No. 792,020. PATENTED JUNE 13, 1905.

A. GRAY.

CIRCUIT BREAKER AND CLOSER FOR ALTERNATING CURRENTS.

APPLICATION FILED SEPT. 7, 1904.

3 SHEETS—SHEET 1.

Fig. 1.

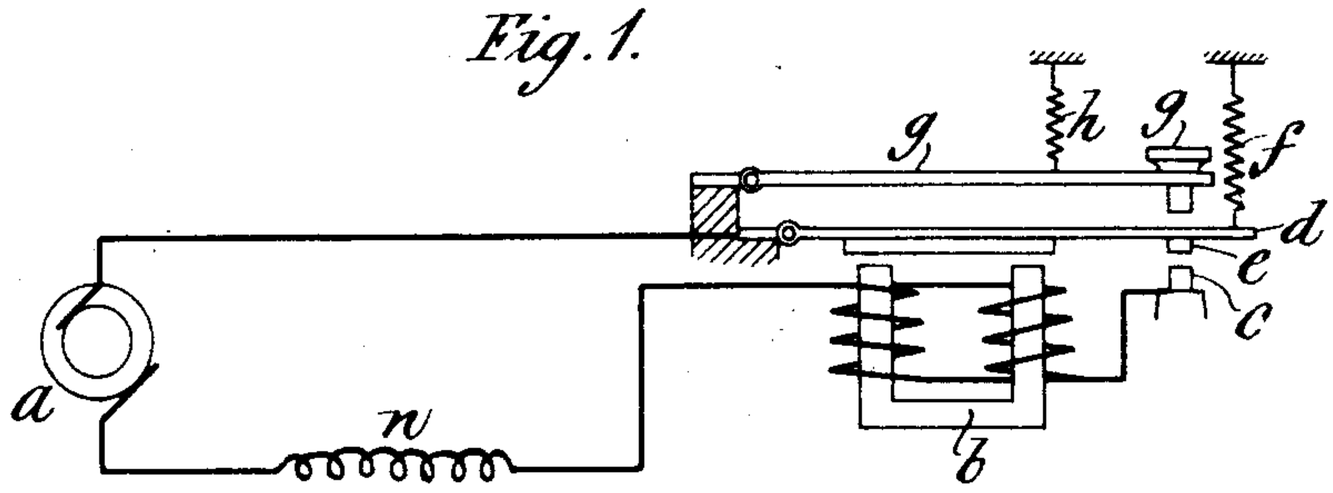


Fig. 2.

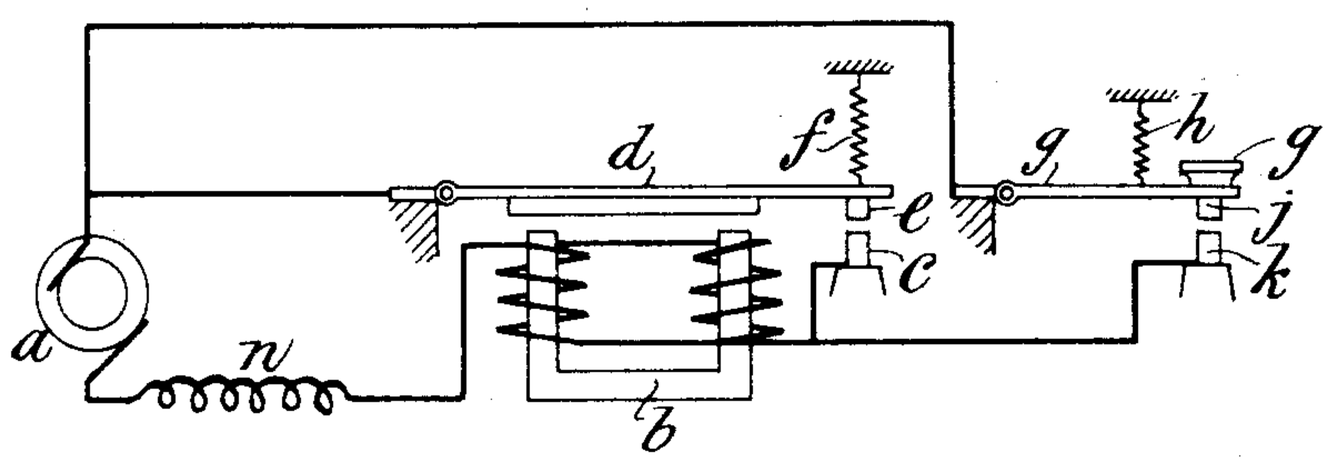
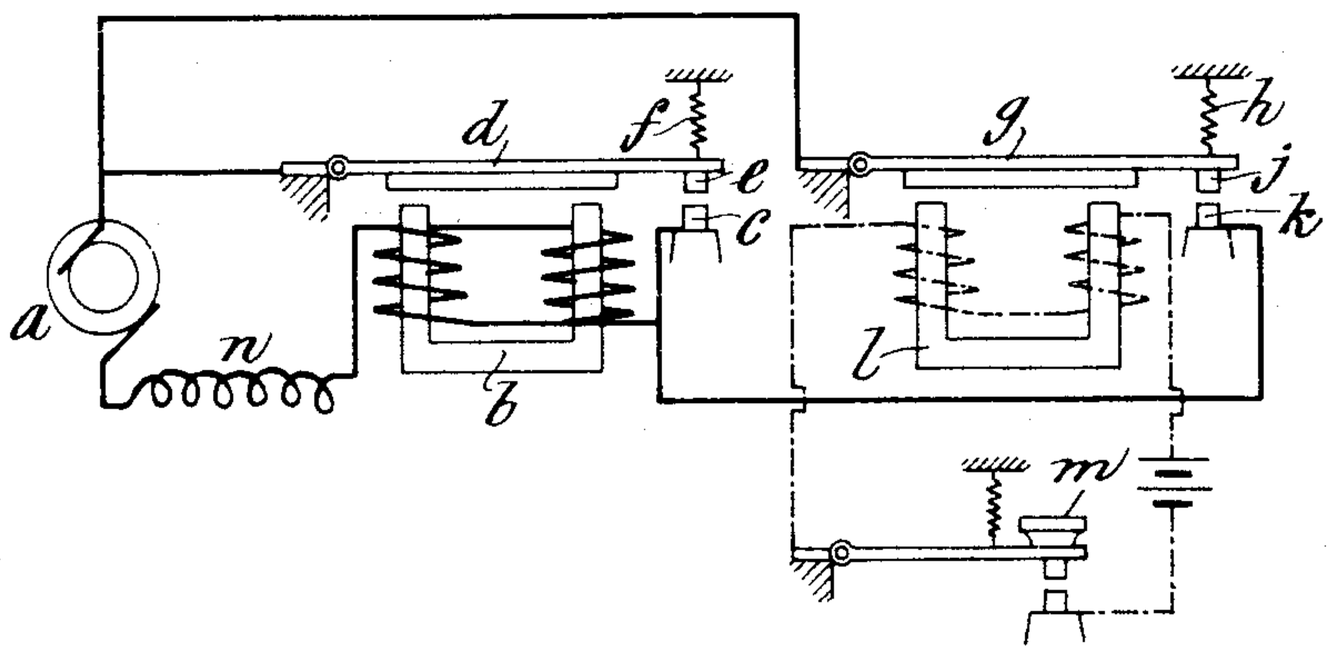


Fig. 3.



Witnesses.

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3 SHEETS—SHEET 2.

Fig. 4.

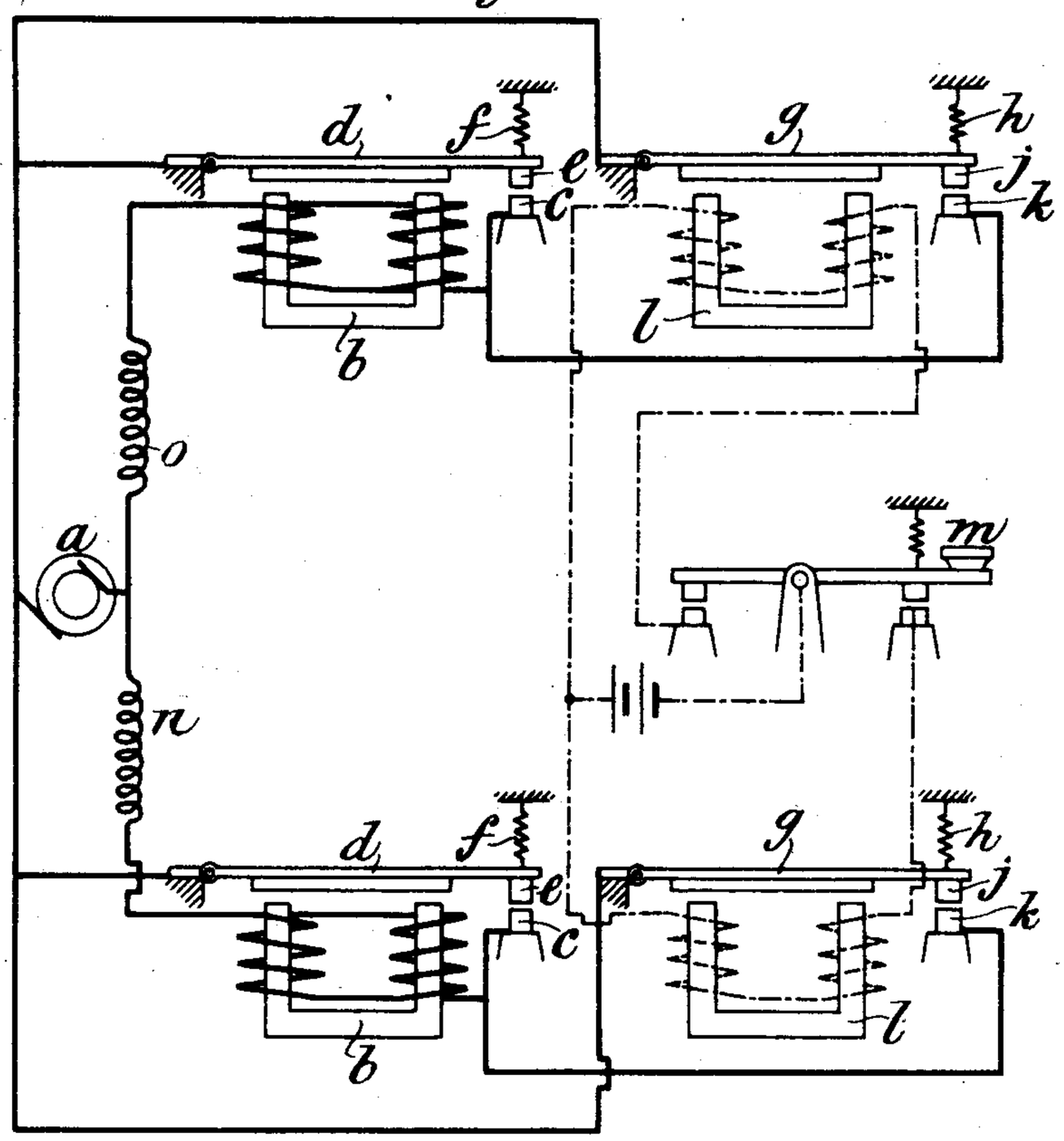
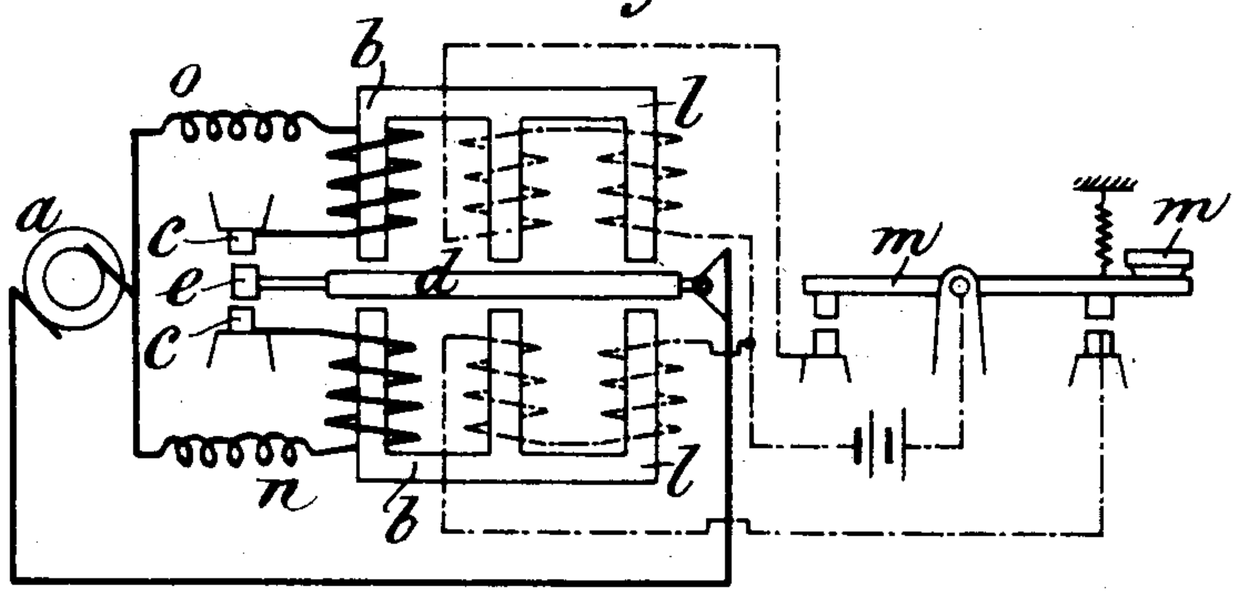


Fig. 5.



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3 SHEETS—SHEET 3.

Fig. 7.

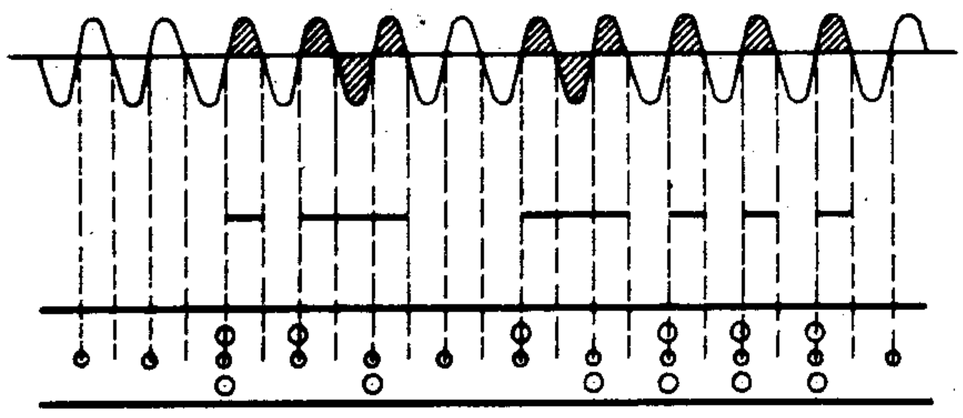
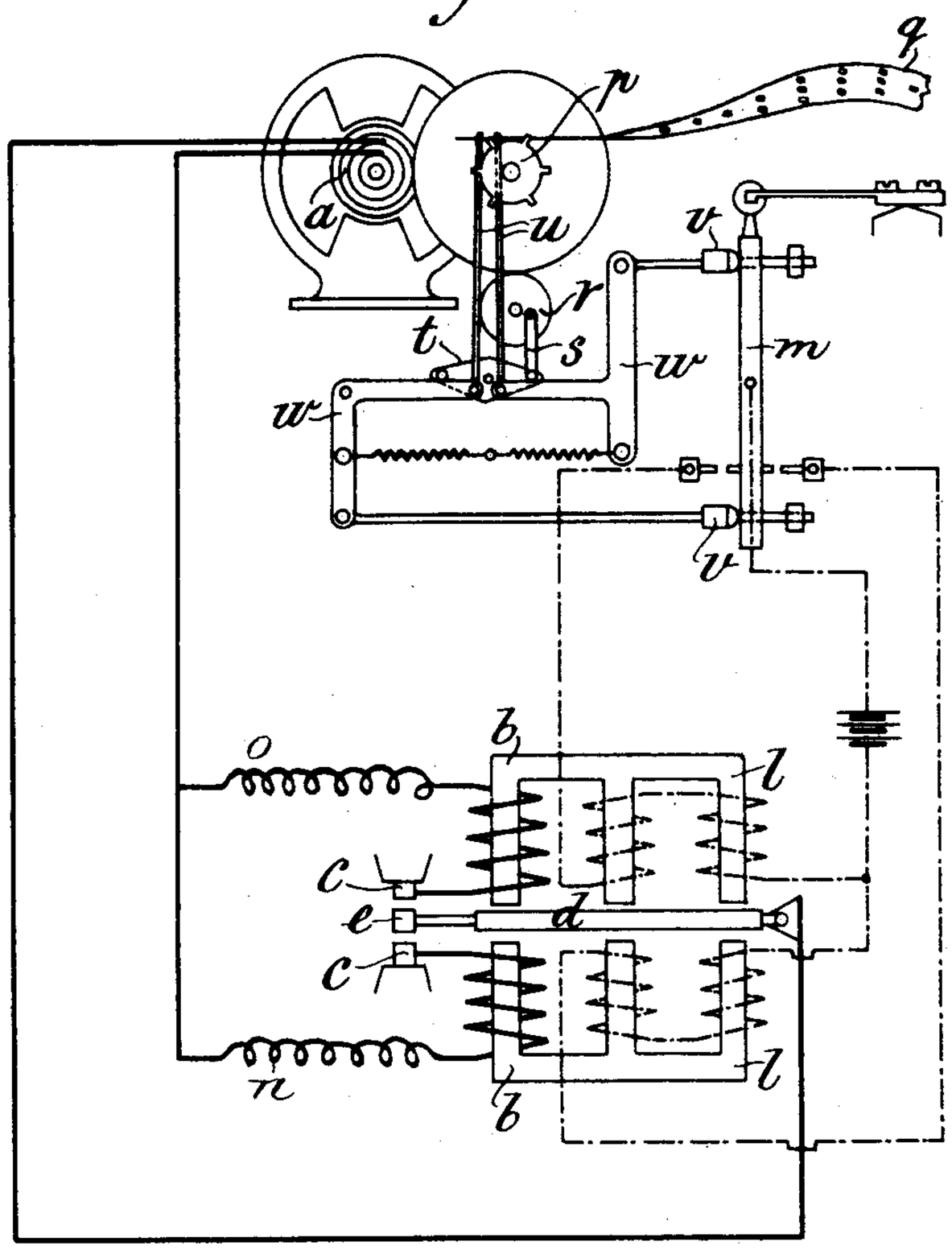


Fig. 6.



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No. 792,020. Patented June 13, 1905.

UNITED STATES PATENT OFFICE.

ANDREW GRAY, OF LONDON, ENGLAND, ASSIGNOR, BY MESNE ASSIGNMENTS, TO MARCONI WIRELESS TELEGRAPH COMPANY OF AMERICA, A CORPORATION OF NEW JERSEY.

CIRCUIT BREAKER AND CLOSER FOR ALTERNATING CURRENTS.

SPECIFICATION forming part of Letters Patent No. 792,020, dated June 13, 1905.

Application filed September 7, 1904. Serial No. 223,614.

To all whom it may concern:

Be it known that I, ANDREW GRAY, electrician, a subject of the King of Great Britain, residing at 18 Finch Lane, in the city of London, England, have invented certain new and useful Improvements in Circuit Breakers and Closers for Alternating Currents, of which the following is a specification.

This invention relates to circuit-closers for heavy alternating currents; and its object is to prevent sparking, which is done according to this invention by causing the current from the dynamo, whenever it is passing, to hold the contact-maker stationary, so that it can only be moved when the current is at zero between two alternations. For this purpose the contact-maker is carried by the armature of an electromagnet energized by a coil in the dynamo-circuit.

Figure 1 is a diagram illustrating the invention in its simplest form. Figs. 2, 3, 4, and 5 are similar views showing modifications. Fig. 6 is a diagram showing the application of the invention to the automatic transmission of messages by wireless telegraphy. Fig. 7 is a diagram showing a dot-and-dash signal.

a is an alternating-current dynamo, one branch of whose circuit includes an electromagnet *b* and a contact *c*, while the other branch passes through the armature *d* of the electromagnet to a contact *e*. The contacts *c* and *e* are held apart by a spring *f*.

g is a key held up by a spring *h*. If the key *g* be pressed down, the contacts *c* and *e* are brought together, and the circuit is closed through the magnet *b*, causing it to attract its armature *d*, so that the circuit remains closed when the key *g* is raised until the current reaches a zero-point, whereupon the spring *f* separates the contacts *c* and *e* without sparking, because at this time there is no current. Fig. 2 shows a similar arrangement; but in this case the key *g*, instead of bringing the contacts *c* and *e* together mechanically, does so electrically. For this purpose it is connected as a shunt to one branch of the dynamo-circuit and carries a contact *j*, which is opposite to a contact *k* in the other branch, so that when the key is depressed the dynamo-circuit is closed through the magnet *b*, thereby bringing the contacts *c* and *e* together.

Fig. 3 shows an arrangement exactly similar to Fig. 2, except that the key *g* is operated electrically instead of mechanically. For this purpose it forms the armature of an electromagnet *l* in a local-battery circuit which is closed by a key *m*.

In the transmitting instruments for wireless telegraphy and in other cases it is often desirable to keep the load on the dynamo constant. For this purpose the back contact is connected to the dynamo-circuit through another circuit electrically equivalent to the transmitting-circuit. In such a case the above-described arrangement is duplicated, as shown in Fig. 4, each half of this arrangement being exactly the same as Fig. 3, and has the same letters. *n* is a coil forming part of the wireless-telegraph transmitter, and *o* is a resistance equal to the resistance of the transmitter. Fig. 5 shows an exactly-similar arrangement, which is rendered more compact by combining the magnets *b* and *l* into a double-wound magnet and by employing a single armature *d*, carrying two contacts *e*.

The arrangements described above render it possible to employ an ordinary Wheatstone automatic transmitter in wireless telegraphy, which has hitherto been impracticable when any considerable power has been used.

Referring to Figs. 4 and 5, I have shown the signaling-key *m* in an intermediate position. Normally, however, the back contact of such key should lie against the contact which is in circuit with the upper magnet *l*.

Fig. 6 shows the application of the arrangement shown in Fig. 5 to the automatic transmission of wireless signals by means of a perforated tape, as in an ordinary telegraph instrument. The pin-wheel *p*, by which the perforated tape *q* is driven, is directly geared to the dynamo *a*, as shown, or is otherwise driven synchronously with it, so that the speed of the perforated paper and the times at which the contacts are made can be adjusted to coincidence with the time of sparking.

r is a crank-wheel geared to the wheel p and connected by the rod s to the rocking lever t, which causes the needles u to reciprocate up and down. If these needles in their upward movement come against the paper q, they are arrested before the stops v (which are connected to them by the lever w) move the key m sufficient to close the local-battery circuit; but if one of the needles passes through a hole in the paper the key m closes one or other of the circuits. In this way it is possible to utilize the alternator with maximum economy—that is to say, instead of requiring a frequency so high that the duration of contact required for a dot will insure at least one spark occurring within the interval comprised in a dot the transmitting is so timed that the contact of a dot is made when the spark is about to occur.

With a low frequency a normal speed of transmission can be obtained by making one spark for a dot and three sparks for a dash and missing one spark for a space between the elements of a letter, three sparks for the space between the letters, and five sparks for the space between the words in a sentence, as shown at Fig. 7.

At higher frequencies moderate speed of transmission can be obtained by making the spaces longer—that is to say, missing a greater number of sparks—though of course at a sacrifice in efficiency; but, again, should a higher speed of transmission be required the first-described spacing can be adopted for the higher frequency.

What I claim is—

1. In a circuit breaker or closer for alternating currents, two circuits, means, comprising a magnet for opening one circuit while the current is at or near zero, said means operating to simultaneously close the other circuit, substantially as described.

2. In a circuit breaker or closer for alternating currents, two circuits, a movable member carrying contacts for closing said circuits, means for opening one of said circuits while the current is at or near zero, said means operating to simultaneously close the other circuit, substantially as described.

3. In a circuit breaker or closer for alternating currents, two circuits, automatic means for opening one circuit while the current is at or near zero, and to simultaneously close the other circuit, substantially as described.

4. The combination of an alternating-current generator, a circuit connected to it, a contact and an electromagnet in one branch of the circuit, an armature to the electromagnet, a contact carried by the armature in the other branch of the circuit, a spring connected to the armature and tending to separate the contacts, a second circuit through the electromagnet and means for closing this circuit.

5. The combination of an alternating-current generator, a circuit connected to it, a contact and an electromagnet in one branch of the circuit, an armature to the electromagnet, a contact carried by the armature in the other branch of the circuit, a spring connected to the armature and tending to separate the contacts, a second circuit through the electromagnet, a circuit-closer in this circuit, an electromagnet operating it, a local battery energizing the latter electromagnet and means for closing the battery-circuit.

6. The combination of an alternating-current generator, two circuits connected to it, a contact and an electromagnet in one branch of each circuit, an armature to each electromagnet, contacts carried by the armatures in the other branches of the circuits, means constantly tending to separate the contacts, a second circuit through each electromagnet, and means for simultaneously closing one of the latter circuits and breaking the other.

7. The combination of an alternating-current generator, two circuits connected to it, a contact and an electromagnet in one branch of each circuit, an armature to each electromagnet, contacts carried by the armatures in the other branches of the circuits, means constantly tending to separate the contacts, a second circuit through each electromagnet, circuit-closers in these circuits, electromagnets operating them, a local battery energizing these electromagnets, and means for simultaneously closing the battery-circuit through one magnet and breaking it through the other.

8. In a circuit breaker or closer for alternating currents, the combination of a pivoted contact-maker, a contact carried by it and connected to one branch of the circuit, a second contact opposite to the first and connected to the other branch of the circuit, a spring acting on the contact-maker and tending to separate the contacts, an armature carried by the contact-maker, an electromagnet energized by the current acting on the armature and tending to bring the contacts together, and an ordinary automatic telegraph-transmitter closing a circuit through the electromagnet.

9. The combination of an alternating-current generator, a circuit connected to it, a contact and an electromagnet in one branch of the circuit, an armature to the electromagnet, a contact carried by the armature in the other branch of the circuit, a spring connected to the armature and tending to separate the contacts, a second circuit through the electromagnet, and an ordinary automatic telegraph-transmitter revolving synchronously with the generator closing this circuit.

10. The combination of an alternating-current generator, a circuit connected to it, a contact and an electromagnet in one branch of the circuit, an armature to the electromagnet, a contact carried by the armature in the other branch of the circuit, a spring connected to the armature and tending to separate the contacts, a second circuit through the electro-

magnet, a circuit-closer in this circuit, an electromagnet operating it, a local battery energizing the latter electromagnet, and an ordinary automatic telegraph-transmitter revolving synchronously with the generator closing the battery-circuit.

11. The combination of an alternating-current generator, two circuits connected to it, a contact and an electromagnet in one branch of each circuit, an armature to each electromagnet, contacts carried by the armatures in the other branches of the circuits, means constantly tending to separate the contacts, a second circuit through each electromagnet, and an ordinary automatic telegraph-transmitter revolving synchronously with the generator simultaneously closing one of the latter circuits and breaking the other.

12. The combination of an alternating-current generator, two circuits connected to it, a contact and an electromagnet in one branch of each circuit, an armature to each electromagnet, contacts carried by the armatures in the other branches of the circuits, means constantly tending to separate the contacts, a second circuit through each electromagnet, circuit-closers in these circuits, electromagnets operating them, a local battery energizing these electromagnets, and an ordinary automatic telegraph-transmitter revolving synchronously with the generator simultaneously closing the battery-circuit through one magnet and breaking it through the other.

ANDREW GRAY.

Witnesses:
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WILMER M. HARRIS.