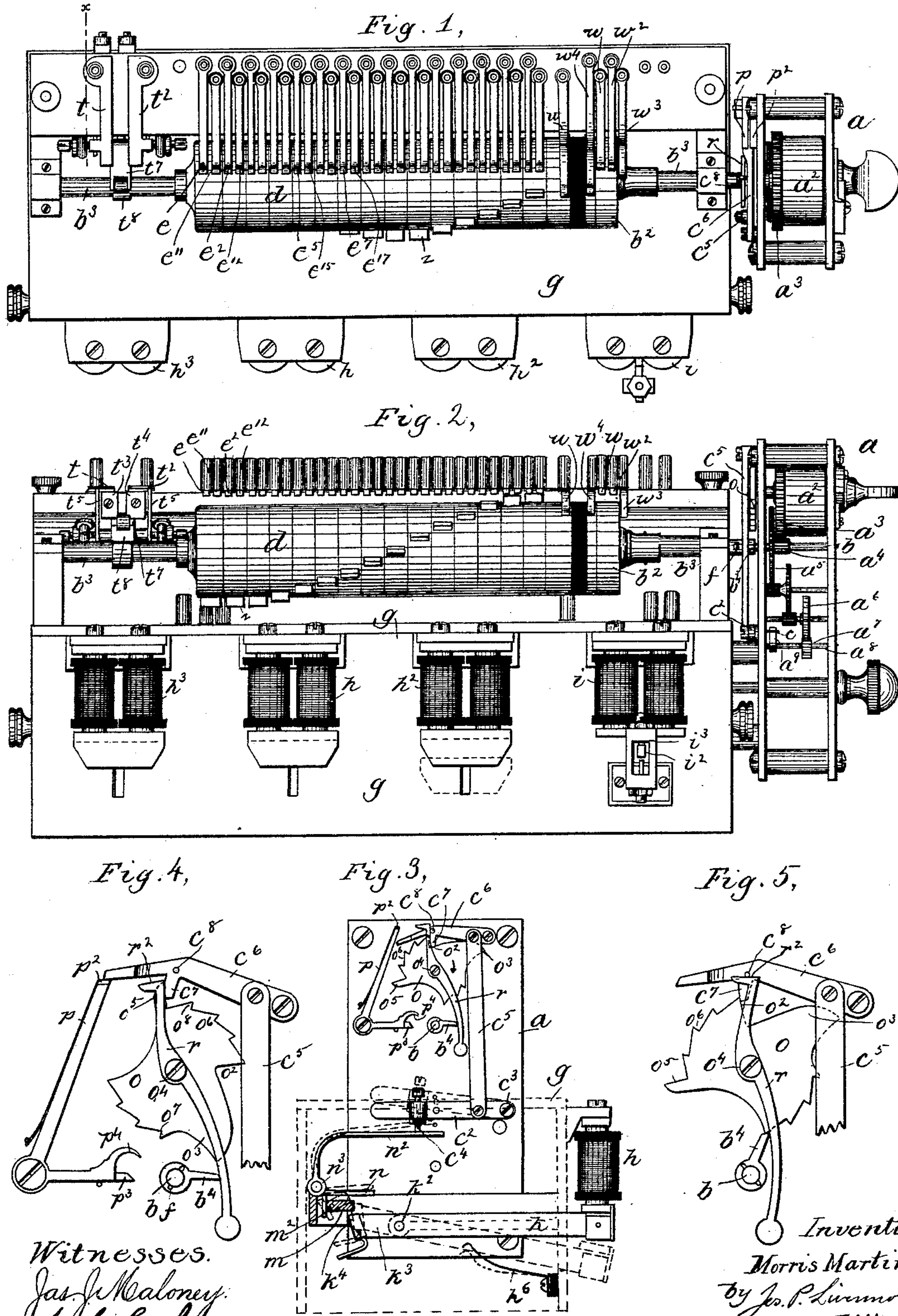
(No Model.)

2 Sheets—Sheet 1

M. MARTIN.

TELEGRAPHIC TRANSMITTING APPARATUS.

No. 459,013. Patented Sept. 8, 1891.



Witnesses.
Jas. J. Maloney.
A. J. Lock

Inventor;
Morris Martin,
by Jos. P. Livermore
Att'y.

(No Model.)

2 Sheets—Sheet 2.

M. MARTIN.

TELEGRAPHIC TRANSMITTING APPARATUS.

No. 459,013. Patented Sept. 8, 1891.

Fig. 6

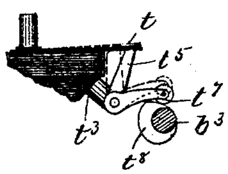


Fig. 7.

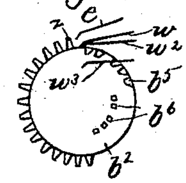
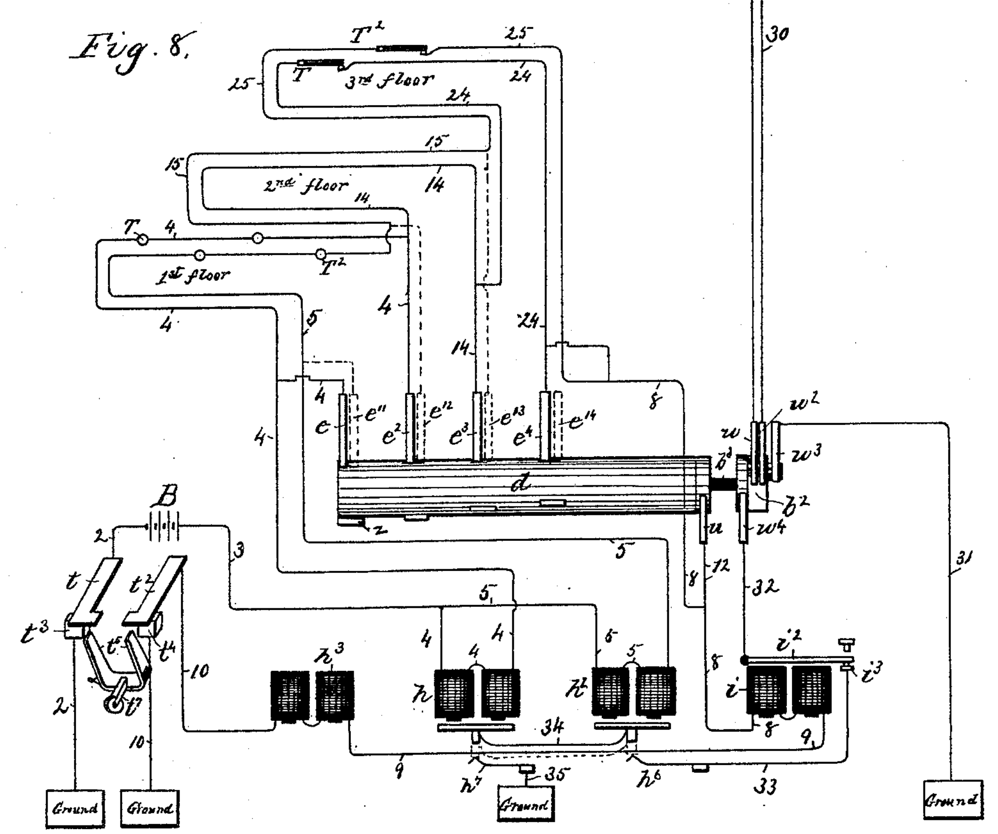


Fig. 8.



Witnesses.
Jas. J. Maloney
A. J. Lock

Inventor,
Morris Martin
by Jas. P. Livermore
Att'y.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

MORRIS MARTIN, OF MALDEN, MASSACHUSETTS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE UNITED STATES ELECTRIC FIRE SIGNAL COMPANY, OF MAINE.

TELEGRAPHIC TRANSMITTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 459,013, dated September 8, 1891.

Application filed July 14, 1890. Serial No. 358,683. (No model.)

To all whom it may concern:

Be it known that I, MORRIS MARTIN, of Malden, county of Middlesex, State of Massachusetts, have invented an Improvement in Telegraphic Transmitting Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

My invention relates to apparatus for transmitting signals or messages in an electric circuit, and is intended to be operated automatically when the message is to be sent—as, for example, upon the breaking out of a fire.

The invention is shown embodied in an automatic fire-alarm-telegraph apparatus, and relates to the transmitting portion, which is located in the building or group of buildings to be protected, and is caused to operate to send a signal or message to the signal-receiving station or main office when the fire breaks out. The message transmitted is of the same kind as commonly used for fire-alarm signaling, and is produced by a movable signaling-surface and motor which sets it in motion, so as to cause a definite number and arrangement of changes in the current passing through said circuit, which in turn produce a corresponding number of effects on the receiving-instrument, and thus make known the locality at which the transmitting-instrument is operated, as each transmitter in a given circuit produces a different arrangement of current changes or different signal from all others.

The present invention relates partly to the mechanical construction of the detent mechanism for controlling the starting and stopping of the signaling-surface, which will be hereinafter referred to as the "break-wheel," and the means for controlling the motor also comprising electric circuits and instruments therein, which are, however, independent of the main or transmitting curcuit in which the signal of the break-wheel is transmitted. The motor is provided with a detent or stopping device arranged to be tripped by the action of the armatures of any one of a number of different electro-magnets. In this instance three of such electro-magnets are employed. The said electro-magnets are connected with an electric circuit which extends throughout the different parts of the building or group of buildings to be protected, and is provided with thermostatic instruments, which when operated by a rise in temperature above the normal temperature of the building, as by the breaking out of a fire, cause a change in the said circuit, and thus cause the electro-magnets connected therewith to be operated. This circuit, which will be called the "controlling-circuit" to distinguish it from the main or transmitting circuit, is normally closed, and the several electro-magnets connected with the instrument normally hold their armatures attracted and are so arranged that when one of the armatures is released by its magnet it falls away from the field thereof so far that it cannot be attracted again by the subsequent energizing of the magnet, and such falling movement also starts the motor of the break-wheel that governs the main circuit. If but a single magnet were employed to control the motor and such magnet were operated to release the motor upon the breaking of the circuit or demagnetization of the magnet, it is obvious that any accidental break in the circuit or other derangement—such as a ground or cross connection—would cause the magnet to be demagnetized, which would cause the motor to be started and the fire-alarm signal to be sent.

As accidental breaks or derangements in the circuit occur with some frequency, there would be danger of a large number of false alarms being sent if the simple arrangement of a detent-controlling magnet in a normally-closed circuit were employed to control the motor. One of the main objects of the present invention is to diminish as far as possible the liability to the transmission of false alarms by the derangement of the circuit, and in order to accomplish this result in accordance with this invention the exposed portion of the circuit—that is, the part that extends through the building and is provided with thermostats for automatically controlling it—is divided into branches, herein shown as two in number, each of which contains one of the controlling or starting magnets, so that the breakage of either one of these branches demagnetizes its corresponding magnet, which, as before stated, sets the motor in operation; but a breakage of one branch only does not demagnetize the magnet in the other branch, nor does it open-circuit the battery, the current of which still has a circuit through the other branch. The signal produced by the motor in such operation as occurs when one only of the starting-magnets releases it is what may be called an "incomplete signal," as will be hereinafter explained, and produces a different message at the receiving-station from that produced by the action of a fire on the thermostat; but it is of value, as it calls attention to the fact that the circuit at the transmitting-station is deranged by having one of its branches broken. If, however, a fire breaks out, since both branches extend through practically the same space, the thermostats in each will be affected by the fire, and consequently both branches will be opened by their thermostats and both detent-controlling magnets will drop their armatures, and the controlling-circuit will be completely open. This release of both armatures does not, however, produce any different mechanical effect upon the transmitter from that produced by the release of only one of said armatures; but it causes a different message to be sent, constituting a complete fire-alarm message, which shows not only the location of the transmitter—that is, indicates the location of a building or group of buildings in which a fire has broken out—but also shows the particular part of a building or group of buildings in which the thermostats have been operated. The two branches of the controlling-circuit after passing through the separate magnets come together and pass as a single circuit through a relay-magnet which controls the main transmitting-circuit in a manner which will be hereinafter described. Thus as long as either branch of the controlling-circuit is complete the said relay-magnet will remain energized and will produce no effect on the main circuit, the transmitting break-wheel in which will send the signal corresponding to the building-number only. When, however, both branches are broken, the said relay-magnet will be thrown into open circuit and its armature will be retracted and thereby transmit an impulse into the main circuit, which will, however, be timed so as not to interfere with the main signal produced by the break-wheel, but will cause an addition to the said main signal, and the motor that operates the main break-wheel also operates a movable signaling-surface co-operating with the controlling-circuit and so arranged as to govern the operation of said relay, causing its armature to produce a greater or less number of movements, and consequently to transmit a greater or less number of impulses or circuit changes into the main line, according as the branches are broken in one or another portion of the building. This last result is attained as follows: The controlling branches are each composed of loops extending into the different parts of the building—as, for example, one to each floor—and the said loops are brought back to the transmitting-instrument and connected with separate contact-springs, which will, for convenience, be referred to as constituting a regular series, the first loop passing to the first floor of the building, having its ends connected, for example, with springs 1 and 2, the second loop extending through the second floor of the building, having its ends connected with springs 2 and 3, and so on. The springs co-operate with a drum connected with the circuit beyond the meeting-point of the branches and having projections that make and break contact with the series of springs consecutively in the rotation of the drum. Thus if both branches are opened in the third loop, for example, or between the third and fourth springs, the operation is as follows: The opening of both branches opens the circuit of the relay, before mentioned, and then as the drum begins to rotate it makes contact first with the first spring, and as the circuit is complete up to said spring it continues from the spring to the drum and onto the relay, energizing the same and producing a closed impulse in said relay, which is transmitted by the relay to the main line. As the second projection on the drum passes the second spring, the same operation is repeated, as the controlling-circuit is complete up to the second spring. The same operation takes place when the third projection passes the third spring; but when the fourth projection passes the fourth spring no effect is produced on the relay, as both branches are broken before arriving at the fourth spring, so that contact of the fourth spring with the drum cannot close the circuit through the relay, as is the case with the preceding springs. If there are more than four springs in the series, all beyond the fourth will produce no effect, as the complete break in both branches of the controlling-circuit in the loop between the third and fourth springs throws all beyond the third spring into open circuit. The projections on the drum are so arranged with relation to the signaling-surface of the break-wheel that sends the signal for the general locality that all the impulses transmitted into the main circuit through the agency of the drum and relay will take place at the time that the break-wheel is not producing its breaks in the main circuit, and with the arrangement just described the signal produced by the springs, drum, and relay will be a series of dots, if the Morse register receiving apparatus is used, as is commonly the case, the number of which corresponds to the number of the loop in which the two branches of the controlling-circuit have been opened by the action of the thermostats.

For convenience the signal of the main break-wheel will be referred to as the "building-number," and the signal produced by the springs and the drum and relay controlled thereby will be called the "floor-number," and from the description previously given it is evident that if only one of the branches of the controlling-circuit is broken the building-number only will be transmitted, while if both branches are broken in a given loop the building-number followed or preceded by the floor-number will be sent, and consequently the reception of a signal containing both floor and building numbers will be understood as indicating that a fire has broken out in the floor of the building thus indicated, while if the building-number alone is received it will be understood that some derangement of the circuit other than that produced by the breaking out of a fire has taken place, and the proper inspection and repairs may be made as soon as convenient.

As it may frequently happen that the thermostats in both branches will not be operated by the rise in temperature at the same moment, it would result that when the first branch was opened the motor would begin to operate the same as for a broken line, and a thermostat in the other branch might not be operated until the motor had nearly completed its run for a single signal. To provide for such emergengy and insure that the full message shall be repeated the desired number of times after the second thermostat has been operated, the detent of the motor is so constructed that when released by the operation of one of the controlling-magnet armatures it will run so as to turn the break-wheel a definite number of times or give what is called a "certain number of rounds or repetitions of the signal"—in this instance four—and will then be automatically stopped if no other of the controlling-magnets has been operated in the meantime; but if a second controlling-magnet should be operated, as by the breaking of the second branch, the effect of its armature on the detent mechanism will be such that the motor will make its complete operation of four rounds after the second armature has been operated, so that if at any time one of the branches becomes opened, either by accidental breakage or by the action of a fire at some considerable period of time in advance of the other, the motor will run its full course, owing to the release effected by the magnet so operated, and will then stop, having transmitted the building-number only; but when the second magnet is operated by the opening of the second branch the motor will again start and run its full course, transmitting the full fire-alarm signal or giving both the building-number and the floor-number, and it is only when both branches are open that the proper fire-alarm signal can be given, and as an accidental break or rupture of the wiring would rarely occur in both branches at the same time there is only a very small possibility of a false fire-alarm being transmitted. As shown in this instance, the controlling-circuit has one terminal connected with the ground and then passes through the battery, from which the two branches are extended, each in the several loops, through the several sections or floors of the building or structure to be protected and are then brought together and carried as a single line through the relay, beyond which the circuit passes through another magnet, which also controls the detent-motor, and is then grounded, preferably, through a different ground connection from the one at the other end of the battery-line, one connection being, for example, made with the gas-piping and the other with the water-piping of the building. By this arrangement if a ground connection should come to the line anywhere between the battery, which is near one ground connection, and the detent-controlling magnet last referred to, which is near the other ground-terminal of the line, the current will be diverted from the last-mentioned or "grounded" magnet, as it will be called, causing the same to be demagnetized and to release the motor, which would run and transmit the building-number only, thus calling attention to this derangement of the wires.

Figure 1 is a plan view of a transmitter embodying this invention; Fig. 2, a front elevation thereof; Fig. 3, a sectional view showing the detent mechanism of the motor mainly in end elevation and in normal position; Fig. 4, a detail showing the detent mechanism in the position occupied when the motor is just released and set into operation; Fig. 5, a similar view showing the parts in the position occupied just as the motor is finishing its movement and is about to be re-engaged and stopped by the detent; Fig. 6, a sectional detail on line x, Fig. 1; Fig. 7, an end elevation of the break-wheel and drum, and Fig. 8 a diagram showing the circuit connections of the various parts.

The motor a consists of a clock-work or train of wheel-work of usual construction, shown in this instance as actuated by a main-spring a^2, which drives a gear a^3, meshing with a pinion a^4 on the shaft b, provided with a gear a^5, forming a portion of the governing-train, which terminates in an escape-wheel a^6, (see Fig. 2,) controlled by an anchor or pallets a^7, which are vibrated by the teeth of the escape-wheel a^6 when the motor is running. The said pallets a^7 are connected with the shaft a^8, provided with a stop-finger a^9, which is controlled by a stop projection c, constituting the primary detent or stopping and starting device of the motor. When the pin c engages with either side of the finger a^9, as shown in Fig. 2, it prevents the vibration of the shaft and pallets, and the latter lock the escape-wheel, and thus prevent the motor from running; but when the said projection c is raised above the path of vibration of the finger a^9 the latter is released and permits the motor to run until the said projection c is again dropped into the path of vibration of the end of the arm a and again arrests the motor. The shaft b of the train before referred to is the one that drives the signaling-surface of the apparatus shown as a break-wheel b^2, governing the main transmitting-circuit, as will be hereinafter described, and the said shaft also drives the drum d, which, in connection with suitable contact-springs e e^2, &c., controls the operation of the relay-magnet which transmits the floor-number into the main circuit when a fire is broken out.

For convenience of construction the motor a, Figs. 1 and 2, is contained in a separate frame-work from that which supports the shaft b^3 of the break-wheel b^2 and drum d, the said shaft b^3 being connected with the shaft b of the motor by a suitable clutch device, (shown in Figs. 2, 3, and 4,) as a transverse pin f in the end of the shaft b, which pin engages with a slot in the end of the shaft b^3, as shown in Fig. 2, when the motor-frame a is connected with the frame that supports the bearing for the shaft b^3. The latter frame is mainly in the form of a box g, (see Figs. 1, 2, and 3,) at the front of which are supported the several magnets h, h^2, h^3, and i, the magnets h and h^2 being the ones included in the two branches of the controlling-circuit, as will be hereinafter more fully explained with reference to the diagram. The magnet h^3 is included between the junction of said branches and the ground, being the magnet that is affected by a ground connection on the controlling-circuit, as before explained, while the magnet i is the relay-magnet that is included in the controlling-circuit beyond the junction of its branches and is controlled by the drum d and springs e, and in turn by its armature transmits the corresponding impulses into the main circuit governed by the break-wheel b^2.

So far as the mechanical construction is concerned the magnets h h^2 h^3 are alike and all in the same relation to the actuating-motor a, each of said magnets controlling the device that effects the disengagement of the detent a^9 c of the motor before mentioned. This disengagement of the detent and its subsequent control are effected by the following mechanism, (best shown in Figs. 3, 4, and 5:) The magnets h h^2 h^3 are arranged in a row on the frame g, as shown, and the armature of each is supported at the end of a lever k, (see Fig. 3,) extending into the said box and pivoted at k^2 therein in such manner that when the corresponding magnet is demagnetized its armature falls by gravity or is otherwise retracted, turning the said lever k from full to the dotted line position, Fig. 3. The armature-levers k of the three magnets h h^2 h^3 are all alike, and the portion k^3 of said levers at the rear of their pivots stands beneath a plate or blade m, extending lengthwise of the frame g and pivoted at m^2 in such position that the upward movement of the arm k^3 of any one of said levers will turn the said blade from the full to the dotted line position on its pivot. The said levers k are provided at their extremities with dogs or pawls k^4, which are shown as weighted and pivoted in such manner that in the upward movement of said pawls produced by the dropping of the armatures the said pawls will engage the blade m and turn the same, as shown; but when the levers k are moved back from the dotted to the full line position the dogs k^4 will pass down by the plate m without moving the latter. When one of the magnets h h^2 h^3 is demagnetized and the corresponding armature permitted to drop, the said armature falls so far as to be substantially out of the field of the magnet, and consequently remains in its dropped position, whatever may be the condition of the magnet, until it is restored by hand or some other means than the normal attraction of the magnet. The dropping of any armature-lever k rocks the plate m momentarily from the full to the dotted line position; but in this movement the dog k^4 passes by the edge of the plate m, so that the latter immediately after being rocked to the dotted-line position is permitted to fall back to its full-line position, and if another of the armature-levers k is dropped the same operation on the plate m will be repeated, and so on, the plate m being operated by each armature-lever independently of the condition of the others when such operation takes place. The plate m in its rocking movement engages an arm n of a detent-tripping lever n^2, fulcrumed at n^3 and engaged with the detent-arm c^2, that carries the detent projection c, which engages and controls the other detent member a^9, as best shown in Fig. 2. The said detent-arm c^2 is pivoted at c^3 on the end of the motor frame-work and is provided with a projection c^4, shown in this instance as the end of a screw which may be adjusted as required and which rests over the end of the actuating-lever n^2, so that the said arm c^2 is raised whenever the lever n^2 is operated by the plate m upon the movement of said plate produced by the dropping of one of the magnet-armatures. As before stated, the plate m is only moved momentarily and the lever n has the same momentary operation, so that it only lifts the detent-arm c^2 for an instant, and if the latter were controlled only by the lever n^2 it would immediately fall back and re-engage the detent c a^9, so that the motor would only run for an instant. The detent-arm c^2, when actuated by the lever n^2, is immediately placed under control of the controlling mechanism, which retains the detent disengaged for a definite period of time of running of the motor, and at the end thereof causes the said detent to be again engaged and the motor to be stopped. To effect this controlling of the detent, the arm c^2 is connected by a link c^5 with a controlling-arm c^6, which is itself governed by a movable patterned controlling or supporting device o, the said arm c^6 having a projection c^7, that rests on said controlling device o and normally engages with a deep notch or shoulder o^2 on said controlling device o, as shown in Fig. 3, permitting the arm c^2 to drop low enough to engage the detent. The said device o is weighted or provided with an extension o^3, which tends to cause it to rotate on its supporting pin or hub o^4, on which it is loosely hung, in the direction of the arrow, Fig. 3, and the moment the arm c^6 is raised, as before described, by the lifting of the detent-arm c^2 the said device o turns by gravity in the direction of the arrow to the position shown in Fig. 4, in which it is arrested by a long shoulder o^5 striking on the projection c^7 of the arm c^6, and said arm c^6 will thus be supported on the toothed high part o^6 between the outward shoulder o^5 and the inward shoulder o^2 until the device o is turned in a direction opposite to the arrow, so as to bring the notch o^2 again under the projection c^7.

In order to insure the dropping of the controlling device from the position shown in Fig. 3 to that shown in Fig. 2, when the arm c^5 is raised by the momentary action of the actuator n^2 and m one or more additional supports $p\,p^2$ are employed, which bear against the end of the arm c^6, as shown in Fig. 3, and are acted upon by a spring so as to immediately fall under the end of the said arm, as shown in Fig. 4, when said arm is raised, they supporting the arm with the projection c^7 a trifle above the highest part of the supporting device o^6, so that the latter is free to turn by gravity in the direction of the arrow, Fig. 3, until arrested by the still higher shoulder o^5, as shown in Fig. 4.

The turning back of the controller o from the position shown in Fig. 4 to that shown in Fig. 3, so that the projection c^7 may drop into the notch o^2 and stop the motor, is effected as follows: The mechanism being so constructed that it requires a definite number of complete rotations of the shaft b b^3, and consequently of complete rounds of the break-wheel b^2, before such stopping of the motor can take place, this dropping of the detent-controlling arm c^6 and the connected detent-arm c^2 is effected by a projection b^4 on the shaft b, which, as the motor runs immediately after its detent is disengaged, travels around and first acts upon the arm p^3 of the highest support p^2 (the said arms p^2 p^3 constituting an elbow-lever) and rocks the said lever so as to carry the projection p^2 out from beneath the end of the arm c^4, which then drops by gravity onto the end of the projection p, the arm p^4 of which is shortly after engaged by the projection b^4 and operated in the same manner, dropping the arm c^6 until its projection c^7 rests upon the surface o^6 at the side of the shoulder o^5.

The two arms p p^2 are employed for a greater certainty in catching the arm c^6 when suddenly raised, since if it fails to be caught by the arm p^2 it will certainly be caught by the arm p and supported until the controller o can be dropped back. After the projection c^7 is thus brought upon the surface o^6 the arm b^4, in continuing its movement, engages with a projection or tooth o^7 of the controller o and turns the same in the direction opposite the arrow far enough to carry the shoulder or tooth o^8 of the surface o^6 past the projection c^7, which then drops at the side of the shoulder or tooth o^8 and sustains the controller after the arm b^4 has passed the tooth o^7. This movement has brought another tooth at the lower part of the controller into the path of the arm b^4, which at the end of the next rotation engages the said tooth and moves the controller along a step farther, where it is engaged by the next tooth of the surface o^6, and in this manner the controller is turned back step by step at each rotation of the break-wheel shaft from the position shown in Fig. 4 to that shown in Fig. 3, and the number of teeth to be engaged by the arm b^4 and the corresponding number of holding-teeth on the supporting part o^6 determine the number of rotations of the shaft b that will take place after the motor is started before it is stopped by the re-engagement of the detent.

If the final dropping of the arm c^6 were effected solely by the movement of the supporting-surface o^6 produced by the arm b^4, great nicety in construction would be required to have the arm c^6 drop over its shoulder just at the instant that the arm b^4 had ceased acting upon the last tooth or shoulder at the under side of the controller, as if it dropped before the arm b^4 had passed the said arm b^4 would engage the controller and prevent its falling back immediately after the next rise of the detent-controlling arm, while, on the other hand, if the arm b^4 should pass its notch before it had quite carried the shoulder o^2 by the projection c^7 the latter would not be dropped and the controller o would fall back to the tooth preceding the shoulder o^2. In order to prevent this operation, a secondary support is provided, consisting of a weighted dog r, which normally, while the motor is running, hangs on the same support o^4 as the controller o, with its upper end r^2 beneath the projecting pin c^8 on the arm c^6, as shown in Fig. 5, and the arm b is arranged to engage with the under part of the controller until its shoulder o^2 is carried well past the projection c^7, which then drops into engagement with the upper end of said shoulder o^2, as shown in Fig. 5, but is arrested by the support r^2 before it falls deep enough past the shoulder o^2 to permit the engagement of the detent. The arm b^4 in its rotation engages the lower end of the supporting-dog r and turns the same on its supporting-pivot, as will be understood by a comparison of Figs. 4 and 5, until it carries the end r^2 from beneath the pin c^8, as shown in Fig. 3, when the arm c^6 is permitted to drop to the bottom of the notch or shoulder o^2 and the detent is brought into re-engagement. This secondary stop or support r^2 for the controlling-arm c^6 insures the accurate stopping of the motor with the break-wheel shaft at exactly the same point in its rotation at every operation. By the operation of this device if any one of the armatures of the magnets h h^2 h^3 is dropped the detent will be disengaged by the actuating-arm n^2, and will then be retained disengaged by the controlling mechanism o o^6 until the shaft b of the break-wheel has made a definite number of rotations—in this case four—when the detent will be again engaged and the motor stopped; but if at any time after the motor has thus completed its run and been stopped, or at any time while it is making its run of four rounds, another of the magnet-armatures is dropped it will again throw the arm c^6 up onto the support of the arms p p^2, permitting the controller o to fall back again to its starting-point, (shown in Fig. 4,) so that the motor will run for four complete rounds of the break-wheel after the last magnet is operated. The purpose of this construction will be best understood upon reference to the circuit arrangement shown in Fig. 8, which is as follows: The several magnets h, h^2, h^3, and i are all operated by the controlling circuit and current of the battery B therein. One pole of said battery is connected with the ground, (indicated at 2,) while the other pole is connected with wire 3, which is divided into two branches 4 5, which pass through the coils of the magnets h h^2, respectively, and are then connected with the springs e e^{11}, from which they extend through one portion of the structure to be protected—as, for example, the first floor of a building—and are provided with a number of thermostats T T^2, which may be of any suitable or usual construction, being arranged normally to keep the circuit closed, but to open the same when exposed to a temperature somewhat greater than can exist under the normal condition of things, so that they will be operated to break the circuit when a fire breaks out. The two branches 4 5 in a given floor are so arranged that the thermostats T T^2 are about equally exposed to the heat of the fire; but the circuit-wires are so carried that any action that would be likely to break one would not be likely to affect the other, so that an accidental break or rupture of the circuit-wire would affect only one of the branches 4 or 5, while, on the other hand, if a fire should break out both branches would soon be opened by their respective thermostats, although, of course, one might and probably would be opened a short period of time before the other. The branch 4 after passing through the first floor is carried back to the transmitting-instrument and connected with the second spring e^2 of the series, and is also carried on from said spring, as seen at 14, to the next portion of the building to be protected—as, for example, the second floor—from which it returns to the third spring e^3, and is then carried to the next section, as shown at 24, and brought back to the next spring e^4, and so on for as many spaces or sections as the building, structure, or group of buildings to be protected may be divided into. The other branch 5 is also carried, as shown at 15 and 25, through the second and third floor spaces, and, in fact, to all the spaces through which the branch 4 14, &c., is carried, having the same relative arrangement in each space that has already been described for the portions 4 5 of the branches. For the most perfect operation the loops 5 15 25 are carried back to the transmitting-instrument and connected with springs e^{11} e^{12} e^{13}, &c., as shown in dotted lines, Fig. 8, the said springs being arranged to make pairs with springs e e^2 e^3, &c., so that the teeth or projections z of the drum d will touch both springs of each pair simultaneously. It is not absolutely essential, however, to the operation that both branches should be carried back to the transmitter, and the branch 5 15 25 might be made with only the portions shown in full lines, the springs e^{11} e^{12} e^{13}, &c., being omitted. After passing to the last spring e^4 of the series, Fig. 8, the branches 4 14 24 and 5 15 25 unite and are extended, as shown at 8, through the coils of the relay-magnet i, from which the circuit is extended, as shown at 9, to one terminal of the ground-magnet h^3, the other terminal of which is connected, as shown at 10, with the ground. The ground connections 2 and 10 are made through spring-contacts t t^2 and their corresponding anvil-pieces t^3 t^4, the purpose and mode of operation of which will be hereinafter explained. The wire 8 between the junction of the branches and the relay i is connected by wire 12 with a contact-spring u, that makes electrical contact with the drum d or an extension thereof during the entire rotation of the said drum. The result of this arrangement is as follows: When the entire circuit 2 3 and the branches 4 14 24 and 5 15 25 and the continuation 8 9 10 are complete and intact and the magnets h, h^2, h^3, and i all remain energized and the motor remains locked, if any of the unbranched part of the line 3 or 8 9 10 breaks all of the magnets will be demagnetized and the motor will be set running, causing the break-wheel b^2, the construction of which will be hereinafter briefly described, to transmit its signal into the main line 20 30. The unbranched portions 2 3 8 9 10 of the line are, however, located at or near the transmitting-instrument and may be thoroughly protected, so that an accidental rupture in these portions rarely occurs and scarcely requires to be provided for, although the receipt of a message giving the building-number at the central station should as a rule be promptly attended to by sending an inspector to repair the line at the building from which such signal has been received. The branches 4 14 and 5 15, &c., however, have to be extended for a considerable length, and are therefore more likely to be accidentally broken. A break in one of these branches—as, for example, the branch 5 15 25—will demagnetize the magnet h^2 in that branch; but the magnet h will remain energized, as the current still flows through the unbroken branch 4 14 24, and the circuit through the magnets i and

h^3 will remain substantially the same as before. The result of this operation is that the dropping of the armature of the magnet h^2 sets the motor in operation, as before described, and the break-wheel b^2 sends the building-number; but the relay-magnet i is not affected, and no further effect on the main line 20 30 is produced than that of the break-wheel b^2. Assuming, however, that the break was occasioned by the action of a fire on the thermostats and occurred first in the loop 25 of the branch 5 15 25, the operation would be of course at first the same, as just described, as produced by an accidental breaking of said branch; but after a short period of time one of the thermostats in the loop 24 of the other branch would respond to the increase in temperature, so that this branch also would be broken, thus completely opening the circuit of the battery B and causing the relay-magnet i to be demagnetized, as well as the magnet h and the magnet h^3. The dropping of the armature of the magnet h, either alone or accompanied by the armature of the magnet h^3, would cause the detent-controller o to fall back to the position shown in Fig. 4, as before described, so that the motor would run the four complete rounds after the first time that it passed its starting-point after the dropping of the second magnet-armature. The break-wheel b^2 would continue operating as before and there would be the following additional effect on the relay-magnet i: The said magnet i, as before stated, would be demagnetized upon the breaking of the second branch, although it would not be affected by the breaking of one branch only. Then as the drum rotated its projections would pass and make contact with the springs e e^2 e^3 e^4 consecutively, the said projections being so arranged as to break contact with one spring before making contact with the next. As a result of this operation, when a projection of the drum made contact with the spring e the circuit of the battery B would be completed through the relay i by wires 2 3 4, spring e, drum d, spring u, wires 12, 8, 9, and 10, and the relay-armature would be attracted as long as the projection of the drum d made contact with the spring e. Then as it passed the said spring the relay-armature would be retracted, and as the next projection made contact with the spring e^2 the relay would again be energized, the circuit being the same as before, except that it includes the first loop between the wire 3 and the spring e^2, said loop not having been broken. As the third projection passes the spring e^3 the relay will again be energized, the circuit then including the unbroken loop 14; but when it passes the spring e^4 no effect will be produced on the relay, as the circuit of the battery B is completely broken in both branches before arriving at the spring e^4. Thus the armature of the relay-magnet i makes a number of vibrations or movements corresponding to the number of loops in the branches which are intact, and said movements of the armature are employed to transmit corresponding impulses into the main-line circuit 20 30, the said number of impulses corresponding to the number of loops in which both branches of the circuit are broken, and thus giving a signal which is the number of the floor or section of the building in which the fire has broken out.

The way in which the different signals are transmitted into the main-line circuit is as follows: The said circuit and the arrangement of the receiving-instruments therein form the subject of another application for Letters Patent, Serial No. 358,682, filed July 14, 1890, and it is sufficient for an understanding of the present case to explain that the main line 20 30 extends to a receiving-station and is provided with a receiving instrument, or instruments, which responds to breaks in the line 20 30 when the latter is in the condition of a closed metallic circuit disconnected from the ground, and said instruments, or one of them, also respond when the main line 20 30 is connected with the ground and the ground connection is broken and closed in accordance with the current-impulses to be transmitted. The break-wheel b^2, when sending the building-number alone, produces both these effects, so that the signal is received by the line when intact and in working condition on the metallic-circuit instrument, and if the line extending from one side of the break-wheel to the central office is broken the said message is received over the ground-circuit through the line at the other side of the break-wheel. This result is effected by the construction of break-wheel best shown in Fig. 7. The portions 20 30 of the main line entering at the two sides of the stations are connected with two springs w w^2, which normally rest in contact with the surface of the break-wheel b^2, and are thus connected, keeping the metallic circuit closed. When the break-wheel is set in motion, a series of notches b^5, corresponding to the number of the signal, (in this instance "23,") pass beneath the springs, thus causing them to become electrically separated, so as to cause breaks in the metallic circuit, which produce the corresponding signal at the receiving-station. Immediately after these notches have passed the springs w w^2 and while the latter remain in contact with the surface of the break-wheel a number of projections b^6 on the latter, corresponding to the arrangement of the notches, pass a contact-spring w^3, connected by a branch wire 31, Fig. 8, with the ground, and thus produce, as shown in this instance, the same number and arrangement of closures in the grounded circuit that the notches produce breaks in the metallic circuit, although it is obvious that the breaks and closures might be reversed, if desired. After both notches b^5 and projections b^6 have passed the corresponding springs there is a sufficient portion of the periphery of the break-wheel which has to pass in contact with the springs w w^2 before the notches come around at the end of the rotation of the said springs to afford time for the reception of the floor-number signal, if such signal is to be sent. This floor-number signal is produced by the movement of the armature-lever i^2 of the relay-magnet i, if said relay is affected by the controlling circuit and drum d and springs e e^2, as before described, as follows: The said armature-lever i^2 is connected by wire 32 with the break-wheel b^2, as by a spring w^4, which rests in contact with the said break-wheel during the entire rotation thereof. One of the stops (in this instance the front stop i^3) of the relay-armature lever i^2 is adapted to be connected by wire 33 34 35 with the ground in case the building-number is to be transmitted, so that in such event the attractive movements of the armature i^2 produced in response to the action of the projections of the drum d and springs e e^2, as before described, will produce a number of closed impulses in the ground branch 32 33 34 35, which will be received the same as those produced by the projections b^6 in the ground branch 31. If the relay-armature were arranged to close on its back stop, it would keep the ground on the main line all the time, except when the teeth corresponding to the springs e e^2, &c., up to the loop that was opened were passing the said springs, which would produce an objectionable record, while if it closed upon the front stop and the latter were connected directly and permanently with the ground it would remain closed all the time when the motor was operated without causing the relay to respond, as is the case when the accidental derangement of the controlling-line occurs. This would also be objectionable, and in order to cause the relay to send closed impulses only in response to the drum d and springs e e^2, &c., the ground connection from the front stop i^3 includes contact-springs h^6 h^7, which co-operate with the armatures k of the magnets h h^2, the said armature being electrically connected by the metallic frame-work, as indicated at 34 in the diagram, while the springs h^6 h^7 are insulated from said frame-work and disconnected from said armatures when the latter are attracted, as shown in Fig. 3, one of said springs being connected by wire 35 with the ground and the other by wire 33 with the relay-contact i^3. It thus requires the dropping of the armatures of both magnets h h^2 to connect the ground branch 33 34 35 of the main circuit 20 30, so as to make the relay-armature operative to transmit into the main line, and as it is only when the armatures of both magnets h h^2 have been released that the building-number is to be transmitted, and as it is only under these conditions that the relay-armature will respond, it is obvious that the floor-number will be transmitted with certainty, in addition to the building-number, over the main line 20 30. As the magnet h^3 is connected with the ground near the end of the controlling-circuit remote from the battery, a ground connection made at any point on the said circuit will short-circuit the said magnet, which will drop its armature and cause the motor to start; but as the magnets h h^2 are placed in the battery-circuit near the battery they will not be shunted by a ground connection on the exposed part of the branches. The relay i would also be demagnetized by the grounding of the circuit; but this would produce no effect on the receiving-instrument, and the motor would run and turn in the building-number by the break-wheel b^2 the same as for an accidental break in the controlling-line.

In order to bring the relay i into circuit again in case it has been shunted by a grounding action on the controlling-circuit, the switch t^5 is employed, the same consisting of an elbow-lever having one arm divided into two prongs which normally stand disconnected from the springs t t^2, as shown in full lines, Fig. 6. The other arm t^7 of said elbow-lever is in position to be acted upon by a cam t^8 on the shaft b^3 of the drum, which cam immediately after the motor is set in motion acts on the said arm t^7, which is shown as provided with a friction-roll, and turns the switch t^5, so that its prongs lift the springs t t^2 from their ground-contacts t^3 t^4, and at the same time connect the said springs t t^2 together, thus making a direct metallic connection between the terminals 2 10 of the circuit of the battery B, which will then work as a metallic circuit unaffected by the single ground-contact that has accidentally been made with it. The switch t^5 bears with sufficient friction upon the springs t t^2 to remain in engagement therewith after the cam has passed them, so that after the building-number has been sent in by the action of the ground-magnet h^3, showing a disabling of the line, the circuit of the battery B will remain as a metallic circuit and will operate the same as the ground-circuit before described to again transmit the building-number if one of the branches should become accidentally broken, or to transmit the building-number, followed by the floor-number, if both branches should be broken.

The advantage of carrying the loops 5 15 25 of the second branch to the springs e^{11} e^{12} e^{13}, &c., is as follows: If either branch should be broken accidentally—for example, in loop 1—and a fire should subsequently break out in loop 3, the latter floor-number—namely, 3—would surely be transmitted, as the battery B would find a circuit through one or the other of the branches up to the third loop, and consequently the drum would transmit three impulses to the relay-magnet i, causing the latter to transmit the correct floor-number. If, however, only one of the branches should have its loop extended to the transmitter, as shown in full lines, and that branch should become accidentally broken, for example, in the first loop or in any loop nearer the battery than the one in which a fire might subsequently break out, then if the second loop should be opened by a fire the floor-number transmitted would be that corresponding to the loop which was accidentally broken and not the one corresponding to the location of the fire, as the circuit through the springs and drum would be complete only up to the break nearest the battery. In other words, in either arrangement it requires the opening of both branches to cause the relay to respond, and where but one branch is carried to the transmitter-drum it will always transmit the number of the loop in that branch nearest the battery that is broken, if it happens to be broken in more than one loop, while if both branches are carried to the drum and are broken one in one loop and the other in another loop more remote from the battery the floor-number corresponding to the last-mentioned loop will be transmitted. Such inaccuracies, however, are of not much consequence, as the essential thing is to distinguish between fire-alarms and what may be called "disabled-line alarms," which is done with certainty, except in case both branches should be accidentally broken, which would be a rare occurrence. Usually when the line is in normal condition a thermostat in one branch will almost certainly be operated in advance of one in the other branch, so that the fire-alarm commonly received consists of one or two rounds of the building-number alone, followed by four rounds consisting of the building-number followed by the floor-number. The armature of the magnet h^3 is provided with a considerably stronger retractor than that of the other armature, so that if the battery B weakens the said armature will be released and cause the transmission of the building-number, and also cause the battery to be put in metallic circuit, while the battery strength is still sufficient to properly operate the other magnets h, h^2, and i.

The apparatus may be modified in various ways as to mechanical construction, and the invention in its main features is not limited to the specific details of construction herein shown.

I claim—

1. The combination of a motor and detent therefor with two electro-magnets and armatures, each operatively connected with the motor-detent, and a circuit having two normally-closed branches, each including the coils of one of said detent-magnets and being extended through an exposed locality and containing thermostatic circuit-controllers therein, as set forth, whereby the breaking of one of said branches affects the corresponding magnet and causes it to release the motor-detent, but a breakage of both of said branches is required to completely open the said circuit, substantially as described.

2. The combination of the motor and its detent with two detent-operating electro-magnets and armatures included in two branches from a battery-circuit, and an electro-magnet included in an unbranched portion of said circuit, a signaling-surface operated by said motor, and contacts co-operating therewith connected with one or both of said branches, said signaling-surface and contacts governing the current through the last-mentioned magnet when both said branches of the battery-circuit are opened, substantially as described.

3. The combination of a motor and detent therefor with three magnets and armatures, each governing the operation of said detent, and a circuit for the said magnets having two branches, one of which passes first through the coils of one of said magnets and the other of which passes first through the coils of the other of said magnets, said branches beyond said magnets being each provided with a series of circuit-breakers beyond which said branches are joined together, the circuit beyond this junction passing through the coils of the third magnet, substantially as and for the purpose described.

4. The combination of a motor and detent therefor with three magnets and armatures, each governing the operation of said detent, and a circuit for the said magnets including a battery having one terminal connected with the ground and its other terminal connected with two branches which pass first each through the coils of one of said magnets and beyond said magnets are each provided with a series of circuit-breakers beyond which said branches are joined together, the circuit beyond this junction passing through the coils of the third magnet and to the ground, and a switch operated by said motor that removes the ground connections and places the terminals of the circuit adjacent to said ground connections in metallic connection, substantially as and for the purpose described.

5. The combination of the motor and its detent with two detent-operating electro-magnets and armatures and a relay magnet and armature, a controlling-circuit including a battery and having two branches passing through the coils of said detent-magnets, respectively, and an unbranched portion passing through the coils of said relay, and a signaling-surface operated by said motor governing the current through the coils of said relay when both said branches are broken, and a main circuit disconnected from the said controlling-circuit and operatively connected with the armature of the said relay, substantially as described.

6. The combination of the motor and break-wheel operated thereby, and transmitting-circuit responsive to said break-wheel, and a detent for said motor with two detent-operating magnets included in separate branches of a controlling-circuit disconnected from the said transmitting-circuit, and a relay having its coils included in the unbranched portion of said controlling-circuit and its armature operatively connected with the main transmitting-circuit, substantially as described.

7. The combination of the motor and break-wheel operated thereby and a transmitting-circuit responsive to said break-wheel with a detent for said motor, two detent-operating magnets included in separate branches of a controlling-circuit disconnected from said transmitting-circuit, and a relay having its coils included in the unbranched portion of said controlling-circuit, and a ground branch connected with the said transmitting-circuit controlled by the armature of said relay and provided with circuit-closers controlled by the detent-operating magnets, substantially as described.

8. The combination of the motor and its detent and a signaling-surface operated thereby with two detent-operating electro-magnets and armatures and a relay-magnet and armature, a controlling-circuit including the coils of said relay-magnet and having two branches including the coils of said detent-magnets, respectively, and being extended through several distinct localities, one of said branches being connected at points between said localities with contact-pieces co-operating with the said signaling-surface which governs the current passing through said relay-magnet when both of said branches are broken, and a main circuit disconnected from said controlling-circuit and operatively connected with the armature of said relay, substantially as described.

9. The combination of the detent with the detent-controller normally impelled in one direction, but prevented from moving while the detent is engaged, an independent detent-holder, as *p*, for retaining said detent disengaged and at the same time permitting the detent-controller to be moved into position to retain the detent disengaged, and an engaging part of the motor which operates the said detent-holder and controller, as described, whereby the latter permits re-engagement of the detent only after a definite run of the motor, substantially as described.

10. The combination of the motor with its detent and a detent-controller normally impelled in one direction, but prevented from moving while the said detent is engaged, the said motor being provided with a portion that intermittingly engages the said detent-controller and moves the same step by step toward the position to permit re-engagement of the detent, and a secondary detent-controller, as *r*, which prevents engagement of the detent after the detent-controller is brought into position to permit such engagement, substantially as and for the purpose described.

11. The combination of the detent-supporting arm, as c^6, with the detent-controller *o*, having a notch or shoulder o^2 and shoulder o^5, both co-operating with the detent and a toothed supporting portion o^6, and actuating-teeth o^7, operated by the motor, substantially as and for the purpose described.

12. The combination of the main transmitting-circuit, a transmitter-motor, and detent therefor with two detent-controlling magnets and armatures and circuit-changers operated by said armatures connected in series with one another with said main transmitting-circuit, whereby the operation of both magnets is required to make the portion of the main circuit controlled by said circuit-changers operative for transmission, substantially as described.

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

MORRIS MARTIN.

Witnesses:
JOS. P. LIVERMORE,
JAS. J. MALONEY.