

(No Model.)

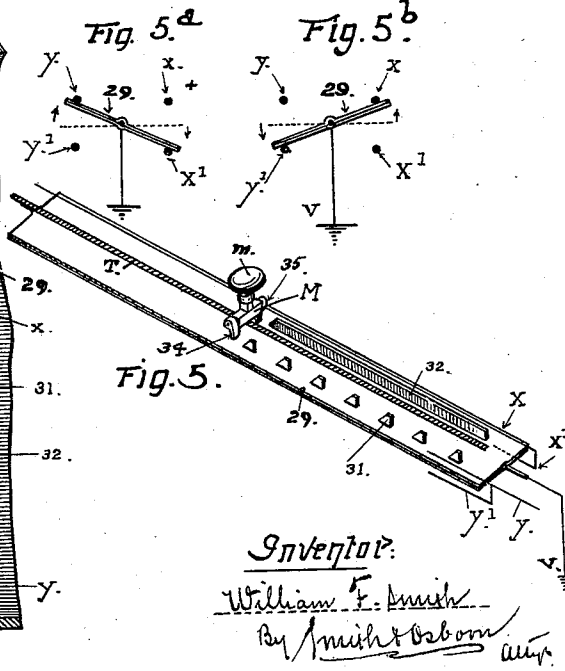
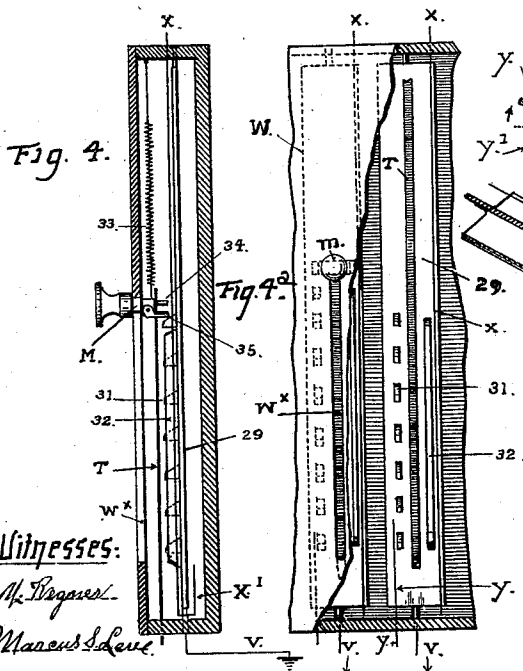
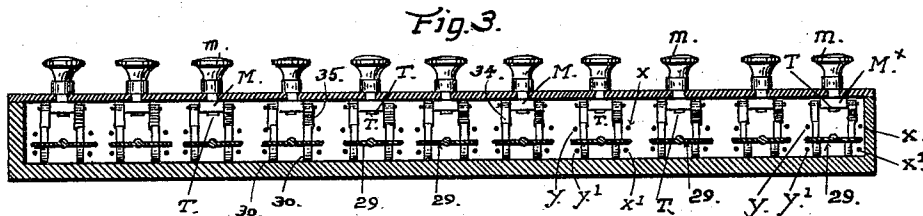
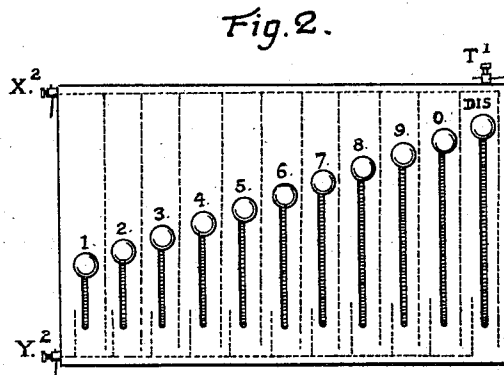
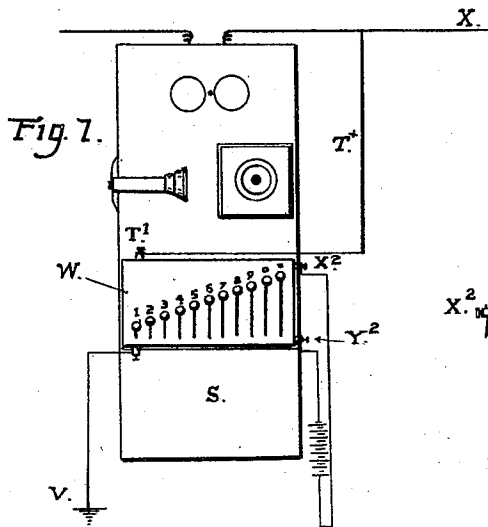
4 Sheets—Sheet 1.

W. F. SMITH.

ANNUNCIATOR SIGNAL FOR TELEPHONE SYSTEMS.

No. 581,044.

Patented Apr. 20, 1897.



Witnesses:

Al. B. Rogers.

Manuel Schaefer.

Inventor:

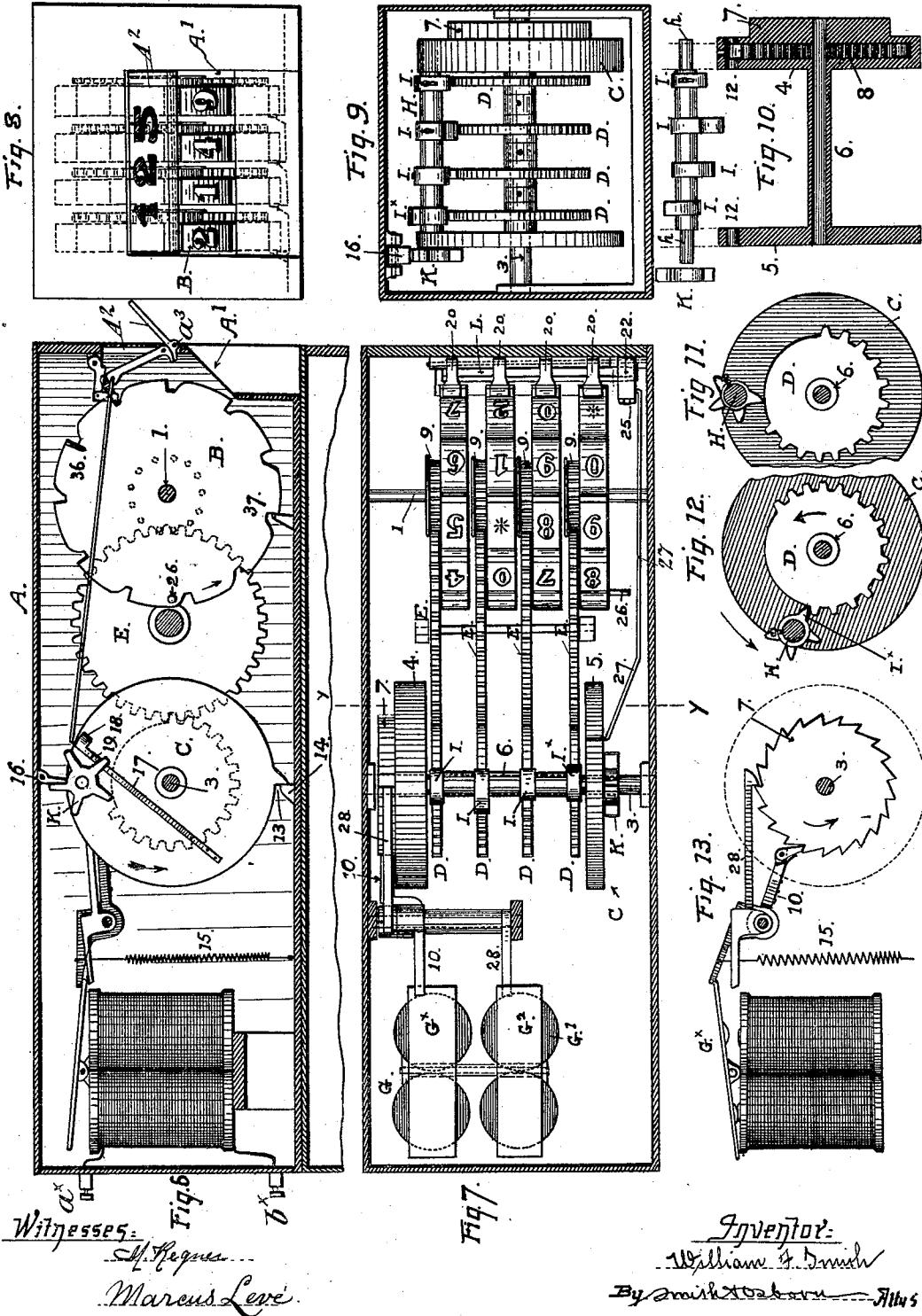
William F. Smith

By Smith & Osborn

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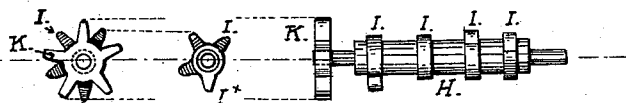
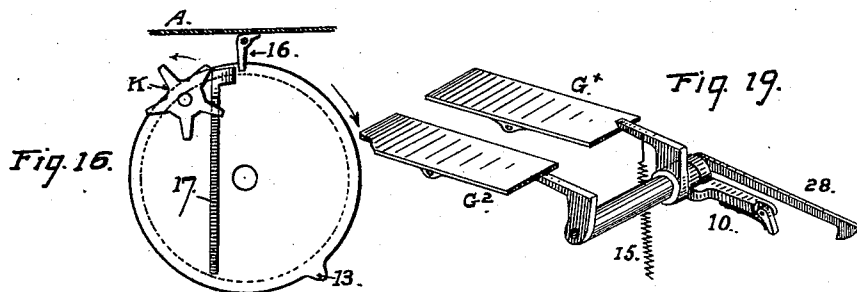
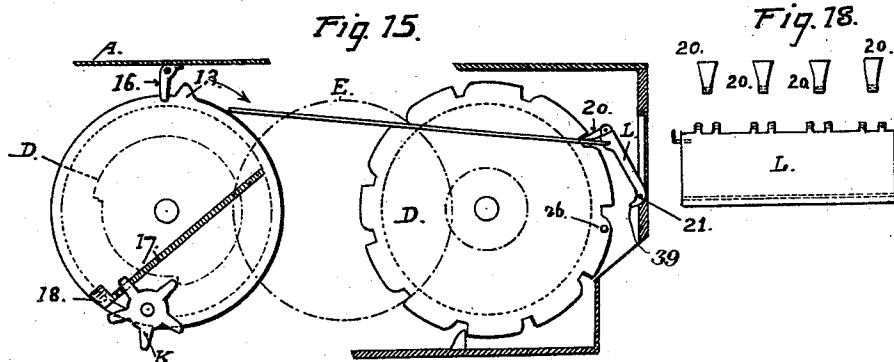
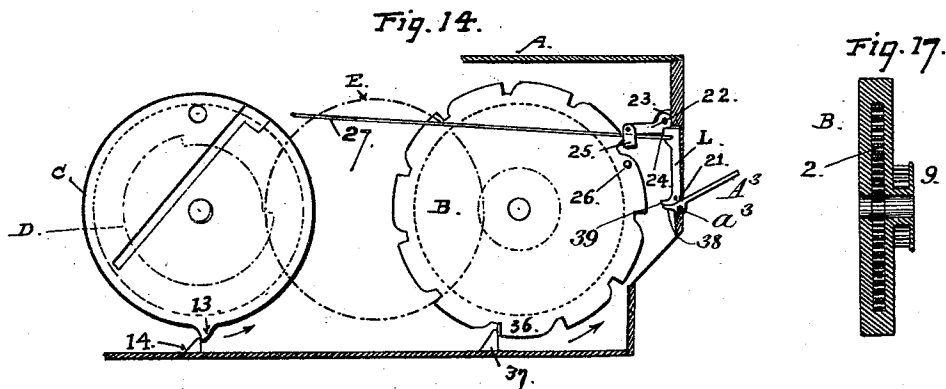
4 Sheets—Sheet 3.

W. F. SMITH.

ANNUNCIATOR SIGNAL FOR TELEPHONE SYSTEMS.

No. 581,044.

Patented Apr. 20, 1897.



Witnesses:

Marcus Levee

M. H. Hagner

Inventor:

William F. Smith

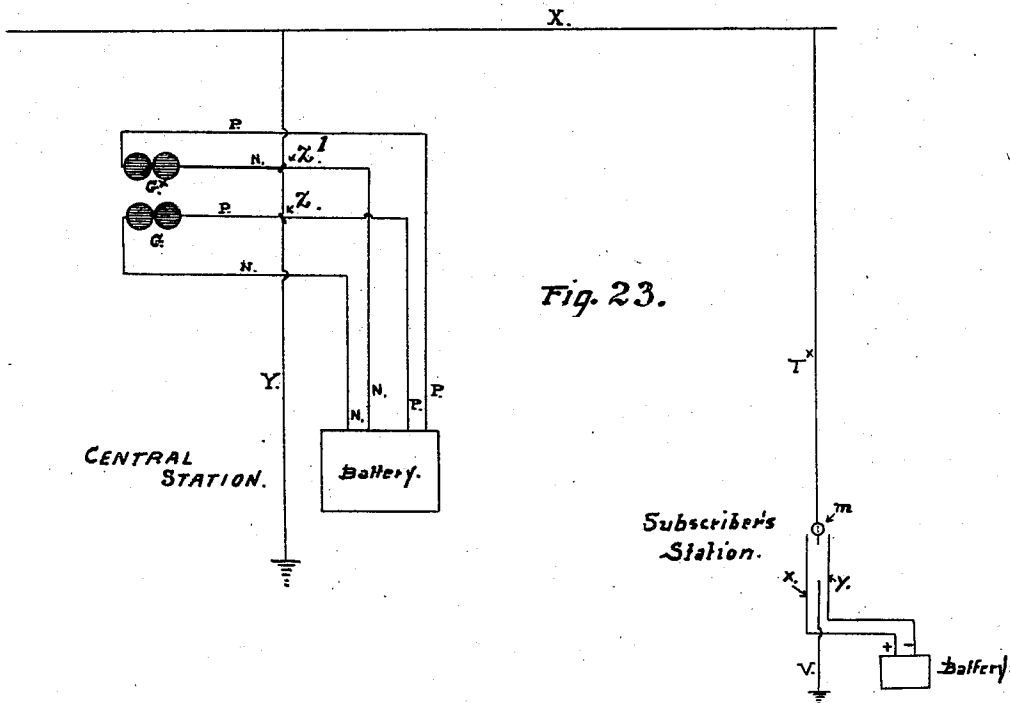
By Smith & Osborn
715 7th Ave

W. F. SMITH.

ANNUNCIATOR SIGNAL FOR TELEPHONE SYSTEMS.

No. 581,044.

Patented Apr. 20, 1897.



Witnesses:

Marcus S. Levi.

Attest _____

Inventor:

William F. Smith

By Smith & Co.

UNITED STATES PATENT OFFICE.

WILLIAM FREDERICK SMITH, OF SAN FRANCISCO, CALIFORNIA.

ANNUNCIATOR-SIGNAL FOR TELEPHONE SYSTEMS.

SPECIFICATION forming part of Letters Patent No. 581,044, dated April 20, 1897.

Application filed August 4, 1894. Renewed March 8, 1897. Serial No. 626,547. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM FREDERICK SMITH, a citizen of the United States, residing in the city and county of San Francisco and State of California, have invented certain new and useful Improvements in Subscribers' Individual Calling and Clearing-Out Signals for Telephone Systems, of which the following is a specification.

My invention relates to improvements in means for calling the operator at a central office or switching-station from a subscriber's station on a telephone-line; and the improvements embrace certain means and mechanism of novel construction for signaling the operator and registering at the station-switchboard the number of the telephone with which the subscriber desires to connect his telephone for conversation; also, means and mechanism of novel construction operating electrically from the subscriber's station two or more number-bearing or register-wheels at the station-switchboard to set the said wheels in different positions, and thereby register the number of another telephone in the system with which connection is desired; also, means of novel construction operative from the subscriber's station to restore all the number-bearing wheels to their normal position, displaying no numbers at the switchboard, as soon as the conversation has ceased and the line is ready to be cleared.

The general object of these improvements is to provide at the station for every subscriber's line an individual calling-register, operative by pulsations of the electric current from the subscriber's telephone in such manner that the subscriber calls the operator at the station by setting the register to indicate and display at the switchboard the number of the telephone with which the subscriber desires connection, thereby dispensing with all conversation between the subscriber and the operator over the line and substituting a visual signal and register in place of the oral communication with the operator heretofore required to make known at the station the number of the subscriber called for.

The following description explains the nature of my said improvements and the manner in which I proceed to construct and produce and apply and operate the same, refer-

ence being had to the accompanying drawings, forming part of this specification.

In the said drawings, Figure 1 represents in front elevation the subscriber's telephone at one end of the line X and the parts of my apparatus that are located on the telephone. Fig. 2 is a view on an enlarged scale of the mechanism located at the telephone and connected with the line to transmit electric pulsations, both of a positive and a negative character, by which the register mechanism is actuated. Fig. 3 is a longitudinal section, on an enlarged scale, on the line *x x*, Fig. 2. Fig. 4 is a cross-section, also enlarged, this section being taken on the line *x y*, Fig. 2. Fig. 4^a is a top view of a portion of the case with the top cover broken away to expose parts beneath it. Fig. 5 is a perspective view of one of the sliding buttons and its contact-plate within the case. Figs. 5^a and 5^b are diagrams designed to illustrate the two positions of the circuit-closing rocker-plate of the signal-transmitting mechanism. Fig. 5^a illustrates the position of the tilting contact-plate when pulsations of its positive current from the battery at the subscriber's station are being transmitted over the line; and Fig. 5^b illustrates the opposite position, into which the same contact-plate is thrown when the negative current is sent over the line. Fig. 6 is a view of the register mechanism in side elevation with the inclosing case shown in section. Fig. 7 is a top view of the same. Fig. 8 is a view of the front end of the register as it appears when viewed from the front of the switchboard. Fig. 9 is a vertical cross-section at the line *y y*, Fig. 7. Figs. 10, 11, and 12 represent some parts of the mechanism in detail. Fig. 13 is a side view of the relays and the pawl-and-ratchet mechanism operated by them. Fig. 14 is a side elevation in detail of the number-bearing wheel and the connected gears, showing the position of the mechanism when there is no signal displayed. Fig. 15 is a similar view of the same parts in the position they occupy when registering a telephone-number. Fig. 16 is a view of the revolving barrel in another position from that shown in Fig. 15. Fig. 17 is a section through one of the register-wheels. Fig. 18 is a top view of the hinged plate and its pawl that lock the register-wheels. Fig.

19 is a perspective of the two pawls that operate and control the barrel. Figs. 20, 21, and 22 are details of the star-wheel, its shaft, and tappets that lock the segment-gears in the barrel. Fig. 23 is a diagram representing the positive and negative circuits of the signal-sending device.

That part of the apparatus which is located at the subscriber's station comprises a number of circuit making and breaking buttons or slides connected into the subscriber's circuit between the local battery and the line, or otherwise interposed in the circuit in such manner that electric pulsations of both positive and negative character are produced and transmitted over the line to a main office or switching-station by the movements of the slides, the polarity of the pulsations produced by any one of the slides being determined by the direction in which the slide is moved. By such pulsations of the electric current the receiving or registering mechanism located at the switching-station is operated from the subscriber's station. This last-mentioned part of the complete apparatus is composed, essentially, of several register-wheels arranged for independent rotation on a common center behind a sight-opening in the switchboard and mechanism constructed to set the wheels in position for displaying at the sight-opening any given number by the action of a current of one polarity and to restore the parts to their first position again ready for another signal by the action of a reverse current. Through this mechanism situated at the switchboard the subscriber registers and makes known to the operator by a visual signal the number of the subscriber's line with which connection for conversation is desired, and in like manner by the act of throwing off this signal or restoring the register-wheels to their first position the signal for disconnecting the two lines is given to the operator when the conversation is ended and the line is ready to be cleared. This part of the whole apparatus, which I have termed the "register mechanism," performs the two-fold function of a visual signal to notify the operator of a connection to be made and giving the number of the telephone with which connection is desired and a clearing-out or disconnecting signal to inform the operator when the line is out of use. The construction of this register mechanism will be described first with reference to the drawings, Figs. 6 to 22, inclusive, and afterward in connection with the mechanism located at the subscriber's station by which the register is operated.

A indicates a case or box inclosing all the parts of the mechanism, having binding-posts $a \times b \times$ for the electric wires X Y, the former being the subscriber's line and the latter the switchboard-line. A' is a sight-opening in the front end of the case, and B B B B are wheels or circular disks with broad rims, each wheel bearing on the surface thereof the ten numer-

als from "0" to "9," inclusive, and a blank space between the first and last numerals, the same being equally spaced around the circumference of the wheel.

The register-wheels are centered on a common fixed shaft or spindle 1 to rotate easily and independently and in such close relation to the aforesaid sight-opening that the numerals exposed to view can be read clearly from the front of the case, but the size of the opening is so regulated that only one numeral on each wheel is exposed to view. By proper rotation of one or more of them the four wheels are set to show at the opening A' any telephone-number consisting of from one to four numerals, or they are set to expose only the portions of their rims that bear no numerals, which last-mentioned position is the normal one for all the wheels when the mechanism is set for operation. In the present illustration of these wheels the spaces bearing no numerals are marked with an asterisk, and these are set into position at the sight-opening when the mechanism is out of action and the line is not in use.

Each wheel B is moved on the shaft 1 in one direction, step by step, to bring a given numeral to view through the agency of a pawl-and-ratchet mechanism operated by the vibration of an armature connecting a set of gears. Each wheel being moved in one direction by these parts is brought back to its normal position after the required exposure of the numeral by the reaction of a coil-spring 2, contained within the wheel, attached to the fixed shaft 1 and to the wheel that it is put in a state of tension by the previous rotation of the wheel.

C is a spring-drum or skeleton barrel set to rotate freely on a stationary shaft 3 behind the shaft 1 and composed mainly of two circular heads 4 5, united by a hollow axle 6, a ratchet-wheel 7 on the outer face of one head 4, and a coil-spring 8 within the same head, properly connected to the fixed shaft and to the head to be put in tension by the rotation of the barrel in one direction and by its reaction to bring the same back to its first position.

D D are segment-gears loose on the hollow axle of the barrel, and E E are intermediate spur-gears or "idlers" connecting the before-mentioned gears with lantern-pinions 9 on the register-wheels.

The toothed portion of each gear D is always in mesh with its intermediate gear E, and the latter gear is always connected into the pinion 9, but the movement of the barrel C on its center produces no movement of the said gears D until they are locked in the barrel, because the said gears set normally loose on the hollow axle. When one is locked, however, so that it cannot turn on the hollow axle, it will rotate the gear E and turn its register-wheel whenever the barrel C is rotated, and the extent of such rotation is determined by the amount of rotative movement

of the barrel. This movement is produced by the vibrations of the armature G^x of a polarized relay G in the rear end of the case acting on a spring-controlled vibrating pawl 10, which in turn operates on the ratchet-wheel on the barrel C , and according to the number of vibrations of the armature the barrel is rotated a greater or less distance.

The segment-gears are locked in the barrel by the mechanism, consisting of a shaft H with reduced journal portions h on the ends, set loosely in bearings 12 in the heads of the barrel, and a number of dogs or tappets I , one for each segment-gear, fixed on the shaft and set in line with the gears D . The four tappets are set on the shaft H at points around the circle at intervals apart corresponding to the intervals between the teeth or points of a star-wheel K on the outer end of the shaft; but the number of points of this wheel is greater by one than the tappets before mentioned, so that while three of the tappets on the shaft set at equal distance apart there is a gap or double interval in the circle between the first tappet I^x and the last tappet. This arrangement of the tappets and the teeth of the star-wheel will be understood from Figs. 9 to 12, inclusive, Sheet 2, and Figs. 20, 21, and 22, Sheet 3. The point of each tappet when turned toward the axle of the gears will clear the smooth portion of the gear, but will contact with the first tooth as the barrel C is turned on its axis in the direction indicated by the arrows, Fig. 12, and thus it will carry around the gear as the barrel is rotated; but as the shaft H can assume no position in which more than one tappet at a time will engage a segment-gear in each rotation of the barrel it will be seen that the three remaining gears are always loose and will give no movement to the register-wheels when one gear is locked in the barrel.

The first position and starting-point of the barrel C is determined by a stop 13 on the rim of the head 5 and a fixed stop 14 on the bottom of the case. From this point the barrel moves in the direction of the arrow, Figs. 5, 7, and 8, as the pawl 10 is vibrated. In every case, however, at the time of starting from the position of rest the first tappet I^x , nearest the left-hand end of the shaft H , sets in working position to engage the gear D beneath it, while the remaining tappets standing at different angles around the shaft clear the teeth of the remaining gears in the barrel, so that only the first gear D is moved and only the first register-wheel is turned. Preparatory to the next gear of the set D being locked in the barrel to set the second register-wheel, the barrel is thrown back to its starting-point, in which reverse movement the star-wheel moves the distance of one point or tooth, bringing the second tappet into working position and turning up the first tappet out of action. In like manner the barrel is turned to the starting-point again for each succeeding gear, and in this manner all the

register-wheels are set in position to make up the required number at the sight-opening. The star-wheel K is turned the distance of one tooth at such reverse movement of the barrel by means of the stop 16, hinged at the top of the case over the barrel by a joint that allows it to swing freely in one direction, but to set rigidly in the opposite direction with its end standing in the path of the star-wheel, the leading point of which strikes the stop as the barrel is turned, and thus moves the shaft H the distance of one point of the star-wheel; but in the opposite movement of the barrel the stop 16 presents no resistance and the star-wheel passes it without being moved.

A clutch 17 on the head 5 of the barrel locks the star-wheel and prevents it from turning under the resistance offered to the tappets by the gears on the axle when the barrel is rotating. This clutch is composed of a flat spring set in a recess in the head 5 behind the star-wheel and secured at one end to the head, but detached at the opposite end, on which is a wedge-shaped plate or incline 18. On the body of this spring, below the incline, a stop 19, projecting in the path of the points on the star-wheel, prevents that wheel from turning as long as the spring stands out from the recess. When the spring is pressed back, however, its before-mentioned stop will clear the star-wheel and allow it to be turned by this swinging stop 16, and this movement of the spring is effected by the contact of the incline 18 with the swing-stop 16 as the barrel turns back, at which time the incline, being in advance of the star-wheel, meets the swinging stop and is by it pressed back before the point of the star-wheel reaches it. The position of these parts at the time of such operation is shown in Fig. 16.

As already mentioned, the register-wheels are turned and set by the operation of the before-described barrel and its gears and are brought back to position after each operation by the recoil of the inclosed spring in each wheel, at which time the register-wheels are held at rest by the stops 36 37. This manner of operating the wheels therefore requires locking means to hold each wheel after it is set and also a releasing means when the wheels are to be restored to their first position. For this purpose a number of pawls 20 are pivoted on the top edge of a hinged plate L in front of the wheels in line with the rims of the wheels, one pawl in front of each wheel and in the path of the notches formed in the rim between the number-bearing faces. The lower end of the plate L is hinged at 21 to the front of the case, and on this point it drops backward and throws the whole set of pawls against the rims of the wheels whenever it is released from its position against the front plate of the case. In the last-mentioned position it is retained by a hinged latch 22, pivoted at the forward end in lugs 23 on the case, and on that point movable in a vertical arc at the free outer end, so that by throwing up

that end of the latch the plate L is released and allowed to drop. On the bottom of the latch a shoulder 24 engages and holds that plate, and on the outer end of the latch a finger 25, loosely pivoted and arranged to swing in one direction, but to stand rigid and originally in the opposite direction, depends in the path of a stop-pin 26 on the side of the first or left-hand wheel of the set B. That pin projecting in line with the end of the finger 25 is brought against it at the first movement of that wheel, and by lifting the latch it throws down the plate L and all the pawls into action upon the wheels, thereby holding such wheels against reverse movement while they are being set.

The subsequent operation to release and restore the wheels is effected by a pawl 27, attached by one end to the left-hand side of the plate L, and from that point extending backward to and over the rim of the left-hand head of the barrel C, at which end it is bent at a right angle to stand across the rim and in the path of the stop 13 on the rim. The rod is of such length and its free outer end is so placed with relation to the before-mentioned stop that by a fifth or additional rotation given to the barrel after the four register-wheels have been set the stop 13 will be brought around beyond the bent end of the rod, and in the return movement of the barrel the stop, striking the end of the rod, pushes back the hinged plate L to upright position, where it is caught and held by the latch 22. It should be noticed that the four preceding rotations of the barrel C, by which is meant the four successive forward and return rotative movements that set the four wheels B, are shorter in length than the fifth rotation, and in no one of the four movements of the barrel is the stop 13 brought beyond the end of the rod; but only by the fifth rotative movement is the head 5 carried around to that point where in the return of the barrel by the reaction of its coil-spring the stop 13 engages and pushes back the rod. The position of the parts in that return movement is shown in Fig. 15.

The relays G and G' , each actuating an individual armature G^x or G^2 , are connected with the two poles of a local battery at the switchboard in such manner that the relay G is operative by impulses of a positive current, and the relay G' is operative in like manner by impulses of a negative character from a local battery at the switchboard, the connection being made by the wires N N P P, as indicated in the diagram Fig. 23. In these two circuits, in which are included the relays G and G' , there is interposed two polarized circuit-closers Z and Z' , the one, Z , responding to pulsations of a positive character and the other, Z' , to pulsations of opposite polarity as the same are transmitted over the line X from the subscriber's station. Said polarized circuit-closers are connected by the wire Y into the line X to the subscriber's telephone, and at that sta-

tion by the special mechanism which I shall now proceed to describe, the electric pulsations are transmitted over the line to the polarized circuit-closers in the local circuit at the switchboard in the central station. By pulsations of a positive character the relays actuate the lever 10 and the detent 28, as before described, and by negative pulsations the armatures G^x or G^2 reset those parts and release the barrel for the following operation. By these means the register-wheels are set one after the other in regular order to form the signal. The first one G^x of these relays operates the pawl 10, that turns the ratchet-wheel 7 on the barrel, and the second one G^2 operates the detent 28; that in one position locks the barrel and in another position releases the barrel and allows it to return against the fixed stop 14. The pawl and the detent are centered on the same shaft, but they rock on it independently of each other. The armature G^x of the first relay sets under the arm on the hub of the lever that carries the pawl 10, and by the pulsations of the current the armature is attached at one end to one pole of the magnet, while the opposite end throws up the arm of the lever and depresses the opposite pawl-carrying end, thereby moving the ratchet-wheel 7 the distance of one tooth. The return movement of the lever when the current is broken is produced by the spring 15.

The armature G^2 , actuated by the second relay, is set over and rests upon the arm of the detent 28, so that when attracted to one pole of the relay the armature presses down that end of the detent and raises the opposite hooked end out of the teeth of the ratchet-wheel. The contrary movement of the same armature allows the hooked end to drop into the wheel and lock the barrel. Each relay, being polarized, is responsive to currents of both polarities. In the case of the first relay G the pulsations of a positive current transmitted on the line will cause that relay to attract the outer end of the armature G^x and work the lever 10, while in the second relay the same pulsations, acting on the outer end of the second armature G^2 , will lift its inner end from the arm of the detent and drop the hook 28 into the ratchet-wheel. On the other hand, a negative current, by attaching the inner ends of the two armatures to their respective relays, will set the lever 10 and the detent 28 clear of the ratchet-wheel, and standing in that position when the current ceases that armature will allow the barrel to make the return movement against the fixed stop 14.

Referring to Figs. 6, 8, and 14 of the drawings, a hinged drop-plate A^2 will be noticed on the front of the case A directly over the sight-opening. The object of this plate is to call the attention of the operator by the change in the position of the plate at the first movement of the mechanism to the signal being registered. It is hinged at a^3 and is moved by a curved toe 38 on the hinged plate

L, acting against a similarly-shaped toe 39 on the end of the plate. These two parts 38 39, projecting inside the case behind the lines of the pivots, are so arranged that when the plate L is released from the latch 22 and drops down to lock the register-wheels it raises or tilts the plate A² to stand at a greater angle above the horizontal, so that the number on the front is presented more plainly to view, but in the opposite movement of the plate L the drop-plate returns toward the horizontal again. By these two different positions the drop-plate indicates to the operator when a register is in action and when it is not in use. The number on the front of the drop-plate is the telephone-number of the subscriber's line to which the register is connected.

The calling device located at the subscriber's telephone is composed principally of a number of sliding buttons *m*, each electrically and separately connected into the subscriber's line by a conducting-strip T and a conducting-wire T^x, a corresponding number of circuit-closing rocker-plates 29, and a local battery having wires or conductors *x y* leading from its poles to the rocker-plate. Each rocker-plate is pivoted at the ends in the inclosing case W, directly beneath the slot *w^x* in the cover in which the sliding button works, and the top surface of the rocker-plate is insulated from the bottom surface, so that one side or surface forms a separate conductor from the other side. On the top side and along one side of the line-pivots a number of standing projections 31, fixed at intervals apart, form points of contact between that side of the plate 29 and the slide M to which each button *m* is fixed, while on the opposite side of the pivot, but on the same top side of the plate, a single long projection 32 forms the point of contact between the slide and that side of the plate.

The slide M is always in electrical contact with the fixed conducting-strip T, but is not electrically connected with the rocker-plate except by moving its button *m* in its slot, at which time one or the other of the pivoted dogs 34 35 strikes the contact-points on the top of the plate and causes it to tilt and rock on its pivots. Such dogs are so attached to the ends of the slide M that they are loose and free to swing on their pivots in one direction, but are rigid and stand perpendicularly down from the slide when pressure is brought against them from the opposite direction, and one is thus set to work the reverse to the other, so that when the slide is moved downward in its slot in the case the dog 34 is rigid, and by striking against the projections 31 it tilts the rocker-plate 29, but the opposite dog 35, swinging loosely on its pivot, will not act on the projection 32 beneath it. In the upward or return movement of the slide, however, the dog 35 becomes the rigid and active one, while the other dog 34 swings loosely. The back of each dog is faced

with insulating material, whereby in its return or non-acting movement it makes no connection electrically with the rocker-plate, although it may make mechanical contact. The tilting movement thus produced in the rocker-plate by moving the slide M over it causes the plate to make electric contact on one side of its pivot with a conducting-wire from one pole of the local battery and at the same time to connect the opposite pole of the battery to the ground, and in whichever direction the plate 29 is rocked it connects one pole of the battery into the conducting-strip T and "grounds" the opposite pole.

It should be mentioned that the bottom side of the contact-plate 29, which is insulated from the top side, is permanently connected to a "ground" V.

The wire *x* from the positive pole of the local battery is arranged over the top of the rocker-plate along the side opposite to the projections 34, and the wire *y* from the negative pole is arranged in similar manner over the side of the plate opposite to the long projection 35. From the wire *x* a leg or branch *x'* is carried underneath the rocker-plate on the same side of the pivot, and from the wire *y* a similar leg *y'* is carried beneath the plate on the other side, the result of which arrangement is that when one wire is in contact with the top surface of the rocker-plate the wire from the opposite pole of the battery is then in contact with the bottom surface of the rocker-plate, through which it is connected to a ground by the ground-wire from the pivot of the rocker-plate, because, as before described, the top side of the rocker-plate is insulated from the bottom side. This operation will be understood by referring to Fig. 5 and the diagram Figs. 5^a and 5^b, in which it will be seen that when the slide M is drawn down over the plate 29 the dog 34 is caused to strike the projections 31 and as it passes over each projection to depress that side of the plate and throw up the opposite side. Such movements therefore, as each projection is struck, throw the top surface of the elevated side of the rocker-plate in contact with the positive wire *x* and also the bottom surface of the depressed side in contact with the wire *y* from the negative side of the battery, and in this manner pulsations of a positive character are transmitted over the line X through the connections T T^x, corresponding in number to the number of projections which are struck by the moving slide M, and the circuit from the battery at the switchboard is thrown upon the relays through the polarized circuit-closers Z Z' in corresponding number of vibrations. Fig. 5^b illustrates the position of the rocker-plate at such time of action. The return movement of the button back to the sliding-point tilts the rocker-plate into the opposite direction, as illustrated in Fig. 5^a, thereby causing the upper side of the plate to make contact with the negative wire *y* from

the battery and grounding the wire x from the positive side through the under side of the rocker-plate and the ground V , and in such manner reversing the polarity of the current from the local battery over the line. From this last-mentioned movement of the button in its slot the dog 35 acts against the long projection 32 on the rocker-plate, and by pressing down that side it elevates the opposite side, holding it up against the wire y and pressing down the lower face of the rocker-plate against the leg x' of the wire x .

Each sliding button when moved in its slot in one direction produces, by contact with the projections 31 on the rocker-plate beneath, as many electric pulsations of one polarity as there are projections in the row on that side of the rocker-plate. When moved back to position of rest at the end of the slot, the same button produces one single long pulsation of opposite polarity corresponding to the length of the projection on the rocker-plate. By the currents thus transmitted to the polarized relays $Z Z'$, before described, with which the signal mechanism at the switchboard is in circuit, the lever 10 and detent 28 are actuated first by the current of one polarity to set the register-wheel and afterward by the current of the opposite polarity to reset the parts of the mechanism ready for the next setting movement. Thus the barrel C is rotated and then reversed and set in position again for the next movement by the simple sliding movement of the button along its slot from one end to the other and back again to the starting-point, as already described. In this operation the two currents of different polarities thrown upon the polarized relays by each button turn and set the register-wheels according to the order in which the buttons are selected and moved by the person sending in the signal, and the number of figures composing the signal to be shown at the sight-aperture of the station-switchboard determines the number of buttons to be moved and the order in which they can be operated.

Every sliding button produces electric pulsations of one polarity in number corresponding to the number of projections 31 on its rocker-plate when moved in one direction, and a single long pulsation of opposite polarity when moved back to its first position, and by the currents thus transmitted to the polarized relays $Z Z'$, with which the signal mechanism at the switchboard is in circuit, the lever 10 and detent 28 are actuated, as before described, to rotate the barrel C and then to reverse and reset it, such two different currents being produced by each individual button, and according to the order in which the same are moved the barrel moves and sets the register-wheels to show the desired signal-number at the sight-aperture.

All the positive wires $x x$ are connected to the common binding-post X^2 and all the negative wires y to the post Y^2 . To these posts

are connected the conductors $X^3 Y^3$ from the battery Z , Fig. 23.

The strips $T T$ are connected to a common binding-post T' on the case, and the wire T^x , Fig. 1, from the line X is connected to that post. In like manner all the ground-wires are brought to a common binding-post V' , to which is connected the ground V .

The eleventh slide-button in the case W , which I have termed the "disconnecting-button," sends over the line the required number of pulsations to turn the barrel C such farther distance on its axis that it throws off the hinged plate II and thereby releases all the register-wheels. Thus after the conversation over the line is ended and the subscriber desires to be disconnected he moves the disconnecting-slide M^x to the end of the slot and allows its spring to throw it back again, the effect of which is to release all the register-wheels composing the signal and restore them to position again for subsequent operation.

As thus constructed, arranged, and connected the whole apparatus operates as follows to transmit from a subscriber's telephone to the operator a visual signal showing the number of the telephone with which connection is desired and also at the end of the conversation to signal the operator for disconnection: By that one of the slides first moved in the case W the subscriber sends over the line positive pulsations, which, acting on the polarized circuit-closers $Z Z'$, throw the positive side of the battery at the switchboard upon the relays and causing their armatures to first throw down the detent 28 and then work the pawl 10 to turn the barrel as many teeth of the ratchet-wheel as there are vibrations of the armature given. The first segment-gear D being locked in the barrel by the tappet I , which sets in line with it, the first register-wheel is turned and set in position by the movement of the gear D . At the return movement of the slide produced by the spring when released by the subscriber the current is reversed and a single pulsation from the opposite pole of the battery is produced, the effect of which is to tilt the armatures of the relays into their first position and thereby throw out both the pawl and the detent from the ratchet and release the barrel. The spiral spring in the barrel then brings it back to position against the fixed stop 14, ready for the next operation. In this return movement the incline 18 on the clutch 17 strikes the hinged stop 16, by which the star-wheel K is released, and its leading point, engaging the same stop, turns that wheel the distance of one point and by such movement sets the second tappet on the shaft II in line and working position with the second segment-gear on the barrel. In the same manner the next slide M when drawn down operates the barrel and sets the second register-wheel, and when moved back in its slot it resets the parts for the next operation. All

the four register-wheels are thus operated on and set in position to form the required signal-number.

It should here be mentioned that in every case of setting a signal of less than four numerals it is necessary to move all the register-wheels, because the first wheel to the left is always connected into the barrel when the mechanism is set for service and also because the fourth or last wheel must be operated before the long rotation of the barrel can be given to release and throw back all the wheels for the disconnecting-signal. On this account a signal-number composed of two numerals will be formed of two ciphers, followed by the required numerals, and in producing the same the first and second register-wheels will be set to show "0" and then the remaining third and fourth wheels to display the proper numbers to form the signal.

Having thus fully described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. A register mechanism for telephone-lines, comprising register-wheels arranged behind a sight-opening at a switchboard; a rotating barrel carrying loose gears, one to each register-wheel, and connected to it by intermediate gearing, means for locking said loose gears separately and in successive order at the beginning of each rotative movement of the barrel and means for releasing each locked gear at the end of each rotative movement before the next one of said gears is locked; means actuated by pulsations of an electric current to rotate said barrel step by step a predetermined distance to set the register-wheels; and means for releasing said barrel at the end of each setting movement, and a spring arranged to restore the barrel to its first position, combined for operation substantially as set forth.

2. In a register mechanism for telephone-lines the combination, in a suitable case behind a sight-opening of the register-wheels B; spring-barrel C; gears D each connected into its individual register-wheel; the shaft H, star-wheel K, tappet I, hinged stop 16, clutch 17 and stops 13 14; the ratchet-wheel 7, pawl 10, detent 28 and spring 15; and means for operating said pawl and detent by pulsations of electric currents of different polarities, substantially as set forth.

3. In a register mechanism the spring-barrel C, loose gears D, shaft H, tappets I, star-wheel K, hinged stop 16; and the stops 13, 14; the ratchet-wheel 7, pawl 10 and detent 28; and means for operating said pawl and detent consisting of the polarized relays G G' and armatures G^x G² combined for operation substantially as set forth.

4. In a register mechanism the combination, of the spring-barrel C, loose gears D, shaft H, tappets I, star-wheel K and hinged stop 16; means for rotating said barrel step by step in one direction and afterward releasing it and allowing it to return to its

starting-point by the reaction of its spring; and the stops 13 14 controlling such starting-point, substantially as set forth.

5. In a register mechanism the combination, of register-wheels B, coil-springs 2, locking-plate L, dogs 20, latch 22 and push-rod 27; the rotating barrel C and gears connecting the register-wheels separately and independently with said barrel; means for locking said gears separately and in successive order in said barrel; stops 13 14 controlling the starting-point of the barrel and also operating the push-rod; and means for rotating said barrel step by step and for releasing it to its starting-point, substantially as set forth.

6. A switchboard-register for telephone systems, comprising register-wheels arranged behind a sight-opening; pawl-and-ratchet mechanism actuating said register-wheels separately and in successive order; a locking mechanism holding said wheels in position and coil-springs adapted by their recoil to restore said wheels to normal position when released; polarized relays actuating through electric pulsations of one polarity the pawl-and-ratchet mechanism, and operating through pulsations of the opposite polarity on the said locking mechanism to release the register-wheels; in combination with a local circuit including a battery and a current-reversing circuit-closer at the subscriber's station connected with or into the polarized relays of the switchboard mechanism through the subscriber's line and transmitting electric pulsations to said mechanism, constructed for operation substantially as set forth.

7. In a subscriber's register for telephone-lines the combination, with register-wheels having coil-springs which are adapted to reset the wheels to the starting-point after each setting movement, of the stops 36 37, hinged plate L, pawls 20, latch 22, stop 26, push-rod 27, stop 14 and the hinged drop A² arranged for operation at a sight-opening as set forth.

8. The combination, with an electrically-actuated register mechanism at a switchboard, of the circuit making and breaking and current-reversing mechanism located at the subscriber's station comprising the slotted case W, the separately-operating slides M one for each of the ten digits and each slide having an increased length of stroke over the next one in ascending order, individual contact-plates 29 each movable under the contact with it of the corresponding slide and normally connected to a ground; the conductors α γ arranged on opposite sides of said plate, and one of which by the movement of said plate is brought in contact with that piece under the stroke of its slide M downward, and the other one of which is brought into contact with said plate under the upward movement of the slide, thereby reversing the polarity of the current; the conductor T connected with the subscriber's line and electrically connected with all the slides; and the disconnecting-slide M^x having a length of

stroke greater than the last slide, constructed and arranged for operation substantially as set forth.

9. The combination with a visual signal at
5 the switchboard-station composed of number-bearing wheels, mechanism operative under electric pulsations of both polarities to operate said wheels, a local circuit and battery
10 including polarized circuit-closers in the circuit between the subscriber's telephone and the switchboard-station and operative under pulsations transmitted over the subscriber's line, of circuit-closing devices at the subscriber's telephone, a local circuit including

a battery and said circuit-closing devices, and 15 connection between such devices and the subscriber's line whereby the polarized circuit-closers in the main circuit are operated by pulsations from the secondary circuit at the subscriber's end of the line to open and 20 close the operating-circuit containing the signal mechanism for operation as set forth.

In testimony that I claim the foregoing I have hereunto set my hand and seal.

WILLIAM FREDERICK SMITH. [L. s.]

Witnesses:

EDWARD E. OSBORN,
M. REGNER.