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L. O. McPHERSON.

ELECTRIC IGNITER FOR GAS OR VAPOR ENGINES.

APPLICATION FILED MAR. 25, 1897.

Fig. 1

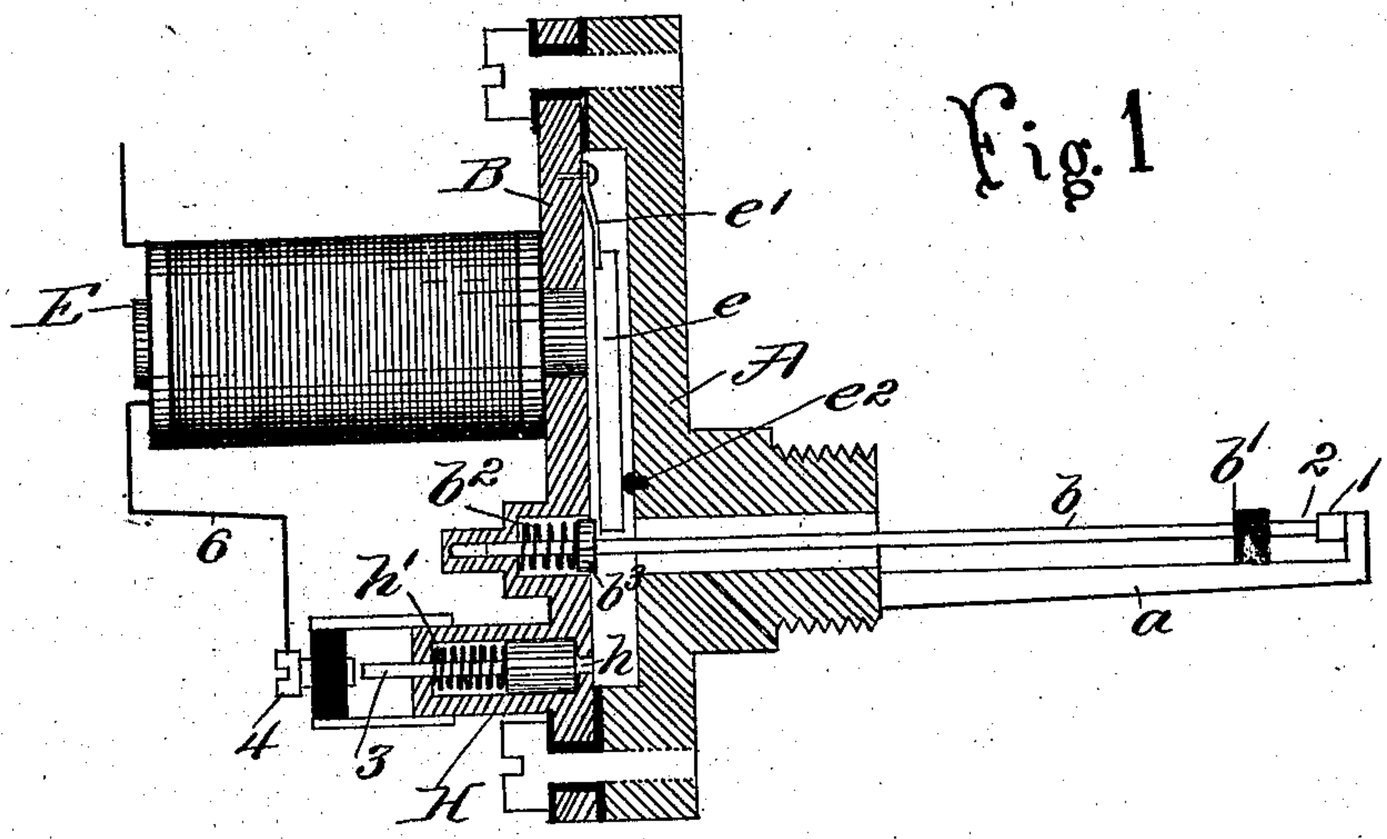
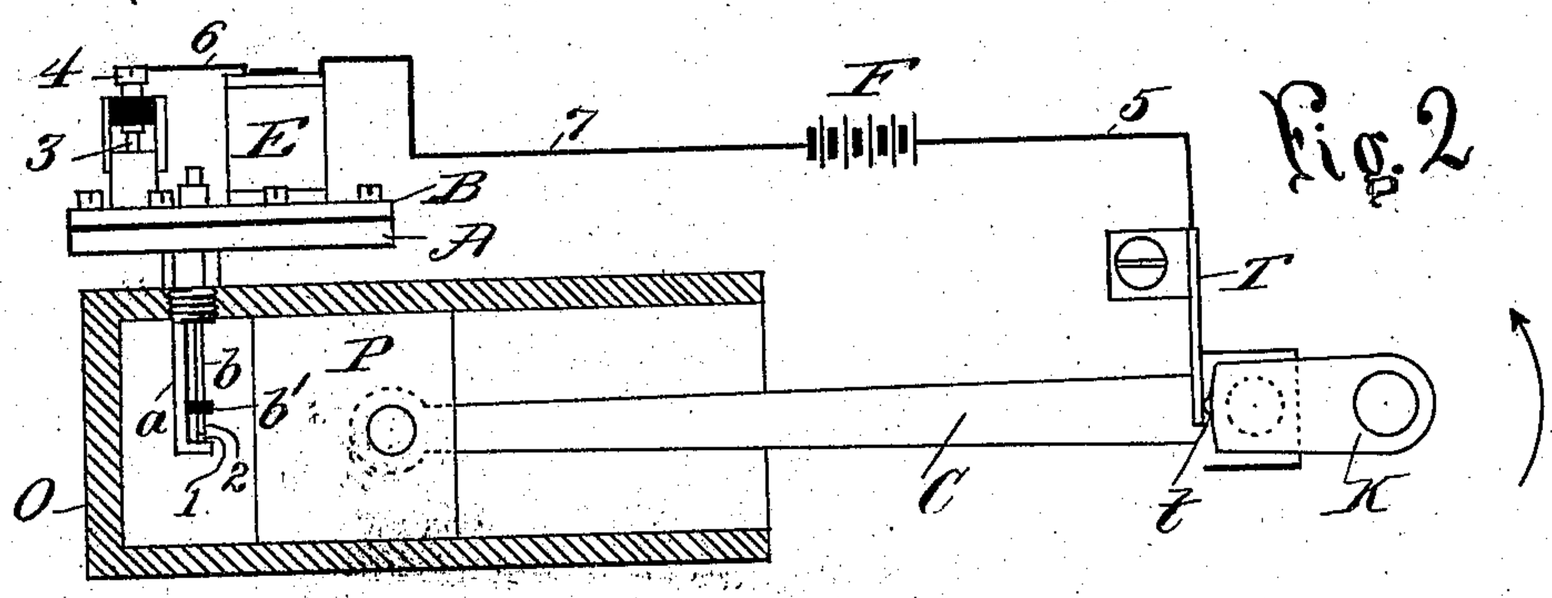


Fig. 2



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ELECTRIC IGNITER FOR GAS OR VAPOR ENGINES.

No. 885,072. Specification of Letters Patent. Patented April 21, 1908.

Application filed March 25, 1897. Serial No. 629,181.

To all whom it may concern:

Be it known that I, LEON O. MCPHERSON, a citizen of the United States, residing at Highland Park, in the county of Lake and State of Illinois, have invented a new and useful Electric Igniter for Gas or Vapor Engines, of which the following is a specification.

This invention relates to gas or vapor engines of the class wherein a charge of inflammable or explosive material is exploded within the cylinder or working chamber of the engine.

The object of the invention is to provide a simple and efficient means for utilizing an electric current for igniting the inflammable mixture.

The invention consists substantially in the construction, arrangement and mode of operation all as will be more fully hereinafter set forth, as shown in the accompanying drawing and finally specifically pointed out in the appended claims.

Referring to the accompanying drawing and to the various views and reference signs appearing thereon—Figure 1 is a detached view in section illustrating a form of apparatus embodying my invention and for carrying the same into practical operation. Fig. 2 is a view illustrating my invention as applied to an engine, only such of the working parts of the engine being shown as are necessary to show the coöperative relation and operation of my invention.

The same part is designated by the same reference sign wherever it occurs throughout the several views.

Electrical igniters for gas or vapor engines, as usually constructed, are of a combined electro-mechanical nature employing the movements of certain parts of the engine with certain mechanical adjuncts to secure the ignition spark. Such apparatus is often dependent upon rubbing or sliding contact pieces within the working chamber. Such an arrangement is defective, objectionable and unsatisfactory by reason of the fact that the heat generated in such chamber and to which heat such rubbing or sliding surfaces are subjected, causes such surfaces to rapidly wear out and deteriorate, thereby rapidly destroying the efficiency of the igniter and in a very little time perceptibly varying the time of explosion and hence requiring frequent renewal or adjustment. Other forms of apparatus of this class employ stuffing boxes or glands through the walls of the working chamber of the engine in order to permit of the communication of external motion through the cylinder or chamber walls to the sparking points within. Such arrangements are also defective, objectionable and unsatisfactory for the reason that it is exceedingly difficult to maintain such stuffing boxes or glands gas tight under service conditions.

I will now describe my construction and arrangement and mode of operation whereby I avoid all the objections, defects and inefficiencies noted and provide a construction that is extremely simple, inexpensive, durable and efficient and practically invariable through long periods of active service.

In carrying my invention into practical operation I provide an electric circuit including two contact points arranged within the chamber or cylinder of the engine or in connection and coöperative relation with respect to the explosion chamber of the engine, such contact points being movable towards and from each other, and I rupture such circuit between the two contacts magnetically within the cylinder or explosion chamber and hence without external movement. The current may be supplied in any suitable manner, as from a battery or from any suitably arranged generator, and such circuit may be primarily opened or closed in any suitable or convenient manner, and many different forms of apparatus may be employed for carrying the electrical principles of my invention into practical effect and operation.

In the accompanying drawings reference sign A designates a suitable casting having a threaded portion or nipple adapted to be screwed into a correspondingly threaded opening into the engine cylinder or explosion chamber, O. This casting is provided with an extension, *a*, arranged to project into the explosion chamber and carries at its free end one of the contacts or spark producing electrodes, 1. This projection also supports, near the free end thereof, an insulating block

b', which serves as a guide and support for a rod b, forming or carrying the other and co-operating contact or spark electrode 2. Securely bolted or otherwise secured to but electrically insulated from the casting A is a plate or casting D, of suitable non-magnetic material, the construction and arrangement being such as to form an air or gas tight chamber between said plate and casting, such chamber being in free communication with the cylinder or explosion chamber O, through the nipple above referred to. An electro-magnet E, is arranged with one of the poles thereof rigidly attached to and projecting through the plate or casting B. Any suitable or desirable construction of electro-magnet may be employed but may be smaller than heretofore ordinarily employed for this purpose, owing to the greater efficiency of the spark producing electrodes, as will be more fully hereinafter set forth. In case an electro-magnet is employed having a laminated core, such core should be well soldered or suitably covered at the inner end, in order to prevent leakage of the gas through the core, as the end of such core projects through casing B and into communication with the chamber between the plate B and the casting A, and which, as above pointed out, is in free communication with the working chamber of the engine. The plate or casting B is provided with a cored recess arranged to receive and form a guide bearing for the outer end of contact rod b, and a spring b^2 is arranged in said cored out portion and bears against a collar b^3, carried by said rod b, and normally acts upon said rod to press the contact point or electrode 2, carried by the inner end thereof, firmly into contact with the electrode 1. An arm, e, supported at one end by a spring e', is arranged within the chamber between plate B and casting A, and forms the armature of the pole of the electro-magnet, E. The normal action of spring e', is to hold said arm away from the pole of magnet E and against a suitable insulated or insulating stop e^2. The free end of said arm e, is so relatively arranged with respect to rod b, that when the coils of said magnet E are energized, thereby exerting an attractive force upon said arm to overcome spring e', and move said arm against the pole of said magnet E, said rod b, is engaged by said arm and moved in a direction to break electrical contact between the points 1, 2. A convenient arrangement is shown wherein the collar b^3, carried by rod b, is normally arranged in the path of the free end of arm e, so as to be struck thereby when said arm is attracted by magnet E, thereby compressing spring b^2, and effecting a quick separation of the electrodes 1, 2.

From the foregoing description it will be readily seen that in order to produce a spark to ignite the explosive charge it is only necessary to couple up a source of current with the electrodes 1 and 2 in series with the coils of magnet E, thereby causing said magnet to exert an attractive force on armature lever or arm e, which, under the movement imparted by such attractive force strikes the collar b^3, a smart blow thereby effecting a temporary rupture of the circuit by separating the electrodes 1, 2, and producing the desired spark. The moment this rupture occurs the attractive force exerted by the electro-magnet upon lever e, ceases and spring e' returns said lever to its normal position against stop e^2, thus permitting spring b^2 to again establish contact between electrodes 1, 2, whereupon the magnet is again energized and the above operation is repeated and the operation proceeds so long as the connections are maintained.

In order to adapt the apparatus more perfectly to the engine conditions most commonly met with in service, I may, if desired, provide a circuit controlling device, the function of which is to prevent a closing of the circuit except at the proper time for exploding a charge of gas. Many different specific forms and arrangements of apparatus may be employed for performing this duty. In Fig. 1, I have shown a simple arrangement, wherein I provide plate B with a suitable cored cylindrical recess or chamber, in which I arrange a diaphragm or piston H, carrying a contact stem or rod 3, adapted to make contact with a suitable insulated terminal 4, arranged in the circuit. The diaphragm or piston H, normally holds the stem 3 out of contact with the terminal 4. This may be accomplished by arranging a spring h', to normally bear on piston H and maintain the same in one limit of its movement. The chamber in which piston or diaphragm H, is located communicates through an opening h, with the chamber formed between plate or casting B and casting A, and hence with the explosion or working chamber or cylinder O of the engine. In most engines the explosive charge is compressed to a desired degree at the moment it is desired to effect the explosion. In this feature of the invention I utilize the compression of the charge to effect a movement of piston H in a direction to overcome spring h', and to cause the rod or stem 3 to make contact with terminal 4, thus closing what is normally a gap or break in the electrical circuit.

I will now describe in more detail the electrical operation, reference being had to both of the figures.

Reference sign K is the engine crank, which is connected to and reciprocates the piston rod C, which carries the piston P. The crank K carries a projecting contact surface t, adapted, at the desired period of time

and point of travel or rotation thereof, to contact with a stationary contact spring T, for the purpose of closing the sparking circuit at the proper time. The contacts T, *t*, constitute what is commonly known as the timer.

In Fig. 2, the piston is shown at the end of its compression stroke, the circuit is closed between contacts T and *t*, the gas in the explosion chamber and also in the space between plate B and casting A is compressed, the stem or rod 3 is pressed into contact with terminal 4. Under these conditions current passes from the source, for instance, a battery F, through connection 5, contacts T and *t* of the timer, the engine frame and connecting parts, to arm *a*, electrodes 1, 2, rod *b*, plate or casting B piston stem 3, terminal 4, connection 6, the windings of magnet E, connection 7, and thence returning to battery F. The passage of current through this closed circuit energizes magnet E, thereupon attracting armature lever *e*, which on its movement towards the pole of magnet E strikes collar b^3, thereby breaking the circuit by separating electrodes 1, 2, and hence creating the spark which ignites the charge and the engine begins its operation. Immediately following the circuit is broken between the timer contacts T, *t*. This circuit remains broken upon the return or exhaust stroke of the engine even when the points T, *t* again contact with each other, for in such case little or no compression takes place in the working chamber and hence the circuit will be broken by the controller, the piston or diaphragm H of which holds contact stem 3 out of contact with terminal 4, and hence no sparking occurs. Thus the use of the controller, including the piston or diaphragm H, rod 3, terminal 4, and spring *h'*, will be found advantageous in preventing waste of current upon the strokes of the piston where no sparking is required. The controller may be dispensed with, if desired, and as will be readily understood. This is especially true in the case of engines exploding a charge at every revolution of the crank shaft and wherein the speed is governed by the character of the explosion, and also in engines employing the Beau de Rochas or double cycle with a reducing gear for operating the valves and arranged to explode a charge at every second revolution of the crank and governing the speed by regulating the mixture of the explosive charge. The timer contacts T, *t*, may be placed on the moving parts of the engine at any suitable point beyond said reducing gear, so that the timer will only make contact at each second revolution of the crank, the same being once at every revolution of the engine parts actuated by the reducing gear and therefore the controller, piston H, rod 3, contact 4, and connections, may be dispensed with, the timer contacts T, *t*, being all that is necessary to complete the current circuit through the coils of magnet E.

As above indicated, any desired source of current may be employed, and in Fig. 2 I have shown a battery F, for supplying the current. It is obvious, however, that my invention is not limited to a battery in this regard, and if desired I may dispense with battery power altogether, and instead employ a suitable mechanically operated generator.

From the foregoing description it will be seen that I provide an exceedingly efficient and simple arrangement of apparatus for electrically igniting the explosive charge of gas or vapor engines; that I avoid the objections and disadvantages hereinabove mentioned; and that by reducing the size of the electrode to a minimum I also avoid impairment of the apparatus by reason of deposits of soot and other products of combustion upon the contact points, which deposits being a conductor, rapidly establish short circuits in some forms of apparatus of the prior art.

It will be readily seen by persons skilled in the art that a magnet E may be made small and the moving parts extremely light, thereby securing great rapidity of movement of the circuit rupturing devices. This is a decided advantage, for the reason that I am enabled to employ small platinum or other inoxidizable metal or electrodes, at comparatively small expense, whereas in the case of larger parts and larger contact points or electrodes, in order to satisfactorily withstand the mechanical shock and wear to which they are all subjected, the use of platinum would involve an almost prohibitive expense, and moreover, it is a well established fact in actual practice that small wire electrodes are more efficient in the production of sparks for the purpose set forth than larger ones of the same material, therefore I not only reduce the opportunity for mechanical wear by reducing the size of the parts in accordance with my invention but I also, and at the same time, increase the efficiency of the apparatus while maintaining an equal length of life of the apparatus.

Of course it will be readily understood by persons skilled in the art that instead of the lever *e* directly breaking the circuit of magnet E, said lever may be arranged to break a separate circuit of sufficiently high voltage to produce the required spark.

Having now set forth the object and nature of my invention and various forms of apparatus and modes of procedure embodying the same, and having explained the construction, function, mode of operation and electrical action thereof, I desire it to be distinctly understood that I do not confine or limit myself to the exact form and arrangement shown, as many changes therein and

variations therefrom would readily suggest themselves to persons skilled in the art and still fall within the spirit and scope of my invention. But

What I do claim as new and useful and of my own invention and desire to secure by Letters Patent of the United States, is:—

1. The combination with a gas engine cylinder, a casting adapted to be applied thereto and carrying a fixed electrode, a movable electrode projecting only on the cylinder face of the casting, a chamber in the casting open only to the cylinder, means arranged in the chamber for operating the movable electrode, and a magnet for actuating said means, as and for the purpose set forth.

2. The combination with a gas engine cylinder, an electrode arranged therein, a casting applied to said cylinder and carrying on its cylinder face a coöperating electrode, one of said electrodes being movable, a lever arranged on the cylinder side of said casting for moving said movable electrode, and an electro-magnet arranged on the outside of said casting for actuating said lever, as and for the purpose set forth.

3. The combination with a gas engine cylinder, of a casting adapted to be applied thereto and carrying a fixed electrode, a movable electrode extending only on the cylinder face of the casting, said casting being provided with a chamber open only to the cylinder, a lever arranged in said chamber adjacent to said movable electrode for operating the latter, and an electro-magnet for actuating said lever, as and for the purpose set forth.

4. The combination with a gas engine cylinder, of a pair of contacts arranged therein and in series in an electric circuit, means for closing said circuit, a casting adapted to be applied to said cylinder and provided with a chamber open only to the cylinder, means arranged within said chamber for relatively moving said electrodes, and a magnet for operating said means, as and for the purpose set forth.

5. The combination with a gas engine cylinder, of a pair of relatively movable contacts arranged to extend into said cylinder and arranged in series in an electric circuit, a timing apparatus for automatically closing said circuit, and a magnet located outside of said cylinder and adapted when energized to relatively move said electrodes to break said circuit, as and for the purpose set forth.

6. The combination with a gas engine cylinder, of a pair of relatively movable contacts arranged to extend therein and in series in an electric circuit, means for closing said circuit at one point, a circuit controller for automatically closing said circuit at another point, and a magnet located outside of said cylinder and arranged in said circuit and adapted when energized to relatively move said electrodes to break said circuit, as and for the purpose set forth.

7. An igniting mechanism for combustion engines, comprising a closed casing communicating with the engine cylinder, contacts whose contacting portions are located in said cylinder, and an electro-magnetically-actuated device located in said casing and adapted to impart a blow to one of said contacts, whereby it is separated from the other.

8. An igniting mechanism for combustion engines, comprising a closed casing communicating with the engine cylinder, contacts whose contacting portions are located in said cylinder, devices in said casing for imparting a blow to one of said contacts, whereby it is separated from the other contact, and an electro-magnet located outside of said casing for operating said devices.

9. The combination, with the cylinder of a gas engine, of electrodes arranged within the cylinder, an electromagnet for separating the same outside the cylinder, other means for bringing them together, an electric generator in circuit with the electrodes and with the electromagnet, a circuit controller also in said circuit, and mechanical means connected to a movable part of the engine for actuating the circuit controller to complete the circuit and thereby actuating the electromagnet and the electrodes to produce the spark.

10. The combination, with the cylinder of a gas engine, of electrodes within the cylinder, an electromagnet arranged outside the cylinder to operate the electrodes, an electric generator for energizing the magnet, a circuit controller for the circuit of the generator, and means connected to a movable part of the engine for actuating the circuit controller and thereby actuating the electromagnet to operate the electrodes.

11. The combination, with the cylinder of a gas engine, of electrodes normally in contact arranged within the cylinder, automatic means for bringing them together, an electromagnet arranged outside the cylinder for separating them, an electric generator the circuit of which includes the electromagnet and the electrodes, means connected to a movable part of the engine for closing the electric circuit through the magnet and electrodes whereby when the circuit is closed by said means the electrodes are operated by the electromagnet and the automatic means to produce a series of sparks.

12. The combination, with the cylinder of a gas engine, of two electrodes, mechanical means for bringing the electrodes into contact, an electromagnet for separating the electrodes, an electric circuit including the electrodes and the electromagnet whereby the electromagnet is energized or deënergized

by the making or breaking of the contact between the electrodes, and means connected to a movable part of the engine controlling the circuit of the magnet and electrodes whereby when said circuit is closed by said means the circuit of the magnet is automatically made and broken to produce a series of sparks at the electrode.

In witness whereof I have hereunto set my hand this 23rd day of March, 1897, in the presence of the subscribing witnesses.

LEON O. McPHERSON.

Attest:
FRANK T. BROWN,
S. HUTCHISON.