July 23, 1935. S. SMITHSON 2,009,125

MEANS OF INTENSIFYING ELECTRICAL ENERGY

Filed Jan. 19, 1932

Fig. 1.

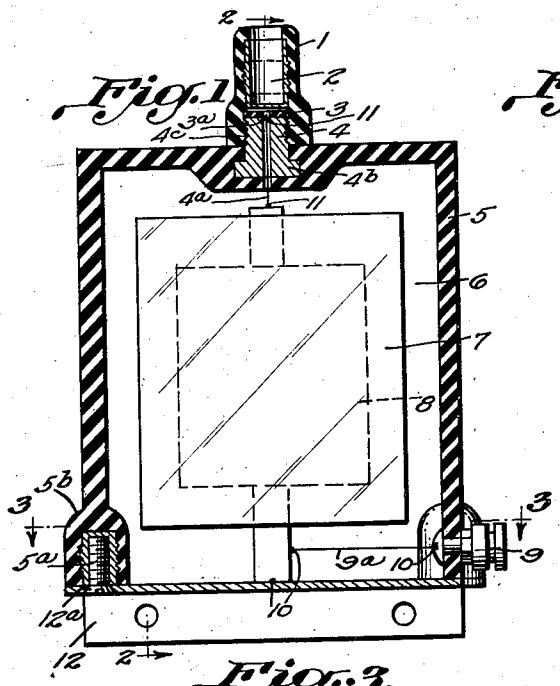


Fig. 2.

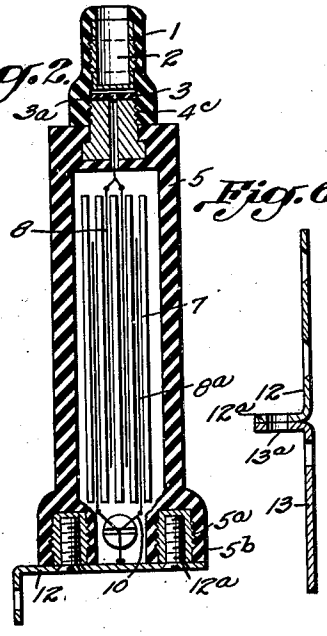


Fig. 6.

Fig. 3.

Fig. 5.

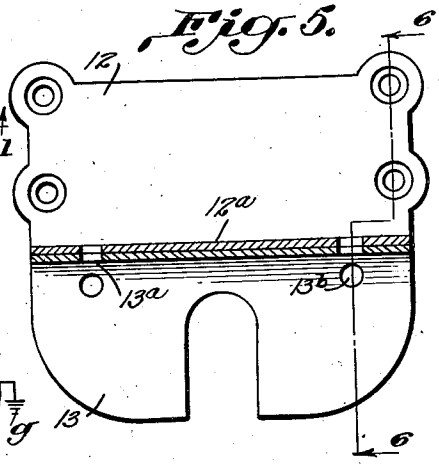
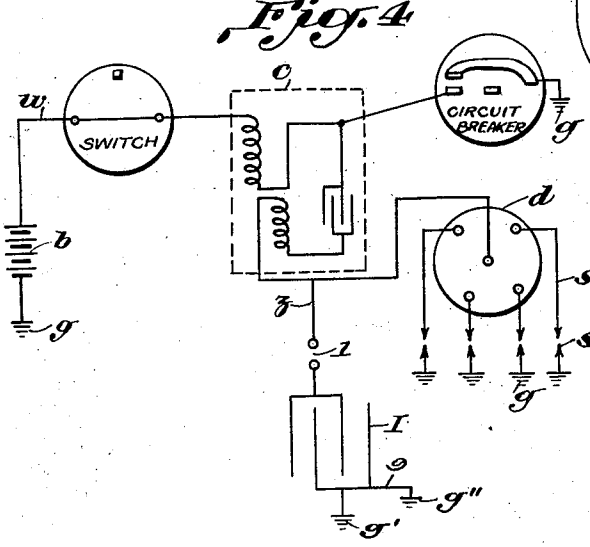


Fig. 4.



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UNITED STATES PATENT OFFICE

2,009,125

MEANS OF INTENSIFYING ELECTRICAL ENERGY

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Application January 19, 1932, Serial No. 587,598

4 Claims. (Cl. 123—148)

This invention relates generally to electrical apparatus and is more particularly directed to a method and means of increasing the efficiency of high tension electrical systems for the performance of certain work, as in motor-vehicle ignition systems, wherein a spark spanning a gap between two electrodes is utilized to ignite a highly compressed gaseous mixture within the combustion chamber of the engine cylinder.

While, as will be manifest from this disclosure, my invention may be readily applied to secondary or high tension systems designed for other uses, I have elected to confine my description, more or less, to its application to the ignition system of an internal combustion engine, of the type commonly employed in motor-vehicle construction. However, this is done merely for illustrative purposes, and is not to be interpreted in any way, whatsoever, as limiting my invention to this specific use.

The propagation of the charge-igniting spark under the high resistance within the combustion chamber of the internal combustion engine has long been recognized as an important factor in determining efficient engine performance, and, with the recent trend to higher compression ratios, it has been found that, in many instances, the high tension ignition systems of existing designs are unable to satisfactorily meet the conditions that are imposed upon them. This results in a slow burning mixture, or other poor combustion characteristics, and a concomitant rapid loss in engine power, due to carbonization, spark plug deterioration and other causes which flow therefrom.

Attempts have been made to compensate for, or offset, the recognized shortcomings of the present types of ignition systems, particularly in automotive vehicles, by various means, such as air gap devices attachable to the spark plug terminal, or so-called intensifiers or condensers, and different types of coils, designed to be connected in the secondary circuit of the system. However, for one reason or another, usually due to poor electrical characteristics, or because of their obvious impracticability from production and other standpoints, these various proposed expedients have failed of adoption. Thus, at the present time, there is no device available that will satisfactorily respond to the conditions that must be met to increase the efficiency of the high tension or secondary circuit, so that the spark will possess those characteristics that are requisite to the adequate performance of its intended function.

Therefore, it is the primary object of this invention to produce a simple and efficient method of improving or increasing the efficiency of high tension electrical systems generally, where the ultimate work of the energy must be performed under adverse conditions, such as may obtain where a spark or arc must be produced under high atmospheric or other pressures.

More specifically, it is the object of this invention to provide a method and means of increasing the efficiency of the secondary or high tension circuit of an internal combustion engine ignition system and to provide for the propagation of a spark that will possess certain characteristics which will insure substantially instantaneous and complete combustion of the highly compressed mixture within the combustion chamber of the engine cylinder, in order that the maximum working effort may be obtained therefrom.

Further, another important object of this invention is to provide a method of effecting a reorganization of an electric current of predetermined amperage and voltage, by reducing the amperage and proportionately increasing the voltage, thereby bringing about a change in the chemical action of the current with a reduction in the thermal units and a multiplication of ions, this reorganized current, when passed between the electrodes of a spark plug, for example, providing for a distinct advance in systems of ignition, as in a motor-vehicle power-plant.

Another object of the invention is to provide a simple, compact and practical device for carrying my method into practice, that may be economically produced and readily incorporated in the secondary circuit of an electrical ignition system by those unskilled in the art.

My invention also comprehends specific steps in the construction of a device, as aforesaid, whereby assembly of certain of the cooperating components may be greatly facilitated, the complete structure being highly resistant to those detrimental strains and stresses to which it may be subjected in use, so that effective service over a long period of time, without replacements and repairs, may be insured.

Other objects and advantages flowing from the practicing of my invention, will doubtless become evident as the description proceeds, and I would have it clearly understood that I reserve unto myself all rights to the full range of equivalents of the steps of my method and of the elements of the structure whereby my method may be carried

into effect, as well as in its use, to which I may be entitled under my invention in its broadest aspect.

I will now describe my invention in conjunction with a preferred form of apparatus or structure which may be utilized in the practicing thereof, as shown in the accompanying drawing, in which,

Figure 1 is a transverse sectional elevation thereof.

Figure 2 is a vertical section of the line 2—2 of Figure 1.

Figure 3 is a longitudinal section on the line 3—3 of Figure 1.

Figure 4 is a diagrammatic view showing elements of an ignition system, as in a motor-vehicle, in which my intensifier is incorporated.

Figure 5 is a plan view of the supporting base, which serves as a means of attachment, and

Figure 6 is a cross-section on the line 6—6 of Figure 5.

Referring now to the drawing in detail, in which like characters of reference are employed to designate similar parts in the several views, my device embodies a series of primary and secondary plates of brass or other suitable material, as indicated at 8 and 8*a*, respectively, these plates being separated one from the other, by dielectrics, such as the plates 7 of glass or other non-conductive material, that may be adaptable to the purpose. In the assembly of these components, any suitable method may be followed for binding or securing them in their necessary relationship. However, in practice, I have found that the work may be expedited and permanency of the assembly insured, by employing tape of fibrous material, as paper, coated with a suitable adhesive, as the tying element. The metal and non-metallic plates are arranged in properly superposed relation and the tape is then wrapped about them, after being moistened sufficiently to cause it to adhere to the surfaces with which it contacts. Any number of windings may be employed and they may be located in zones adjacent the ends of the plates, or elsewhere, the free end of the tape being sealed to the winding which it overlies.

The primary plates 8 are electrically connected, as by a wire 11, to the preferably brass member 4, the latter being centrally bored, as at 4*a*, to facilitate the location of said wire in the assembly operation. This member 4 is provided with an enlarged head portion 4*b* and an externally threaded shank, as at 4*c*, the head portion being embedded or anchored in the top wall of the container 5 which is formed from any suitable highly insulated and durable material, as fibre, bakelite or other composition that will respond to the essential requirements.

As will be observed, the threaded shank of the member 4 projects above the top surface of the container in which said member is mounted, to engage the internally threaded terminal cap 1 of insulated material, whereby the latter may be firmly held in engagement with the surface of the container upon which it abuts, as will be seen from Figure 1 of the drawing.

Within the aforesaid cap 1, I insert a brass socket or other suitable fitting 2, in threaded engagement therewith, by means of which a suitable electrical connection may be made in the ignition system in which my invention is to function. This socket or fitting 2, as will be noted from the drawing, is spaced upwardly from the adjacent end of the member 4 to provide for the interposition therebetween of an annular disc 3 of highly insulated material, as bakelite or fibre, having a central aperture 3*a* therein, this apertured disc forming a resistance means and air gap between said member 4 and the socket 2.

The secondary plates 8*a*, are electrically connected, as by a wire 10, to the metallic base member 12, which is adapted to be fixed to the bottom of the container 5 by suitably located screws 12*a* in meshing engagement with the sleeves 5*a* threaded, or otherwise secured, in the container wall, which is preferably thickened at its base for their reception, as indicated at 5*b*. Adjacent the base of the container 5, I provide a ground terminal 9, which in the present showing, projects laterally through the wall thereof and is also connected to the secondary plates 8*a*, by any suitable conductor, as the wire 9*a*. This ground tap may be of the screw and nut type illustrated or of any other appropriate form.

With the assembly of the internal elements complete, as described, they are embedded in a compound or composition of high electrical and heat resisting characteristics, such as halo wax, sulphur, pitch or other material, with which the interior of the container is filled, and the base member is then applied thereto in the manner heretofore explained.

The instrument is now ready for service, and, through the medium of its base 12 and the cooperating metallic bracket member 13, may be securely mounted, as by bolting, upon any suitable metal part of the engine with which the ignition system in which it is to function is employed. To facilitate such mounting, the bracket 13 is attachable to the base 12 in different relative positions, two sets of openings 13*a* and 13*b* being provided therein for the purpose, these openings being adapted to register with the holes in the flange 12*a* of the base 12, for the reception of suitable interlocking devices, as bolts and their securing nuts (not shown).

As will be manifest, when the instrument is mounted as just explained, it is electrically grounded through its metallic base 12. However, if it is found necessary or desirable to mount it upon a non-conductive surface or support, an electrical ground may be made by means of a wire connected to the aforesaid tap or terminal 9, leading to a suitable metallic ground, as, for example, a part of the engine. With the appropriate ground established, one end of a wire is then connected to the socket or fitting 1, in any suitable manner, as by a lug, to insure the maintenance of the connection in use, the installation being completed by connecting the other end of this wire into the high tension lead wire that extends from the coil to the distributor of the ignition system, as by splicing, or in any other manner that will serve the purpose, the instrument, as will be evident, shunting the coil.

The manner in which my device may be employed in a motor-vehicle ignition system, as herein described, is illustrated in the diagrammatic showing of Figure 4, wherein the battery *b*, grounded at *g*, is connected by the wire *w* to the coil *c*, the latter being wired, as at *v*, to the distributor *d* in the primary circuit. The intensifier, generally indicated by the reference character I is grounded, as at *g'* or *g''*, and connected in the secondary or high tension circuit by a lead *z* from its terminal 1 to the cable *x—y* between the coil and the distributor, the latter of which has the usual leads *s'* to the spark-plugs *s*.

From the foregoing, it will be clearly apparent that I have provided a so-called intensifier, em-

bodying a condenser and an air gap, that is compact, of a substantial and rugged construction and easily attachable for operation to any standard ignition or other high tension system where the nature of the work to be performed by the energy developed, renders its use desirable or essential. Due to the electrical characteristics of the condenser, as associated with the air gap, and the means utilized in establishing the necessary connections, I have found that my device, in actual use, materially increases the efficiency of the engine performance. For example, starting of an engine is more easily accomplished, while the instantaneous combustion of the complete charge of the mixture, which results in the use of my invention, insures a steady and smooth movement of the engine pistons, thereby eliminating the objectionable vibration that develops from a comparatively slow burning mixture, or incomplete combustion, as a result of poor ignition characteristics of the spark produced by the present types of high tension ignition systems. Again, greater power is obtained, with a saving in fuel consumption for a given amount of work, the carbonization of the cylinder walls and burning of the spark plug electrodes being substantially eliminated, all of these desirable results flowing from the changes in the chemical action of the spark which are effected through the medium of my apparatus.

While I have described my invention, more or less specifically, with reference to the embodiments shown, my method may be practiced by other means and the details of the components of the structure and their arrangement may be changed and equivalents substituted therefor, without departing from the spirit and scope of my invention, as defined by the appended claims.

I claim:

1. An instrument for intensifying the electrical energy delivered by a high tension circuit designed for the performance of certain work, embodying a housing of insulating material, a condenser, including, primary and secondary plates and dielectric material therebetween, enclosed within said housing, a terminal on said housing adapted for connection to an electrical device in said circuit, conductor means between the primary plates and said terminal, including an air gap, a metallic base for said housing, a tap projecting from said housing, adjacent said base, and means electrically connecting said secondary plates to said base and an electrical connection between said latter means and said tap, said base and said tap respectively providing alternative means for electrically grounding said instrument.

2. An electrical instrument adapted to function as a spark intensifier in an internal combustion engine ignition system, embodying a container of insulated material, a condenser embedded within a mass of material of high electrical and heat resisting characteristics, a terminal on said container, means forming an electrical path between said condenser and said terminal, said means including an air gap, said terminal being connectable to an electrical unit of the ignition system, a metal base for said container, means electrically connecting said base to said condenser and a bracket member forming a universal mounting for said base and cooperating therewith and with a metallic supporting surface to provide an electrical ground for said condenser.

3. An instrument for intensifying the electrical energy in the high tension circuit of an ignition system for internal combustion engines, including a coil and a distributor, comprising a condenser, a housing of insulating material enclosing said condenser, said housing embodying a surface of conductive material adapted to function as a supporting base therefor, a conductor embedded in a part of said housing, said conductor being centrally bored, an insulated sleeve external of said housing associated with said conductor, a socket fitted within said sleeve, said socket being in spaced relation to said conductor, means extending through the bore thereof electrically connecting said conductor to said condenser, an element of insulated material, centrally apertured, interposed between the spaced surfaces of said conductor and said socket and means electrically connecting said condenser to said housing surface of conductive material, whereby said surface may function to ground the condenser in said circuit, said socket being electrically connectable in said circuit between said coil and said distributor.

4. The combination with the high tension circuit of an ignition system for an internal combustion engine having a coil and a distributor, of a device for changing the characteristics of the energy delivered for the performance of the work, said device including a condenser, insulating material enclosing said condenser, a terminal external of said condenser-enclosing material, a path for electrical energy between said condenser and said terminal embodying an air gap and means for grounding said condenser in said circuit through its enclosing insulation, said terminal being connectable in said circuit between said coil and said distributor, whereby said device may function in said circuit.

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