J. H. SWANSON.

TELEPHONE LINE SELECTIVE SWITCH DEVICE.

APPLICATION FILED MAR. 8, 1910.

1,035,493.

Patented Aug. 13, 1912.

3 SHEETS—SHEET 1.

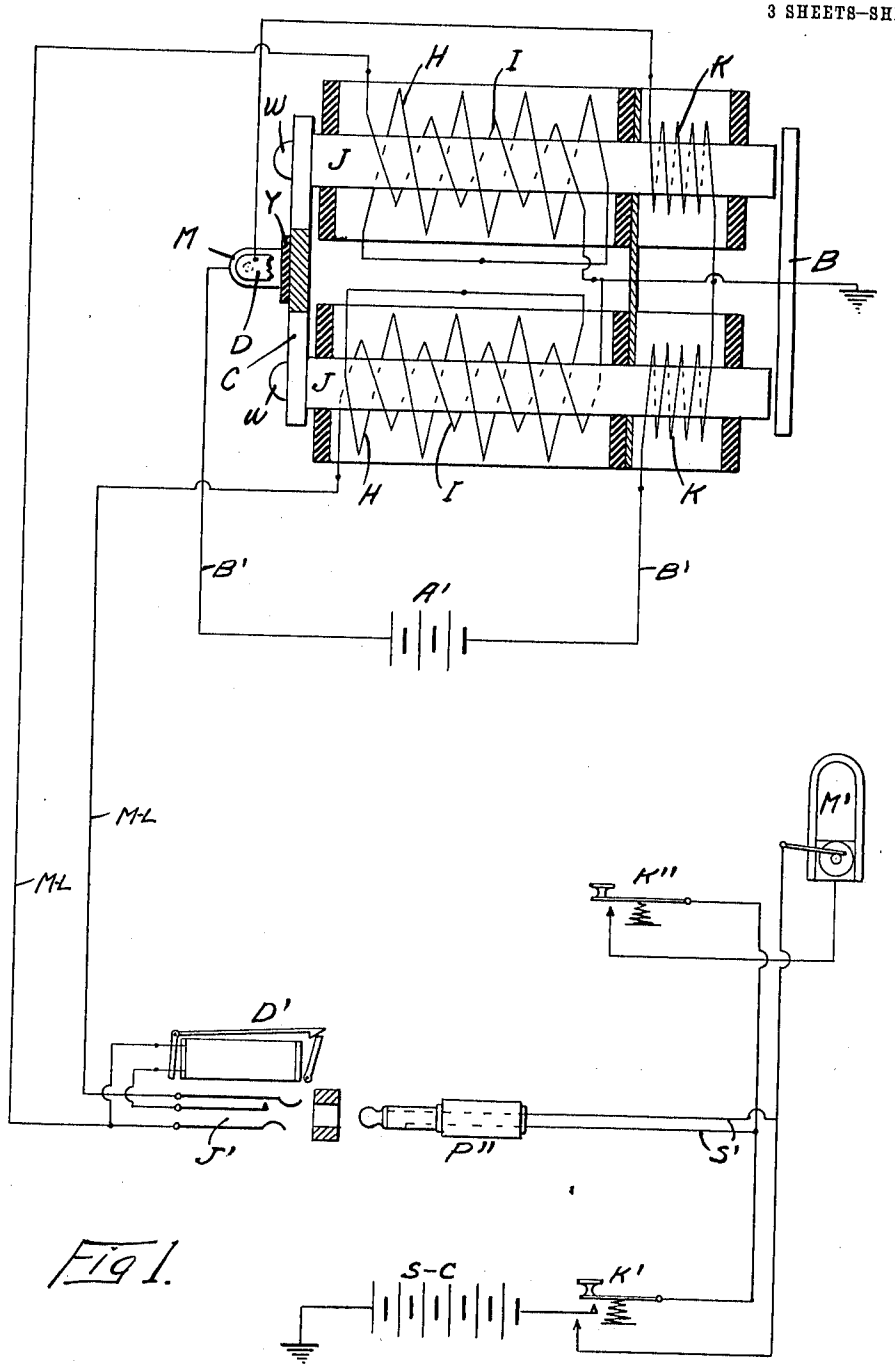

Fig 1.

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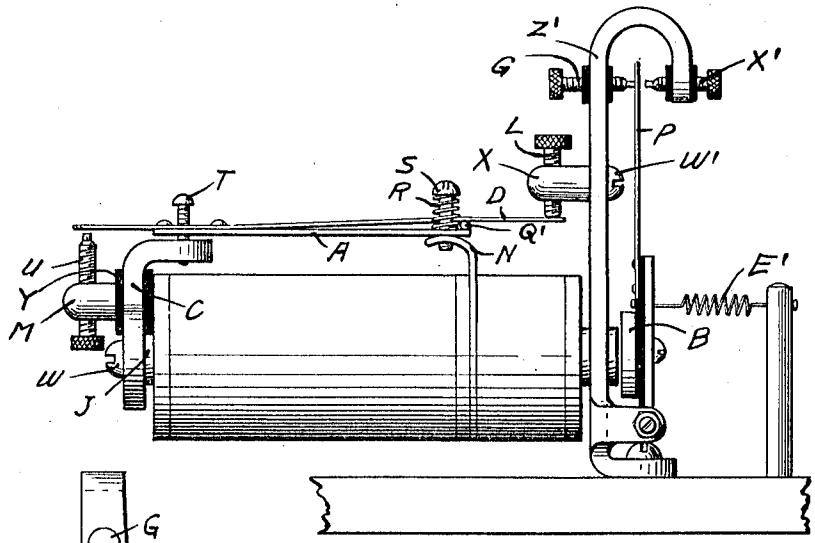


Fig 2.

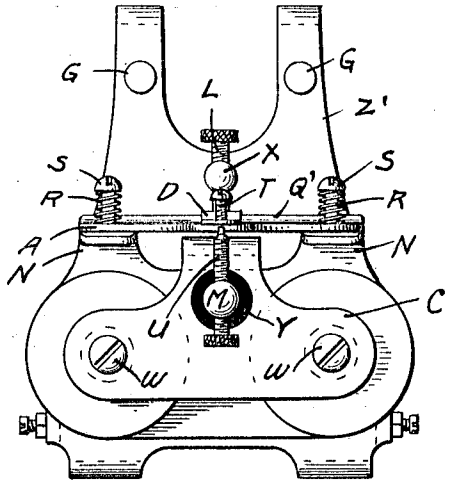
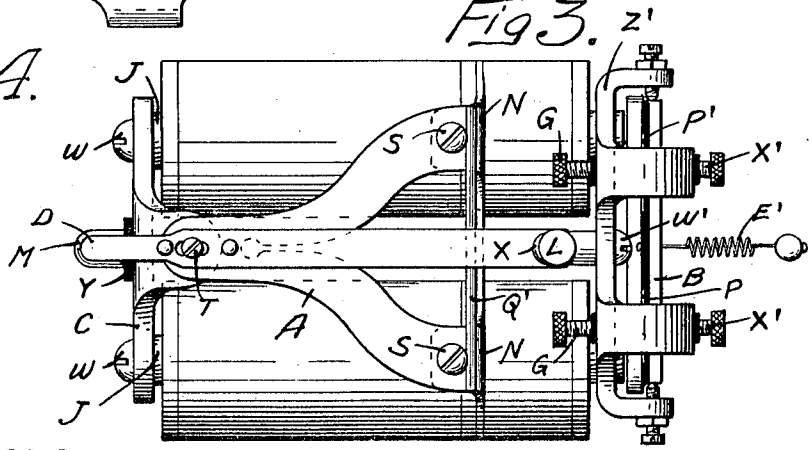


Fig 4.

Fig 3.



WITNESSES

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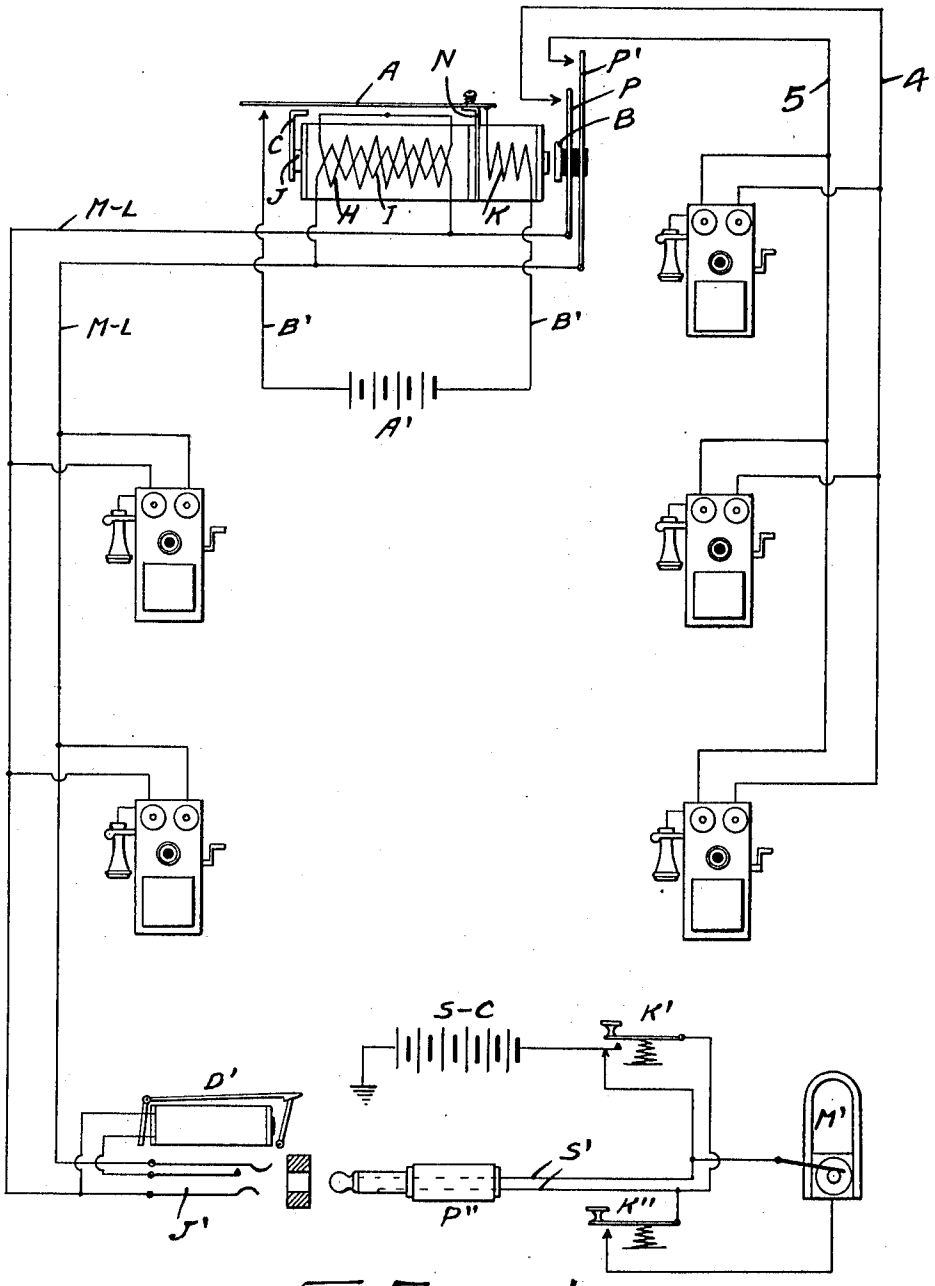

Fig 5.

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UNITED STATES PATENT OFFICE.

JOHN HENRY SWANSON, OF MINNEAPOLIS, MINNESOTA, ASSIGNOR OF ONE-HALF TO T. F. ROBINSON, OF MINNEAPOLIS, MINNESOTA, AND ONE-HALF TO ROBINSON LOOMIS MOTOR TRUCK CO., OF MINNEAPOLIS, MINNESOTA, A CORPORATION OF MINNESOTA.

TELEPHONE-LINE SELECTIVE-SWITCH DEVICE.

1,035,493. Specification of Letters Patent. Patented Aug. 13, 1912.

Application filed March 8, 1910. Serial No. 548,040.

To all whom it may concern:

Be it known that I, JOHN H. SWANSON, of Minneapolis, Hennepin county, Minnesota, have invented certain new and useful Improvements in Telephone-Line Selective-Switch Devices, of which the following is a specification.

The object of my invention is to simplify and improve the apparatus shown in Letters Patent of the United States, issued to me November 30, 1909, No. 941,743.

My present invention has for its primary object the same general result attained by the apparatus of my patent above referred to, but accomplishes such result by a more reliable and greatly simplified mechanism at the substation, performing the operation with greater certainty, eliminating chances of disorder and the possibility of operation of the substation apparatus by other than the applied current of predetermined character.

My present invention aims to provide a substation apparatus operable only by a steady current traversing the relay windings for the purpose of closing the main line conductors, and to effect the opening of the substation line apparatus by an alternating current traversing the said windings. The steady current applied for this purpose need not be in excess as to quantity and measure of the alternating current.

In my present invention the electromagnet employed in the relay substation apparatus is equipped to offer the greatest possible impedance and self inductive resistance to an alternating current. I accomplish this by providing an electromagnet solenoid having a primary winding in the line circuit, and a local circuit winding that is short circuited from one core to the other of the magnet and is adapted to offer an inductive resistance so that when an alternating current is passed through the coils it will have no effect on the local circuit armature but will repel the steel armature of the subscriber's circuit. I also provide a local winding with each primary winding. I do not wish to be confined to any special form of inductive winding, but I have found the coils, wound in a clockwise direction and a non-clockwise direction, are efficient for the purpose designed. The electromagnet forming part of the substation apparatus has all the characteristic features of a slow acting magnet. To this end its iron cores are preferably long in proportion to the outside diameter and as much iron is used as is practicable with a view of offering impedance to the altering current magnetic flux.

In the accompanying drawings forming part of this specification, Figure 1 is a diagrammatic view of the central station connection and the apparatus at the substation connected therewith, Fig. 2 is a side view of a substation apparatus, Fig. 3 is a top view of the same, Fig. 4 is an end view, Fig. 5 is a diagrammatic view illustrating the connections of the subscriber's circuit with the local circuit controlling device, the arrangement of the contact springs being slightly modified for convenience of illustration.

In the drawing, a source of steady current is indicated at S—C and a source of alternating current at M′.

A represents a primary armature of soft iron, lying in a magnetic field of force parallel to the cores J—J, and flexibly supported upon branch pole pieces N—N and extending within the magnetic field of force toward a yoke C. The said armature is preferably Y-shaped and has its free end directly over the yoke C. The movement of the armature is limited by the screw T. This screw passes through a hole in the armature and as the hole is slightly larger than the screw, the armature is free to move toward and from the yoke C, the movement being limited by the head of the screw. The branches of the armature A are held down upon the pole pieces N—N by means of screws S—S and by this means I effect a more perfect magnetic contact between armature A and pole pieces N—N. The screws S—S and springs R—R are preferably of iron or steel to act partially as conductors of magnetism between the pole pieces N—N and armature A. The armature A acts as a primary armature in a combined local battery controller and the substation contact making apparatus for the purpose of making contact between the main line conductors and the substation conductors. The armature A, lying between the

ends of an electromagnet, is Y-shaped and the fork of the Y is affected by the magnetic influence in the said electromagnet when the free ends of the electromagnet present a like polarity and the yoke of the electromagnet an opposite polarity. It will therefore be understood that if an armature, such as I have herein referred to, can be placed with its branches upon the free ends of a U-shaped electromagnet and the fork of said armature near the yoke of the said magnet, the fork will be attracted toward said yoke and when an exciting current traverses the cores to produce in the free ends of the U-shaped magnet magnetism of like polarity, the yoke in said magnet will assume an opposite polarity. This exciting current is introduced into the main line by the operator at the central station by means usually employed for this purpose, the connection with the source of energy being arranged so that currents of like sign will be introduced on both sides of the line simultaneously. As shown, this exciting current is controlled by the key K′ which connects both lines M—L with one side of the battery or the battery S—C, or the source of direct current. The other side of the battery is connected to a ground, and the windings I, I, are also connected at I′ to a ground, thereby forming a circuit whereby a direct current may be passed from a battery or other source through the windings about the pole pieces of the magnet in multiple. The yoke or central point in the U-shaped magnet will be energized and the two pole pieces at the opposite end of the magnet will also be energized, the pole pieces having magnetism of like signs opposite from the yoke at the neutral point. The Y-shaped magnet will thereupon be attracted to close the local circuit. Upon breaking the circuit through the main line the springs connected with the soft iron armature will return it to its normal position, breaking the local circuit. The closing of the local circuit energizes the pole pieces through said local circuit windings to attract the steel armature and close the subscriber's circuit. This will remain closed until an alternating current is passed through the main line when the steel armature will be repelled and the subscriber's circuit broken.

I will now proceed to describe in detail the apparatus by which I prefer to accomplish the making and breaking of the circuits through the substation relay.

A flat spring D is secured to armature A, projecting over yoke C and contact screw U, serving as a contact spring in the local battery circuit. Q′ is a non-magnetic bar extending across the branches of armature A and acting as a fulcrum for the spring D. Screw L, supported by stud X, secured to the front plate Z′ by screw W′ permits the adjustment for the spring D and tension of armature A. The electromagnet yoke C, secured to magnetic cores J—J by screws W—W, has in its middle portion an extension bent at an angle forward and toward the pole pieces N—N to conduct the magnetic flux in its natural course. Secured to and insulated from the yoke C by insulated washer Y is a stud M, through which contact screw U extends to form in part the local battery circuit. The front plate Z′ is of non-magnetic metal and may be made in various forms and I do not wish to be confined to the particular type herein shown.

The steel armature B herein shown is supported and pivoted across the electromagnet cores J—J and is free to move toward and from said cores. A tension spring E′ holds the steel armature away from the magnetic cores when not attracted.

By referring to Fig. 1, the substation apparatus is represented with the windings upon the electromagnet cores. I—I, representing the primary windings of the relay, are wound upon the electromagnet cores J—J. M—L represents the main line conductors extending from the central station to the substation, and to which the terminals of the primary windings I—I are connected in multiple when the battery current is impressed upon both the central station lines in multiple, and which windings I, I, are connected in series when an alternating current or a direct current is impressed upon the central station lines in series. The apparatus at the central station includes a switch board jack J′, a visual signal D′, a plug P″, and switch board cords or conductors S′. S—C is the source of steady current, above referred to, controlled by current closing key K′. The source of alternating current M′ is controlled by key K″. By the insertion of plug P″ into jack J′ and depressing the key K′, a steady current is directed into line M—L which completes its circuit through primary windings I—I. By these means the electromagnet cores J—J become magnetically charged, the pole pieces N—N assume a polarity of like sign, and the yoke C assumes a polarity of opposite sign. The effect is to attract armature A and close local circuit through battery A′, contact spring D and screw U, conductors B′ and local battery windings K—K. These are oppositely wound upon the cores J—J so as to induce in the free ends of the cores a polarity of opposite sign. The steel armature B is thereby attracted to the core ends J—J. The application of the steady current at the central station may now be broken, whereupon the armature A is relieved of attraction in the yoke C and is drawn away from the contact screw U by flat spring D, thereby opening the local bat-

tery circuit. The steel armature remains in its attracted position, and the circuit remains closed through the subscriber's line. When it is desired to release the steel armature from the ends J—J and thereby open circuit in spring contact P, an alternating current is applied to line conductors M—L. This current, traversing the primary windings, I—I, will induce in the magnetic cores J—J a feeble magnetic flux of an alternating character, causing the steel armature B to be repelled from the cores J—J, thereby opening the spring contacts controlled thereby.

I prefer to provide a winding H on each magnet, inclosing the primary winding, the ends of the winding H, which I may prefer to designate as the local winding, being joined together to form independent coils for each core. These windings, as shown clearly in Fig. 1, are purely local and their presence has the effect of increasing the impedance in the primary winding to an alternating current. Said windings will have no function however, when a direct current is used.

Referring to the diagrammatic view Fig. 5, the contact springs P and P′ are in circuit with the main line conductors and carried by the steel armature B and adapted to close the circuit through the subscriber's line 4 and 5. These contact springs P and P′, as indicated in Fig. 2, engage insulated stop screws X′, which limit the movement of the springs in one direction.

From the foregoing it will be understood that the alternating current, traversing the windings I—I, does not in any way influence the armature A, consequently the application of the alternating current to the main line conductor will not close the local battery circuit, but will cause the release of the armature B. Furthermore, the local battery current, traversing the windings K—K, will not in any way affect armature A. The soft iron armature lies parallel to the electromagnet cores, its free end is directly in a neutral field when the free ends of the said cores are influenced by the alternating current to release the steel armature; that is, when said free ends are magnetically charged so that they present unlike polarity. By well known physical laws, the central portion of such a U-shaped magnet will be neutral or dual as to magnetism, thus leaving the soft iron unaffected. Hence the alternating current in main line conductors M—L M—L will not affect the soft iron armature. To affect the soft iron armature A, it is necessary to cause current of like signs to be applied to the two sides of the line conductors M—L M—L simultaneously by connecting the two sides with one pole of the battery in multiple and ground their opposite end through windings I—I and the other pole of the battery to ground. The effect of this is to excite in the electromagnet cores J—J magnetism of like signs in their free ends and magnetism of the opposite polarity, thereby attracting soft iron armature A.

I am thus able, by the application of a direct, steady current, to close the local circuit through the soft iron armature, the closing of the local circuit energizing the core ends to attract the steel armature and close the substation circuit. This circuit, through the substation line, will remain closed as long as required, the direct current being cut off in the meantime from the main line. As soon as it is desired to open the subscriber's circuit the operator will apply the alternating current to the main line whereupon the steel armature will be repelled from the magnet cores and the subscriber's circuit opened, all without affecting the armature A or again closing the local circuit.

This relay may be utilized in a telegraph as well as a telephone circuit and for signaling purposes generally, and I do not wish to be confined entirely to the use herein described and set forth. The local coil for the magnets forms an important feature of the invention, as it insures the release of the steel armature without in any way affecting the armature of the local circuit.

I claim as my invention:

1. The combination with a central station line, and a substation line normally disconnected from said central station line, and having a subscriber station, of means for automatically connecting and disconnecting said substation line to and from said central station line including a relay comprising parallel cores, means for passing a current in multiple about said cores, a soft iron armature energized by said current, a local circuit for said relay controlled by said armature, a steel armature energized by said local circuit, devices controlled by said steel armature for making and breaking the connection between the substation line and the central station line, and means for passing a current about said core in series for repelling said steel armature, said soft iron armature being so disposed as to be unaffected by the currents passing in series about said cores.

2. The combination with a central station line, and a substation line normally disconnected from said central station line, and having a subscriber station, of means for automatically connecting and disconnecting said substation line to and from said central station line, including a relay comprising parallel cores, means for passing a direct current in multiple about said cores, a soft iron armature energized by said current, means for passing a local current about

said cores in series, devices for controlling said local current operated by said soft iron armature, a steel armature, devices controlled by said steel armature for making and breaking the connection between the substation line and the central station line, said steel armature being so disposed relative to the cores, as to be moved by the local circuit passing about the cores, and means for passing an alternating current about the cores in series, for repelling said steel armatures to break the connection with the central station line, said soft iron armature being so disposed as to be unaffected by the current passing in series about said cores.

3. The combination with a central station line, and a substation line normally disconnected from said central station line, and having a subscriber station, of means for automatically connecting and disconnecting said substation line to and from said central station line, including a relay comprising parallel cores having a connecting yoke at one side thereof, a soft iron armature having its movable part adjacent said yoke, a steel armature adjacent the free ends of said cores, primary windings on said cores, means for passing a direct current in multiple through said primary windings, whereby said soft iron armature is energized, a local battery, windings arranged in series on said cores, devices for connecting said windings to the local battery, controlled by said soft iron armature, the current of said local battery energizing said cores for attracting said steel armature, and means for passing a current through said primary winding in series for repelling said steel armature, and devices controlled by said steel armature for making and breaking the connections between the substation line, and the central station line.

4. The combination with a central station line and a substation line normally disconnected from said central station line, and having a subscriber station, and means for automatically connecting and disconnecting said substation line to and from said central station line, including a relay comprising parallel cores, a yoke connecting said cores at one end of said relay, a soft iron armature lying in a plane substantially parallel to the longitudinal axes of the cores, and having a movable end adjacent the central part of said yoke, a steel armature located adjacent the free ends of said cores, a primary winding on said cores adjacent the yoke, means for passing a direct current through said primary windings in parallel, whereby the soft iron armature is energized, windings on said cores adjacent the free ends thereof, a local battery, devices for connecting said local battery with said windings adjacent the free ends of the cores, said devices being controlled by the movable soft iron armature, devices for connecting the substation line to the central station line controlled by said steel armature, and means for passing an alternating current in series through the primary windings for repelling the steel armature to disconnect the substation.

5. The combination with a central station line and a substation line normally disconnected from said central station line, and having a subscriber station, of means for automatically connecting and disconnecting said substation line to and from said central station line, including a relay comprising parallel cores, means for passing a direct current in multiple about said cores, a soft iron armature energized by said current, means for passing a local current about said cores in series, a local circuit for said relay, devices operated by said soft iron armature for controlling said local circuit, a steel armature, devices controlled by said steel armature, for making and breaking the substation line and the central station line, said steel armature being so disposed relative to the cores as to be moved by the current in the local circuit passing about the cores, means for passing an alternating current about the cores in series for repelling said steel armature, said soft iron armature being so disposed as to be unaffected by the current passing in series about said cores, and closed secondary windings located upon each of the cores.

6. The combination with a central station line, and a substation line normally disconnected from said central station line, and having a subscriber station, means for automatically connecting and disconnecting said substation line to and from said central station line, including a relay comprising parallel cores, a yoke connecting said cores at one end of said relay, a soft iron armature lying in a plane substantially parallel to the longitudinal axes of the cores, and having a movable end adjacent the central part of said yoke, a steel armature located adjacent the free ends of said cores, a primary winding on said cores adjacent the yoke, means for passing a direct current through said primary windings in the parallel whereby the soft iron armature is energized, windings on said cores adjacent the free ends thereof, a local battery, devices for connecting said local battery with said windings adjacent the free ends of the cores, said devices being controlled by the movable soft iron armature, devices for connecting the substation line to the central station line controlled by said steel armature, and means for passing an alternating current in series through the primary windings for repelling the steel armature to disconnect the substation, and closed secondary windings located upon each of the cores.

7. The combination with a central station

line, and a substation line normally disconnected from said central station line, and having a subscriber station, and means for automatically connecting and disconnecting said substation line to and from said central station line including a relay comprising parallel cores, a yoke connecting said cores, at one end of the relay, a Y-shaped soft iron armature located in a plane substantially parallel with the axes of the cores, the outer ends of the armature being rigidly supported and the connected movable end of the armature being disposed adjacent the central part of said yoke, primary windings on said cores, means for passing a direct current through said central station line and the primary windings in multiple whereby the soft iron armature is attracted, windings on said cores, a local battery, devices for connecting said local battery to said last named windings, said devices being controlled by the movable armature, a hardened steel armature adjacent the free ends of said cores, said steel armature being energized and attracted by the local current passing in series through the windings on the cores, devices for connecting the substation line to the central station line, controlled by said hardened steel armature, and means for passing an alternating current in series through the primary windings for repelling the hardened steel armature to disconnect the substations.

8. The combination with a central station line and a substation line normally disconnected from said central station line and having a subscriber station, and means for automatically connecting and disconnecting said substation line to and from said central station line, including a relay comprising parallel cores, a yoke connecting said cores at one end of the relay, a Y-shaped soft iron armature located in a plane substantially parallel with the axes of the cores, the outer ends of the armature being rigidly supported and the connected movable end of the armature being disposed adjacent the central part of said yoke, primary windings on said cores, means for passing a direct current through said central station line, and the primary windings in multiple, whereby the soft iron armature is attracted, windings on said cores, a local battery, devices for connecting said local battery to said last named windings, said devices being controlled by the movable armature, a hardened steel armature adjacent the free ends of said cores said stationary armature being energized and attracted by the local current passing in series through the windings on the cores, devices for connecting the substation line to the central station line controlled by said hardened steel armature, means for passing an alternating current in series through the primary windings for repelling the hardened steel armature to disconnect the substation, and closed secondary windings on each of the cores offering an impedance to said alternating current.

9. The combination of a main line and a substation line, of means for connecting and disconnecting said lines including a relay comprising cores, a soft iron armature having its movable part located adjacent the end of the cores at one end of the relay, primary windings on said cores, means for passing a current in multiple through said windings for attracting said armature, a local battery, windings on said cores, whereby a current from the local battery may be passed in series about said cores, devices for controlling said local circuit operated by said armature, a hardened steel armature at the other end of the relay adjacent the ends of the cores, whereby said local current passing in series about said cores will attract said steel armature, devices for connecting the main line to the substation line controlled by said steel armature, and means for passing an alternating current through said primary windings in series for repelling the steel armature.

10. The combination of a main line and a substation line, of means for connecting and disconnecting said lines including a relay, comprising cores, a soft iron armature having its movable part located adjacent the end of the cores at one end of the relay, primary windings on said cores, means for passing a current in multiple to said windings for attracting said armature, a local battery, windings on said cores, whereby a current from the local battery may be passed in series about said cores, devices for controlling said local circuit operated by said armature, a hardened steel armature at the other end of the relay adjacent the ends of the cores whereby said local current passing in series about said cores will attract said steel armature, devices for connecting the main line to the sub line controlled by said steel armature, means for passing an alternating current through said primary windings in series for repelling the steel armature, and secondary closed windings on said cores, offering impedance to the alternating current.

11. The combination, with a central station line, of a relay consisting of a U-shaped magnet, an armature, a local circuit controlled by said armature, the application of currents of like sign to said central station lines producing magnetism of same polarity at the opposite corresponding poles of said U-shaped magnet and magnetism of opposite polarity at the other or neutral point of said magnet, said magnet having windings thereon in circuit with said local circuit, a steel armature attracted by the cores of said last named windings and a

subscriber's circuit and station controlled by said steel armature.

12. A relay comprising a magnet having pole pieces at one end and an opposite neutral point, a primary winding for said magnet and a line circuit therefor, an armature, a local circuit arranged to be closed by the attraction of said armature to said neutral point, said local circuit being broken when the circuit is opened in said main line, subscriber's circuit, and means for closing the same by the closing of said local circuit, said subscriber's circuit remaining closed after the opening of said local circuit, and means whereby the passage of an alternating current through said primary winding will disconnect said subscriber's circuit, said armature being so disposed as to be unaffected by said alternating current.

13. A relay comprising an electro-magnet having a primary winding and a main line circuit connected therewith, a local circuit, an armature attracted by the passage of a direct current through said main line and primary winding to close said local circuit, a subscriber's circuit, an armature therefor energized by the closing of said local circuit to close said subscriber's circuit, and an independent inductive winding for said magnet adapted to render an alternating current in said primary winding ineffective to close said local circuit, but causing it to repel said subscriber's circuit armature and open said subscriber's circuit.

14. A relay comprising a magnet U-shaped in form and provided with a primary winding a main line circuit adapted to be connected with said primary winding, a local circuit and means for closing said local circuit when a direct current is passed through said primary winding, the cores of said magnet having end windings in said local circuit, a steel armature attracted by the energizing of said core ends when said local circuit is closed, a subscriber's circuit for said steel armature, and a local winding for said magnet adapted to render an alternating current ineffective to close said local circuit but effective to repel said steel armature and open said subscriber's circuit.

15. The combination with a first line, and a second line normally disconnected from said first line, of means for automatically connecting and disconnecting said second line to and from said first line, including a relay, means for passing a current in multiple through the windings of said relay, a soft iron armature adapted to be attracted by the passage of said current, a local circuit for said relay controlled by said armature, a steel armature attracted by the closing of said local circuit, devices controlled by said steel armature for making and breaking the connection between the first line and the second line, and means for passing the current through the relay windings in series, for repelling said steel armature, said soft iron armature being so disposed as to be unaffected by the currents passing in series through said windings.

In witness whereof I have hereunto set my hand this 24″ day of February 1910.

JOHN HENRY SWANSON.

Witnesses:

L. C. CRONEN,

J. A. BYRNES.