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IGNITION SYSTEM FOR AIRPLANE ENGINES AND THE LIKE

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Fig. 2.
This invention relates to ignition systems for airplane motors or engines, and particularly to ignition systems provided with supercharging means, that is, means for supplying air and maintaining desired pressure thereof adapting the system for so-called high-altitude flying.

The invention has for its object the provision of a unitary ignition system for airplane motors which includes a supercharging system for filling both the source of high tension current and the harness with air under pressure.

More specifically, an object is to provide an ignition system for a multi-cylinder airplane engine which is fired from a single source of high tension E. M. F., and incorporates means for circulating air under pressure through the source of current and ventilating the same, together with a ventilated harness that is also filled with air under pressure.

Another object is to provide an associated air or gas pump correlated with the source of current for circulating air under pressure, thereby increasing the dielectric strength and eliminating corrosive gaseous products from vital parts.

Another object is to provide an improved arrangement of multi-unit current source having a casing which is substantially airtight and has separate compartments with air circulating connections whereby improved ventilation is had.

Still another object is to provide a unitary ignition system having means for supercharging, in which all parts are balanced and matched. Other objects of the invention will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts, which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a fragmentary view showing, mainly in elevation, an ignition system and the present invention which has a magneto as the current source;

Fig. 2 is a view, partly in section and partly in elevation, showing details of the magneto employed in the ignition system of Fig. 1;

Fig. 3 is another view, partly in section and partly in elevation, showing a detail in the harness here employed; and

Fig. 4 is a view showing a modification, in which a battery is the source of current.

Referring now to the drawings, and particularly to Fig. 1, an airplane engine E of the internal combustion type is shown by way of example. The engine is fired electrically and to this end has a plurality of spark plugs 10, one for each cylinder if it has a single ignition, a pair being used for dual ignition. The plugs 10 are supplied with high tension electric current through harness 11, from a suitable source 20, such as a magneto, preferably one supplying effective fuel firing high tension current which may be largely unidirectional, as taught in U.S. Patent No. 2,015,091, issued in the name of M. E. Spohn on September 24, 1935.

The harness 11 comprises a plurality of conductors 12 leading from terminal connectors of a chamber C and are part of a distributor housed in a chamber B (see Fig. 2) of an enclosed magneto, shown generally at 20, and arranged to be driven from the engine E. Each conductor 12 (see Fig. 3) has an envelope 13 of solid insulating material, such as rubber, forming a cable. Such cable is disposed in slightly spaced relation on the interior of a hollow metal, substantially airtight sheath 14 that is preferably flexible, and has an air-bleeding terminal 15 through which a terminal portion 12' of conductor 12 is passed in an insulating manner in order that it may be conductively connected to a spark plug 10, as shown in Fig. 3. The terminal portion 15 of the sheath 14 is preferably detachable and is provided with one or more air-bleeding perforations, as shown at 16.

Each sheath 14 of the harness 11 is led in an airtight manner from a suitable opening in an air manifold 18 that is closed at one end and houses the cables leading from compartment C of the magneto 20; air manifold 18 having a connection 19 that communicates with and may be integral with the casing portion housing the C-compartment of magneto 20 (a second connection 19' being shown and used when dual ignition is employed).

The magneto here shown at 20 is that of my copending application, Serial No. 374,324, filed January 14, 1941, and comprises a plurality of functioning unit components of a magneto-electric machine, each housed in a substantially airtight compartment of a casing that is made as a substantially imperforate structure and adapted to be filled with air under pressure. In the arrangement shown, it is desired that the magneto be driven at one-half engine speed. This
ratio may be had by means of a cam shaft in the engine, a gearing incorporated in the engine, or a suitable speed changing gearing in the magneto, as desired.

Associated with the same driving connections is a pump 30, which is adapted to pump a fluid dielectric and may be of any suitable variety, for example, a rotary pump with reciprocating vanes. Such pump in order to pump air has an inlet from the atmosphere, preferably provided with an air filter 31, and an outlet here shown connected to a conduit 32 by which air under pressure is supplied at 22 to compartment A of the magneto. In compartment A is disposed a functioning unit component of the magneto comprising a rotor 24, and windings 25; the casing also having a compartment B for another unit component comprising breaker and distributor mechanism, as shown at 26, 27.

It is obvious from the drawings, more particularly Fig. 2, and preceding portion of the specification, that the chambers B and C are defined from each other by a partition wall of insulating material, and that this partition wall serves as a distributor head in which are anchored terminal mountings whereby the conducting cables in chamber C including those leading to the spark plugs, such as conductors 12 ecscend in insulating material formed 72, are brought into conducting relation with the rotary distributing plate 27 in chamber B. The distributing mechanism structure is more completely described in the above identified application Serial No. 374,324. However, since such details relate to subject matter not herein claimed their repetition herein is deemed unessential. For ready reference the partition wall between chambers B and C which prevents gases from passing from one to the other is referenced 100. As shown this wall 100 is a substantially flat plate of substantially uniform thickness having the opposed faces thereof disposed in substantially parallel planes and as is obvious may be formed or cut from sheet insulating material. Each cable 12,13 terminates at the plate 100, serving as a distributor head, in a suitable terminal mounting as shown, each terminal mounting including a stationary terminal 72 mounted in a suitable bushing 80. A high tension current super cable 256 terminates at the plate 100 in a suitable transfer terminal 66 in a bushing 67. The rotating distributor plate 27 of insulating material carries an electrode 71, which is charged from the windings of the coil 25 and through cable 256 by means of cooperation of terminal 66 and a contrarily located contact 61 in the rotating plate 27. The contact 61 is connected to the electrode 65 by means of an embedded conductor 64 as shown.

The air pressure in compartment A is preferably limited in value. To this end, the magneto casing has disposed in its wall at a desired point a safety valve 21, or other suitable device. From compartment A the air or other fluid dielectric passes in parallel paths to compartments B and C. Accordingly, a passage 33 is provided in the separating wall between compartments A and B. The parallel path is through a conduit 34 formed on the outer wall of compartment B to convey conductor 256 from compartment A to compartment B. About the cable in conduit 34 is a sufficient clearance to permit the desired entrance of air under pressure at 35 into compartment C. The air in this latter compartment passes out through the connection 19 into the manifold 18. The compartment B is provided with one or more vents 36, which are preferably screened, for bleeding the air therein to the atmosphere.

In the manifold 18, the air under pressure is seen to pass into the harness 31 by dividing itself into a plurality of small streams, each entering the clearance space in a shroud 34 surrounding the cable therein. The air in such clearance spaces is seen to flow to the sides and then through the openings 16, in terminal portions 15, to the atmosphere.

In operation, when the magneto 20 is being driven by the engine E, the air in 30 is also being driven, and air drawn from the atmosphere through the inlet 31 is compressed and discharged under pressure through conduit 32 into the casing of the magneto at 22, i.e., into compartment A of the magneto casing. The presence of this air under pressure is seen to provide a fluid dielectric of relatively high dielectric strength about the windings; this is especially desired at high altitudes or in rarefied atmospheres.

During operation, the air from compartment A passes by way of opening 33 into compartment B. Simultaneously air is passed by conduit 34 and opening 35 into compartment C. Any ozone, or other corrosive by-products having the sparks in compartment B, is here flushed out with the air vented to the atmosphere through the vent or vents at 36.

The air which enters compartment C passes through connection 19, alongside of the cable therein, and thence to manifold 18, the air thus entering manifold 18 then passing into the harness sheathing and thence to the atmosphere through opening 16. Such a harness is seen again to provide a fluid dielectric about the cables leading to the spark plugs and to the spark plug terminals, and assists in insulating the same from the sheaths 14 and insures generally the proper performance of the ignition system.

The present invention is seen to provide a unitary ignition system in which all of the parts may be made to have a balanced performance; the air passed into the system maintains at all times a proper fluid dielectric about the high tension current carrying parts.

While the ignition system above described employs a magneto, as its source of E. M. F., the invention is not so limited, as a battery having a make-and-break device and distributor of the type commonly used in automotive practice may also be used as a modified form of the invention. A modification using such source is shown in Fig. 4, the coil comprising one unit of the source, the breaker and distributor another. By the present invention, the source has a casing provided with separate or segregating compartments, one for each of said units.

In the modification shown in Fig. 4, the casing having compartments is shown at 40; the compartments being denoted 41, 42, and 43, respectively. In compartment 41 is a coil 45, while compartment 42 contains a breaker 46 and a distributor 47. Compartment 44 contains the usual battery and as shown is connected to compartment 41 by a suitable conduit for the conductors between the battery and coil device 45. Compartment 43 is a cable compartment. From the connectors 48 of the latter run the cables carrying conductors 12 to the spark plugs 10. An associated gas pump 50, run from engine E,
has an inlet 51 and an outlet 52 connected to discharge respectively into compartments 42 and 43. A connection 53 leads from compartment 43 to compartment 41. Both compartments 41 and 42 vent to the atmosphere, while the compartment 43 discharges through a connection 19 into a manifold 18, as in the former case, so as to pass the fluid dielectric from the pump 50 to the compartments 41, 42, and 43, and thence to the harness.

While the fluid dielectric referred to above is air, other insulating gases, such as nitrogen, carbon dioxide, and the like, may be employed.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A magneto-electric machine, comprising, in combination, a casing therefor having a plurality of segregating compartments, a functioning unit component of a magneto in each of said compartments, and means for supplying fluid dielectric under pressure to each of said compartments.

2. A magneto-electric machine, comprising, in combination, a casing therefor having a plurality of segregating compartments, a rotor and a stator provided with windings in one compartment, a breaker and distributor mechanism in a second compartment, and conductor cables for ignition purposes in a third compartment, a pump for supplying air under pressure to said compartments and harness, and driving means for said rotor and pump.

3. A magneto-electric machine, comprising, in combination, a casing therefor having a plurality of enclosing compartments, a rotor and a stator provided with windings in one compartment, a breaker and distributor mechanism in a second compartment, and conductor cables for ignition purposes in a third compartment, an associated pump for supplying air under pressure, a conduit leading the air discharged by said pump into said rotor-containing compartment, and conduits leading from said rotor-containing compartment with one leading to said breaker-containing compartment and another leading to said cables-containing compartment.

4. In an ignition system for airplane engines and the like, the combination comprising an engine having spark plugs, a source of high tension E. M. F. having a substantially closed casing formed with compartments and a functioning unit component thereof in each of said compartments, encased harness leading from a compartment of said casing to said engine spark plugs, and means for supplying fluid dielectric under pressure to said casing compartments and encased harness in succession.

5. In an ignition system for airplane engines and the like, the combination comprising an engine having spark plugs, a source of high tension E. M. F. having a substantially closed casing formed with compartments and a functioning unit component thereof in each of said compartments, a pump for supplying air under pressure, encased harness leading from a compartment of said source of high tension E. M. F. to said engine spark plugs, and means for conveying the air discharged by said pump in succession to said compartments and to said harness.

6. In an ignition system for airplane engines and the like, the combination comprising an engine having spark plugs, a magneto having a substantially closed casing formed with compartments and a functioning unit component thereof in each of said compartments, an associated pump for supplying air under pressure, said pump and magneto having a common driving means driven by said engine, encased harness leading from a compartment of said magneto to said engine spark plugs, and means for conveying the air discharged by said pump in succession to said compartments and to said harness.

7. In an ignition system for airplane engines and the like, the combination comprising a multi-cylindred engine having spark plugs for each cylinder, a single magneto-electric machine having a casing, said magneto-electric machine having means for coupling the same to be driven by said engine at half engine speed, a pump for supplying and maintaining air at desired pressure driven from said coupling, and encased harness leading from said magneto for supplying said high tension current to each of said spark plugs; said pump, said casing and said encased harness being arranged for the passage of air at desired pressure therethrough successively in the order named.

8. In an ignition system for airplane engines and the like, the combination comprising a multi-cylindred engine having spark plugs for each cylinder, a single magneto-electric machine having a casing, a pump for supplying and maintaining air at desired pressure, means in common with said pump and said magneto-electric machine for driving the same from said engine, harness connected to said casing comprising a plurality of high tension current conducting cables each leading from said magneto-electric machine to one of said engine spark plugs, each of said cables having a flexible substantially air-tight metal sheath in spaced relation thereto and provided with terminal air-bleeding means, and conduit connections between said pump and magneto-electric machine whereby the supercharging air passes from said pump, through at least the portion of said casing to which said harness is attached and thence through said sheaths in parallel, finally bleeding to the atmosphere.

9. In an ignition system for airplane engines and the like, the combination comprising a multi-cylindred engine having spark plugs for each cylinder, a single source of high tension E. M. F. having a casing provided with separate compartments, a functioning unit component of said source of high tension E. M. F. in each of said compartments, encased harness leading from one of said compartments to said spark plugs, common means for supplying fluid dielectric under pressure to said encased harness and the compartment from which it leads, and means for separately supplying fluid dielectric under pressure to at least one other of said compartments which contains a sparking functioning unit.

10. A magneto-electric machine, comprising, in combination, a casing therefor having a plurality of enclosing compartments, a rotor and a stator provided with windings in one compartment, a breaker and a distributor mechanism in a second compartment, conductor cables for ignition purposes in a third compartment, an encased ignition harness including portions of at
least some of said cables leading from said third compartment, means for supplying fluid dielectric under pressure, a conduit leading fluid dielectric supplied by said first-mentioned means into said rotor-containing compartment, a passage leading from said rotor-containing compartment to said breaker-containing compartment, and another

11. A magneto-electric machine, comprising, in combination, a casing therefor, a portion in said casing defining with a portion thereof a first compartment, a second partition in said casing defining with the remaining portion thereof second and third compartments, a rotor and stator provided with windings in the first compartment, breaker and distributor mechanism in the second compartment, conductor cables for ignition purposes in the third compartment, means for supplying fluid dielectric under pressure, a conduit leading fluid dielectric supplied by said means into said rotor-containing compartment, saidfirst-mentioned partition being provided with a passage for leading fluid dielectric from said rotor-containing compartment, and a conduit leading from said rotor-containing compartment to said cable-containing compartment, said breaker-containing compartment being provided with means for bleeding fluid to permit controlled escape thereof to the atmosphere.

12. In an ignition system for airplane engines and the like, the combination comprising a multi-cylindered engine having spark plugs for each cylinder, a magneto-electric machine having a casing therefor, a portion in said casing defining with a portion thereof a first compartment, a second partition in said casing defining with the remaining portion thereof second and third compartments, a rotor and stator provided with windings in the first compartment, breaker and distributor mechanism in the second compartment, conductor cables for ignition purposes in the third compartment, means for supplying fluid dielectric under pressure, a harness connected to said third compartment comprising a plurality of high tension current conducting cables each leading from said magneto-electric machine to one of said engine spark plugs, each of said cables having a substantially fluid-tight metal sheath in spaced relation thereto provided with terminal fluid-bleeding means, a conduit leading the fluid dielectric supplied by said first-mentioned means into said rotor-containing compartment, said first-mentioned partition being provided with a passage for leading fluid dielectric from said rotor-containing compartment to said breaker-containing compartment, and a conductor leading from said rotor-containing compartment to said cable-containing compartment, said breaker-containing compartment being provided with fluid-bleeding means to permit control of escape of fluid to the atmosphere.

13. In an ignition system for airplane engines and the like, the combination comprising a casing having a plurality of enclosing compartments, a set of windings in one compartment including a primary adapted to carry low tension current and a secondary adapted to supply high tension current, a breaker and distributor mechanism in the second compartment, said breaker being adapted periodically to interrupt flow of low tension current in the primary, conductor cables for ignition purposes in a third compartment, means for supplying fluid dielectric under pressure, a harness connected to said third compartment comprising a plurality of high tension current conducting cables each leading from said magneto-electric machine to one of said engine spark plugs, each of said cables having a substantially fluid-tight metal sheath in spaced relation thereto provided with terminal fluid-bleeding means, a conduit leading the fluid dielectric supplied by said means into said windings-containing compartment, a conduit leading from the latter compartment to the cables-containing compartment for passage of fluid dielectric under pressure therewith and serving with the third compartment as a passage for a conductor cable from one of the windings to the distributor mechanism, said}

press means having a passage leading the fluid dielectric supplied by said first-mentioned means into said windings-containing compartment, means having a passage leading the fluid dielectric supplied by said second-mentioned means into said cable-containing compartment, and another

10. A magneto-electric machine, comprising, in combination, a casing therefor, a portion in said casing defining with a portion thereof a first compartment, a second partition in said casing defining with the remaining portion thereof second and third compartments, a rotor and stator provided with windings in the first compartment, breaker and distributor mechanism in the second compartment, conductor cables for ignition purposes in the third compartment, means for supplying fluid dielectric under pressure, a harness connected to said third compartment comprising a plurality of high tension current conducting cables each leading from said magneto-electric machine to one of said engine spark plugs, each of said cables having a substantially fluid-tight metal sheath in spaced relation thereto provided with terminal fluid-bleeding means, a conduit leading the fluid dielectric supplied by said means into said windings-containing compartment, a conduit leading from the latter compartment to the cables-containing compartment for passage of fluid dielectric under pressure therewith and serving with the third compartment as a passage for a conductor cable from one of the windings to the distributor mechanism, said

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windings - containing and breaker - containing compartments being connected together by a passage permitting fluid dielectric under pressure to be forced from the former to the latter, said breaker-containing compartment being provided with fluid-bleeding means.

16. In a distributing mechanism for high tension magnetos the combination comprising a casing member adapted to be divided into a chamber for housing supply and distributing cables in an atmosphere of fluid dielectric under pressure and another chamber for housing a rotary distributing member, and a partition in said casing member adapted to prevent access of fluid from one of said chambers to the other, said partition including terminal mountings whereby the ends of cables housed in the one chamber may be brought into conducting relation with the rotary distributing member in the other chamber.

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