

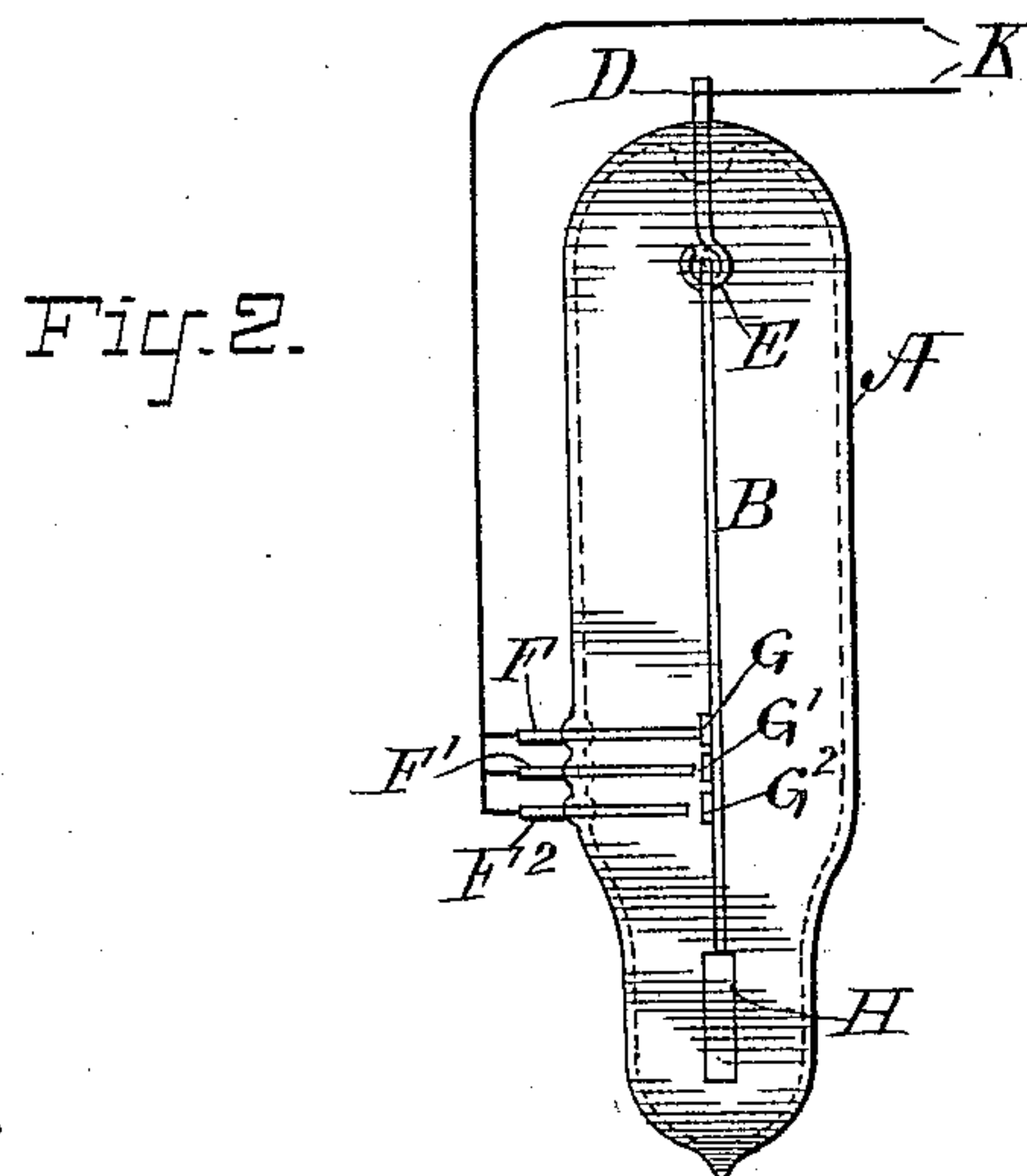
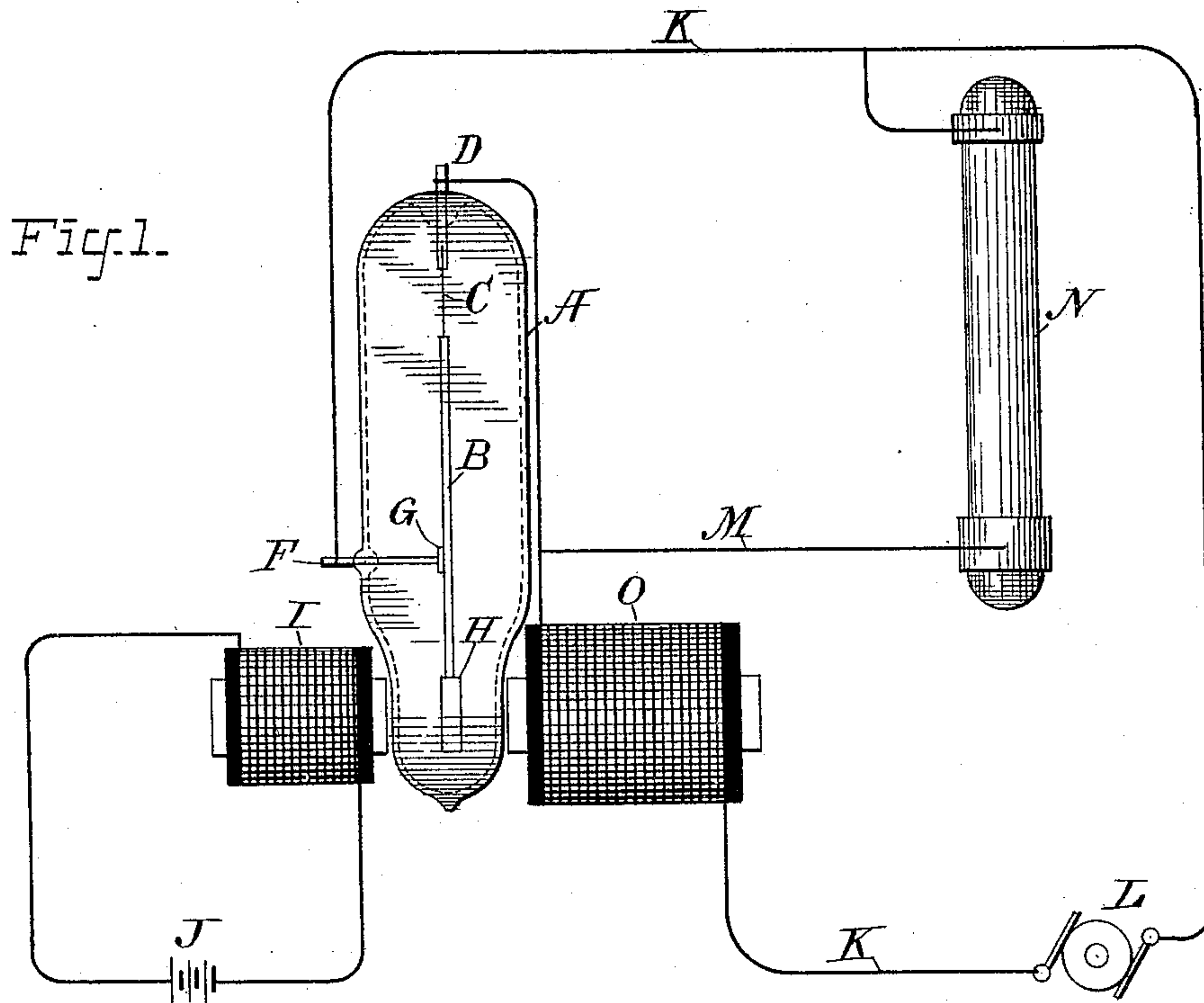
(No Model.)

2 Sheets—Sheet 1.

D. McF. MOORE.  
MAGNETIC CIRCUIT BREAKER.

No. 604,682.

Patented May 24, 1898.



WITNESSES

*Wm. A. Capel.*  
*D. H. Decker*

INVENTOR

*D. McF. Moore*

(No Model.)

2 Sheets—Sheet 2.

D. McF. MOORE.  
MAGNETIC CIRCUIT BREAKER.

No. 604,682.

Patented May 24, 1898.

Fig. 3.

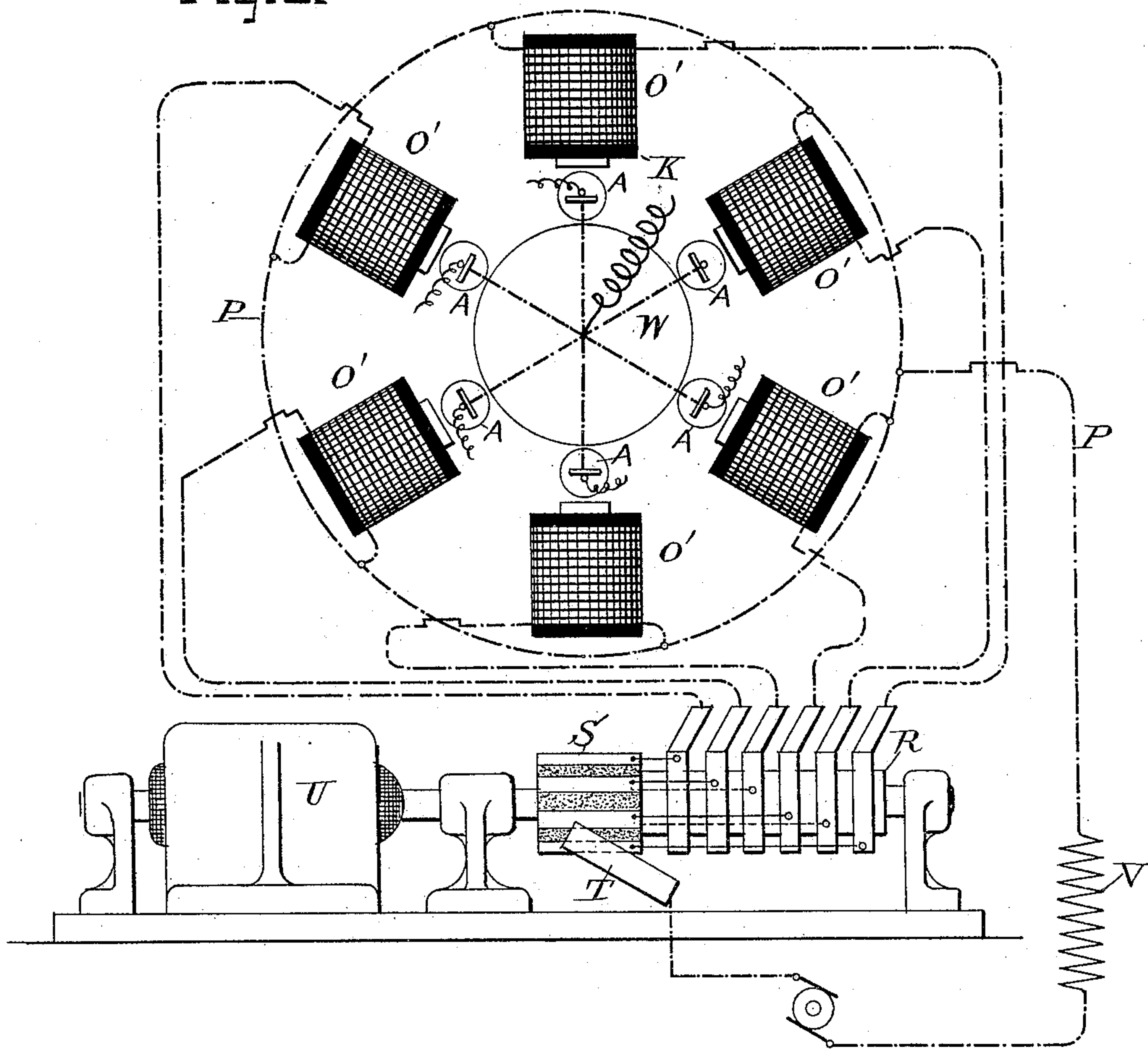
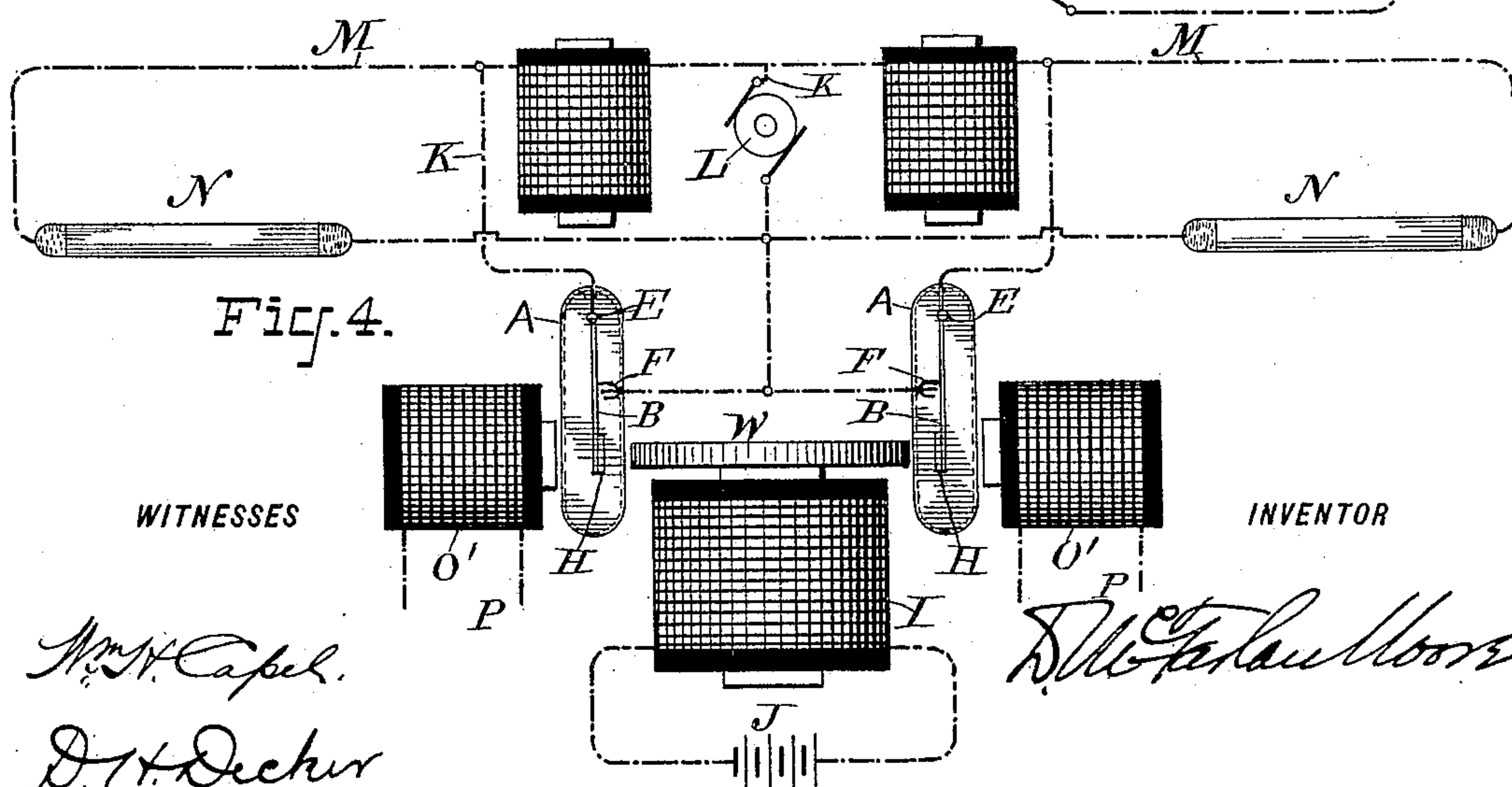


Fig. 4.



*W. H. Capel.*  
*D. H. Decker*

*D. McF. Moore.*



# UNITED STATES PATENT OFFICE.

DANIEL MCFARLAN MOORE, OF NEWARK, NEW JERSEY, ASSIGNOR TO THE  
MOORE ELECTRICAL COMPANY, OF NEW YORK, N. Y.

## MAGNETIC CIRCUIT-BREAKER.

SPECIFICATION forming part of Letters Patent No. 604,682, dated May 24, 1898.

Application filed September 8, 1896. Serial No. 605,109. (No model.)

To all whom it may concern:

Be it known that I, DANIEL MCFARLAN MOORE, a citizen of the United States, and a resident of Newark, in the county of Essex and State of New Jersey, have invented a certain new and useful Magnetic Circuit-Breaker, of which the following is a specification.

My invention relates to magnetically-actuated circuit breakers or interrupters, and is especially designed for use in electric-lighting systems heretofore patented to me.

The main object of the present invention is to improve upon the action and longevity of such circuit-breakers as shown in my Patent No. 548,127, granted October 15, 1895. In circuit-breakers of the form there shown and in other forms where the armature is carried by a spring-tongue contact, on whose resiliency depends the return to the fixed contact and the degree of pressure thereagainst, the tension of the spring is bound to change as the fixed contact gradually wears away. This impairs the electrical contact. I overcome this difficulty by mounting the armature upon a non-resilient tongue which is returned to the fixed contact and given the desired pressure thereagainst by means of a magnet acting counter to the circuit-breaking magnet. In other words, I use a magnetic retractor instead of a spring-retractor. Another improvement upon the circuit-breaker of said patent resides in substituting fresh contact-surfaces for the ones that become impaired by wear. It is impractical to adjust or remove the fixed contacts in circuit-breakers *in vacuo*; but the substitution herein set forth accomplishes the same result in circuit-breakers whether or not they employ non-resilient tongues or tongues vibrating in a constantly-maintained magnetic field.

With these objects in view the invention consists in the combination, in a circuit-interrupter *in vacuo*, of a series of contact-surfaces standing in substitute relation to one another.

The invention further consists in the construction, combination, and arrangement of parts hereinafter fully described, and set forth in the claims.

In the accompanying drawings, which form

a part of this specification, Figure 1 diagrammatically represents my invention, and Fig. 2 represents a modification thereof. Figs. 3 and 4 are diagrammatic representations of a plan for successively operating a series of circuit-interrupters.

The contacts of the circuit-interrupters are preferably located in an exhausted receiver, though for some purposes they may be operated in the open air. For use, however, in my lighting system and in other circuits where an absolute and instantaneous interruption is desired said contacts are located in an exhausted receiver. In the drawings this receiver is indicated at A and is preferably made of glass or like material, though it may be made of any material capable of sustaining a high degree of vacuum.

The vibrating part or contact-tongue is indicated at B as suspended by a thin strip of metal C from the leading-in conductor D. This connection of the tongue to the contact may be made in other ways, as by a pivot or other form of loose joint, (typified at E in Figs. 2 and 4.)

Located within the receptacle, in a position to normally engage the tongue or a contact-piece G, mounted thereon, is a fixed contact F, and at the lower end of the tongue is the armature H. In this form of circuit-closer, as above outlined, the tongue is held in engagement with the fixed contact magnetically, as by a magnet located on the same side of the tongue as the fixed contact. This magnet may be of the permanent sort or it may be an electromagnet, as indicated at I, Fig. 1, and I', Fig. 4, located in a circuit supplied from any suitable source, as J, the magnet exerting a constant attraction upon the armature. The remaining circuits are the same as those shown in the patent above referred to and consist of the circuit of induction K, supplied from any suitable source, as L, and having the lighting branch M, here shown as containing a vacuum-tube lamp N. The circuit-breaking magnet O may be located in the circuit of induction, as in Fig. 1 in said patent, and is of a strength sufficient to overcome the attraction of magnet I and so interrupt the circuit at the contact F, or it



may be in an independent circuit, as seen in Figs. 3 and 4.

The tongue B being non-resilient it must be supplied with a retractor, and such retractor in the present instance consists of a magnet, as I or I', which, as soon as circuit is broken at contact F, through the action of magnet O or O', acts to draw tongue B back to contact F immediately upon the cessation of current in said magnet O or O'. In the case of magnet O in the circuit of induction, Fig. 1, such cessation of current occurs immediately upon the attraction thereby of the tongue B. In the case of magnet O' in an independent circuit, Figs. 3 and 4, the flow of current therethrough is controlled by an independent circuit-breaker. Such independent circuit-breaker may be of any desirable construction. The one here shown, however, is intended for use in connection with a series of interrupters and is constructed to successively make and break circuit through the series of circuit-breaking magnets O'.

In Fig. 3 six circuit-interrupters A are indicated, each provided with a circuit-breaking magnet O'. Each of these magnets is connected to a common supply-circuit P, fed from any suitable source of current, as indicated at Q, and each is separately connected by a suitable brush to a ring upon a rotary commutator R, to which current is supplied at its segmental end S from the source Q by means of a brush, as T. Each segment is connected to one of the rings in the usual manner, as indicated, and the brush T is so proportioned to the segments that it preserves connection with one until it engages the succeeding one, thereby preventing interruption of the current and the consequent sparking. This commutator may be rotated in any suitable way, as by an electric motor, (typified at U.) As the magnets O' are small magnets with minimum time constants, a non-inductive resistance is placed in the circuit P, as at V.

In the apparatus just described current is made to flow successively through the several magnets O', and the tongues B of the circuit-interrupter are thereby caused to successively leave the contacts F. The magnetic retractor for the interrupters may consist of a magnet for each, as in Fig. 1, but may just as well consist of one magnet, as I', having an extended pole-piece W, about which the interrupters may be located, as shown. This magnet is constantly energized during the operation of the apparatus and from any suitable source, as J, and acts to retract the tongues B as soon as circuit is interrupted in the attracting-magnets O'.

In Fig. 3 only a portion of the circuit of induction K is shown, and in Fig. 4 it is shown only in connection with two lamps, while the circuit to magnets O' is not shown. In this form of apparatus the self-induction coils have but the one function to perform and are indicated at O<sup>2</sup> in the circuit of induction K.

Each circuit K is shown supplied with one of these coils; but obviously one coil might serve them all by being placed in that portion of the circuit from L which is common to all the circuits K. The lighting branches from said circuit are indicated at M as containing the tubular lamps N. This apparatus insures a positive and regular action of the interrupter, and by regulating the speed of the commutator any desired frequency of interruptions in the circuit of induction may be attained.

It will be noted that in this arrangement each interrupter supplies an independent lighting-circuit; but I might readily and obviously so arrange the contacts in the several interrupters that they may act successively in the same circuit, substantially as in my application, Serial No. 571,341, filed December 7, 1895. So, also, if desired, the magnets O' may be replaced by an alternating-current rotating magnetic field.

In this form of circuit-interrupter above described the wearing away of contact F by constant use does not interfere with the proper action of the interrupter, its only effect being to slightly vary the rate of vibration due to the slight increase in amplitude, since there is no increase in the resistance of the tongue to return to the fixed contact, as in the case of the spring-tongue, on account of the increase in the amplitude of vibration. In this form of interrupter, however, it is advisable to provide fresh contact-surfaces located in substitute relation to the one first engaged by the tongue. Such an arrangement is shown in Fig. 2. In this construction upon the wearing away of contact F a fresh contact-plate, as G', will come into engagement with a fresh fixed contact F', and as the latter wears away contact-plate G<sup>2</sup> will engage with fixed contact F<sup>2</sup>, the several fixed contacts being all connected to the circuit of induction, as indicated. Another form for providing successively new contact-surfaces is seen in Fig. 4.

The form of the receiver and its contained contacts may be varied and the relative arrangement and size of parts may be changed in many ways other than those above set forth without departing from the spirit of my invention. For instance, one obvious modification which has been tried consists in balancing the vibrating tongue horizontally on a central pivot, as in my application, Serial No. 615,971, filed December 17, 1896, concurrently herewith, and placing the constant magnet I at one end of the tongue to hold the latter normally in engagement with the fixed contact and the circuit-breaking magnet at the other end of the tongue.

What I claim as my invention is—

1. A circuit-interrupter consisting of an exhausted receiver, a non-resilient vibrating tongue therein, a fixed contact also in the receiver for engagement with the tongue, a magnet exterior to the receiver tending to hold the contacts in engagement, and the circuit-



interrupting magnet also exterior to the receiver but acting on said tongue in opposition to the other magnet.

5 2. In a circuit-interrupter *in vacuo*, the combination with the vibrating member, of cooperating contacts located in substitute relation to one another for the purpose set forth.

10 3. The combination with a series of circuit-interrupters, of a magnet normally holding the vibrating part of each interrupter in engagement with its cooperating contact, and a series of circuit-breaking magnets successively energized, as and for the purpose set forth.

15 4. The combination with a series of circuit-interrupters, of a magnetic retractor common to all of them, a circuit-breaking magnet for each interrupter, a circuit common to said

magnets, and a commutator in said circuit for successively creating a flow of current 20 through said magnets, substantially as and for the purpose set forth.

5. The combination of a series of circuit-interrupters in each of which the vibrating part is normally magnetically held in engagement 25 with its cooperating contact, and magnetic means for successively withdrawing said vibrating parts from their cooperating contacts.

Signed at New York, in the county of New York and State of New York, this 24th day of 30 July, A. D. 1896.

DANIEL MCFARLAN MOORE.

Witnesses:

WM. H. CAPEL,

D. H. DECKER.