

C. E. BEACH.
SIGNALING SYSTEM.
APPLICATION FILED OCT. 12, 1914.

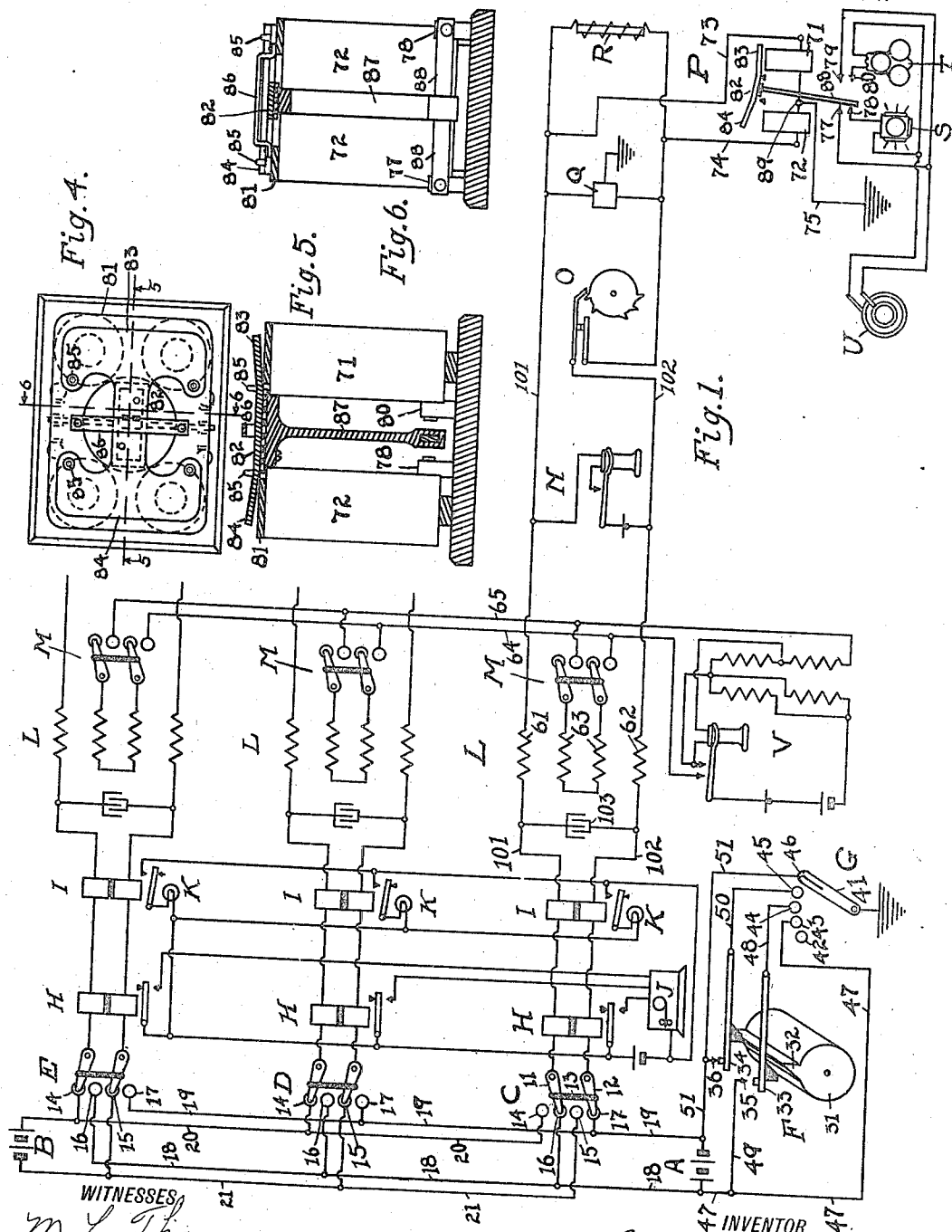
C. E. BEACH.
SIGNALING SYSTEM.

SIGNALING SYSTEM.

APPLICATION FILED OCT. 12, 1914.

Patented Sept. 25, 1917.

2 SHEETS—SHEET 1.



WITNESSES
M. L. Thomas
R. C. Palmatier

M. L. Thomas

R. C. Palmatier

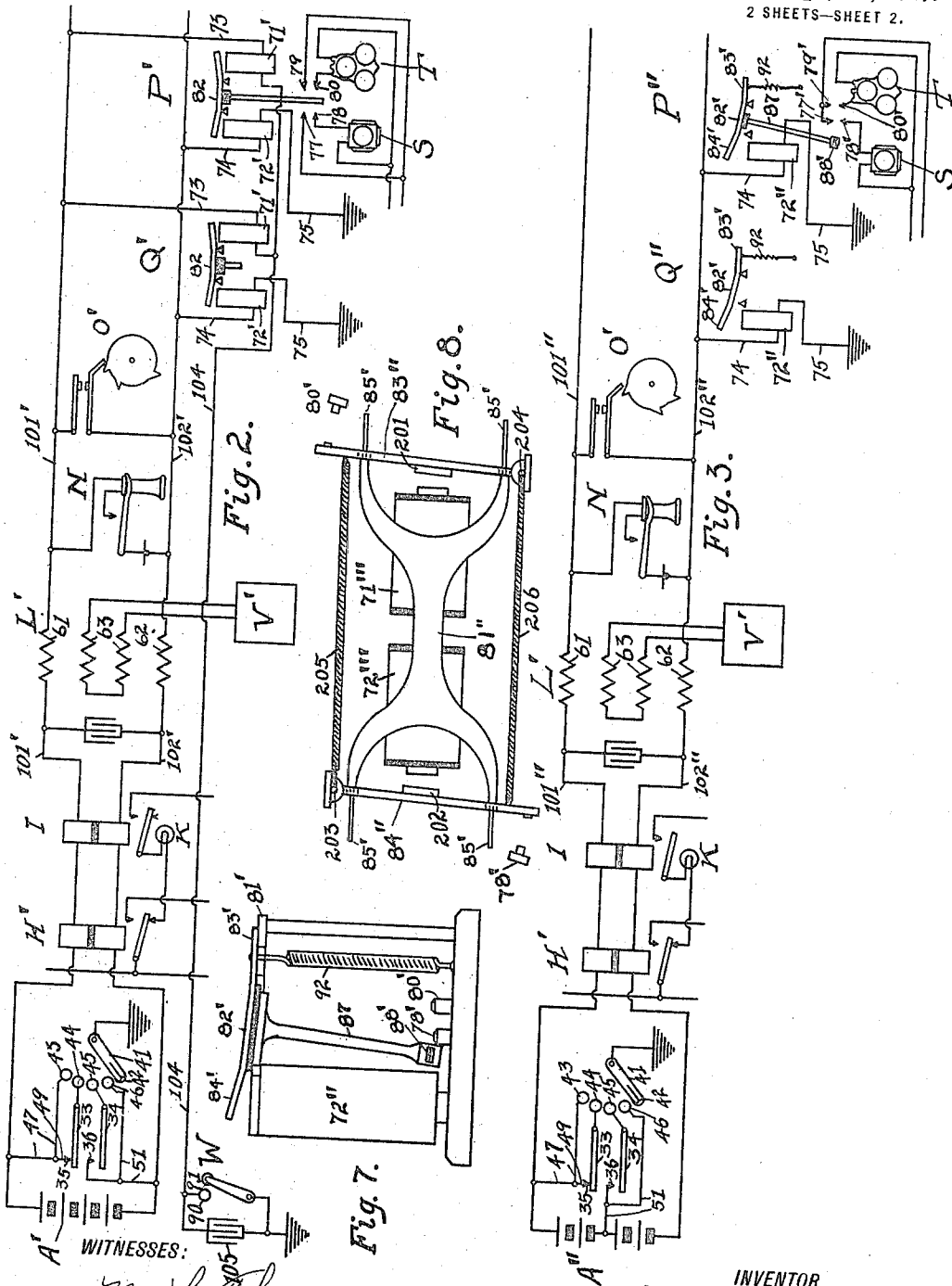
Clarence E. Beach,

Clarence E. Beach,

1,240,811.

C. E. BEACH.
SIGNALING SYSTEM.
APPLICATION FILED OCT. 12, 1914.

Patented Sept. 25, 1917.
2 SHEETS—SHEET 2.



WITNESSES:

M. L. Thomas
R. C. Palmater

INVENTOR

Clarence E. Beach

UNITED STATES PATENT OFFICE.

CLARENCE E. BEACH, OF BINGHAMTON, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE GAMEWELL FIRE ALARM TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

SIGNALING SYSTEM.

1,240,811.

Specification of Letters Patent.

Patented Sept. 25, 1917.

Application filed October 12, 1914. Serial No. 866,322.

To all whom it may concern:

Be it known that I, CLARENCE E. BEACH, a citizen of the United States, residing at Binghamton, in the county of Broome and State of New York, have invented certain new and useful Improvements in Signaling Systems, of which the following is a specification.

This invention relates to signaling systems in which different classes of signals are transmitted over the same circuit, and is particularly adapted for use in connection with municipal police signaling systems; although features of this invention are adapted for use, either separately or in combination with each other, with various signaling systems.

An object of this invention is to provide a signaling system having a circuit including both telegraphic and telephonic equipment and direct current alarm mechanism so connected to the same circuit that said alarm mechanism may be employed without interference between such alarm mechanism and the telegraphic and telephonic equipment.

Another object of this invention is to provide such a system in which the alarm mechanism is adapted to selectively control or operate either or both of two sets of independent alarm devices.

Another object of this invention is to provide a system capable of simultaneously signaling alarms to part or all of the circuits of a common battery system, without operatively impairing telephonic communication through or between such circuits on account of the action, either of grouping the circuits, or of transmitting signals thereon.

Another object of this invention is to provide a form of such a system which is adapted for use in cases where so-called open circuit batteries are employed as a current source, and it is therefore desired to avoid any current drain whatever on the current source except during the transmission of alarm signals.

Another object of this invention is to provide improved signal formulating mechanism adapted to selectively transmit code signals to either or both of two sets of alarm mechanisms in such signaling systems.

A further object of this invention is to provide an improved relay or controlling mechanism specially adapted to parallel con-

nection in a signaling circuit, and differentially responsive to makes and breaks in a ground or common return connection to either side of the signaling circuit.

Other objects are described in the following specification and more particularly pointed out in the claims.

In so applying this invention to a signaling system employing a plurality of circuits as to embody all of its features, two current sources are provided, and a circuit condition changing means is connected with one of the current sources so as to be adapted to cause predetermined circuit condition changes in all circuits supplied by such source.

The circuit condition changing means comprises alarm signal formulating mechanism, and alarm selecting mechanism; the formulating mechanism embodying circuit controllers arranged to alternately close two current paths in accordance with any desired code, and so arranged that said current paths are never both closed; the selecting mechanism comprising a switch, whereby either or both of the circuit controllers of the formulating mechanism may be rendered effective, and whereby either of the circuits controlled by the formulating mechanism may be opened or closed without operating said mechanism.

A transfer switch is provided for each of the signaling circuits, each of these switches being adapted to connect its circuit to either current source without simultaneously disconnecting said sources, so that any circuit may be transferred from the current source associated with the circuit condition changing means to the other current source, or vice versa, without impairing the current supply to such circuit.

One or more telephone stations and one or more telegraph stations are connected to the circuit in any well known manner.

It is preferable that such telephone stations be connected in parallel with each other, and the telegraph stations may be connected in series with each other, or in parallel with each other and with the telephone stations.

Alarm controlling relays are connected to the circuit in parallel with each other, and between the opposite sides of said circuit.

If any or all of the stations are connected in series with each other, so as to require the use of a normally closed circuit, a suitable impedance is included in the circuit beyond the last relay.

If the telegraph stations are in series, and the telephone stations are in parallel with each other and with the relays, said impedance should comprise suitable inductive reactance.

For establishing telephonic correlation with another circuit a repeating coil is provided, having two substantially equal windings, one of which is serially included in one side of the circuit, and the other of which is serially included in the other side of the circuit. Other windings are provided for these repeating coils, and means for connecting such other windings to other circuits, as desired.

Between each repeating coil and its associated current source transfer switch, relays are provided for controlling signal mechanism.

Each of these relays is provided with two approximately equal windings, one winding of each relay being serially included in one side of its associated circuit, and the other winding being serially included in the other side of said circuit.

Suitable signal receiving or indicating mechanism is controlled by each of these relays.

The alarm controlling relay mechanisms are of novel form, and each comprises two electromagnets, a terminal of one magnet being connected to one side of the circuit, and a terminal of the other magnet being connected to the other side of said circuit.

The remaining terminals of the magnets are connected to a common return conductor, as for instance, to the ground.

An armature structure for these magnets is so mounted in relation thereto that the energy of one of said magnets will be applied, to the portion of said structure associated with the other of said magnets, during a portion of the movement of said armature at a leverage which is substantially greater than the leverage at which the energy of such magnet will be applied to said portion during the remainder of the movement of said armature.

A contact arm is carried by the armature structure whereby circuit connections may be established between either of two sets of contacts, and alarm mechanism is associated with each relay, as for instance, a lamp controlled by one contact, and a bell controlled by the other contact.

For signaling systems in which it is not desired to provide facilities for transmitting alarm signals on certain of a plurality of circuits without causing all such circuits to be affected by such signals, but one cur-

rent source need be provided, and the switch mechanism for transferring the various circuits from one source to another can be omitted, while employing the other features of this invention.

For signaling systems in which it is not desired to provide telephonic intercommunication between a plurality of circuits, the use of repeating coils may be dispensed with, while employing the other features of this invention.

For signaling systems employing so-called open circuit primary batteries, and in which it is therefore desirable that there should not be a continuous current drain on such batteries, all of the features of this invention may be employed by providing two normally disconnected common return conductors, as for instance, the ground, and a third wire, and connecting one of the magnets of each alarm controlling relay between one side of the circuit and one of the common return conductors, as for instance, the third wire, and connecting the other magnet of such relay between the other side of the circuit, and the other common return conductor, as for instance, the ground, keeping the two common return conductors normally disconnected from each other, and connecting the two common return conductors through a condenser, if necessary to secure absence of noise in the telephone circuit, and providing facilities for directly connecting such conductors by a switch (which may be associated with the circuit condition changing means) whenever it is desired to cause the operation of the alarm relays.

For signaling systems in which it is not necessary to maintain an electrical balance between the circuit conductors and the common return conductor, by connecting one magnet of each alarm relay between one circuit conductor and the common return conductor, and connecting the other magnet of each relay between the other circuit conductor and the common return conductor, provision may be made for open circuit battery operation by employing a retractile spring, or a permanent magnet, in place of one of the electromagnets in the relay, and connecting the other magnet between one of the circuit conductors and the common return conductor, and arranging the relay so that:—when the armature is in completely retracted position both alarm mechanism circuits will be open; when in partially retracted position, one of the alarm mechanism circuits will be closed; and when in fully attracted position the other of the alarm mechanism circuits will be closed,—and thus all other features of this invention may be employed.

From the foregoing examples, it is apparent that this invention is capable of

various differing embodiments, including the addition or omission of many parts, and that various features of this invention are adapted for use with various signaling systems, either separately or in combination with each other, and the particular construction, arrangement and operation, of parts shown in the accompanying drawings and hereinafter described, are given merely with a view of enabling this invention to be better understood, and not as a limitation to my claims.

Like characters of reference denote similar parts throughout the accompanying drawings, in which:—

Figure 1 shows the embodiment of many features of this invention as applied to a closed telegraphic and open telephonic circuit signaling system;

Fig. 2 shows the embodiment of many features of this invention as applied to a normally open telegraphic and telephonic circuit signaling system, with two common return conductors;

Fig. 3 shows certain features of this invention as applied to a normally open telegraphic and telephonic circuit signaling system, using the ground, or but one common return conductor;

Fig. 4 is a plan view of an alarm controlling relay adapted for use as shown in Fig. 1 and Fig. 2;

Fig. 5 is a sectional view of the relay shown in Fig. 4, taken on the line 5—5;

Fig. 6 is a sectional view of the relay shown in Fig. 4, taken on the line 6—6;

Fig. 7 is a view of a modified form of the relay shown in Fig. 4 adapted for use in the manner indicated in Fig. 3, and;

Fig. 8 shows a different form of relay mechanism embodying features of this invention.

Referring now to Fig. 1, A and B represent batteries, which are of such capacity that either may supply all current required for telegraphing, telephoning, and alarm signaling in all of the circuits associated therewith.

Switch mechanisms C, D, and E are provided, one for each of the signaling circuits, and each having switch arms 11 and 12, connected by an insulating yoke 13, and co-operating with separately insulated contacts 14, 15, 16, and 17.

The contacts 14 and 16 are so located with relation to the switch arm 11 that in moving said arm from one contact to the other, it will connect with both of said contacts during a portion of its movement, and the contacts 15 and 17 maintain a similar relation with switch arm 12, the yoke 13 being of such length that while the arm 11 is touching both contacts 14 and 16, the arm 12 will touch both contacts 15 and 17.

The bus bar 18 connects one terminal of

the battery A with the contacts 16 of each of the switches, and the bus bar 19 likewise connects the other terminal of said battery A with the contacts 17 of each of the switches.

The conductors 20 and 21 similarly connect the terminals of battery B with the contacts 14 and 15, respectively, of each of the switches.

Circuit condition changing means, consisting of the alarm signal formulating mechanism F, and of the alarm selecting mechanism G, is associated with the battery A.

The alarm signal formulating mechanism F comprises the cylinder 31 which may be rotated in any desired manner, as for instance, by suitable clock work of any well known form, and having one or more teeth or projections 32, so that it may be employed for any desired code signaling.

The contact controlling tracers 33 and 34 are so mounted, with relation to their associated contact points 35 and 36, respectively, and the tooth or teeth 32, that when the cylinder 31 is rotated around its axis, the tracers 33 and 34 will be alternately brought into engagement with their contact points 35 and 36, and so that there will always be at least one of said tracers out of contact with its associated contact point.

The alarm selecting mechanism consists of the switch arm 41, permanently connected to the ground, and the free end of said switch arm comprises two prongs, so as to adapt said switch arm to make independent contact upon two contact studs at the same time. The contact studs 42, 43, 44, 45, and 46 are arranged in the path of the switch arm 41, the contacts 44 and 45 being so situated, that the switch arm 41 may be readily adjusted so that one of its prongs may connect with one of these studs, and the other of its prongs with the other.

The contact stud 43 is connected through the conductor 47 to one terminal of battery A, contact stud 44 is connected through conductor 48 to tracer 33, point 35 is connected through conductor 49 to conductor 47, contact stud 45 is connected through conductor 50 to tracer 34, and contact stud 46 is connected through conductor 51 to point 36 and to the other terminal of battery A.

As the arrangement of corresponding parts is similar in each of the circuits, a detailed description of but one of these circuits will be herein given.

The relays H and I are each provided with two substantially equal windings, one winding of each relay being included in the conductor 101 leading from switch arm 11, and the other winding of each relay being co-operatively included in the conductor 102 leading from switch arm 12.

J is a typical multiple pen register whose pens are separately controlled by the relays

H in a well known manner, so as to be responsive to current changes due to the operation of telegraph stations connected with said conductors 101 and 102, and said relays, register, and their connections therefore constitute telegraphic signal receiving mechanism.

Each of the relays I controls a typical line lamp K, connected in a well known manner, so as to be responsive to current changes incidental to bringing of any telephone station into signaling condition, and therefore the relays I and their associated lamps and connections form telephonic signal indicating mechanism.

A repeating coil is typically indicated at L, said coil comprising the windings 61 and 62, serially included in the conductors 101 and 102, respectively, and the windings 63. The intercommunicating switch M is associated with the windings 63 of each repeating coil, these switches being connected to conductors 64 and 65. Such number of telephone and telegraph stations, and relay mechanisms are connected to the conductors 101 and 102 as may be desired, the manner of connection of the telephone stations being typically indicated at N, and the manner of connection of the telegraph stations being typically indicated at O. One of the relay mechanisms is diagrammatically indicated at P, another relay mechanism being indicated at Q.

The relay P comprises the magnets 71 and 72, one terminal of the magnet 71 being connected to the conductor 101 through conductor 73, and one terminal of magnet 72 being connected to conductor 102 through conductor 74. The remaining terminals of magnets 71 and 72 are connected to each other at junction 89, which is connected to the ground through conductor 75.

Beyond the last telegraph station, and preferably beyond the last telephone station or relay mechanism, the conductors 101 and 102 are connected by the inductive impedance R, which is of sufficiently low resistance to normally permit sufficient current to flow through conductors 101 and 102 to cause the armature of the relay H associated therewith to move to attracted position, and having sufficient inductive reactance to prevent short-circuiting the alternating telephone current.

The magnets of alarm relays, such as P and Q, must be wound to so high a resistance, with relation to the current flow at which the relay H will retain its associated armature, that the aggregate current flow through such relay mechanisms will not be sufficient to maintain the armature of said relay H in attracted position when either the conductor 101 or conductor 102 is broken beyond all of said alarm relays, and the inductive reactance of these magnets must be

sufficient to prevent their acting to short-circuit the alternating telephone current.

Each relay I must be so adjusted that its armature will remain in, or move to, retracted position when the current flow through the windings of such relay is limited to that which the current sources A or B will cause to pass through the conductors 101 and 102, when said conductors are connected only by the impedance R and by alarm relays such as P and Q.

The resistance of each telephone station is such that when the circuit through such station is closed between conductor 101 and conductor 102, the increased current flow resulting therefrom will be sufficient to cause the associated relay I to move its armature to attracted position.

The condenser 103 connects the conductors 101 and 102 at a point in said conductors between the repeating coil L and the relays H and I for the purpose of facilitating the passage of alternating telephone current from the telephone stations through said repeating coil.

An alarm lamp is typically indicated at S and an alarm bell is typically indicated at T, a suitable source of energy for said lamp and bell being typically indicated at U. Fixed contacts 77 and 78 control the connection of the lamp S with current source U, and fixed contacts 79 and 80 likewise control the alarm bell T.

Referring now to Figs. 4, 5 and 6, which show the construction of relay P in greater detail, a non-magnetic plate 81 is secured to the poles of the magnets 71 and 72, the poles of said magnets projecting through suitable openings in said plate.

The armature structure 82 is mounted upon the plate 81 and has the inclined ends 83 and 84 so formed with relation to the magnets 71 and 72 that when the portion of the armature between the bends adjacent to said inclined ends is resting upon the plate 81, the end 83 will incline away from but extend across the poles of the magnet 71, and the end 84 will incline away from but extend across the poles of the magnet 72.

The locating pins 85, secured to the plate 81, pass through suitable openings in the armature structure 82, and are arranged to permit such movement of said armature structure as will bring one or the other of the inclined ends substantially parallel to and against the poles of its associated magnet. When the armature structure 82 moves, in response to the attraction of its end 83 toward the magnet 71, until said end is substantially parallel to and against the poles of said magnet, said armature structure rocks on the bend adjacent to said end 83, and hence during such movement said bend acts as a fulcrum for said structure, and when the end 84 is moved substantially

parallel to and against the poles of the magnet 72, the bend adjacent to said end 84 acts as a fulcrum for said structure.

It will therefore be seen that two fulcrums are so provided that this armature structure is adapted to rock upon either fulcrum, and that when so rocked the pull of the magnet upon one of the inclined ends of said structure will have a great advantage over the pull of the other magnet upon the other end of said structure. It will further be seen that when neither magnet is energized, the armature structure will be held upon both fulcrums by the force of gravity, and that the magnets may therefore be energized and deenergized without disturbing said armature structure, so long as the pull of one magnet does not exceed the pull of the other magnet by the difference in advantage which exists when the armature structure is resting upon but one fulcrum, and that whenever the pull of either magnet exceeds said difference, such magnet will draw toward its poles the inclined end of the armature structure associated therewith and move the other inclined end away from the poles of the other magnet.

It will further be seen that whenever the pull of the two magnets becomes substantially equal, after the armature structure has been rocked upon one fulcrum as just described, the superior advantage of the magnet which is acting upon the end of the armature structure which is farthest from its supporting fulcrum, will cause the armature structure to rock upon said fulcrum to the position where it rests upon both fulcrums, where its movement will be arrested through the substantially equal pull of the two magnets, as already explained.

If the relay is to be subjected to such shocks or movement as might cause the armature structure 82 to become disengaged from the pins 85, a guard 86 should be provided to keep such structure in engagement with said pins.

The contact arm 87 is mounted upon, but insulated from, the armature structure 82, and carries at its free end the movable contact 88 in such position that, when the end 83 is substantially parallel to and against the poles of magnet 71, said bar 88 will connect the fixed terminals 77 and 78, and that when the end 84 is in like relation to the magnet 72, said bar will connect the fixed terminals 79 and 80. These parts therefore constitute a circuit controller and on account of governing the operative condition of the alarm devices S and T may be called alarm controlling mechanism.

An operator's set connected to the conductors 64 and 65 is typically shown at V.

The operation of the equipment shown in Fig. 1 is as follows:

When the switches C, D and E are rest-

ing upon their contacts 14 and 15, the current path through the circuit connected to switch C is as follows,—from one terminal of battery B through bus bar 20, contact 14 and switch arm 11 of switch C, the windings of relays H and I and repeating coil L which are included in conductor 101, impedance R, telegraph station O, the windings of repeating coil L and relays I and H included in conductor 102, switch arm 12 and contact 15 of switch C, and conductor 21 to the other terminal of battery B.

Current paths also exist between conductors 101 and 102 through the two magnets of relays P and Q in series with each other, but the current flow through these relays is very slight in proportion to the current flow through the impedance R on account of their high resistance.

The current flow through the windings of relay H is such as to cause the armature of said relay to move to, and remain in, attracted position, thereby deenergizing the connection between this relay and the register J, but the current flow through the windings of relay I is insufficient to cause said relay to attract its armature and thereby close the circuit through its associated lamp K.

As the magnets 71 and 72 of each alarm relay are energized to a substantially equal extent, the armature structure of said relays will be held upon both fulcrums.

If the transmitting mechanism at telegraph station O is now operated, such operation will cause a series of substantially complete breaks in the circuit through conductor 102, corresponding to the notches in the character wheel at said station, and upon each of these breaks the magnet of relay H will permit its armature to retract and close its connection through register J, and thus cause responsive operation of said register.

If the circuit is closed through telephone station N, such closure will permit sufficient additional current to pass between conductors 101 and 102 to cause the armature of relay I to move to its attracted position and thereby light its associated lamp K.

The telephone call thus indicated may be answered by moving the switch M to the position which connects the windings 63 of the repeating coil to the conductors 64 and 65, and then utilizing the operator's set V for conversation with the telephone station N.

At the conclusion of the conversation, the switch M should be moved to disconnect the windings 63 from the conductors 64 and 65, and upon breaking the circuit through telephone station N, the armature of relay I will move to its retracted position and thereby extinguish its associated lamp K.

If it is desired to establish telephonic

communication between two circuits, as for instance, the circuit connected to switch C and the circuit connected to switch D, this result can be accomplished by moving the switches M of both of said circuits so as to connect their repeating coil windings 63 to the conductors 64 and 65.

If it is desired to transmit a code signal to the alarm bell T, the switch C should be moved so that its arms rest upon its contacts 16 and 17 and the switch arm 41 should be moved to its contact 44, and the cylinder 31 rotated so as to suitably influence the tracers coöperating therewith. Whereupon, each closure between the tracer 33 and point 35 will provide a connection between the ground conductor 75 of each of the alarm relays and the terminal of the current source A connected to conductor 47.

During each of such closures, the current flow from source A will be as follows—from the terminal of said current source which is connected to conductors 18 and 47, various current paths are provided as follows:—

One path from current source A through bus bar 18, contact 16, arm 11, windings of relays H and I and repeating coil L included in conductor 101, which path I will term the path through conductor 101; and another path from said terminal of current source A through conductors 47 and 49, point 35, tracer 33, conductor 48, contact 44, switch arm 41, to the ground, and from the ground connections 75 at each of the alarm relays through said ground connections to the junctions 89, which path I will term the ground path.

From each junction 89 of the alarm relays, two current paths are provided, one path from each of said junctions through its associated magnet 71 and conductor 73 to conductor 101 where this path joins the path through conductor 101, and which path I will term the path through magnets 71. The other path, from each of said junctions 89 through its associated magnet 72 and conductor 74 to the portion of conductor 102 which is between repeating coil L and impedance R, which path I will term the path through magnets 72.

Another current path is provided, from conductor 101, through impedance R, to conductor 102, which path I will term the path through impedance R.

A further current path is provided, through conductor 102, windings of repeating coil L and relays I and H included therein, switch arm 12, contact 17, and bus bar 19 to the other terminal of current source A.

From the foregoing it will be seen that the current path through magnet 71 is in parallel with the path through magnet 72, but in view of the difference in potential between conductor 101 and conductor 102,

the current flow through magnet 71 will be reversed, from the direction in which the current flows through such magnet when the ground connection is open, and said reversed current flow will be very slight, as the fall of potential between the junction 89 and the conductor 101 will only be that due to the difference between the fall of potential resulting from the current flow through the windings of relays H and I and repeating coil L in conductor 101, and the fall of potential due to the current flow through the ground path.

It will furthermore be seen that when the ground path is open, the magnets 71 and 72 are connected in series between conductors 101 and 102; and that, when the ground path is closed, magnet 72 is connected across the terminals of current source A with merely the resistance of one winding of relays H and I and repeating coil L, and the ground path, in series therewith, so that the current flow through said magnet 72 will be greatly increased.

Inasmuch, therefore, as the current flow through magnet 71 will not only be very slight but will be in the reverse direction so as to tend to demagnetize said magnet, and as the greatly increased current flow through magnet 72 will strongly energize said magnet, the armature structure 82 will move in response to the attraction of said magnet 72 and connect contacts 79 and 80 to cause the operation of alarm bell T.

It will further be seen that whenever the ground path is broken, as by the separation of tracer 33 from point 35, the energization of magnets 71 and 72 will become equalized, as the current will then flow through said magnets in series between conductors 101 and 102, and thus cause armature structure 82 to move to break the connection between contacts 79 and 80.

Owing to the peculiar arrangement of the various parts of this system, the changes in the current flow through winding 61 of repeating coil L caused by the opening and closing of the ground path will be balanced by exactly opposite changes in the current flow through winding 62 of said coil, and therefore will not cause any current flow to be induced in the windings 63 of said coil, and the fall of potential between conductors 101 and 102 will not be altered as a result of such opening and closing of the ground path.

If it is desired to sound the alarm bell T continuously, the switch arm 41 should be moved to its contact 43, whereupon the terminal of current source A connected to bus bar 18, will be connected to ground through the conductor 47, contact 43 and switch arm 41, and the other current paths will be the same as those established when the tracer 33 was brought into contact with point 35, and

each alarm relay will act to close its contacts 79 and 80 so as to sound the alarm bell T as long as the switch arm 41 remains upon contact 43.

5 If it is desired to transmit a code signal to the alarm lamp S, instead of to the alarm bell T, the switch arm 41 should be moved to its contact 45, whereupon the operation of the cylinder 31 will cause the alarm relays to act in response to their magnets 71, in the same manner in which they acted, in response to their magnets 72, when the switch arm 41 was connected to contact 44.

10 If it is desired to cause the alarm lamp S to burn continuously, the switch arm 41 should be moved into connection with contact 46, whereupon the magnets 71 will be energized in like manner.

15 If it is desired to transmit a code signal to both the alarm lamp S and the alarm bell T, the switch arm 41 should be moved to a position where it connects with both contacts 44 and 45, whereupon the operation of cylinder 31 will alternately connect the terminals of current source A to the ground path, and thus alternately cause the armature structures of the alarm relays to move in response to their magnets 71 and 72.

20 If it is desired to operate the cylinder 31 without causing a response of the alarm devices S and T, the switch arm 41 should be moved to a position where it rests upon contact 42 and does not touch contact 43.

25 If it is desired that a signal transmitted to some of the circuits shall not affect the alarm relays of other circuits, the transfer switches of the circuits which it is desired to have responsive to such alarm signal should rest upon their contacts 16 and 17, and the transfer switches of the circuits which it is desired to have unresponsive to such alarm signal should rest upon their contacts 14 and 15.

30 It will be noted that the makes and breaks of the increased current flow through telephone station N, will not operatively affect the alarm relays P and Q, as all such changes will affect both magnets of each relay to a substantially corresponding extent.

35 It will also be noted that if there are a considerable number of alarm relays connected across the circuit, and a series telegraph station located between the relay nearest to the current source and the other relays is operated, the operation of such telegraph station would unbalance all of the relays, and would unbalance the relay between the current source and such telegraph station to an extent which might be sufficient to cause the operation of said relay, but in practice, the signals of such telegraphic stations may be transmitted by the use of breaks which are so short, with rela-

tion to the closed circuit periods of such telegraph signals, that such alarm relay would not be operatively affected. However, should the conductor 101 or the conductor 102 be broken at such a point that there was a materially greater number of alarm relays at the side of the break farthest from the current source, the alarm relays between such break and the current source might be operatively affected during the continuance of the break.

40 If it is desired to avoid a continuous alarm in the event of such a break, there must be no permanent metallic connection between conductors 101 and 102 outside of the central office, and therefore the telegraph stations should be of the normally open circuit type and be connected in parallel between said conductors, and the impedance R should be omitted, while two common return conductors may be provided (arranged, for example, as shown in Fig. 2), or one common return conductor may be provided and single electromagnet relays may be employed, as indicated in Fig. 3.

45 Fig. 2 shows certain features of my invention applied to a system similar to that shown in Fig. 1 except as follows:

50 Only one circuit and one current source is shown in Fig. 2, although it is evident that this system is adapted for common battery operation with other circuits, and with two current sources and transfer switches, as shown in Fig. 1.

55 The impedance R is omitted, the telegraph stations are connected in parallel between conductors 101' and 102', and instead of connecting a terminal of the magnet 71 and a terminal of the magnet 72 of each alarm relay to a common return ground, the corresponding terminal of one magnet only (as magnet 72') is connected to the ground, and the terminal of the other magnet (as magnet 71') is connected to the common return conductor 104.

60 At headquarters the common return conductor 104 is connected to contact 90 of switch W, whereby said conductor 104 may be directly connected to the ground whenever it is desired to transmit an alarm signal.

65 A condenser 105 may be permanently connected between the conductor 104 and the ground, so as to substantially balance the conductors 101' and 102' as far as telephone conversation is concerned.

70 In view of the fact that the embodiment of this invention shown in Fig. 2 comprises normally open circuit, parallel connection telegraph stations, the connection provided from relay H' for register J is applied to the front or closed-circuit contact of said relay.

75 The current path through the contacts of the relay I is controlled by the back or nor-

normally open circuit contact of the relay H', so that the line lamp K, will not be rendered operative upon closures of a telegraph station, but will be rendered operative only as a result of current increases due to the establishment of a current path through a telephone station. The relays H' and I are so adjusted that the current flow, upon the establishment of a current path through a telephone station, will cause the armature of relay I to move to attracted position but will not cause the armature of relay H' to so move, while a practical short-circuit between the conductors 101' and 102', as through the closing of the normally open contacts at a telegraph station, will cause the armatures of both relays H' and I to move to attracted position.

The operator's set V' is directly connected to the windings 63 of repeating coil L', but if a plurality of circuits were employed, the switches M could be interposed between said operator's set and said windings 63, as shown in Fig. 1.

The operation of the equipment shown in Fig. 2 is as follows:

When the switch W is resting upon its normally open contact 91, and the telegraph and telephone stations are not in use, no current will flow from the battery A', and the relays H' and I and the magnets of the alarm relays P' and Q' will not be energized.

If the transmitting mechanism at telegraph station O' is now operated, such operation will cause a series of closures, each establishing a short circuit between conductors 101' and 102', and corresponding to the teeth on the character wheel at said station. Upon each of these closures the armatures of relays H' and I will move to attracted position, the armature of relay H' closing its register connection, and thus causing responsive operation of said register, and breaking the connection through the contacts of relay I so as not to cause the lighting of the associated lamp K.

If the circuit is closed through telephone station N, such closure will permit sufficient current to pass between conductors 101' and 102' to cause the armature of relay I to move to its attracted position and thereby light its associated lamp K, but such current will be insufficient to cause the magnet of relay H' to move its armature to attracted position.

A telephone call thus indicated may be answered by utilizing the operator's set V' and, upon breaking the circuit through telephone station N at the conclusion of the conversation, the armature of relay I will move to its retracted position and thereby extinguish its associated lamp K.

If it is desired to transmit a code signal to the alarm bell T, the switch W should be

moved so that its arm will rest upon contact 90, and the switch arm 41 should be moved to its contact 44 and the tracers 33 and 34 suitably influenced, whereupon each closure between the tracer 33 and point 35 will provide a connection between the common return conductor 104 and the ground conductor 75 of each of the alarm relays and the terminal of the current source A' connected to conductor 47.

It will be noticed that upon closing the switch W, the magnets of the alarm relay will be connected in multiple-series between conductors 101' and 102', and will therefore be subjected to substantially equal current flow, and hence the armature structures of each of said relays (which were held upon both fulcrums by gravity, before the switch W was closed) will not be operatively affected by such current flow.

During each of the closures between tracer 33 and point 35, the current will flow through paths corresponding to those described for like closures in connection with Fig. 1 (except that in Fig. 2, the switch W corresponds with the junction 89 of Fig. 1), and therefore the current flow through the magnets 71' will be very slight and in reverse direction, so as to tend to demagnetize said magnets, and the current flow through the magnets 72' will be greatly increased so as to strongly energize said magnets, and the armature structures 82 of said relays will thus be caused to move, in response to the attraction of said magnets 72', and connect their associated contacts 79 and 80 to cause the operation of their alarm bells T.

It will furthermore be seen that the makes and breaks in the common return paths shown in Fig. 2 will have the same effect as the makes and breaks in the ground path shown in Fig. 1, and that the peculiar arrangement of the various parts is maintained, whereby the changes in the current flow through winding 61 of repeating coil L', caused by such makes and breaks, will be balanced by exactly opposite changes in the current flow through winding 62 of said coil, and therefore will not cause any current flow to be induced in the windings 63 thereof, and the fall of potential between conductors 101' and 102' will not be altered as a result of such opening and closing of such common return paths.

If it is desired to sound the alarm bell T continuously, the switch arm 41 should be moved to its contact 43, when the results will be the same as from the corresponding operation of the switch arm 41 of Fig. 1.

If it is desired to transmit a code signal to the alarm lamp S, the switch arm 41 should be moved to its contact 45, and the tracers 33 and 34 suitably influenced, whereupon each closure between the tracer 34 and point 36 will provide a connection between

the common return conductor 104 and the ground conductor 75 of each of the alarm relays and the terminal of the current source A' connected to conductor 51. During each 5 of these closures, the current will flow through paths corresponding to those described for like closures in connection with Fig. 1, and therefore the current flow through the magnets 72' will be very slight, 10 and in reverse direction so as to tend to demagnetize said magnets, and the current flow through the magnets 71' will be greatly increased so as to strongly energize said magnets, and the armature structures 82 of 15 said relays will thus be caused to move, in response to said magnets 71', and connect their associated contacts 77 and 78 to cause the operation of their alarm lamps S.

It will be noted that the makes and breaks 20 of the increased current flow, incident to the use of a telephone station, will not operatively affect the alarm relays P' and Q', as all such changes will affect both magnets of each relay to a substantially corresponding extent if the circuit through switch W 25 is closed, and will not operatively affect such magnets if said switch is open.

It will also be noticed that so long as switch W is open and no telegraphic or 30 telephonic stations are in use, none of the alarm relays will act in response to any break in either the conductor 101' or the conductor 102'. However, if during such a break a closure was established through a 35 telephone or telegraph station farther from the current source in the circuit than such break, part or all of the alarm relays might act in response to such break during the continuance of such closure.

40 If a telegraph or telephone station is operated while the alarm relays are in either of their signaling positions, the closures produced by such telegraph or telephone station will decrease the current flow through 45 the effective magnets thereof by increasing the fall of potential across the winding of the relays H' and I and the repeating coil L' in series therewith, due to the additional flow of current therethrough, but such decrease will be insufficient to operatively affect 50 said alarm relays, and in the instance of the operation of a telegraph station such closures should be extremely short with relation to the open circuit periods of the signals transmitted. 55

Fig. 3 shows certain features of my invention applied to a system similar to that shown in Fig. 2 except as follows:

60 Only one electromagnet is provided at each alarm relay, these magnets all being connected between one of the line conductors (as conductor 102'') and the common return ground.

At headquarters, the conductor 51, instead of being connected to the terminal of 65

the battery A'' to which conductor 102'' is connected, is connected at such an intermediate point in said battery that the fall of potential between said point and said terminal, is sufficient to operate the alarm 70 relays for one step, but is insufficient to operate said relays for two steps, as will be hereinafter more fully explained.

The construction of the relays, shown in connection with Fig. 3, is shown in greater 75 detail in Fig. 7, in which it will be noted that the armature structure 82' is mounted in a manner similar to that shown in Figs. 4, 5 and 6, and electromagnet 72'' is mounted in suitable relation to the inclined end 84' 80 of said structure, while means is provided for moving said end 84' away from said magnet 72'', consisting of a spring 92 applied to the inclined end 83' of said armature structure. 85

A movable contact 88' is carried by the contact arm 87, moving with the armature structure 82', and the fixed contacts 79' and 80' are so mounted in the path of said movable contact 88' that when the inclined 90 end 84' of armature structure 82' is moved substantially parallel to and against the poles of electromagnet 72'', said contacts 79' and 80' will be connected by the contact 88'. 95

The fixed contacts 77' and 78' are so mounted, in the path of the movable contact 88', that when the armature structure 82' is resting upon both of its fulcrums, said contacts 77' and 78' will be connected by the 100 contact 88', but when said armature structure 82' is in a position where either inclined end thereof is substantially parallel to the plate 81', said contact 88' will not connect said contacts 77' and 78'. 105

The strength of the spring 92 is such that when the magnet 72'' is deenergized the armature structure will rock upon the fulcrum adjacent to its inclined end 83' until said end is moved substantially parallel to 110 and against the plate 81', and such that when said magnet 72'' is energized by a current flow such as will pass therethrough when conductor 47 is connected to ground (see Fig. 3); the pull of said magnet 72'' upon 115 the inclined end 84' of said structure 82' will cause said structure to first rock upon the fulcrum adjacent to its inclined end 83' until it rests upon both fulcrums, and to thereafter rock upon the fulcrum adjacent to 120 its inclined end 84' until such inclined end is substantially parallel to and against the poles of said magnet 72''.

Owing to the fact that the pull of the magnet 72'' operates at much greater advantage, against spring 92, when the armature structure 82' is rocking upon the fulcrum adjacent to its end 83', than when said structure is rocking upon the fulcrum adjacent to its end 84', it is evident that a much 130

weaker current flow through the magnet 72'' will move said armature structure, from the position where its end 83' is substantially parallel to and against the plate 81', to the position where said structure rests upon both of its fulcrums, than the current required to move said armature structure, from the position where it rests upon both of its fulcrums, to the position where its inclined end 84' is substantially parallel to and against the poles of the magnet 72''. And in practice it has been found that if the conductor 51 is connected midway between the terminals of the battery A'', such a relay as that shown in Fig. 7 may be adjusted so that it will operate, without readjustment, through widely differing circuit and battery conditions.

The operation of the equipment shown in Fig. 3 is as follows:

When the switch arm 41 is resting upon its normally open contact 42, and the telegraphic and telephonic stations are not in use, no current will flow from the source A'', and hence the relays H' and I, and the magnets 72'' of the alarm relays P'' and Q'', will not be energized, and the armature structures of the relays P'' and Q'' will be held in such position by their springs 92 that their associated movable contacts 88' will not connect any of their fixed contacts.

The results of operation and use of telegraph and telephone stations shown in Fig. 3 correspond with Fig. 2.

If it is desired to transmit a code signal to the alarm bell T, the switch arm 41 should be moved to its contact 44, and the tracers 33 and 34 suitably influenced, whereupon each closure between tracer 33 and point 35 will provide connection between the ground terminals of the relays Q'' and P'' and the terminal of the battery A'' connected to conductor 47.

During each of the closures between tracer 33 and point 35, the current will flow through the following path:

From the terminal of battery A'' connected to conductor 101'', through conductors 47 and 49, point 35, tracer 33, contact 44, switch arm 41 to the ground, and from the ground connection of each alarm relay, through the magnets 72'' of such relay, conductor 74, conductor 102'' and the windings of repeating coil L' and relays I and H' included therein, to the other terminal of battery A'', and the resultant current flow through the magnets 72'' will be comparatively great, as each of these magnets is thus connected across the entire battery A'', with only the resistance of the ground path and the path through conductor 102'' in series therewith, and therefore the armature structures 82' of said relays will be caused to move to the position where their associated contacts 88' will connect their coöperating

contacts 79' and 80', and thus cause their alarm bells T to sound.

The various parts of Fig. 3 do not maintain the peculiar arrangement, shown in Figs. 1 and 2, whereby changes in the current flow through one winding of the repeating coil caused by makes and breaks in the common return paths shown by said figures will be balanced by exactly opposite changes in the current flow through the other winding of the repeating coil, and therefore a current flow will be induced in the windings 63 of the repeating coil L' shown in Fig. 3, and the fall of potential between the conductors 101'' and 102'' of said figure will be somewhat altered, as a result of such opening and closing of the ground path.

If it is desired to sound the alarm bell T continuously, the switch arm 41 should be moved to its contact 43, when the result will be the same as when the tracer 33 is in contact with the point 35 when the switch arm is resting upon contact 44.

It will be noted that the makes and breaks of the increased current flow incident to the use of a telephone station will not operatively affect the alarm relays P'' and Q'', as the only influence of such current changes, upon the magnets of these relays, will be to slightly alter the fall of potential across the windings of the relays H' and I and the repeating coil winding 62 included in the conductor 102''.

If it is desired to transmit a code signal to the alarm lamp S, the switch arm 41 should be moved to its contact 45, and the tracers 33 and 34 suitably influenced, whereupon each closure, between the tracer 34 and point 36, will provide a connection between the grounded terminals of each of the alarm relays and the point in the battery A'' to which the conductor 51 is connected. During each of these closures the current will flow through the magnets 72'' of the alarm relays and back to the other terminal of the battery A'', through the path described in connection with the transmission of code signals when the switch arm 41 was described as resting upon the contact 44. This current flow will be substantially less than the flow when the switch arm 41 was resting upon either contact 43 or contact 44, as the magnets 72'' are now each connected across one half of the battery A'', with the resistance of the ground path and the path through conductor 102'' in series therewith. The armature structures 82' of said relays will therefore be caused to move only to the position where said structures rest upon both of their fulcrums, and their associated contacts 88' will then connect their coöperating contacts 77' and 78', and thus cause operation of their alarm lamps S.

If it is desired to light the alarm lamp S continuously, the switch arm 41 should

be moved to its contact 46, when the current flow and position assumed by the armature structures of the alarm relays will be the same as during closures between tracer 34 and point 36 when the switch arm is resting upon contact 45.

If it is desired to transmit a code signal to both the alarm lamps S and the alarm bells T, the switch arm 41 should be moved to a position where it connects the contacts 44 and 45, and the tracers 33 and 34 suitably influenced, whereupon each of the closures between said tracers and contact points will provide a connection and cause a response of the alarm relays such as already described.

The closure of the current path through a telephone station will not prevent the described operations of the alarm relays, as such closure, while increasing the current flow, through the windings of relays H' and I and winding 62 of repeating coil L', so as to increase the fall of potential across said windings, will not increase said fall of potential to an extent which will leave an insufficient fall of potential, across the magnets 72'' of the alarm relays, to cause the intended response thereof.

While the operation of a telegraph station will greatly increase the current flow, through the windings of relays H' and I and winding 62 of repeating coil L' included in conductor 102'', during the closures incident to the operation of such station, and thereby greatly increase the fall of potential across the terminals of said windings,—in practice, the signals of such telegraph station may be transmitted by the use of closures which are so short, with relation to the open circuit periods of such telegraph signals, that the alarm relays will not be operatively affected thereby.

It will be seen that, with the various parts arranged as shown in Fig. 3, none of the alarm relays will act in response to any break in either the conductor 101'' or the conductor 102''. However, if during such a break a closure was established through a telephone or telegraph station farther from the current source in the circuit than such break, part or all of the alarm relays might act in response to such a break during the continuance of such a closure.

It is evident that a wire conductor may be employed in the place of the ground connection between the switch arm 41 and the conductors 75.

In employing the particular embodiment of the features of this invention shown in Figs. 2 and 3, it is necessary to limit the number of alarm relays to one which will pass a current insufficient to cause the relay I to act to close its circuit.

Fig. 8 shows a form of relay so embodying certain features of this invention; that

said relay may be used in the place of the relay shown in Figs. 1, 2, 4, 5, and 6. Or by substituting a spring (such as the spring 92 shown in Fig. 7) or a permanent magnet for one of the electromagnets shown in Fig. 8, the relay shown in said figure may be used in place of the relays shown in Figs. 3 and 7.

In constructing the relay shown in Fig. 8, electromagnets 71''' and 72''' are suitably mounted, and an armature structure is provided therefor, consisting of the inclined ends 83'' and 84'', pivoted at 203 and 204, and carrying the armatures 201 and 202, respectively.

The springs 205 and 206 are connected to the inclined ends 83'' and 84'', respectively, in such manner as to tend to move said ends toward the magnets 71''' and 72'''.

The strut plate 81'' passes between the inclined ends 83'' and 84'', and is provided with the locating pins 85' extending through suitable openings in the inclined ends 83'' and 84''.

As the transmission of motion, from the inclined end 83'' to the inclined end 84'', through the plate 81'' is similar to the corresponding transmission between inclined end 83 and inclined end 84 in Figs. 4, 5, and 6, the points of engagement between the inclined ends 83'' and 84'' and the plate 81'' are, for want of a better term, herein called fulcrums.

The fulcrums are so positioned as to hold the inclined ends 83'' and 84'' a suitable distance from their cooperating magnets.

When the armature structure moves, in response to the attraction of the inclined end 84'', toward the magnet 72''' until the armature 202 is substantially parallel to and against the poles of said magnet, said inclined end 84'' rocks on the corner of the plate 81'' adjacent to the free end of said inclined end 84'', and the inclined end 83'' rocks on the corner of the plate 81'' adjacent to the pivoted end of said inclined end 83'', and hence during said movement said corners act as a fulcrum for said structure, and when the armature structure is moved, in response to the attraction of the inclined end 83'', toward the magnet 71''' until the armature 201 is substantially parallel to and against the poles of said magnet, the corner of the plate 81'' adjacent to the free end of said inclined end 83'', and the corner of said plate 81'' adjacent to the pivoted end of the end 84'', act as a fulcrum for said structure.

It will therefore be seen that two fulcrums are so provided that this armature structure is adapted to rock upon either fulcrum, and that when so rocked the pull of a magnet upon one of the inclined ends of said structure will have a great advantage over the pull of the other magnet upon the

other end of said structure. It will further be seen that when neither magnet is energized, the armature structure will be held upon both fulcrums by the action of the springs 205 and 206, and that the magnets may therefore be energized and deenergized without disturbing said armature structure, so long as the pull of one magnet does not exceed the pull of the other magnet by the difference in advantage which exists when the armature structure is resting upon but one fulcrum, and that whenever the pull of either magnet exceeds said difference, such magnet will draw toward its poles the end of the structure associated therewith and move the other end away from the poles of the other magnet.

It will further be seen that whenever the pull of the two magnets becomes substantially equal, after the armature structure has been rocked upon one fulcrum, as just described, the superior advantage of the magnet which is acting upon the end whose supporting fulcrum is nearest to its pivot, will cause said armature structure to rock upon said fulcrum to the position where both fulcrums become effective, where the movement of said structure will be arrested through the substantially equal pull of both magnets and both springs, as already explained.

The ends 83'' and 84'' may be connected to one conductor of the current source U (see Fig. 1) and thus form an operative equivalent to contacts 77 and 79, and the contacts 78' and 80' may be connected to the lamp S and bell T so that said lamp and bell will be controlled as shown in Fig. 1.

Having now fully described this invention, what I claim and desire to secure by Letters Patent of the United States is:

1. In an electric signaling system: two current sources; a plurality of signaling circuits each having connected thereto,—switch mechanism for connecting said circuit to either current source without simultaneously disconnecting said sources, telegraphic signal receiving mechanism, telephonic signal indicating mechanism, one or more telegraphic transmitting stations, one or more telephone stations, relay mechanism adapted to operatively affect certain alarm receiving or indicating devices upon a predetermined change in the condition of said circuit and to operatively affect other alarm receiving or indicating devices upon a different predetermined change in the condition of said circuit, and means for establishing telephonic correlation with another circuit; circuit condition changing means associated with one of said current sources and adapted to cause said predetermined changes in the condition of circuits connected to said source; and conductors between said mechanisms and stations and said circuit condi-

tion changing means whereby said circuit condition changes will operatively affect said relay mechanism but will not operatively affect the transmission of telegraphic signals or telephonic communications in said circuits.

2. In an electric signaling system: two current sources; a plurality of signaling circuits each having connected thereto,—switch mechanism for connecting said circuit to either current source without simultaneously disconnecting said sources, telegraphic signal receiving mechanism, telephonic signal indicating mechanism, one or more telegraphic transmitting stations, one or more telephone stations, relay mechanism adapted to operatively affect certain alarm receiving or indicating devices upon a predetermined change in the condition of said circuit and to operatively affect other alarm receiving or indicating devices upon a different predetermined change in the condition of said circuit, and means for establishing telephonic correlation with another circuit; alarm signal formulating mechanism associated with one of said current sources; alarm selecting mechanism adapted to control said alarm signal formulating mechanism to cause either or both of said predetermined changes in the condition of circuits connected to said source; and conductors between said mechanisms and stations whereby said circuit condition changes will operatively affect said relay mechanism but will not operatively affect the transmission of telegraphic signals or telephonic communications in said circuits.

3. In an electric signaling system: two current sources; circuit condition changing means associated with one of said current sources and adapted to cause a predetermined change in the condition of circuits connected to said source; a plurality of signaling circuits each having connected thereto,—switch mechanism for connecting said circuit to either current source without simultaneously disconnecting said sources, telegraphic signal receiving mechanism, telephonic signal indicating mechanism, one or more telegraphic transmitting stations, one or more telephone stations, and one or more relay mechanisms each adapted to operatively affect alarm receiving or indicating devices when said circuit is connected to the current source having said circuit condition changing means associated with it and said circuit condition changing means is operated; and conductors between all of said mechanisms, stations, and said circuit condition changing means whereby the operation of said circuit condition changing means will not operatively affect the transmission of telegraphic signals or telephonic communications in any of said circuits.

4. In an electric signaling system: two current sources; circuit condition changing means associated with one of said current sources and adapted to cause a predetermined change in the condition of circuits connected to said source; a plurality of signaling circuits each having connected thereto,—switch mechanism for connecting said circuit to either current source without simultaneously disconnecting said sources, telegraphic signal receiving mechanism, telephonic signal indicating mechanism, one or more telegraphic transmitting stations, one or more telephone stations, one or more relay mechanisms each constructed and arranged to operatively affect alarm receiving or indicating devices when said circuit is connected to the current source having said circuit condition changing-means associated with it and said circuit condition changing-means is operated, and means for establishing telephonic correlation with another circuit; and conductors between all of said mechanisms, stations, and said circuit condition changing means whereby the operation of said circuit condition changing-means will not operatively affect the transmission of telegraphic signals or telephonic communications in any of said circuits.

5. In an electric signaling system: two current sources; circuit condition changing means associated with one of said current sources and adapted to cause a predetermined change in the condition of circuits connected to said source; a plurality of signaling circuits each having connected thereto,—switch mechanism for connecting said circuit to either current source without simultaneously disconnecting said sources, telegraphic signal receiving mechanism, telephonic signal indicating mechanism, one or more telegraphic transmitting stations, one or more telephone stations each having a central energy telephone set, one or more relay mechanisms each constructed and arranged to operatively affect alarm receiving or indicating devices when said circuit is connected to the current source having said circuit condition changing-means associated with it and said circuit condition changing-means is operated, and means for establishing telephonic correlation with another circuit; and conductors between all of said mechanisms, stations, and said circuit condition changing means whereby the operation of said circuit condition changing-means will not operatively affect the transmission of telegraphic signals or telephonic communication in any of said circuits.

6. In an electric signaling-system, the combination of a plurality of signaling-circuits leading from a central station, two current sources therefor, telegraph-transmitting stations, telephone stations, relay-mechanism with associated alarm-mechanism

arranged in said circuits, telegraphic signal-receiving mechanism, and telephonic signal-indicating mechanism at the central station responsive to the telegraph-transmitting stations and telephone stations in said circuits, a circuit condition changing-means at the central-station for the relay mechanisms, associated with one of the current sources only, separate switches for connecting the signaling circuits with either current source to the exclusion of the other, and when connected with the current source with which said circuit condition changing-means is associated, will cause responsive operation of the relay mechanism and its associated alarm mechanism in the circuit or circuits so connected upon operation of the circuit condition changing-means therefor, and the other signaling circuits will not be controlled by the operation of the circuit condition changing-means.

7. In an electric signaling-circuit, a current source, telegraphic signal-receiving and telephonic signal-indicating mechanism at a central station, two conductors connecting in series said mechanisms and said current source and extending from said station, and including beyond said station, one or more telegraphic transmitting-stations, one or more telephone stations, and one or more relay-mechanisms, each adapted to control one or more alarm-receiving or indicating devices, a third conductor connected to the relay-mechanisms, and movable means at the central station to connect said third conductor with a terminal of the current source, whereby the relay-mechanism is caused to respond.

8. In an electric signaling circuit: a current source; one or more telegraphic transmitting stations; one or more telephone stations; one or more relay mechanisms each adapted to control one or more alarm receiving or indicating devices; two parallel conductors connecting the current source, all of said stations, and relay mechanisms, and telegraphic signal receiving and telephonic signal indicating mechanism serially included in the circuit between said current source and the parallel connections to all of said stations and relay mechanisms; a third conductor permanently connected to each relay mechanism; and movable means for connecting said third conductor to a terminal of the current source, whereby the relay-mechanism is caused to respond.

9. In an electric signaling circuit: a current source; one or more telegraphic transmitting stations; one or more telephone stations; one or more relay mechanisms each adapted to control one or more alarm receiving or indicating devices; two parallel conductors connecting the current source, all of said stations, and relay mechanisms,—and telegraphic signal receiving and telephonic

- signal indicating mechanism, including an inductive reactance, serially included in circuit between said current source and the parallel connections to all of said stations and relay mechanisms; a third conductor permanently connected to each relay mechanism; and movable means for connecting said third conductor to a terminal of the current source, whereby the relay-mechanism is caused to respond.
10. In an electric signaling circuit: a current source; one or more telegraphic transmitting stations; one or more telephone stations; one or more relay mechanisms each adapted to control one or more alarm receiving or indicating devices; two conductors connecting in parallel the current source, all of said stations, and relay mechanisms,—and each serially including telegraphic signal receiving and telephonic signal indicating mechanism between said current source and the parallel connections to all of said stations and relay mechanisms; a repeating coil having one winding connected in series in one of said two conductors and another winding connected in series in the other of said two conductors, between the telegraphic and telephone signal mechanism and all of said stations and relay mechanisms; a third conductor connected to each relay mechanism; and means for connecting said third conductor to a terminal of the current source.
11. In an electric signaling circuit: a current source; one or more telegraphic transmitting stations; one or more telephone stations; one or more relay mechanisms each adapted to control one or more alarm receiving or indicating devices; two parallel conductors connecting the current source, all of said stations, and relay mechanisms,—and telegraphic signal receiving and telephonic signal indicating mechanism serially included in circuit between said current source and the parallel connections to all of said stations and relay mechanisms; a third conductor permanently connected to each relay mechanism at a point, electrically, about midway between said two conductors; and movable means for connecting said third conductor to a terminal of the current source, whereby the relay-mechanism is caused to respond.
12. In an electric signaling circuit: a current source; one or more telegraphic transmitting stations; one or more telephone stations; one or more relay mechanisms each adapted to control one or more alarm receiving or indicating devices; two parallel conductors connecting the current source, all of said stations, and relay mechanisms,—and telegraphic signal receiving and telephonic signal indicating mechanism, including an inductive reactance, serially included in circuit between said current source and the parallel connections to all of said stations and relay mechanism; a third conductor permanently connected to each relay mechanism, at a point, electrically, about midway between said two conductors; and movable means for connecting said third conductor to a terminal of the current source, whereby the relay-mechanism is caused to respond.
13. In a signaling mechanism; two magnets, armature structure so mounted with relation to said magnets as to be operatively unaffected by substantially equivalent energization of both of said magnets, and alarm controlling mechanism operatively affected by said structure only upon and during a predetermined excess energization of a certain one of said magnets.
14. In a signaling mechanism; two magnets, armature structure so mounted with relation to said magnets as to be operatively unaffected by substantially equivalent energization of both of said magnets, alarm controlling mechanism operatively affected by said structure only upon and during a predetermined excess energization of a certain one of said magnets, and other alarm controlling mechanism similarly affected only upon and during a predetermined excess energization of the other of said magnets.
15. A signaling circuit comprising two conductors; a common return conductor; relay mechanism comprising two electromagnets each having a terminal connected to said circuit and a terminal connected to the common return conductor; an armature structure so mounted with relation to said magnets as to be operatively unaffected by substantially equivalent energization of both of said magnets; alarm controlling mechanism operatively affected by said structure only upon a predetermined excess energization of a certain one of said magnets; other alarm controlling mechanism similarly affected upon a predetermined excess energization of the other of said magnets; and means for connecting the common return conductor to either terminal of said circuit.
16. A plurality of signaling mechanisms each having; two electromagnets, each magnet having one lead connected to an independent terminal and the other lead connected to a common terminal; an armature structure for said magnets; two fulcrums upon which said structure is so mounted as to be adapted to rock responsively to said magnets; conductors connecting the independent terminals of said magnets; a current source between said conductors; and means for connecting either of said conductors with all of said common terminals.
17. A current source; circuit conductors connected to the terminals of said current source; a common return conductor; signal formulating mechanism comprising two circuit controllers, one connected to one ter-

5 minial of the current source and the other
connected to the other terminal of the cur-
rent source, and means for alternately clos-
ing said circuit controllers, so arranged that
10 there is no time during which both of said
circuit controllers are closed, and; means
for connecting the common return conductor
to one or the other terminal of the current
source or to either or both of said circuit
15 controllers.

18. A current source; circuit conductors
connected to the terminals of said current
source; a common return conductor; signal
formulating mechanism comprising two cir-
20 cuit controllers, one connected to one ter-
minal of the current source and the other
connected to the other terminal of the cur-
rent source, and means for alternately clos-
ing said circuit controllers, so arranged that
there is no time during which both of said
circuit controllers are closed, and; means
for connecting the common return conduc-
tor to one or the other terminal of the cur-
rent source or to either or both of said cir-
25 cuit controllers, or to an open contact.

19. A current source; circuit conductors
connected to the terminals of said current
source; a common return conductor; signal
formulating mechanism comprising two cir-
30 cuit controllers, one connected to one ter-
minal of the current source and the other
connected to the other terminal of the cur-
rent source, and means for alternately clos-
ing said circuit controllers, so arranged that
35 there is no time during which both of said
circuit controllers are closed, and; a switch
having a plurality of contacts, one being

connected to one circuit controller, another
to the other circuit controller, another to
one terminal of the current source, another
40 to the other terminal of the current source,
and another being open, the common con-
tacting member of said switch being con-
nected to the common return conductor.

20. A current source; circuit conductors 45
connected to the terminals of said current
source; a common return conductor; signal
formulating mechanism comprising two cir-
cuit controllers, one connected to one ter-
50 minal of the current source and the other
connected to the other terminal of the cur-
rent source, and means for alternately clos-
ing said circuit controllers, so arranged
that there is no time during which both of
said circuit controllers are closed, and; a 55
switch having a plurality of contacts, one
being connected to one circuit controller,
another to the other circuit controller, an-
other to one terminal of the current source,
another to the other terminal of the cur- 60
rent source, and another being open, the
common contacting member of said switch
being connected to the common return con-
ductor, said switch being arranged to per-
mit contact of the common contacting mem- 65
ber with both of the circuit controller con-
tacts at one time.

In witness whereof, I hereunto subscribe
my name, this 10th day of October, A. D.,
1914.

C. E. BEACH.

Witnesses:

M. L. THOMAS,

R. C. PALMATIER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents
Washington, D. C."