No. 837,201. PATENTED NOV. 27, 1906.

A. E. DOMAN.

AUTOMATIC CIRCUIT BREAKER.

APPLICATION FILED MAY 21, 1902.

Fig. 1.

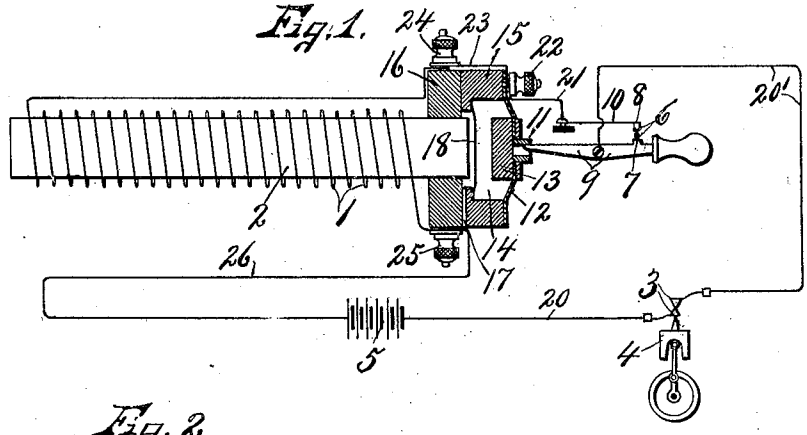


Fig. 2

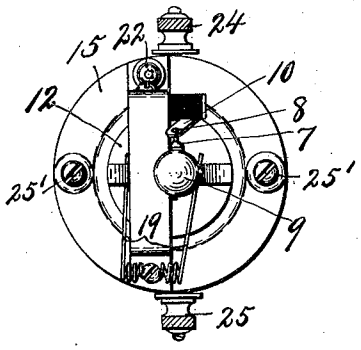


Fig. 3.

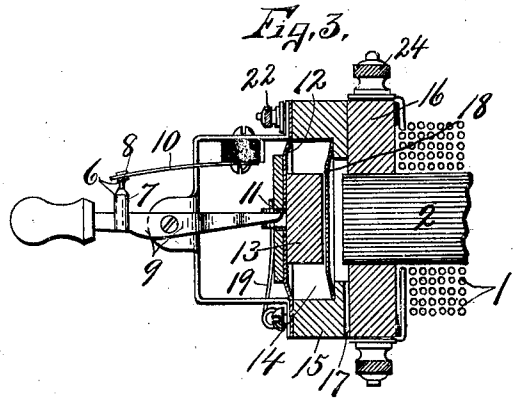


Fig. 5.

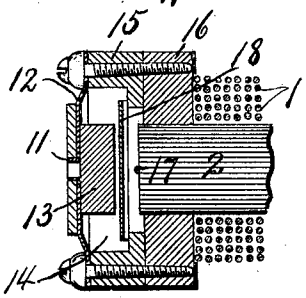
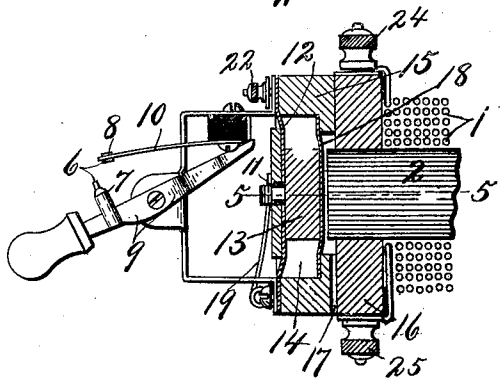


Fig. 4.



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AUTOMATIC CIRCUIT-BREAKER.

No. 837,201. Specification of Letters Patent. Patented Nov. 27, 1906.

Application filed May 21, 1902. Serial No. 108,349.

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 Automatic Circuit-Breakers, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates to improvements in automatic circuit-breakers, and is particularly applicable for use in connection with vapor-engines in which the explosive mixture is ignited by an electrical spark, the device being also applicable for use in connection with any electric circuit in which the direct current is susceptible to pulsations of varying frequency or reduction.

The broad object of my invention is to utilize a variation in the frequency or reduction of direct-current impulses for making or breaking of the electric circuit.

A more specific object is to automatically break the electric circuit in which the sparking terminals of a vapor-engine or similar device are connected should said terminals remain in contact when the engine or device is at rest and the circuit is closed.

Another object is to provide a circuit-breaker connected in a working circuit using a direct current of pulsating character, which circuit-breaker is not influenced by the pulsations of the working current, but is brought into action under the influence of a steady flow or continuous current through the same circuit or another circuit controlled by the working circuit.

To this end the invention consists in the combination, construction, and arrangement of the parts of an automatic circuit-breaker, as hereinafter fully described, and pointed out in the claims.

Referring to the drawings, Figure 1 is a diagrammatic view of an electric working circuit adapted for use in the ignition of the explosive mixture of vapor-engines, showing a sparking coil and my improved circuit-breaker partly in section and diagrammatically. Fig. 2 is an end view of the sparking coil and my improved circuit-breaker attached thereto. Figs. 3 and 4 are longitudinal sectional views through one end of the sparking coil, showing my improved circuit-breaker in operative position in Fig. 3 as closing the circuit and in its inoperative position in Fig. 4, in which the circuit is broken. Fig. 5 is a sectional view taken on line 5 5, Fig. 4.

Similar reference characters indicate corresponding parts in all the views.

As previously stated, my invention is particularly applicable for use in connection with vapor-engines, in which a sparking or induction coil and terminals are employed to ignite the explosive mixture.

It frequently happens that when the engine in which the sparking terminals are used is at rest the sparking terminals either remain in contact one with the other or by casual manipulation of the engine by hand the sparking terminals are brought into contact and the attendant or operator fails to open the switch to break the working circuit. Therefore there is a continuous flow of the current from the source of electric energy as a battery, which under these circumstances soon exhausts itself, and when the operator or attendant wishes to start the engine the battery-current, if any, is insufficient to produce a spark at the contact-terminals. It is thus seen that in order to maintain the battery energy at its full degree of efficiency it is necessary to employ some means influenced by a continuous or steady current which will break the circuit and at the same time is not susceptible to operation by a pulsating-current in which the pulsations are substantially uniform in frequency. This, together with the objects previously stated, I have sought to carry out, and I have shown in the drawings one form of my invention as used in connection with a sparking coil and terminals of an electric circuit for igniting the explosive mixture of a vapor-engine and consisting, essentially, of asparking coil 1 and core 2, contact make-and-break device, consisting of terminals 3, adapted to be brought into contact intermittently by a moving part, as a piston 4 of an engine, (shown diagrammatically in Fig. 1,) all of which parts may be of any desired form, size, or construction, the current being supplied from any source of electric energy, as a battery 5. (Also indicated diagrammatically in Fig. 1.)

Connected in the electric circuit is a switch or circuit breaker 6, consisting of contact-terminals 7 and 8, the terminal 7 being mounted upon a movable member, as a lever 9, at one side of its fulcrum, and the terminal 8 is mounted upon a spring-arm 10, portions of the lever 9 and spring-arm 10 forming a part of the circuit when the terminals 7 and 8 are in contact. One of the terminals, as the terminal 7, is arranged to move auto-

matically out of contact with the terminal 8 for breaking the circuit under certain conditions hereinafter described, and in order to effect this break in a simple manner the terminal 7 is mounted upon a weighted end of the lever 9 in such manner that when the lever is released the weighted end automatically drops by gravity, and thereby disengages the terminal 7 from the terminal 8. These terminals 7 and 8 are normally held in contact by a detent 11, which is mounted in such manner that the pulsations of a direct current caused by the intermittent contact of the sparking terminals 3 does not sufficiently effect the detent to release the lever 9; but under pulsations of low frequency or a continuous steady current said detent is operated to release the lever and permit the terminals 7 and 8 to disengage one from the other. The means for controlling the operation of the lever or, rather, of the detent is here shown as consisting of a diaphragm 12, an armature 13, mounted upon the diaphragm in alinement with the core 2, and a suitable chamber 14, interposed between the diaphragm and adjacent end of the core for receiving an elastic body, as air or liquid. The detent 11 is mounted upon the diaphragm 12 in such manner as to receive the adjacent end of the lever 9 for holding the same in its operative position with the terminals 7 and 8 in contact.

The diaphragm 12 is secured to the outer face of a suitable head or annular ring 15, which in turn is secured to the adjacent head 16, forming one of the supporting-heads of the core 2 and coil 1. This diaphragm forms the outer wall of the chamber 14, and the head 16 of the adjacent end of the core 2 forms the inner wall of said chamber, while the head or annular ring 15 forms the inclosing side wall surrounding the chamber, and it is thus apparent that the air or other fluid in the chamber 14 offers a certain degree of resistance to the inward movement of the diaphragm 12 and armature 13 and prevents the operation of the detent 11 and switch 6 during the intermittent flow or pulsations of the direct current caused by the intermittent contact of the terminals 3. In order to render this action more certain and automatic, I interpose a valve 18 between the chamber 14 and a vent 17, the vent 17 serving to admit air or other fluid to the chamber 14 when the diaphragm 12 and armature 13 are in their normal position, and the valve serves to prevent the sudden escape of air from said chamber when the intermittent pulsations through the coil 1 tend to attract the armature 13, the cushion thus afforded between the diaphragm 13 and closed valve 18 preventing the withdrawal of the detent 11 from engagement with the adjacent end of the lever 9 during such intermittent action or pulsation of the current.

Should the sparking terminals 3 remain in contact when the engine is at rest, it is evident that the current would be continuous and steady through the coil 1 and that under such conditions the armature 13 and diaphragm 12 are gradually drawn toward the core 2 against the cushion in the chamber 14, it being understood that under this continued attraction of the armature the air or other fluid is gradually expelled from said chamber through leakage to the vent 17 around the valve 18 until the detent 11 is withdrawn from holding engagement with the lever 9, whereupon the weighted end of the lever automatically drops and disengages the terminal 7 from the terminal 8, thus breaking the circuit and preserving the energy of the battery 5. As soon as the circuit is broken the diaphragm 12 and the armature attached thereto is returned to its normal position by any desired means, as a spring 19. When the operator or attendant desires to again start the engine, the switch-lever 9 is manually rocked to the position seen in Figs. 1 and 3, with the terminal 7 in contact with the terminal 8, and the detent 11 in holding engagement with the adjacent end of the lever, said parts remaining in this position until the lever is again released by the continuous or steady flow of the current, the operation of breaking the circuit being entirely automatic.

In the operation of my invention, Fig. 1, the current flows from one pole of the battery through a wire 20 to the terminals 3 and is continued through an additional wire 20′ to the fulcrum of the lever 9, which is in electrical connection with the wire 20′. When the terminals 7 and 8 are in contact, the current then flows through the spring 10, wire 21, to a binding-post 22, and thence over an additional wire 23 to a second binding-post 24, from which the current passes through the coil 1 to a third binding-post 25 and thence over the wire 26 to the other pole of the battery 5. The valve 18 is interposed between the vent 17 and the main chamber 14 and opens at the edges, as seen in Fig. 5, to admit air or other fluid to said chamber 14 when the diaphragm 12 is moved to its normal position by the spring 19, said valve being automatically closed by the compression of the fluid in the chamber when the diaphragm is drawn toward the adjacent end of the core 1 under magnetic influence upon the armature 3. The air-passage 17 opens to atmosphere and communicates with the space between the valve 18 and end of the core 2, and the valve 18 opens in the chamber 14, and therefore the atmospheric pressure will always be the same in the space between the valve 18 and the adjacent end of the core 2 and also in the chamber 14 when the diaphragm 12 is drawn outwardly by the spring 19. This valve 18 allows the air to readily

enter the chamber 14, but closes communication between said chamber and the air-inlet 17 when the diaphragm 12 is drawn inwardly by attraction of the electromagnet-core 2. This compression of the air in the chamber 14 prevents the tripping of the detent 11 under quick-current impulses; but under continued attraction of the electromagnet the valve 18 is sufficiently loose to allow the air to leak around its open edges into the space between the valve 18 and adjacent end of the core 2, from which it can escape through the vent 17. The head 15 is removably secured to the head 16 by suitable fastening means, as screws 25', and while this is a particularly simple, compact, and efficient means for carrying out the object of my invention it is evident that other forms of circuit-breaker may be employed and that the means for controlling the circuit-breaker may be connected to a separate circuit controlled by the working circuit. I have described particularly the method of operating or releasing the circuit-breaker by the continuous current; but it is apparent that should the periodicity of the pulsations of the current become sufficiently frequent to produce a continuous influence upon the armature 13 and diaphragm 12 the detent 11 would likewise be withdrawn from holding engagement with the lever 9 and thereby release said lever and break the working circuit. In like manner should the pulsations be extremely slow, in which instance the contact-terminals 3 would be held for a considerable period of time in contact, this would also tend to operate the detent to release the lever and break the working circuit.

The operation of my invention will now be readily understood upon reference to the foregoing description and the accompanying drawings, and it will be noted that the essential feature of this invention is the application of a variation or cessation of current impulses in an electric circuit to the automatic operation of a switch or circuit-breaker to open said circuit and that various means may be devised for accomplishing this result. Therefore I do not limit myself to the precise construction and arrangement shown and described.

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

1. The combination with a direct electric circuit, of an intermittently-acting make-and-break device in said circuit, means to operate said device to open and close the circuit at regular short intervals, a sparking coil connected in said circuit and provided with a core, a circuit-breaker in the electric circuit, a detent holding the circuit-breaker in its closed position, a diaphragm and an air-chamber at one end of the core and an armature on the diaphragm operatively connected to trip the detent when the circuit is closed through the coil for a longer period of time than the regular periods of contact make-and-break device.

2. The combination with a direct-current electric circuit and a source of electric energy, of a contact make-and-break device connected in said circuit and operating at regular intervals, means to actuate said device, a normally closed circuit-breaker and an electromagnet both in the same circuit with said device, an air-chamber, and a diaphragm at one end of the magnet, means on the diaphragm to hold the circuit-breaker in its closed position, and an armature on the diaphragm attracted by the magnet when the circuit is closed for a longer period than the regular interval of contact of the make-and-break device to trip the means which holds the circuit-breaker.

3. The combination with a direct-current electric igniting circuit of a gas-engine, of an intermittently-acting make-and-break device in said circuit, a reciprocating piston connected to actuate said device at regular short intervals, a normally closed circuit-breaker in the electric circuit a movable diaphragm, an armature on the diaphragm, a detent on the armature holding said circuit-breaker in its closed position, and an electromagnet connected in the electric circuit said armature and diaphragm being brought into action by the magnet when energized longer than the regular interval of operation of the make-and-break contact device to trip the detent.

4. An electric circuit having a direct current and including in the circuit the make-and-break sparking terminals of a gas-engine, a spark-coil in the circuit, an air-chamber at one end of the coil having one of its walls movable, an armature carried by the movable wall and attracted by the energizing of the coil, and means controlled by the movable wall to break the circuit when the terminals remain in contact.

5. An electric circuit having a direct current and including in the circuit the make-and-break sparking terminals of a gas-engine, connected in the circuit, an armature for said device, means between the armature and magnetic device acting to resist the magnetic pull upon the armature under the pulsating current produced by the intermittent contact of the terminals, and means controlled by the armature for breaking the circuit when intermittent contact of the terminals ceases and they remain in contact.

6. In combination with an intermittently-acting make-and-break contact device of an electric circuit in which a direct current is employed, an electromagnetic element connected in the circuit, an armature for said element, a fluid-cushion between said element and armature acting to resist the mag-

netic pull upon the armature during the intermittent action of the contact device, and means controlled by the armature to break the circuit when said intermittent action ceases and the contact is closed.

7. In combination with an intermittently-acting make-and-break contact device of an electric circuit in which a direct current is employed, an electromagnetic element connected in the circuit, an armature for said element, pneumatic means including a movable diaphragm carrying the armature and operating to resist the magnetic pull upon the armature during the intermittent action of the contact device, a detent on the armature and additional means controlled by the detent for breaking the contact when the intermittent action ceases and the contact remains closed.

8. The combination with a source of electric energy and a direct-current electric circuit, of make-and-break contact-terminals connected in said circuit for igniting the explosive mixture of a gas-engine, a circuit-breaker in and for said circuit, an electromagnetic element connected in and energized by said circuit, said terminals, circuit-breaker and electromagnetic element being connected in series in said circuit, a detent for the circuit-breaker, an armature attracted by the electromagnetic element and connected to trip the detent when the contact of the terminals is unduly prolonged, and an air-chamber between the armature and magnetic element operating to resist the attraction of said means under regular current impulses in the circuit.

9. The combination with the sparking terminals and piston of a gas-engine, the latter operating to produce a regular intermittent contact of the terminals, of a source of electric energy producing a direct current and its working circuit in which the terminals are connected, a normally closed self-opening electric switch and an electromagnetic device both connected in said circuit, a detent holding the switch closed, an armature for said device and connected to control the operation of the detent, and an air-cushion between the armature and said device to retard the action of the armature under regular pulsations of the current, the prolonged contact of the terminals causing the attraction of the armature to trip the detent and permit the opening of the switch.

In witness whereof I have hereunto set my hand this 17th day of May, 1902.

ALBERT E. DOMAN.

Witnesses:
FRED C. CARPENTER,
L. B. DOMAN.