No. 819,268. PATENTED MAY 1, 1906.

A. E. DOMAN.

ELECTRIC SPARKING DEVICE.

APPLICATION FILED FEB. 1, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

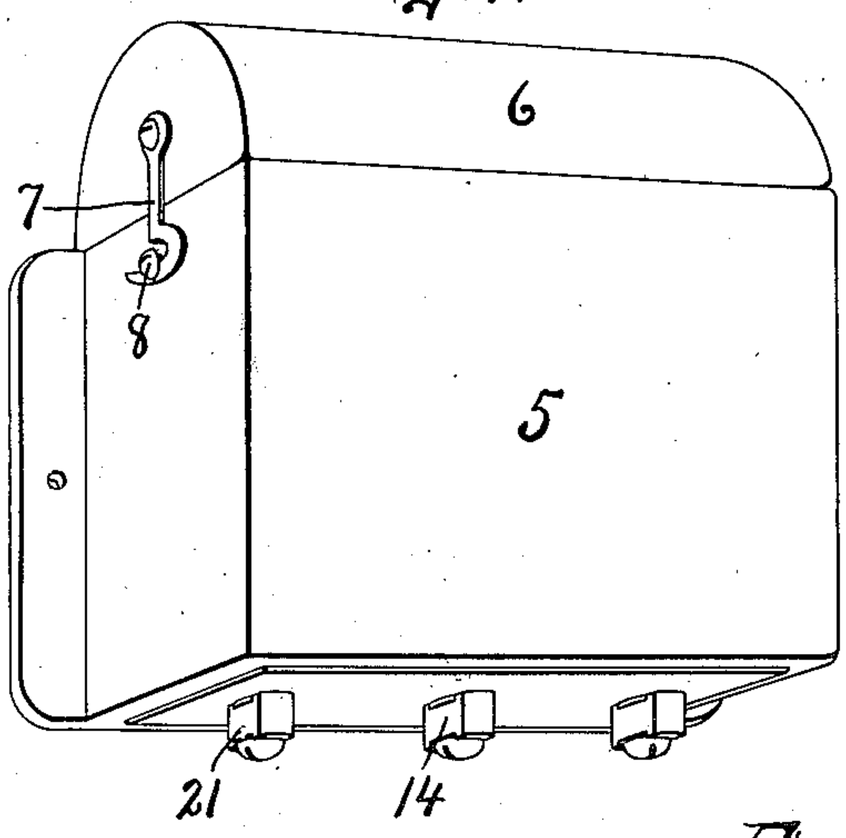


Fig. 2.

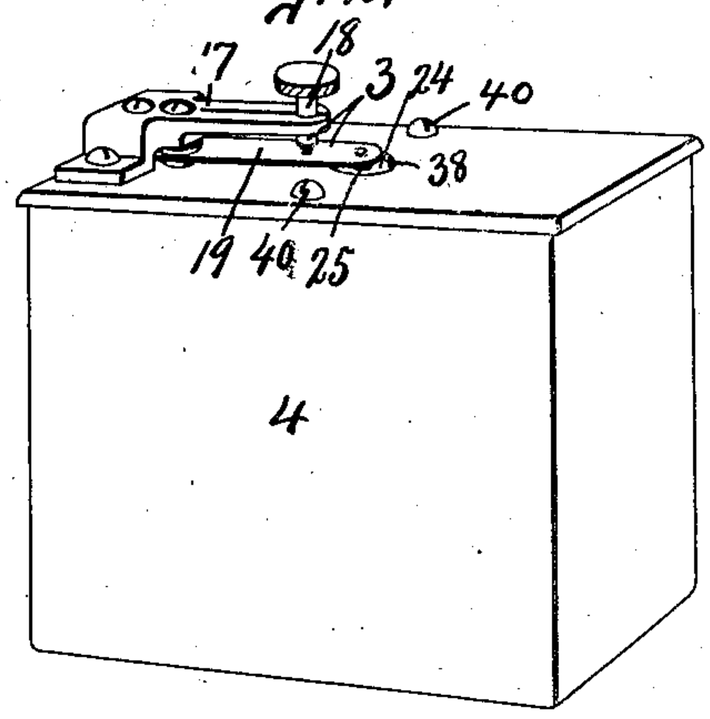
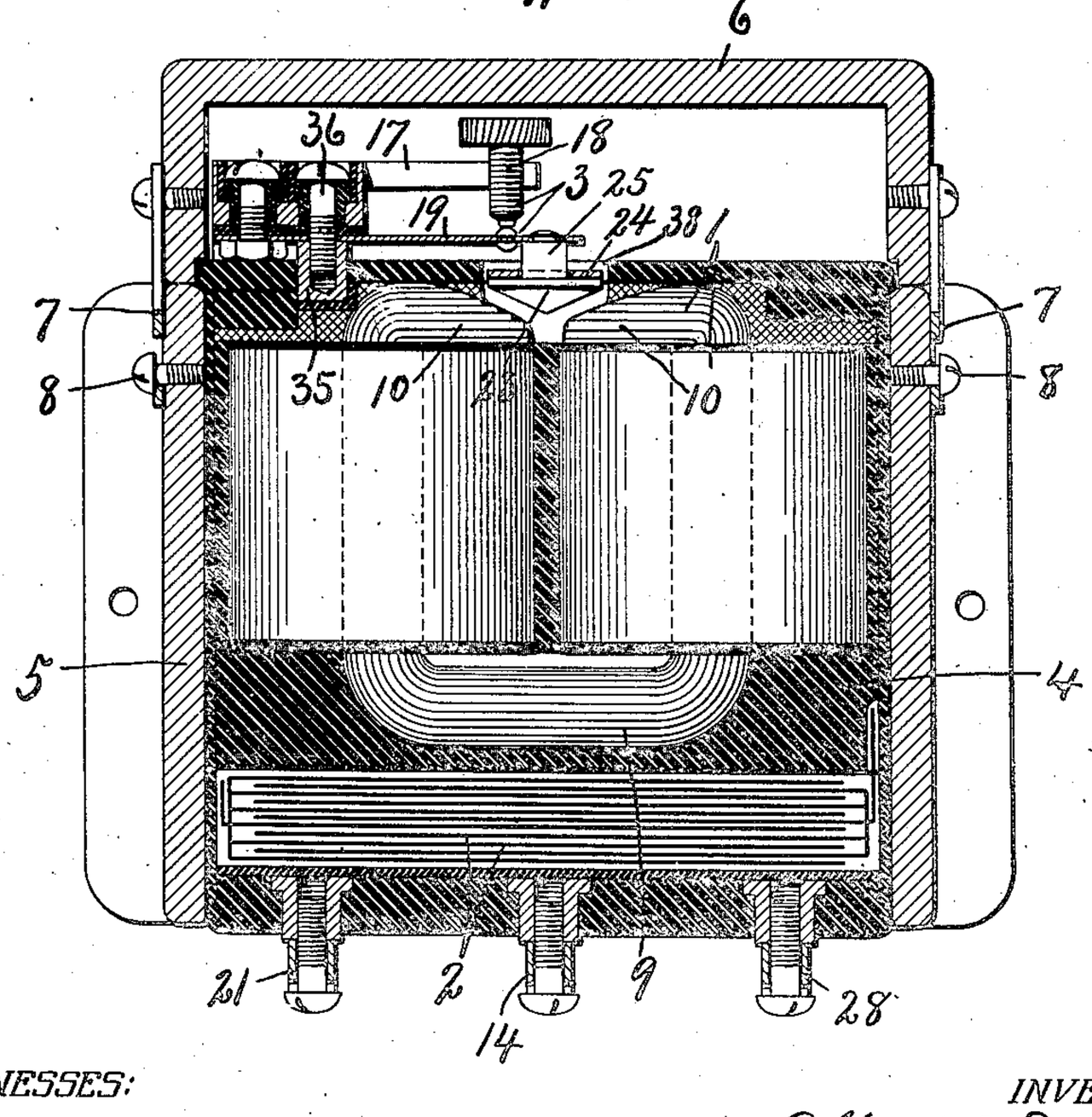


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 4

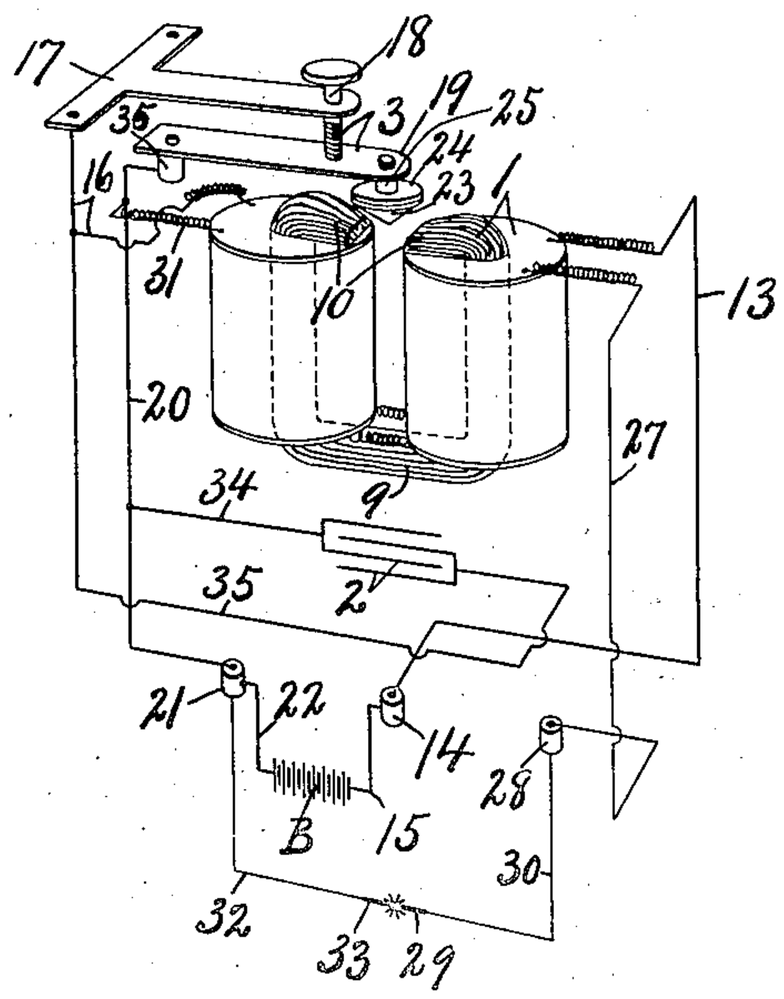


Fig. 5

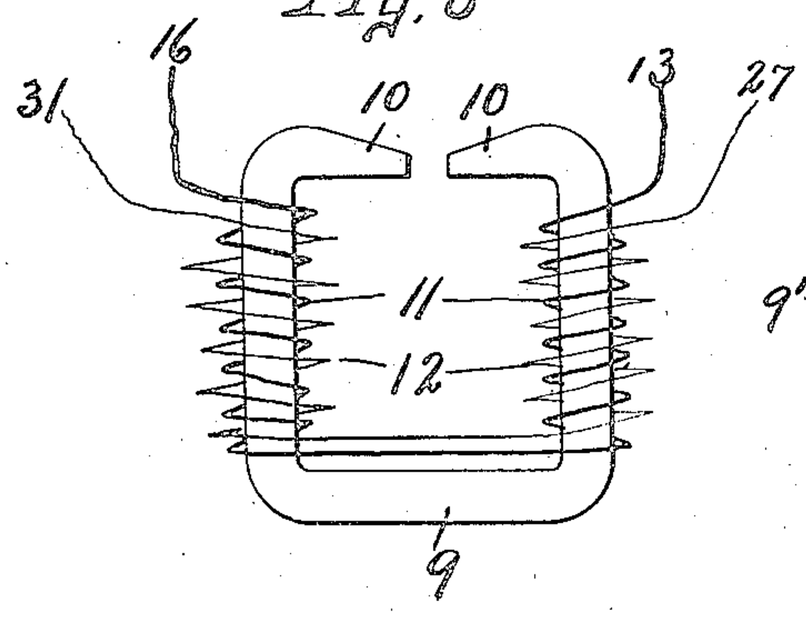
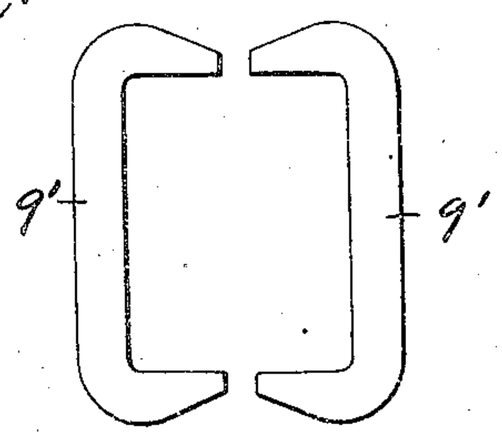


Fig. 6



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UNITED STATES PATENT OFFICE.

ALBERT E. DOMAN, OF ELBRIDGE, NEW YORK.

ELECTRIC SPARKING DEVICE.

No. 819,268. Specification of Letters Patent. Patented May 1, 1906.

Application filed February 1, 1905. Serial No. 243,738.

To all whom it may concern:

Be it known that I, ALBERT E. DOMAN, of Elbridge, in the county of Onondaga, in the State of New York, have invented new and useful Improvements in Electric Sparking Devices, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates to improvements in electrical sparking devices for gas-engines and analogous uses, and refers more particularly to the sparking coil and its accessories for producing an intense electric spark with a substantially low electro force or battery energy.

This sparking device is especially adapted for use on automobiles in which a vapor-engine is used as the propelling power; but it will be clearly evident that it is equally adapted for other analogous uses, such as igniting the explosive mixtures of stationary or marine gas-engines.

The primary object is to provide an induction-coil in which the reluctance of the magnetic circuit is reduced to a minimum by bringing the poles or ends of the core of said coil into close relation with each other and to provide each end of the core with a separate primary winding each having a secondary winding.

Another object is to provide a simple make-and-break contact device with a sectional armature in which one of the sections is loose and more or less inert, so that when the armature is suddenly attracted by the energizing of the primary coil the inertia of the movable or loose section of the armature allows a vibratory finger or spring to separate from its contact-terminal with a quick break, but slow recovery. This action is due to the sudden attraction of the section of the armature which is fixed to the vibrating spring and is drawn away from the loose superimposed section by reason of its inertia and the fact that the loose member immediately follows the section which is fixed to the vibrating spring to retard its recovery, thereby not only effecting a quick break and consequent increased spark, but also operating to save current and prolong the life of the battery.

A further object is to assemble the various parts of the electric spark device in a compact manner in a suitable case, so that the make-and-break contact device may be easily and quickly adjusted and repaired at any time, all of the parts being assembled upon or within a suitable insulating-block which is adapted to be inserted in or removed from the case.

In the drawings, Figure 1 is a perspective view of my improved sparking device, showing particularly the construction of the outer inclosing case and its cap and projecting terminals or binding-posts. Fig. 2 is a perspective view of the insulating-block containing the spark-coil, condenser, and make-and-break contact device. Fig. 3 is a longitudinal vertical sectional view through the outer case and insulating-block, showing the manner of assembling the spark-coil, condenser, and vibrator or make-and-break contact device upon the insulating-block and within the inclosing case. Fig. 4 is a diagrammatic view of the various parts of my invention, showing the electrical connection of such parts with each other and with a source of electric energy and sparking terminals. Fig. 5 is an elevation of the core of the spark-coil seen in Fig. 3. Fig. 6 is a similar elevation of a modified form of core which may be used in place of that seen in Figs. 3 and 5.

The invention comprises, essentially, a spark-coil 1, a condenser 2, and a vibrator or make-and-break contact device 3, all of which parts are mounted within and upon a suitable block 4 of insulating material—such as wood, hard rubber, or other equivalent substances—and this insulating-block is fitted within the outer casing or shell 5, of wood or similar material, which is neatly finished and provided with a removable cap 6, said cap being held in place in this instance by hooks 7, which are detachably interlocked with shoulders 8 at opposite ends of the box or case.

The spark-coil, which forms one of the essential features of my invention, comprises a U-shape core 9, consisting of a bunch of wires or strips of magnetic metal, such as soft iron, having their ends bent in parallel lines and their extremities 10 turned toward and in close proximity to each other, as best seen in Figs. 3 and 4, each parallel side or arm of the core being provided with a primary winding 11 and a secondary winding 12, the primary and secondary windings of each coil being electrically connected to its like winding of the other coil to establish a continuity of circuit through both coils.

One of the primary coils is connected by a

wire 13 to a binding-post 14 and thence by a wire 15 to a source of electric energy, as a battery B. The other primary coil is connected by a wire 16 to a metal frame 17, carrying an adjusting-screw 18, which is normally in electrical contact with a metal spring 19. This spring 19 is connected by a wire 20 to a binding-post 21 and thence to the other pole of the battery B by a wire 22, as best seen in Fig. 4, thereby establishing a battery or primary circuit through the primary windings of the spark-coil. The free end of the spring-arm 19 is provided with an armature 23, having a loose section 24 of suitable material, preferably metal, which normally adds weight to the armature, and being loosely mounted upon the armature is more or less inert or sluggish in its action as compared with the instantaneity of action of the armature when the spark-coil is energized. The armature 23 is secured by a stud or rivet 25 to the free end of the spring-arm 19, and its lower face is preferably conical, as shown in Figs. 3 and 4, to present as much area as possible to the flattened ends or extremities 10 of the core 9, thereby increasing the magnetic pull upon the armature.

The loose section 24 is preferably made in the form of a washer, which encircles the stud 25 and rests loosely upon the upper horizontal face of the armature 23. It is now clear that when the induction-coil is energized by the battery-current the armature 24 and free end of the spring 19, attached thereto, are suddenly attracted or drawn toward the ends 10 of the core 9 and that on account of the inertia of the loose weighted section 24 the armature 23 for the instant is separated or drawn away from the loose section 24, thereby relieving the inertia of the armature to this extent and permitting a quick break between the contact-terminals, as the spring 19 and adjusting-screw 18 of the make-and-break contact device. This is an important feature of my invention, for the reason that I am enabled to produce an extremely quick break in the circuit, which results in an increased sparking effect at the sparking terminals of the induced current, presently described, and at the same time while the breaking action is rapid the recovery of the armature sufficient to allow the closing of the primary circuit by the make-and-break contact device is somewhat slow, owing to the fact that soon after the armature is drawn down the loose member or section 24 follows to retard the reaction, and thereby saves to a limited extent the loss of current and increases the life of the battery.

One secondary coil is connected by a wire 27 to a binding-post 28 and thence to a sparking terminal 29 by means of a wire 30, while the other secondary coil is connected by a wire 31 to the terminal 21 by means of the wire 20 and thence to a second sparking terminal 33 by means of a wire 32, thereby connecting the sparking terminals 29 and 33 in the induction-circuit.

The condenser 2 may be of any desired construction, but preferably consists of the usual layers of tin-foil with interposed layers of paper or other insulating material, one terminal of the condenser being connected by a wire 34 to the wire 20 and is therefore connected to the spring-terminal 19, while its other terminal is connected by a wire 35 to the wire 16, and consequently is connected to the terminal 18, thus placing the condenser in circuit with the make-and-break contact device. The construction, manner of connecting, and purpose of the condenser 2 are well known, and it is therefore believed to be unnecessary to further illustrate or describe the same.

By constructing the core 9 U shape in the manner previously described and bringing its ends into close proximity to each other it is apparent that the reluctance of this magnetic circuit is reduced to a minimum, and that this materially increases the electromagnetic effect of the core when the primary coils are energized, and that this increased magnetic effect is concentrated to attract the armature 24 with great positiveness and force, even by the use of a small battery energy, and that this positive and forceful attraction of the armatures causes an instantaneous break at the terminals 18 and 19, which produces a high degree of electromotive force in the secondary circuit.

It will be observed upon reference to Figs. 3 and 4 that the make-and-break contact device is mounted upon the upper end of the insulating-block 4, in which is embedded a suitable nut 35 to receive a clamping-screw 36, whereby the parts of the vibrator or make-and-break contact device are secured to the insulating-block.

The central portion of the top of the insulator-block 4 is formed with an aperture 38, through which the armature 23 and its loose section 24 play.

The induction-coil proper consists of the core 9 and its primary and secondary windings and is embedded into and entirely surrounded by the insulating-block 4 below the make-and-break contact device, while the condenser 2 is also inclosed within the insulating-block just below the induction-coil.

The top of the insulating-block 4 just above the induction-coil is removable by removing the make-and-break contact device and is secured to the underlying portions of the insulating-block by screws 40, the object of this removable top being to permit the induction-coil to be elevated bodily out of its casing when desired to repair or inspect any part thereof. In like manner the lower part of the insulating-block 4 may be removed to permit the removal or the inspection of the

condenser, the bottom of the insulating-block below the condenser being adapted to receive and support the binding-posts 14, 21, and 28. This insulating-block 4, with the induction-coil, condenser, and make-and-break contact device mounted thereon, is inserted and fit closely within the case 5, and the top of the insulating-block projects beyond the sides of the main body to engage the top edge of the outer case 5, and thereby support said insulating-block from further downward movement, while the cap 6 covers the top of the block and vibrator and engages the top of said block to prevent its upward movement, so that when the hooks 7 are engaged with their shoulders 8 the top 6 is locked to the case 5 and also operates to lock the insulating-block from vertical movement within the case.

In Fig. 6 I have shown the core of the spark-coil as consisting of two sections 9′, each of which is formed with a bunch of soft-iron wire or strips having their extremities bent laterally toward each other for reducing the reluctance of the magnetic circuit, each core-section being adapted to receive a primary and secondary winding in the manner previously described for the core 9.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. An electric sparking device, comprising a spark-coil having parallel cores turned toward each other at one end beyond the main body of the cores to diminish the reluctance of the magnetic circuit, a vibrator electrically connected in series with the primary windings of the spark-coil and having its armature playing between said inturned ends of the cores, and sparking terminals in circuit with the secondary windings of said coil

2. An electric sparking circuit comprising two electromagnets having their pole-pieces projecting laterally toward each other some distance beyond their cores to diminish reluctance in the magnetic circuit, said electromagnets having primary and secondary windings, a source of electric energy for the primary windings, sparking terminals in circuit with the secondary windings, a vibrator electrically connected in the primary circuit in series with said primary windings and having its armature playing between said pole-pieces.

3. An electric sparking device comprising a body of insulating material, a spark-coil embedded in and inclosed by said body and having pole-pieces bent laterally toward each other beyond their cores to reduce reluctance to the magnetic circuit, said insulating-body having an opening through which portions of the pole-pieces are exposed, a vibrator connected in series with the windings of the spark-coil and having its armature playing in said opening, and sparking terminals electrically connected in the secondary circuit.

4. In an electric sparking device, a body of insulating material, a spark-coil embedded in said body and having pole-pieces extending toward each other beyond their cores, a vibrator electrically connected in series with the primary windings of said spark-coil and having its armature playing between said pole-pieces, sparking terminals in the secondary circuit and a condenser electrically connected in the primary circuit, and also embedded in the body of insulating material.

5. An electric sparking device comprising a body of insulating material, a sparking coil embedded in and inclosed by said body, a vibrator mounted upon the exterior of said body and electrically connected in the primary circuit of the spark-coil, said vibrator having its armature playing between the pole-pieces of the spark-coil, and a sectional casing inclosing the body of insulating material and vibrator.

6. In an electric sparking device, an induction-coil and a make-and-break contact device in the primary circuit, said device including a vibrating arm carrying an armature and a loose weighted member on the armature, the inertia of which causes the armature to leave it when attracted by the core of the spark-coil to permit a quick break, said loose member immediately following the attracted armature to retard its recovery.

7. In combination with a spark-coil having the ends of its core brought into close relation with each other, a make-and-break contact device electrically connected in series with the primary winding of the spark-coil, and including a vibrating member carried by the armature for the purpose described and means to retard the action of the vibrating member in closing the circuit after each break.

8. In an electric sparking device, a spark-coil having the ends of its core brought close together, a make-and-break contact device having its vibrating member provided with an armature normally resting in close proximity to the projecting ends of said core, a weighted member mounted loosely upon the armature for the purpose described, and a condenser connected to the terminals of the make-and-break contact device, said device being electrically connected in series with the primary windings of the spark-coil.

9. An electric sparking device comprising an insulating-block, a spark-coil inclosed or embedded within said block, a condenser also inclosed within the block below the spark-coil, and a vibrator mounted upon the top of the block above the spark-coil, said spark-coil having its ends brought upwardly into close relation to each other and the insu-

lator-block having an opening in its top registering with the projecting ends of the core, an armature secured to the vibrating member of the vibrator and a weighted member resting loosely upon the top face of the armature for the purpose described.

10. In combination with an inclosing case open at the bottom and top, an insulating-block fitted in the case, a cap covering the upper end of the case and insulating-block and detachably secured to said case, a spark-coil embedded in the insulating-block and having the ends of its core brought close together at the top, and a make-and-break contact device mounted on the insulating-block and having its vibrating member provided with an armature suspended over the adjacent ends of said core, and a weighted member loosely mounted upon the top face of the armature for the purpose described.

In witness whereof I have hereunto set my hand this 25 day of January, 1905.

ALBERT E. DOMAN.

Witnesses:
A. E. BROWN,
D. C. MERRIMAN.