(No Model.) 2 Sheets—Sheet 1.

G. L. ANDERS.

Telephone Signaling Apparatus.

No. 240,878. Patented May 3, 1881.

Fig. 1.

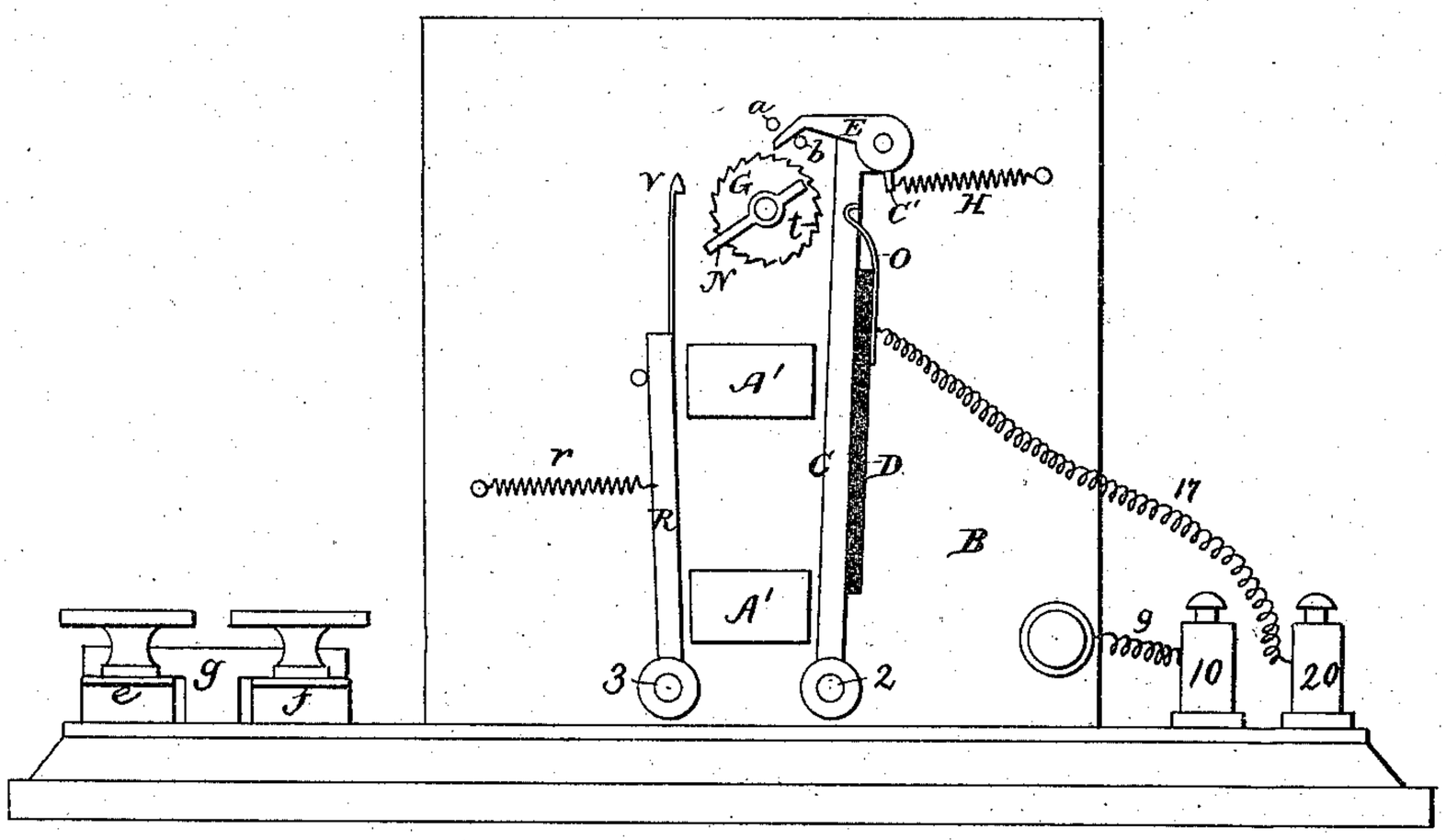
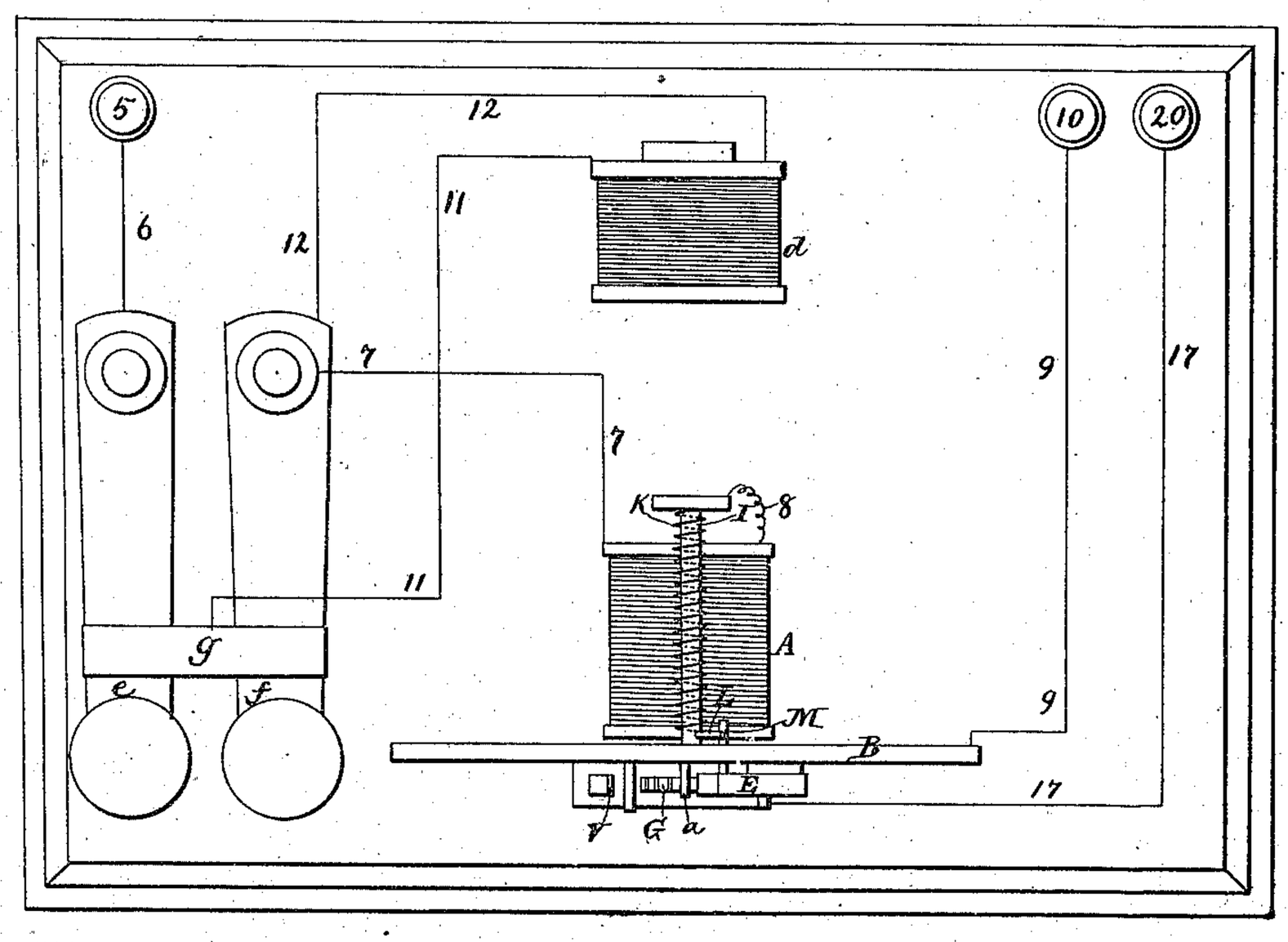


Fig. 3.



Witnesses.
Jos. P. Livermore
L. F. Connor.

Inventor.
George L. Anders
by Crosby & Gregory
Attys.

(No Model.) 2 Sheets—Sheet 2.

G. L. ANDERS.

Telephone Signaling Apparatus.

No. 240,878. **Patented May 3, 1881.**

Fig. 2.

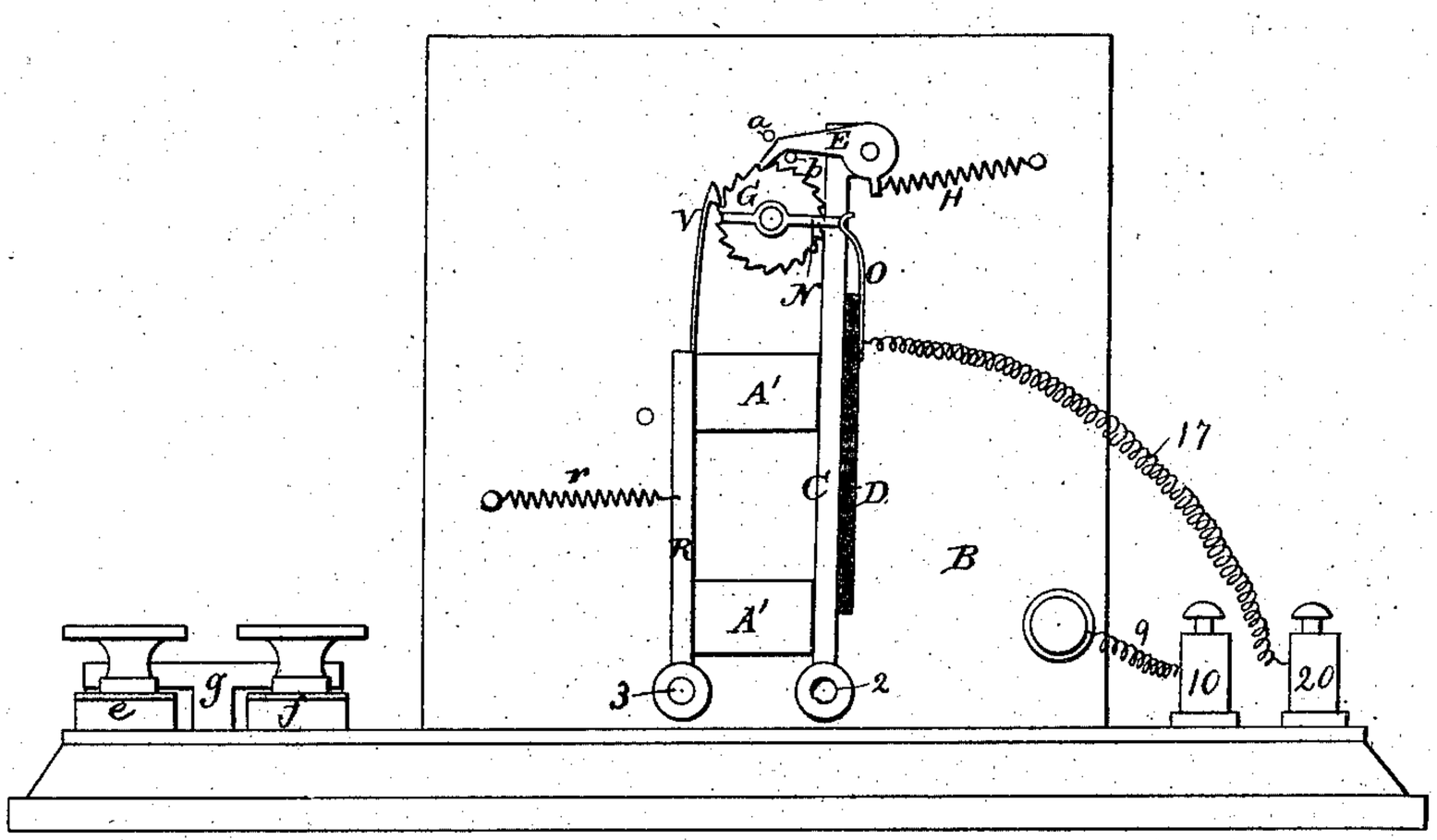


Fig. 4.

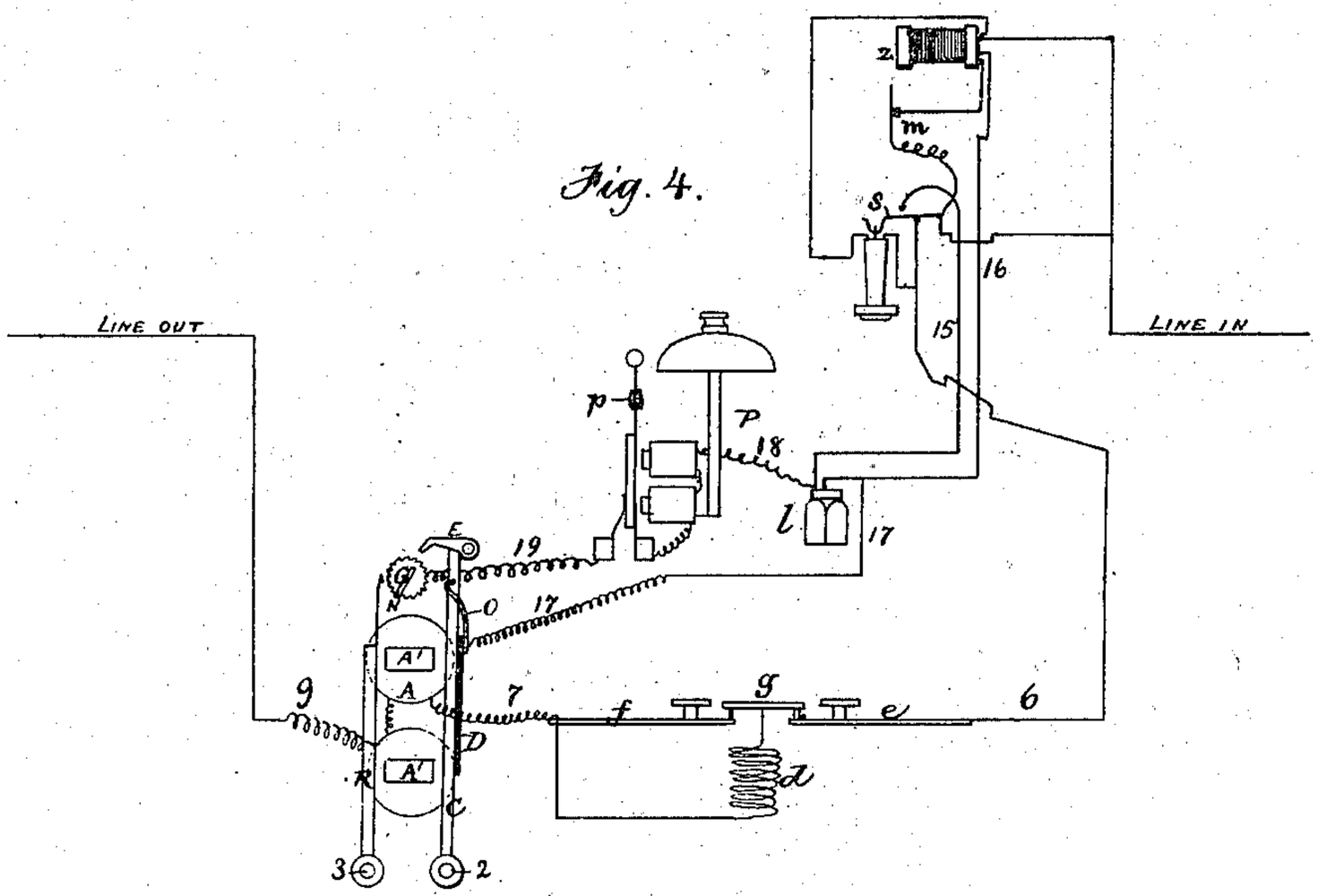
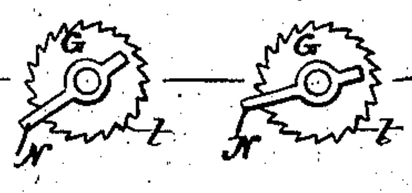


Fig. 5.



Witnesses.
Jos. P. Livermore
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Inventor:
George L. Anders
by Crosby & Gregory
Attys.

UNITED STATES PATENT OFFICE.

GEORGE L. ANDERS, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO AMERICAN BELL TELEPHONE COMPANY, OF SAME PLACE.

TELEPHONE SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 240,878, dated May 3, 1881.

Application filed April 19, 1880. (No model.)

To all whom it may concern:

Be it known that I, GEO. L. ANDERS, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Telephone Signal Apparatus, of which the following description, in connection with the accompanying drawings, is a specification.

My invention relates to signals, and is one of that class known as "individual" signals, in which a series of stations are all provided with signals operated in the same electric circuit, but arranged so that only the desired one of the whole series will be operated at any one time.

In an individual-signal system invented by me and patented under the number 219,059 and date September 2, 1879, a signal-controlling mechanism having a step-by-step movement actuated by an electro-magnet was arranged to allow a signal to be given after a certain number of movements, the said number being different in each instrument, and consequently an operator, by sending the proper number of electric impulses of the right character to actuate the step-by-step mechanism, can set any one of the instruments in condition to give a signal, after which the signal may be operated in any manner which will not interfere with the step-by-step mechanism. As a step-by-step mechanism may sometimes fail or skip one movement, it is possible that one of the instruments might get out of its proper arrangement or cause its signal to be sounded after the wrong number of impulses. I provided a device by which all the instruments could be placed in unison or brought to a common starting-point from which the appropriate number of movements or impulses for a given instrument would arrange it to give its signal.

In the patent referred to, as well as in other modifications of the same principle upon which applications for patents are now pending, the different operations of setting the controlling mechanism and ringing the bell, or bringing the different instruments into unison, have been separately performed by currents of opposite polarity applied by a common reversing-key, which must be placed between the battery and all the instruments that are to be affected thereby, and has been shown as manipulated by an operator at a central office, such method of operation being perhaps the best when all the signals are to be given from one point.

The object of my present invention is to enable signals to be given from any one to any other station independently of all the rest of the stations on the same circuit, which could only be accomplished where reverse currents are employed by placing a sufficient battery at each station to operate all the signal-instruments.

I accomplish this by actuating the step-by-step mechanism by variations in the strength of the current, each such variation causing the said mechanism in all the instruments to advance one step, and being easily made by an operator at any station by introducing resistance into the circuit at that station. The instruments are brought to a unison or common starting-point by breaking the circuit, and in practice this operation may be used as a return-signal to show that the signal has been received, the communicant desiring to call another operating a key to interpose resistance the proper number of times to enable the desired signal to be sounded, and the one called, upon receiving the signal, operating a key to break the circuit, and consequently set the instruments in unison, which, being observed, informs the first signaler that the second has received his notice. The suitable resistance-coils and keys to interpose them and break the circuit can readily be supplied in connection with each instrument, and require no adjustment or care.

The invention also consists in the method of giving the signal by causing the step-by-step mechanism, after the appropriate number of movements for a given instrument, to close a circuit through a vibrating bell, and as herein shown the said circuit is the local circuit of the usual microphone transmitting-instrument, which is not required for transmitting while a signal is being given or the communicating apparatus out of use and a signal awaited.

It is obvious that this apparatus may be operated from a central office alone, if desired,

in which case the resistance-coils and keys for interposing them may be omitted at all except the central station.

Figure 1 is a front elevation of a signal apparatus with the parts in the position assumed when the circuit is broken and all the instruments in unison or at the common starting-point for operation; Fig. 2, a view of the same with the parts in position to give a signal; Fig. 3, a plan view thereof, and Fig. 4 a diagram showing more clearly the electric circuits and their relation to the instrument. Fig. 5 is a diagram showing the relative position of the arm for closing the signal-bell circuit in two instruments of a series.

The operating electro-magnet A is supported on the frame-work, with its poles A′ extending through a plate, B, sustaining the parts of the step-by-step movement, actuated by the armature C, pivoted at 2 on the said plate B. The armature C is provided at its upper end with a pawl, E, which, when the said armature is drawn up to the magnet, as shown in Fig. 2, engages the ratchet-wheel G, pivoted on a shaft, I, and moves it forward one tooth, meeting at the end of said movement the pin *a*, which presses it against the wheel G, to prevent it from being carried farther by its momentum. When the armature C is released and falls back from the magnet, the pawl E strikes the pin *b*, and is raised thereby out of range of the teeth of the wheel G, to allow it to turn back; but while the step-by-step movement is going on the said wheel is engaged by the retaining-pawl V, held in proper position therefor by the armature R, pivoted at 3, and remaining attracted to the magnet A during the movement of the armature C, which is released by a reduction of the strength of the current, as hereinafter described, not sufficient to cause the release of the armature R.

The retracting-spring H of the armature C is attached to the pawl E in such manner, as shown, that it also has a tendency to force the end of the said pawl down into engagement with the wheel G.

In the step-by-step movement of the wheel G caused by the vibration of the armature C, the said wheel is rotated against a slight retracting force, shown as a spiral spring, K, surrounding the shaft I, and attached at one end to the said shaft and at the other to the frame-work, so that when both of the pawls V and E are withdrawn by their retracting-springs H and *r*, as shown in Fig. 1, upon the demagnetization of the magnet A the said wheel is rotated in a reverse direction by the said spring K until the pin L upon its shaft I engages a pin, M, on the plate B, and thus stops the said shaft and wheel at a definite point, from which it will be started upon a new operation of the armatures C R. As in its normal condition the circuit is closed through the magnet A, both armatures C R will be attracted as soon as the key used to break the circuit and set back the wheel G, as just described, is returned to its normal condition, and consequently the pawls E V will remain, as shown in Fig. 2, in engagement with the teeth of the said wheel G, itself set back in the position shown in Fig. 1, until a new signal is to be given, when the armature C is vibrated and the wheel G rotated. The said ratchet-wheel G may be provided with any means to control a signal either mechanically or electrically, permitting the said signal to be given only when the said wheel has reached one definite point in its rotation and remains there, this part of the instrument being denominated the "signal-controlling mechanism." In the present invention the signal is controlled electrically, the wheel G being provided with a circuit-closing arm, N, which, after a certain number of vibrations of the armature C, and consequent advancement of the wheel G, comes in the position shown in Fig. 2, to be met by the complementary circuit-closer O, carried by the armature C, but insulated therefrom by the block D in the movement of the said armature up to the poles of the magnet.

It will be seen that the arm N has a rotary movement, while the circuit-closer O, which is a yielding spring, comes against it, thus giving a rubbing contact.

The arms N in the different instruments of the circuit are all placed in different positions relative to the starting-point of the wheel G. If the tooth *t*, which is opposite the circuit-closer O when the instruments are in their normal initial position, as before described, is taken as a starting-point, the arm N of the instrument in hand is placed opposite the seventh tooth, so that if just seven of the proper changes are made in the current to vibrate the armature C, the arm *n* will be brought around opposite and met by the circuit-closer O, to close a local circuit and sound a signal placed therein, the pieces N O being the terminals of the said local circuit, as hereinafter described.

The arms N in the different instruments are placed opposite different teeth, counting from the one *t*, as shown, for two instruments in Fig. 5; and it will be seen that the local circuits are momentarily closed at each instrument, where the said arm is at a less distance from the tooth *t* than that of the station to be signaled. The signals are consequently made slow in action, and do not operate until the circuit has been closed for a longer time than intervenes between the steps of the movement.

The instruments are operated as follows: The circuit of the actuating-current, starting from the binding-screw 5, passes by wire 6 to the spring breaking-key *e* normally in contact with its back-stop *g*, through which the current passes to the resistance-key *f*, joined by wire 7 with the coils of the magnet A, from which the circuit is continued by wire 8 to the frame-work of the instrument, and thence by wire 9 to the binding-screw 10. Between the back-stop *g* of the keys *e f* and the magnet A

are placed the resistance-coils *d*, which should preferably be of a resistance equal to more than half of the main circuit, the said coils being shown as connected by wire 11 with the back-stop *g*, and by wire 12 with the key *f*. By this arrangement, when the keys *e f* are in their normal position the circuit passes over them and the stop *g* through the magnet *a*, the resistance *d* being short-circuited, and the current acts with full force on the magnets A of the different instruments, which consequently hold both armatures C R in the position shown in Fig. 2. When the key *f* is depressed the short circuit is broken between it and the stop *g*, and the current is obliged to pass through the coils *d*, thereby reducing the magnetic force of the magnet A without wholly demagnetizing it. The retracting-springs H and *r* are so adjusted that the former overcomes the attractive force of the magnet when thus reduced, but the latter does not, so that at each depression of the key *f* the armature C falls back, and when the key is released is again attracted, thus moving the signal-controlling mechanism in all the instruments. For example, if it be desired to call the station of the instrument shown in the drawings, the key *f* of the instrument of the station calling would be depressed seven times, bringing the arm N of the said instrument opposite the circuit-closer O, which would remain pressed against it, retaining a local circuit through it closed until the instrument was further operated, the arms N of the other instruments in the circuit either having passed or not yet reached their corresponding circuit-closers O. The said local circuit is shown in Fig. 4 as passing through the local battery *l* of the usual microphone-transmitter *m*, the circuit 15 16 thereof used for transmission being then open at the usual automatic switch *s*.

The transmitter *m* is connected with the line by an induction-coil, *z*, having its primary circuit in the local transmitting-circuit 15 16 and its secondary circuit in the line-wire. The coils of the telephone-receiver, which, when not in use, hangs upon the switch *s*, as shown, are connected with the line-wire. A shunt around the receiver and induction-coil is closed when the switch *s* is depressed, and broken when it is allowed to rise on removal of the telephone-receiver.

The local circuit for signaling is shown as passing from the battery *l*, by wire 17, to the circuit-closer O, and from the other pole of the said battery, by wire 18, to the vibrating bell P, and thence by wire 19 to the frame-work of the machine and arm N. This local circuit is connected at the binding-screws 10 20 of the other figures. In order that the signals P should not operate during the momentary closing of the circuit at O N at the stations not to be called, the said signals should be slow in their action, which can be secured by providing a weight, *p*, on their hammers.

As before described, the local circuit of any instrument, after once being closed, will remain so until the instrument is further operated, which might be done by depressing the key *f*, in which case another station would be called, but will usually be done by depressing the breaking-key *e*, which breaks the circuit at *e g*, and consequently demagnetizes the magnets A, and releases both armatures C R of all the instruments, and allows the wheels G to be all placed at their common starting-point. This will usually be done by the person receiving the signal, who thus stops his signal from ringing, while the falling back of the armatures C R indicates to the one who sent the signal that it has been received.

It is obvious that the wire 12 from the resistance *d* might be joined directly with the binding-screw 10, in which case the instrument from which the signal was sent would not properly operate its own wheel G, as both the armatures *c k* would be released by depressing the key *f*; but it is not necessary that the instrument of the station calling should operate.

It will be noticed that the signal-controlling mechanism is very light and easily moved, so that the apparatus can be operated with scarcely more power than is needed to give the required pressure of the spring O for a good electrical contact, or, in other words, to operate a common relay.

It is obvious that the mechanical construction may be varied, as well as the means of controlling the actuating electric current, without departing from my invention, which consists, mainly, in adapting an individual-signal system operated by successive changes in an electric current to be used for signaling between the different stations on a circuit. The signal-controlling mechanism may render all the signals silent but one mechanically, as in some of my former inventions, and the signal operated by currents in the same main circuit which operates the controlling mechanism, or the circuit-closer N O may close a shunt of the said main circuit or throw a signal into the main circuit.

I claim—

1. In an electric signal apparatus, a series of instruments at different stations in the same electric circuit, each consisting of a signal-controlling mechanism and an electro-magnet to operate it to set the controlling mechanism in position to allow a signal to be given by a definite number, different for each instrument of the series, of changes in the electric current controlling the said operating-magnet, and mechanism, also controlled by an electro-magnet, to set all the signal-controlling mechanisms in unison or at a common starting-point by another change in the electric current, and means at each of the said stations to make either of the said changes in the electric current, thereby to enable an operator at any station to cause a signal to be given at any other station of the circuit, or to set all the instruments in unison

after a signal has been given, the coils of the electro-magnets, as well for setting the several instruments in unison as for operating them to give a signal, being included in the circuit connecting the stations, so as to be traversed by the currents on said circuit, substantially as described.

2. In a signal apparatus, a signal-controlling mechanism to be set in position to give a signal, and an electro-magnet and an armature therefor operated to actuate the said controlling mechanism by variations in the strength of an unbroken electric current, and mechanism operated upon the demagnetization of an electro-magnet to set the signal-controlling mechanism at a definite starting-point, substantially as described.

3. In an electric signal apparatus, a series of signal-stations, each containing instruments consisting of signal-controlling mechanism and an electro-magnet and its armature, operated by interposing resistance in the circuit a definite number of times to set the said mechanism in position to give a signal, and mechanism operated by breaking the circuit to set the signal-controlling mechanism at a definite starting-point, combined with a key at each one of the said stations, to enable the operator to break the circuit and set the mechanism of all the instruments at the said starting-point, substantially as described.

4. In an electro-magnetic instrument, the combination, with step-by-step mechanism, of armatures connected respectively with devices for actuating the step-by-step mechanism, and with a retaining-pawl, and operated by currents of different strength, as explained, so that the retaining-pawl is not affected by the variations in the strength of current required to operate the actuating-armature, but is released by a further weakening or cessation of the current, substantially as described.

5. The combination, with two local circuits connected with the poles of the same battery, of a telephonic transmitter and switch in one of said circuits and a vibrating or circuit-breaking bell and circuit-closer in the other, said circuit-closer being operated by currents on the main line, substantially as described.

6. In a signal apparatus, a series of instruments, each containing mechanism adapted after a definite number, different in each, of impulses to close an electric circuit, combined with vibrating bells placed in the said circuit, made slow in operation, whereby they will not be sounded by the momentary closing of the said circuit caused by the movement thereof necessary for the operation of a signal at another station, substantially as described.

7. The herein-described circuit-closer, consisting of an arm forming one terminal of an electric circuit and capable of being rotated by a vibrating armature, and a circuit-closer forming the other terminal of the said circuit, carried by the said armature and brought thereby into contact with the said arm when it has arrived in the proper position in its rotation, substantially as described.

8. An electro-magnet and two armatures, one adapted to be vibrated by changes in the strength of a continuous electric current to operate a step-by-step mechanism, and the other adapted to prevent a backward movement of the said mechanism while thus operated, but to release it when the current is broken, substantially as described.

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

GEORGE LEE ANDERS.

Witnesses:
JOS. P. LIVERMORE,
N. E. C. WHITNEY.