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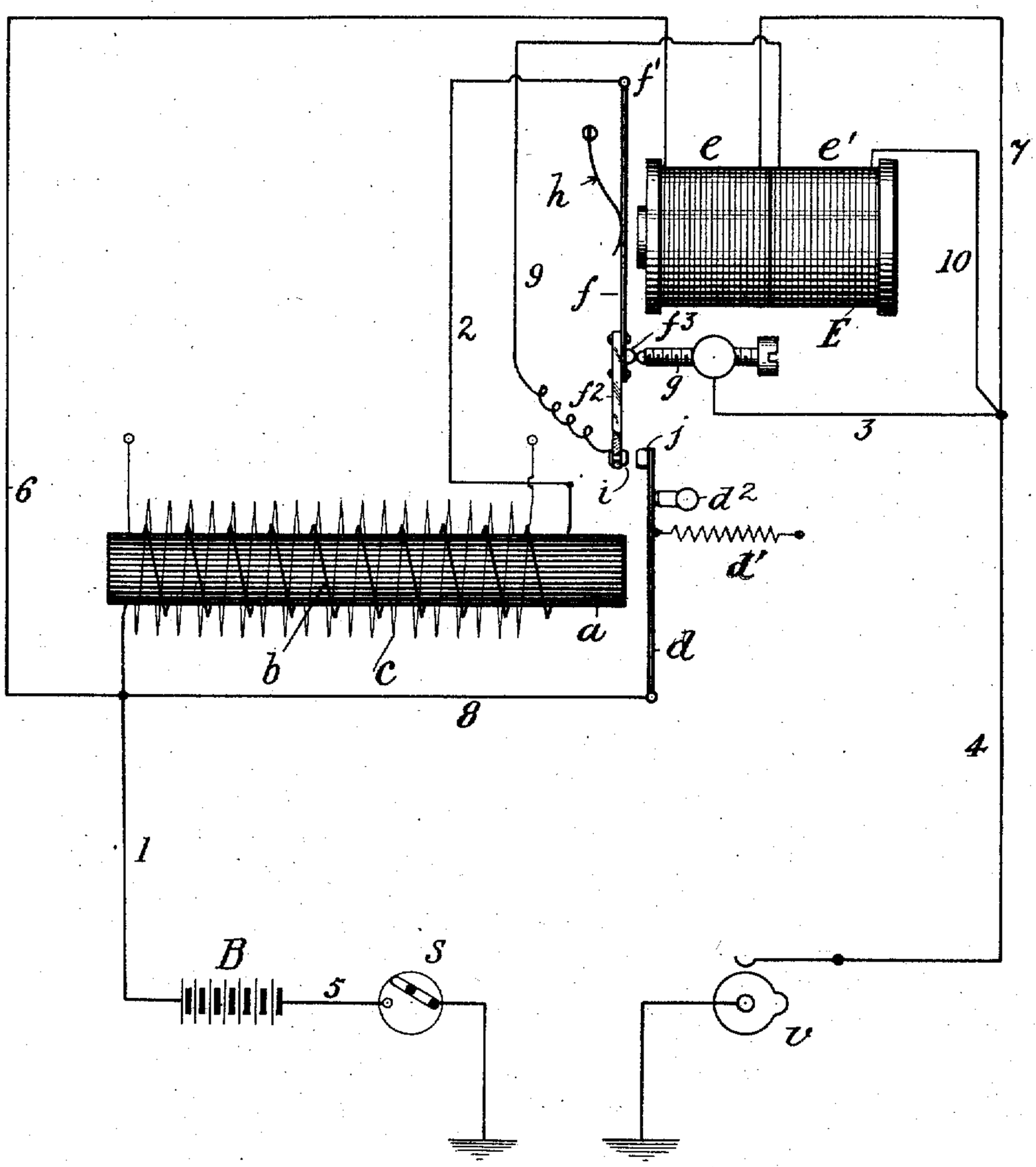
R. VARLEY.

INDUCTION COIL.

APPLICATION FILED JULY 18, 1904.

NO MODEL.



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UNITED STATES PATENT OFFICE.

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INDUCTION-COIL.

SPECIFICATION forming part of Letters Patent No. 772,592, dated October 18, 1904.

Application filed July 18, 1904. Serial No. 216,932. (No model.)

To all whom it may concern:

Be it known that I, RICHARD VARLEY, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Induction-Coils, of which the following is a full, clear, and exact description.

This invention relates to induction-coils, and has special reference to the vibratile circuit-interrupter for the primary circuit thereof.

The object of the invention is to provide a construction and mode of operation for such apparatus which will afford low resistance at the closed contacts coupled with ease of interruption or separation of the contacts.

The ordinary vibrator for induction-coils consists of a tongue or armature actuated in one direction by the magnetic attraction of the coil and in the opposite direction by a spring, the contacts controlled by said tongue being normally closed and the spring being applied in such a manner as to tend to hold them closed. An adjustment-screw is commonly provided to vary the tension of the spring, and thus the force, with which the two contacts are pressed together during the closure of the circuit. Inasmuch as the magnetism of the coil must overcome the power of this adjustable spring in order to open the circuit, it is evident that there is a critical point of adjustment of the spring where the strength of the magnetic attraction is properly balanced against that of the spring, so that the circuit will be opened promptly and closed with sufficient force or pressure on the contacts to afford a low resistance for the primary current. Increasing the tension of the spring lowers the resistance of the contacts by the pressure thereby afforded; but it entails more work upon the coil to separate the contacts. It is desirable to have low resistance at the contacts upon the closure of the circuit, so that the full available current can flow through the primary circuit, and it is likewise desirable to have the construction such that the coil will have little work to do to separate the contacts, for then in case the coil is actuated at very short intervals and its core does not become fully magnetized in the time current is flowing such magnetism as is induced in the core will be sufficient to separate the contacts. Obviously under these conditions a device which affords extra pressure at the contacts when the circuit is closed through the primary, which pressure is counteracted by an extraneous force at the moment the magnetism of the coil comes into play to separate the contacts, is a desideratum. This, it is believed, is provided by my invention.

In the accompanying drawing the figure represents conventionally and diagrammatically my improvements in induction-coil circuit-controllers.

Referring to the drawing by letter, *a* represents the usual bunched-iron wire core of an induction-coil.

b is the primary winding of the coil, and *c* the secondary winding.

d is a pivoted armature subjected to the magnetic attraction of the core *a*, which is opposed by the pull of a light spring *d'*, which normally holds the armature against a backstop d^2.

E is an auxiliary electromagnet having two windings thereon represented by *e* and *e'*, respectively, which are wound in opposition to each other or connected so that when current flows through both of them simultaneously the core is in a neutral magnetic condition. In front of the pole-piece of this magnet is an armature-lever *f*, pivoted at *f'* and carrying at its free end a strip of ivory or other light insulating material, (indicated by f^2.) On the metal portion of armature *f* is a platinum contact f^3, which is held normally against the end of a contact-screw *g* by a spring *h*, the end of the screw being tipped with platinum in the usual manner. The spring *h* is comparatively light, being sufficient only to normally hold the contacts f^3 and *g* together. The insulating-strip f^2 carries another platinum contact *i*, which stands opposite a similar contact *j* on the free end of armature-lever *d*, but normally out of contact there-

with. In circuit with the primary winding of the induction-coil is the usual battery or source of electricity B, a hand-switch *s*, and a periodical circuit-controller *v*, these devices being connected in a circuit a part of which may be grounded through a metallic frame or other grounding device in the ordinary manner.

Where the apparatus is used to furnish the igniting-spark for an explosive-engine, the circuit-controller *v* will be on some shaft or part driven by the engine, so that the circuit will be closed at such intervals as will supply a spark at the terminals of the secondary winding in the engine-cylinder at the proper instant to explode the charge therein.

The operation of the apparatus is as follows: Assuming the switch *s* to be closed and the engine to be running, when the primary circuit is completed by the controller *v*, current will flow from source B, wire 1, primary winding *b*, wire 2, armature-lever *f*, contacts f^3 and *g*, wire 3, wire 4, circuit-controller *v*, ground and wire 5 to battery. At the same instant a current will also flow from wire 1 by wire 6 through coil *e* of magnet E and wire 7 to wire 4, thus connecting coil *e* in shunt or parallel relation with the primary winding of the induction-coil. The core *a* of the coil and the core of magnet E are therefore simultaneously energized, the latter by an insignificant current, since the winding is such as to prevent any but a negligible amount to flow therein, but still enough to draw strongly upon the armature-lever *f*, so that the contacts f^3 and *g* are for the instant pressed firmly together, producing a very low resistance-contact and affording a free path for the battery-current through the primary winding. This energizes the core of the induction-coil which acts upon armature-lever *d*, causing it to move forward and bring the contacts *j* and *i* together. This closes another circuit parallel to the other two circuits traced, as follows: from wire 1 by wire 8, armature lever *d*, contacts *j* and *i*, wire 9, coil *e'*, and wire 10 to wire 4. Coil *e'* being differentially wound to coil *e* the magnetism of the core of magnet E is neutralized, and the force which before pressed the contacts f^3 and *g* together is instantly counteracted. Therefore the work which the stroke of armature *d* has to perform in order to separate contacts f^3 and *g* is merely that necessary to overcome the light spring *h*, and this it does with a sharp quick action, since it strikes the lever *f* a hammer-blow. Upon the opening of the circuit at the contacts f^3 and *g* the primary winding is deënergized, and spring *h* returns armature *f*, while lever *d* is returned by its spring, whereupon the same cycle of operation above described is repeated. It will thus be seen that a construction has been provided wherein at the moment the primary circuit is closed an extra pressure is brought to bear upon the main contacts, which affords a full flow of current through the primary, and this is immediately succeeded by a counteracting of this extra pressure, leaving the magnetism of the induction-coil but little work to do to open the circuit.

The windings of magnet E will be of such a nature that the amount of current taken by them will be negligible. It is obvious that said windings *e* and *e'* may be placed upon separate cores and the cores presented to opposite sides of the lever *f* without departing from the spirit of my invention. It is also pointed out that sparking at the contacts f^3 and *g* is largely prevented by the fact that the contacts *i* and *j* are closed when f^3 and *g* are opened.

Having described my invention, I claim—

1. In an induction-coil, the combination of a vibratile circuit-controller, means for creating a pressure of the contacts thereof and means for relieving said pressure during the periods of energization of the coil.

2. The combination of an induction-coil, a pair of contacts controlling the circuit thereof, an armature under the magnetic influence of the coil, means for pressing said contacts together at the instant of passing current through the coil, and means actuated by the energized coil for relieving said pressure and separating the contacts, substantially as described.

3. The combination of an induction-coil, a pair of contacts controlling the primary circuit thereof, means for normally holding said contacts together with a light pressure, means for increasing said pressure at the instant current is passed through the primary winding of the coil, and means controlled by the magnetism of the coil for counteracting said increased pressure.

4. The combination of an induction-coil, a pair of contacts controlling the primary circuit thereof, means for normally holding said contacts together with a light pressure, means for increasing said pressure at the instant current is passed through the primary winding of the coil, and means controlled by the magnetism of the coil for counteracting said increased pressure and thereafter separating the contacts.

5. The combination of an induction-coil, a pair of normally closed contacts controlling the primary circuit thereof, an electromagnet in circuit with the primary winding of the induction-coil which when energized tends to press said contacts together, and means controlled by the magnetism of the coil for counteracting the pressure of said contacts produced by said electromagnet.

6. The combination of an induction-coil, an electromagnet adapted to be energized simultaneously with the primary of said coil, a pair

of contacts controlling the circuit of the primary and means whereby the closing of the circuit through said primary winding and electromagnet will first increase the pressure of said contacts, then counteract said increase of pressure and finally separate the contacts, substantially as described.

In witness whereof I subscribe my signature in the presence of two witnesses.

RICHARD VARLEY.

Witnesses:
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