same to admix or combine with the air already in said system so as to lower the moisture-content thereof, whereby the presence of moisture within said system may be eventually and completely eliminated. It is also pointed out that the expanded air ejected from the ignition system must pass through the absorbent before it can escape into the blast tube 37 which obviously causes or brings about further dehydration of the air present within said system. Due to the use of equalization of pressure, only a relatively small quantity of air passes through the dehydrator in normal operation, whereby the capacity of said dehydrator and the amount of absorbent employed may be relatively small. Thus, a dehydrated, pressure-equalized, ignition distribution system of economical construction and operation is provided. The maintenance of this system is also economical because, due to the small quantity of air passing through said dehydrator, it is only necessary to infrequently renew the absorbent. Since the bowl 44 of the dehydrator A is constructed of glass or other transparent material, and since the absorbent is indicative of its moisture content by change in color, the condition of said absorbent may be visually observed whenever desired. Of course, whenever the absorbent becomes saturated with moisture, the same is removed and reactivated by evaporating the moisture therefrom. Manifestly, any dehydrator would be suitable for the purposes of this invention, although a particular type of dehydrator has been described and illustrated herein.

The foregoing description of the invention is explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What I claim and desire to secure by Letters Patent is:

1. In combination with the ignition system of an internal combustion engine, means for enclosing the system, means for maintaining the

air pressure within said enclosing means substantially equal to the surrounding atmospheric pressure, and means for substantially dehydrating the air within the enclosing means to provide a moisture free air.

2. In combination with the ignition system of an internal combustion engine, means for enclosing the system, means for controlling the intake and exhaust of air into and from said enclosing means, and means for dehydrating the air at the time it is admitted to the enclosing means to maintain substantially a dry air having a pressure substantially equal to surrounding atmospheric pressure within said means.

3. An ignition distribution system including, a housing enclosing the system, means for admitting and releasing air to and from the housing, and means for dehydrating the air prior to its admittance to said housing, whereby a dry, moisture-free air of a pressure substantially equal to the surrounding atmospheric pressure may be maintained within the housing.

4. An ignition system including, a container enclosing and spaced from the system, and means for maintaining a substantially dry air of a pressure substantially equal to the surrounding atmospheric pressure within the space between the container and system, whereby ignition failure due to the presence of moisture is eliminated.

5. In combination with the ignition system of an internal combustion engine, a closed housing surrounding the system, a pressure-equalizing line connected to the housing and open to atmosphere for admitting and releasing air to and from said housing so as to maintain the air within the housing at a pressure substantially equal to atmospheric pressure, and a dehydrator connected in the line for absorbing the moisture contained in said air, whereby only substantially dry, moisture-free air is admitted to said housing.

6. The method of maintaining an electrical ignition system free from detrimental extraneous matter, wherein the system is enclosed, which includes, establishing communication between the external atmosphere and the interior of the enclosure to substantially equalize the external and internal pressures, and dehydrating the air within said enclosure, whereby only substantially dry, moisture-free air of a pressure substantially equal to the external atmospheric pressure is maintained within the enclosure.

7. The method of maintaining an electrical ignition system free from detrimental extraneous matter, wherein the system is enclosed, which includes, setting up communication between the external atmosphere and the interior of the enclosure to substantially equalize external and internal pressures, and dehydrating the air as it is admitted to said enclosure, whereby only substantially dry, moisture-free air of a pressure substantially equal to the external atmospheric pressure is admitted to and maintained within the enclosure.

8. The method of maintaining an electrical ignition system free from detrimental extraneous matter wherein the system is enclosed by an impervious enclosure which includes, establishing communication between the external atmosphere and the interior of the impervious enclosure and maintaining the air within said enclosure dry and at substantially the same pressure as that of the atmosphere.

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