

No. 696,298.

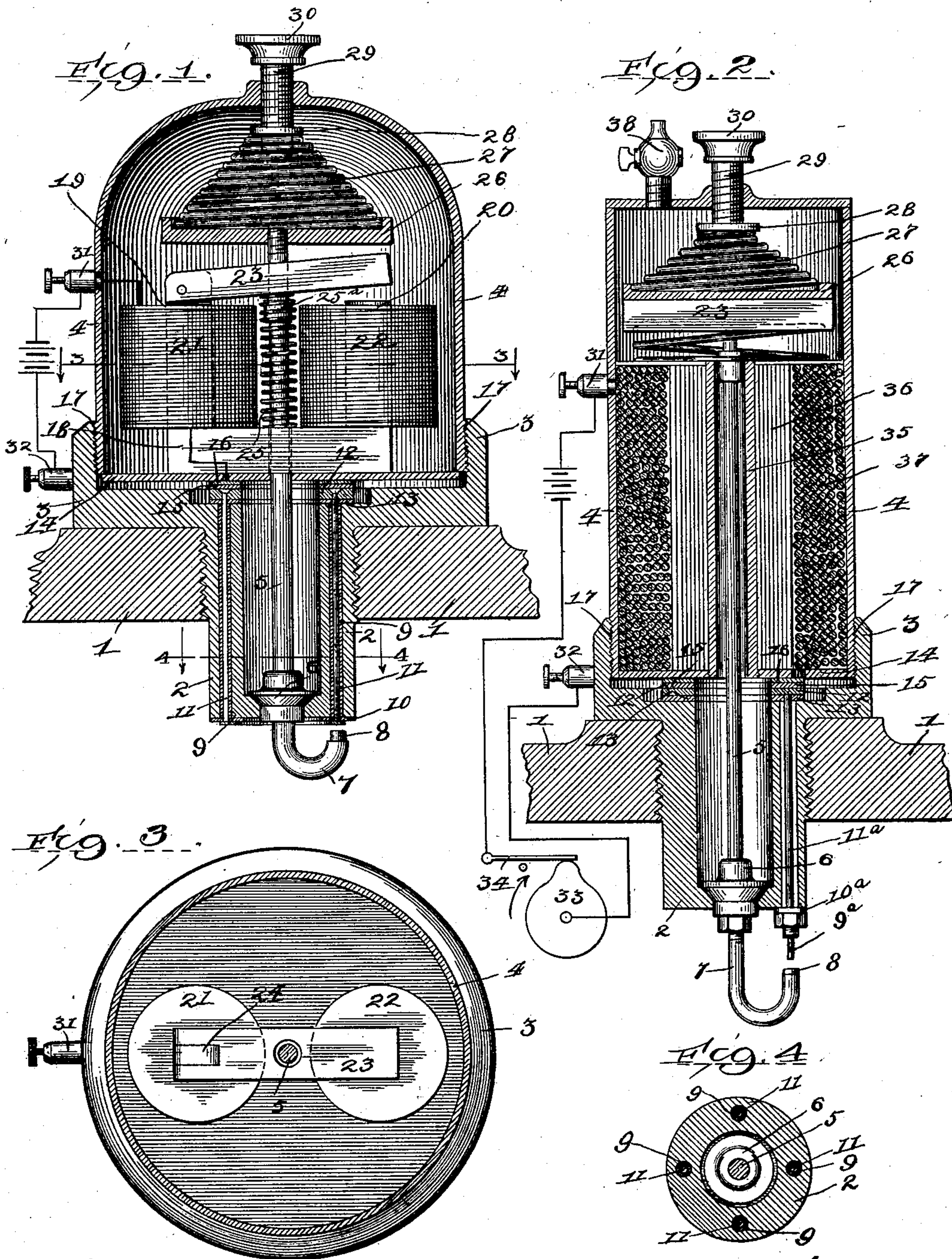
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V. G. APPLE.

ELECTRIC IGNITER FOR GAS ENGINES.

(Application filed Aug. 31, 1901.)

(No Model.)



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UNITED STATES PATENT OFFICE.

VINCENT G. APPLE, OF DAYTON, OHIO, ASSIGNOR TO DAYTON ELECTRICAL MANUFACTURING COMPANY, A CORPORATION OF OHIO.

ELECTRIC IGNITER FOR GAS-ENGINES.

SPECIFICATION forming part of Letters Patent No. 696,298, dated March 25, 1902.

Application filed August 31, 1901. Serial No. 74,020. (No model.)

To all whom it may concern:

Be it known that I, VINCENT G. APPLE, of Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Electric Igniters for Gas-Engines; and I hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to improvements in electric igniters for gas-engines.

The object of my invention is to provide an electric igniter for gas-engines which shall automatically produce a series of sparks within a given time for the purpose of exploding the charges of fuel that are admitted into the cylinders of such gas-engines and compressed therein for the purpose of producing power.

A further object of my invention is to provide a device whereby the pressure within the cylinder of the gas-engine is the means by which the electric circuit is closed through the igniter and the electric current circulating through the electromagnetic operative part of the igniter is the means by which the circuit is opened, the circuit opening and closing points being located in the cylinder or in a chamber adapted to communicate therewith.

Another object of my invention is to provide a device which will produce a great number of sparks within a given time, so as to more completely ignite the charge.

Another object of my invention is to provide a device whereby the time at which the spark is made within the cylinder may be determined by the extent to which the gases within the said cylinder have been compressed.

In the drawings, Figure 1 shows a central section of a vertical elevation of my device. Fig. 2 is a similar view of a modification of the same device. Fig. 3 is a section through line 3 3 of Fig. 1. Fig. 4 is a section through line 4 4 of Fig. 1.

In all of the views the same characters of reference indicate similar parts.

The wall of the engine-cylinder is represented by 1. This is preferably the head of the cylinder. It is provided with a screw-

threaded perforation, in which my device is inserted.

My device is mounted upon a hollow plug 2, the upper end 3 being enlarged and flanged to receive the casing 4. A central vertical stem 5 is provided with a valve 6, which is seated in the bottom wall of the plug 2. The stem 5 is provided with an upwardly-curved end 7, which carries upon its extremity a contact-point of metal, practically non-oxidizable, such as platinum. A stationary contact 9 of similar metal, with this, forms the contacts at which the spark is made.

In Fig. 2 a coacting contact consists of a thin annular ring 9, preferably made of the same character of metal and which is insulatedly supported upon the end of the plug 2 by means of a mica or asbestos washer 10. It is held in its place by means of insulated bolts 11, which pass through vertical perforations made in the stud 2 for this purpose and which engage at their upper surfaces with a similar platinum or other metal ring 12. The latter ring is also insulated by means of a washer 13, which is made of asbestos or mica or other suitable insulating substances. The bottom of the casing 14 has attached to it a similar insulated conducting washer or ring 15, which is insulated from the bottom of the said casing by means of a washer 16. The ring 15 is adapted to make electrical contact with the ring 12 when the casing 4 is screwed into the upwardly-extending flange 3 of the plug 2.

The casing 4 is adapted to be screwed into the upper end of the plug 2 at the point 17.

In Fig. 1 a yoke 18 is located on the bottom 14 of the casing 4, through which the valve-stem 5 passes freely. On either end of the said yoke there are mounted electromagnet-cores 19 and 20. On these cores the electromagnet-windings 21 and 22 are supported. An armature 23 is pivoted to the core 19 and moves freely thereon. It is perforated, so that the valve-stem 5 passes freely through it. An open helical spring 25 surrounds the valve-stem 5, the lower end abutting against the upper surface of the yoke 18. The upper end is attached to an enlargement or thimble 25^a, fixed upon the valve-stem 5. The lower surface of the armature 23 rests upon this en-

largement, and by this means the free end of the armature 23 is held removed from the core 20 of the magnet. The valve 5 terminates above the armature 23 and supports on its upper end a pan 26. This pan contains a conically-wound open compression-spring 27, which terminates against a washer 28, that is fixed to a screw 29. The screw is threaded in the upper portion of the casing 4 and is provided on its upper end with a knurled nut 30. One end of the electric coil terminates in the insulated washer 12. The other end terminates in an insulated binding-post 31. Another binding-post 32 is connected to the frame of the device. In Fig. 1 I have shown the battery B connected between these two binding-posts.

In Fig. 2 I have shown the battery connected directly to binding-post 31 and to a revolving cam 33, which is adapted to be rotated by the engine. A brush 34 is adapted to make contact with the said cam and close the circuit through the battery and coil for a definite period at a definite time. The time at which the cam will close the electric circuit with reference to the stroke may be varied by shifting the said cam upon the mechanism by which it is driven.

In Fig. 2 I have shown a solenoid instead of an electromagnet as shown in Fig. 1, in which the core is composed of an iron tube 35 and a bundle of fine iron wires 36, distributed equally around the said tubular core. The windings or coil surrounding this core I have designated 37. The armature 23 is circular in shape and is fixed directly to the pan 26, which holds the spring 27.

In Fig. 2 I have also shown a cock 38, by means of which a vent from the chamber contained within the casing 4 may be regulated. In practice I have found that this cock is hardly necessary, as the condensation of the gases within the chamber is sufficient during the intervals between the successive explosions to cause a difference of pressure between the interior of the cylinder and the interior of the casing 4 to unseat the valve 6 and close the electric circuit thereby.

The use and operation of my device are as follows: It is designed to be used in connection with gas or vapor engines in which the charge taken into the cylinder of such engines is compressed before it is fired. As shown in Fig. 1, the igniter may be used without the timing device, comprising the cam and brush, that is shown in connection with Fig. 2.

I will first describe the invention in connection with the device illustrated in Fig. 1. Spring 27 is adjusted by means of the screw 30 to hold the valve 6 closed against a predetermined compression. When the gases are compressed within the cylinder to an extent sufficient to overcome the tension of the spring 27, the valve 6 is opened, and electrical connection is made between the contacts 8 and 9, closing the electric circuit from the battery through the electromagnet and the contacts 8

and 9. At this time the magnet-cores 19 and 20 become highly magnetized and in virtue thereof attract the armature 23. The armature 23, acting in conjunction with the spring 27, is attracted with considerable force and, pressing against the enlargement, thimble, or washer 25^a, tends to close the valve 6. As soon as the valve 6 is moved in the direction toward closing the contact is broken between 8 and 9, the magnets are again demagnetized, and the pressure of the gases once more opens the valve 6, producing a vibratory motion of the stem 5 and a series of quick intermittent breaks between the contacts 8 and 9 as a result of the combating forces produced by the pressure of the charge and by the electromagnet effected by the battery B acting in conjunction with the compression-spring 27. The tension of the spring 27 may be varied by means of the screw 30, so that a greater or less pressure will be required to unseat the valve 6. A series of sparks extending over an appreciable time are made between the contacts 8 and 9 instead of one spark, as is usual with devices of this character. The result of this is that the sparks will persistently continue until the entire charge has been thoroughly ignited.

In Fig. 2 I have shown a timing device to be operated by the engine. By this arrangement the electric spark cannot occur between the contacts 8 and 9 except during the time when the circuit is closed between the cam 33 and the brush 34. The time at which the contacts will be closed between the cam 33 and the brush 34 with reference to the stroke of the engine may be varied by shifting the cam forward or backward upon the shaft by which said cam is driven, and the length of time that the contact will be closed between these members may be varied by advancing the brush 34, so that a longer contact will be maintained between the said cam and the brush at the particular period when the spark is desired. Other means than this may be used for producing the timing results—as, for instance, the pressure may be admitted to the valve 6 by a timing device.

I do not desire to be limited to a timing device consisting of the means shown for closing the circuit, which includes an electromagnet adapted to open the said circuit.

The drawings illustrate one way in which my invention may be carried into effect. There are other means that may be used—as, for instance, the vent-valve 38 may be opened and closed at a predetermined time. The difference of pressure on the valve 6 will cause it to open for the purpose described.

Instead of a valve a diaphragm or a close-fitting piston may be used for closing the electric circuit between the electric contacts. The substitution of a diaphragm or piston for the valve is so obvious to those skilled in the art as to require no further explanation. I consider them equivalents, and when the word "valve" is used in the claims I wish to be

understood to mean a valve or equivalent device, such as a piston or diaphragm, or any means by which motion may be effected to move the electrodes into contact or to separate them as a result of the changing difference of pressure between the interior and exterior of the engine-cylinder.

The discharge of the electromagnet is usually sufficient to produce the required spark between the moving electrodes; but an inductive spark-coil may be included in the circuit when desired.

Having described my invention, what I claim as new and useful, and desire to secure by Letters Patent of the United States, is—

1. In an electric igniter, for gas-engines, the combination with an engine-cylinder of two electrodes, a means operated by the difference in pressure existing between the interior and exterior of said cylinder, adapted to control said electrodes, an electromagnet adapted to control said means, and a source of current for energizing said electromagnet, substantially as set forth.

2. In an electric igniter, for gas-engines, the combination with an engine-cylinder of a stationary electrode, a coacting, movable electrode, a valve for moving said electrode, adapted to be unseated by the difference of pressure existing between the interior and exterior of said cylinder, and to close contact between said electrodes, an electromagnet adapted to open the circuit at said contacts, and a source of electric current for energizing said magnet, substantially as set forth.

3. In an electric igniter, for gas-engines, the combination with an engine-cylinder of two electrodes, a valve adapted to be unseated by the difference of pressure existing between the interior and exterior of said cylinder, and to close the circuit between said electrodes, an electromagnet adapted to open the circuit between said electrodes, a source of current for energizing said magnet, and a means for normally holding said valve on its seat, substantially as set forth.

4. In an electric igniter, for gas-engines, the combination with an engine-cylinder of two electrodes, a valve adapted to be unseated by the difference in pressure existing between the interior and exterior of said cylinder, and to close the circuit between said electrodes, an electromagnet adapted to open the circuit between said electrodes, a source of current for energizing said magnet, a spring for normally holding said valve on its seat, and a means for adjusting the tension of said spring, substantially as set forth.

5. In an electric igniter, for gas-engines, the combination with an engine-cylinder of two electrodes, a valve adapted to close the circuit between said electrodes, an electromagnet adapted to open the circuit between said electrodes, a source of current for energizing said magnet, and a means for timing the movement of said valve and said magnet, or both, substantially as set forth.

6. In an electric igniter, for gas-engines, the combination with an engine-cylinder of a stationary electrode, a coacting, movable electrode, a valve for moving said electrode adapted to be unseated by the compression of the charge within the cylinder of said engine, an electromagnet adapted to seat said valve, and a source of electric current for energizing said magnet, substantially as set forth.

7. In an electric igniter, for gas-engines, the combination with an engine-cylinder of two electrodes, a means operated by the difference in pressure existing between the interior and exterior of said cylinder adapted to close a circuit between said electrodes, an electromagnet adapted to open said circuit, and a source of current for energizing said magnet and for producing the sparks between said electrodes, substantially as set forth.

8. In an electric igniter, for gas-engines, the combination with an engine-cylinder, of two electrodes, a means operated by the difference in pressure existing between the interior and exterior of said cylinder, adapted to control said electrodes, an electromagnet adapted to control said means, a circuit including said magnet and said electrodes, and a source of current for energizing said circuit, substantially as set forth.

9. In an electric igniter, for gas-engines, the combination with an engine-cylinder of two electrodes, a means operated by the difference in pressure existing between the interior and exterior of said cylinder, adapted to control said electrodes, an electromagnet adapted to control said means, a circuit including said magnet and said electrodes, a source of current for energizing said circuit and electrodes outside of said cylinder, adapted to be closed periodically by a moving part of said engine, substantially as set forth.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

VINCENT G. APPLE.

In presence of—

L. M. ARNOLD,
CHARLIE SOUERS.