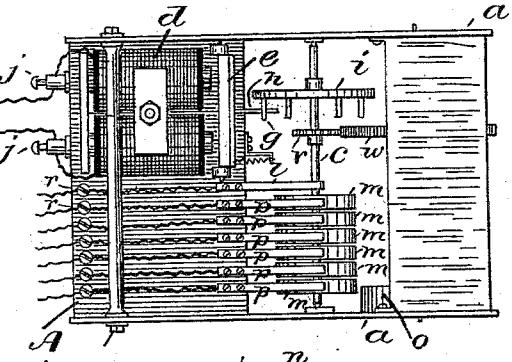
(No Model.) 2 Sheets—Sheet 1.

T. D. LOCKWOOD.

INDIVIDUAL SIGNALING APPARATUS.

No. 296,588. Patented Apr. 8, 1884.

Fig. 1.



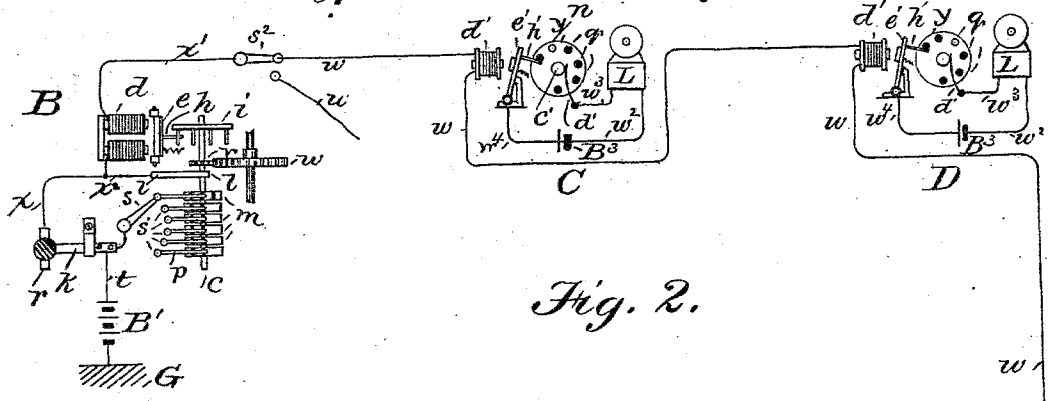
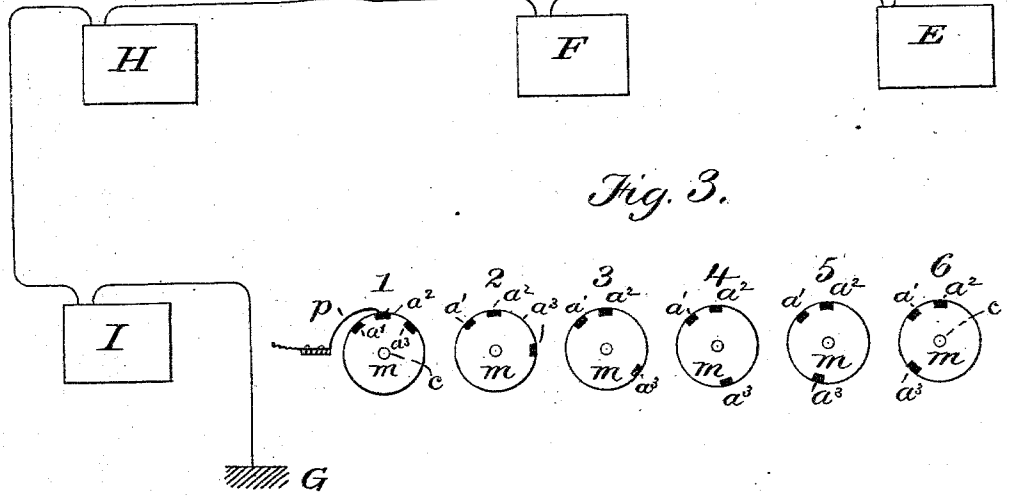


Fig. 2.

Fig. 3.



Witnesses.

J. H. Cheever.

Geo. Willis Pierce

Inventor.

Thos D Lockwood

(No Model.) 2 Sheets—Sheet 2.

T. D. LOCKWOOD.

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Fig. 5.

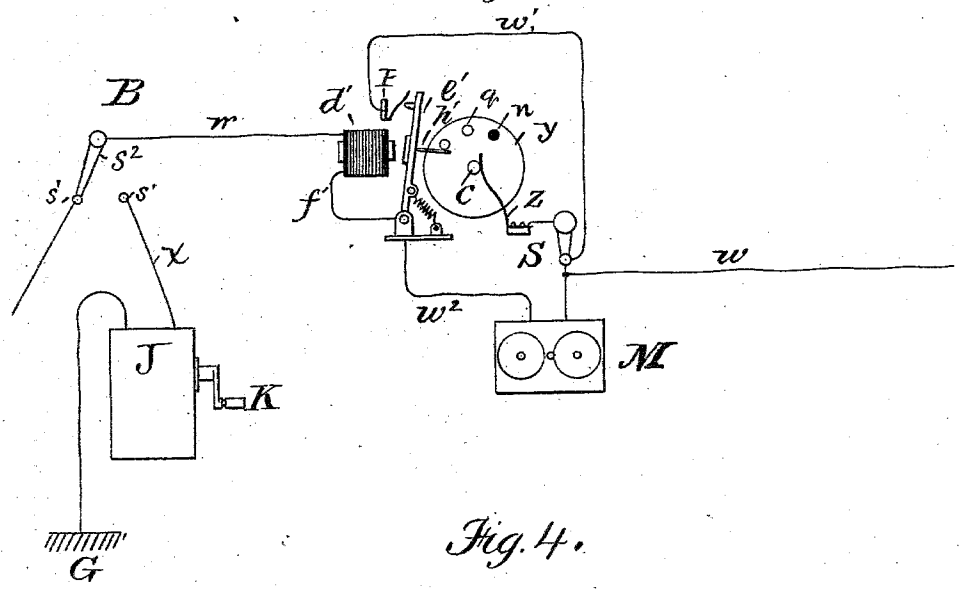
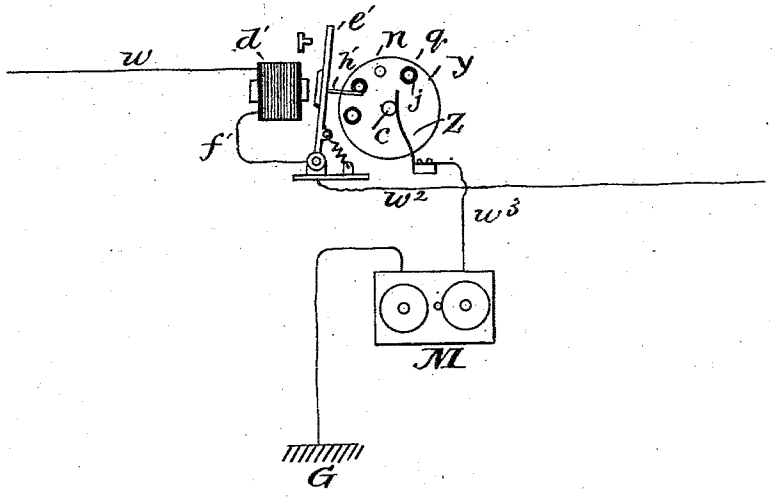


Fig. 4.



Witnesses.
J. H. Cheever.
Geo. Willis Pierce

Inventor:
Thos. D. Lockwood

UNITED STATES PATENT OFFICE.

THOMAS D. LOCKWOOD, OF MALDEN, MASSACHUSETTS.

INDIVIDUAL SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 296,588, dated April 8, 1884.

Application filed December 22, 1883. (No model.)

To all whom it may concern:

Be it known that I, THOMAS D. LOCKWOOD, of Malden, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Individual Signaling Apparatus, of which the following is a specification.

My present invention is an improved apparatus for signaling upon telephone or telegraphic lines in cases where more than two stations are connected on the same line or circuit. It especially relates to that class of electrical signals wherein the alarm device at each station is included in a branch or local circuit which is normally inert or disconnected from the main circuit, but which is adapted to be brought into action by the influence of currents passing in the main line.

My invention has for its object to enable the operator at the central station of a telephone-exchange or principal station of a line to sound a call signal or alarm at any one of the stations, as may be desired, without signaling any of the other stations on the same line, and to effect this result efficiently, but surely, and by means of apparatus of very simple construction and general character.

To this end my invention consists in placing at the central station a suitable automatic transmitting device with controlling appliances, and at each sub-station a signaling-instrument adapted to follow and reproduce the movements of the transmitter, moving when the said transmitter moves, and resting when it rests.

To be more specific, the central-office apparatus consists in a clock-movement provided with a motor—such as a spring, *o*—and having a detent or stop, which, normally, is in position to maintain the clock-train quiescent, but which is adapted to be withdrawn therefrom by the attractive power of an electro-magnet, and to again fall back and arrest the movement of the clock-work when the said electro-magnet loses its attractive power. The clock train or movement is furnished with a series of rotary circuit breakers or controllers equal in number to the greatest number of sub-stations on any of the lines, each circuit-controller representing one sub-station signaling-instrument. The electro-magnet which actuates the stopping and starting device is in the line-circuit, and I provide in combination therewith a source of electricity—such as a voltaic battery—and suitable electric connections, whereby the electric currents or impulses emanating from said source may be directed to the line through the electro-magnet only, or through the electro-magnet in conjunction with any one of the circuit-controllers. The circuit-controller employed determines which sub-station instrument shall be sounded by automatically opening the main circuit after a predetermined time shall have elapsed from the starting of the transmitter. As each sub-station instrument reaches its ringing position at a period differing from any of the others, it follows that the alarm-instrument which corresponds to the special circuit-controller that is switched into circuit will be the one to respond to the action of the transmitter. At each sub-station a clock-movement actuated by a suitable motor is also placed, and it is adapted to rotate isochronously and synchronously with the clock-work of the transmitting-instrument. All of the sub-station mechanisms are normally at rest, being so maintained by an electro-magnetic detent similar in character to that at the central office. The alarm-instrument is included in a branch or local circuit, which is adapted to be brought into action in each instrument at a time differing from all of the others, as will be more particularly hereinafter described.

In a former patent granted to me November 1, 1881, No. 249,147, I showed three forms of signaling-circuit, each normally separated from the main line, but each adapted at a suitable time to be made a part thereof, or to become active by the currents passing therein; and I propose to employ the same forms in connection with my present invention, the essence of which consists, not in the sub-station-circuit arrangement, but in the peculiar transmitting-instrument, and in the said transmitter in combination with its circuit-connections and responding instrument.

In the accompanying drawings, Figure 1 is a plan view of my transmitting-instrument. Fig. 2 represents, diagrammatically, the combination of the same transmitter in circuit with suitable signaling devices and operating appliances. Fig. 3 shows a side view of the several transmitter-wheels. Fig. 4 shows a

modification of the application of my invention, showing the signaling-instrument included in an earth branch; and Fig. 5 is a second modification, showing its applicability to arrangement in a derived circuit of the main line.

In the operation of this invention, it will be seen that a single pulsation of electricity given at the central station will release the clock-work of the transmitting device, and simultaneously the clock-movements of every individual signaling device on the line. The transmitting device will, as soon as it is in motion, include one of the circuit-controllers in the line, and the battery-current continues to flow to line through the given circuit-controller, the transmitter, electro-magnet, and also through all the sub-station electro-magnets until the first insulating-point is reached on the circuit-controlling wheel, when the circuit is automatically opened, all the electro-magnets instantly becoming demagnetized and suffering their armatures to fall back and arrest their clock mechanism at the first stop-pin that reaches the retracted detent; but one of the sub-station mechanisms—that corresponding to the circuit-controller operated at the central station—will stop with a metallic or conducting stop-point in contact with the armature-detent, and thus a local circuit including an electric bell will be closed, and the bell will ring for as long a time as the central station may determine. The operator may then once more press the key for an instant and release the clock mechanisms, whereupon they will continue in motion until the next insulating-space on the circuit-controller comes in contact with the circuit-spring, when the circuit is again opened and the mechanisms again simultaneously come to rest. This second insulating-space is identical in position for all of the circuit-controllers, and serves as a "line-in-use" signal, and any sub-station observing that its mechanism is stopped upon the last pin will understand that some sub-station is using the line.

In Figs. 1 and 2, A is the automatic transmitter, which is placed at the central or principal station, B, and is composed of the following elements: In a suitable case, *a*, an ordinary clock-movement driven by a spring or other motor, *o*, is placed, which, by the spur-wheel *w* and pinion *v*, actuates an arbor, *c*, carrying a vertical stop-wheel or escapement, *i*, which has projecting from one of its sides stop-pins *g g*, and a number of circuit wheels or controllers, *m*. The circuit-controllers are shown in elevation in Fig. 3, and consist of disks or bodies of conducting material having insulating-pieces let into their periphery. They are adapted to be fixed upon the arbor *c*, and while two of the insulating-pieces are in the same position for each circuit-wheel the third is in a position which differs for each wheel. The non-conducting piece a^2 in each represents the point on which the contact-spring *p* normally rests, thus holding the line through the circuit-wheels open. The piece a', immediately to the left of the piece a^2, represents the position of "line in use," and is in the same position for each wheel. The piece a^3 differs for each wheel, in wheel 1 being but one space in front of the piece a^2, in wheel 2 two spaces in front, in wheel 3 three spaces in front, and so on. Each wheel has a separate contact-spring, *p*, bearing thereon, the said contact-springs each being in electrical connection with one of a series of metal switch-studs, *s'*. These studs are all in the radius of the switch *s*, which may be set on any of them, thus determining the circuit-wheel which shall be made operative. The switch *s* is permanently united by wire with the strap-key *k*, or any equivalent device—such as a press-button—and the key is, by the wire *t*, connected with a battery, B', the other pole of which is to earth. The battery may of course, be replaced by a dynamo or magneto electric machine, if such be found more convenient. The clock-train is normally arrested and maintained inert by a detent, *h*, projecting from the armature-lever *e* of an electro-magnet, *d*, and resting against a pin, *g*, of the escapement-wheel *i*, and therefore, when the said magnet is excited and the armature attracted thereto, the clock-work is released and becomes active, rotating the circuit-controllers *m*. One of the wires, *x*, leading from the magnet, is united with the anvil *r* of the key, and also has a branch, x^2, to the contact-spring *l*, which at its free end bears on the arbor *c*. The other magnet-wire, *x'*, leads to a switch, s^2, of any convenient form, and may thereby be connected with any outgoing line.

A line-wire, *w*, leads successively to the sub-stations C, D, E, F, H, and I, at each of which is placed the responding instrument for signaling, which I will now describe.

A clock-movement similar in character to the one employed in the transmitting device is adapted to rotate the disks *y* at each station, and these disks each have a number of stop-pins, *q*, projecting horizontally from them and arranged to engage with the detent *h'* of the armature *e'*, when the said armature is in its normal position—*i. e.*, when it is not attracted by the electro-magnet *d'*. All of the stop-pins *q* at each disk are made of non-conducting material, except one, *n*, which is made of metal, and which differs in position for each station. Thus, in station C, the metal pin *n* is the second of the series, in station D the third, and so on. They correspond to the second insulating-space in the circuit-controllers at the central station, and the rotatable disk is thus made to possess the double function of clock-movement regulator and circuit-commutator.

The body of the disk is of metal, and, through the arbor *c'*, is connected by the spring *d'* and wire w^3 with the alarm-bell L in the circuit of a local battery, B^3. The said battery is on one side united by wire w^2 with the bell, and on the other side by wire w^4 with the armature *e'* of the main-line electro-magnet *d'*, and since the armature normally makes contact with the

disk only through one of the non-conducting pins *q*, the local circuit is normally open; but when the disk *y* is released and permitted to rotate for part of a revolution and then arrested, so that its conducting-pin *n* comes in contact with the armature-detent *h'*, the local circuit is closed and the bell rings, and as the pin *n* of any given sub-station disk differs in position from all of the others, none of the bells at the other stations will ring.

The precise details of operation are as hereinbefore indicated.

To call, say, station 2, the operator at the central station first sets his switch *s* on the second stud, *s'*, connecting it with circuit-controlling-wheel No. 2; but since the free end of the contact-spring as yet rests on the normal-condition non-conducting piece a^2, no current goes to line. He then presses the key *k* for an instant on its anvil *r*, thus directing the battery-current *via* wire *x*, magnet *d*, and wire *x'*, to line, energizing at the same time the central and sub-station magnets, *d d'*. The armatures at all sub-stations are thereby attracted, and the clock-movements all start together. As soon, however, as the transmitting device starts, the non-conducting piece a^3 passes from under the spring *p*, which then rests on the metal periphery of the circuit-controller *m*, and the battery-circuit remains closed onto the line *via* wire *t*, key *k*, switch *s*, second stud, *s'*, circuit-wheel *m*, arbor *c*, spring *l*, wire x^2, magnet *d*, wire *x'*, and switch s^2. The clock-trains at all of the stations consequently continue to rotate the disks *y* until the insulating space or piece a^3 reaches and passes under the contact-spring *p*, when the battery-circuit is automatically broken and the armatures of all the stations fall back, arresting all the disks on the second stop-pin after the normal position, or the third pin, counting from the normal-position pin. The second sub-station disk, being thus arrested with its metal stop-pin *n* in contact with the armature-detent, will close the local circuit of the battery B^3, and the bell L will ring as long as the local circuit is closed, which may be for a greater or less time, as determined by the central-office operator. When the signal is responded to by the sub-station operator, the central office will cause the alarm to cease, and will also again permit the clock-train to move by simply giving a second signal momentary pressure of the key *k*. This throws the battery again to line *via* the wire *x* and electro-magnet *d*, energizing all the magnets once more, and permitting the motors to actuate the clock-trains and rotate the disks *y* until the second insulating-space, *a'*, is reached, when the disks again stop altogether, and may be so left until the completion of the communication, the abnormal position of the disk at each station indicating that the line is in use at some station. Upon the completion of the communication a single electrical impulse given by the key releases the clock-trains still once more, and they finally come to rest in the normal position.

It is of course obvious that in the use of my invention I am not restricted to any special order in the arrangement of the sub-station, but may transpose the numbers in any way which may be convenient, provided that when any individual station is to be called I switch into circuit at the central station the circuit-controller corresponding thereto.

In Fig. 4 I show a modification of the sub-station mechanism, in which the signal-bell is connected in the circuit of a ground branch. The main wire *w* enters the electro-magnet helix *d'*, passes by wire *f* to the armature *e'*, then out to the next station by wire w^2. A contact-spring, *z*, bears upon the arbor *c*, and is united with the ground branch wire w^3, leading to signal-bell M and ground G. The disk *y* and the pins *q* may be of non-conducting material, while the ringing-pin *n* may be of metal, and connected with the arbor by a wire or link of metal; or the arrangement may be as shown—viz., a metal disk, from which the ordinary stop-pins, *q*, are insulated by non-conducting bushes *j*, the ringing-pin being, on the contrary, in metallic contact with the disk, and consequently with the arbor or the stopping-pins *q*. When the signal is given, the armature is attracted, as in the former plan, and falls back, when the circuit is opened by the automatic action of the transmitter, thus making contact with the short circuit to ground, through the bell M, *via* detent *h'*, pin *n*, disk *y*, arbor *c*, spring *z*, and wire 3.

The second modification, Fig. 5, shows the alarm-bell in a derived circuit of the main line. The said line, after passing through the actuating electro-magnet *d'*, extends by wire *f* to the armature *e'*, where it divides, the normal route being *via* armature-lever, detent *h'*, disk *y*, arbor *c*, spring *z*, switch S, and out by wire *w*. This route normally short-circuits the bell, which is in the derived circuit leading from the armature by wire w^2 and bell M to the main line out *w*. A branch, *w'*, is led from the main wire outside of the instrument to the plate P, and when the armature is attracted the main line closes on this plate before it withdraws from the stop-pin *q*, so that no beat is lost. The object of the switch S is to enable the sub-station operator to open manually the direct branch, so that he may send a signal to the central station by means of signaling apparatus, which, in practice, is included in the bell branch. In this modification it will be necessary that all the stop-pins, as also the disk, shall be of conducting material, the ringing-pin only being a non-conductor. When the disk stops on the ringing-pin, the direct circuit is opened and the main line passes through the bell, which may then be rung by the central-office operator, who transfers the main line by means of the switch s^2 from the wire *x*, leading to the transmitting device, to the button *s'*, leading by wire *x'* to the generator J, and then turning the crank K, or otherwise sending rapidly-alter-

nating currents to line, rings the bell. The currents thus sent, being alternating and very transient, will not affect the neutral armatures of the electro-magnets *d'*, but will cause the bell M to respond and give the alarm.

Although I have described but one line in combination with the transmitting device, it is clear that it may be readily connected, by well-known switching devices, to any number of lines and made to serve them, so that it is only necessary to have a single transmitter for a large central station.

My invention is preferably intended for use in combination with telephone systems, and those skilled in the art may readily connect transmitting and receiving telephones therewith; but I have not considered it necessary to show the necessary connections in this specification, as forming no part of my invention; and

I claim—

1. The hereinbefore-described system of electric signaling circuits and apparatus, consisting of an automatic circuit-controlling device at a central station, said device comprising a series of movable circuit-controllers adapted to break the circuit at a time different for each, a main battery or equivalent source of electricity, and a series of sub-station signaling-instruments each in a local circuit or in a branch or derived main-line circuit, and each provided with a commutator controlled by an electro-magnet in the main circuit, adapted to respond to the circuit changes effected by the central-office circuit-controlling device, whereby the several signaling-instruments, each at a time differing from the others, may be energized and caused to give the signal, or brought into position to give the signal, substantially as described.

2. The combination, with an electric signaling-circuit, of a series of clock-work motors each controlled by an electro-magnet included in the said circuit, a series of rotary circuit-controllers, such as described, attached to and adapted to be rotated by one of the motors, and means, as indicated, whereby a battery may be momentarily connected with the main circuit independent of the circuit-controllers, to energize all of the electro-magnets included therein, and to start the motors and immediately thereafter to connect the battery to line through any desired one of the circuit-controllers, so that as soon as the said circuit-controller in its rotation opens the circuit all the electro-magnets in circuit will be automatically arrested, substantially as and for the purposes described.

3. The combination, substantially as hereinbefore described, in an electric signaling-circuit connecting a central-station and a series of sub-stations, of a central station signaling-instrument consisting of a motor, a controlling electro-magnet, a number of circuit-controllers actuated by said motor, means, as indicated, whereby a battery may be directed to line through either of the said circuit-controllers, and other means whereby any one of the circuit-controllers can be placed in the line-circuit and made operative to the exclusion of the others, with a series of sub-station signaling-instruments each corresponding to one of the central-station circuit-controllers, and each consisting of an alarm-bell in a normally incomplete or inoperative shunt, branch, or local circuit, a motor similar to that of the central-office instruments, a commutator or circuit-changer actuated thereby for completing or making operative the bell-circuit, and an electro-magnet in the main-line circuit adapted to respond to changes in the current traversing the same, and to control the motor, the central and sub-station instruments being adapted to be simultaneously set in motion by a single electric impulse, and to be stopped at the ringing-point of the station desired by the automatic action of the central-office instrument in opening the battery-circuit after a lapse of time, depending in length upon the circuit-controller employed, whereby the bell at the sub-station corresponding to the circuit-controller employed may be rung, the bells at the other stations remaining quiescent, for the purpose specified.

4. A signal-transmitting instrument consisting of a clock-work and actuating-motor therefor, an electro-magnet in an electric circuit controlling the said motor, a series of circuit wheels or controllers driven by said clock-work, any one of which may be manually included in the said electric circuit, and each of which is provided with a non-conducting unison-point located in the same position in each one of the series, a non-conducting point differing in position for each wheel, and adapted to break the circuit at a definite point in the revolution of the wheels, and a third non-conducting point identical in position for each wheel, adapted to break the main-line circuit when the revolution is nearly completed, to serve as a visual signal, and a key circuit-closer to close the battery through the electro-magnet independent of the circuit-wheels, all in combination, whereby the said transmitter is adapted to energize its own electro-magnet, and any others which may be in circuit therewith, and thus to release the motor and clock-work and actuate the circuit-controlling wheels by closing the circuit with the key, to open the circuit again, discharging the electro-magnets, and automatically stop the motor at a definite period in the revolution of said wheels, and when the said motors are again manually started by means of the key to open the circuit a second time at a point near the completion of the revolution, substantially as and for the purposes described.

5. The combination of a signal-transmitting instrument consisting of a clock-work and motor therefor, an electro-magnet controlling the said motor, a series of circuit-wheels driven by said clock-work, a switch for connecting any of the said circuit-wheels in the main-line, and a key for closing the circuit of a battery

onto the line independent of the route through the circuit-wheel, and a main battery with two or more alarm-instruments, each consisting of a clock-work and motor, a controlling electro-magnet therefor in the main-line circuit, an electro-magnetic bell in a normally-inactive independent or branch circuit, and a commutator actuated by the clock-train and motor, the said commutator at each alarm-instrument being adapted to correspond with any one of the signal-transmitter circuit-wheels, as described, and to close or make operative its own bell-circuit at a time differing from all the others, all arranged as described, whereby the transmitting and signal-receiving motors may be simultaneously released and automatically stopped by the action of the circuit-wheel corresponding to the alarm-instrument to be rung, substantially as and for the purposes specified.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 19th day of December, 1883.

THOS. D. LOCKWOOD.

Witnesses:
J. H. CHEEVER,
GEO. WILLIS PIERCE.