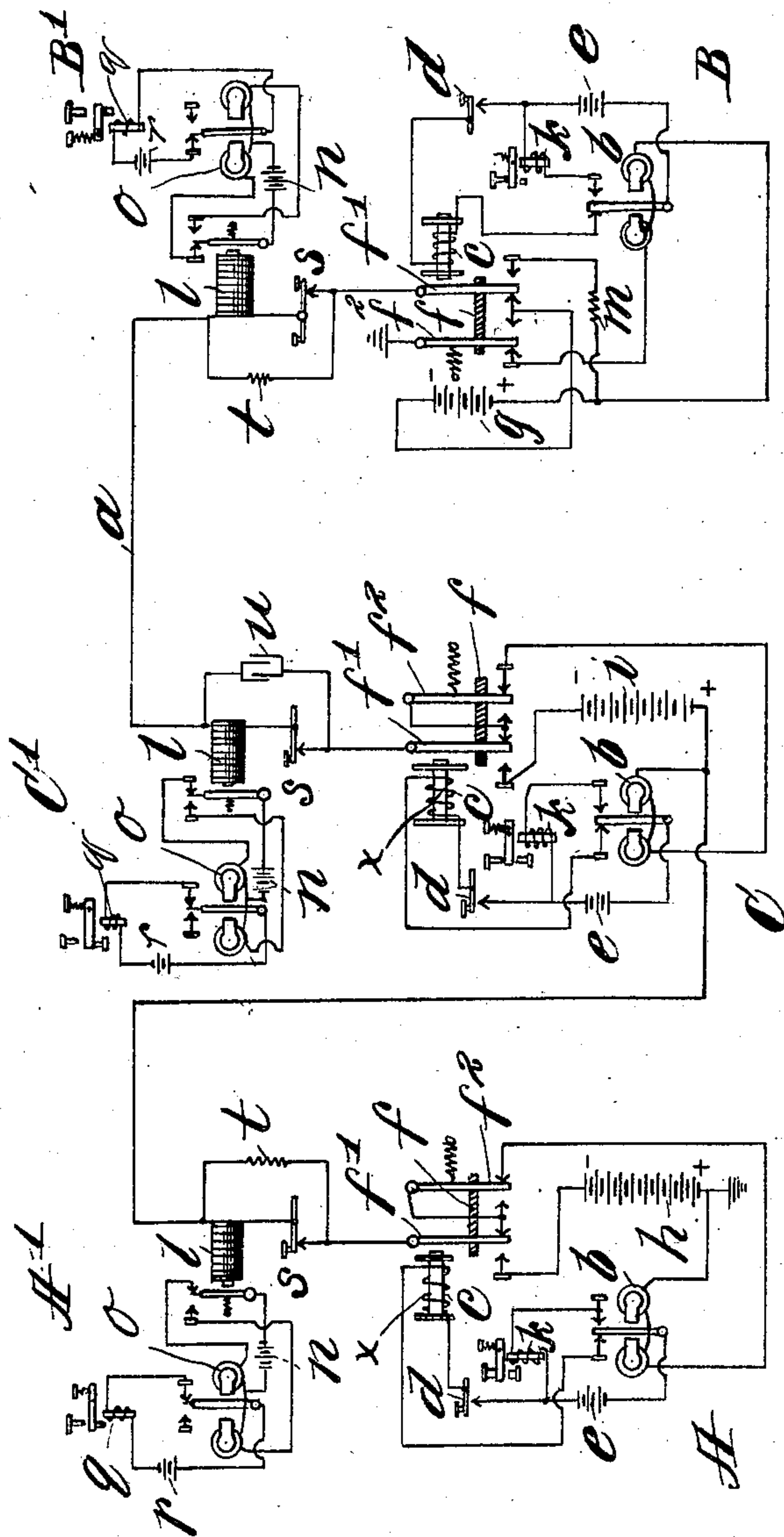


No. 877,002.

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H. O. RUGH.
TELEGRAPH SYSTEM.
APPLICATION FILED DEC. 26, 1906.



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UNITED STATES PATENT OFFICE.

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TELEGRAPH SYSTEM.

No. 877,002.

Specification of Letters Patent.

Patented Jan. 21, 1908.

Application filed December 26, 1906. Serial No. 349,528.

To all whom it may concern:

Be it known that I, HARRY O. RUGH, citizen of the United States, residing at Sandwich, in the county of Dekalb and State of Illinois, have invented a certain new and useful Improvement in Telegraph Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to telegraph systems, and has a number of objects and advantages, which will be readily understood by those skilled in the art.

The preferred embodiment of my invention is illustrated by the accompanying drawing, that shows a plurality of telegraph stations united by the same main conductor.

I have indicated three stations, A, B, C, forming part of one telegraph system, though I do not wish to be limited to the number of these stations united by the conductor or line a . I have also indicated three other stations A^1 , B^1 , C^1 , entering into another telegraph system but including the same conductor a , but I do not wish to be limited to the number of stations A^1 , B^1 , C^1 . The organization of my invention is such that messages may be transmitted between the stations of either telegraph system without in any way interfering with the effectiveness of operation of the apparatus at the stations of the other telegraph system. At each of the stations A, B, C, I have indicated a polarized relay b of a type well known to those skilled in the art of telegraphy.

The armature of each relay normally engages a normal contact that constitutes a terminal of a circuit changing or switch controlling relay x , the other terminal of which relay being connected with the telegraph key d . The contact of this key d is normally separated therefrom and constitutes a terminal of a local circuit battery e that includes the armature of the associate polarized relay b . When the key d is depressed in the act of transmitting a telegraph signal, the local circuit including the battery e is closed, the switch-controlling magnet c thereupon being energized to operate the switching device f , which, in the embodiment of the invention shown, includes two switch-arms f^1 , f^2 . When, in the state of rest, the main circuit, so far as stations A, B and C are concerned, may be traced from the ground at station A, through the polarized relay b thereat, the normal con-

tact of arm f^2 , the normal contact of arm f^1 , the portion of the main conductor a intervening between stations A and C, the polarized relay b at station C, the normal contact of arm f^2 at station C, the normal contact of arm f^1 at station C, the portion of the main conductor intervening between stations C and B, the arm f^1 at station B, the normal contact of said latter arm, the battery g at station B, the polarized relay at station B, the normal contact of arm f^2 at station B, to ground. By the expression "normal contacts" I mean those contacts that are normally engaged when the line is not in service. By the expression "alternate contacts" I mean those contacts which normally are not engaged but which are engaged when the magnets in association therewith are operated. It may be explained that the alternate contact of a relay is that contact which is not engaged when the relay is idle, but which is engaged when the relay is operated. For example, in the diagram, the elements f^2 are shown in engagement with contacts, these contacts being normal contacts, as they are engaged with these switch elements f^2 when said switch elements are idle. The alternate contacts of the switch elements f^2 are those contacts facing said switch elements, but which are out of connection therewith when said switch elements are in their idle positions, these latter contacts being engaged by said switch elements when said switch elements are operated.

An operation of the relay c at station A, will include the battery h at said station in circuit with the conductor a , current from which battery thereupon finding path through the relays b at stations C and B. An operation of the relay c at station C, will connect the battery i in circuit with the conductor a and with the relays b , b at stations A and B. An operation of the relay c at station B, will cause a reversal of the connection of the battery g with the transmission conductor a , and, as a consequence, a reversal of the current through the relays b , b at stations A and C, causing their armatures to be swung to the right, effecting the operation of the telegraph sounders at the receiving stations, as will be explained.

It will be observed that the battery g is constantly in circuit, though, when the key d at station B is operated, its connection with the conductor a is reversed. The purpose of including this battery g constantly

in circuit is to enable the said battery to take part in effecting the operation of the instruments at stations A¹, B¹ and C¹, as will appear. I am aware that it is old to provide
 5 such a battery constantly in circuit for this purpose, but it is new to effect the reversal of the battery when the key *d* at the station where said battery is located, is operated, with advantageous results that will appear.

10 When a telegraph signal is received at either of the stations A, B, C, the armatures of the relays *b* at the receiving stations are moved to the right to thereupon engage their alternate contacts, that constitute terminals
 15 of sounder relays *k*, *k* included in normally open local circuits. The polarized relay at the sending station maintains its armature in its initial position, the operator at the sending station reading his outgoing signals
 20 by the operation of the switching device controlled by his relay *c*. Any other suitable arrangement may, of course, be employed to enable the sending operator to read his own outgoing signals. If a message is being
 25 sent from the station B, the line supplying battery *g* is alone in service; if a message is being sent from either of the other stations A and C, the battery *h* or *i*, as the case may be, is also included in circuit but is opposed
 30 to the battery *g*, and, in order to enable the battery *h* or *i* to become effective, it possesses twice the voltage of battery *g*, one-half of the voltage being employed to overcome the
 35 voltage of battery *g*, while the remainder is employed for the operation of the instruments at all of the remaining stations, including stations A¹, B¹, C¹; polarity of the battery
 40 *h* or *i* being reversed, the relays *b* at the receiving stations have their polarities reversed, whereby the local sounder circuits thereat are closed, since the armatures of
 said relays *b* are swung to the right.

It is one important object of my invention to maintain the voltage of battery or other
 45 operating current impressed upon the line *a*, of uniform value, irrespective of the station at which current is being impressed upon the line, and to this end the larger batteries *h* and *i* are normally disconnected from the
 50 line, and, when they are included in the line for purpose of transmitting messages, the effective value thereof is reduced to that of the battery *g* by reason of the opposition of the battery *g* to the batteries *h* and *i*. In
 55 this way, the line relays *l* at stations A¹, C¹, B¹ are always subject to substantially the same pressure and may be adjusted to such pressure. Hitherto such line relays were
 60 subject to widely varying pressures, according to the stations at which current was impressed upon the line, as is well known.

By my invention a perfect inter-relation is afforded between the apparatus at stations A, C, B, and the apparatus at stations A¹,
 65 C¹, B¹ that will permit of the operation of the

apparatus of the first group of stations and the operation of the apparatus at the second group of stations, independently, and whereby the line relays *l* having been adjusted to operate at suitable pressure, are never
 70 thrown out of adjustment by being operated or subjected to unsuitable pressure.

By the apparatus illustrated and described, it will be impossible for a greater
 75 voltage to be impressed upon the line *a* that is furnished by the battery *g*, even though all of the keys *d* be depressed at the same time, for it will be seen that when the key *d* is depressed, current from the battery *g* is reversed, causing the armatures of relays *b* at
 80 stations A and C to swing to the right, whereby the local circuits including the switch operating magnets *c*, are opened, so that the closure of the keys *d* at stations A and C will not then be effective in moving the switch
 85 elements *f*¹, whereby the batteries *h* and *i* are positively excluded from circuit.

It will be seen that when an operator at any station A, C, B, works his key *d*, the operating circuits of the relays *c* at the remaining of said stations are opened at the
 90 relays *b* thereat, so that the operator who first impresses current upon the line, has control of the line for the time being, by disconnecting the sending mechanism at the other
 95 stations. If an operator wishes to interrupt, he may do so by maintaining his key *d* depressed, acquiring sufficient control of the line for the purpose of such interruption as soon as the sending operator releases his
 100 key. This is the preferred way of rendering the signal-sending apparatus at receiving stations ineffective by apparatus at a sending station. When an operator has released his key, his control over the line is removed
 105 during the release of the key, so that another operator who may depress his key during the time of this release, may acquire control of the line. In systems of the type to which
 110 my invention particularly relates, this feature is of particular service, for thereby the line is prevented from being subject to excessive battery voltage, which would interfere with the proper operation of the system as a whole. These features of my present in-
 115 vention I consider to be broadly new with me.

At station B, where the reversible battery *g* is located, I provide a resistance *m* that is substantially equal to the resistance of the relay *b* thereat, so that when the relay *c* is
 120 energized for the purpose of reversing the battery *g*, in order to operate the telegraph instruments at stations A and C, current from said battery may be directed through a resistance similar to that it normally en-
 125 counters by way of the relay *b* at station B, whereby the line relays *l* may still be subject to operating current of a given pressure, it being necessary, of course, to exclude the relay *b* from circuit at station B when mes-
 130

sages are being transmitted from said station, for otherwise the circuit of the switch operated magnet *c* will be open.

At each of stations A^1 , B^1 , C^1 , I have indicated a suitable type of telegraphic apparatus, comprising at each station a line relay *l* whose armature is normally attracted as the line relays *l* are normally in closed circuit with the battery g^1 , whose normal contact constitutes a terminal of a relay *o*, preferably a polarized relay, in construction and circuit arrangement generally similar to the polarized relays *b*, the armature of the line relay being connected with one terminal of the battery *n*, the other terminal of which battery is connected between the coils of the relay *o*. When an armature of the line relay is in its normal attracted position, the right-hand coil of the corresponding relay *o* is included in circuit with the battery *n* to cause the normal closure of the local sounder circuit including a sounder *q* and the local battery *r*. When a message is to be transmitted from either of the stations A^1 , B^1 , C^1 , the key *s* at the sending station is opened, thereby opening the circuit of the battery *g* so far as the line relays *l* are concerned. It will be seen that this portion of my invention comprises a system of telegraphy including a line, a line relay at each of a plurality of telegraph stations in normally closed circuit therewith, sending keys at said stations for opening the circuit through the line relays, signal-receiving relays *o* at said stations including magnet coils, circuit through which is normally maintained by the armatures of the line relays, and means acting independently of said magnet winding normally maintaining the armatures of the signal-receiving relays in normal positions. The specific means disclosed for maintaining the armatures of the signal-receiving relays *o* in normal positions, are the polarized portions of said signal-receiving relays.

In order that the line circuit may be maintained intact so far as the stations *A*, *B*, *C* are concerned, the contacts of the keys *s* are shunted by suitable conducting media, such as the resistance *t* shown at stations A^1 , B^1 , or the condenser *u* shown at station C^1 , these elements *t*, *u* serving to convey the telegraphic current that is impressed upon the line at either of the stations *A*, *B*, *C*, and affording sufficiently high resistance to prevent the current maintained therethrough from operating the line relays *l*, when keys *s* are open. The armatures of the line relays *l* being released, circuits through the left-hand coils of the polarized relays *o* are closed, the armatures of the said relays thereby being forced to move to the left, causing the sounder circuits including the sounders *q* to be opened, whereby the message may be read at the sending and receiving stations.

The provision of the battery *n* in connection with two operating coils and an armature common to said coils, in association with some means for normally maintaining said armature in one position, is an important feature of my invention, irrespective of the association of the apparatus at stations *A*, *B*, *C* with the transmission line, though it is of particular importance where such stations *A*, *B*, *C* are associated with the line. This feature of my invention prevents static discharges or other currents of indefinite value, or such as are impressed upon the line when the battery *g* is reversed, from permitting armatures of the polarized relays *o* from shifting from their normal contacts, whereby false operations of the sounders at stations A^1 , B^1 , C^1 are prevented. I use the term "battery" in the sense of any suitable source of current.

I prefer to use local signal receiving circuits at each of the telegraph stations, as most distinct sounds can thereby be secured, but I do not wish to be limited to this arrangement, and I, therefore, use the expression "signal receiving circuits" in the broad sense, such circuits being primarily the circuits that include the polarized relays, the additional signal receiving or sounder circuits being preferably controlled by polarized relays. I use the term "signal receiving relays" also in the broad sense, whether or not they control other circuits.

While I have herein shown and particularly described various instrumentalities that are employed in the equipment of the preferred embodiment of my invention, I do not wish to be limited to the precise embodiment of the invention illustrated, as modifications may readily be made without departing from the spirit of the invention, but,

Having thus described my invention, I claim as new and desire to secure by Letters-Patent the following:—

1. A system of telegraphy including a line, a line relay at each of a plurality of telegraph stations in normally closed circuit therewith, sending keys at said stations for opening the circuit through the line relays, signal-receiving relays at said stations including magnet coils, circuit through which is normally maintained by the armatures of the line relays, and means acting independently of said magnet winding normally maintaining the armatures of the signal-receiving relays in normal positions.

2. A system of telegraphy including a line, a line relay at each of a plurality of telegraph stations in normally closed circuit therewith, sending keys at said stations for opening the circuit through the line relays, signal-receiving relays at said stations including magnet coils, circuit through which is normally maintained by the armatures of the line re-

lays, and means acting independently of said magnet windings for maintaining the armatures of the signal-receiving relays in normal positions, said signal-receiving relays each including another magnet winding adapted to be included in circuit when the armature thereof is released, whereby the armature of said signal-receiving relays may be moved to their alternative positions.

3. A system of telegraphy including a line, a line relay at each of a plurality of telegraph stations in normally closed circuit therewith, sending keys at said stations for opening the circuit through the line relays, polarized signal-receiving relays at said stations including magnet coils, circuit through which is normally maintained by the armatures of the line relays, and means acting independently of said magnet windings for maintaining the armatures of the signal-receiving relays in normal positions.

4. A system of telegraphy including a line, a line relay at each of a plurality of telegraph stations in normally closed circuit therewith, sending keys at said stations for opening the circuit through the line relays, polarized signal-receiving relays at said stations including magnet coils, circuit through which is normally maintained by the armatures of the line relays, and means acting independently of said magnet windings for maintaining the armatures of the signal-receiving relays in normal positions, said signal-receiving relays each including another magnet winding adapted to be included in circuit when the armature thereof is released, whereby the armature of said signal-receiving relays may be moved to their alternative positions.

5. A system of telegraphy including a line uniting a plurality of telegraph stations having signal-sending apparatus, operating batteries at said stations for connection with the line, and means at one sending station, governed at another sending station, for preventing the connection of battery thereat with the line.

6. A system of telegraphy including a line uniting a plurality of telegraph stations having signal-sending apparatus operating batteries at said stations for connection with the line, and means at each sending station, governable at other sending stations, for preventing the connection of battery thereat with the line.

7. A system of telegraphy including a line uniting a plurality of telegraph stations having signal-sending apparatus, and means at one sending station, operating independently of the signal-receiving apparatus thereat and governed at another sending station, for rendering ineffective the signal-sending apparatus at the first station.

8. A system of telegraphy including a line uniting a plurality of telegraph stations having signal-sending apparatus, and means at

each sending station, operating independently of the signal-receiving apparatus thereat and governable at other sending stations, for rendering ineffective the signal-sending apparatus thereat.

9. A system of telegraphy including a line uniting a plurality of telegraph stations having signal-sending apparatus, operating batteries at said stations for connection with the line, and means at one sending station, governed by the sending apparatus at another sending station, for preventing the connection of battery thereat with the line.

10. A system of telegraphy including a line uniting a plurality of telegraph stations having signal-sending apparatus operating batteries at said stations for connection with the line, and means at each sending station, governable by the sending apparatus at other sending stations, for preventing the connection of battery thereat with the line.

11. A system of telegraphy including a line uniting a plurality of telegraph stations having signal-sending apparatus, and means at one sending station, operating independently of the signal-receiving apparatus thereat and governed by the sending apparatus at another sending station, for rendering ineffective the signal-sending apparatus at the first station.

12. A system of telegraphy including a line uniting a plurality of telegraph stations having signal-sending apparatus, and means at each sending station, operating independently of the signal-receiving apparatus thereat and governable by the sending apparatus at other sending stations, for rendering ineffective the signal-sending apparatus thereat.

13. A system of telegraphy including a line uniting a plurality of telegraph stations having signal-sending apparatus, operating batteries at said stations for connection with the line, means at one sending station, governed at another sending station, for preventing the connection of battery thereat with the line, signal-receiving apparatus at said stations including polarized signal-receiving relays, a plurality of other telegraph stations having line relays in substantially closed battery circuit, sending mechanism at said latter stations for opening the normally closed circuit of said latter line relays in order to operate said latter relays, and means whereby the telegraph line is made continuous for the current passing between the stations having the said polarized relays.

14. A system of telegraphy including a line uniting a plurality of telegraph stations having signal-sending apparatus, operating batteries at said stations for connection with the line, means at each sending station, governable at other sending stations, for preventing the connection of battery thereat with the line, signal-receiving apparatus at said stations including polarized signal-re-

ceiving relays, a plurality of other telegraph stations having line relays in substantially closed battery circuit, sending mechanism at said latter stations for opening the normally closed circuit of said latter line relays in order to operate said latter relays, and means whereby the telegraph line is made continuous for the current passing between the stations having the said polarized relays.

15. A system of telegraphy including a line uniting a plurality of telegraph stations having signal-sending apparatus, means at one sending station, governed at another sending station, for rendering ineffective the signal-sending apparatus thereat, signal-receiving apparatus at said stations including polarized signal-receiving relays, a plurality of other telegraph stations having line relays in substantially closed battery circuit, sending mechanism at said latter stations for opening the normally closed circuit of said latter line relays in order to operate said latter relays, and means whereby the telegraph line is made continuous for the current passing between the stations having the said polarized relays.

16. A system of telegraphy including a line uniting a plurality of telegraph stations having signal-sending apparatus, means at each sending station, governable at other sending stations, for rendering ineffective the signal-sending apparatus thereat, signal-receiving apparatus at said stations including polarized signal-receiving relays, a plurality of other telegraph stations having line relays in substantially closed battery circuit, sending mechanism at said latter stations for opening the normally closed circuit of said latter line relays in order to operate said latter relays, and means whereby the telegraph line is made continuous for the current passing between the stations having the said polarized relays.

17. A system of telegraphy including a line uniting a plurality of telegraph stations having signal-sending apparatus, operating batteries at said stations for connection with the line, means at one sending station, governed by the sending apparatus at another sending station, for preventing the connection of battery thereat with the line, signal-receiving apparatus at said stations including polarized signal-receiving relays, a plurality of other telegraph stations having line relays in substantially closed battery circuit, sending mechanism at said latter stations for opening the normally closed circuit of said latter line relays in order to operate said latter relays, and means whereby the telegraph line is made continuous for the current passing between the stations having the said polarized relays.

18. A system of telegraphy including a line uniting a plurality of telegraph stations having signal-sending apparatus, operating

batteries at said stations for connection with the line, means at each sending station, governable by the sending apparatus at other sending stations, for preventing the connection of battery thereat with the line, signal-receiving apparatus at said stations including polarized signal-receiving relays, a plurality of other telegraph stations having line relays in substantially closed battery circuit, sending mechanism at said latter stations for opening the normally closed circuit of said latter line relays in order to operate said latter relays, and means whereby the telegraph line is made continuous for the current passing between the stations having the said polarized relays.

19. A system of telegraphy including a line uniting a plurality of telegraph stations having signal-sending apparatus, means at one sending station, governed by the sending apparatus at another sending station, for rendering ineffective the signal-sending apparatus thereat, signal-receiving apparatus at said stations including polarized signal-receiving relays, a plurality of other telegraph stations having line relays in substantially closed battery circuit, sending mechanism at said latter stations for opening the normally closed circuit of said latter line relays in order to operate said latter relays, and means whereby the telegraph line is made continuous for the current passing between the stations having the said polarized relays.

20. A system of telegraphy including a line uniting a plurality of telegraph stations having signal-sending apparatus, means at each sending station, governable by the sending apparatus at other sending stations, for rendering ineffective the signal-sending apparatus thereat, signal-receiving apparatus at said stations including polarized signal-receiving relays, a plurality of other telegraph stations having line relays in substantially closed battery circuit, sending mechanism at said latter stations for opening the normally closed circuit of said latter line relays in order to operate said latter relays, and means whereby the telegraph line is made continuous for the current passing between the stations having the said polarized relays.

21. A system of telegraphy including a line, a line relay at each of a plurality of telegraph stations in normally closed circuit therewith, a battery in substantially permanently closed circuit with said line, sending keys at said stations for opening the circuit through the line relays, whereby signals may be sent and received over said lines between the stations having said line relays, a plurality of other telegraph stations including signal-receiving apparatus responsive to current having polarity reversed with respect to the current normally flowing through the aforesaid line relays, mechanism at one station for reversing the connection of said

battery with respect to the line, shunt conductors about the aforesaid sending keys which are substantially opaque to that current passing over the line that is adapted to operate the aforesaid line relays, and which permit the passage of the reversed current from said battery to operate the said receiving apparatus, whereby signals may be sent over said line between the latter stations while signals are being sent over said line between the former stations in either direction, a second battery of preponderating voltage, and means at another of the latter stations for impressing current from said battery in opposition to the current of the first aforesaid battery, whereby the signal-receiving apparatus at another station which is responsive to reversed polarity may be operated.

22. A system of telegraphy including a line, a line relay at each of a plurality of telegraph stations in normally closed circuit with said line, sending keys at said station for opening the circuit through the line relays, whereby signals may be sent and received over said lines between the stations having said line relays, a plurality of other telegraph stations including signal-receiving apparatus responsive to current having polarity reversed with respect to the current normally flowing through the aforesaid line relays, mechanism at one station for reversing the connection of said battery with respect to the line, means whereby said line is made continuous for the current passing between the latter stations while the circuit of the aforesaid line relays is open, whereby signals may be sent over said line between the latter stations while signals are being sent over said line between the former stations in either direction, a second battery of preponderating voltage, and means at another of the latter stations for impressing current from said battery in opposition to the current of the first aforesaid battery, whereby the signal-receiving apparatus at another station which is responsive to reversed polarity may be operated.

23. A system of telegraphy including a line, a line relay at each of a plurality of telegraph stations in normally closed circuit therewith, a battery in substantially permanently closed circuit with said line, sending keys at said stations for opening the circuit through the line relays, whereby signals may be sent and received over said lines between the stations having said line relays, a plurality of other telegraph stations including signal-receiving apparatus having polarized relays responsive to current having

polarity reversed with respect to the current normally flowing through the aforesaid line relays, mechanism at one station for reversing the connection of said battery with respect to the line, shunt conductors about the aforesaid sending keys which are substantially opaque to that current passing over the line that is adapted to operate the aforesaid line relays, and which permit the passage of the reversed current from said battery to operate the said receiving apparatus, whereby signals may be sent over said line between the latter stations while signals are being sent over said line between the former stations in either direction, a second battery of preponderating voltage, and means at another of the latter stations for impressing current from said battery in opposition to the current of the first aforesaid battery, whereby the signal-receiving apparatus at another station which is responsive to reversed polarity may be operated.

24. A system of telegraphy including a line, a line relay at each of a plurality of telegraph stations in normally closed circuit therewith, a battery in substantially permanently closed circuit with said line, sending keys at said stations for opening the circuit through the line relays, whereby signals may be sent and received over said lines between the stations having said line relays, a plurality of other telegraph stations including signal-receiving apparatus having polarized relays responsive to current having polarity reversed with respect to the current normally flowing through the aforesaid line relays, mechanism at each station for reversing the connection of said battery with respect to the line, means whereby said line is made continuous for the current passing between the latter stations while the circuit of the aforesaid line relays is open, whereby signals may be sent over said line between the latter stations while signals are being sent over said line between the former stations in either direction, a second battery of preponderating voltage, and means at another of the latter stations for impressing current from said battery in opposition to the current of the first aforesaid battery, whereby the signal-receiving apparatus at another station which is responsive to reversed polarity may be operated.

In witness whereof, I hereunto subscribe my name this twenty fourth day of December A. D., 1906.

HARRY O. RUGH.

Witnesses:

G. L. CRAGG,
E. C. HENNIS.