

(No Model.)

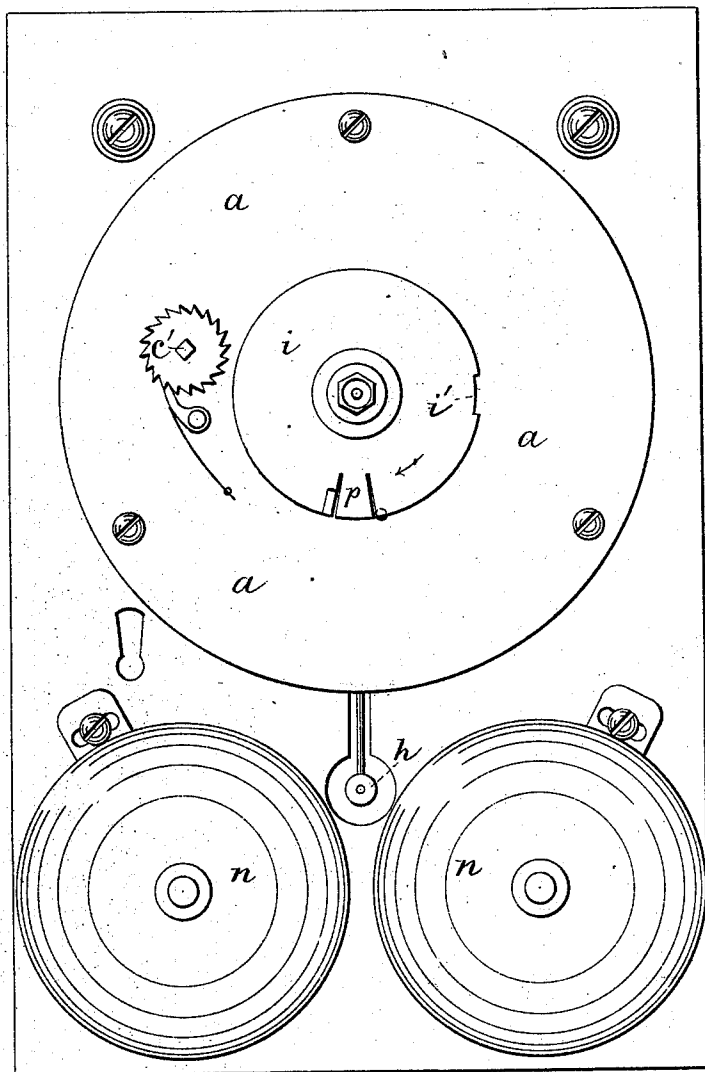
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G. L. ANDERS.
TELEPHONE SIGNAL.

No. 251,810.

Patented Jan. 3, 1882.

Fig. 1.



WITNESSES.

W. D. Dearborn.
L. F. Connor.

INVENTOR—

George L. Anders
by *Brooklyn* *Attys.*

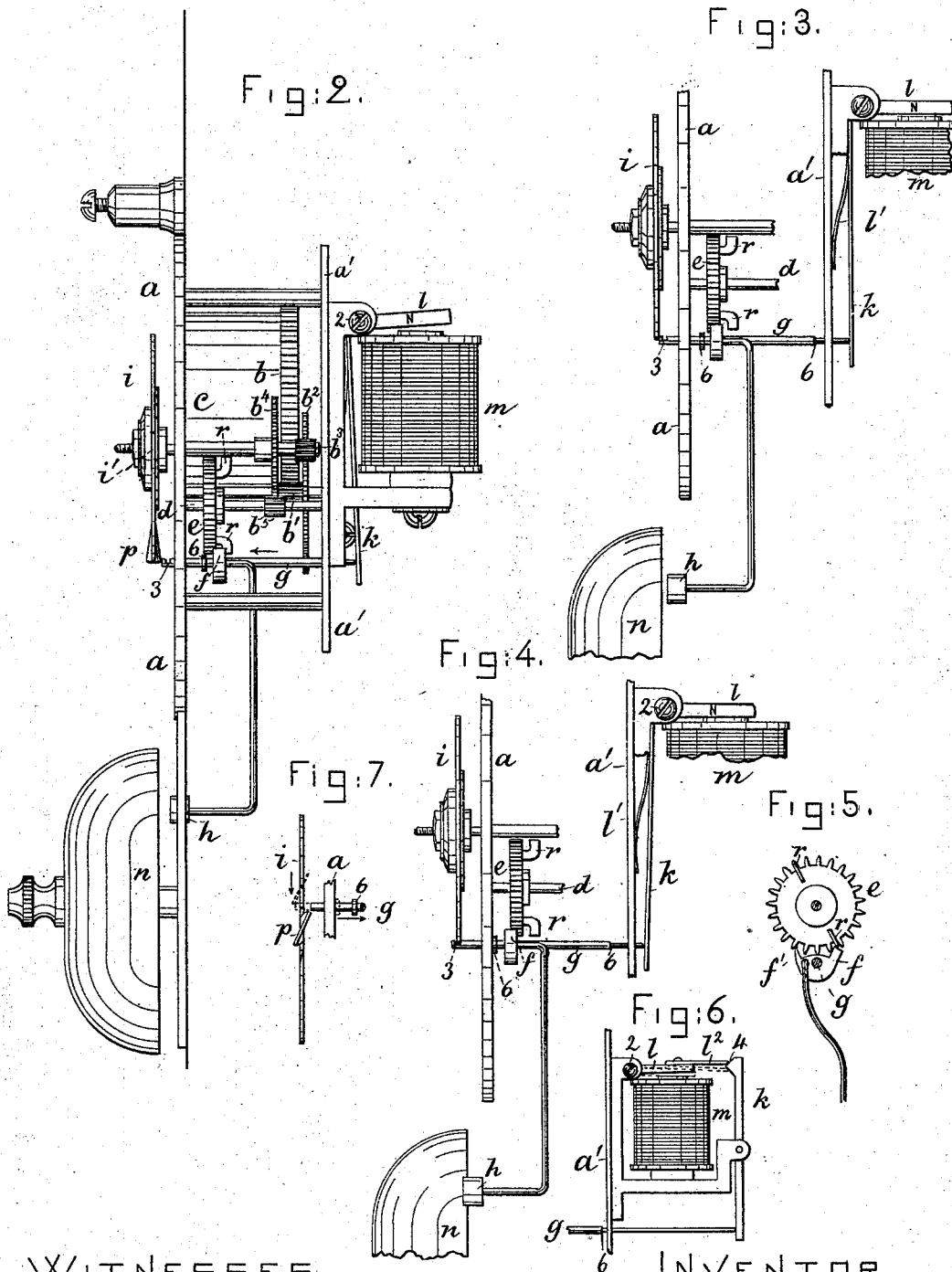
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WITNESSES—

V. D. Dearborn,
L. F. Connor

INVENTOR—
George L. Anders
by Crosby & Morgan
Attys.

UNITED STATES PATENT OFFICE.

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

TELEPHONE-SIGNAL.

SPECIFICATION forming part of Letters Patent No. 251,810, dated January 3, 1882.

Application filed November 20, 1880. (No model.)

To all whom it may concern:

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

My invention relates to signal apparatus for use in telephone-exchanges and for similar purposes, it being an "individual" apparatus, or one in which any desired instrument of a series in the same circuit can be sounded without sounding the others. The instruments are actuated mechanically, being shown as clock-works, or trains of wheel-work actuated by a weight or spring and having an escapement or means for regulating their speed of movement. This train of wheel-work is provided with a detent or stop mechanism, self-operated, to stop the said train after it has run for a short interval of time. This detent is released to allow the train to run (until after the said interval it stops itself) by the armature of an electro-magnet, and the magnets for starting the instruments at all the stations on a subscriber's circuit are included in the said circuit, so that by throwing an electric current thereon the trains will all start simultaneously, and they are constructed to all run substantially isochronously and to automatically stop at the same time.

A controlling device controls the operation of the instruments, it being arranged to co-operate with the starting-magnet, so that when the said magnet operates to start the trains the said controlling device prevents any of the said instruments from operating upon their signals, and thereafter while the trains are running the controlling devices move with them, and each during a certain portion of its movement will allow the mechanism of the instrument to be properly operated to act upon and sound its signal during the rest of its movement. The controlling devices are arranged so that the period when the mechanism can be operated to cause the signal to sound is different in each instrument, and consequently only one of the said instruments can be thus operated at any one time, it thereafter sounding

during the rest of the interval until the instrument automatically stops, while the other instruments run on in silence, their controlling device having prevented them from being operated to act upon and sound their bells. The mechanism by which this is accomplished in this instance is as follows: The train of wheel-work terminates in an escape-wheel, which acts upon pallets in the usual manner to oscillate a pendulum, which also operates under the proper circumstances as a bell hammer, hitting a bell at each oscillation. This pendulum and the pallets are secured on an arbor or rock-shaft that is rocked by the escape-wheel acting on the pallets to thus oscillate the said pendulum, and is free to move longitudinally in its bearings, such a movement thereof being made and controlled by the before-mentioned electro-magnet and controlling device, which is in this instance a disk carried on one of the arbors of the train, making one revolution between the time of starting the mechanism and its automatic stopping. The said rock-shaft has three positions in its bearings—one in which the pallets engage and are locked together with a stop-wing on the escape-wheel, and thus stop the train; the second in which the pallets are disengaged from the stop-wings and the mechanism is allowed to run, but the pendulum or bell-hammer is not in position to strike the bells; and the third in which the clock-work remains running as in the second position, but the pendulum is brought into position to strike the bells, one on each side of it, at each oscillation. The armature of the electro-magnet, or an arm or lever operated thereby, tends, when its magnetic condition is changed, to move the said rock-shaft toward the third position from either the first or the second, and the controlling-disk normally forms an obstacle to the movement of the said rock-shaft to the third position when it arrives at or is in its second position, so that when the magnet operates upon the said rock-shaft it moves it from its first position until it strikes the said disk, which stops it in the second position. This movement of the armature thus causes all the clock-works of the series to start, but with their

pendulum not in position to strike the bell, so that unless further operated on they continue to run silently until automatically stopped, as hereinafter described. A certain portion of the disk is so constructed that when it is opposite the rock-shaft it permits the said rock-shaft, if then impelled by the magnet, to pass to the third position, after which the disk will retain it in this position during the rest of the rotation, in which the pendulum will continue operating on the bells and sounding the signal. An inclined portion or cam carried by the disk at the end of a certain movement (herein shown as a complete rotation of the said disk) acts upon the ends of all the rock-shafts which are either in the second or third position and moves them to the first position, where the pallets engage the stop-wing and the trains are stopped. The portion of the controlling-disk that allows the rock-shaft to be moved from the second position to the third position is placed at different points measured from the stopping-cam last described in the different instruments, so that when one of the said portions (shown as a notch in the periphery of the disk) is in position to allow the rock-shaft and the connected pendulum to be moved, to thereafter ring the bell in one of the instruments of the series, an unnotched portion of the said disk will be opposite to the end of the said rock-shaft in each of the other instruments of the series, thereby preventing them from being moved to the third position by the magnets which operate simultaneously with the one by which the rock-shaft was so moved.

By this apparatus only one electro-magnet at each instrument is required to control the operation of the said instrument, and two magnetic impulses, both of the same nature, are sufficient to cause any desired bell of the series to be rung, one of these impulses operating to move the rock-shafts of all the instruments from the first to the second position, thereby setting all the trains in movement, and the second to throw the rock-shaft of the instrument at the station it is desired to signal to the third position and cause the bells thereof to ring, the said second impulse being produced at the proper time after the trains have thus been started, when the notch of the instrument it is desired should signal has arrived in proper position opposite the end of the rock-shaft. Both of these impulses of the electro-magnets may be produced by electric currents of the same strength and polarity, and by polarizing the armature or cores of the said magnet it will require a current of definite polarity to cause it to attract its armature, and consequently currents of the opposite polarity might be used on the line for other purposes—as, for example, signaling from the subscribers to the central office; or by giving the magnets of a portion of the instruments one polarity and of the rest of the instruments the other polarity either set could be operated independently of the other by sending the cur-

rent in the proper direction, so that without any change in the mechanical construction of the instruments double the number of stations could be signaled individually by polarized magnets that could by using neutral magnets. For example, supposing the controlling-disks were constructed to operate for four stations, eight such instruments might be used, four to be operated by positive and four by negative currents, so that when controlled by a reversing-key either of the first four stations could be signaled by using the positive key, the other four not being affected thereby, and the second four could similarly be signaled by a negative key without operating the first four.

Figure 1 is a front view of a signal apparatus embodying my invention; Fig. 2, a side view of the main operative parts thereof, the rock-shaft being in the first position, and the pallets consequently engaged by the stop-wing and the clock-work stopped; Fig. 3, a side view of the controlling-disk, magnet, and escape-ment, the rock-shaft of the latter being in the second position, in which it has been stopped by the controlling-disk; Fig. 4, a similar view of the same parts, but with the rock-shaft in its third position to cause the bells to be sounded; Fig. 5, a detail, showing a rear view of the escape-wheel and stop-wings thereon and the pallets and pendulum-rod; Fig. 6, a modification of the connecting mechanism between the armature and the rock-shaft; and Fig. 7, an under side view of the stop-cam on the controlling-disk and the end of the rock-shaft, the dotted lines showing the latter in its third position and just engaged by the former, to be thereby moved, as indicated by the arrows, to the first position, indicated by the full lines, which show the parts in the same position as in Figs. 1 and 2.

The main operating parts are sustained on suitable frame-plates, *a a'*, the clock-work or train of wheel-work *b b' b² b³ b⁴ b⁵* being driven by a mainspring in a barrel, *c*, Fig. 2, wound in the usual manner by the squared shaft. Upon the arbor *d*, carrying the pinion *b⁵* of the said train, is an escape-wheel, *e*, the teeth of which act upon the pallets *f f'* upon the rock-shaft *g*, in the usual manner, to give it a rocking motion, whereby the pendulum *h*, connected with the said rock-shaft, is oscillated, it regulating the speed of the said train in the well-known manner. The rock-shaft *g* has a longitudinal movement in its bearings in the plates *a a'*, by which the plane of oscillation of the pendulum *h* may be changed, as in Figs. 2, 3, 4, in which the said rock-shaft occupies three different positions. The width of the escape-wheel *e* and pallets *f* is such that they are not disengaged from one another by this movement of the rock-shaft, limited by the shoulders *b* thereon. A controlling-disk, *i*, carried upon and rotating with one of the arbors of the train of wheel-work, has its periphery in the path of movement of the rock-shaft *g* in the direction of the arrow, Fig. 2, so that when moved in this di-

rejection by the arm *k*, connected with the armature *l*, pivoted at 2, of the electro-magnet *m*, the end of the said rock-shaft strikes the disk *i*, as shown in Fig. 3, and is prevented from further longitudinal movement. The pendulum *h* in this movement advances toward the bells *n*, but not sufficiently to strike them, as shown in Fig. 3.

The controlling-disk *i* is cut away or provided at one part of its periphery with a notch, *i'*, and when the said notch is opposite to the end of the rock-shaft *g* no obstacle is offered to the movement of the rock-shaft in the direction of the arrow, Fig. 2. Consequently, if the magnet *m* is charged at the time when the said notch *i'* is opposite the end of the rock-shaft *g*, the arm *k*, in acting on the said rock-shaft, will move it in the direction of the arrow, Fig. 2, to its third position, (shown in Fig. 4,) where the pendulum *h* is in position to strike the bells *n* at each oscillation.

The rock-shaft *g* is cut away at 3 to allow the unnotched portion of the periphery of the controlling-disk *i* lying beyond the notch *i'* thereof to pass by the end of the said rock-shaft, as shown in Fig. 4, so that during the remaining portion of the rotation of the said disk the rock-shaft remains in its forward or third position, (shown in Fig. 4,) and the pendulum *h* strikes a blow on one of the bells *n* at each oscillation.

The controlling-disk *i* and electro-magnet *m*, arranged to co-operate, as herein shown, in controlling the position of a movable shaft or pin, may be employed for other purposes besides changing the position of the bell-hammer—as, for example, the movement of the said shaft between its second and third positions might operate a circuit-closer or control an electric circuit.

A stop-cam, *p*, shown as a portion of the disk *i*, inclined relative to the plane of the said disk, arrives in the rotation of the said disk opposite the end of the rock-shaft *g*, as shown in the dotted lines, Fig. 7, and in its further rotation moves the said rock-shaft in the direction of the arrow, Fig. 7, until the pallet *f* is brought in the path of the stop wings *r*, shown as two in number, on the escape-wheel *e*, so that when in the rotation of the escape-wheel one of the said stop-wings reaches the pallet *f*, it becomes locked together therewith, as shown in Figs. 2 and 5, and the clock-work is thereby stopped, the stop-cam *p* having in the meantime passed wholly beyond the end of the rock-shaft *g*, as shown in Fig. 1, so as not to impede it when again moved by the arm *k*.

The notches *i'* are placed at different distances from the cam *p* in the different instruments of the series, so that if the said instruments are started simultaneously a notch, *i'*, will be opposite the rock-shaft *g* in only one instrument at a time, and each instrument will have its own period of time during which the rock-shaft *g* of that instrument, and of that one instrument only, can be moved into the

third position, as shown in Fig. 4, to cause the bells *n* to be rung.

The magnets *m* may be neutral electro-magnets; but I sometimes prefer to have either their cores or armatures polarized.

As herein shown, the armatures are polarized, so that when the current passes through the magnet in one direction it merely acts to repel the said armature, and consequently produces no movement therein, as they are already held back from the poles of the magnet by the retracting-spring *l'*; but when it passes in the other direction it attracts the said armature and causes it to operate on the rock-shaft.

The magnets *m* are shown as normally demagnetized, and operate the instrument while a current is passing through their coils; but it is obvious that, except when two oppositely-polarized sets are used, they could be normally magnetized and their armatures operated by retracting-springs when the current is removed to act upon the rock-shaft *g*. In either case, in an arrangement like that shown in Fig. 2, if the magnet should remain out of its normal condition, the arm *k* would remain pressing against the rock-shaft *g*, and would start the instruments as soon as stopped and throw them one after another into operation upon their bells, so that the instruments would go on operating continuously, and the signals would be sounded as long as the circuit or magnets remained in their abnormal condition. This might be obviated by making the force of the arm *k* in acting on the rock-shaft *g* greater than that of the cam *p* on the disk *i*, so that the cam would not be able to move the said shaft in opposition to the arm *k*, but would itself, together with the connected train of wheel-work, be stopped thereby. In the modification shown in Fig. 6 the arm *k*, which operates upon a rock-shaft, *g*, is not positively connected with the armature *l* of the magnet *m*, but has an inclined projection, 4, at its end, operated upon by the finger *l'* on the armature *l*. By this arrangement the arm *k* and rock-shaft *g* are only acted upon while the armature *l* is being moved to or from the poles of the magnet, so that if the said armature should remain attracted, as shown in dotted lines, it would not prevent the free back movement of the arm *k* as it would if the arm *k* were rigidly connected therewith, as shown in Fig. 2, and would not again operate it to start the train.

The disk *i* might have more than one cam *p* if it were desired to have the interval of operation of the instrument less than that occupied by a complete rotation of the said disk, and a sufficient blank space should be left between the last notch passing the rock-shaft *g* and the stop-cam *p* to allow a sufficient time of operation of the bells set in operation at the passage of the said notch.

In operation the instrument remains normally in the position shown in Figs. 1 and 2, and when it is desired to signal a station the

operator throws the current on the lines, causing the magnets *m* to attract the armatures *l* and the arm *k* to move the rock-shaft *g* in the direction of the arrow in Fig. 2 until they are all stopped by the disks *i*, as shown in Fig. 3, there being no notch directly adjacent to the cam *p*. By this movement the pallets *f* are disengaged from the stop-wings *r*, and the trains all begin to move under the stress of the mainspring, the pendulum *h* oscillating, but not being in position to strike the bells *n*. As the mechanism continues to move the disks *i* rotate and the notches *i'* thereof in the different instruments each come in turn opposite to the end of rock-shaft *g*. When it is time for the notch *i'* of the instrument at the station which it is desired to signal to be opposite the said rock-shaft the operator throws another current on the line, which causes the arm *k* to throw the rock-shaft *g* of the said instrument into the position shown in Fig. 4, while in the other instruments the rock-shafts are prevented from moving from the position shown in Fig. 3 by the unnotched portion of their controlling-disks *i*. After this movement has taken place the clock works continue moving, the one having its pendulum in the position shown in Fig. 4 ringing its bells, while the others remain silent, until when the disks *i* have made a complete rotation the cams *p* move all the rock-shafts back, and the pallets *f* are engaged by the stop-wings *r*, and the instruments are all stopped, as first described. A suitable pointer will be carried by the same arbor as the disk *i*, and a dial used therewith will be spaced to show the time that the notch *i'* of each instrument passes the end of the corresponding rock-shaft, such a dial not being shown, as it is common in individual signaling apparatus of various kinds.

I claim—

1. In a signal apparatus, a bell, a bell-hammer therefor, and a mechanical motor to set the said hammer in motion, combined with controlling mechanism, substantially as described, whereby the said bell-hammer, in its movement caused by the motor, is either prevented from striking the said bell or caused to strike it to give a signal, as desired, without interruption to the said movement.

2. In a telephone-signal instrument, the following elements in combination, viz.: a mechanical motor having a uniform movement, a bell-hammer operated thereby, a bell, and a controlling device, as explained, to control the position of the bell-hammer relative to the bell, whereby in a series of such instruments all may have their bell-hammers kept in motion by the motor and any desired one of the said bell-hammers may be brought into operation upon its bell independently of the others, substantially as and for the purpose described.

3. The combination, with a mechanical motor, automatic stopping mechanism, a controlling-disk revolved by said motor, and an electro-magnet and devices controlled thereby for start-

ing said motor, of a mechanical alarm and devices, as indicated, for causing the alarm to sound when required, said devices being movable under the attraction of the electro-magnet when it is excited by an electric current and the controlling-disk is in the proper predetermined position, but being prevented from moving under said attraction by the disk except when in said position, substantially as described.

4. In a signal apparatus, a mechanical motor and a bell-hammer vibrated thereby and connected with a rock-shaft longitudinally movable in its bearings to change the plane of vibration of the said hammer, combined with an electro-magnet to move the said shaft, and a moving controlling device, as indicated, to control its movement, allowing the said shaft to be moved by the magnet into position to cause the hammer to operate on the bell only when the controlling device is in a certain position in its movement, substantially as described.

5. In a signal apparatus, a mechanical motor and a bell-hammer mounted on a rock-shaft and adapted to be set in vibratory movement by the said motor, the said rock-shaft being movable in its bearings longitudinally, combined with stopping mechanism operated by the longitudinal movement of the said rock-shaft to stop the motor, and an electro-magnet to move the said rock-shaft, and a controlling device to govern its movement, the said magnet and controlling device co-operating, as described, to cause an impulse of the magnet in acting on the said rock-shaft when at rest, to disengage the stopping mechanism and allow the motor to set the hammer in vibration but not in position to strike its bell, and a second impulse to either throw the said hammer in position to strike the bell or not, according to the position of the controlling device, without interrupting its vibratory movement in either case, substantially as described.

6. The combination, with the longitudinally-movable rock-shaft and bell-hammer mechanically vibrated thereon, of an electro-magnet to bring a pressure upon the said shaft, and the notched controlling-disk to afford an obstacle to the said rock-shaft, except when the notched portion is opposite thereto, substantially as described.

7. The longitudinally-movable rock-shaft and bell-hammer connected therewith and pallets thereon, and an escape-wheel to operate them, combined with the stop-wings and a stop-cam to move the said rock-shaft and bring the pallets into position to engage the said stop-wings, substantially as and for the purpose described.

8. The controlling-disk, notched and provided with an inclined or cam portion, combined with a shaft or pin movable in a direction transverse to the plane of the said disk, and an electro-magnet to move it, the disk being arranged, as described, to afford an obstacle to the movement of the said shaft, except when in the ro-

tation of the said disk its notched position is opposite to the said shaft, when the end of the latter may be moved through the said notch and retained there during the further rotation of the disk until engaged by the cam thereof and moved back by the said cam, substantially as and for the purpose set forth.

9. In a telephone-signal apparatus, a series of mechanical motors or clock-works to control the operation of the signals and automatic stop mechanism to stop the said motors, combined with an electro-magnet to operate upon the said stop mechanism to start the motor, the said magnet or its armature being polarized, whereby a current of one polarity causes it to attract

its armature to start the motor, while a current of the other polarity causes no movement in the armature, substantially as described, and for the purposes set forth.

10. The combination of the shaft *g*, controlling-disk *i*, and the electro-magnet *m* and its armature and arm *k l*, substantially as described, and for the purpose set forth.

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,
L. F. CONNOR.