(No Model.)

2 Sheets—Sheet 1.

J. BURRY.

CIRCUIT BREAKING APPARATUS.

No. 510,156. Patented Dec. 5, 1893.

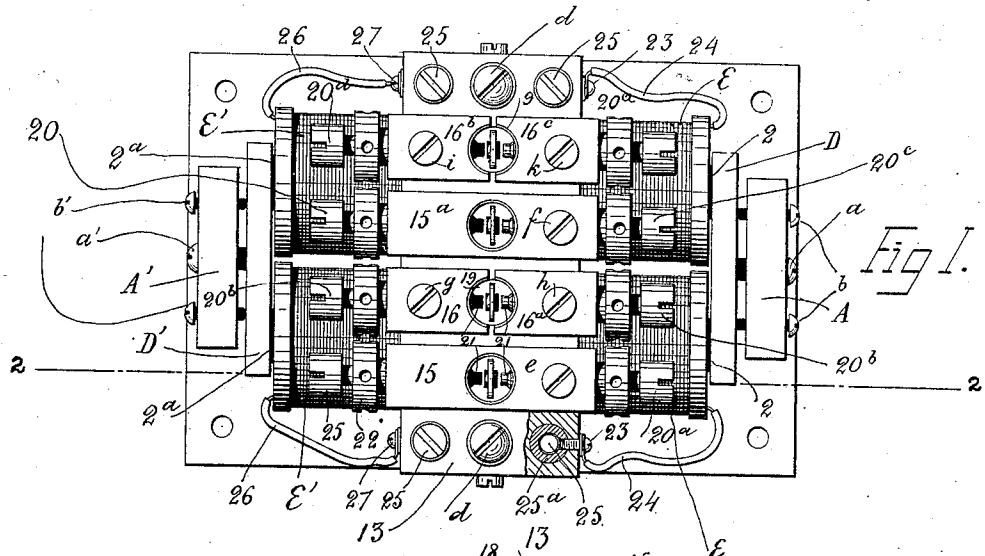

Fig 1.

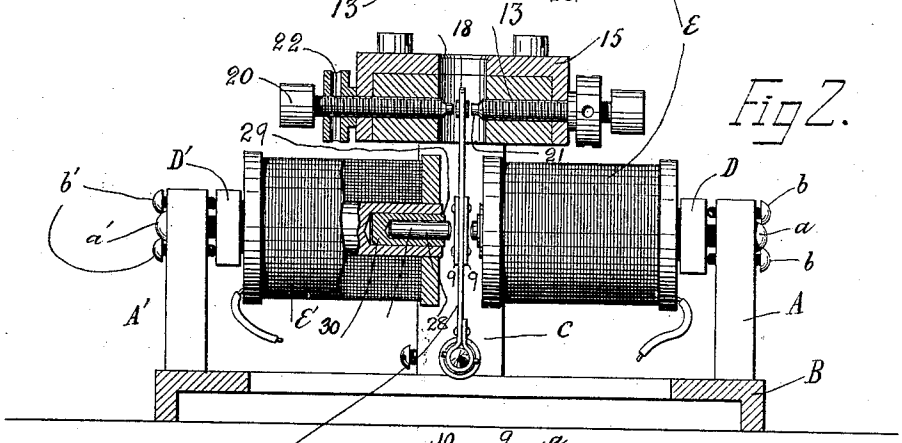

Fig 2.

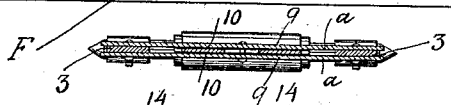

Fig 3.a

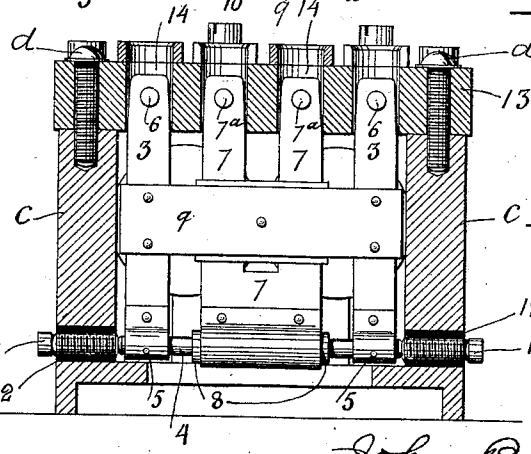

Fig 3.

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(No Model.) 2 Sheets—Sheet 2.

J. BURRY.

CIRCUIT BREAKING APPARATUS.

No. 510,156. Patented Dec. 5, 1893.

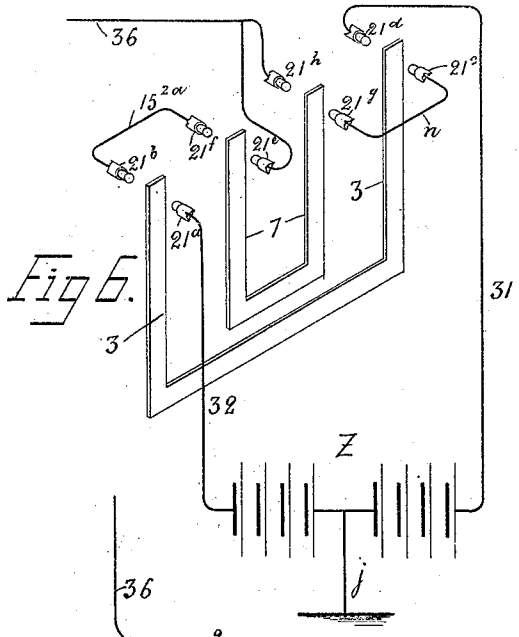

Fig 6.

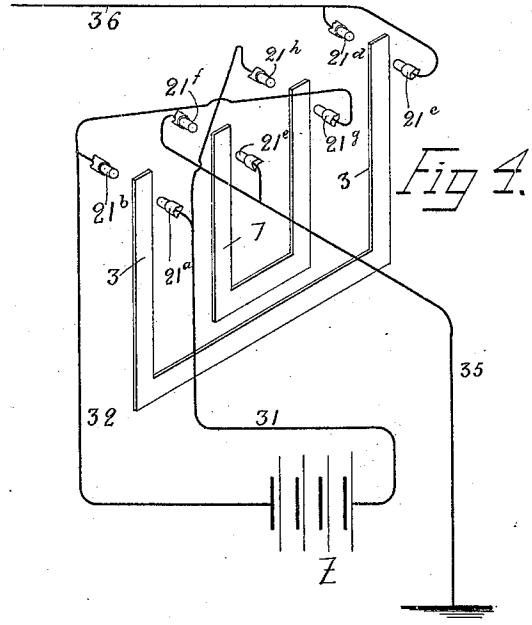

Fig 4.

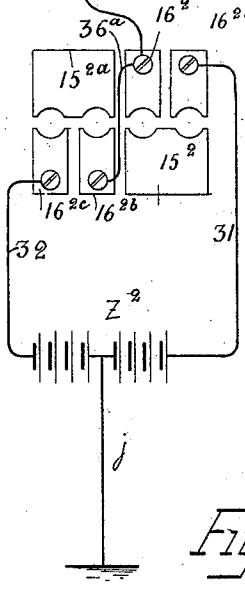

Fig 7.

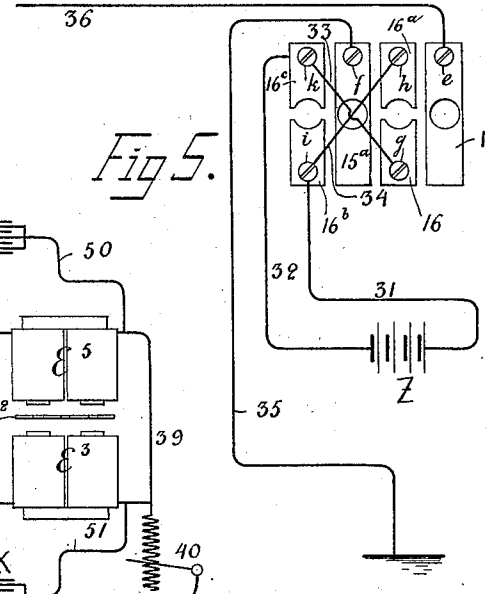

Fig 5.

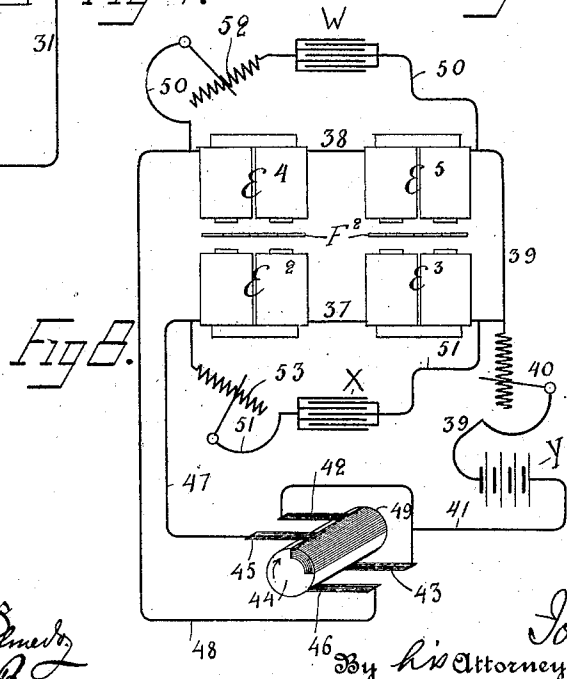

Fig 8.

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UNITED STATES PATENT OFFICE.

JOHN BURRY, OF NEW YORK, N. Y.

CIRCUIT-BREAKING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 510,156, dated December 5, 1893.

Application filed July 14, 1893. Serial No. 480,793. (No model.)

To all whom it may concern:

Be it known that I, JOHN BURRY, a citizen of the United States, and a resident of the city of New York, in the county and State of New York, have invented certain new and useful Improvements in Circuit-Breaking Apparatus, of which the following is a specification.

My invention relates to electric circuit breaking apparatus, and consists of a movable circuit controller comprising a number of electrically independent conducting sections combined with at least two contacts for each section at each side thereof for co-action therewith, and connections between said contacts, whereby, in both extremes of motion of the movable part, the current enters one of said sections by one contact, leaves it by another, traverses a connection to a contact bearing against a second section, leaves this second section by a second contact, and so on to other sections or to line, whereby the circuit is broken simultaneously at a number of points in series therein by moving said part, and of other combinations of devices, all hereinafter described, and more particularly pointed out in the concluding claims.

The particular form of my invention illustrated in the accompanying drawings, and hereinafter described, is a relay, but I do not limit myself to relays.

The preferred form of my invention is shown in the accompanying drawings, forming part of this specification, in which—

Figure 1 is a plan view of my new relay. Fig. 2 is a sectional view in the vertical plane indicated by the line 2—2 in Fig. 1. Fig. 3 is a sectional view taken in the vertical plane of the armature. Fig. 3ª is a horizontal sectional view of the armature. Fig. 4 is a diagram of, and Fig. 5 shows, the method of arranging the electrical connections of the relay shown in Figs. 1, 2 and 3. Figs. 6 and 7 are similar views, respectively, showing another method of arranging these connections, and Fig. 8 is a diagram showing two of my relays connected with a source of electric energy and a switch for diverting the current alternately to opposing sets of electro-magnets.

The relay shown in Figs. 1, 2, and 3 consists of the following:—Upon the base B are the end posts A A′ and side posts C preferably integral therewith. Attached to the post A is a bar D which is rigidly attached to or integral with the soft iron cores 2 of the electro magnets E. I prefer to attach this bar D to the post A by means of a screw *a*, and to use a number of screws *b* through post A and bearing against bar D to adjust the distance of the bar from post A, and the height of the magnet from the base. Upon the post A′, I secure the bar D′ with its electro-magnets E′, cores 2ª, as by a screw *a′* and adjusting screws *b′*. The free or unattached ends of the electro-magnets E, E′, are adjacent or facing each other. In the space separating the electro-magnets E, E′, I place the movable armature F, shown as pivoted to the side posts C, but insulated therefrom. The armature F is composed of two metallic sections insulated from each other, but, in conjunction with devices hereinafter set forth, forming part of one electric circuit. One of the said sections is composed of the uprights 3, and the shaft 4 to which the uprights are or may be rigidly attached, as by pins 5. Each upright 3 is provided on each face at or near its upper end with a contact point 6. The other section is formed of the U-shaped piece 7 supported on the shaft 4 but separated therefrom by insulation 8 so as to be electrically free from the same. Each leg of section 7 has two contacts 7ª thereon. The said sections are preferably made of a resilient metal for a purpose hereinafter stated. The two sections are secured together by the two bars or armatures 9 fastened or riveted to the uprights 3 and riveted together between the legs of the section 7, pieces of insulation 10 separating the bars from section 7. These bars 9, secured opposite the cores may form the keeper and give additional rigidity to the armature, insuring that the free ends of the sections will move in unison, this unison being requisite to the best working of the relay. The shaft 4 is supported in a well known manner by the screws 11 working in ferrules 12 of insulating material inserted in holes in the posts C.

Secured to the tops of posts C by screws *d*, is a block 13 of insulating material, said block having a hole 14 for each leg of the sections of the armature. (Of course, two or more of these holes may be united to form a slot and effect the same result.) Fitting over

the block 13 are two U-shaped caps of metal 15 and 15^a and four L-shaped caps of metal 16, 16^a, 16^b, 16^c. Caps 15 and 15^a are secured to the block 13 by screws *e*, *f*, respectively, and caps 16, 16^a, 16^b, 16^c, &c., are secured thereto by screws *g*, *h*, *i*, *k*, respectively. The pieces 15, 15^a, have or may have holes 18 therein which come over the holes 14 thereunder; the ends of pieces 16, 16^a, 16^b, 16^c, may have semi-circular cutaways 19 therein which come over the holes 14 thereunder. Pairs of screws 20^a, 20^b, 20^c, 20^d, pass through the caps and the block 13 into the holes 14 from the opposite sides as shown. These screws may have the usual lock-nuts 22, as shown, and are provided with contact-points as hereinafter described.

The electro-magnets E are electrically connected together, and each is electrically connected to the binding screw 23 on its side by means of the wire 24. Binding screw 23 presses against another binding screw 25. See Fig. 1. The electro-magnets E′ are similarly connected with each other; and with binding screw 25 by the wires 26 and screws 27. A metal ferrule 25^a may be placed in the cap 13 and the screws 25 engage a thread therein. Screws 23, and 27 engage a threaded hole in ferrule 25^a. Binding screws 25 are connected with a battery or other source of electric energy in the manner shown in diagram in Fig. 8 as hereinafter described.

I sometimes provide the soft iron cores of the electro-magnets with a short bar or piece of iron or shell, as 28, inserted in a hole 29 in the core. This bar 28 is insulated from the core by a thimble or ferrule 30, of suitable material. This is done to prevent sticking of the bars 9, a thing very liable to happen, when the bar 9 touches bar 28. The object of this arrangement will appear hereinafter.

Fig. 5 shows the manner in which the various parts of the relay shown in Fig. 1 are electrically connected, and Fig. 4 shows the action of the armature.

The reference letter Z marks a battery or other source of electrical energy, the poles of which are connected respectively by conductors 31, 32, with the pieces 16^b, 16^c, as by binding screws *i*, *k*. A conductor 33 connects the pieces 16^c and 16, and a conductor 34 connects the pieces 16^b and 16^a. The piece 15^a is (or may be) connected to earth by a conductor 35, while the piece 15 is (or may be) connected to line 36. The diagram, Fig. 4, shows more clearly the action of the parts hereinbefore described. The legs 3 vibrate between the contacts 21^a and 21^b of screws 20^d and contacts 21^c and 21^d of screws 20^a, while legs 7 vibrate between the contacts 21^e and 21^f of screws 20^c and the contacts 21^g and 21^h of screws 20^b. When the armature rests with its contacts against the contact points 21^a, 21^c, 21^e, 21^g, the current traverses line 36 to contact 21^c, to section 3, to contact 21^a, to conductor 31, to battery Z, to conductor 32, to contact 21^g, to section 7, to contact 21^e, to conductor 35 to earth. When the armature is at the other extreme of its motion, the current traverses line 36, to contact 21^d, to section 3, to contact 21^b, to conductor 32, to battery Z, to conductor 31, to contact 21^h, to section 7, to contact 21^f, to conductor 35, to earth, but the direction of this current is the reverse of that of the first named. In each case, there are four simultaneous breaks in series in the circuit each time the armature is moved away from either set of contacts.

I will now describe how the armature is, or may be caused to be moved by the electro-magnets E, E′, reference being had to the diagram Fig. 8 wherein are shown two relays with their electro-magnets E^2, E^3, and E^4, E^5 joined in series, the contacts, for co-action with the armatures and supports, being omitted. Magnets E^2, E^3, are joined by conductor 37, and magnets E^4, E^5, by conductor 38. The source of electric energy, as a battery Y, has one pole connected with magnets E^3, E^5, by a conductor 39, there preferably being a rheostat 40 forming part of said connection. The other pole is connected with the magnets E^2, E^4, by the conductor 41, the brushes 42, 43, the circuit controller, brushes 45, 46, the conductor 47 to magnets E^2, and the conductor 48 to the magnets E^4. The circuit controller is or may be composed of a shaft 44 (which may be rotated by any suitable motor) and a piece of insulation 49 set therein longitudinally. This insulation 49 preferably occupies about one-quarter of the circumference of the shaft; when it is under the brushes 42, 45, the circuit in which the magnets E^2 E^3 are placed is broken; the same is true of the circuit, including magnets E^4, E^5, when the insulation is in contact with the brushes 43, 46. With the construction shown, there are times when both circuits are closed, then one is opened and closed, then the other is opened and closed; that is, for one revolution of the shaft 44, each circuit is opened once, and at two different times the current is divided between them.

In order to more quickly discharge the electro-magnets when their circuits are opened, I connect electro-condensers, as W, X, therewith, as by wires 50, 51, placing rheostats 52, 53 in these connections in order to be able to vary the resistance.

Taking the parts in the positions shown in Fig. 8 with the shaft turning in the direction indicated by the arrow, the current is weakening in the magnets E^4, E^5, and is just starting through magnets E^2, E^3. The effect of this is to weaken the pull of magnets E^4, E^5 on the armatures; at the same time the magnets E^2, E^3, begin to attract the armatures weekly; when the shaft has turned far enough to break the connection between brushes 43 and 46, the magnets E^4, E^5 are discharged quickly by the condenser W and the armature flies over to the magnets E^2 E^3. The reverse of all this takes place as the circuit through brushes 43, 46 is completed and

the circuit through brushes 42, 45 is broken. With the shaft 44 making many revolutions per minute, as in fact it does, the circuits are made and broken with great rapidity and the armatures move back and forth accordingly. If the armatures are made of flat resilient metal as shown in the drawings and described above, the springiness thereof accelerates their rate of motion on starting. If the small bars 28 are used, their effect is to increase the size of the armature when it is in contact with them and so add to the attraction of their electro-magnets, and to maintain good contact by the armature after the current through their magnet is broken, and leads to a quick breaking away by the armature when it yields to the attraction of the other magnets.

Each armature F in Fig. 8 forms or may form, part of an independent circuit, though two or more may form parts of one circuit.

Fig. 7 shows an arrangement of the top parts of the relay, omitting contact screws and other parts, and Fig. 6 shows the diagram for same. The various parts are essentially the same as those in Figs. 4 and 5, and are designated by references differing from those in Figs. 4 and 5 by the superior index ^{2} prefixed to the indices of said figures.

I do not limit myself to the construction of the armature shown in the drawings, as I am aware that the same may be varied in many ways without departing from my invention. Nor do I limit myself to the methods or ways of connecting up the contacts for the armature shown in the drawings. Also, many changes in details may be made without departing from my invention.

The base B, and the four standards A, A′, C, C, rising therefrom are cast or formed preferably in one piece as this insures the rigidity of the structure. The base is in the form of a hollow square or rectangle, or other hollow form, and is shaped so that the armature may be removed downward away from the contact points supported from the standards C, C, on loosening its supporting screws.

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

1. The combination of an armature comprising a number of conducting sections insulated from each other, one or more electro-magnets at each side of said armature, said magnet or magnets on one side being electrically independent of the one or those on the other side, two contacts at each side of each of said sections, and means electrically connecting said contacts by twos or multiples thereof, whereby the circuit through said armature may be broken simultaneously at a number of points in series, substantially as described.

2. The combination of a resilient armature comprising a number of conducting sections insulated from each other, one or more electro-magnets at each side of said armature, said magnet or magnets on one side being electrically independent of the one or those on the other side, two contacts at each side of each of said sections, and means electrically connecting said contacts by twos or multiples thereof, whereby the circuit through the armature is broken simultaneously at a number of points in series when the armature moves, the resiliency of the armature aiding in moving the same, substantially as described.

3. The combination of an armature comprising a number of resilient sections insulated from each other, one or more electro-magnets at each side of said armature, said magnet or magnets on one side being electrically independent of the one or those on the other side, two contacts at each side of each of said sections, and means electrically connecting said contacts by twos or multiples thereof, whereby the circuit through the armature is broken simultaneously at a number of points in series when the armature moves, the resiliency of the armature aiding in moving the same, substantially as described.

4. The combination of an armature comprising a number of U-shaped conducting sections insulated from each other, one or more electro-magnets at each side of said armature, said magnet or magnets on one side being electrically independent of the one or those on the other side, two contacts at each side of each of said sections, and means electrically connecting said contacts by twos or multiples thereof, whereby the circuit through said armature may be broken simultaneously at a number of points in series, substantially as described.

5. The combination of an armature comprising a number of U-shaped resilient conducting sections insulated from each other, one or more electro-magnets at each side of said armature, said magnet or magnets on one side being electrically independent of the one or those on the other side, two contacts at each side of each of said sections, and means electrically connecting said contacts by twos or multiples thereof, whereby the circuit through the armature is broken simultaneously at a number of points in series when the armature moves, the resiliency of the sections aiding in moving the armature, substantially as described.

6. The combination of an armature composed of conducting section 7, shaft 4 and arms 3 forming a second section, insulation 8, and bars 9 insulated from section 7, with electro-magnets E, and E′, independent electrically of each other, two contacts at each side of each of the said sections and means connecting said contacts by twos, whereby the circuit through the armature is broken simultaneously at four places in series when the armature is moved, substantially as described.

7. The combination of oppositely disposed electro-magnets or sets thereof, condensers electrically connected with each set, an armature between said sets of magnets and oper-

ated thereby, a source of electric energy, electric connections, and means for switching a current through said sets of magnets alternately, substantially as described.

8. The combination of oppositely disposed electro-magnets or sets thereof, condensers electrically connected with each set, an armature between said sets of magnets and operated thereby, a source of electric energy, electric connections, rheostats between each condenser and the magnets connected therewith, and between the said source of energy and the magnets, and means for switching a current through said sets of magnets alternately, substantially as described.

9. Oppositely disposed electro-magnets, circuits arranged to charge and discharge them alternately, an armature composed of a number of independent conducting sections insulated from each other, two contacts at each side of each of said sections for coaction therewith, and an electric circuit including said contacts and connecting them by twos or multiples thereof, whereby the said circuit is opened at a number of points simultaneously by the movements of said armature, all in combination, substantially as described.

10. The combination of oppositely disposed electro-magnets, an armature consisting of independent conducting sections placed between them, at least two contacts at each side of each section, electric connections joining said contacts by twos or multiples thereof, a switch, and independent electric connections therefrom to the said magnets, whereby they are alternately charged and discharged, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 29th day of June, 1893.

JOHN BURRY.

Witnesses:
PAUL WILCOX,
R. W. BARKLEY.