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Inventor:  
Charles S. Beardsley  
By Albert Eugene Dorrance  
his attorney.

# UNITED STATES PATENT OFFICE.

CHARLES S. BEARDSLEY, OF CLEVELAND, OHIO.

## ELECTROMAGNETIC IGNITER.

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Specification of Letters Patent.

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*To all whom it may concern:*

Be it known that I, CHARLES S. BEARDSLEY, a citizen of the United States of America, and a resident of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Electromagnetic Igniters, of which the following is a specification.

My invention relates to improvements in electromagnetic igniter or sparking devices especially adapted for use in connection with gas engines of automobiles and the like, and has for its object the provision of such an igniter which will avoid certain defects hereinafter pointed out, and will be simple and cheap in construction while withstanding ordinary usage for long periods. In devices of this class which of necessity are attached directly to the engine cylinder-head, the several parts are subjected to a high degree of heat, and in view thereof certain precautions must be taken in order to avoid deterioration of the parts. For example, in a device of this character wherein springs are employed the heat within a short time destroys the temper of the spring and causes imperfect action of the device. Even if precautions are taken to remove the spring as far as possible from the engine cylinder it becomes necessary to provide ground joints within the igniter in order to insure a close fit and exclude some of the heat from the actuating spring. Accordingly, I have constructed an igniting device wherein springs are altogether avoided and a positive actuation is insured by providing a relatively strong permanent magnet normally to close the circuit of the igniter.

Further details of construction and the relation of parts may best be gathered by reference to the accompanying drawing in connection with which the specification and claims are to be read, wherein—

Figure I is a vertical sectional view through an igniting device constructed in accordance with my invention. Fig. II is a view in elevation of the casing wherein the several parts are mounted, and Fig. III is a diagram illustrating generally the electrical relation of the parts.

Throughout the several figures of the drawing I have indicated similar parts by the same character of reference.

Referring first to Fig. I, a general idea of the simple structure of my invention will at once be gathered. Therein the perforated

casing *a* is provided with upper and lower heads *a'*, *a''*, the latter of which is screw-threaded below and is designed to be inserted within the engine cylinder-head (not shown in the drawing). Within said casing *a* is provided an electro-magnet *b* which is series-connected with the contact arm *c*. This arm is pivotally mounted to be actuated by the respective armatures *c'*, *c''* carried upon the non-magnetic rocker-bar *c'''*. Adjacent to the electro-magnet is the permanent magnet *d* which normally causes the contact point *c''* to engage with its contact *c'''*, adjustably mounted within the casing-head *a''* and normally extending within the engine cylinder-head. Suitable insulating members *i*, *i'*, preferably asbestos-faced, are provided within the casing and serve to mount the electro-magnet and permanent magnet in position for the proper actuation and engagement of the igniter contacts. Circuit is established through the insulated binding screw *e*, spring *e'* and stud *e''* with which one terminal of the magnet winding is connected, the other terminal being grounded upon the frame *f* which carries the contact arm *c*. The mechanical relation of the parts is apparent from an inspection of Fig. I, while the electrical relation in use will best be gathered by considering Fig. III, wherein the battery *B* is intermittently closed through the igniter circuit containing in series-relation the circuit-closer *C*, the windings *E* of electro-magnet *b*, and the contacts *c''*, *c'''* which are normally held closed by means of the permanent magnet *d*, conductor *A* completing the circuit of the several parts.

The operation of the device will be perfectly clear when it is noted that the electro-magnet will be energized upon each closure of the connected circuit, thereby actuating the contact arm to separate the contacts *c''*, *c'''* and cause a momentary spark between these parts, which, as stated, are positioned within the engine cylinder-head. Immediately the circuit is opened the electro-magnet will be deenergized, and the permanent magnet *d* will serve to close the series contacts. Depending upon the speed of rotation of the circuit-closer *C*, one or more sparks for igniting the charge within the engine cylinder will be produced between the contacts *c''*, *c'''*, but preferably a number of such sparks, caused by the repeated vibration of the contact arm *c*, are produced to effect complete explosion.

Preferably the electro-magnet is of rela-



tively low resistance having been wound by me to approximately five-eighths of an ohm. Moreover, I preferably employ subdivided armature parts  $c'$ ,  $c^2$  as shown in Fig. I and indicated in the diagram, for the purpose of avoiding magnetic interference between the permanent and electro-magnets co-acting in my improved device. While I have described the circuit as being grounded upon the frame or casing, it is obvious that separate insulated leads may be used either for battery or magneto igniter circuits.

Having dispensed with springs, it will be appreciated that my improved device which employs a permanent magnet positively to close the circuit is not liable to deterioration under conditions of hard usage and high degrees of heat, and admirably serves instantly to close the circuit upon the deenergization of the electro-magnet.

Having now explained the preferred details of construction present in a device embodying my invention, I claim as new and desire to secure by Letters Patent the following:

1. In an electro-magnetic igniter, the combination with an electro-magnet and its armature, of a series-connected contact arm actuated thereby, a co-acting contact part, and a permanent magnet opposing the electro-magnet and normally maintaining the contact parts in closed relation, substantially as set forth.

2. In a device of the class described, the combination with an electro-magnet and its armature, of a vibrating contact arm and its stationary contact; the former being actuated by the said armature, and a permanent magnet normally maintaining said contacts in closed relation, substantially as set forth.

3. In a device of the class described, the combination with an electro-magnet and its armature, of a vibrating contact arm and its stationary contact; the former being actuated by the said armature, a permanent magnet normally opposing the electro-magnet, and a separate armature therefor normally retracted to maintain the contacts in closed relation, substantially as set forth.

4. In an electro-magnetic igniter, the combination with an electro-magnet and its armature, of a vibratory contact arm in series-relation with the windings of said electro-magnet, a stationary contact engaged thereby, a permanent magnet positioned adjacent to the electro-magnet, and a separate arma-

ture therefor connected with the contact arm and normally maintaining said contacts in engagement, substantially as set forth.

5. In an electro-magnetic igniter, the combination with the casing, of an electro-magnet and a permanent magnet positioned in the upper portion thereof, a non-magnetic vibratory member, armatures mounted upon said vibratory member and respectively positioned before the electro and permanent magnets, a series-contact upon the vibratory member and a stationary contact with which it is normally held in engagement under the influence of the permanent magnet, substantially as set forth.

6. In a device of the class described, the combination with a movable contact arm, a co-acting contact, an armature actuating the same, a permanent magnet acting normally to maintain said contacts in closed relation, and means opposing said permanent magnet for intermittently separating said contacts to produce electric sparks therebetween, substantially as set forth.

7. In an igniting device of the class described, the combination with a casing, of an interior closure member dividing the same into two separate compartments, one of which is substantially gas-tight, a movable contact-arm and its co-acting contact positioned within the latter compartment, a permanent magnet normally maintaining said contacts in engagement, and means positioned in the other compartment for actuating said contact arm out of engagement with its co-acting contact, whereby said actuating means is relatively insulated from heat, substantially as set forth.

8. In an igniting device of the class described, the combination with a casing, of a diaphragm dividing the same into two separate compartments, one of which is open to the external air, an electro-magnet positioned within the latter compartment, a movable contact arm and its co-acting contact positioned within the other compartment, and a permanent magnet normally maintaining said contacts in engagement, substantially as set forth.

Signed at Cleveland, this third day of August, 1908, in the presence of two subscribing witnesses.

CHARLES S. BEARDSLEY.

Witnesses:

FRANK H. FORREST,  
ALBERT LYNN LAWRENCE.