(No Model.)

F. W. COLE.

ELECTRIC SIGNALING APPARATUS.

No. 465,991. Patented Dec. 29, 1891.

Fig. 1.

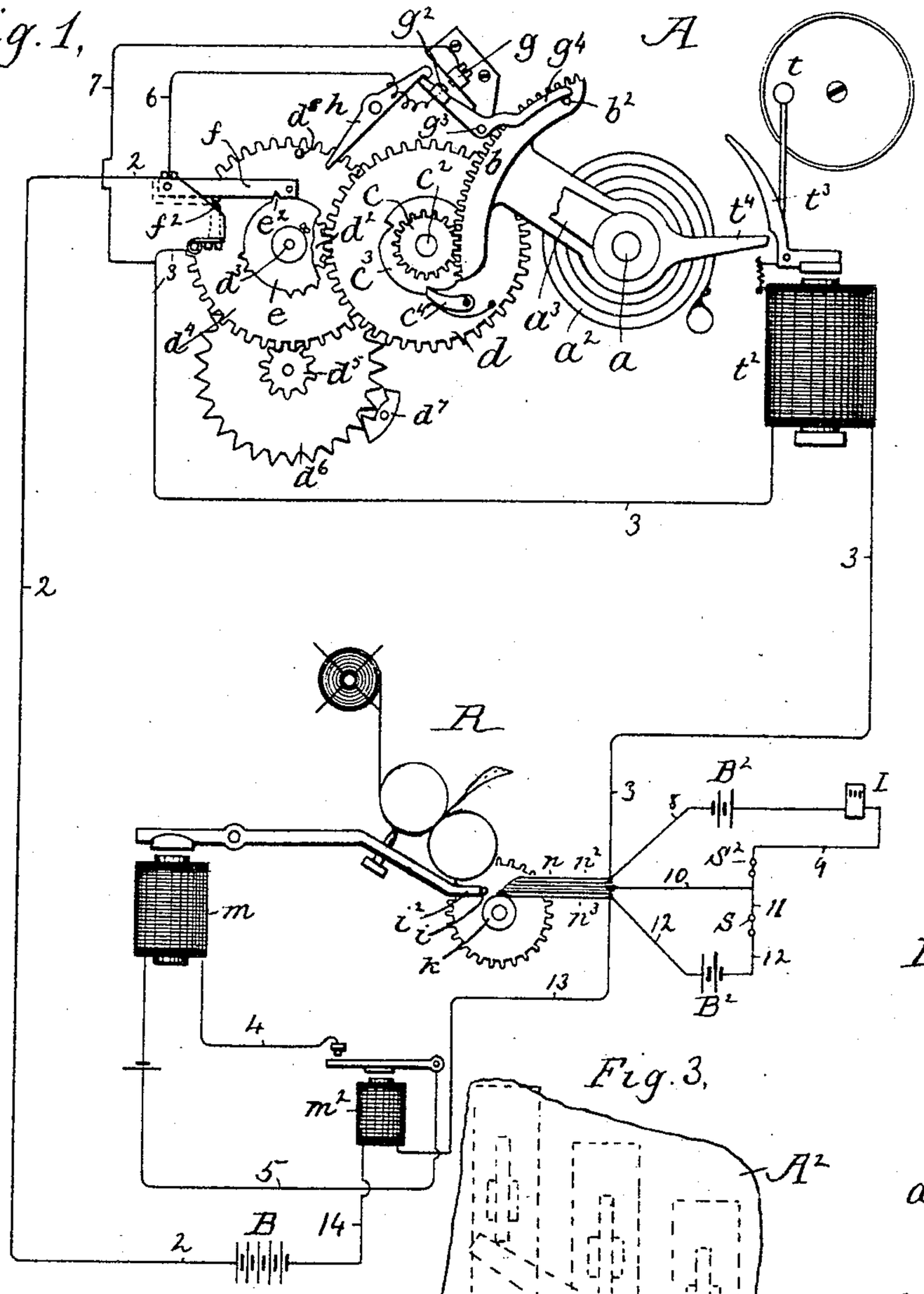


Fig. 4.

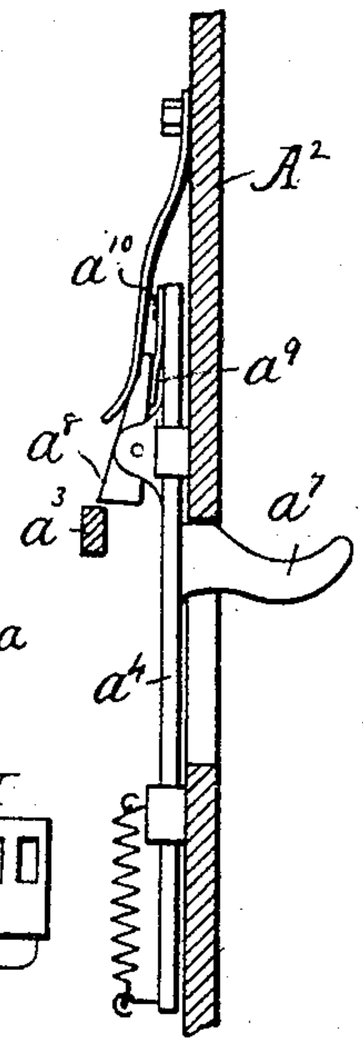
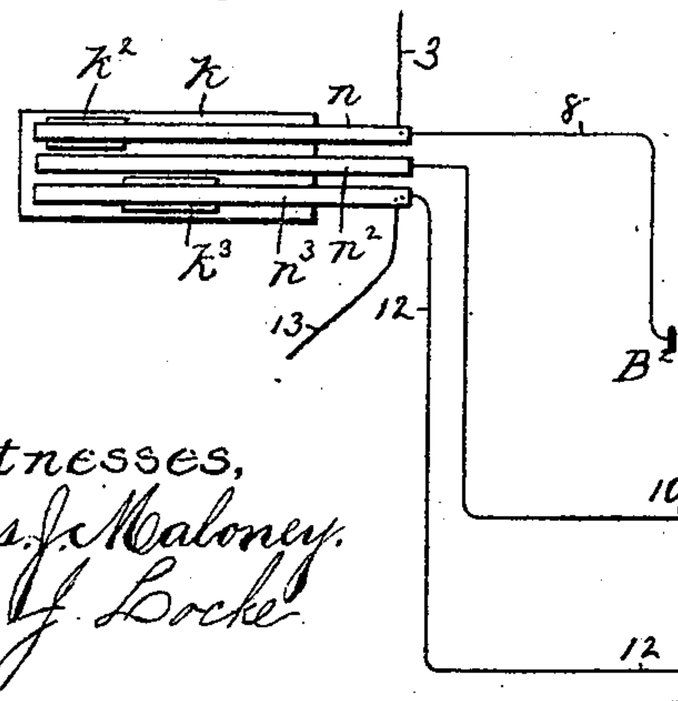


Fig. 3.

Fig. 2.



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ELECTRIC SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 465,991, dated December 29, 1891.

Application filed January 6, 1890. Serial No. 335,980. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK W. COLE, of Newton, county of Middlesex, State of Massachusetts, have invented an Improvement in Electric Signaling Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like figures and letters on the drawings representing like parts.

My invention relates to an electric signaling apparatus comprising a signal box or transmitter for automatically transmitting a message by breaking and closing an electric circuit or producing other changes in the current of said circuit, and a receiving apparatus at a signal-receiving station or stations which is responsive to such changes in the circuit, and thus makes known at the receiving-station the signal or message sent by the operator of the signal-box.

The object of the invention is to enable the operator of the transmitter to send information of different kinds and to cause the message to be received upon any desired one of several different instruments, which may, if desired, be located at different points or in different buildings, according to the nature of the message, which message, so far as the characters or circuit changes of which it is composed are concerned, is always the same, but has a different meaning or signification according as it is received upon one or another of the different instruments referred to.

For convenience the apparatus will be described as employed in a police-telegraph and as adapted to give three distinct pieces of information—one, for example, being that the police-wagon is wanted at the transmitting-box; the second, that the person at the transmitting-box desires to communicate by telephone or otherwise with the person at the receiving-station, and the third, merely that a person is present at the signal-box and ready to receive any message or communication from the receiving-station, but does not himself care for any further communication with said station.

It is to be understood that the terms "transmitting" and "receiving" stations are merely relative, the former referring to the signal-box, from which the greater number of messages are transmitted, and the latter to the point or points at which said messages are made known, but that on occasion messages may be transmitted in the reverse direction, in which case for the time being what has before been called the "receiving-station" would become the transmitting-station, and the reverse.

The construction of the receiving apparatus is such that while the different information is received on different instruments and at different places, if need be—as, for example, some messages being received and calling for a response from the police-station proper and others being received and calling for a response from the wagon-house or stable—all of said messages may be and, as shown in this instance, are recorded by a single telegraphic register or message-receiving instrument. These several effects are attained in accordance with this invention by the following means:

While, as before stated, the signal-box produces in all cases exactly the same current-changes and transmits exactly the same characters, which are usually a number-signal that identifies the box and thus indicates the locality from which the message is received and at which it is to be answered, if at all, the said box may be manipulated in different ways according to the nature of the message or information which it is desired to impart; and combined with said signal-box is a switch or circuit-changer, located at any desired point, preferably at the receiving-station, which governs several distinct circuits or distinct loops or branches of the main circuit, said switch being operated by a time-motor adapted to run in unison with the motor of the signal-box, and placing the said circuits or loops or branches one at a time and consecutively in control of the transmitter, and retaining each one in such control a sufficient length of time to receive the message of the box if the said message is transmitted at that time, so that by causing the transmitter to send its message at one or another time with relation to the time-movement of the said switch the message may be received in the desired one of said circuits or branches of the main circuit, and its proper significance given to it thereby. In other words, the same message received in one controlled local or branch

circuit has one signification, and in another branch another signification, and so on for as many branches as there may be, the signification of the message being determined in part at least by the circuit in which it is received and depending upon the synchronism of movement of the motors of the transmitting and receiving instruments. Of course every message is transmitted over all parts of the main circuit external to the local circuits or loops or branches of the main circuit, in one only of which it can be received, and, if desired, all the messages can be received on a signal-instrument included in said main circuit outside of the loops by which the significance of the signal is determined.

Figure 1 is a front elevation of the main operative parts of a signal-box or transmitter forming part of the apparatus embodying this invention, the circuits and a sufficient portion of the receiving apparatus to afford an understanding of the invention being shown in diagram. Fig. 2 is an additional diagram, showing more clearly the different loops of the main circuit and their controlling-switch; Fig. 3, a detail showing, in front elevation, a portion of the device for manipulating the signal-box; and Fig. 4, a sectional view showing, in side elevation, a portion of the device represented in Fig. 3.

The signal-box A, Fig. 1, may be of substantially the construction of the well-known sector or pull box used in fire-alarm-telegraph apparatus, comprising a shaft a, acted upon by a main spring or equivalent actuator a^2, and provided with a toothed sector or portion of a gear b, which meshes with a pinion or small gear c loose on an arbor c^2, and connected with a ratchet or notched disk c^3 that co-operates with a pawl c^4 on a gear-wheel d. Thus when the arbor a and sector b are turned in opposition to the stress of the spring a^2, as by a winding arm a^3, which may be manipulated directly or through intermediate mechanism by the hand of the operator, the connected gear c and ratchet c^3 are turned with relation to the pawl c^4 without moving the gear d, and when the sector b is permitted to run back under the stress of the spring a^2 the ratchet engages the pawl c^4 and turns the wheel d with it, and said wheel d drives a further train of wheel-work comprising a pinion d^2 fixed upon an arbor d^3, provided with a gear d^4, meshing with a pinion d^5 that carries an escape-wheel d^6, which, in co-operation with a vibrator or pendulum d^7, regulates the speed of movement of the said train when turned by the sector b. As shown in this instance, the sector b is of such length that by a full movement it can turn the ratchet c^3 once around, so that the pawl will engage with the same shoulder of the ratchet that left it on the beginning of the movement of the sector, and the latter in running back will thus cause the gear d to make a complete rotation; but the ratchet c^3 has three shoulders, so that by a third of the full movement of the sector b, the pawl will engage the next shoulder to the one that left it at the beginning of the movement, and will thus turn the wheel d one-third around, or by a two-thirds movement of the sector the second shoulder of the ratchet will be engaged and the wheel d will make a two-thirds movement, so that by differently manipulating the sector, the wheel d may be made to turn one-third around, or two-thirds around, or wholly around at a single operation of the sector. The gears d and d^2 are so proportioned that one-third of a rotation of the gear d makes a complete rotation of the gear d^2, so that the said pinion d^2 may be turned one, two, or three times around according to the manipulation of the sector.

The arbor d^3 carries the circuit-controlling part proper of the transmitter, which will be referred to by the usual name of "break-wheel" and is marked e, said wheel being in this instance a cam-wheel having projections or teeth that operate a key or lever f, constituting one member of a circuit-closer which normally rests in contact with the other member f^2, but is lifted from contact as each tooth of the wheel e passes and acts upon a suitable projection or portion of the key-lever f. The box also contains a circuit-closer, controlling a shunt or branch circuit around the members ff^2, so that when said shunt is closed the said members ff^2 cannot open the main circuit or produce any substantial effect thereon. The said shunt-circuit closer consists of a stationary member g and a movable member g^2, which latter is carried by a lever pivoted at g^3 and controlled as follows: The arm g^4 of said lever stands at the side of the sector b and is acted upon by a projection b^2, carried by said sector, such projection being so arranged that in the last part of the movement of the sector b to its normal position and during a sufficient portion of said movement to produce one complete rotation of the break-wheel e, as before mentioned, the said projection b^2 acts on the arm g^4 and moves it to the position shown in Fig. 1, separating the members g g^2, opening the shunts, and thus giving the break-wheel or circuit-closer ff^2 control of the main line. The movable member g^2 of the shunt-circuit closer is also controlled by a lever h, which, when engaged with the circuit-closer lever, as shown in Fig. 1, retains it open independently of the projection b^2, said lever h being operated by a projection d^8 on the wheel d^4, that accompanies the break-wheel and makes one, two, or more complete rotations, according as the sector b is moved to different points in operating the box, as before described. Thus if the sector b is moved far enough only to give one turn of the break-wheel, the pin b^2 does not leave the arm g^4 long enough to permit the circuit-closer g g^2 to close, so as to effectually cut out the break-wheel, which in its revolution causes the main line to be broken intermittently, so as to transmit the desired signal. If, however, the sector is moved far enough

to make two or more rotations of the break-wheel, the pin b^2 in such movement passes off from the arm g^4; but the shunt-circuit closer is still kept open by the lever h until, immediately after the sector is released by the operator and begins its return movement, the rotation of the wheel d^4 produced thereby will trip the lever h and permit the shunt-circuit closer to close and remain closed until in the last part of the movement of the sector the pin b^2 opens it, as before described, through one complete rotation of the break-wheel.

The pin d^8 on the wheel d^4 is so located that it does not trip the lever h, as just described, until after the break-wheel has made one break in the circuit; but before it makes a second break the lever h is tripped and the shunt is closed, so that the said break does not open the line or produce any effect therein.

The one projection or tooth e^2 of the break-wheel that produces a break in the circuit before the shunt-switch lock h is tripped does not form any part of the signal of the break-wheel and the break in the circuit produced by it does not constitute any part of the message, its function being to start a time-motor controlling a switch at the receiving-station, as will be hereinafter described, and the projection b^2 so located with relation to the curved arm g^4 of the shunt-switch that it does not open the shunt until after the tooth e^2 has passed the circuit-breaking key, so that the said shunt is open only up to the moment when its lock h is tripped after the starting of the motor, and then again by the projection b^2 after the tooth e^2 has passed the circuit-breaker, but before the remaining teeth of the break-wheel pass and act upon the circuit-breaker during the last rotation of the break-wheel. Thus, if the sector is moved far enough to give two turns to the break-wheel the latter produces one break in the main circuit, and the circuit then remains closed by the shunt during the time occupied by one rotation of the break-wheel, after which the shunt is opened and the break-wheel produces its intermittent break in the line in its next and last rotation. If the sector has been moved far enough to produce three turns of the break-wheel the same breaks in the main circuit would be made, but the interval of time between the first break and the series of breaks would be that occupied by two rotations of the break-wheel, and so on for as many rotations of the break-wheel as the sector may be made to produce.

The messages are received at the main or receiving station by an instrument R, a sufficient portion of which is shown in diagram to illustrate its operation, said instrument being substantially the usual telegraph-register having its marker controlled by an electro-magnet m, which may be included in the main circuit, but is shown as in a local circuit 4 5 controlled by a relay m^2 in the main circuit, which is shown as including a battery B. The said register has a detent or stop consisting of members $i\ i^2$, which are disengaged at the first movement of the register-marker, and permit the paper-feeding train of the register to move for a length of time equal to the maximum length of time that a break-wheel can be operated by the transmitting-box a, in this case equal to the time occupied by three rotations of the break-wheel. The said register-train constitutes a clock-work or time-motor, which actuates a commutator or switch shown as consisting of a contacting-cylinder k, the surface of which 4 is represented developed in Fig. 2 and has non-conducting portions $k^2\ k^3$, arranged as there shown. The surface of said switch co-operates with three springs $n\ n^2\ n^3$, all of which normally rest on the conducting portions of the cylinder when the latter is at rest in the position assumed when the detent $i\ i^2$ is engaged. As shown in this instance, the springs $n\ n^2\ n^3$ form terminals of branches of the main circuit extending to different points and including such instruments as may be required; but when the three springs rest on the conducting portion of the cylinder k, the latter affords direct connection from one to the other, so that the current is diverted from said branches.

The main circuit and its branches and connections may be traced as follows: One pole of the battery B connects with the main line 2, extending out to the transmitting-station and connected with one member, as f, of its circuit-breaker, the other member of which is connected with the main line 3, extending onto the next transmitter if there be more than one in circuit, as is usually the case, and finally returning to the main station, where it is connected with one of the springs, as n, that co-operate with the cylinder k of the register. The before-described break-wheel shunt is represented by lines 6 7, connecting the members $f\ f^2$ of the main-circuit breakers, respectively, with the members $g\ g^2$ of the shunt-circuit closer. The spring n is connected with one terminal of a loop or branch 8, which, as shown in this instance, may extend to the engine-house and include an indicating-instrument I, and then extend back, as shown at 9, to the wire 10, which connects with the spring n^2, said wire 10 forming a part of a second branch extending therefrom, as shown at 11, and including an indicating-instrument S, from which the said loop or branch returns, as shown at 12, to the spring n^3, which is connected by wire 13 with one terminal of the relay-magnet m^2, the other terminal of which is connected by wire 14 with the opposite pole of the battery B, from which the tracing of the circuit is begun. Either branch 8 9 10 or 10 11 12 may extend to any desired point and include instruments of any desired kind. As shown in this instance, the said branch 8 9 10, as before stated, extends to the engine-house and controls an indicating-instrument or message-receiver I of any suitable kind at that point,

and also controls a signal-instrument—for example, a tap-bell and annunciator-drop S^2—which may be at the same station as the register R, so as to call attention at that station to those signals which affect the branch 8 9 10. The signal S may be also an audible signal of different sound or tone from the one S^2, and may be at the same station with the register R, and may be understood as a call to communicate by telephone.

The non-conducting portions k^2 k^3 of the commutator or switch-cylinder k are so arranged that the first portion k^2 travels under its spring n during the time occupied by the first rotation of the break-wheel at the transmitting-box after the said box is started, and the surface k^2 passes under its spring n^3 during the second rotation of the break-wheel after the box is started if it make more than one, and both of said non-conducting portions will have passed through corresponding springs, so that all three of the springs n n^2 n^3 will rest upon the conducting portion during the third rotation of the break-wheel, if it makes three rotations after the transmitting-box has been set in operation, so that the transmission of a signal from the box a will have the following different effects, according as the sector b is manipulated to produce one, two, or three turns of the break-wheel. As before stated, the transmitting-box makes one break in the circuit at the beginning of the transmission of the signal. This break in acting on the relay m^2 and register-magnet m releases the detent i i^2 of the register, and thus sets the switch-cylinder k in motion. If the sector is moved only far enough to make one turn of the break-wheel, the latter will continue in control of the main circuit and will transmit its signal while the insulating part k^2 of the switch-cylinder is passing under the spring n, and thus severing the direct connection between the springs n n^2, so that the only path of the current is through the branch 8 9 10, thus causing the instruments I and S^2 to respond to the message of the wheel, and as the break-wheel finishes its movement by the time that the insulating portion k^{20} passed the spring k there is no change in the main line, and consequently no effect on the receiving apparatus during the remainder of the movement up to the time when it is arrested by the detent i i^2. If, on the other hand, the sector of the box has been moved far enough to produce two rotations of the break-wheel, the register would have started at the beginning of the first rotation; but the break-wheel would have been cut out by the shunt-switch g g^2 during the first rotation, in which time the insulating portion k^2 of the switch-cylinder passes the spring n, and in the balance of the movement of the switch-cylinder the springs n n^2 are connected directly by said cylinder, and thus afford a shunt for the branch 8 9 10, which is not affected by changes in the main circuit; but during the second rotation of the break-wheel in which the shunt is opened at g g^2 by the projection b^2 the insulating portion k^3 of the switch-cylinder passes under the spring n^3, thus removing the direct connection between the springs n^2 n^3 and causing the current to pass through the branch 10 11 12 and operate the signal S, which would be understood as a telephone-call. If, again, the signal-box were so operated as to cause the break-wheel to make three rotations, the register beginning at the beginning of the movement of the break-wheel would carry both insulating portions k^2 k^3 beyond their corresponding springs n^2 n^3 during the time that the break-wheel was making its idle rotations—that is, while its shunt was closed, and in the final rotation of the break-wheel, in which its shunt is open, so that it controls the main circuit, the springs n n^2 n^3 would all be open, the conducting portion of the cylinder k, which would afford direct connection from the line 3 and spring n to the spring n^3 and line 13, so that both branches 8 9 10 and 10 11 12 would be shunted and the instruments therein not affected. The register, however, responds to all messages of the break-wheel, and the signal would be recorded on the register. Thus it will be seen that the same break-wheel, always transmitting the same message, may be caused to transmit the said message into one circuit, as 8 9 10, or into another circuit, as 10 11 12, or into neither of said circuits, and the same messages will be understood differently under these three conditions—the first, for example, being a call for a wagon, and being transmitted directly to the wagon-station, the second being a call to answer the telephone, and the third merely an indication that the person is at the box and ready to receive a signal from the station, if need be.

When the different instruments are in branches of the main circuit, as shown, and the said branches are normally shunted, a portion of the battery may be in the branches, as indicated at B^2 in the lines 8 and 12, the current of which will normally act locally in the branches 8 9 10 and 10 11 12 and retain the magnets of the instruments therein energized, and when the shunt for either of the said branches is open, so that they are thrown into and become part of the main circuit, the said battery B^2 will act in conjunction with the main battery B.

When it is desired to give information at the box that the person arriving at the box is to communicate by telephone with the person at the receiving-station, such information can be given by operating a bell t at the box, (see Fig. 1,) the hammer of which is actuated by the armature of an electro-magnet t^2 included in the main circuit, so as to respond to breaks in said circuit. The armature-lever of said magnet is provided with a curved arm t^3, which stands in such position with relation to a projection t^4 from the segment b or its shaft a that the said projection t^4 mechani-

cally locks the arbor and prevents the bell from sounding while the segment *b* is in condition to operate the box to which said bell belongs, and it is only when said box is in its normal state of rest that the said bell can sound. This prevents the bell from responding to the current changes by the box itself in transmitting a signal, and if the bell should sound when the box was opened by the operator to transmit a signal it would show that another signal was being transmitted from some other place over the same line, so that the operator would have to wait until the said signal was finished before sending his own. If the bell should sound immediately after a message had been transmitted by the same box, it would be understood as a call to the telephone or might convey any other meaning, according to an established code, although each of the signal-boxes and the main station will be provided with telephones, so as to render code-messages unnecessary.

Figs. 3 and 4 represent a form of actuating mechanism that may be used to properly manipulate the sector *b*, as hereinbefore described, to give it the different operations required. The said mechanism comprises an arm a^3, connected with the shaft *a* and extending across a number of pull-slides a^4 a^5 a^6, each provided with a pull hook or handle a^7, working in a slot in the inner door or cover A^2, which incloses the operative mechanism of the box. Each of said pull-slides is provided with a pivoted catch or dog a^8, acted upon by a spring a^9 on the pull-slide, which spring tends to throw it out of engagement with the arm a^3, (see Fig. 4,) and also acted upon by a stronger spring a^{10}, connected with the cover A^2, which, when the slide is in its uppermost position, overcomes the spring a^9 and holds the end of the dog a^8 in position to engage with the arm a^3. The slides a^4 a^5 a^6 may all have the same length of movement, governed by the length of the slots through which the finger-hooks a^7 work, but are arranged at different distances from the shaft *a* or axis on which the arm a^3 turns, the slide a^5 being twice and the slide a^6 three times as far from the said axis as the slide a^4. Thus the complete movement of the slide a^4 produces three times the angular movement of the arm a^3 that the slide a^6 does and twice as much movement as the slide a^5, the said slide a^6 moving the arm a^3 far enough to cause the segment *b* to turn the ratchet c^3 the space between two adjacent shoulders sufficient in the return movement of said segment to cause the break-wheel to make one complete rotation, as before stated. The slide a^5 causes the break-wheel to make two rotations, and the slide a^4 causes the break-wheel to make three rotations, producing the effects before described.

It is not essential to the invention that the different circuits 8 9 10 and 10 11 12, controlled by the switch *k*, should be branches or loops of the main circuit or should become a part of the main circuit if the signal is to be transmitted into them; but such construction is considered to be desirable, as in that case the operation of the main line depends upon the loop being in working condition, so that it will be certain that if the message is received by the relay *m* and the register R that said message must also have been transmitted through the instruments in circuits 8 9 10 or 10 11 12, provided that the message was transmitted at the proper time to pass into one or the other of said circuits.

I claim—

1. A signal-box or transmitter comprising a break-wheel and actuating-motor therefor having different ranges of movement capable of producing different numbers of rotations of said break-wheel at each operation of the box, and governing mechanism by which the last rotation only of said break-wheel operates the circuit, combined with a receiving-instrument comprising a time-motor or clock-work and electro-magnet controlling the same, whereby the said motor is started in unison with the actuating-motor of the transmitter, and a switch operated by the said time-motor, and one or more circuits and instruments therein controlled by the said switch, which circuits are successively made responsive to the main circuit during definite portions of the time-movement of said motor corresponding to complete rotations of the break-wheel, substantially as and for the purpose described.

2. A signal-box comprising a break-wheel and actuating-motor therefor having different ranges of movement capable of producing different numbers of rotations of said break-wheel at each operation of the box, a shunt for said break-wheel and switch therein, and actuating devices for said switch operated by the break-wheel motor, which cause the closing of said switch immediately after the motor begins to operate and open the said switch during the last rotation of the break-wheel, substantially as described.

3. The signal-box comprising a break-wheel and actuating-motor and winding-arm connected with said motor-train, said winding-arm having a to-and-fro movement and said train moving always in one direction during the return movement of said winding-arm, combined with a shunt-circuit for said break-wheel and switch therein, and a part connected with said winding-arm that engages the movable member of said switch during a portion of the movement of the winding-arm, and a lock engaging with the movable member of the said switch, and a tripping projection operated by the motor-train for disengaging said lock, substantially as described.

4. The combination of the break-wheel actuating-motor of a signal-box with a signal-operating electro-magnet included in the circuit of said signal-box and having an armature provided with a tapping-hammer, and an obstruction to the movement of the armature

movable with the said motor, said obstruction being in position to prevent movement of the armature while it is moving with the motor, and being in position to permit movement of the said armature when the said obstruction and the motor are at rest, substantially as and for the purpose described.

5. The combination of a transmitting-instrument comprising a break-wheel and motor for rotating the same different number of times at each operation, with a receiving-instrument comprising a motor adapted to run in unison with said break-wheel, and a switch having movable contacts operated by said motor, and co-operating contacts, two of which are connected with the main circuit, and loops connected with said contacts and receiving-instruments in said loop, the said contacts being normally connected at the switch and thereby shunting the loops and instruments therein from the main circuit, and batteries in said loops, whereby the instruments therein are energized when said loops are shunted from the main circuit, substantially as and for the purpose described.

6. A transmitting-instrument comprising a break-wheel and motor by which said break-wheel may be caused to make different numbers of rotations at each operation of the box, combined with a receiving-instrument and circuit connecting the same with the transmitting-instrument, the said receiving-instrument consisting of a time-motor running in unison with the transmitter break-wheel, and a switch having movable contact portions operated with a time-movement by said motor and co-operating contacts, two of which are connected with the main circuit, and one or more loops or branches connected with said contacts, said contacts being normally connected at the switch and thereby shunting the loops connected with them, and one of said contacts being disconnected from the others at the switch during a definite period of the time-movement thereof, whereby the loop connected with said contact, which is disconnected from the others at the switch, is brought into the main circuit, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FREDERICK W. COLE.

Witnesses:

JOS. P. LIVERMORE,

M. E. HILL