

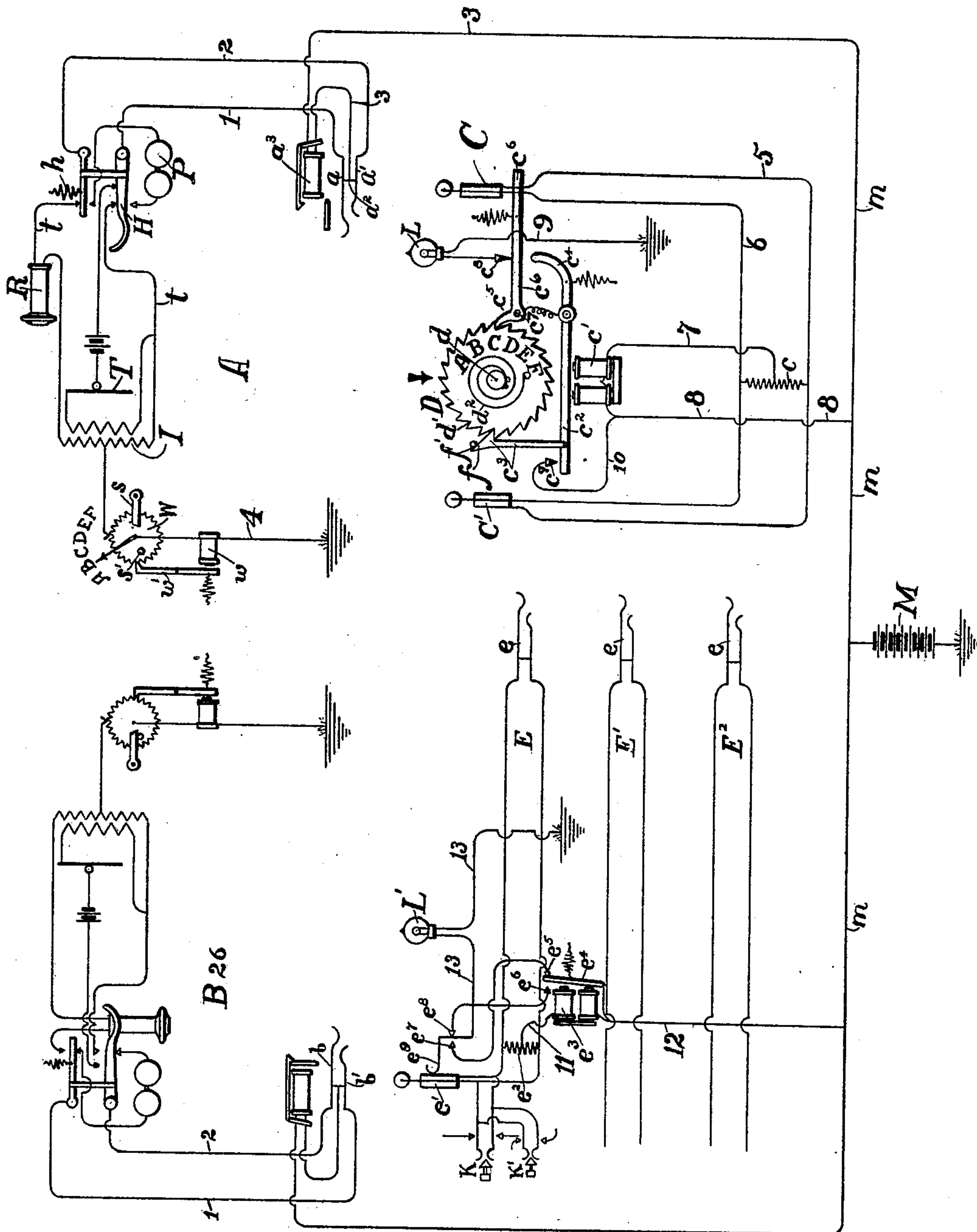
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Patented Apr. 3, 1900.

E. E. CLEMENT.
TELEPHONE EXCHANGE SYSTEM.

(Application filed June 16, 1898.)

(No Model.)



Witnesses:
Wm. D. Sharkey.
D. J. Low.

Inventor:
E. E. Clement.

UNITED STATES PATENT OFFICE.

EDWARD E. CLEMENT, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR
TO THE SUN ELECTRIC MANUFACTURING COMPANY, OF NEW JERSEY.

TELEPHONE-EXCHANGE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 646,677, dated April 3, 1900.

Application filed June 16, 1898. Serial No. 683,654. (No model.)

To all whom it may concern:

Be it known that I, EDWARD E. CLEMENT, a citizen of the United States, residing in the city of Washington, in the District of Columbia, have invented a new and useful Improvement in Telephone-Exchange Systems, of which the following is a specification.

My invention relates to telephone-exchange systems, and has for its object to lessen the amount of apparatus required for the operation of large exchanges and to increase the speed thereof.

With these ends in view I divide my central-office switchboard into sections interconnected by trunk-lines. I group upon each section a certain number of subscribers' line terminals. I provide for each operator a certain number of cord-circuits and plugs. In each cord-circuit I arrange an indicating device bearing the numbers or letters of the various board-sections. At each subscriber's station I provide a selective signaling device or impulse-transmitter which upon the operator plugging in in answer to a call cooperates with the indicating device in the cord-circuit to apprise the operator of the section upon which the subscriber with whom conversation is desired has a line-terminal, thus enabling the operator to make the proper trunking connections instantly and without any oral communication.

The invention in this case is closely related to that presented in my application filed June 16, 1898, Serial No. 683,652, but is distinguished therefrom by its use of a signal in the operator's circuit instead of automatic connecting means.

My invention is fully illustrated in the accompanying drawing, in which the figure is a diagrammatic representation of one form of my system, showing two subscribers' stations and a portion of the central office.

Referring to the drawing, A and B are subscribers' stations, each provided with a transmitter T, a receiver R, an induction-coil I, an impulse-transmitter W, a hook-switch H, and a bell or ringer P. Line-wires 1 and 2 from station A terminate in jack-springs $a a'$, which normally rest upon an anvil a^2 , from which the wire 3 leads through the annunciator a^3 to the battery M and ground.

The impulse-transmitter W at the subscriber's station is connected in a ground-tap, consisting of wire 4, taken off from the middle point of the secondary of the induction-coil I and including the magnet w , which is adapted to control a detent w' . A stop s and a pin s' on the impulse-transmitter are arranged to determine a positive zero-point for the same.

Adapted to cooperate with jack-springs $a a'$ is the plug C, having its tip and sleeve connected, respectively, to the tip and sleeve of a similar plug C' by the cord-circuit 5 6. Bridged across this circuit 5 6 is an impedance-coil c , from the middle point of which a wire 7 is led to a magnet c' , from which a wire 8 leads to battery-wire m , battery M, and ground. Arranged to be attracted by the magnet c' when energized is an armature c^2 , carrying upon one end a pawl c^3 and upon the other end a releasing-hook c^4 and journaled upon a fixed support. Loosely journaled upon a shaft d is a wheel D, provided with teeth d' and connected with shaft d through the medium of the coiled spring d^2 , one end of which is fixed to the wheel and the other to the shaft. Adapted to engage with the teeth d' on the wheel is a stop-detent c^5 , forming part of a lever c^6 , pivoted at c^7 and overlying the end of the releasing-arm c^4 . Any suitable stop device is employed upon the wheel (preferably similar to that shown on wheel W at the subscriber's station) whereby the wheel will normally rest at zero.

The end of the lever c^6 extends into the seat of the plug C and is provided with an orifice, through which the plug-cord 5 6 passes, the plug itself when in its seat resting upon and keeping the lever depressed. Arranged so as to make contact with the lever when it rises is an anvil or spring c^8 , from which wire 9 leads to a lamp or other signal L and to ground. Bridged over the circuit 8 is a wire 10, which terminates in a contact c^9 , adapted to be closed upon by the armature c^2 when the latter is retracted.

The plug C' cooperates either with line-jacks $a a'$ or with trunk-line terminals $e e$, from which the trunk-lines E, E', and E² lead to other sections of the switchboard or to other exchanges. As all of these trunk-lines are arranged in a similar manner and contain

similar apparatus, the description of one will suffice for all. The trunk-line E terminates at one end in the jack *e* at one board-section and at the other in the plug *e'* at another board-section. Bridged between the two sides of the trunk-circuit at the latter section is an impedance-coil *e²*, from the middle point of which a wire 11 is led to a magnet *e³*, from which a wire 12 leads to the battery-wire *m*, battery M, and ground. An armature *e⁴* of the magnet *e³* is connected to the same wire 12 and is adapted to rest normally against a back stop *e⁵* and to be drawn up when the magnet is energized against the front stop *e⁶*, said stops being connected to anvils *e⁷* and *e⁸*, respectively, of the switch *e⁹*, which extends into the seat of the plug *e'* and is caused by the presence of said plug in the seat to normally make contact with the anvil *e⁸*. From the spring *e⁹* the wire 13 leads to a lamp or other signal *L'* and to ground.

The operation of the system thus described is as follows: Assuming that subscriber A desires to converse with subscriber B and knowing that the subscriber B is connected to a terminal on the B switchboard and is No. 26, A sets his variable-signal transmitter W, which is only shown diagrammatically because it may be any well-known type of variable-signal impulse transmitter. He then removes his telephone-receiver R from the hook H, which, rising under the influence of the spring *h*, breaks the circuit of the bell P and connects the line-wires 1 2 to the talking-circuit *t*. The impulse-transmitter W, with its ground-wire 4, is thus connected directly to the line-wires 1 2 through the opposite ends of the induction-coil I. The effect of this is to allow current from the battery M to energize the magnet *a³*, which is of high resistance, leaving magnet *w* insufficiently energized to perform any work. The magnet *a³* displays its signal, whereupon the operator, lifting the plug C from its seat, inserts it in the jack *a a'*. Several effects are produced by this act. The first is the separation of the jack-springs *a a'* from the anvil *a²*, and consequent cutting out of the drop-magnet *a³*. The second is the energization of both magnets *w* and *c'*, which are alike of low resistance. The third effect is the momentary lighting of the lamp L, caused by the closure of the lever *c⁶* upon the contact *c³*, while the armature *c²* is resting on its back contact *c⁹*. The magnet *w* being immediately energized by the current passing through it attracts its armature *w'* and releases the wheel W, which under the influence of a spring and train (not shown) begins to revolve, making and breaking the circuit. Suitable means are provided for preventing the detent from again stopping the wheel after it has once started, and as the wheel turns it makes and breaks the circuit a number of times corresponding to the distance through which it was turned in setting. Having been set to B, it will step the wheel D around through

the agency of the magnet *c'* until the letter "B," borne upon the face thereof, appears to the operator. When the wheel W has reached zero, the circuit remains closed through one of its teeth to the ground, and consequently the armature *c²* remains attracted. The operator perceiving the letter "B" to indicate the section desired inserts plug C' in the jack *e* of the trunk-line E, leading to section B of the switchboard. Current immediately passes from the battery M over wire *m*, wire 12, magnet *e³*, wire 11, impedance-coil *e²* in both directions, both sides of the trunk-circuit in parallel, the spring-jack, cord-circuit 5 6, jack-springs *a a'*, line-wires 1 2 in parallel, talking-circuit, induction-coil I, and through the wire 4 to ground. This energizes the magnet *e³*, which attracts its armature, closing a branch circuit from the battery M through the wire 12, armature *e⁴*, contact *e⁶*, anvil *e⁸*, spring *e⁹*, wire 13, and lamp *L'* to ground. Lamp *L'*, which is associated with the plug *e'* upon the B section of the board, becoming incandescent apprises the operator at that section that some one connected with plug *e'* desires a further connection with one of the jacks upon her section. She immediately communicates with the calling subscriber by means of her key K, and having ascertained the number of the line wanted to be 26 she inserts the plug *e'* in the jack *b b'*, completing the through-circuit through the wires 1 2 to the called subscriber B, whose bell she rings by means of the calling-key K'. In withdrawing the plug *e'* from its seat the spring *e⁹*, it will be observed, has been allowed to shift over to close upon the anvil *e⁷* and break with the anvil *e⁸*. As long as the two subscribers are connected and either of them has his telephone-receiver off the hook both magnets *e³* and *c'* will hold their armatures attracted because of the ground upon the line. The lamp L is so connected to the anvils *c⁸* and *c⁹* that it will become incandescent only upon the deenergization of the magnet *c'*, while the lamp *L'*, which is normally in connection with the front stop of the armature *e⁴*, and thereby is adapted to serve as an advance signal for the trunk-line, is switched over by the act of withdrawing the plug *e'* into connection with the back stop *e⁵* of the armature *e⁴*, and is thereby adapted to become incandescent only upon the deenergization of said magnet *e³*. When both subscribers have hung up their telephone-receivers on the hooks, the magnets *c'* and *e³* release their armatures, which thereupon fly back, closing the circuits of both lamps L and *L'* and indicating to the two operators that disconnection is desired. Thereupon the plugs are withdrawn. When the plug C is returned to its seat, it depresses the lever *c⁶* and through the arm *c⁴* raises the armature *c²*, whose pawl *c³* has an inclined face *f*, sliding upon a pin *f'*. Both pawls *c³* and *c⁵* are thus disengaged from the teeth *d'* of the wheel D, which is thereupon turned by the spring *d²* until it reaches its zero-point

and stops there because of the stop device, and the lamp L is simultaneously extinguished by the double break in its circuit. When the plug e' is replaced in its seat by the B operator, the spring e^9 again makes contact with the anvil e^8 , whereby the lamp L' is extinguished and again becomes ready to act as a trunk-signal. The trunk-signals and the subscribers' apparatus herein set forth form no part of the present invention, as they are already described and properly claimed in the concurrent applications, to which reference has heretofore been made.

I am aware that it is not broadly new to signal from the subscriber to the operator for the purpose of indicating in a general way the desired connection. I believe, however, that I am the first person to put a signal of this character in the operator's cord-circuit, and I claim the same, broadly, as my invention. The saving effected is very considerable, and the efficiency of the system as a whole is greatly increased thereby.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In a telephone-exchange system, a switchboard, line-terminals thereon, operator's connective means for the same, a variable-signal transmitter at each subscriber's station, and an operator's variable-signal receiver normally disconnected from any line but placed under control of any one of said

signal-transmitters, when connection is made by the operator with the corresponding line, substantially as described. 35

2. In a telephone-exchange system, a switchboard, terminals thereon, and subscribers' lines connected thereto, plugs and cords for interconnecting the same, variable-signal telegraph-transmitters at the subscribers' stations, and variable-signal telegraph-receivers connected with the plug-cord circuit, substantially as described. 40

3. In a telephone-exchange system, subscribers' lines and terminals therefor, grouped upon separate switchboards or switchboard-sections, trunk-lines interconnecting the boards or sections, and connecting-cords and plugs at each board or section, variable-signal telegraph-transmitters at the subscribers' stations, and variable-signal telegraph-receivers in connection with said plug-cord circuits, whereby any subscriber may indicate to the answering operator, the number or letter or the board-section upon which the terminal of the wanted subscriber is located, substantially as described. 55

In testimony whereof I have hereunto set my hand this 15th day of June, A. D. 1898, 60 in the presence of two witnesses.

EDWD. E. CLEMENT.

Witnesses:

MORTIMER A. JONES,
JNO. W. SCOTT.