E. R. BRODTON.

RELAY.

APPLICATION FILED AUG. 3, 1908.

928,104. Patented July 13, 1909.

2 SHEETS—SHEET 1.

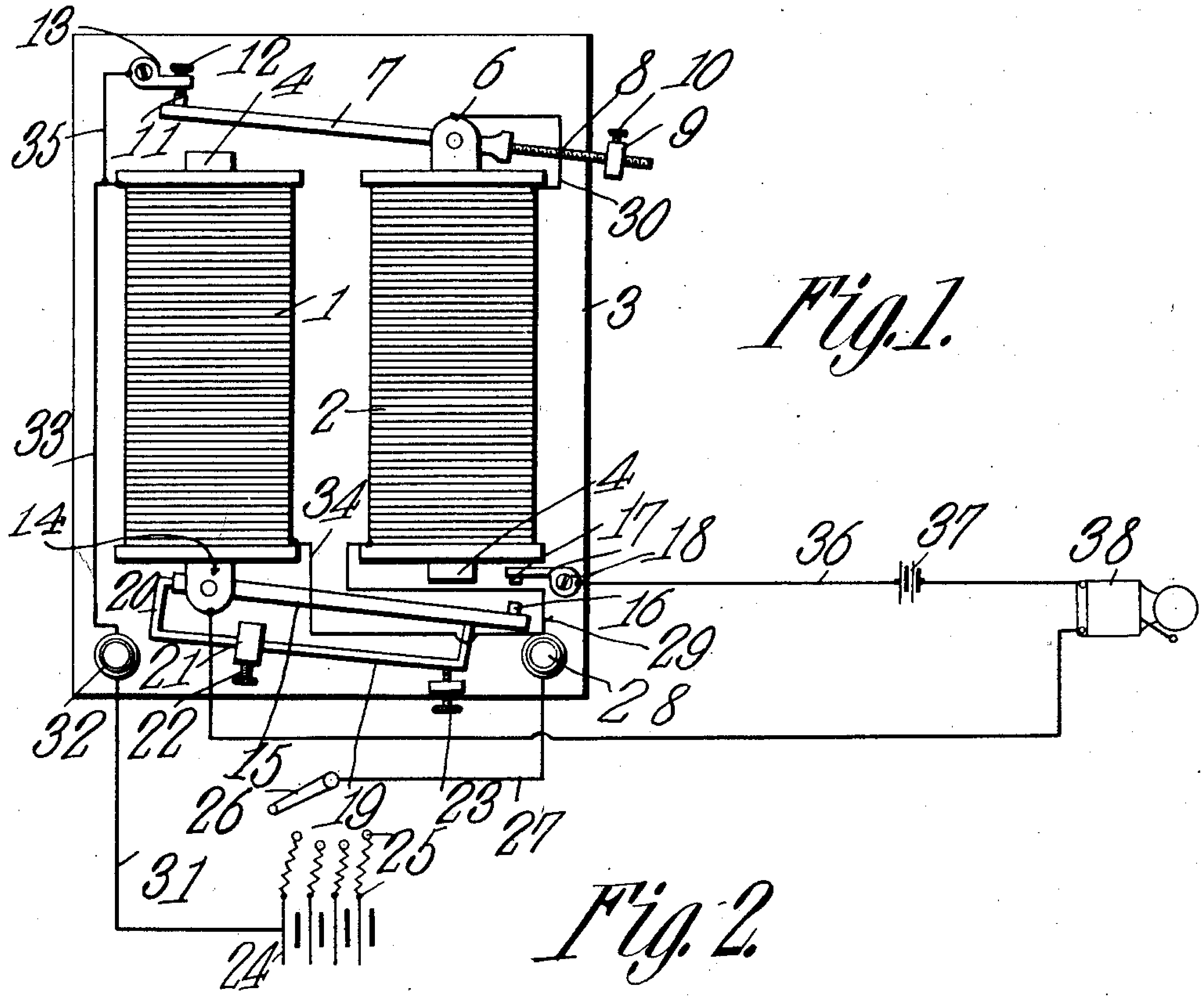
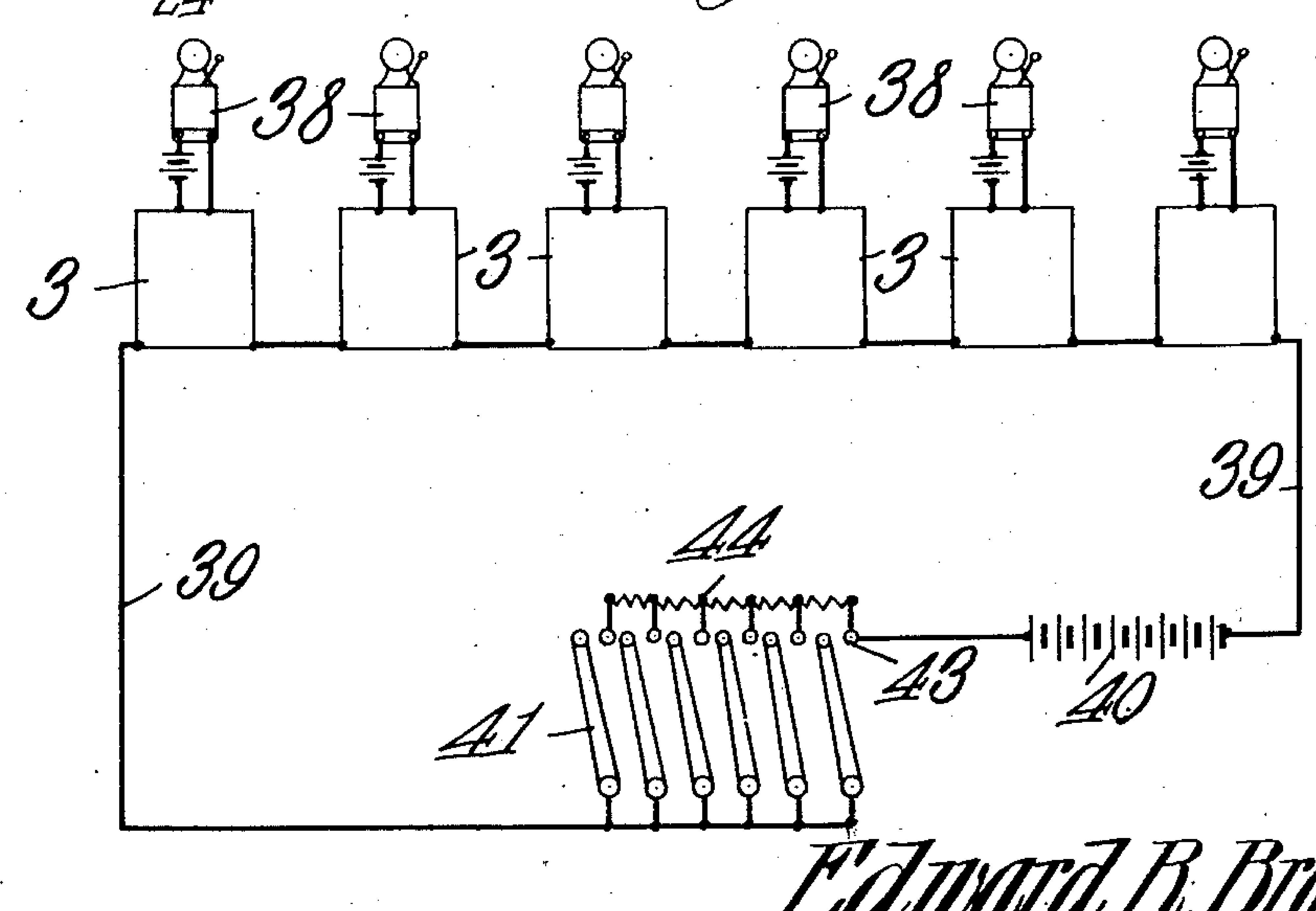


Fig.1.

Fig. 2.



Inventor
Edward R. Brodton,

Witnesses
E. G. Stewart
F. T. Chapman

By C. A. Snow & Co.
Attorneys

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2 SHEETS—SHEET 2.

Fig. 3.

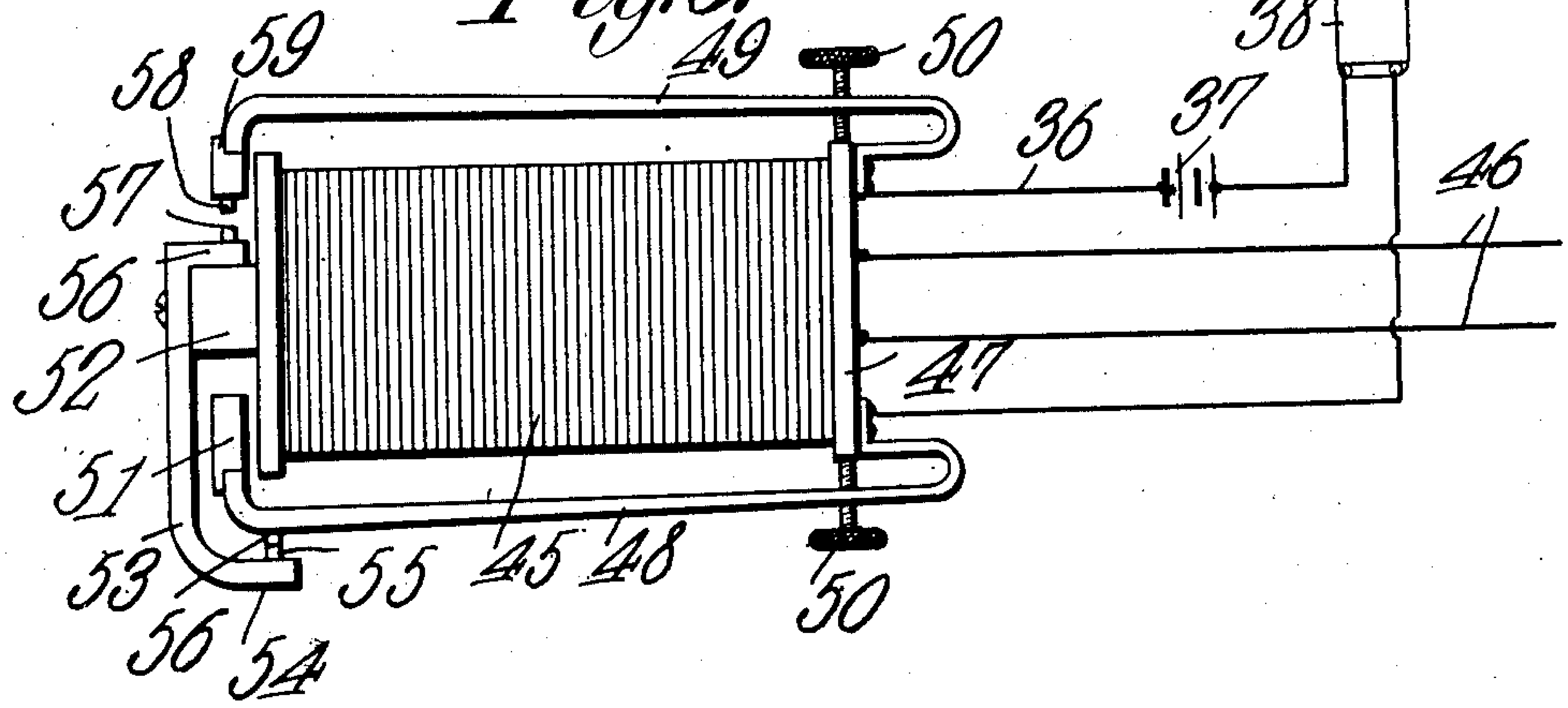
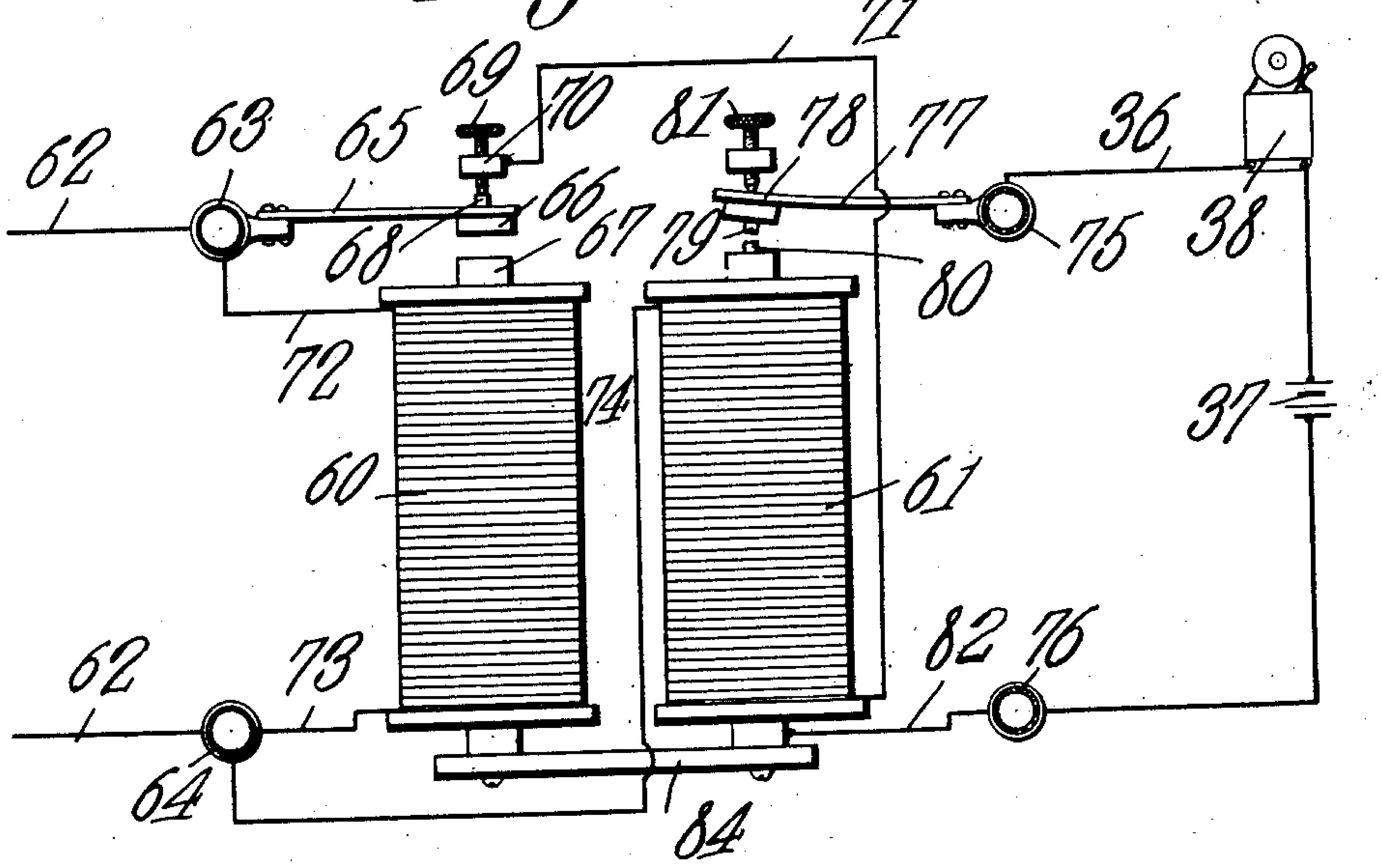


Fig. 4.



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E. J. Stewart

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Inventor

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By C. A. Snow & Co

Attorneys

UNITED STATES PATENT OFFICE.

EDWARD ROBERT BRODTON, OF MOBILE, ALABAMA, ASSIGNOR OF ONE-FOURTH TO GEORGE H. FONDÉ AND ONE-FOURTH TO ERNEST E. WAGAR, BOTH OF MOBILE, ALABAMA.

RELAY.

No. 928,104. Specification of Letters Patent. Patented July 13, 1909.

Application filed August 3, 1908. Serial No. 446,739.

To all whom it may concern:

Be it known that I, EDWARD ROBERT BRODTON, a citizen of the United States, residing at Mobile, in the county of Mobile and State of Alabama, have invented a new and useful Relay, of which the following is a specification.

This invention has reference to improvements in relays and its object is to produce a relay which will operate only under a predetermined amount of current, that is it will fail to operate under a certain minimum current and will cut itself out of circuit automatically at a certain maximum current.

By means of the present invention any number of bells or type-writer keys or suitable electromechanical devices may be caused to operate selectively over two line wires or a single line wire and a ground return. Furthermore the relay forming the subject matter of the present invention may be used as a cut-out switch so that if placed in a line it will cut itself entirely out in case of an over-load.

The invention comprises electromagnetic means which may be adjusted to respond to any predetermined minimum amount of current, and when the predetermined amount of electric current is flowing then the electromagnetic means is energized to a sufficient extent to operate a circuit closer included in a charged local circuit so that suitable translating devices in the local circuit become energized. Should however, the line circuit become abnormally heavy then another circuit controlling means is operated by the relay and the local circuit is broken.

The invention will be best understood from a consideration of the following detailed description, taken in connection with the accompanying drawings forming a part of this specification in which drawings:

Figure 1 is a diagram illustrating one form of the relay and the circuit connection therefor. Fig. 2 is a diagram showing a number of relays arranged in a single circuit for selective operation. Fig. 3 is a diagram showing a form of relay differing mechanically in some respects from that shown in Fig. 1. Fig. 4 is a view showing a relay working on the same principle as Fig. 1 but mechanically similar to that shown in Fig. 3.

Referring to the drawings, there is shown in Fig. 1 a type of relay particularly suited for use where the action of gravity may be utilized. The action of gravity is to be desired wherever it may be used, since springs sometimes lose their tension and the action of gravity is always uniform.

In Fig. 1 are shown two magnets 1 and 2 mounted upon a suitable base 3. The magnets shown are of the ordinary type consisting of a coil of wire wound around a suitable core 4, but it will be understood that any type of magnet may be employed and these magnets are to be taken as typical of either magnets or solenoids. The magnets 1 and 2 are arranged side by side within a short distance one of the other and the core of the magnet 3 is provided with supports or ears 6, between which is journaled an armature lever 7, the free end of the armature lever 7 being in operative relation to the corresponding end of the core 4 of the magnet 1. The other end of the armature lever 7 carries a threaded stem 8 upon which is mounted a nut 9 acting as a counter weight, and a clamp screw 10 passing through the nut 9 serves to hold the same in any adjusted position. That end of the armature lever 7 in operative relation to the core of the magnet 1, is provided with a contact pin or stud 11 in the path of which is an adjustable thumb screw 12 carried by a bracket 13 fastened on the base 3 of the relay. That end of the core 4 of the magnet 1 remote from the armature lever 7 carries ears 14 in which is pivotally supported another armature lever 15, having its active or free end in operative relation to the core 4 of the magnet 2, at the end of the said core remote from the ears 6. The free end of the armature lever 15 carries a contact stud or pin 16 in the path of which is another contact stud or pin 17 carried on a bracket 18 fastened on the base 3. Carried by the armature 15 is a bar or rod 19 parallel with said armature and secured thereto by end extensions 20. The rod or bar 19 carries a sliding weight 21 held in any adjusted position by a clamp screw 22. In the path of the bar 19 or if desired in the path of the armature 15 is an adjustable thumb screw 23 mounted on the base 3. By suitably adjusting the weights 9 and 21 the degree of responsiveness of the respective armatures 7 and 15 may be regulated as desired.

In the structure shown in Fig. 1 there is provided a current source indicated by the battery 24 and the separate cells of the battery are carried off to contacts 25 in the path of the switch arm 26, which latter in turn is connected by a conductor 27 to a binding post 28 on the base or support 3. This binding-post 28 is connected by a conductor 29 to one side of the coil of the magnet 2, and the other side of this magnet coil is connected by a conductor 30 to the ears 6 on the core 4 of the magnet 2. The batteries 24 are connected in series and on one side are connected by a conductor 31 to a binding-post 32 on the support 3, and this binding-post is connected by a conductor 33 to one side of the magnet coil 1, the other side of which latter is connected by a conductor 34 to the binding-post 28 before mentioned. The conductor 33 branches off by another conductor 35 to the bracket 13. The ears 14 and the bracket 18 constitute the respective terminals of a local circuit 36 which latter includes a current source 37 in the form of a battery or other means of current supply and a translating device 38 shown as an ordinary trembler bell but which may be replaced by any other type of translating device. Now let it be assumed that the weight 9 is so adjusted as to materially over-balance the armature 7 and maintain its stud or contact 11 against the adjusting screw 12. Let it be further assumed that the switch arm 26 is moved into contact with the first of the contact studs 25. The circuit is now complete from the battery 24 to the conductor 31, binding-post 32, conductor 33, coil 1, conductor 34, binding-post 28, conductor 27 and switch-arm 26, back to the battery. There is also established a circuit by the conductor 35, branching off from the conductor 33, then to the bracket 13, screw 12, contact 11, armature lever 7, ears 6, conductor 30, coil of the magnet 2, conductor 29 and from there to the binding-post 28 and conductor 27 back to the battery 24. Both armatures 7 and 15 are so over-weighted as not to respond to the pull of either magnet and furthermore, the magnet 1 may be wound to higher resistance than the magnet 2 so that the greater amount of current is diverted through the said magnet 2. If the switch-arm 26 be moved on to the second contact 25 so as to include two cells of battery then a greater current will flow through the two magnets 1 and 2, and if it be assumed that the magnet 2 be of lower resistance then the major portion of the current will flow through the magnet 2. Assuming that the weight 21 is properly adjusted the armature 15 will respond to the stronger pull of the magnet 2 under the conditions just named and this armature will be lifted toward the magnet 2 so that the contacts 16 and 17 are brought together and the local circuit 36 is then established from the battery 37 to the bracket 18, contacts 17 and 16, armature lever 15, ears 14 and by the conductor 36 through the bell 38 back to the battery 37. Now the bell 38 will begin to ring and continue to ring so long as the local circuit is closed. If the bell 38 be replaced by an electric light then the light will glow so long as the circuit remains closed. Suppose now that the lever 26 is moved over the other contacts 25 until finally the voltage delivered by the battery 24 is sufficient to drive enough current through the coil 1 to energize it to an extent which will overcome the weight 9 and cause the armature lever 7 to move toward the corresponding core 4, thus separating the contact 11 from the screw 12. Under these circumstances the branch circuit through the magnet 2 is broken and the latter being deënergized no longer maintains the armature 15 in the raised position and it gravitates to the position shown in the drawings thus rupturing the local circuit 36. The circuit through the coil 1 however, remains intact and is not broken by either armature. The coil or magnet 1 therefore remains energized so long as the switch 26 has been pulled to a sufficient extent to include the desired number of battery cells 24. If the direction of movement of the switch-arm 26 be reversed then the battery cells are progressively cut out by reducing the voltage of the circuit until finally the pull of the magnet 1 is no longer able to overcome the counterbalancing effect of the weight 9 and the armature lever will move upward until its contact 11 again comes against the adjusting screw 12 and the circuit through the magnet 2 is again completed, thus once again completing the local circuit 36 and causing the bell 38 to respond. A further reduction of the number of battery cells in circuit will ultimately so weaken the magnet 2 as to reduce its pull to a point where it is no longer able to overcome the weight of the armature 15 and weight 21, and the latter falls away from the contact 17, thus breaking the local circuit 36.

Referring to Fig. 2 there is shown a system in which a number of relays are designated in the drawings merely by the base 3, but which otherwise may agree with the showing of Fig. 1. The magnets 1 of these several relays are included in series in the line of wires 39, in which latter is also included a current source 40, shown diagrammatically as a battery of large size. Branched across the two sides of the line circuit 39 is a series of switch-arms 41. In the path of each one of the switch-arms 41 is one of a series of terminals 43 included in one of the circuit conductors 39 and between the terminals 43 is included a resistance coil 44, the terminals 43 being branched off from said coil. The rheostat or resistance 44 and terminals 43 are so arranged that each switch-arm will include in the circuit a definite amount of resistance, the resistance included by one switch-arm being different from that of any other switch-arm. By properly choosing the resistance of the coil 1 of the relays 3 any predetermined one of the relays may be operated by any predetermined one of the switch-arms 41. In this way the relays are selectively operated in the one line circuit 39. The system of Fig. 2 provides a selective system of signaling if the translating devices 38 be bells or lamps or these translating devices may be replaced by type-writer keys so that the keys may be operated at a distance.

Referring to Fig. 3 there is shown a simplified type of relay and in this case but one magnet 45 is used, and this may be included in the main circuit 46. Mounted on one head 47 of the coil 45 or in any other position are two spring arms 48 and 49. These arms 48 and 49 may be made of brass or other non-magnetic material and are shown as returned on themselves with an adjusting screw 50 passing through one of the legs of the arm. The free end of each arm 48 and 49 lies alongside of the coil 45 approximately parallel thereto. At the extreme end of the arm 48 is an armature 51 in operative relation to the core 52 of the coil 45. Fastened to the core 52 is a bracket 53 having one end 54 underriding the arm 48 and provided with a contact stud or terminal 55, while the arm 48 has a similar contact stud or terminal 56 arranged to engage the terminal 55 when the spring arm is moved away from the coil 45. The bracket 53 is made of brass or some other non-magnetic material and at the upper end is bent around the core 52 and there carries a contact stud 57 in the path of another contact stud 58, on an armature 59 carried on the free end of the spring arm 49, in operative relation to the projecting end of the core 52.

In the description of Fig. 3 it has been assumed that the spring arm 48 is below the magnet coil 45, and the spring arm 49 above the same, but since these are spring arms and not acted upon by the force of gravity, it will be understood that they may be located in any position relative to the coil 45 and that the latter may also assume any position.

In the structure shown in Fig. 3 the terminals of the local circuit 36 are connected directly to the end of the spring arms 48 and 49 respectively as indicated in the figure. Let it be assumed that by a proper manipulation of the screws 50 the spring arms 48 and 49 have been so adjusted that the arm 48 will respond to the pull of the magnet only when the same is energized by a predetermined maximum current, while the spring arm 49 is actuated by the magnet when the latter is energized by a predetermined minimum current. As soon as the minimum strength of current is reached then the pull of the magnet 45 is sufficient to attract the armature 59, against the resistance of the spring 49 and the local circuit is completed at the contacts 57 and 58, and may be traced from the battery through the arm 49, contacts 58 and 57, bracket 53, contacts 55 and 56, spring arm 48 and through the local bell circuit back to the battery 36. The bell 38 or other translating device is thus energized and continues to operate so long as the local circuit remains closed. Suppose now that the predetermined maximum current is reached then the magnet 45 is more strongly energized and ultimately the spring 48 is unable to resist the pull of the magnet upon the armature 51. When the armature 51 is moved toward the core 52 then the local circuit is broken at the contacts 55 and 56 and remains broken so long as the pull of the magnet 45 is sufficient to overcome the resistance of the spring 48.

The structure shown in Fig. 4 is substantially like that shown in Fig. 1 except that springs are substituted for the action of gravity in the circuit completing and breaking devices. In Fig. 4 there are two electromagnets 60 and 61 similar to the magnets 1 and 2 of Fig. 1. Line wires 62 come to binding-posts 63 and 64. The binding-post 63 carries a spring arm 65 at the end of which is an armature 66 in operative relation to the core 67 of the magnet 60, and the spring 65 at the armature end also carries a contact stud 68 in the path of which is an adjusting screw 69 mounted in a bracket or support 70 from which leads a conductor 71 to one side of the magnet coil 61. A conductor 72 leads from the binding-post 63 to one side of the coil of the magnet 60 and the other side of this magnet is connected by a conductor 73 to the binding-post 64. The side of the coil of the magnet 61 remote from that to which the conductor 71 is connected is also connected by a conductor 74 to the binding-post 64. There are also other binding-posts 75 and 76 to which are connected the terminals of the local circuit 36 including the battery 37 and translating device 38. Fastened to the binding-post 75 is a spring arm 77 carrying an armature 78 with its free end in operative relation to the core of the magnet 61 and this armature is provided with a contact stud 79 arranged to engage another contact stud 80 on the core of the magnet 61. The movement of the spring arm 77 and its armature 78 away from the magnet 61 is regulated by a thumb screw 81. The binding-post 76 is connected by a conductor 82 to the core of the magnet 61. The two magnets 60 and 61 have their cores connected together by a supporting bar 84 which may be either of insulating material or the cores of the magnets 60 and 61 should be insulated from the connecting bar 84. When no current is passing the spring arm 65 maintains the contact 68 against the screw 69 while the spring 77 maintains itself against the back screw 81 with the contact terminals 79 and 80 separated. The spring and windings being properly adjusted for the current desired, a current of the proper minimum value will pass by the binding-post 63, arm 65, contacts 68 and 70, conductor 71 to the coil 61 and from thence by the conductor 74 back to the binding-post 64 and the other side of the main circuit. At the same time the current will branch through the conductor 72 to the coil 60 and return to the binding-post 64 through the conductor 73. With the minimum current the magnet 60 will not respond sufficiently to attract the armature 66 and so separate the contacts 68 and 70, but under the assumed conditions the magnet 61 will respond with sufficient energy to attract the armature 78 against the action of the spring 77, and bring the terminals 79 and 80 into contact thus completing the local circuit 36 through the binding-post 75, arm 77, contacts 79 and 80, the core of the magnet 61 thence by conductor 82 to the other binding-post 76, and through the local circuit back to the battery. Should the current increase sufficiently the magnet 60 is finally energized to such an extent as to overcome the resistance to the spring 65 and then the circuit through the magnet 61 is broken at the contacts 68 and 70, and the magnet is deënergized, so that the spring arm 77 will cause the rupture of the circuit at the contacts 79 and 80.

It is to be observed that both of the cut-out and the relay sides of the device are operated from the same current source and when a series of relays are included in the circuit, then each succeeding relay is cut in only after the preceding relay has been cut out of the circuit, so that the action of the device is positive and reliable.

What is claimed is:—

1. A relay comprising electromagnetic means included in a line circuit and a plurality of armatures controlled by the electromagnetic means and responsive, respectively, to different line currents, one of said armatures being includable in a local circuit and the other of said armatures being includable in the line circuit.

2. A relay comprising electromagnetic means included in a line circuit and two armatures controlled by the electromagnetic means and each biased to respond selectively to a predetermined line current, one armature responding to a different current than the other armature, and one armature being includable in a local circuit and controlling the latter and the other armature being includable in the line circuit and controlling the local circuit.

3. A relay comprising electromagnetic means responsive to a predetermined minimum current, a local circuit controlled by said electromagnetic means, another electromagnetic means responsive to a predetermined maximum current, and means controlled by the second named electromagnetic means for controlling the circuit to the first-named electromagnetic means.

4. A relay comprising two electromagnets, an armature for each magnet, one magnet and armature being active to a predetermined minimum current and the other magnet and armature being active to a predetermined maximum current, a local circuit including translating devices and controlled by one of the armatures of one of the magnets and a circuit controlled by the armature of the other magnet and itself including the first named magnet.

5. A relay comprising two electromagnets each responsive to a predetermined but different current than the other magnet, armatures for each magnet, means for adjustably biasing each armature, circuit terminals under control of one of the armatures and in circuit with the other magnet, and a local circuit including translating devices under the control of the armature of the said other magnet.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

EDWARD ROBERT BRODTON.

Witnesses:

D. P. Bester, Jr.,

George Hayden.