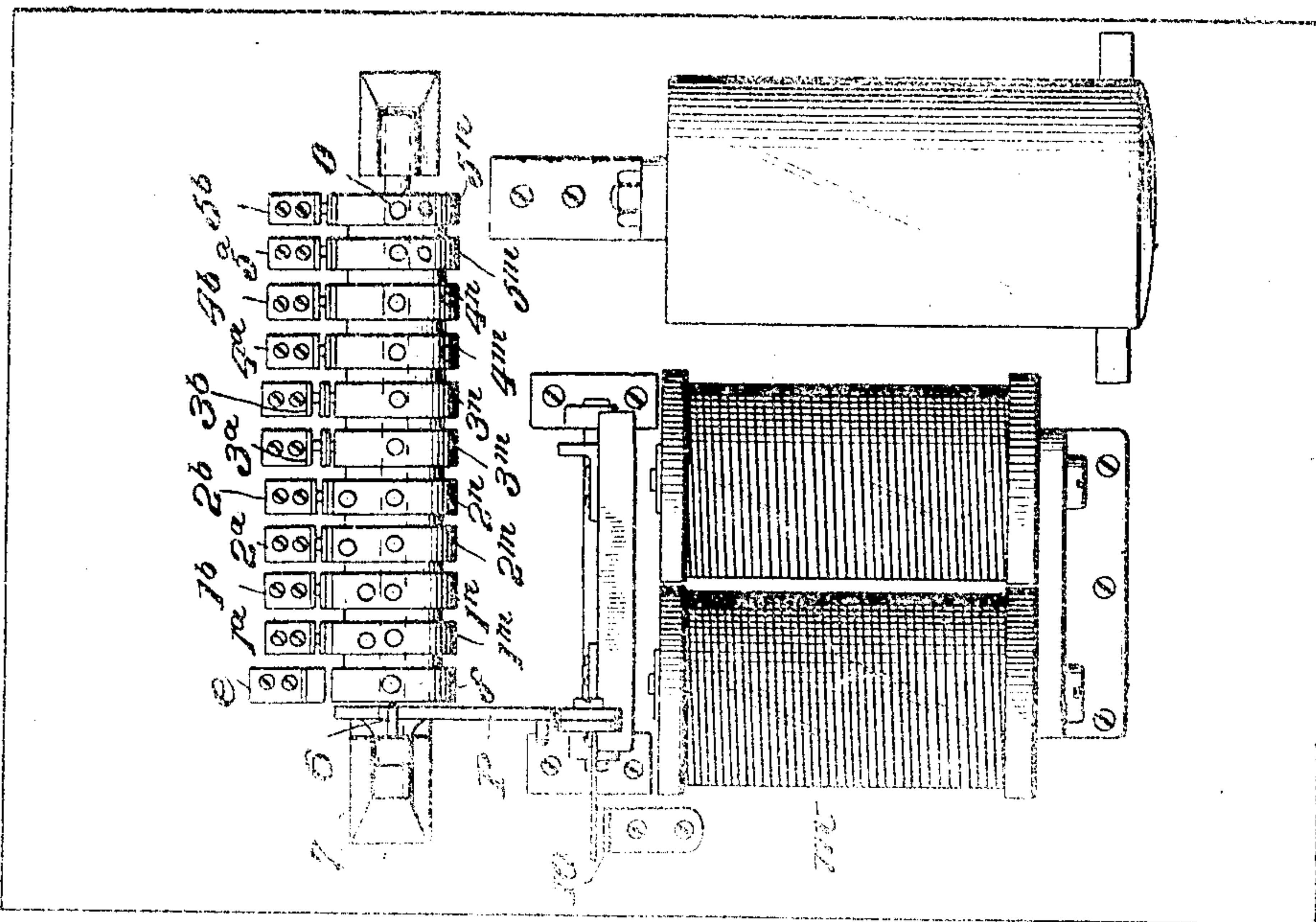
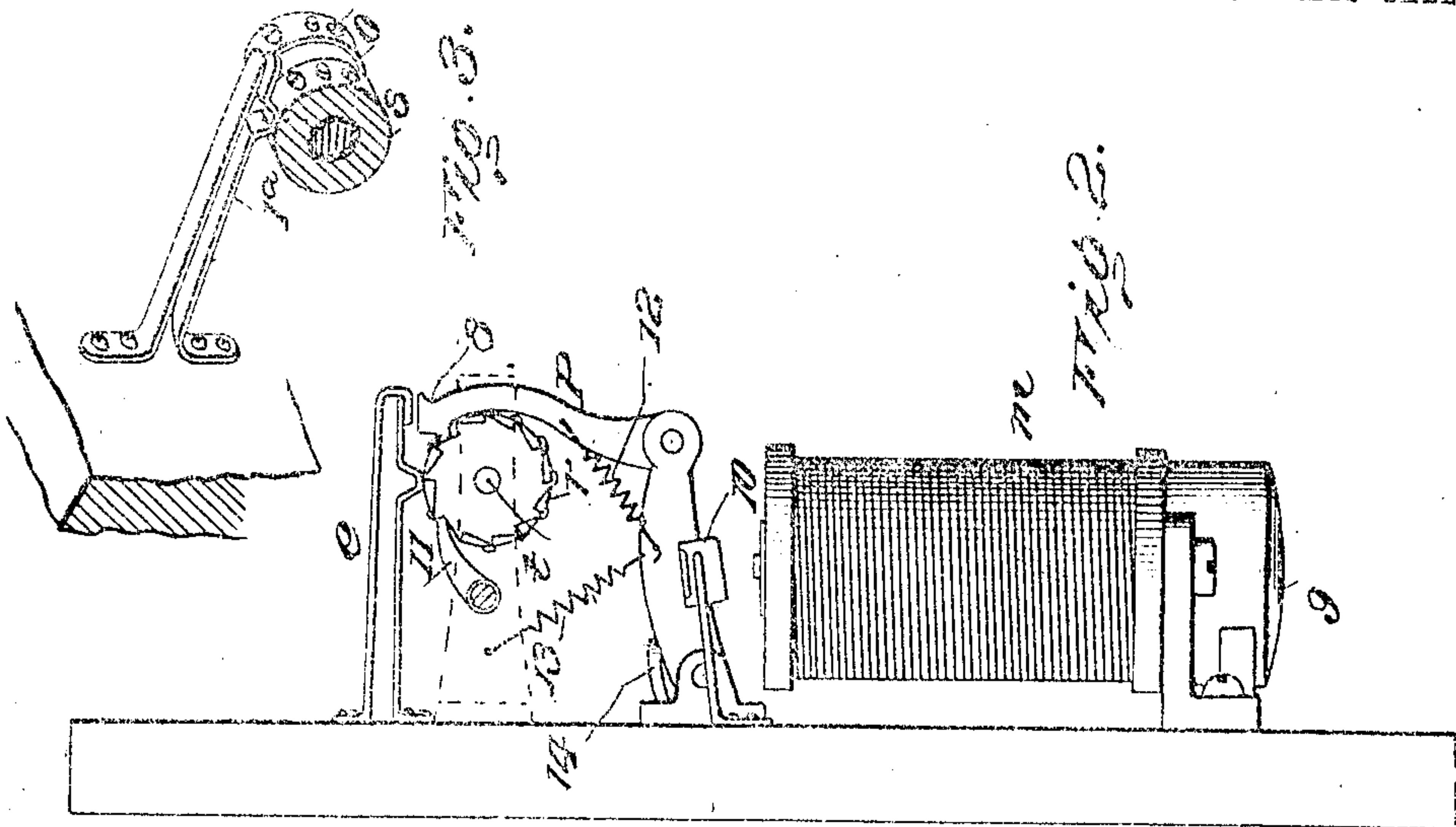


A. J. FARMER.
 TELEPHONE PARTY LINE SWITCHING APPARATUS.
 APPLICATION FILED APR. 19, 1905.

920,043.

Patented Apr. 27, 1909.
 3 SHEETS—SHEET 1.



Witnesses
Wm. H. Miller
T. Howell

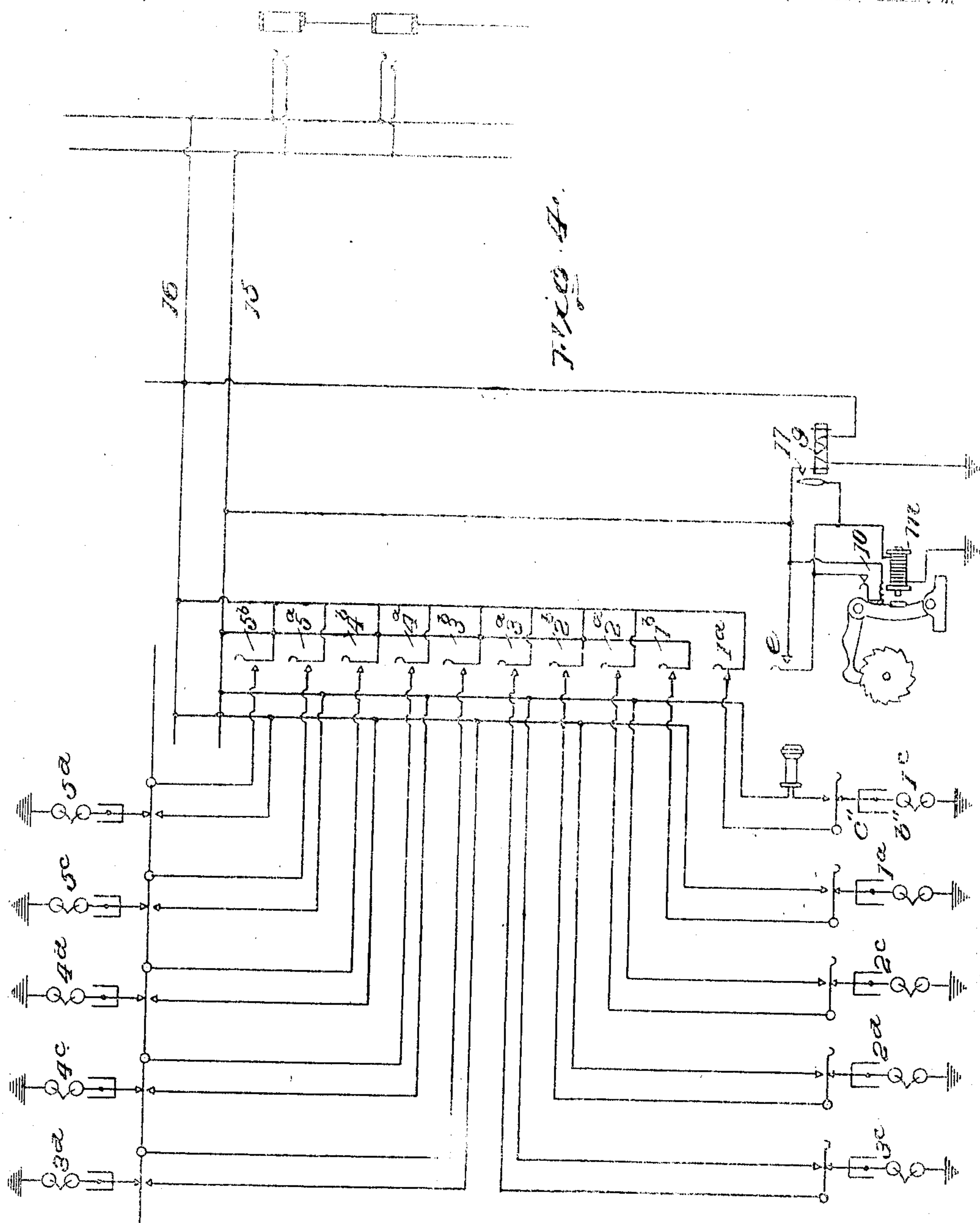
Fig. 4.

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 3 SHEETS-SHEET 2.



Witnesses

J. J. Irvine
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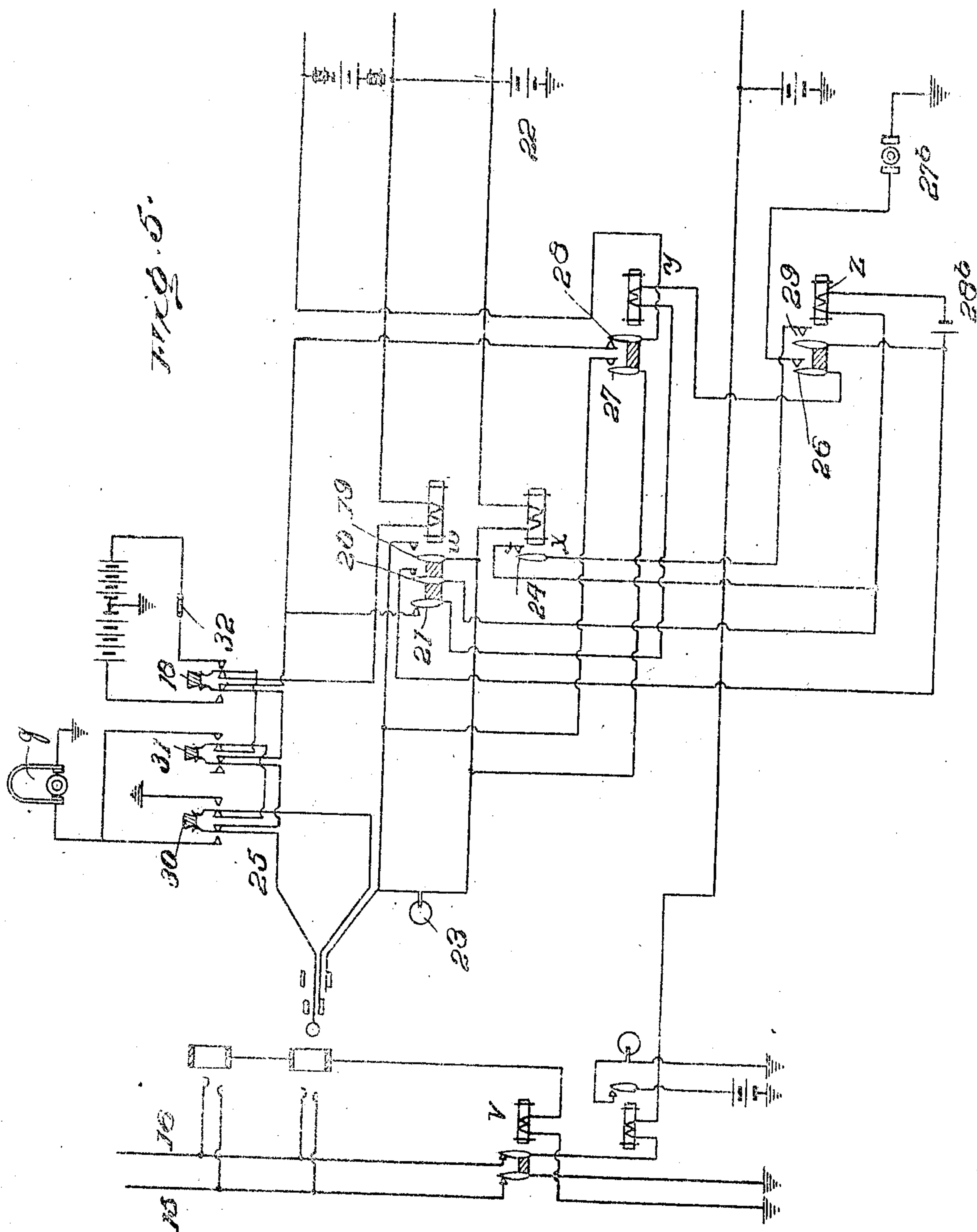
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3 SHEETS—SHEET 3.



Witnesses

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UNITED STATES PATENT OFFICE.

ARTHUR J. FARMER, OF DETROIT, MICHIGAN.

TELEPHONE PARTY-LINE SWITCHING APPARATUS.

No. 920,043.

Specification of Letters Patent.

Patented April 27, 1909.

Original application filed December 26, 1903, Serial No. 186,538. Divided and this application filed April 19, 1905.
Serial No. 256,428.

To all whom it may concern:

Be it known that I, ARTHUR J. FARMER, a citizen of the United States of America, and a resident of Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Telephone Party-Line Switching Apparatus, of which the following is a specification, the same constituting a division of my application, Serial No. 186,538, filed December 26, 1903.

My invention relates to improvements in telephone party-line switching apparatus, and has for its object the provision of means for selectively connecting and calling the desired station, for effecting the proper sequence of signals at the exchange, and thereafter automatically restoring the selective apparatus to normal or initial position, and otherwise simplifying and rendering more effective, the connection, selection and restoration of telephone lines of this class.

The selective feature of my system I obtain principally, by interposing between the central-office and the several parties served by a given exchange-line, an appliance which I shall term a junction box, the same containing switching mechanism for connecting in circuit all of the stations upon the line, or associated therewith, or merely a given station or group of stations out of the entire number. The actuation and restoration of the junction-box apparatus are controlled by the exchange-operator through a key or switch appliance controlling the sources of current in a common battery exchange system; or the restoration may be automatically accomplished by introducing into the cord-circuit suitable apparatus controlled by the called subscribers' switch-hook.

In selecting a party current preferably is transmitted to the junction-box over both sides of the line to ground; while for effecting its restoration, but one side is used, the appliance including means for checking it in its normal position for calling or receiving a call from any of the parties. To meet the added functions, the central-office apparatus is modified slightly, including therein relay-mechanism and a source of current, preferably pulsating, automatically connected in circuit with the junction-box apparatus when the line requires restoration to normal condition.

My invention, however, will be more

readily understood by making reference to the accompanying drawings illustrating apparatus and a telephone system equipped in accordance therewith, wherein:—

Figure 1 shows in plan view the junction-box appliance adapted for switching the various subscribers into and out of circuit; Fig. 2 is a side elevation of the same; Fig. 3 is a detail view illustrating the preferred form of switching-contacts with a portion of the contact-making drum employed therein; and Figs. 4 and 5 respectively show in diagram ten subscribers' circuits associated with the junction-box and its metallic-circuit exchange-line; and the modified central-office apparatus so far as it pertains to the calling side of the cord circuit;—the multiple jacks being duplicated in the two figures, better to indicate the relation of these diagrams.

The same character of reference is employed throughout the drawings to indicate similar parts, or diagrammatic representations thereof.

Having given above, a general statement as to the system of my invention, the details of its embodiment described therein, will be more readily grasped, by first setting forth the structure of the junction-box shown in Figs. 1 to 3. I have chosen to base my description on the assumption that ten parties, connected two by two, are to be served by a given exchange-line, and accordingly, five sets of contact-making springs $1^a, 1^b$ to $5^a, 5^b$ are provided in the junction box, each of which is adapted to control one limb of its party-line. An additional set of contact-springs e is utilized for governing the circuit through the actuating electro-magnet m . Fig. 3 illustrates the preferred form of springs used herein, with the exception merely, of the set e , which requires normally-open, or back-contact-making springs as indicated in Fig. 2; i. e. in the normal, or initial position of the junction-box. Thus set 1^a , for example, is seen to comprise two relatively-long, flexible, springs mounted on the insulating base of the device; the inner one of which is crimped, or provided with a projection or elevation, adapted to be engaged by the pins o on the drum s , to flex said springs and effect a rubbing contact therebetween. Accordingly, all contacts in the junction-box are made between the stationary spring-parts, and do not depend on

sliding, or relatively movable contact-parts. Mounted on a common shaft *t* before these sets of contact-making springs, are the controlling pin-bearing disks *f* and $1^m, 1^n$ to $5^m, 5^n$, arranged in pairs, but each controlling its own set of springs. Four projecting pins, diametrically disposed in varying relation, are borne by each of the paired disks; those upon the pairs being identical, so that when the controlling drum *s*, formed of said disks, is in any other than normal position, but two sets of springs, corresponding to the two paired disks, are closed together. Thus springs 3^a and 3^b , respectively engaged by the pins in disks 3^m and 3^n , are shown flexed into engagement to connect the corresponding line-conductors with the exchange. In the initial position, or positions, however, the transverse row of pins *o* engages, each its corresponding, spring, opening contacts *e*, and closing the remainder of the circuits in the junction-box controlling the party lines. At the outer end of the shaft *t* is mounted the ratchet wheel *r*, operated through pawl *p*, by the pivoted armature of the electro-magnet *m*. The teeth upon said wheel indicate and correspond to the several operative positions of the controlling-drum. In the preferred type of apparatus, one step of the ratchet wheel is designed to open one pair of contacts and close the adjacent pair, or, assuming the drum to be in the initial position, it will break contact between all pairs of springs excepting only springs 1^a and 1^b , which will be momentarily separated and then immediately brought into contact again. If springs 5^a and 5^b be engaged by corresponding pins *o*, instead, their contact will be broken momentarily, and then, currently with a step of the ratchet, contact will be reestablished between springs 5^a and 5^b as well as between all the other sets of springs, excepting *e*, which are opened. This places the junction-box in its normal or initial position. Since there are five separate pairs of contact-springs to be actuated, and one initial position is requisite, the drum must be rotatable into six operative positions. The range of movement of the armature, however, is relatively small, and accordingly, I have grouped all six positions upon the semi-circumference of the drum by arranging the sets of pins to form the successive contacts between the springs, on one-half its circumference; the other half bearing similarly disposed or related contact-making pins, adapted to duplicate the several operative positions. Accordingly, there are two normal or initial positions out of the twelve operative positions of the drum. Likewise, there are two in which each of the pairs of springs $1^a, 1^b$, and 2^a and 2^b , are connected together, and so on. Thus, in all but the initial positions, two of the sets or pairs of springs are alternatively

actuated into contact to close circuit with their respective line-conductors, in common with the closure of the circuit to the magnet *m* through the springs *e*.

The ratchet-wheel of the device, necessarily is provided with twelve equi-distant teeth, representing the twelve operative positions of the drum. It is perfectly obvious, however, that by alternating merely the ratchet wheel and adjustable pin-bearing disks to suit existing conditions, different numbers of lines may be accommodated by the junction-box; and for this reason, the drum is built up of disks whose contact-making pins, or operative positions, may be changed as required. I may state, however, that the arrangement described, employing duplicating contact-making pins upon each disk to avoid completely rotating the drum each time a station is selectively called, is the one to be preferred. A back-stop pin 6 mounted on the standard 7, serves to determine the play or movement of the pawl *p*, by reason of its engagement with the projection 8 thereon; thus checking the movement of the pawl, armature and ratchet-wheel each time in their proper positions. One of the pair of contacts 10 is secured to the base portion of the device, while the other is carried by the armature; the same being so positioned that they are in engagement with each other only during the reciprocation of said armature under the influence of magnet *m*. An inclosed relay 9, whose windings are connected with one of the line-conductors, is disposed upon the base adjacent to the actuating magnet. Further mechanical details of the junction-box apparatus, comprise a dog 11 bearing against the ratchet-wheel and springs 12, 13 acting respectively upon the pawl and armature; while a back-stop 14 serves as a rest for the armature when retracted by the spring.

The figures of the drawing, in connection with the foregoing description, set forth very plainly how the corresponding contact-making and breaking pins, insulated in their respective disks, effect the opening of the circuit between springs *e*, and the closure of circuit between the paired sets of springs in turn, when rotated into engagement with the projecting portions of their respective springs.

Having gained an adequate idea of the mechanism for effecting the several circuit changes within the junction-box, reference to the remaining figures of the drawing will make clear the relation of the several parts and their coöperation in the system of my invention.

Fig. 4 will be recognized as a diagrammatic representation of ten telephone stations $1^a, 1^b$, to $5^c, 5^d$, connected with the line-conductors 15, 16, extending to the exchange through the medium of the junction-box ap-

including battery 28^b and contacts 20; provision being made for the closure of another circuit through the same whenever contacts 24 and 29 are simultaneously
 5 closed—or when they are closed during the same period. Since the restoring current from source 27^b is to be sent to line only when the plug is inserted in the jack and the subscriber hangs up his receiver, it be-
 10 comes necessary to provide such an arrangement of circuits and relays that a circuit will be partially completed when the subscriber takes down his receiver, and electrically closed upon his hanging up the
 15 same. Moreover, the relay apparatus associated with the cord circuit, must be restored to normal condition upon the removal of the plug from its jack.

For the purpose of illustrating the work-
 20 ings of my invention, let us assume that the operator has received a call for subscriber 3^c, and trace out the various steps or circuit-changes necessary to secure his connection in circuit, and the return of the apparatus
 25 to normal condition. Ordinarily all that is demanded of the operator is to plug into the desired jack, press three times on key 18, and then selectively ring the desired subscriber by means of ringing-key 31 which
 30 transmits current from generator *g* over line 16 and the bell of subscriber 3^c to ground; the remainder of the operation normally being automatic. Should the party not
 35 answer, however, key 18 would be pressed three times more by the operator, and the plug would be removed from the jack. We will follow the operation, assuming that sub-
 40 scriber 3^c answers his call. Upon plugging in, current flows from grounded battery 22 through relay *x*, to lamp 23, ring and thimble of the plug and jack, relay *v* and to ground thereby insuring the closure of contacts 24 while the plug remains in the jack. Super-
 45 visory-relay *w* is energized upon the subscriber answering his call and removing the receiver from its hook, by reason of the low resistance bridge across the line; hence contacts 21 are opened and contacts 20 re-
 50 main closed while subscriber 3^c is talking. The latter contacts complete an independent circuit including battery 28^b, through the windings of relay *z*, and its contacts 26 and
 55 29 are actuated into engagement. Contact 26, it will be seen, is one of the controlling contacts in the grounded circuit including the source of intermittent current 27^b and magnet *m*, for effecting automatic restora-
 60 tion. The closure of contacts 29 of relay *z*, during the engagement of contacts 24 of relay *x*, completes a separate circuit from battery 28^b through relay *z*, so that the latter will remain energized while the plug is in the jack. When subscriber 3^c hangs up his receiver, the supervisory relay is at once de-
 65 energized, thus opening contacts 19 and 20

and closing contacts 21. The latter closes the circuit already partially established, from the source of intermittent current 27^b, through contacts 26 and 21, the key-contacts and those of the plug and jack to line-con-
 70 ductor 15, thence to magnet *m*; where the current impulses serve to step the junction-box apparatus into initial position, whereupon the circuit to magnet *m* is broken in the manner before described, and the appa-
 75 ratus remains at rest. While this is occurring the intermittent current is flowing through the windings of relay *y*, so that its contacts 27 are alternately closed and opened, and contacts 28 simultaneously opened and
 80 closed; the one shunting the supervisory-lamp, and the other opening the cord circuit to the answering side, to prevent any restoring current from reaching that side of the connection. Supervisory-lamp 23, now
 85 normally lighted, is alternately extinguished and relighted, by reason of the intermittent shunt, until the junction-box apparatus is completely restored; thus serving to warn
 90 the operator not to take down the connection until the lamp burns steadily as a proper signal therefor. Removing the plug upon getting the said signal, of course, restores the exchange-apparatus to normal condition, and,
 95 as explained, the several stations connected with the junction-box apparatus, are left bridged across the main line conductors, so that any one can signal the exchange in the well known manner.

In the foregoing, I have clearly set forth,
 100 I believe, the most desirable application of my invention, but I may merely allude to other advisable employments thereof. For example, the number of contact-springs in the junction-box, and the corresponding
 105 operative positions, are readily and very simply altered to meet existing requirements, by adding or removing the springs and changing the contact-making disks upon the drum. The connection of the
 110 junction-box with the subscribers' circuits, likewise is subject to numerous alterations to meet varying conditions. Thus, although practical privacy in the use of the line is obtained in the example given, since
 115 all the parties but one are disconnected during conversation, and a selective signal is provided for, five parties may be given service in absolute privacy and over individual metallic lines, using the same ap-
 120 paratus; the contact-springs then controlling both limbs of the line. Twenty, or any intermediate number of parties, might, on the other hand, be connected to the appa-
 125 ratus for service should it be desired; selective calling being provided for simply by adopting the well known polarized bells and corresponding means for ringing them. However, these, and other modifications will
 130 be plain to those skilled in the art, and

pliance previously considered. The use of the same characters of reference in the drawings shall render the diagram largely self-explanatory. It will be observed that each station is connected with one or the other of the line conductors in a permanent manner, while connection with the other or opposite line conductor, is controlled by an individual spring within the junction-box. For example, line conductor 15 is continuous to station 1^a, in common with four other stations, but the circuit to said station, via conductor 16, is controlled entirely by the paired contact springs 1^a within the junction-box. On the other hand, station 1^a is permanently connected with line conductor 16, while springs 1^b govern the return circuit over line-conductor 15. I have already explained, however, that under the circumstances of use assumed, a set or group of springs (comprising two pairs of springs, as 1^a, 1^b) is simultaneously actuated into and out of engagement; hence stations 1^a, 1^d, must together be connected in multiple with and disconnected from the line-conductors. The signaling-bells *b''* at the several stations are respectively connected between one or the other of the line-conductors and ground through the usual condensers *c''*, so that the operator can, in the simplest manner possible, selectively call the desired station when its group of two is connected in circuit; such connection necessarily being coupled with the disconnection of all the other groups, except in the initial or normal position of the apparatus. It is important to observe that in each case the ringing side of the station-line is the controlled limb of the circuit. Relay 9, in the particular arrangement shown, is permanently connected between conductor 16 and ground, while the actuating electro-magnet *m* is associated with line-conductor 15 through the medium of any of the multiple-contacts *c*, 10 or 17; the first being the controllable contact-springs within the junction-box, the second the auxiliary contacts directly actuated by the armature, and the third the contacts of relay 9. All of these are initially or normally separated. The characteristics of the junction-box apparatus, accordingly, are seen to be such that the operator may, by directing current over both line-conductors in parallel, with ground return, step the contact-controlling drum from the initial position into any of the five operative positions wherein the stations are connected to line two by two, for the purpose of selective signaling; whereas, to return the junction-box apparatus to the initial position, current is directed over line-conductor 15 only. Having given attention to the foregoing, the reason for this will be apparent. In the initial position contact-springs *c* are separated, so that no current can reach magnet *m* until the relay contacts

17 are closed. However, immediately the controlling drum is advanced from its initial position, circuit through the magnet *m* is established between contacts *c*, and the drum may be advanced through its several positions until initial position is again reached, merely by directing current over line-conductor 15. In order to insure the complete return to initial position, however, I preferably provide the auxiliary contacts 10, which are closed during the movement of the armature, and serve to afford an independent path for the current actuating the magnet, and avoid the premature opening of the circuit by reason of the separation of springs *c*. It will be understood that the several windings connected between the line-conductors and ground are of such high impedance as to preclude the formation of a low resistance bridge across the metallic line-conductors.

A number of modifications of the standard calling side of the operator's cord-circuit will be observed in the diagram given in Fig. 5. By reason of these, the operator is enabled to accomplish the results already alluded to, in that she can after selectively signaling any station return the junction-box apparatus to the normal or initial position manually, or the same may be done automatically upon the subscriber's hanging up his receiver. For selecting a party and subsequent manual restoration, key 18 is pressed the requisite number of times to select a pair of stations, one of which is then rung by means of key 30 or 31, and when return to the initial position is desired, switch 32 is opened and the same key 18 is again pressed the number of times necessary to restore the junction-box apparatus. Switch 32 is provided for the purpose of sending current over one or both of the line-conductors by way of key 18, and may be opened when manual restoration is resorted to, for preventing the controlling drum from being actuated past the initial position. I will set forth, however, the preferred mode of effecting the restoration of the junction-box apparatus and automatically connecting all of the party-lines in circuit. It will first be observed that the supervisory-relay *w*, in addition to the usual contact 19 for controlling the signal-lamp, is equipped with the contacts 20 and 21 for effecting a special purpose. In circuit with the lamp 23 and battery 22 is provided a relay *x*, whose contacts 24 intermediately control a special circuit. Included in circuit with the cord 25, are the relay *y*, contacts 21, 26, and source of intermittent current 27^b. Contacts 28 of the latter relay serve to open and close the answering-side of the cord-circuit, while the contacts 27 are provided for the control of a shunt about the supervisory-lamp 23. Another relay *z*, is connected in a local circuit

I claim the following as setting forth my invention:—

1. In a switching appliance of the class described, the combination with the controlling electro-magnet and its armature, of a relay device governing the circuit there-through, and in multiple with its actuated contact, a normally open, self-controlled contact, and a contact closed only during the movement of the armature, substantially as set forth.

2. In a switching appliance of the class described, the combination with a rotatable element and electro-magnetic means for effecting its actuation, of a plurality of actuated but stationarily mounted springs for effecting the control of the party line circuits, and a pair alternative to all of the other springs, and normally open for controlling the electro-magnetic means substantially as set forth.

3. In a party-line switching appliance, the combination with a rotatable element and electro-magnetic means for actuating the same, of a plurality of stationarily mounted pairs of contacts or springs for effecting the circuit changes, one pair being alternative to all of the others and normally open for governing the electro-magnetic means, all associated with said element and actuated thereby, and a relay device

governing contacts in multiple with the latter, substantially as set forth.

4. In a switching mechanism of the class described, the combination with an electro-magnet and its armature, of circuit-controlling or switching contacts, associated parts for effecting the actuation thereof by the movement of the armature, and an auxiliary contact controlling the circuit through the magnet, the same being normally open but adapted to be closed during the movement of the armature substantially as set forth.

5. In a switching appliance of the class described, the combination with an actuating electro-magnet and its armature, of circuit-controlling or switching contacts, associated mechanism for effecting the actuation thereof by the movement of the armature, paired governing contacts and auxiliary contacts jointly controlling the circuit through the magnet; the latter being in multiple with the other contacts and normally maintained open, but adapted to be closed during the movement of the armature, substantially as set forth.

Signed at Detroit, Michigan, this 27th day of March, 1905.

ARTHUR J. FARMER.

Witnesses:

S. E. THOMAS,
ALLAN McLERIE.