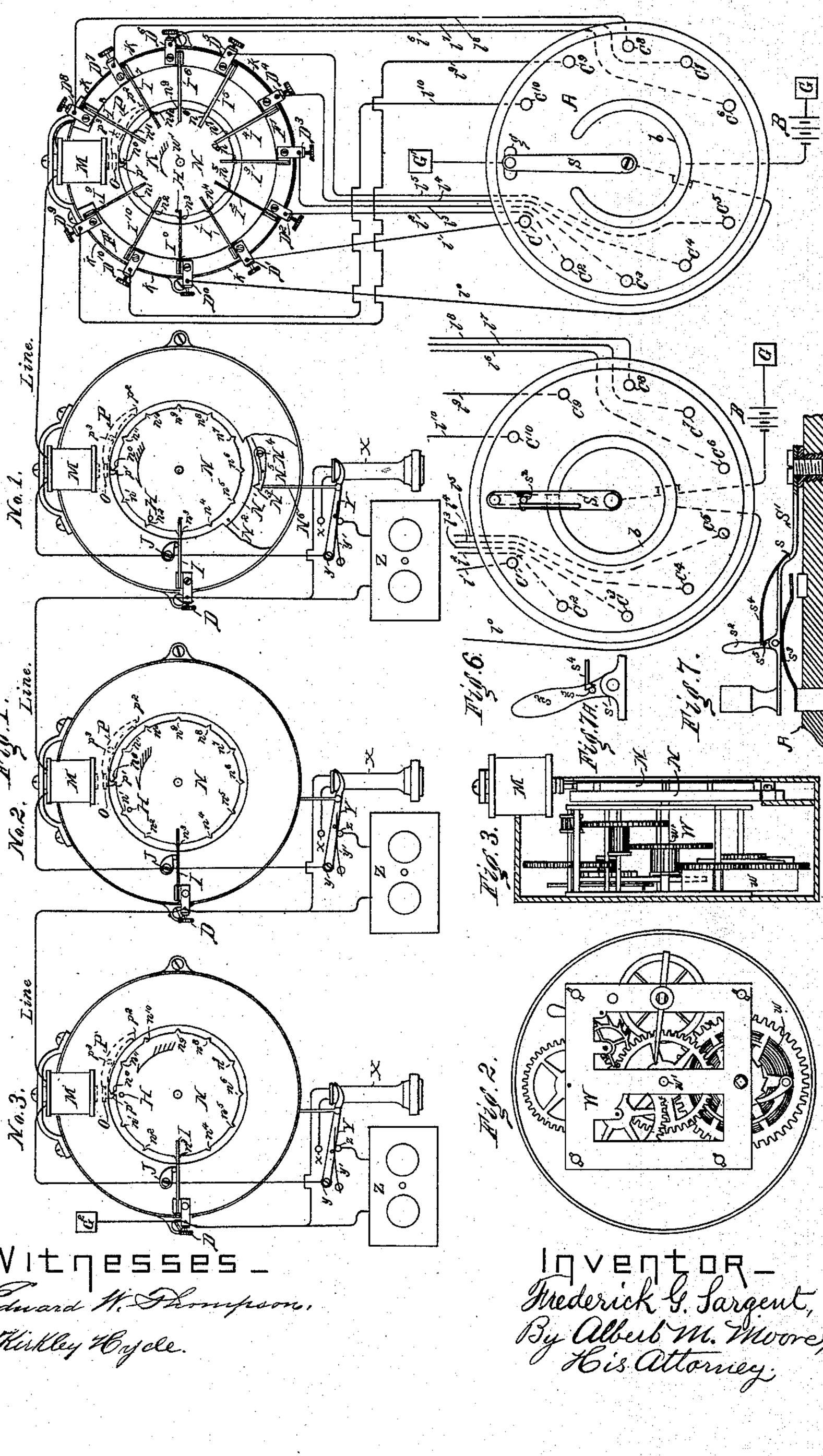
(No Model.) 2 Sheets—Sheet 1.

F. G. SARGENT.

ELECTRIC SIGNALING APPARATUS.

No. 326,158. Patented Sept. 15, 1885.



Witnesses—
Edward W. Thompson,
Kirkley Cycle.

Inventor—
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His Attorney.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 4.

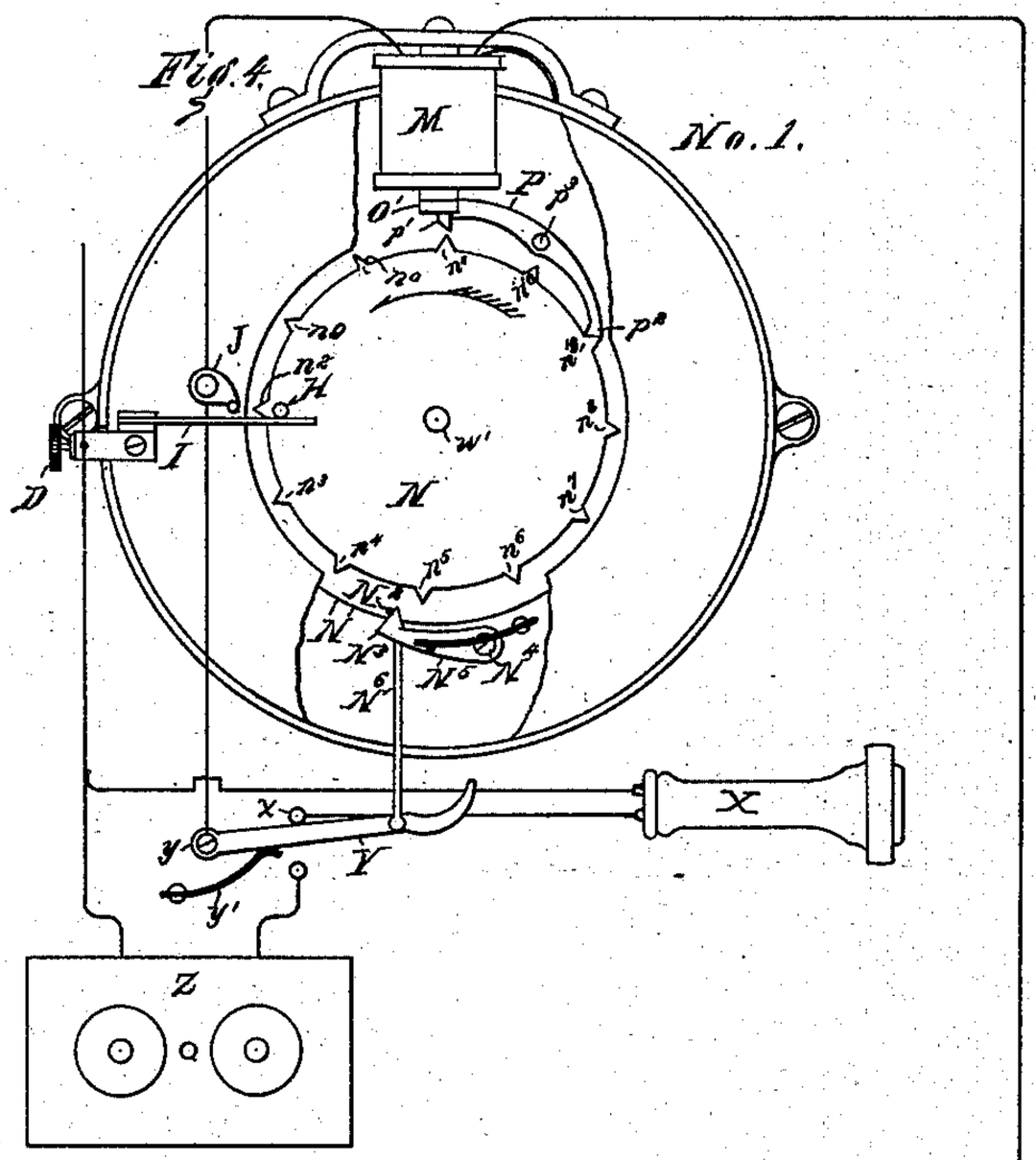
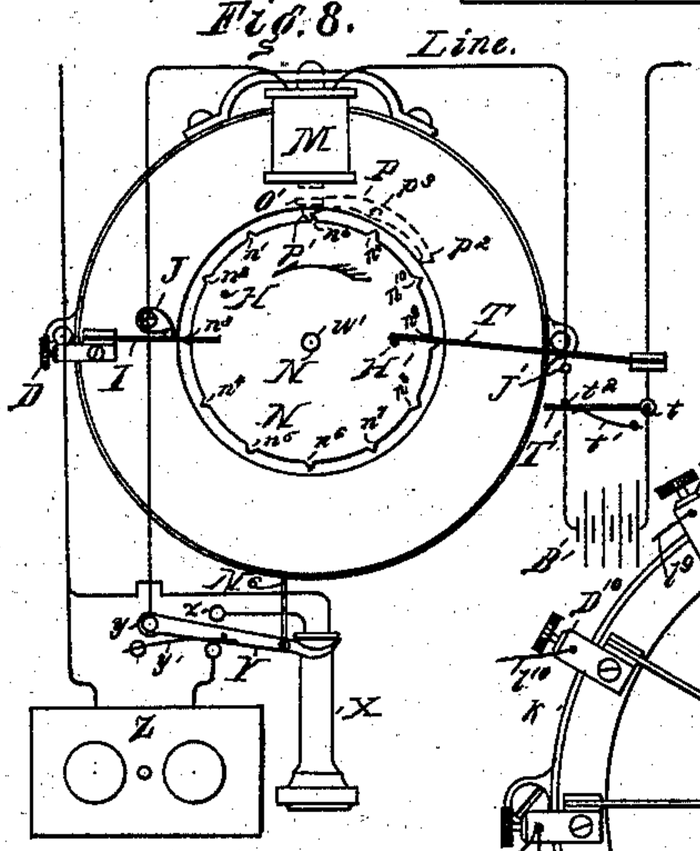
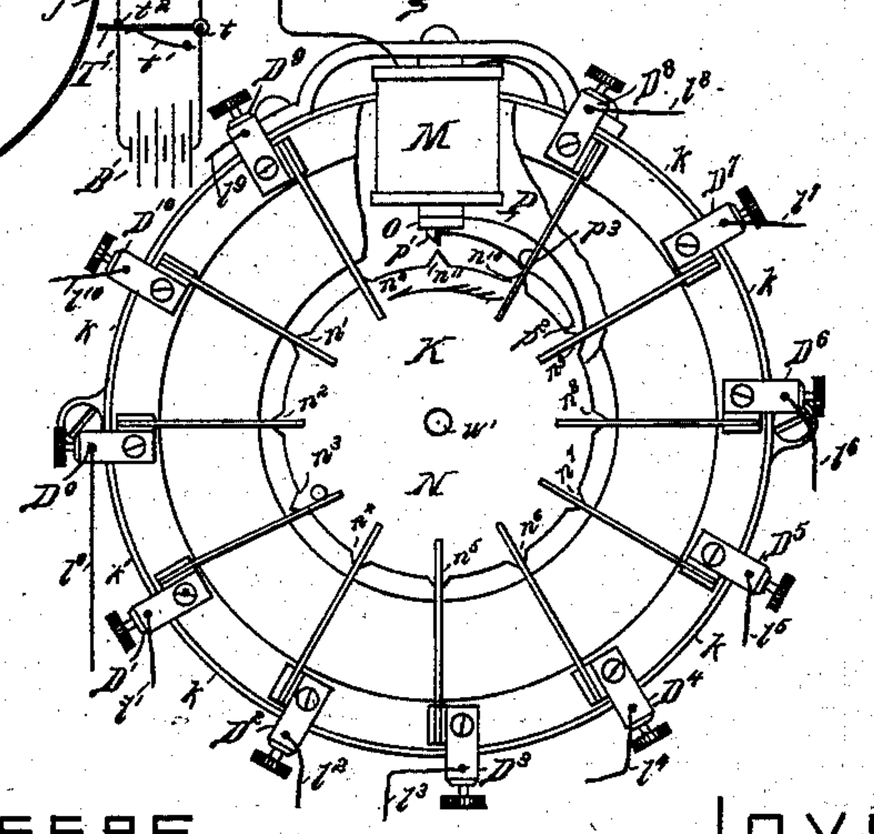


Fig. 8.



Line.

Fig. 5.



Witnesses—

Edward W. Thompson.

Kirkley & Cycle.

Inventor—

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UNITED STATES PATENT OFFICE.

FREDERICK G. SARGENT, OF WESTFORD, MASSACHUSETTS.

ELECTRIC SIGNALING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 326,158, dated September 15, 1885.

Application filed April 8, 1884. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK G. SARGENT, a citizen of the United States, residing at Westford, in the county of Middlesex and Commonwealth of Massachusetts, have invented certain new and useful Improvements in Electric Signaling Apparatus, of which the following is a specification.

My invention relates to electric signaling apparatus, and is more especially adapted for use in telephonic circuits, to enable the central office to signal any one of a number of sub-stations on a circuit without at the same time calling any other sub-station on the same circuit; and it consists in the devices and combinations hereinafter described and claimed.

In the accompanying drawings, on two sheets, Figure 1 is a diagrammatic representation of a telephonic circuit showing the essentially-novel features of my invention at a central station and at three sub-stations, except that no means of calling the central office from a sub-station are shown, the central-station switch-board and caller being adapted for use with ten stations, the catch-lever and some of the connecting-wires being shown in dotted lines; Fig. 2, a front elevation of clock-work, such as may be used to rotate the disk of any instrument in the circuit, and its case; Fig. 3, a central vertical section of the same with an electro-magnet at the top of the case; Fig. 4, an enlarged elevation of sub-station 1, the hand telephone or receiver being removed from its hook and the disk being thereby locked, said sub-station 1 being connected by wire to the central-office caller, of which Fig. 5 is a front elevation. Fig. 6 is a plan of the switch-board and connections used with a closed circuit; Fig. 7, an enlarged central section of a portion of the same, showing the switch-lever in side elevation; Fig. 7ª, an enlarged view of the handle pivoted on said switch-lever. Fig. 8 shows the parts represented in Fig. 4 in front elevation, together with the local battery and means of calling the central office.

A in Fig. 1 is a switch-board of insulating material, preferably circular, to the center of which is pivoted the switch S. The switch-board is provided with metallic contact-spots C' C^2 C^3 C^4 C^5 C^6 C^7 C^8 C^9 C^{10}, equal in number to the number of sub-stations which the switch-board and caller K are capable of accommodating, and provided, also, with a ground-strip, g, grounded at G'. The contact-spots C' C^2, &c., are connected by wires l' l^2, &c., to the binding-screws D' D^2, &c., of the caller, as described below. The pivot of the switch is connected to the binding-screw D^0. There is a metallic strip, b, made in the form of the arc of a circle, connected to the battery B, as shown, the battery being grounded at G. The battery-strip b is concentric with the switch-board A, and is of such a length and so disposed that the switch S, when in contact with any of the contact-spots C' C^2, &c., is also in contact with said battery-strip b, and when in contact with the ground-strip g, is out of contact with said battery-strip.

The caller K at the central office consists of a metallic case, k, upon which is supported an electro-magnet, M, the coils of which are connected at one end to said case k, and at the other end to the line out, the armature O of said magnet being secured to a lever, P, pivoted at p^3. (See Fig. 5.) The lever P is provided at each end with a catch, p' p^2, each catch having an inclined outer face, and the front catch, p', or catch immediately below the armature, having a straight inner or rear face.

Within the case k is a metallic clock-work, W, of any suitable well-known construction, (see Figs. 2 and 3,) driven by a mainspring, w, or by a weight, if preferred, and adapted to revolve the spindle w' once in half a minute.

Upon the spindle w' is secured centrally the metallic disk N, which is provided with as many V-shaped projections or teeth, n' n^2 n^3 n^4, &c., as there are binding-screws D^0 D', &c., on said caller, and with another tooth, n^0, which is in shape like the rear half of one of the other teeth—that is, having a straight front side—the inclination of the sides of the teeth corresponding with the inclination of the inclined surfaces of the catches p' p^2, to allow the catches to slide over them when the armature O is not held against the electro-magnet M. The teeth n^0 n', &c., are arranged at equal distances around the disk N. When the circuit is not in use, the front catch, p', engages the tooth n^0, as shown in Fig. 1, and the lever P is of such a length that when the electro-magnet M at-

tracts the armature O, disengaging the front catch, p', and then releases the armature, the lever P will vibrate on its pivot p^3 as it is struck by the teeth in succession—that is, the front catch being struck by the front side of one tooth will be raised, throwing down the rear catch, and then the rear catch will be struck by the front side of the next tooth but one, throwing down the front catch, and so on, until the tooth n^0 again strikes the front catch, and the disk N is prevented from further rotation.

The binding-screws D^0 D', &c., are supported upon an arc-shaped strip, F, of insulating material, and are each in electrical connection with a separate very flexible metallic spring, I^0 I' I^2 I^3 I^4 I^5 I^6 I^7 I^8 I^9 I^{10}, each spring standing radially to the disk N and directly over a whole tooth when the disk is not in use, except that the spring I^0, connected by wire to the pivot of the switch, is a little shorter than the others, and when the line is not in use is bent slightly by a metallic pin, H, inserted in the metallic disk N, in the radius which passes through the tooth nearest said spring I^0, at which time, evidently, the ground-plate G' is in electrical connection with the line through the ground-strip g, switch S, wire l^0, spring I^0, pin H, disk N, clock-work W, case k, and electro-magnet M. The springs I', &c., are so flexible that they oppose no substantial resistance to the revolution of the disk N.

At each sub-station there is a case, electro-magnet, armature, catch-lever, clock-work, and disk provided with teeth, and a pin, precisely like the parts of the same name at the central office, except that the position of said pin H on the disk N with reference to the tooth n^0 is different from that of the central office, and different from that of any other sub-station.

At each sub-station there is a single binding-screw, D, insulated from the case, and a single spring, I, shaped and supported like the springs I' I^2, &c., which spring I, for convenience, should always be placed at the same part of the instrument, say at the left, and ninety degrees from the top of the case, as shown in Figs. 1 and 4. The free end of the spring I is always in contact with the metallic post J in the face of the instrument when the line is not in use. The line runs from the central office to the electro-magnet M, thence to the post J, which is connected by wire to the pivot y of the forked switch Y, the latter being of well-known construction.

This switch Y is held in spite of the spring y' against the contact-point z by the weight of the hand-telephone X or receiver hanging thereon when not in use. The contact-point z at each station is connected through the magneto-bell Z or other signal to the screw-cup D. The receiver X is electrically connected by wire to the contact-point x and to the binding-screw D, as shown, so that removing said receiver from the fork Y puts it in circuit, it being thrown up by the spring y', and hanging it in the fork puts it out of circuit in the usual manner.

From the binding-screw D, at each sub-station, except the one farthest from the central office, the line runs to the coil of the electro-magnet of the sub-station next farthest from the central office, and from said coil to the post J, and so on, as above described, the binding-screw D at the last station being connected to the ground at G^2.

Behind the disk N, concentric with it, and secured to the same shaft, there is at each sub-station another disk, N', slightly larger than said disk N. The disk N' is provided with a pin, N^2, which projects from its face at right angles to the same, but is not long enough to strike the spring. The pin N^2 on the larger disk is at such a distance from the pin H on the smaller disk that when the former pin, N^2, strikes the stop N^3 the latter pin, H, will be pressing against the spring I and holding it out of contact with the post J. The stop N^3 is a lever pivoted to a stationary part of the case of the instrument at N^4, its free end being thrown upward by the spring N^5, and said lever being connected by a link, N^6, to the forked switch or telephone-hook Y, so that when the receiver is in the fork the stop N^3 does not interfere with the rotation of the disks, but when the receiver is removed from the fork, and thereby put into circuit, the stop will be raised by the springs (either one of which may be made strong enough for that purpose) and will stop the rotation of the disks when the stop-pin strikes the stops, the act of removing the telephone from the fork also breaking the current momentarily and allowing the disks to start again. Suppose, now, that it is desired to call sub-station 1 from the central office. The receivers being all hung up, the switch S is turned over contact C' on the key-board, touching the battery-strip b, and a current from the battery is sent to line through battery-strip b, switch-lever S, wire l^0, spring I^0, central-office clock-work W, and magnet M, and through all the magnets and springs at the sub-stations to ground G^2 at the last station. The current will raise the armatures and front ends of the catch-levers P and start the clock-work at each station, and the clock-movements will cause the disks N at each station to rotate in substantially equal times with each other and with the central-office disk, until stopped by the half-tooth coming in contact with the front catch of the catch-lever, or by removing the hand-telephone from its fork, both as above described. The rotation of the disk at the central office will carry the pin H beyond the spring I^0 and break the circuit, but the circuit will be closed immediately by said pin H striking against the spring I', (which is connected, as above described, by wire l' to the contact-point C',) the pin at station 1 at the same time touching the spring I, and immediately push-

ing said spring away from the post J and sending the current through the signal-box, (thereby ringing the bells Z,) and thence to line through the other stations as before, the pin H being in contact with its spring at only one station at a time. If the hand-telephone be not now removed from its fork, the pin H at No. 1 sub-station will stop against its spring, each disk N being held from rotation by the rear catch pressing against a tooth of the disk, (the armature at each station being attracted by the closing of the circuit, as above described,) and the bell at the station called will ring until the circuit is broken. It will be seen that although in every revolution of the disk at any station the spring I will be once bent away from its contact-post J, there will be no current sent through the signal of such sub-station unless the switch-lever at the central station is on such a contact-point that the pin H closes the circuit through the spring of the caller connected to said point at the same time that the pin H at said sub station bends its spring I away from the contact-post J at that station. Thus in signaling sub-station 1 there is no current through the caller at the time the pin H in station 2 presses the spring I away from the post J, because the pin of the caller has then passed that spring which is connected to the contact-point on which the switch lies. In the same way, in calling sub-station 2, the switch would be on contact-point C^2, and when the pin in either sub-station 1 or 3 presses the spring away from the contact-post the pin of the caller is pressing against the spring I′ or the spring I^3, neither of which last-named springs would, in the case supposed, be connected to the battery by the switch S.

When any sub-station is called, the lessee thereof should take down the receiver while his bell rings. If he does so, the disk at his sub-station and the disks at all the other sub-stations will be started by the breaking of the circuit when the fork rises off from the lower contact, Z. The disk of his sub-station will be stopped by the lever N^3 rising in front of the stop-pin N^2, as above described, while the disks at the other sub-stations will be stopped by the closing of the circuit and the attraction of the armature when the fork rises against the upper contact, X, and will be held from rotation until the circuit is broken, when they will return to the unison-point. The switch S at the central office may then be placed on another contact-point, and another sub-station on the same circuit be thereby called and placed in communication with the one first called.

The above description applies to the use of the devices therein named with an open circuit. The same devices may, however, be used with a closed circuit, (see Figs. 6 and 7,) and no change be made in the caller at the sub stations; but it will be necessary to connect the pivot of the switch S with the battery, instead of with the strip or arc *b*, and to keep the switch at all times in contact with the strip, which may therefore for convenience merely be a complete circle, b^2, instead of an arc. It will be necessary to connect the starting-spring I^0 with this arc or circle. The other spring-connections are the same as before described. The switch S being thus arranged and wired, the electro-magnets will hold up their armatures and the disks will be prevented from turning by the rear catch pressing against a tooth of the disk until such time as the circuit is broken by lifting the switch-lever S out of contact with the circle. This may be accomplished by having the contact-points C project to such a distance from the switch-board that the switch-lever cannot touch the circle, but will be lifted above it when its point rests upon any one of the contact-points; but I prefer to use a switch-lever, S′, of the kind shown in Fig. 7, which is like the one shown in Fig. 1, except that it is offset upward at *s* between the pivot and the circle, the parts of the lever on each side of the offset being parallel to the face of the switch-board A. About half-way between the offset and the point of the switch the switch is slotted and provided with ears *s′*, between which is pivoted the handle s^2, to which is secured beneath the switch a metallic strip, s^3, the outer end of which, by moving the upper end of the handle away from the center of the switch-board, may be brought near enough to the switch-board to be in contact with a contact-point, the inner end of said strip s^3 being thereby raised out of contact with the circle *b*. On the other hand, it is apparent that when the handle s^2 is tipped toward the center of the switch-board the inner end of the strip s^3 will be in contact with the circle and the outer end thereof will be raised too high to touch a contact-point over which it may be extended. In either case the strip is always in contact with the switch. Whichever of the switches last named are used the switch is normally in contact with the circle and the circuit is closed.

In order to call any sub-station—say sub-station 3—the switch in Figs. 6 and 7 is swung over the proper contact-point and thrown out of contact with the circle and into contact with the contact-point, which evidently breaks the circuit and releases the armature. This allows the disks to revolve and the catch-lever to rock back and forth upon its pivot until the pin in the caller, reaching the third spring, I^3, from the starting-spring, closes the circuit, at which time the pin H at sub-station three will touch its spring, and, pushing it away from the post, will cause the current to pass through the signal, as before; but when the circuit is closed by the pin H of the caller touching the spring I^3 the armatures will be attracted and the rear catches will hold the disks, as above stated, and the signal at sub-station 3 may be rung

as long as the operator at the central office desires, unless the receiver be taken from its fork, which switches out the signal, as already described. When the operator at the central office, after calling sub-station 3, desires to bring the instruments at the sub-stations to the unison-point, he moves the switch off from the point C^3, but not into contact with the circle *b*, whereupon, the circuit being broken, the disks rotate, rocking the catch-levers until at each station the front catch engages with the half-tooth, as above described, and the strip s^3, by moving the handle s^2, may be brought in contact with the circle, closing the circuit, lifting the armature, and throwing the rear catch down in front of the second tooth back of the half-tooth.

The handle s^2 may be held in either of its positions by the spring-catch s^4 pressing against one side or the other of the pin s^5, projecting from the handle. The arrangement shown in Fig. 8 may be used to call the central office on an open circuit when and only when the disk N is in its normal position of rest. The disk N at each sub-station is provided with another pin, H′, set nearer the center of the disk than the pin H, so as not to come in contact with the spring I, and projecting farther from the disk than the pin H, to admit of the spring-switch T being set far enough from the disk to allow the pin H to pass it without touching. The outer end of the spring-switch T is connected to the line, and said spring T normally rests against the pin H′, and is thereby held out of contact with the post J′ in the line.

Below the spring-switch T is a local battery, B′, normally short-circuited by the switch T′, which is pivoted at *t* in the line, and pressed up by the spring *t′* against a contact, t^2, in the line. When the disk is in its normal position—that is, not in use—it will be seen that if the local battery B′ be thrown into line, by depressing the switch T′ a current therefrom will operate the customary signal in the central office, and also set all the disks in the circuit in rotation, as above described. The rotation of the disks will cause the pin H′ to pass the switch T, which will then fall upon the post J′ and short-circuit the local battery B′ out of the line. This will take place at each sub-station, so that no other sub-station can break in and interrupt the station calling. Of course a hand magneto-generator might be substituted for the local battery, and if this generator be provided with the customary automatic switch the switch T′ may be omitted.

The devices shown in Fig. 8 may be used on a closed circuit by omitting the local battery, in which case depressing the switch T′ will break the circuit and set the disks in rotation, as above described, and will also operate any suitable well-known signal in the central office placed in the line l^0, which connects the circle *b* and the spring I^0. In this case, also, breaking the circuit at the central office or at a sub-station will allow every disk, including the one at the central office, to make a single revolution, because the circuit so broken will not be closed again until the pin H of the caller comes in contact with the spring I^0.

The signal system above described will work with a smaller expenditure of electrical force than any other known to me, and may be operated by an electrical generator of any kind. The derangement of the apparatus in any station affects that station only, and if the clock is not wound up at any station that station only is useless for the time being; but this derangement will not prevent communication between the central office and sub-stations on either side of the sub-station where the derangement occurs.

Another advantage of this system is the secrecy with which confidential communications may be transmitted, every other sub-station, except the one properly in connection with the central office, being short-circuited out of the line.

I claim as my invention—

1. The combination of the disk provided with teeth having inclined faces and with a half-tooth or a tooth having a straight front face and an inclined rear face, a lever pivoted near its middle and provided at each end with a catch, the rear one of said catches having inclined front and rear faces, and the other one of said catches having an inclined front face and a straight rear face, the inclination of said teeth and catches being such as to allow said teeth to slide by said catches and to rock said lever on its pivot when said disk is rotated, clock-work to rotate said disk, an electro-magnet and its armature secured to said lever above the front catch thereof, whereby said disk will be stopped at the end of a complete rotation by said front catch engaging said half-tooth and will be stopped whenever said armature is attracted by said magnet by said rear catch being held against the front face of one of said teeth, as and for the purpose specified.

2. The combination of the central-office switch-board, provided with metallic contact-spots, one of which is grounded, and with a metallic contact strip, a battery in electrical connection with the ground and with said strip, a switch-lever adapted to be brought into simultaneous contact with said strip and with any one of said contact-spots, except the one which is grounded, the central-office caller consisting of a metallic disk provided with teeth having inclined faces, and with a tooth having a straight front face and an inclined rear face, and with a metallic pin, clock-work to rotate said disk, a series of metallic contact-springs equal in number to said contact-spots and arranged and adapted successively to be struck and pushed aside by said

pin when said disk is rotated, each of said springs being in electrical connection with one of said contact-spots, an electro-magnet in electrical connection with said disk, a pivoted lever provided at each end with a catch, the rear one of said catches having inclined front and rear faces, the front catch having an inclined front face and a straight rear face, the inclination of said teeth and catches allowing said teeth to slide by said catches when said disk is rotated, and the armature of said electro-magnet secured to said lever above said front catch, whereby, when said switch-lever is in contact with said strip and any one of said contact-spots, said disk will be caused to rotate until said pin comes in contact with that one of said springs which is electrically connected with such spot, as and for the purpose specified.

3. The combination, with a main-line circuit, of an arbor, a disk secured thereto and provided with a pin, a clock-work to rotate said disk, a shunt for a signal and a receiving telephone, a spring-switch normally closing said shunt and adapted to be struck and pushed aside by said pin once in each rotation of said disk to open said shunt, another disk secured to said arbor and provided with a stop-pin, a stop-lever, a pivoted telephone-supporting switch connected to said stop-lever and adapted, when raised, to throw the free end of said lever in front of said stop-pin, and thereby to arrest the rotation of said disk when said shunt is open, as and for the purpose specified.

4. The combination, with a main line, of a disk provided with a pin, and clock-work to rotate said disk when the line is used, a local battery in a shunt-circuit, a switch normally closing said shunt, but adapted to be moved by hand to open said shunt, another switch adapted to close a shunt around said battery and first-named switch, but normally held open by said pin pressing against it when said disk is at rest and the line is not in use, whereby said local battery is always out of circuit when the line is in use, as and for the purpose specified.

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