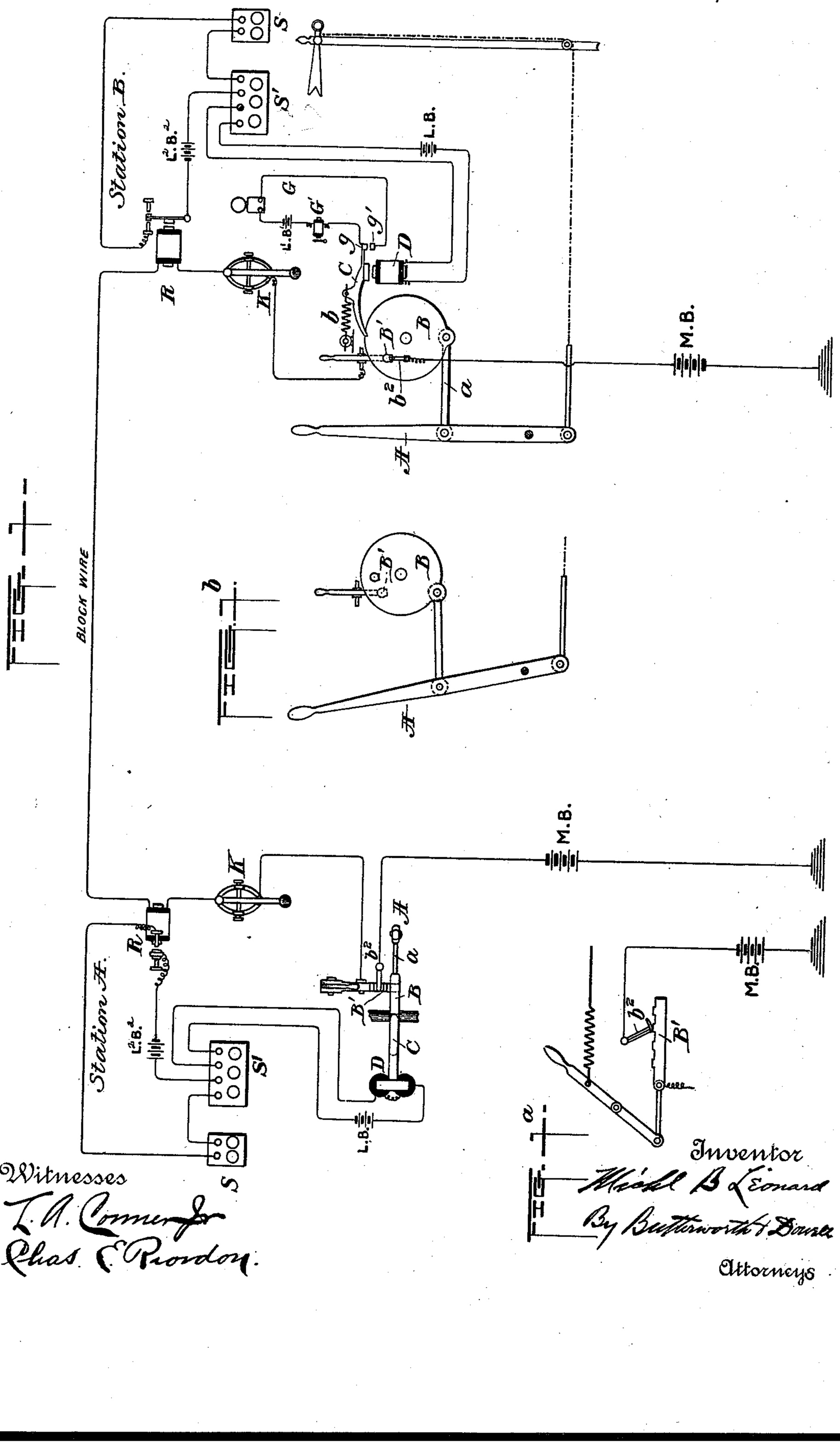
(No Model.)

3 Sheets—Sheet 1.

M. B. LEONARD.

ELECTRIC APPARATUS FOR CONTROLLING SIGNALS.

No. 507,518. Patented Oct. 24, 1893.



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(No Model.) 3 Sheets—Sheet 2.

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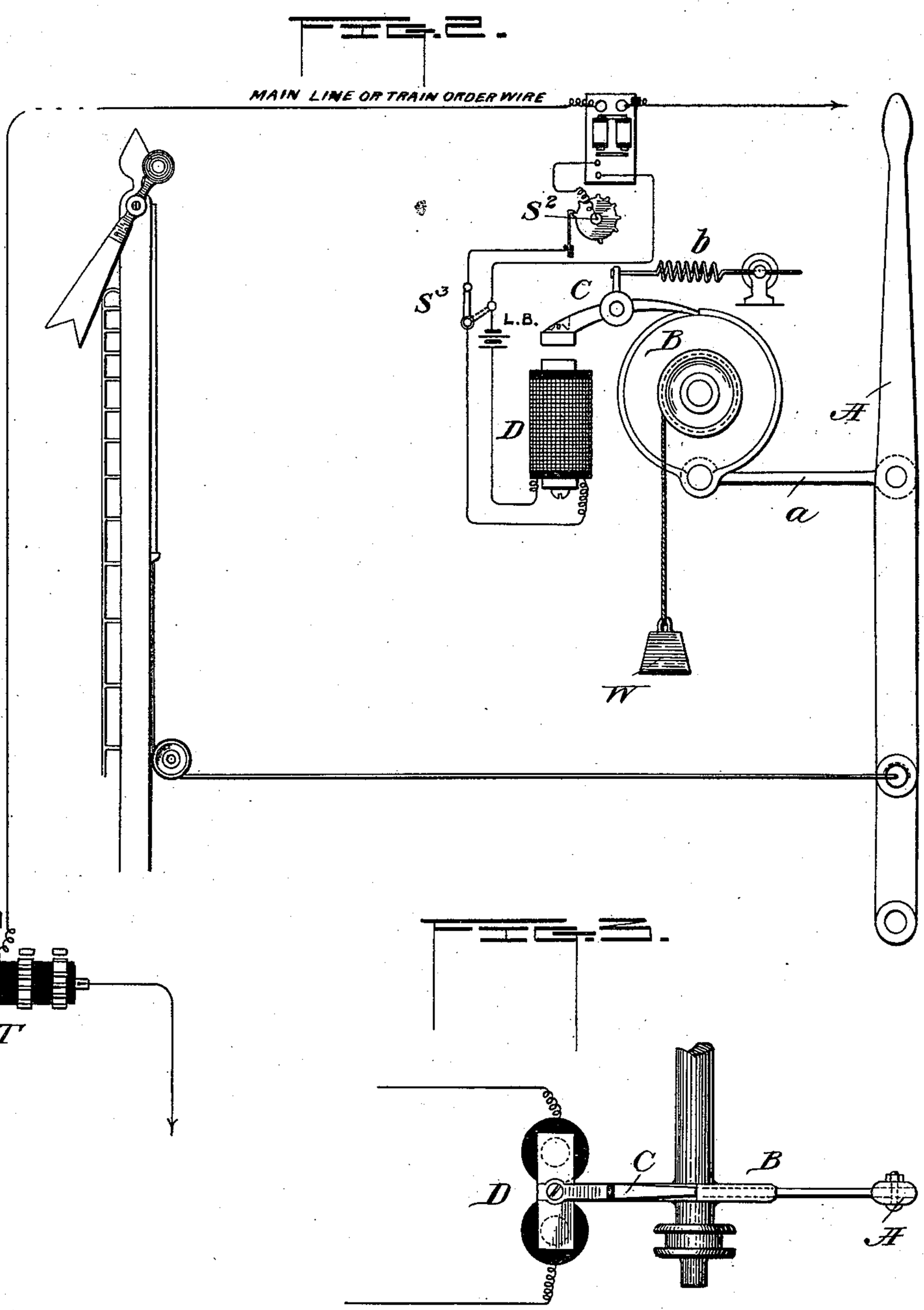

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(No Model.) 3 Sheets—Sheet 3.

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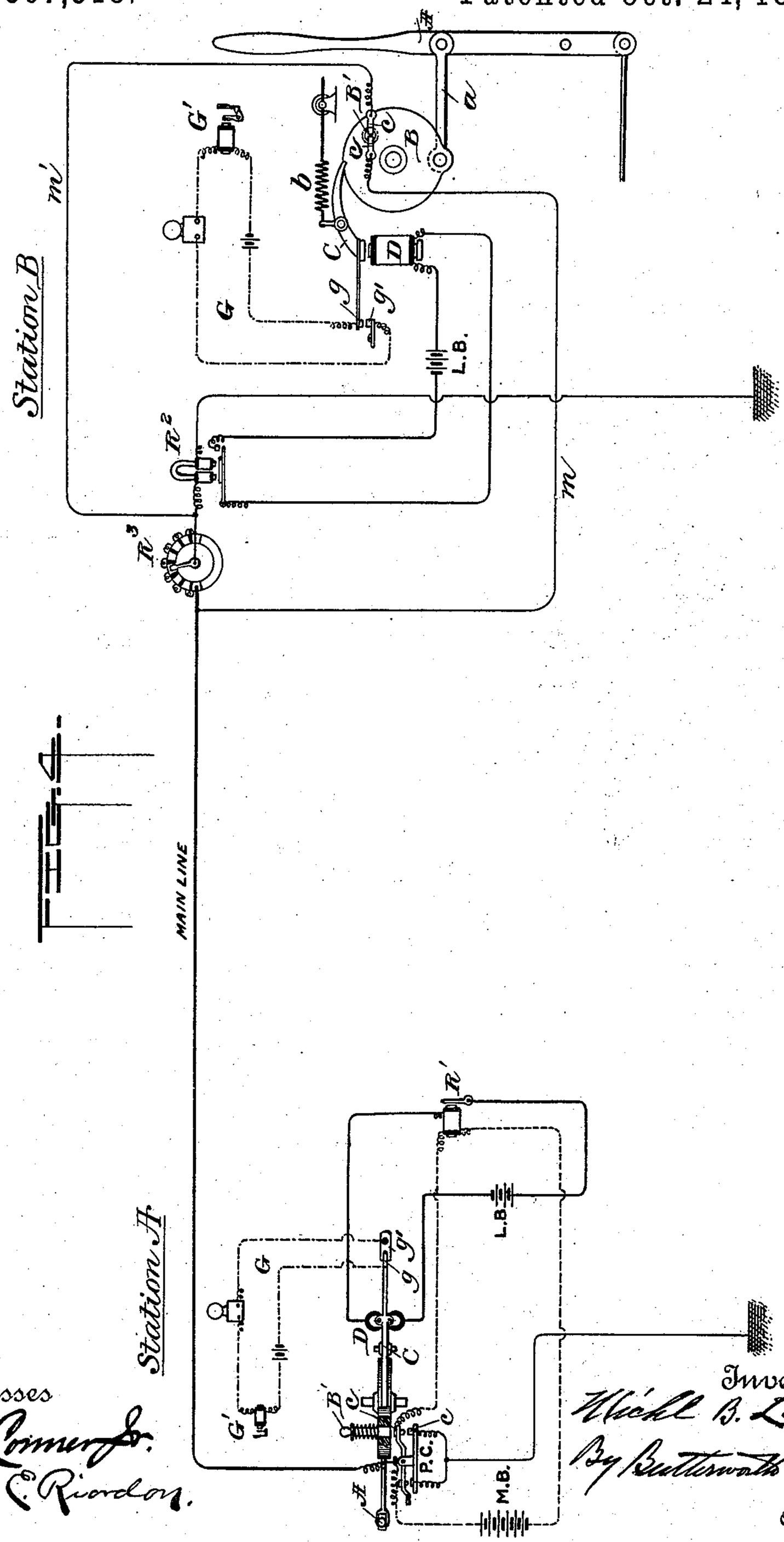

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UNITED STATES PATENT OFFICE.

MICHAEL BARRY LEONARD, OF RICHMOND, VIRGINIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE ELECTRIC SELECTOR AND SIGNAL COMPANY, OF WEST VIRGINIA.

ELECTRIC APPARATUS FOR CONTROLLING SIGNALS.

SPECIFICATION forming part of Letters Patent No. 507,518, dated October 24, 1893.

Application filed March 14, 1892. Renewed March 25, 1893. Serial No. 467,657. (No model.)

To all whom it may concern:

Be it known that I, MICHAEL BARRY LEONARD, a citizen of the United States, residing at Richmond, in the county of Henrico and State of Virginia, have invented certain new and useful Improvements in Electric Apparatus for Controlling Signals; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in electric apparatus for use in controlling semaphore or other signals, such as are usually employed in lock and block signaling between two stations or block offices upon steam railroads; and one object of the invention is to provide means which will require the concerted action of the operators at each of the two stations to permit a train to enter the block; the operation of the apparatus being such that but one train will be permitted to enter the block at a time, thereby lessening the liability to accidents. I accomplish these results by providing each of the semaphores with a locking device whereby the same is locked and held in position until the operator at a distant station unlocks the same by the transmission of suitable electrical impulses and allows the signal to be changed, and by so arranging the mechanisms that the distant operator cannot actuate them, until his own signal is in proper position to enable him to transmit the impulses. I also propose to use this combination for displaying stop or train order signals at a station or stations at a distance from a central or dispatcher's office, by using a preparing or selecting instrument adapted to respond to a predetermined arrangement of electrical impulses and connecting the same with the releasing devices of the semaphore at the distant station, and providing mechanisms to reverse the semaphore when so released. The usual telegraph apparatus key, relay and sounder may be employed for transmitting messages between the stations and on the same line may be placed the selecting instrument to be used when the locking devices of the semaphore require to be released and either or both may be operated without conflicting with each other. In this way I avoid the necessity of providing an extra wire for unlocking the signals, and can perform the work on the regular block wire already in use.

When it is desired to operate the regular block wire independently, as for instance in working a system of "permissive" signals, I can on one extra wire unlock from either end of the block the semaphore or signal lever at the other end. This I accomplish by utilizing the principles of any of the well known duplex telegraph systems—the polar-differential or bridge—using at one office a neutral relay and at the other a polarized relay and a rheostat placed between the main line and such relays; and placing the unlocking magnets on one side of the local circuits of the relays; the latter being operated from the distant stations by substantially the same sort of plunger at each station, causing a current of positive or negative polarity to pass over the line and affect but one of the relays; the relay at the station where the plunger is worked being unaffected. The same may be accomplished by using polarized relays and currents of different polarity without interposing rheostats. In the former method I use the ordinary telegraph instruments and any of the well known forms of selecting apparatus, responding to a predetermined arrangement of impulses to release the locking devices of the semaphore, and permit the same to be reversed, and I thereby dispense with the duplex appliances, and simply place the selector on the block wire.

The invention will first be described in connection with the accompanying drawings, and then pointed out in the claims at the end of this description.

Inasmuch as the several electrical instruments or appliances employed in connection with the locking mechanism which I preferably use in practicing my invention are all old and well known in the art, separately considered, and as I do not propose to make any specific claim herein to the construction of the individual instruments, or appliances, I have not deemed it necessary to illustrate or describe in detail such instruments or appa-

ratus as may be comprised in the complete system or combination embodying my invention; the locking mechanism being adapted to be used in connection with a variety of instruments or appliances which may fulfill the requirements of the combination without rendering it necessary to use any special form or type of instrument in accomplishing the desired results.

Referring to the accompanying drawings which form a part of this specification, and in which similar letters of reference are used to denote corresponding parts of the apparatus, Figure 1, is a diagrammatical representation of a locking apparatus embodying my invention, adapted for lock and block signaling on the regular block wires connecting two block offices or stations. Fig. 1^a, is a detail of the plunger transmitter. Fig. 1^b is a detail of the locking disk. Fig. 2, is a diagrammatical view partly in section of a modification of the apparatus adapted for displaying a "stop" or train order signal at a distant station from the dispatcher's office. Fig. 3, is a detail plan of the unlocking magnet and locking disk shown in Fig. 2; and Fig. 4, is a diagrammatical view of a further modification showing a side elevation of the locking devices and semaphore at "station B," and a plan of the corresponding parts at "station A."

In practice I preferably employ at block stations A and B, (Fig. 1) the usual telegraph key, K, relay, R, and sounder, S, used for working the regular block wire, by which the operators may communicate with each other; these devices being arranged in the usual way, with the usual local battery circuit, so that any particular description or illustration of the same herein is not deemed necessary.

In Figs. 1 and 4 the semaphore lever A, is shown as being locked in position with the semaphore arm (shown in Fig. 1) normally at "danger," while in Fig. 2, it is locked in the same position with the semaphore arm or blade normally at "clear." B, denotes a disk or wheel connecting with the lever A by a link *a*, and having a notch in its periphery which is engaged by one end of the armature C, of the electro-magnet D. The armature C may be actuated by either gravity or a spring *b*, for the purpose of throwing it into engagement with the notched disk B, when released by the magnet thereby preventing backward motion of the semaphore lever and thus locking the block signal until the disk is released by the operator of the distant station as hereinafter described. It will be understood, of course, that the unlocking magnet and plunger circuit connections with the semaphore arm or signal are the same at "station A" as described with reference to "station B."

S', (Fig. 1) denotes a combination lock or selector of the usual or any preferred form, which is connected in the relay's local circuit, and D denotes the electro-magnet which unlocks the disk and enables the signal to be operated, and is placed in a normally open local circuit with local battery L. B. The disk B, is pierced by a hole through which passes a reciprocating bar or plunger B', which is adapted to operate the distant semaphore or signal only when the signal at the station whose plunger is worked is showing "danger." The main or block wire circuit is normally closed through the plunger contacts by means of a brush b^2, connected to line and resting on the plunger bar, as shown clearly in Fig. 1^a, so that when the bar is moved the circuit will be opened at each insulating space, and the circuit is thus made and broken in regular sequence, thus producing and putting to line the desired combination or series of electrical impulses corresponding with the particular semaphore or other signal to which the selector at the distant station is adapted to respond, so as to close the open circuit in which the unlocking magnet is placed, thereby energizing said magnet and unlocking the desired semaphore, signal lever, or apparatus, and permitting the semaphore or signal to be shown at "clear." The selector S' will respond only to the particular combination—as may be determined—on the transmitter at the distant station. The transmitter may be of the well known circular form indicated at T, in Fig. 2, or the plunger itself may be used for a transmitter by making it a metal bar cut with insulating spaces, as may be desired, and as illustrated in Fig. 1^a. If desired, however, a transmitter may be used similar to the American district call box, wound up by a lever, and the lever may be held stationary by mechanical means whenever the signal lever is cleared at that station; the lever to be free to move only when the semaphore or signal lever is showing "blocked" at that station. G, denotes a local battery circuit in which may be placed an annunciator device or electric bell and visual signal G', for the purpose of indicating when the semaphore lever is unlocked. These latter circuits are normally open and are adapted to be closed (by the attraction of the armature C, of the unlocking magnet D) through the contact points *g*, *g'*. The annunciator magnet G', is adapted to actuate a visual signal or plate which may drop down so as to indicate when the semaphore lever is unlocked. The operation of this apparatus is as follows:—Normally the signals at each local station are exhibited at "danger." In this position the disk B is locked by the armature lever C engaging with the notch of the disk, and the transmitter or plunger is in position to transmit the desired combination or series of electrical impulses for unlocking the disk at the distant station. Upon the approach of a train the operator at "station A," desiring to display his signal at "clear" can by the regular block wire used for communicating between stations and the ordinary telegraph instruments transmit a

message to the operator at "station B," and the operator at the latter station, upon being requested so to do, "plunges" or presses in the bar B′, thereby effecting the necessary electrical impulses in the main circuit and thus closing the open circuit of the unlocking magnet at station A, and thereby unlocking the disk B so as to permit the semaphore or signal to be shown at "clear." When an independent circuit is employed for the signal devices a simple closing of such circuit will energize the unlocking magnet. When the operator at "station B" desires to allow a train to enter his block, the operation is exactly similar to that just described with respect to "station A." In either case it is impossible for the operator to unlock the semaphore at the distant station until his own signal is returned to "danger." When the armature C is attracted so as to release the wheel B, this movement of the armature closes the contacts *g*, *g′*, of the annunciator circuit, and thus actuates the annunciator device so as to indicate that the semaphore lever has been unlocked.

With this apparatus the "answer back" and vibrating bell connections usually employed in block signaling systems are unnecessary.

In using the combination for displaying a "stop" signal at a distant station from the dispatcher's office, as illustrated in Figs. 2 and 3 of the drawings, I use a spring or weight W, connected with the disk B, for pulling back the semaphore or signal lever upon being released or unlocked by the magnet D; and I place the selector S^2, with the desired combination, on the regular train order wire—either direct or through the local points of the regular relay—which wire usually passes through every telegraph office on the railroad or any division of it; the local points of the selector controlling the unlocking magnet being open until the predetermined combination of signals is made on the train order wire, by means of the ordinary telegraph key or a suitable transmitter T, at the central station or dispatcher's office; the selector at each station being adapted to respond only to the particular combination corresponding therewith on the transmitter at the dispatcher's office. The transmitter may be of the circular form shown or of any preferred construction. The signal lever will be free to move only when the semaphore or signal lever is showing "blocked" at that station.

S^3, denotes a hand switch which is adapted to be moved by the operator for the purpose of closing the unlocking magnet circuit when the local operator desires to display a "train order" signal independently of the dispatcher's office.

The action of the apparatus in displaying "stop" or "train order" signals is simply the reverse of what it is in the lock and block signaling apparatus; the signal being normally at "safety" or "clear" and falling back to "danger" when released from the dispatcher's office, and adapted to remain at "danger" until it is replaced at "clear" by the operator at the local station. The selector, on receiving the predetermined combination of signals from the dispatcher's office, closes the unlocking magnet circuit, which has hitherto been open, thereby energizing the magnet and releasing the signal lever, which is then brought forward by the weight W, or a spring, so as to display the signal and stop all trains until the lever is moved backward by the operator, whereupon it will be again automatically locked, to be released only in the same way.

In operating the "stop" signal from the dispatcher's office I prefer to use an "answer back" of the well known type in common use, to notify the dispatcher when the signal has fallen to "danger." It may be found useful to place these "stop" signals at points other than the regular stations along the road, to be replaced at "clear" by say the conductor or brakeman of a train stopped by them.

If found desirable I may use a small electro-motor to be set in operation by the local circuit or points on the unlocking magnet, to pull back the signal lever when unlocked by the magnet.

Referring particularly to Fig. 4, P. C., at "station A," denotes a pole-changer which may be placed in the circuit of the main battery M. B., connected to the main line wire in the usual manner. R′ denotes a neutral relay which may be placed between the main battery and the pole changer, for the purpose of controlling the unlocking magnet D, at that station. The unlocking magnets at each station are included in normally open local circuits including local batteries L. B.; such circuits being adapted to be closed by the action of the respective relays R′, R^2, for the purpose of energizing the magnets. R^3 denotes a rheostat placed between the main line and the polarized relay R^2, at "station B" with the plunger circuit closer B′ connected around the rheostat by the wires *m*, *m′*, shunting the current through the plunger contacts *c*, *c*, when these two points are closed by the plunger B′. The contact points *c*, *c*, at each station, for energizing the apparatus at the distant station, are arranged on one side of the disk or wheel B, which latter is pierced by a hole through which the plunger bar B′, passes; this hole being so located that only when the semaphore lever is brought to "danger" will the plunger pass through and make the contact. G, denotes the local battery circuit of the annunciator device and G′ the annunciator magnet and visual signal used for the purpose of notifying the local operator when the semaphore lever is unlocked; these latter circuits at each station being normally open and adapted to be closed by the attraction of the armature C, of the unlocking magnets, through the contact points *g*, *g′*. This arrangement is designed principally to enable the block operators to unlock the semaphores

of my system disconnected from the ordinary block wire, when it is desired to use the block wire for actuating a "permissive" system or for other purposes, and by the use of only a single extra wire. This duplex arrangement is worked as follows:—Artificial resistance equal to three or four times the line resistance having been unplugged in the rheostat R^3, and the neutral relay R′, having been adjusted so that it will not respond to the weakened currents flowing through it, the unlocking magnets can be operated from either end without actuating the magnet at the end where the plunger is worked; this duplex action being accomplished as already stated by utilizing the principles of any of the well known duplex telegraph systems. The proper adjustments having been made, the circuit between the two block stations A and B, is ready for duplex working, which is maintained as follows:—Supposing the operator at "station A," desires to allow a train to enter, he can, by the regular block wire, transmit a signal requesting the operator at "station B," to unlock his semaphore, and the operator at the latter station thereupon "plunges" or presses in the bar B′, thus closing the contacts *c*, *c*, and thereby affecting the relay at "station A," which is adapted to respond every time the contact points are closed by the plunger at "station B," the current being shunted around the rheostat R^3, through the plunger contacts which practically shortens the line wire, increasing the current flowing through the neutral relay R′, and causing it to operate and close the unlocking magnet circuit, bringing the local battery into action and thereby energizing the magnet, which attracts the armature C, and releases the wheel B. The same movement of the armature also closes the contacts *g*, *g′*, of the annunciator circuit, thereby actuating the annunciator device and indicating that the semaphore lever has been unlocked. When the operator at "station A" works his plunger, the neutral relay R′, will not be affected, but the polarized relay R^2, will be actuated in the usual way, it being adapted to respond to currents flowing from one particular side of the battery, while the neutral relay is only actuated by an increase in the quantity of the current passing over the line.

I do not desire to confine myself to the described form of armature-locking, as the same result can be accomplished in a number of ways, by using other means, adapted, like the construction shown, to relieve the strain on the armature, but I preferably use this particular form of locking mechanism as it is simple in construction, and reliable and efficient in use.

A bell or alarm may or may not be used in connection with the visual signal, for directing the attention of the operator to the fact that the semaphore lever is unlocked. The apparatus at each station is designed to be placed in an iron box built on the semaphore lever stand, and of sufficient strength to stand the pull of the lever.

In displaying the stop signals from a central office, which involves a reversal of the operation of actuating the danger signals, I preferably use a local attachment or annunciator device, (not shown) which may be arranged to ring an alarm bell when the signal falls to "danger," thus notifying the local operator who may be asleep or out of the building.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. An electrical apparatus adapted for railroad block systems of signaling between two or more offices or stations, comprising at each station a visual signal, mechanism for locking the signal in normal position, an unlocking magnet adapted to operate upon said locking mechanism and release the signal, an electrical transmitter arranged in relation to the signal locking mechanism so as to operate only when the signal mechanism at that station is placed in normal position; said transmitter being placed in an electric circuit and controlling the unlocking magnet circuit at the distant station so as to affect the distant magnet only, whereby the signal at the distant station is adapted to be unlocked by the operator at the home station and then only when the signal at the latter station is locked in normal position, substantially as described.

2. In an interlocking block signaling system comprising two or more offices or stations, a visual signal for each station, mechanism for locking the signal in normal position, means for releasing the signal including a normally open local circuit, an unlocking magnet placed in said circuit and adapted to unlock the signal, and a transmitting device placed in circuit with the line wire and controlling the unlocking magnet circuit at the distant station so as to release the distant signal only, and means for preventing the operation of the transmitting instrument at either station until the signal mechanism at the station whose transmitter it is desired to operate is placed in normal position, whereby the signal at each station may be unlocked by the operator at the distant station and then only after the latter operator has placed his own signal in normal position, substantially as described.

3. In an interlocking block signaling system comprising two offices or stations, a semaphore lever at each station, a disk connected with said lever and adapted by a partial rotation to shift the signal; said disk being provided with a transverse opening through the same, a plunger-transmitter adapted to register with said opening when the disk and signal lever are in their normal positions, an unlocking magnet provided with an armature-lever adapted to engage and lock the disk in its normal position, and main and local circuit connections, whereby the sig-

nal at each station is adapted to be unlocked from the distant station only when the working plunger and disk occupy fixed positions relatively to each other, substantially as described.

4. In a signaling system, a visual signal and means for locking the same in normal position, comprising a peripherally notched rotatory disk connected with the signal lever and provided with a transverse opening through the same, an armature-lever adapted to engage the notch in said disk so as to lock the same against rotation, an electro-magnet adapted to actuate said armature-lever, a plunger-transmitter adapted to register with the opening in said disk only when the latter is locked with the signal in normal position, and circuit connections substantially as described, whereby the semaphore lever may be unlocked from a distant station only when the signal and locking disk at such station are in their normal positions, substantially as described.

5. The combination with the respective semaphores or signals of a signaling apparatus, of a locking device consisting of a disk connected to the semaphore lever and adapted to be moved a part revolution, an armature adapted to engage and lock said disk, and an electrical transmitting device adapted to operate only when the disk is locked, substantially as described.

6. In a signaling system, a visual signal provided with an operating lever, a disk connected to said lever and adapted by a partial rotation to shift said signal, means for automatically rotating said disk, an electro-magnet whose armature is arranged to engage said disk and thereby lock said signal in normal position, and a selecting instrument adapted to respond to a predetermined arrangement of electrical impulses for the purpose of unlocking the signal, in combination with an electrical apparatus placed at a distance from said signal and adapted to transmit the electric impulses to which said selecting instrument may respond, substantially as described.

7. A selecting or preparing instrument adapted to respond to a predetermined arrangement of electrical impulses, and a transmitting device for transmitting said impulses, in combination with a lock signal and means operated by the selecting instrument to unlock the signal, and means for preventing the operation of these devices until the operator's signal is placed in normal position.

8. In a signaling system, a visual signal and means for locking the same in normal position, in combination with an electrical apparatus placed at a distance therefrom, adapted to transmit electrical impulses and thereby unlock said signal, and means to prevent the transmission of said unlocking impulses until the signal at the transmitting station is placed in normal position.

9. In a block system, a series of signals located at the end of each block, and means connected with each of said signals to prevent the operator from working his own signal, and provided with a locking device at each signal, in combination with an electric selecting apparatus responding to a predetermined arrangement of electric impulses, an electrical impulse transmitting instrument at a distant station adapted to transmit said predetermined arrangement of impulses, and means for preventing the transmission of said impulses until the signal at the transmitting station is locked in normal position.

In testimony whereof I affix my signature in presence of two witnesses.

MICHL. BARRY LEONARD.

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