

(No Model.)

2 Sheets—Sheet 1.

W. W. DEAN.
TELEPHONE EXCHANGE SYSTEM.

No. 564,328.

Patented July 21, 1896.

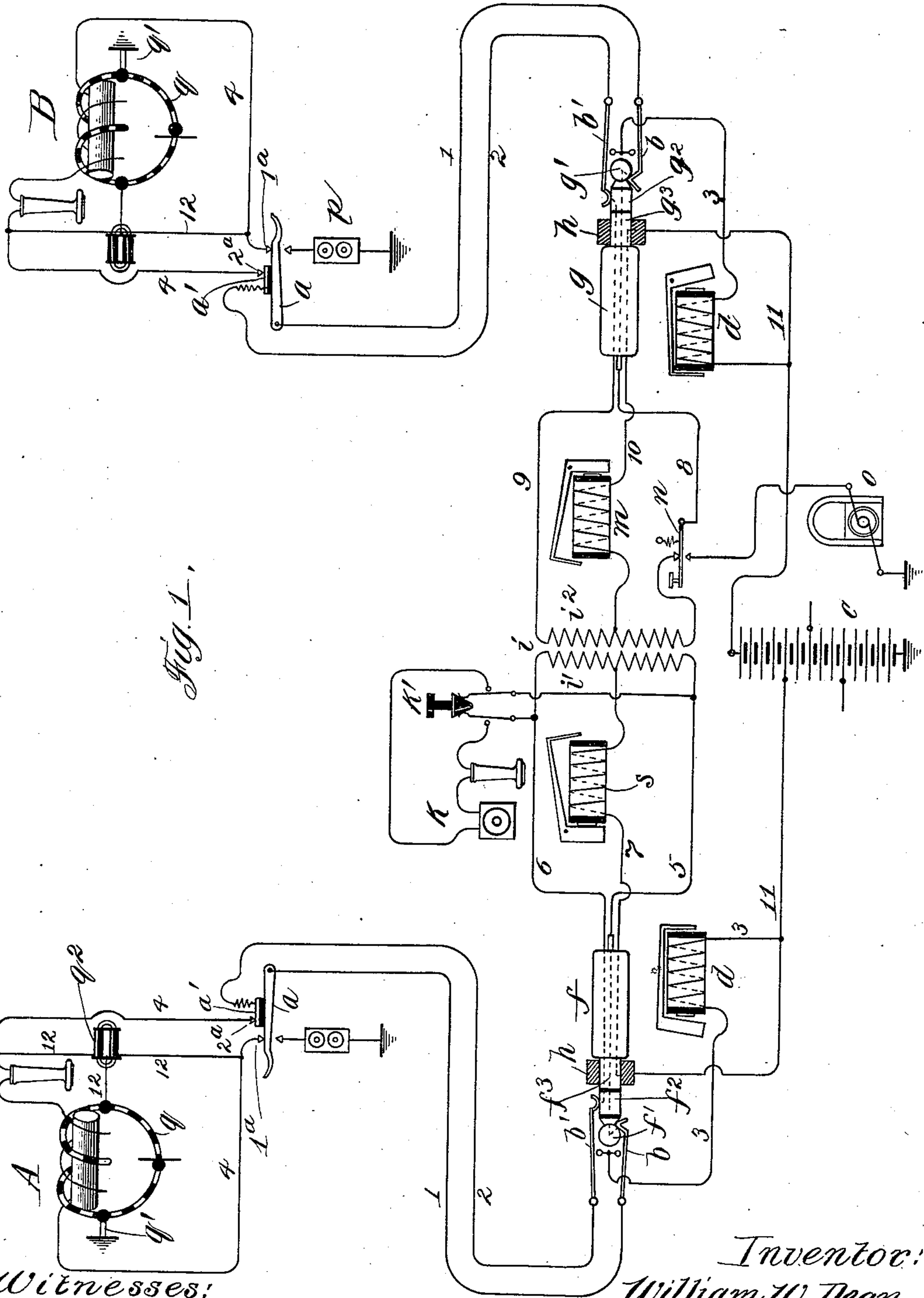


Fig. 1.

Witnesses:
D. H. C. Danner.
George L. Cragg.

Inventor:
William W. Dean,
By Barton & Brown
Attorneys.

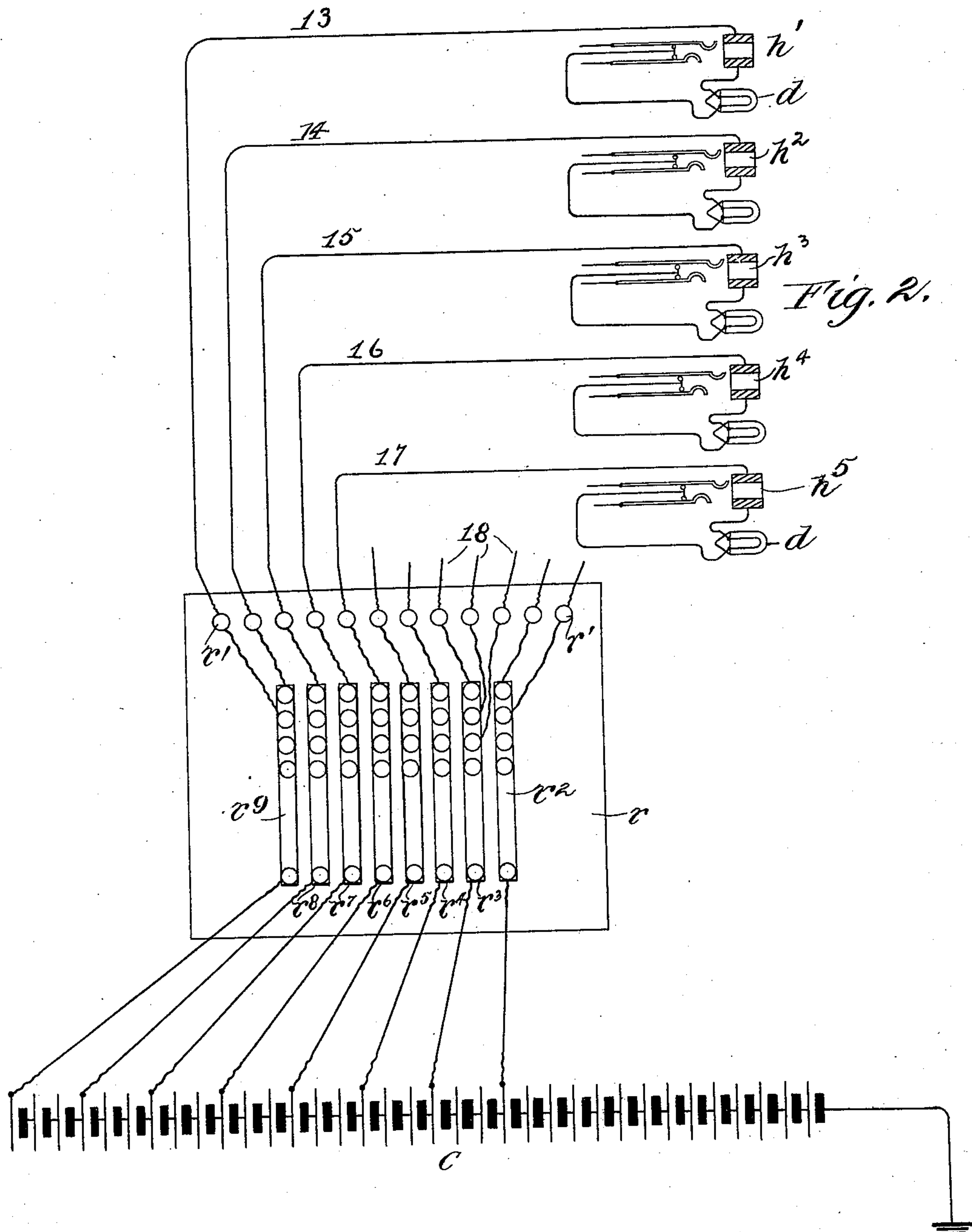
(No Model.)

2 Sheets—Sheet 2.

W. W. DEAN.
TELEPHONE EXCHANGE SYSTEM.

No. 564,328.

Patented July 21, 1896.



Witnesses:
D. H. Canner,
George L. Cragg.

Inventor:
William W. Dean,
By Barton & Brown
Attorneys.

UNITED STATES PATENT OFFICE.

WILLIAM W. DEAN, OF ST. LOUIS, MISSOURI, ASSIGNOR TO THE BELL TELEPHONE COMPANY OF MISSOURI, OF SAME PLACE.

TELEPHONE-EXCHANGE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 564,328, dated July 21, 1896.

Application filed April 10, 1896. Serial No. 586,929. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM W. DEAN, a citizen of the United States, residing at the city of St. Louis, in the State of Missouri, have
5 invented a certain new and useful Improvement in Telephone-Exchange Systems, (Case No. 9,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.
10

In telephone-exchange systems in which centralized batteries are employed for supplying the transmitter-circuits, it is desirable that the current should be practically of the
15 same strength in each of the different transmitter-circuits of the system, for example, a current of half an ampere. In order that this desirable result may be secured, it has been common heretofore to adjust the resistance
20 of the lines supplied by the common battery to as nearly a common standard as might be practicable. Thus compensating resistance would be added to the circuit of the shorter lines of an amount sufficient to bring the resistance of said lines up to that of the longest
25 lines. Such a system is illustrated and described in United States Letters Patent No. 541,077, granted me June 18, 1895, for telephone system, in which system, it will be observed, a centralized battery is connected
30 with the connecting-cords. It is also desirable that practically the same current should be directed through the different subscribers' individual annunciators at the central office, and the same may be said as to the clearing-out annunciators or indicators.
35

My invention herein relates to apparatus whereby the voltage of the battery or source of electrical energy is adjusted with reference
40 to the resistance of the several lines, so that lines of a particular resistance may be readily connected with battery of the desired voltage, and lines of a greater resistance may be supplied with battery of an increased voltage, so
45 that the battery-current directed over any given line of the system to a transmitter-circuit or through the individual annunciators or clearing-out annunciators may be of the desired standard as to volume. In carrying
50 out my invention I preferably connect battery of proper voltage to a connecting piece

or terminal of the individual spring-jack of each of the subscribers' lines, the voltage or amount of battery connected at the different terminals being greater or less according to
55 the greater or less resistance of the different lines respectively. When connection is made at any spring-jack with a plug of any pair of cords, current of the required amount will be directed over the line from the terminal of the spring-jack in which the plug has
60 been inserted, as will be hereinafter more fully explained. By the use of my invention the necessity of employing compensating resistance in the circuit of the short lines is avoided
65 and with great saving of battery energy. Moreover, when incandescent lamps take the place of either the clearing-out annunciators or other indicating devices, the volume of the current is controlled in a more efficient and
70 satisfactory manner than has been heretofore possible where compensating resistances have been relied upon in connection with such indicators.

My invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a diagrammatic illustration of a telephone-exchange system embodying my invention. Fig. 2 is a diagrammatic illustration of the connections at the switchboard
80 more in detail.

Like letters and numerals indicate like parts in both views.

The subscribers' stations A and B are connected with the central office by the limbs 1 2
85 of a metallic circuit terminating at the subscribers' stations in the switch-hooks *a* and the insulated contacts *a'* and at the central office in the line-springs *b b'* normally in contact with anvils constituting terminals of the
90 branches 3 3, grounded through the battery *c*, and which include the individual indicators *d d*. At each subscriber's station the conductor 4 includes the secondary of the induction-coil and the receiver, anvils 1^a and 2^a
95 constituting terminals thereof adapted to include said conductor with its receiver and secondary coil in circuit with the line conductors 1 and 2, when said receiver has been
100 removed from its switch-lever, as shown. At the central office an answering-plug *f* and a

connecting-plug g are employed, each of which is provided with three contact portions, the tip f' and sleeves $f^2 f^3$ of answering-plug f being adapted to make contact, respectively, with line-springs $b b'$ and thimble h of the spring-jack of the calling subscriber, while the tip g' and sleeves $g^2 g^3$ of connecting-plug g are adapted to make contact with the springs $b b'$ and sleeve h of the spring-jack of the called subscriber. The tip f' and the sleeve f^2 constitute terminals of the strands 5 and 6, in series with which is included the primary helix i' of the repeating-coil i and across which the operator's telephone set k may be bridged by depressing the key k' . The calling-subscriber's clearing-out indicator s is included in a strand 7, terminating in the sleeve f^3 of plug f and at the middle of the helix i' .

The tip g' and sleeve g^2 constitute terminals of the strands 8 and 9, in series with which is included the secondary helix i^2 of the repeating-coil i . The called-subscriber's clearing-out indicator m is included in a strand 10, terminating in the sleeve g^3 and at the middle of the helix i^2 . A ringing-key n is included in the strand 8, adapted when depressed to bring the grounded calling-generator o into circuit with the called-subscriber's bell p .

Subscriber A, desiring communication with subscriber B, removes his receiver from its hook, thereby closing circuit from the grounded battery c through his individual indicator d by a portion of the conductor 11, conductor 3, line-springs $b b'$, lines 1 2 leading to station A, then by conductors 4 and 12 through the primary helix q of the induction-coil to ground q' . The operator in response to the signal conveyed by the individual indicator inserts the answering-plug f in the spring-jack of the calling subscriber, thereby removing the individual indicator from circuit. The operator by depressing key k throws her telephone set into circuit with the calling-subscriber's telephone set to ascertain the connection desired, the transmitter of the calling subscriber receiving its battery supply from the grounded battery c , the path of the current from which may be traced from said battery over conductor 11, thimble h , sleeve f^3 of plug f , strand 7, thence in parallel through the halves of the helix i' , strands 5 and 6, sleeve f^2 , and tip f' of plug f , line-springs $b b'$, line conductors 1 2, thence by conductors 4 and 12 through the two halves of the transmitter-circuit in parallel, to ground q' , a retardation-coil q^2 being provided in the bridge-strand 12, permitting the battery-current to flow through said strand and transmitter-circuit, but obstructing the passage of voice-currents.

The apparatus and circuits employed at the subscribers' stations in the present system are similar to those illustrated and described in the above-mentioned Patent No. 541,077. Immediately upon the insertion of plug f within the calling-subscriber's spring-jack, the clear-

ing-out indicator s is included in circuit between the grounded battery c and the ground q' at station A. It will be observed that the circuit thus formed includes only a portion of the battery c , the amount being that required to supply the required current to the transmitter-circuit at said station A. The operator having ascertained the connection desired by the subscriber A inserts connecting-plug g in the spring-jack of the subscriber wanted, as shown, and by depressing key n directs current from generator o by wire 8 and limb 1 of the telephone-line of station B through the bell p at station B.

Subscriber B, on removing his telephone in response to the signal, brings his telephone into circuit, current from the battery c being directed through the clearing-out annunciator m and over the limbs 1 2 of the telephone-line of station B to supply current to the transmitter-circuit at station B, as shown.

The telephone-line of station B being the longer line, all the cells of battery c are shown as included in the circuit thus formed, while the telephone-line of station A, being of less resistance, requires only a portion of battery c to supply the required current to the transmitter-circuit.

In Fig. 2 I have illustrated, somewhat in detail, apparatus whereby the lines of different lengths and resistance may be grouped, those of approximately the same resistance being grouped together. I provide a board r in the nature of a cross-connecting board, upon which are provided binding-posts $r' r'$, &c., and bus-bars $r^2 r^3 r^4 r^5 r^6 r^7 r^8 r^9$. These bus-bars are connected with different parts of the battery, the pressure or voltage at each bus-bar depending upon the number of cells of the battery connected therewith, that is, the pressure at bus-bar r^2 will be least, and so on, the pressure increasing in the order of the numerals, and being greatest at bus-bar r^9 .

I have indicated the spring-jack switches of five telephone-lines in Fig. 2, the thimbles $h' h^2 h^3 h^4 h^5$ thereof being connected, as shown, by wires 13 14 15 16 17 to the proper bus-bars. Thus it will be assumed that the telephone-lines of the switches whose thimbles are indicated by h' and h^2 are the longest lines of the system. They are therefore connected with the bus-bar r^9 . The thimbles of the other spring-jack switches are connected, each in a similar manner, to bus-bars where the required pressure or voltage will be found, that is, wires 13 and 14 represent a group of the longest lines, while the three wires marked 18 represent a group of the shorter lines or lines of least resistance, and they are accordingly connected with bus-bar r^3 .

In Fig. 2 I have also shown incandescent lamps $d d$ connected in circuit, to take the place of the individual annunciators similarly marked in Fig. 1.

It is evident that by my system of adjusting or proportioning the battery to the lines according to their resistance uniform cur-

rent will be supplied to the incandescent lamps when used as signals.

By thus regulating the pressure or voltage according to the resistance of the various lines, substantial saving is effected in battery, and the liability to rupture the lamp-filaments when used as signals and the objections which result from lack of uniformity in current at the transmitter-circuits avoided.

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

1. A telephone-line provided with a transmitter-circuit at a subscriber's station thereon, a spring-jack switch having two line springs or terminals to which the different limbs of the telephone-line are connected respectively, and a third contact piece or terminal for said spring-jack, and a battery connected with the last-named terminal, in combination with a connecting-plug having three contact parts adapted to connect respectively with the terminals or contacts of the spring-jack switch when the plug is inserted therein, said plug being provided with cord-circuits, whereby on inserting the plug in the switch current is directed over the two limbs of the telephone-line in multiple to supply current to the transmitter-circuit.

2. The combination with several telephone-lines, the resistance of said lines being different, and transmitter-circuits being provided at the subscribers' stations thereof, of spring-jack switches at the central office one for each of said lines, said spring-jacks being each provided with two line-terminals, one for each limb of the telephone-line thereof, and with a third contact or terminal for a battery connection, battery connected with the different battery-terminals of the different spring-jack switches proportioned as to voltage according to the resistance of the different lines respectively, in combination with pairs of cords and plugs, adapted on making connection with the spring-jack of any one of the lines to direct current over the same to supply the transmitter-circuit thereof, whereby the current

directed over the different lines is made practically uniform.

3. The combination with a centralized battery, of contacts, as $h^2 h^3$, of spring-jack switches of two different telephone-lines, said lines being of different resistance, the contacts, as $h^2 h^3$, being connected with different portions of the battery according to the resistance of the lines, and switching apparatus adapted to unite the telephone-lines for conversation, and, at the same time, to direct current over said lines to supply the transmitter-circuits thereof, whereby the two lines when connected are supplied with current of a standard value from the same battery.

4. The combination with a centralized battery, of contacts, as $b b' h$ and $b' b h$, of spring-jack switches of two different telephone-lines, said lines being of different resistance, the contacts $b b' b b'$ being the terminals of such lines and the contacts $h h$ being connected with different portions of the battery according to the resistance of the lines, repeating-coils i' and i^2 , plugs f and g provided with three contacts $f' f^2 f^3$ and $g' g^2 g^3$, contacts f' and f^2 and contacts g' and g^2 being respectively connected with the terminals of the repeating-coils i' and i^2 and respectively adapted to engage with the line-terminals $b b' b b'$ and contacts f^3 and g^3 being respectively connected with the middle points of coils i' and i^2 and adapted respectively to engage with the contacts $h h$, the said plugs being thus adapted to unite the telephone-lines for conversation and at the same time to direct current through the spring-jacks and repeating-coils thence over the said lines to supply the transmitter-circuits thereof, whereby the two lines when connected are supplied with a current of standard value from the same battery.

In witness whereof I hereunto subscribe my name this 4th day of April, A. D. 1896.

WILLIAM W. DEAN.

Witnesses:

WM. J. WOELK,

W. E. HARKNESS.