

(No Model.)

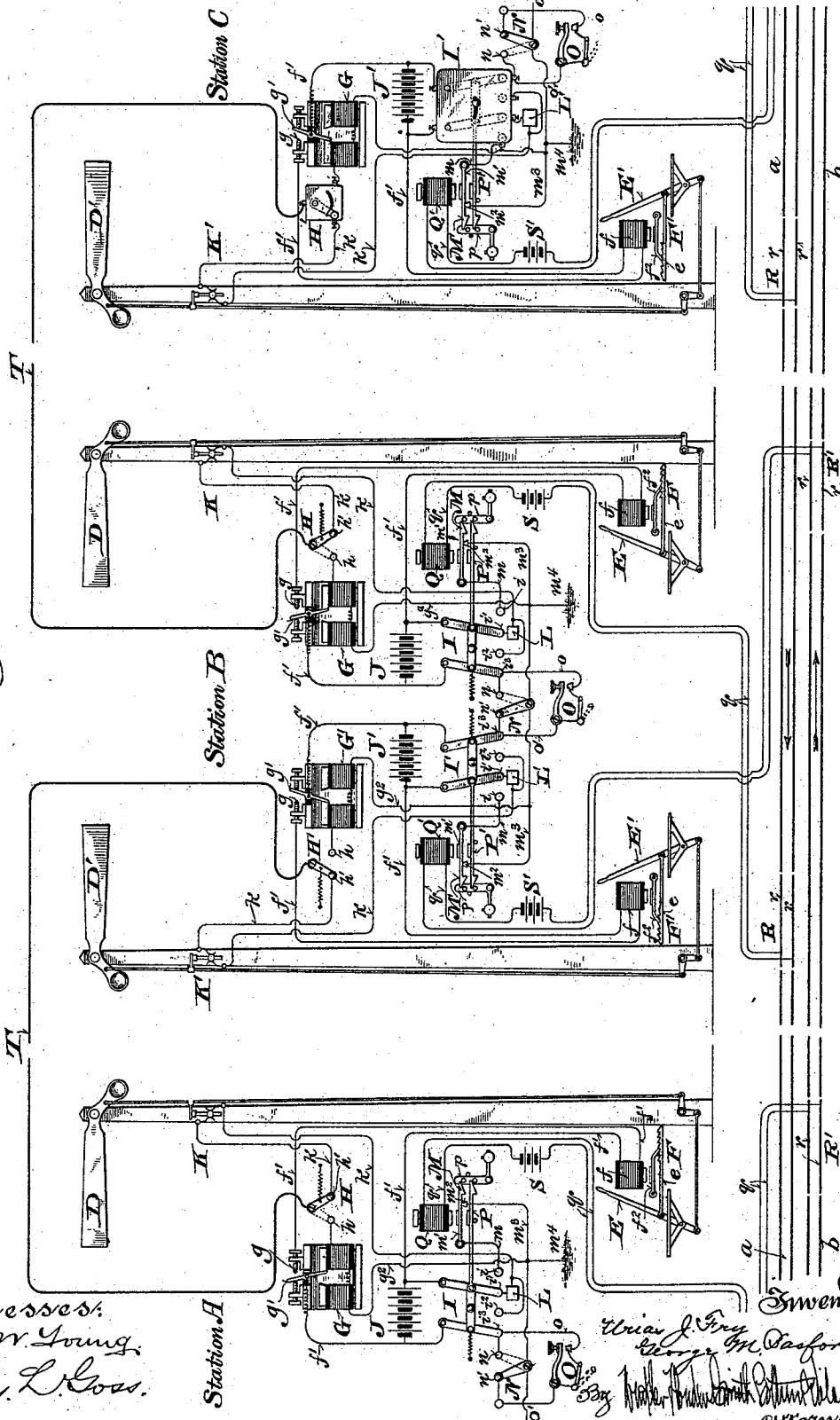
2 Sheets—Sheet 1.

U. J. FRY & G. M. BASFORD.
ELECTRICAL BLOCK SIGNAL APPARATUS.

No. 530,762.

Patented Dec. 11, 1894.

Fig. 1.



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(No Model.)

2 Sheets—Sheet 2.

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Fig. 3.

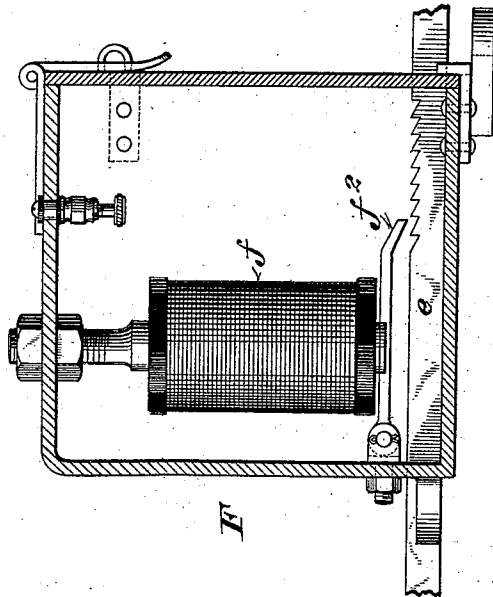
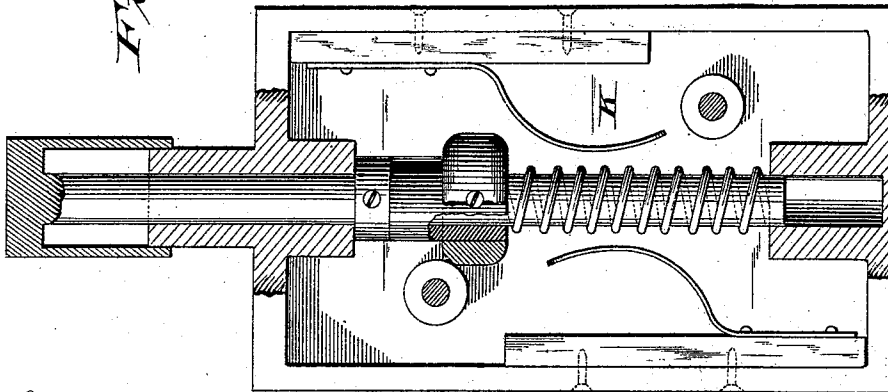


Fig. 2.



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UNITED STATES PATENT OFFICE.

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ELECTRICAL BLOCK-SIGNAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 530,762, dated December 11, 1894.

Application filed July 5, 1893. Serial No. 479,553. (No model.)

To all whom it may concern:

Be it known that we, URIAS J. FRY, of Milwaukee, in the county of Milwaukee and State of Wisconsin, and GEORGE M. BASFORD, of Oak Park, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric Block-Signal Apparatus; and we do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The main object of our invention is to prevent a train from entering a block or section in which there is another train, and for the attainment of that object to provide simple, inexpensive, efficient and durable apparatus.

It consists in certain peculiarities in the construction and arrangement of the component parts of the apparatus, hereinafter particularly described and pointed out in the claims.

In the accompanying drawings like letters designate the same parts in the several figures.

Figure 1 is a diagrammatic view illustrating the application of our improvements to a double track railway; and Figs. 2 and 3 are detail views on an enlarged scale of the automatic circuit breaker, and the signal locking device.

Referring to Fig. 1, representing a portion of a double track railway, including two blocks or sections, A, B and C designate the three signal stations at the terminals of said blocks or sections. Each station is provided with a suitable signal which governs the entrance of trains into the adjacent block or section, means for manually operating the signal, an electrically controlled locking device by which the operation of the signal is controlled from a distant station, a pole changing switch by which the locking device of a distant station is controlled, and suitable electrical transmitting and receiving instruments electrically connected with a distant station at the opposite terminal of the adjacent block

or section, whereby the usual information and orders as to the entrance and passage of trains may be communicated from one station to the other.

The foregoing devices are duplicated in whole or in part at all intermediate stations located at and controlling the adjacent terminals of adjoining blocks or sections. The stations at the terminals of the block system are each provided with a single set of instruments. The instruments and their connections for each terminal of connected blocks or sections being the same, we will explain in detail only those of the intermediate station B.

D represents an ordinary semaphore arm or signal, which in one position denotes "danger," and indicates to the engineer of an approaching train that he cannot enter the block or section in advance, or that said block or section is occupied by another train, or "blocked," and which in another position denotes "safety," and indicates to the engineer of the approaching train that the block or section in advance is "clear," and that his train may enter the same.

E is a lever connected in the usual manner either directly or indirectly with and affording means for manually operating the signal.

F is a locking device, which automatically engages and locks said lever in position to hold the signal at "danger," or to prevent its being "cleared" except at the proper time. The semaphore arm is counterweighted in the usual way so as to automatically carry it to "danger" when it is released, whether intentionally or accidentally.

f is an electro magnet, constituting a part of the locking device inclosed therewith, as shown in detail in Fig. 3, so as to be inaccessible to the operator.

G is a magnet of the polarized type, provided with fixed and movable contacts $g g'$, which are connected by the wires $f' f'$ of a local circuit with the coils of magnet f .

The ordinary polarized relay, such as is commonly used in telegraphic apparatus may be employed to control the circuit in which the unlocking magnet f is placed, and therefore a special instrument is not required for

the purpose. One terminal of the coils of magnet G is connected with a contact h of a switch H, and the other terminal with ground m^4 .

I is a pole changing switch the movable arms of which are connected with opposite poles of a battery J.

K is a circuit controlling device, shown in detail in Fig. 2, attached to the post of the semaphore arm D, and connected therewith in such a manner that the circuit will be broken when the semaphore arm is moved into its clear or safety position, and closed when it is returned to danger position. It is placed in a loop or branch k , connected on one side of said circuit controller with the contact h' of the switch H, and on the other side with the contacts i' and i^2 of the switch I.

By locating the circuit controller K close to the signal with which it is connected, any failure in the intermediate connections between the signal and its operating lever to return the signal to "danger" when the lever is thrown to that position, will be readily detected, because any further operation of the system either for signaling or for telegraphic communication, will be prevented until the defect is remedied.

A Morse sounder or other receiving instrument L, through which communications from station C are received by the operator at station B, is placed in that portion of the branch or loop k which is connected with the contact i' , but not in circuit with the contact i^2 of switch I. The contact i of said switch is connected by a wire m with a pivoted hook or arm m' , constituting part of a circuit breaker M, which comprises a contact m^2 connected by a wire m^3 with the movable part of a switch N and ultimately through one of the contacts n or n' of said switch with the contact i^3 of switch I, the contact n being connected directly with said contact i^3 and the contact n' with the corresponding contact i^3 of a switch I', provided for use in connection with station A. These two contacts i^3 i^3 are in turn connected by wires o and o' with the key and fixed contact of an ordinary telegraphic transmitter O or with any instrument suitable for the transmission of signals or information electrically from one station or point to another. The transmitter O is provided in the usual manner with a switch o^2 , by which the main line or circuit is normally connected with the ground or closed when the transmitter is not in use. At terminal stations where but one set of instruments is required, the switch N is dispensed with, the wire m^3 which has a ground connection m^4 is connected directly with contact i^3 , and the transmitter O is placed in connection with said wire between the ground m^4 and the contact i^3 .

At intermediate stations where two sets of instruments are required, one for use in each direction, the switch N enables us to utilize a single key or transmitter O and a single ground m^4 for both sets of instruments, but even here it may be dispensed with by du-

plicating the transmitting instruments and ground connections arranged and connected as at terminal stations.

P represents a rod or catch pivoted to or connected with the pole changing switch I, and arranged when said switch is turned into engagement with its contacts i and i^2 to engage with a weighted arm or detent p , and when said switch is restored to normal position, as shown, in engagement with its contacts i' and i^3 , to turn said detent into engagement with the hook m' , thereby lifting it away from the contact m^2 , disconnecting the ground m^4 from the contact i of the pole-changing switch I, and depriving the polarized magnet G' at C of the only ground connection that can be made for it at B for a reversed current. The detent p thus holds the arm m' of the circuit breaker M out of engagement with the contact m^2 , until it is released as herein-after explained. To the catch P and arm m' (which may be placed side by side, but for convenience of illustration are shown one above the other) are attached armatures of an electro-magnet Q, the coils of which are connected by wires q q with the rails r r of an insulated section R of track a . The insulated rails or track sections are made of sufficient length to span the greatest distance between consecutive trucks of any train, so that the track circuit will be kept constantly closed by a passing train until it is cleared by the last truck.

In place of the insulated track section R or track circuit, a track instrument of any suitable or well known construction may be employed to control the circuit in which the magnet Q is placed.

For use on railways over which trains pass in both directions on a single track, two insulated track sections or track instruments are required at each intermediate station, but they must be so constructed or arranged that the magnet Q controlled by either section or instrument will be affected by trains passing in one direction only.

The circuit q q is provided with a battery S or may be connected with, and supplied with current by, the main battery J.

Instruments and apparatus constructed, arranged and connected correspondingly with those hereinbefore described are provided at station B for operation in connection with station A, and are designated by corresponding reference letters D', E', F', &c.

Station A is shown equipped with a single set of instruments arranged like those at the right at station B, and station C, with a single set of instruments arranged like those at the left at station B, and are designated by like letters of reference. If stations A and C were intermediate stations controlling blocks or sections of track in both directions, they would obviously be provided with duplicate sets of instruments; but if they were terminals of a block system they would each be provided with a single set of instruments as

shown, except that the switches N would be dispensed with, the wires m^3 connected directly with the contacts i^3 of the pole changing switches I I' and the transmitters O placed in the circuits $m m^3$, between the grounds m^4 and the contacts i^3 . Adjacent stations are connected by single wires T T through the movable arms or parts of switches H H'.

The switches H H' and I I' are automatically restored to their normal positions when released by the operators, by springs, as shown, or by any other suitable means. Their contacts are preferably inclosed so as to render them inaccessible and thereby prevent unauthorized or accidental connection thereof or interference with the circuits which they control.

The operation of our improved apparatus may be explained as follows: It will be understood that in the case of a double track railway such as shown, trains will be run in a single direction only on either track, and for the purpose of illustration we will assume that trains run to the left or westward on track a , and to the right or eastward on track b , as indicated by arrows on Fig. 1, and that the semaphore arms D D govern the movement of east bound trains, and the semaphore arms D' D', the movement of west bound trains. Suppose now, the signals and instruments being in their normal positions as shown, that an east bound train approaches station A, and wishes to enter the block between A and B. The operator at A calls up the operator at B and asks him to unlock the signal at A for a train going east. Track b between A and B being clear, B informs A that he will release his signal. These communications are transmitted through the circuit beginning at A with the ground m^4 passing thence through wire m^3 , switch N, wire o' , transmitter O, wire o , switch I, battery J, again through switch I, sounder L, loop k , including circuit breaker K (which is normally closed), switch H, thence by main line wire T to switch H' at station B, through said switch, loop k , B's sounder L', switch I', battery J', again through switch I', switch N and wire m^3 , to ground m^4 at B. They are sent by the instruments O O and received by the instruments L L'. To send a message to A it is necessary for B to turn the arm of his switch N into engagement with the contact n in order to bring his transmitter O into the circuit just traced. A then turns the arm of his switch H into engagement with the contact h which cuts out both his transmitting and receiving instruments, and brings into circuit with the main line the coils of his polarized relay G, the circuit being completed thence to ground through wire g^2 . B shifts his pole-changing switch I' into engagement with contacts $i i^3$ thereby changing the direction of current by a reversal of the connections of the poles of his battery J' with the main line, the circuit at B being now made from ground m^4 through wires $m^3 m^3$,

circuit breaker M', wire m , switch I', battery J', again through switch I', loop k , including the circuit breaker K', and switch H' to main line T. The current thus reversed shifts the movable part g' of A's polarized relay into engagement with contact g , closing the local circuit f' through battery J and energizing magnet f , which draws the detent f^2 out of engagement with the toothed bar e (see Fig. 3) and thus releases A's signal operating lever E. A now throws his lever over, dropping his semaphore arm or signal D to "clear" and thereby permits the train to pass into the block between A and B. If A should now undertake to communicate with B, or B with A, before A's lever and signal were restored to "danger" position, it could not be done, because the only circuit through which communication can be had between the two stations is broken at A by the circuit breaker K so long as the said signal remains in its "clear" position. A is thus compelled to return his signal to "danger" position before communication can be again established with B. This affords an unfailing reminder to operators to restore their signals to "danger" immediately or soon after they have been placed at "clear," because the entrance of trains into the blocks for which the signals have been "cleared," is required to be immediately reported to the operators at the other ends of such blocks. The restoration of signals to "danger" may, however, be effected automatically by the passage of trains into the blocks for which they have been "cleared," and thus avoid absolutely the possibility of neglect on the part of operators to return their signals to "danger." When B releases his pole-changing switch I', it is automatically restored to its normal position on contacts i' and i^3 , and the current passes again in its original or normal direction through the main line T to A, and, if A's switch H has not already been returned to contact h' , shifts the movable contact g' back out of engagement with the fixed contact g , breaking the circuit f' , de-energizing magnet f and releasing the detent or catch f^2 which drops into engagement with, or into position to engage, the toothed bar e pivoted to lever E. (See Fig. 3.) A's signal D is thus automatically locked in "danger" position, if already in that position, or whenever it is restored to it, and cannot be "cleared" until it is again released by B in the manner hereinbefore explained. The polarized magnets or relays are made or adjusted so that when no current passes through their coils their permanent magnetism will attract and hold the movable contacts g' out of engagement with the fixed contacts g , and a direct current or current of the direction or sense employed to operate the transmitting and receiving instruments will also tend to separate said contacts. Consequently, if A's switch H is returned to normal position before B's pole-changing switch I' is restored to normal position, the circuit

f' at A will be opened by the permanent magnet of the polarized relay G, but it will not be closed by simply placing said switch H on the contact h without the reversal of the current through the main line by said pole-changing switch I' at B.

It will be observed from the foregoing explanation that the coils of the polarized magnets or relays G G' being normally cut out of the main circuits to maintain the required communication between the several stations, lightning, which is liable to strike and follow the main wires T T, is prevented from burning out or injuring the instruments and from accidentally releasing the signals.

When B shifts his switch I' to reverse the current over the main line T for releasing A's signal, the catch P' engages with the detent p and as soon as said switch is released, causes said detent to move and hold the arm m' out of engagement with the contact m^2 , thereby disconnecting the ground m^4 from the contact i of his pole-changing switch I', and depriving the polarized relay G at A of the only ground connection it can have at B. The arm m' is thus held out of engagement with said contact m^2 independently of said switch I' and catch P' until it is released by the passage of the train on track b out of the block between A and B into the block between B and C. The first truck or pair of wheels of said train passing upon the insulated section R' of track b at B, closes the circuit $q q$, and energizing magnet Q', causes it to draw both the arm m' and catch P' out of engagement with the detent p , which being thus released is moved by gravity, a spring or other means, into normal position. The arm m' is however, held away from the contact m^2 by the magnet Q as long as the circuit $q q$ remains closed or until the last pair of truck wheels clears the insulated track section.

By means of the devices just described, an operator at any station is absolutely prevented from again releasing the signal at the opposite end of the block until the train for which said signal has been previously released has passed out of said block and cleared the insulated track section at that station from which the signal was originally released. Furthermore, in the operation of single track railways, the wires $g^2 g^2$ in that case being connected with the contacts $i i$ of the pole-changing switches, and thence through the circuit breakers M M' with the grounds m^4 , when an operator reverses the current at any station to release a signal at another station, and allows a train to enter the intervening block, he is prevented not only from releasing that signal for another train passing in the same direction, but also from operating or clearing his own signal for a train passing in the opposite direction until the first train has passed out of said block. For instance, assuming b to represent a single track railway over which trains pass in both direc-

tions, and that B has released A's signal as hereinbefore explained for an east bound train, B is not only prevented from releasing A's signal again, as stated, but he is also prevented from clearing his own signal D' for a west bound train until the east bound train has passed out of the intervening block, because the polarized relay G' which controls the operation of his signal is deprived of its ground connection m^4 , and any attempt on the part of A to reverse the current by means of his pole-changing switch I would for that reason be ineffectual.

To permit of the passage of the train from B into the block between B and C, the operations hereinbefore explained are repeated, thus rendering it absolutely impossible for a train to enter a block while another train is in that block, unless engineer or trainmen disobey positive orders and disregard signals. Even this contingency can be guarded against by providing derailing switches at each station in connection with the signals D D' and their operating levers E E', so that when signals are placed at danger the switches will necessarily be open.

The polarized magnets G G' may be constructed and arranged to operate directly upon the locking devices F F'. We prefer, however, to employ special releasing magnets $f f$ for that purpose, as shown. We are thus enabled to eliminate the resistance of the main line circuits, thus utilizing the entire strength of the batteries J J' for releasing the signals and rendering a comparatively weak current such as is ordinarily used for telegraphic purposes, sufficient for communication between stations, and for the operation of the polarized relays.

By the term "train circuit" as employed in the claims, we mean to designate any electric circuit which is arranged to be opened or closed by a passing train, whether through the medium of an insulated track section, track instrument or other means.

By means of such variations in details as will be readily understood by those skilled in the art to which our invention pertains, the apparatus herein shown and described may be adapted for use with either normally open or closed circuits or with both, as shown, it being feasible to substitute normally open circuits for such as are shown as normally closed and vice versa.

Various changes in details of construction and arrangement of the various component parts of the apparatus may be made within the intended scope and spirit of our invention.

We claim—

1. In block-signal apparatus the combination with a main line or circuit connecting stations, of a signal, an electrically controlled signal-locking device, a polarized magnet controlling the operation of said signal and constructed and arranged to positively shift its armature in opposite directions when energized by currents of opposite polarity, and to

return said armature to its normal position when the main circuit is broken and a pole-changing switch arranged to reverse the current through the coils of said polarized magnet, substantially as and for the purposes set forth.

2. In block-signal apparatus the combination with a main line or circuit connecting stations, each of which is provided with a suitable signal, of a locking device for each signal, a polarized magnet controlling each locking device, and constructed and arranged to positively shift its armature in opposite directions when energized by currents of opposite polarity, and to return said armature to its normal position when the main circuit is broken and a pole-changing switch at each station arranged to reverse the current through the main line and the coils of the polarized magnet of another station, substantially as and for the purposes set forth.

3. In block-signal apparatus, the combination with a main line or circuit connecting stations each provided with a suitable signal, and with electrical transmitting and receiving instruments, of signal-locking devices, polarized magnets controlling said locking devices, switches arranged to connect and disconnect either the polarized magnet or the transmitting and receiving instruments of each station with the main line, and pole-changing switches each arranged to reverse the current through the coils of the polarized magnet of another station, substantially as and for the purposes set forth.

4. In block-signal apparatus the combination with a main line or circuit connecting stations each provided with a suitable signal and with electrical transmitting and receiving instruments, of signal-locking devices, polarized magnets controlling said locking devices, and pole-changing switches each arranged to reverse the current through the polarized magnet of another station, and to simultaneously cut out of circuit the transmitting and receiving instruments of the station where that pole-changing switch is located, substantially as and for the purposes set forth.

5. In block-signal apparatus, the combination with a main line or circuit connecting stations, of a signal, a polarized magnet controlling the operation of said signal, a pole-changing switch located at another station and arranged to reverse the current through the main line, and a device arranged to control the circuit through the coils of said polarized magnet, and to be operated by said pole-changing switch, substantially as and for the purposes set forth.

6. In block-signal apparatus, the combination of a main line or circuit connecting two stations, one of which is provided with a signal and polarized magnet controlling the operation of said signal, and the other with a pole-changing switch, of a device arranged to control the circuit of said polarized magnet and to be shifted to abnormal position by said

pole-changing switch, and a train circuit arranged to effect or permit the restoration of said circuit controlling device to normal position, substantially as and for the purposes set forth.

7. In block-signal apparatus, the combination with a main line or circuit connecting distant stations, one of which is provided with a signal and a polarized magnet controlling the operation of said signal, and the other with a pole-changing switch, of a circuit controlling device arranged to be shifted into abnormal position by said switch, and in such position to render said magnet inoperative, a train circuit arranged to effect or permit the restoration of said circuit controlling device to normal position, and a detent arranged to hold said circuit controlling device in abnormal position and to be disengaged by said train circuit, substantially as and for the purposes set forth.

8. In block-signal apparatus, the combination of a main circuit connecting two stations, one of which is provided with a signal and a polarized magnet controlling the operation of said signal, and the other, with a pole-changing switch, of a circuit breaker arranged to be opened by the operation of said switch, and a train circuit arranged to close said circuit, substantially as and for the purposes set forth.

9. In block-signal apparatus, the combination with a main circuit connecting the termini of a block, of a signal, a locking device controlling the operation of said signal, a local circuit provided with an electro-magnet arranged to unlock said signal, a polarized relay controlling said local circuit, and constructed and arranged to positively shift its armature in opposite directions when energized by currents of opposite polarity, and to automatically return said armature to its normal position when the main circuit is broken and a pole-changing switch arranged to reverse the current of the main circuit through the coils of said polarized relay, substantially as and for the purposes set forth.

10. In block-signal apparatus, the combination of main lines or circuits connecting stations, each provided with signals and transmitting and receiving instruments, of electrically controlled locking devices governing the operation of said signals, and a switch at each intermediate station arranged to connect the transmitting instrument of that station with the main line leading to the next station in either direction, substantially as and for the purposes set forth.

11. In block signal apparatus, the combination with a main line or circuit connecting distant stations each of which is provided with a battery and a suitable signal, of a locking device for each signal comprising an unlocking magnet in a local circuit with the main line battery, a polarized relay controlling said local circuit, and arranged to positively shift its armature in opposite directions when energized by currents of opposite polarity and

to automatically return said armature to its
normal position when the main circuit is
broken, signal transmitting and receiving in-
struments at each station, a switch arranged
5 to connect either the transmitting and re-
ceiving instruments and the battery or the
polarized relay of each station with the main
line, and a pole changing switch at each sta-
tion arranged to reverse the poles of the main
10 battery to the main line, whereby the entire
energy of a single battery at each station is
utilized for transmitting signals, operating

the polarized relay of the distant station and
unlocking the signal of the local station, sub-
stantially as and for the purposes set forth. 15

In testimony that we claim the foregoing as
our own we affix our signatures in presence
of two witnesses.

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GEORGE M. BASFORD.

Witnesses:

H. M. SPERRY,
LAURA S. RABB.