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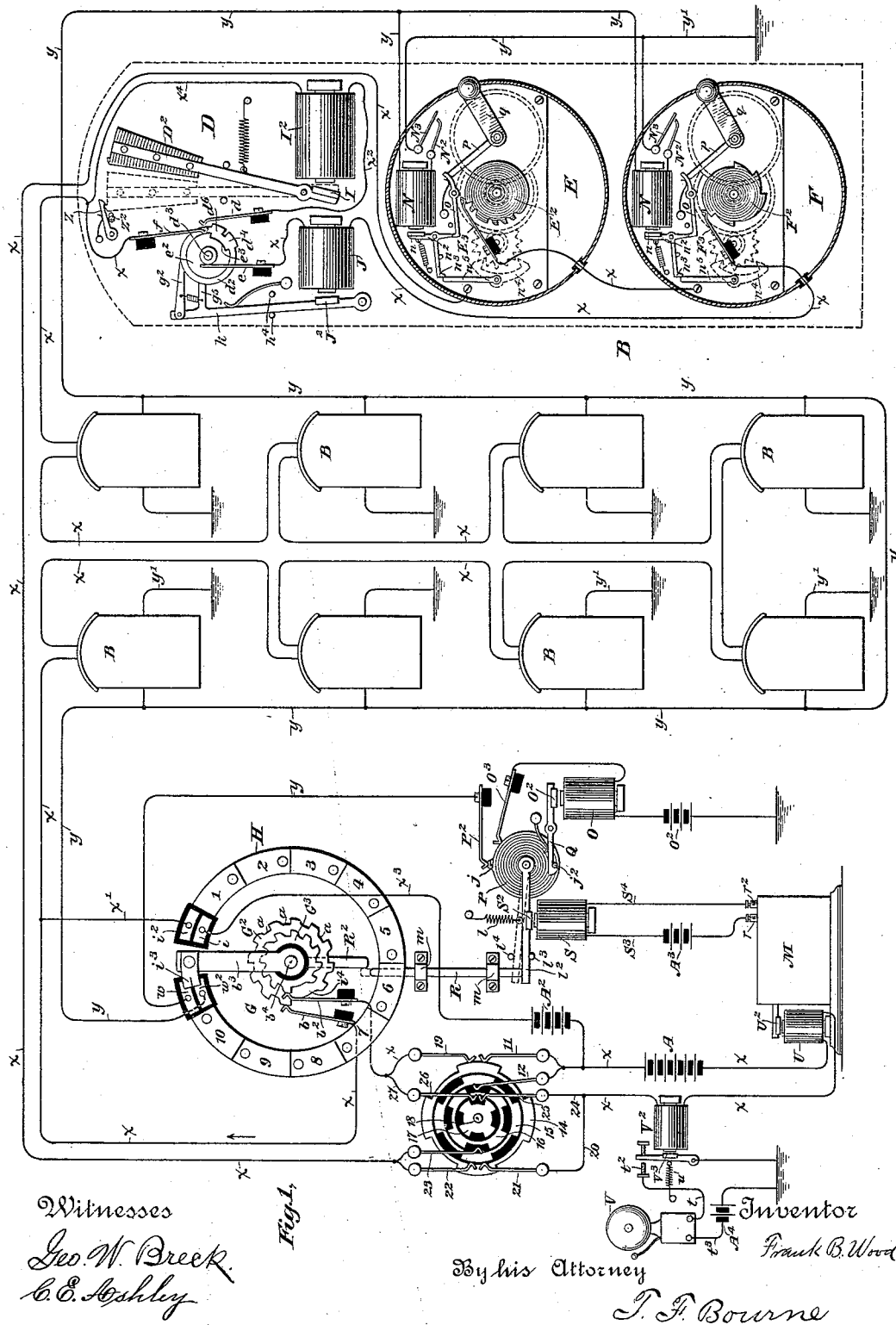
2 Sheets—Sheet 1.

F. B. WOOD.

NON-INTERFERING SUCCESSIVE SIGNALING SYSTEM AND APPARATUS.

No. 461,464.

Patented Oct. 20, 1891.



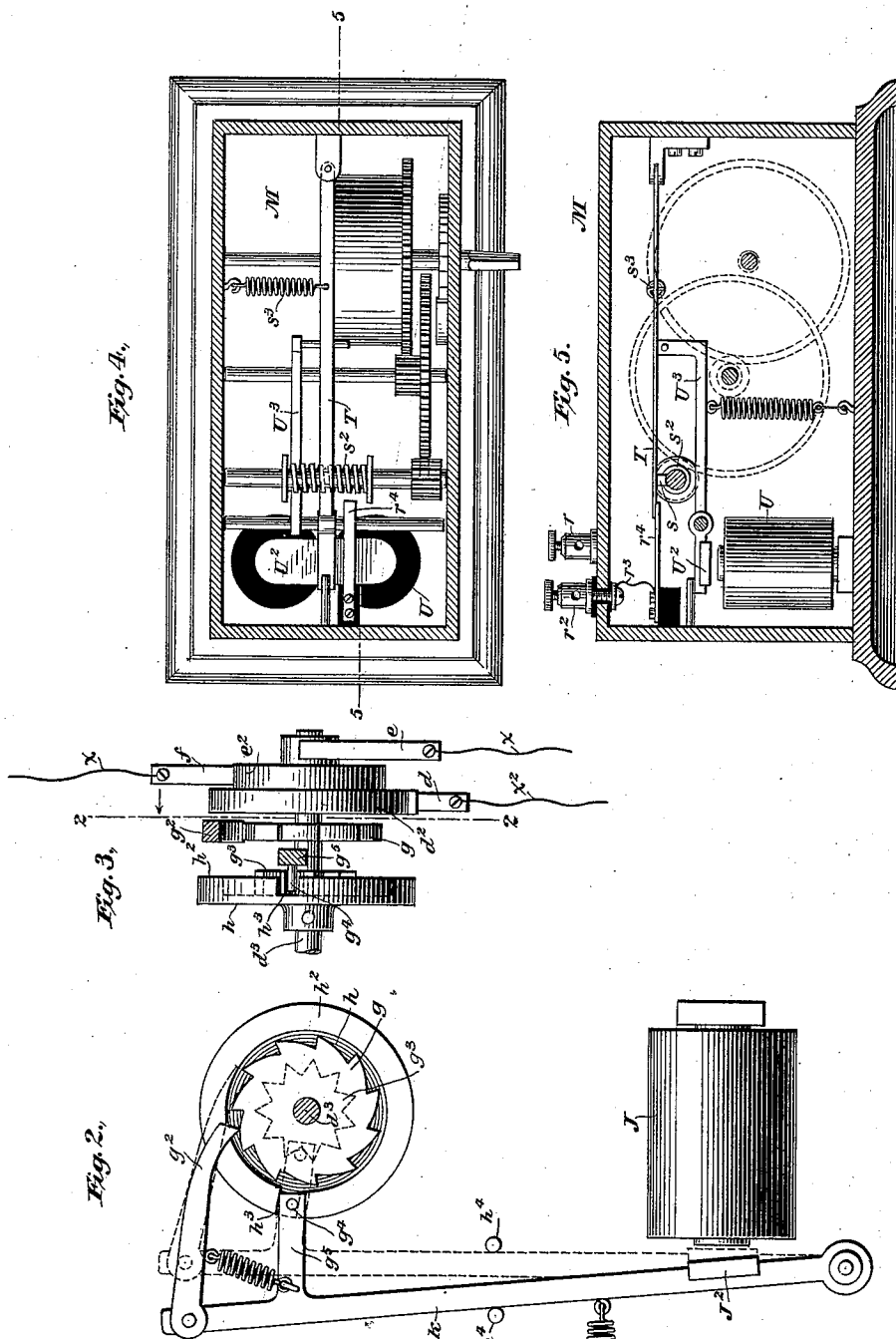
Witnesses
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Fig. 1.
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(No Model.)

2 Sheets—Sheet 2.

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NON-INTERFERING SUCCESSIVE SIGNALING SYSTEM AND APPARATUS.
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Witnesses
Geo. M. Brock
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UNITED STATES PATENT OFFICE.

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NON-INTERFERING SUCCESSIVE SIGNALING SYSTEM AND APPARATUS.

SPECIFICATION forming part of Letters Patent No. 461,464, dated October 20, 1891.

Application filed October 24, 1890. Serial No. 369,205. (No model.)

To all whom it may concern:

Be it known that I, FRANK B. WOOD, a resident of New York city, county and State of New York, have invented certain Improvements in Successive Non-Interfering Electric Signaling Systems and Apparatus, of which the following is a specification.

This invention relates more particularly to fire and police signaling systems, and to that class of systems wherein a call or signal can be sent from the central office to any box or station on a policeman's beat or elsewhere, and wherein, also, a signal can be sent from said station to the central office, as a fire-alarm, or another signal, as a police message.

One object of the invention is to utilize a normally-closed circuit to send the various calls in either direction to or from any box or station in circuit with the central office.

Another object is to utilize a normally-open circuit in connection with said normally-closed circuit to prevent more than one call or signal from passing over the main line at one time and to hold in check any signal mechanism that may be pulled simultaneously with the one nearest the central office, or while one call or message is being delivered, and to then permit the call from the nearest of said pulled mechanisms to pass along the line, and so on consecutively till all the pulled boxes have sent their calls, while also preventing the central office from sending a call to a station or box while a call is passing from the box to the central office, and also preventing the call from passing from a box to the central office while the central office is sending a call to a box, whereby after the call is recorded in the central-office register the circuit will be restored automatically and the central office will be free to send its call to a box or station, while the call-boxes at the several stations will also then be free to send their messages.

The invention consists in the novel details of improvement that will be more fully hereinafter set forth, and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming part of this specification, wherein—

Figure 1 is an elevation of my improved

system and mechanism used therewith, part of the mechanism being in section. Fig. 2 is an enlarged detail view, partly in section, on the line 2 2, Fig. 3, showing part of the signal-operating mechanism in the police-call box. Fig. 3 is an edge view, partly in section, of the mechanism shown in Fig. 2. Fig. 4 is a horizontal section of the register at the central office, showing the means for controlling the mechanism for sending a police call from the central office and for restoring the normally-open circuit; and Fig. 5 is a section on the line 5 5 of Fig. 4.

In Fig. 1 the mechanism on the left is that situated at the central office. The mechanism on the right is that contained in the box from which police and fire alarms are sent to the central office, and the series of boxes in the center of the drawing are the call-boxes, similar to that on the right, in circuit in the main line.

The letter *x* in the drawings indicates the main line for sending messages, calls, or signals to and from the central office. Said main line *x* is a normally-closed line provided with a suitable battery A.

B are police and fire signaling boxes in circuit in the main line and containing mechanism for sending and receiving calls or signals. There may be any desired number of said boxes in the main line *x*, in the example shown there being nine. In each box B there is a police-signal-receiving mechanism D, a police-call-sending mechanism E, and a fire-alarm-sending mechanism F. In the main line *x* is also the mechanism G for sending a police-signal to any box B. This mechanism, as shown, consists of two circuit-breaking wheels $G^2 G^3$, which have a notch *a* for each box B. In the line *x* are two contacts *b b^2* to engage the circuit-wheels $G^2 G^3$, respectively, as shown.

b^3 is a handle on the shaft b^4 of the circuit-wheels $G^2 G^3$, whereby said wheels will be turned simultaneously to break the circuit through $b b^2$. Of course this mechanism $G^2 G^3 b b^2$ can be altered as desired.

H is a dial or the like carrying graduations 1 2 3 4, &c., to indicate the different boxes B, and the handle b^3 will first be placed over any number on the dial in order to operate the

mechanism D in the desired box B. In the mechanism D, I have shown a semaphore-signal D^2 , which is to be operated in a box B from the central station only when the handle b^3 is placed over a number on the dial H corresponding to the box B desired; but an audible or flash signal can be used in place of the semaphore D^2 , if desired. The semaphore D^2 is shown connected with an armature I of the magnet I^2 in the main line x or a branch x^4 thereof. One terminal of the magnet I^2 is connected by a wire x^2 with a contact-strip d , that is adapted to engage a circuit-breaker d^2 on a shaft d^3 , journaled in the box B. The contact d is normally out of engagement with the circuit-breaker d^2 ; but the latter has a projecting part d^4 , which will engage the contact d when the circuit-breaker d^2 is turned sufficiently far. The projections d^4 are so arranged in the several boxes B that only one projection d^4 in all the boxes B will engage its respective contact d at one time; but there is also on each breaker d^2 another projection d^5 , adapted to engage the breaker d . These projections d^5 in all the boxes B are all in the same relative positions with relation to the contact d , so that when the handle b^3 is turned to, say, 10 all the projections d^5 will engage all the contacts d , whereby all the signals D^2 can be operated simultaneously.

e is a contact-strip in circuit in the main line x , (or a branch thereof,) which contact e is always in electrical connection with the shaft d^3 , as shown. The shaft d^3 also carries a circuit-breaker e^2 , which has a notch or depression e^3 about in line with the projection d^4 on the circuit-breaker d^2 .

f is a contact-strip in the main line x (or a branch thereof) and adapted to engage the circuit-breaker e^2 .

J is a magnet in the main line x and connected with the contact e .

The above parts are shown in their normal positions, and the circuit is normally closed through f , e^2 , d^3 , e , and J ; but when the shaft d^3 is turned sufficiently far to cause the projection d^4 to engage the contact d the circuit will be broken through f , e^2 , e^3 , d^3 , e , and J , and closed through d , d^4 , d^3 , and e , thus throwing the magnet I^2 in the line x , so that its armature I can be operated; but the armature I is polarized with a pole opposite to the pole from whence the current in the line x normally flows, so that the armature I will not be actuated until a reverse current is passed through the line, as hereinafter specified.

The circuit-breakers d^2 and e^2 are to be actuated from the central office by means of the circuit-breakers G^2 G^3 . The breakers d^2 e^2 are moved as follows: To the shaft d^3 is secured a ratchet or toothed wheel g , that is adapted to be engaged by a pawl g^2 , carried by a lever K, which carries the armature J^2 of the magnet J. The parts are so adjusted that each time the armature J^2 is attracted by its magnet (through G^2 G^3 b b^2) the wheel g will be turned the space of one tooth, and

thereby the circuit-breakers d^2 e^2 the same distance. The shaft d^3 also carries a star-wheel g^3 , which is adapted to be engaged by a pin or lug g^4 or a projection g^5 , carried by the lever K. (See Figs. 2 and 3.) Said star-wheel and lug act to prevent the wheel g from being turned too far by the pawl g^2 or by any momentum said wheel may acquire. On the shaft d^3 is also a wheel or disk h , that has an annular flange or projection h^2 on one side, whereby a hollow space is formed on one side of the wheel h . (See Figs. 2 and 3.) The pin g^4 passes into said hollow space and is adapted to ride along the inner side of the flange h^2 . One part of the flange h^2 is cut away, as at h^3 , so that the pin g^4 can enter the space h^3 to move the armature J^2 farther away from its magnet J than when the pin g^4 is on the inner side of the flange h^2 . The pin g^4 is in the space h^3 when the other parts are in their normal position, as in Fig. 1. Pins h^4 limit the movement of the lever K.

The strength of the current from the battery A, which normally works the main line, will not be sufficient to cause the magnet J to attract its armature J^2 when the pin g^4 is in the space h^3 , (the armature then being out of the magnetic field,) so that a stronger current must be used to draw the armature J^2 to its magnet, and thus move the pin g^4 out of the space h^3 . This I accomplish as follows: A^2 is a battery connected with the main line x —say between A and G. The battery A^2 also leads by a wire x^3 to a contact i , preferably situated in the dial H. i^2 is another contact adjacent to but insulated from the contact i , which contact i^2 leads by a wire x' to the main line x . The handle b^3 carries a circuit-closer or contact-strip i^3 , which is adapted to close the circuit between x' and x^3 through i and i^2 .

The circuit-wheels G^2 G^3 each have a long break i^4 in such a position that when the strip i^3 is moved to engage the contacts i i^2 the circuit will be broken through b b^2 and closed through i i^2 , thereby throwing the battery A^2 into the main line x , in addition to the battery A, whereby a current of increased strength passes over the line x . This increased current energizes the magnet J, so as to draw the armature J^2 , thereby causing the pawl g^2 to turn the ratchet g and shaft d^3 one tooth or space, at the same time moving the pin g^4 out of the space h^3 and within the circle of the flange h^2 . The space h^3 is now moved out of line with the pin g^4 and the flange h^2 brought in line with the pin g^4 , which thereby prevents the armature J^2 from moving out of the normal magnetic field of the magnet J when the circuit is next broken through x b b^2 . When the handle b^3 is next moved farther to the right, the circuit will be broken through i i^2 i^3 , thus cutting out the extra battery A^2 , and restored through b b^2 G^2 G^3 , thus restoring the normal current from A to the line x . Each time the handle b^3 is

moved over a space 1 2 3, &c., on the dial H the circuit will be made and broken through $b^2 G^2 G^3 a$, whereby the shaft d^3 will be turned step by step as the handle sweeps over 1 2 3, &c., until the shaft d^3 makes a complete revolution as the handle b^3 makes a revolution over the dial H.

Suppose now the operator at the central office desires to operate the signal D^2 in one of the boxes B—say box 9. The parts in all the boxes being in their normal positions, the pins g^4 will be in their respective spaces h^3 in the wheels h . The operator now turns the handle b^3 , which first makes contact through $i^2 j^3$, thereby increasing the current through x , as before stated, whereupon the shaft d^3 will be moved one space. As the handle b^3 passes over the spaces 1 2 3, &c., the shafts d^3 in all the boxes B will be turned step by step, causing the magnet I^2 to be cut into and then out of the line in the boxes 1 2 3, &c., consecutively until the handle b^3 is brought to rest over 9 on the dial, when the line will be closed through $d^4 d^3$, &c., and broken through f, e^2, e^3 , and d^3 , whereby the signal D^2 will be brought into circuit in the box desired. As the projections d^4 in the other boxes B do not at this time engage the contacts d , they having passed that point, the signals in the other boxes B will not be in circuit. When a current is now sent along the line to attract the armature I, the signal D^2 will be operated only in the desired box. When the handle b^3 is next returned to zero, the space h^3 on the wheel h will be brought in line with the pin g^4 , which latter will then enter said space, as before stated, ready to be again drawn out by an increased current.

If it is desired to actuate the signals D^2 in all the boxes B at the same time, the handle b^3 will be brought over the space 10 on the dial, whereby the projections d^6 in all the boxes B will be in contact with their respective contacts d to close the circuit in all the boxes B through the magnets I^2 .

The following is one means for sending a current through the line x to operate the signal D^2 : The current passing from the battery A through the line x in the direction of the arrows is preferably a positive current, and the armature I of the magnet I^2 is polarized with a positive pole, so that it will not be actuated by the normal positive current passing through the magnet I^2 . In order that the armature I^2 may be attracted, a negative current must be sent through the line x in the direction of the arrow. To reverse the current for said purpose and still permit the positive current to pass in the direction of the arrow when the signal D^2 is not to be actuated, I insert two contacts 11 and 12 in the line x . 14, 15, 16, and 17 are circuit-breakers carried by a shaft 18, insulated from each other and from said shaft. The strip 11 is adapted to contact the circuit-breaker 14, as is also and simultaneously therewith, a contact-strip 19, which

leads through the line x to the negative pole of the battery A. The negative pole of the battery A connects by a wire 20 with a contact-strip 21, adapted to engage the circuit-breaker 15. Another contact-strip 22, engaging the circuit-breaker 15, connects with the line x . When thus arranged the current passes from the positive pole of the battery through 11 14 19, through the line x , to 22 15 21 20, to the negative pole of the battery. The positive pole of the battery connects with the contact-strip 12, adapted to engage the circuit-breaker 16 (as is also the strip 23) on the same side of the line as 22; but 12 and 23 are normally out of contact with 16. The negative pole of the battery also connects by a wire 24 with a contact-strip 25, that is adapted to engage the breaker 17, (but normally out of contact therewith,) as is also a contact-strip 26, that connects by a wire 27 with the line-wire x . When now it is desired to actuate the signal D^2 , the circuit-breakers are given a partial turn, which breaks connection between 11 and 19 with 14 and between 21 and 22 with 15 and makes connection between 12 and 23 with 16 and between 25 and 26 with 17. The current now passes from the negative side of the battery, through 24 25 17 26 27 $b^2 G^2 G^3 b x x^4$, to the magnet I^2 , which will immediately attract the positively-polarized armature I, and thus attract the signal D^2 . The current passes thence through $x^2 d^4 d^3 e J x 23 16 12$ to the positive pole of the battery. The armature I may be made to vibrate while the circuit remains closed in manner well known, or the circuit-breakers 14, 15, 16, and 17 may be rotated by hand or by suitable mechanism to make and break the circuit continuously. When the line is to be again used for messages, the circuit-breakers 14, 15, 16, and 17 should be turned back to the position shown in the drawings.

The above-described means for sending a reverse current through the line to actuate the signal D^2 is substantially the same as that described in my application, Serial No. 360,779, filed August 2, 1890, and need not be here further described.

M is the register at the central office in circuit with the main line x , as shown.

The police-call mechanism E and the fire-alarm mechanism F in each box B are each in circuit with the main line x , but will only operate when a normal current from the battery A is passing over the line. The call or signal-sending mechanisms proper E and F may be of suitable construction, in the example shown $E^2 F^2$ being the call or signal writing wheels of said mechanisms, respectively, $E^3 F^3$ being contacts to engage the wheels $E^2 F^2$, respectively. On the police-call E the breaks in the wheel E^2 are preferably short, while in the fire-call F the breaks on the wheel F^2 are preferably long, for the purpose hereinafter set forth.

It is designed that only one call from one mechanism E or F in any box B in the line x

can be sent in at once; and if more than one of such mechanisms be pulled at once or while a call is going in each will have to wait until the one nearest the register has finished, the calls being then allowed to pass in consecutively; also, if a call is passing in from E or F, to prevent the central-office operator from moving the handle b^3 to send a signal, and also, if the central office is using the line, to prevent a call passing along the line from E or F until the central office is through. This I accomplish by connecting the mechanisms E F and H b^3 , with a normally-open circuit y , as follows: In each mechanism E and F is a magnet N in circuit with the line y , or a branch thereof, one terminal of said magnet leading to a contact N^2 . N^3 is another contact adapted to engage N^2 , but normally out of contact therewith, which contact N^3 leads by a wire y' to zero or ground. When contacts N^2 N^3 engage, the normally-open circuit y will be closed. In the line or circuit y is a magnet O, one terminal of which leads through the battery O^2 to ground, while the other terminal leads to a contact O^3 , normally in contact with a circuit-breaker P. The breaker P has a projection j , normally in contact with a contact-strip P^2 in circuit in the line y . The circuit-breaker P is held in the position shown by a catch or lever Q engaging a pin j^2 on the breaker P. The catch or lever Q also carries the armature Q^2 of the magnet O, so that when said armature is attracted the breaker P will be released, which will then be moved to break the circuit through j P^2 by means of a spring l , connected to an arm l^2 , rigidly connected with the breaker P, which spring moves the breaker P to cause the projection j to pass from under the contact P^2 . The motion of the arm l^2 or the breaker P is limited by stop l^3 l^4 .

R is a rod shown resting on the arm l^2 and adapted to slide in bearings m and to be raised by the action of the spring l . The rod R is adapted to prevent the handle b^3 from being moved when the circuit is closed through N^2 N^3 , and for this purpose I have shown an arm R^2 connected with the handle b^3 —say by being secured to the shaft b^4 . This arm R^2 is in such a position that when the parts are in their normal positions the rod or stop R will not engage the arm R^2 ; but when the circuit is closed through N^2 N^3 the armature Q^2 will be attracted, thus releasing the breaker P, whereupon the spring l will act to pass the rod R in front of the arm R^2 , as shown in dotted lines, and thus prevent the handle b^3 from being turned. By the above arrangement when a call or signal is being sent from E or F the operator at the central office is prevented from turning the handle b^3 to send a call or interrupt the call from E or F.

To prevent more than one call or signal from any mechanism E or F in any one or more boxes B to pass over the line x at one time and to hold back any call or signal whose

mechanism may be started simultaneously with another or while another is passing over the line, the following mechanism is used in connection with the normally-open circuit y : The armature n of each magnet N is carried by a lever n^2 , which has a projection or arm n^3 , which is adapted to hold in check the escapement n^4 of the call or signal-writing mechanism E and F—say by coming against an arm n^5 , connected with n^4 , as shown. The end of the lever or catch o is adapted to pass in front of the lever n^2 when the armature n is attracted by the magnet N. The lever o is also engaged by an arm p , connected with the handle q of the call mechanism E and F.

The above parts are constructed and operate substantially similarly to the corresponding parts shown in my application, Serial No. 360,779, before mentioned, where a more detailed description is given.

The arm p is adapted to engage the contact N^2 and to close the circuit between N^2 and N^3 . When this is done the armature n will be attracted, which will raise arm n^3 and release the escapement n^4 to permit a message to be sent along the line x . When the circuit is thus closed, the armature O will attract its armature O^2 , whereupon the circuit-breaker P will be moved by its spring l and break the line through j P^2 , while the rod R will be moved to prevent the handle b^2 from being turned. The call or signal will be received by the register M or otherwise. If more than one mechanism E or F be pulled at the same time, the armature n in the one nearest the register will be attracted and the line y broken, while all the other pulled mechanisms will be held back until said call or signal is recorded and the circuit in y restored through P, when the armature n in the next nearest mechanism will be attracted to permit that mechanism to operate, and so on through all the pulled boxes. If a mechanism E or F be pulled while a call is passing from another mechanism, said first-mentioned mechanism will not operate to send the call until the other is through, as the line y is then broken through P, and thus is not restored till after the signal is recorded; but as soon as P is restored the call from said pulled box will be recorded.

It will be seen that only one main line y is used for all the boxes B, each mechanism E and F having a line y' to zero or ground, whereby the circuit can be closed through N^2 N^3 .

It is preferred that the circuit be closed through P automatically after the signal is recorded in M, and this may be accomplished as follows: S is a magnet whose armature S^2 is carried by the arm l^2 . The terminals of said magnet lead by wires S^3 S^4 to binding-posts r r^3 on the register M, a suitable battery A^3 being in the circuit. One of the posts—say r^2 —leads by a wire r^3 to an insulated contact-strip r^4 , that is adapted to be engaged by a contact-strip T (see Figs. 4 and 5) after the call or

signal has been recorded and then to close the circuit through S. The contact T carries a lug s , that works into a worm s^2 , driven by the gearing of the recorder, the tendency of the worm s^2 being to move the contact T against the tension of the spring s^3 to cause contact between T and r^4 ; but while the signal is being recorded the magnet U of the register lifts the contact T intermittently out of the worm s^2 by means of the armature U² and lever U³, whereupon, in connection with the spring s^3 , the contact T is prevented from engaging contact r^4 ; but after the signal is recorded the armature U no longer lifts the contact T, whereupon the worm s^3 will move the contact T to engage the contact r^4 , which closes the circuit through magnet S, thereby drawing down the arm l^2 , restoring the circuit in y through P, and releasing the handle b^3 . The call-writing wheel E² has short breaks, while the wheel F² has long breaks. This is for the purpose of causing the bell V to be rung only when a fire-alarm is sent from F. The magnet V² of the bell V is in circuit in the main line x and its armature V³ or the armature-support is normally held against the magnet V² by the closed circuit through x . One terminal of the bell mechanism V leads to a contact l^2 , that is adapted to be engaged by the armature V³ or its support. Said armature or its support forms part of the circuit of the bell V, as shown. The other terminal of the bell mechanism V leads by a wire l^3 to a battery A⁴. The spring u for the armature V³ is of such a weak tension that when short breaks pass through the magnet V² from the writing-wheel E² the spring u will not have strength to draw the armature V³ away from its magnet V², and therefore the circuit will not be closed through V³ l^2 , and therefore the bell V will not be rung by the current from E²; but when long breaks from the wheel F² of the fire-alarm pass over the line x the spring u will have sufficient time to draw the armature v^3 and thus close the circuit through V³ l^2 , whereupon the bell V will be sounded to notify the attendant that a fire-alarm is being received by the register or recorder M.

When the operator at the central office is sending a signal to D, no call or signal can be sent from E or F. This is effected by the central office breaking the line y , which is done as follows: The line y leads to the dial H and is connected to the contact strips or plates $w w^2$, which are insulated from each other, as shown. When the handle b^3 is at zero or in the normal position, the strip i^3 will contact w and w^2 , and thus the line y will be closed through $w i^3 w^2$. If now the operator turns the handle b^3 , the circuit will be broken through y at $w w^2 i^3$, as i^3 then disconnects from $w w^2$, and if any mechanism E or F should be pulled while the line y is broken at $w w^2$ the call will be held back, as the magnet N (not then being energized) cannot attract its armature n , and therefore the es-

capement n^4 will not be released to permit the call to pass from E or F. As soon as the handle b^3 is next returned to zero the circuit y will be again closed through $w i^3 w^2$. The magnet N in any mechanism E or F that may have been pulled (and the nearest one to the central office that was pulled, if more than one was pulled) will immediately become energized, which will release said mechanism E or F to send the call or message, while the circuit y will then immediately be broken at P, thus moving up rod R to prevent the handle b^3 from being turned until after the message is recorded in M, whereupon the circuit will be restored through P, as the magnet S then draws down l^2 and R, releasing the handle b^3 .

Z is a catch to hold the semaphore-arm D² after the magnet I² actuates it. A pin or the like Z², carried by the door of the box B, (not shown,) will release the arm D² from the catch Z when the door is opened.

Having now described my invention, what I claim is—

1. A signaling system comprising a normally-closed main line, a series of transmitters in said line, a signal-sending mechanism in said line located at the central office, a normally-open ground-circuit y , connecting with said transmitters, and circuit-breakers connecting the line y with said signal-sending mechanism, so that when said signal-sending mechanism is actuated the line y will be broken by it, substantially as described.

2. A normally-closed main line; a series of transmitters in said line, signal-sending mechanism also in said line and located at the central office, a handle, as b^3 , for said signal-sending mechanism, and a separate normally-open ground-line y , connecting said transmitters, said handle b^3 carrying a contact to make and break the line y when said signal-sending mechanism is actuated, substantially as described.

3. A normally-closed main line, a series of transmitters in said line, signal-sending mechanism also in said line and located at the central office, a handle, as b^3 , for said signal-sending mechanism, a separate normally-open ground-line y , connecting said transmitters, terminals $w w^2$ in said line y and insulated from each other, and contact i^3 on the handle b^3 for making contact from w to w^2 to close the line y at that point, whereby when said signal-sending mechanism is actuated the line y will be broken, substantially as described.

4. A signaling system comprising a normally-closed main line, a signal-sending mechanism in said line located at the central office, a series of transmitters also in said line, a normally-open ground-circuit connecting said transmitters, and mechanism in said open circuit to prevent the signal-sending mechanism in the main line from being operated when a transmitter is using the main line, substantially as described.

5. A normally-closed main line, a signal-

sending mechanism, as G, in said line and an arm or the like R² connected therewith, a series of transmitters in said main line, a normally-open ground-line *y*, connecting said transmitters, a magnet, as O, in the line *y*, and intermediate mechanism actuated by said magnet to engage the arm R² when the circuit is closed through *y* to prevent the signal-sending mechanism in the main line from being actuated when the transmitters are being used, substantially as described.

6. A normally-closed main line, a signal-sending mechanism, as G, in said line and an arm or the like R² connected therewith, a series of transmitters in said main line, a normally-open ground-line *y*, connecting with said transmitters, a magnet O in said line *y*, a rod R to engage the arm R², an arm *l*² to actuate the rod R, a catch, as Q, to hold the arm *l*² in the normal position, the magnet O, actuating said catch, and a spring to move the arm *l*² when it is released by the magnet O, substantially as described.

7. In a signaling system, a normally-closed main line, a signal-sending mechanism in said line located at the central office, a series of transmitters also in said line, a normally-open ground-circuit *y*, connecting said transmitters, circuit-breaking mechanism connecting the line *y* with said signal-sending mechanism to break said line *y* when the signal-sending mechanism is actuated, and mechanism in said open circuit to prevent the signal-sending mechanism from being operated when a transmitter is using the main line, substantially as described.

8. In a signaling system, a normally-closed main line, a series of transmitters in said main line, and a signal-receiving mechanism, as M, also in said main line, a normally-open ground-circuit *y*, connecting with said transmitters, a circuit-breaking mechanism, as O P, in said line *y*, and a magnet connected with said signal-receiving mechanism for restoring the circuit in *y* automatically after the signal is recorded, substantially as described.

9. In a signaling mechanism, a normally-closed main line, a signal-sending mechanism in said line, a series of transmitters in said main line, and a signal-recording mechanism also in said main line, a normally-open ground-circuit *y*, connecting with said transmitters, circuit-breaking mechanism, as O P, in said line *y*, a magnet, as S, connected with the signal-recording mechanism for restoring the circuit in *y* after the signal is recorded, and mechanism in said line *y* to prevent the signal-sending mechanism in the main line from being operated when a transmitter is being used, substantially as described.

10. In a signaling system, a normally-closed main line, a signal-sending mechanism in said line, a series of transmitters in said main line, and a signal-recording mechanism also in said main line, a normally-open ground-circuit *y*, connecting with said transmitters, circuit-

breaking mechanism connecting said line *y* with said signal-sending mechanism to break said line *y* when the signal-sending mechanism is actuated, circuit-breaking mechanism, as O P, in said line *y*, a magnet, as S, connected with the signal-recording mechanism for restoring the circuit in *y* after the signal is recorded, and mechanism in said line *y* to prevent the signal-sending mechanism in the main line from being operated when a transmitter is being used, substantially as described.

11. A normally-closed main line, a series of transmitters in said main line, a signal-receiving mechanism, as M, also in said line, a normally-open ground-circuit *y*, connecting with said transmitters, a magnet O in said circuit *y*, contacts O³ P², circuit-breaker P, projection *j* thereon, catch Q, armature Q², arm *l*² to actuate P, spring *l*, armature S², magnet S in circuit with M, and mechanism in M to close the circuit through magnet S after the signal has been received in M, substantially as described.

12. A normally-closed main line, circuit-breakers G *b* in said line, a handle, as *b*³, for said breakers, and an arm or the like R², a series of transmitters in said line, a signal-recording mechanism M in said line, a normally-open ground-circuit *y*, connecting with said transmitters, terminals *w w*² in said circuit, contact *i*³ on the handle *b*³ to close and break the circuit in *y* through *w w*², magnet O, contacts O³ P², circuit-breaker P, having projection *j*, catch Q, armature Q², arm *l*², spring *l*, rod R, magnet S, armature S², a line-circuit connecting the magnet S with the mechanism M, and mechanism in M to close the circuit through magnet S after the signal is recorded in M, substantially as described.

13. In a signaling system, a normally-closed main line, a transmitter whose call-writing wheel has short breaks, another transmitter whose call-writing wheel has long breaks, a normally-open ground-circuit *y* for controlling said transmitters, a magnet, as V², in said main line, a bell, as V, in a separate circuit, the armature of the magnet V² being included in the circuit of the bell V, and the armature-spring *u*, of such a weak tension as to actuate said armature when long breaks pass through the magnet V², but to not actuate said armature when short breaks pass through the magnet V², substantially as described.

14. A normally-closed main line, a transmitter whose call-writing wheel has short breaks, a transmitter whose call-writing wheel has long breaks, a normally-open ground-circuit *y* for controlling said transmitters, a magnet V² in said main line, a bell mechanism V in a separate circuit, a terminal *l*² in said circuit, the armature V³ for the magnet V², adapted to close the circuit in V through the terminal *l*², and the armature-spring *u*, of such a weak tension as to actuate said armature when long breaks pass through the mag-

net V^2 , but to not actuate said armature when short breaks pass through the magnet V^2 , substantially as described.

15. In a signaling system, a normally-closed main line containing a battery, a circuit-breaker, as $G b$, in said line, a magnet J in the line, the armature J^2 for said magnet being normally out of the magnetic field of said magnet, a normally-open short circuit, as $x' x^3$, containing a battery, as A^2 , and extending from one part of the main line to another between the main battery and the magnet J , a contact-maker connected with the circuit-breaker $G b$ for automatically closing the circuit through $x' x^3$ to throw the battery A^2 into the main line to increase the magnetic field in magnet J , so as to attract its armature, substantially as described.

16. A normally-closed main line, circuit-breakers, as $G b$, in said line, a handle, as b^3 , for said breakers, contact v^3 on said handle, a magnet J in said line, the armature J^2 for said magnet being normally out of the magnetic field of said magnet, a line $x' x^3$ looped in the main line between its battery and magnet J , terminals $i i^2$ in the line $x' x^3$ and insulated from each other, a battery, as A^2 , in the line $x' x^3$, the contact v^3 being adapted to engage i and i^2 to close the circuit in $x' x^3$, while the circuit is broken through $G b$ to throw the battery A^2 into the main line to increase the magnetic field in magnet J , so as to attract its armature, and means, substantially as described, for holding said armature within the normal magnetic field of J after the circuit through $x' x^3$ is broken, substantially as described.

17. A normally-closed main line and a signal-sending mechanism located at the central office, combined with a magnet J , whose armature J^2 is normally out of the magnetic field, lever K , carrying said armature, and pin or projection g^4 , carried by said lever, and with a wheel having a hollow or depression on one side to receive the pin g^4 to hold the armature within the magnetic field of J , and also having a space, as h^3 , to receive the pin g^4 to hold the armature out of the magnetic field of the magnet J , substantially as described.

18. Magnet J , armature J^2 , lever K , projection or pin g^4 , carried by said lever, wheel h , and flange h^3 on said wheel, against the inner side of which the pin g^4 can run to hold the armature J^2 within the magnetic field of J , said flange having a space h^3 to receive the pin g^4 when the armature J^2 is out of the magnetic field of J , combined with the shaft d^3 , carrying the wheel h , toothed wheel g , and pawl g^2 on the lever K , substantially as described.

19. Magnet J , armature J^2 , lever K , pin g^4 ,

carried thereby, and pawl g^2 , combined with the shaft d^3 , wheel h , having rim h^2 , and opening h^3 in said rim, toothed wheel g , and star-wheel g^3 , against which said pin g^4 is adapted to abut, whereby as the magnet J attracts its armature the shaft d^3 will be turned step by step and overrotation prevented by the pin g^4 engaging the star-wheel g^3 , substantially as described.

20. A main line containing a magnet J , shaft d^3 , and intermediate mechanism between magnet J and said shaft for turning said shaft, circuit-breakers $d^2 e^2$ on said shaft, contacts $d f$ for said breakers, respectively, a contact e , leading from the magnet J to the shaft d^3 , the contact d^2 leading to one terminal of a magnet I^2 , whose other terminal leads to the main line, the contact f leading to the main line, whereby when e^2 and f are in contact the magnet I^2 will be out of circuit, but when d and d^2 contact the magnet I^2 will be in circuit in the main line, substantially as described.

21. A main line, a series of magnets J and I^2 in said line, a series of shafts d^3 , a circuit-breaker d^2 on each shaft d^3 , each circuit-breaker having a projection or circuit-closer d^6 , arranged in the same relative position, and a projection or circuit-closer d^4 , arranged in different relative positions, contact d , leading to a terminal of the magnet I^2 , circuit-breaker e^2 on the shaft d^3 , contact f to engage the same, and contact e , leading from the magnet J to the shaft d^3 , substantially as described.

22. A main line containing circuit-breakers $G b$, magnets J and I^2 , shaft d^3 , carrying circuit-breakers $e^2 d^2$, contact e , leading from the shaft d^3 to the magnet J , contact f , leading from the main line to circuit-breaker e^2 , contact d , leading from breaker d^2 to the magnet I^2 , and a step-by-step mechanism, substantially as described, for turning the shaft d^3 to cause e^2 and f and d and d^2 to contact each other, respectively, but alternately, substantially as described.

23. A normally-closed main line, a magnet I^2 , having a polarized armature and a semaphore connected thereto, and a catch, as Z , for holding said semaphore after the current leaves the magnet, combined with a door, a connection on the door for releasing the catch when the door opens to release the semaphore, and with a current-reverser in said line for actuating said semaphore when a reverse current passes through the main line, substantially as described.

FRANK B. WOOD.

Witnesses:

THEO. W. BAYARD,
T. F. BOURNE.