

(No Model.)

W. L. RICHARDS.

TELEPHONE REPEATING CIRCUIT AND APPLIANCE.

No. 542,658.

Patented July 16, 1895.

Fig. 1.

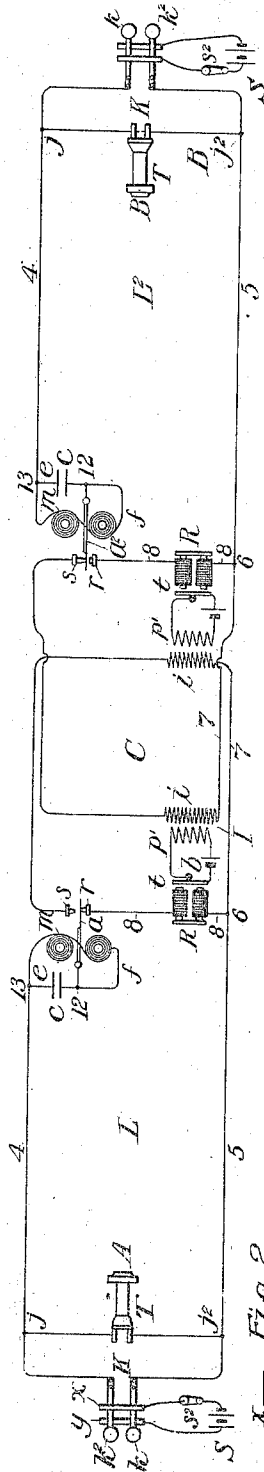
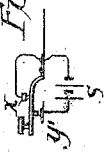


Fig. 2.



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UNITED STATES PATENT OFFICE.

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TELEPHONE REPEATING-CIRCUIT AND APPLIANCES.

SPECIFICATION forming part of Letters Patent No. 542,658, dated July 16, 1895.

Application filed March 16, 1895. Serial No. 542,031. (No model.)

To all whom it may concern:

Be it known that I, WILTON L. RICHARDS, residing at Malden, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Telephone Repeating-Circuits and Appliances, of which the following is a specification.

This invention relates to telephone repeating-circuits or to appliances known generally as "telephone repeaters or relays." Its object is to provide a reciprocally-operating repeater to be placed at a station intermediate between two terminal stations in association with two circuits entering the said intermediate station and extending from the said terminal stations, respectively. Each circuit is provided at the relay-station with two alternative branch extensions containing, respectively, a receiving apparatus and a transmitting apparatus, the receiving apparatus of each being closely associated with the transmitting apparatus of the other in such manner that the former is enabled to actuate the latter and thereby to develop in the receiving-circuit currents similar to those which, under the influence of the transmitter at the distant terminal station, were originally produced in the transmitting-circuit. In this way the messages transmitted over the first circuit are relayed upon the second circuit with renewed strength. An electromagnetic switch is placed in each circuit at the central station and is responsive to current-changing appliances at the distant terminal station of the said circuit. Its office is to transfer the main circuits from either one of its branch extensions to the other as the direction of transmission changes.

More specifically each main circuit divides at the repeating-station into two branches, one of which passes through a receiving or relay magnet, while the other passes preferably through the secondary winding of an induction-coil, whose primary winding is connected up in circuit with a suitable battery and a transmitter, the said transmitter being arranged in close juxtaposition to the receiver or relay-magnet of the other circuit, so that it is in operative relation thereto and adapted to be operated thereby.

In each circuit at the repeating-station is an electromagnet whose armature constitutes or actuates a switch which controls the con-

nection of the receiving and transmitter branches, respectively, with the main line, determining by its position which branch shall at any moment be so connected and which left temporarily disconnected. This electromagnet is preferably in the form of a polarized relay and is responsive to the operation of a reversing-key at the terminal station of its circuit, which reverses the direction of the current of a battery or similar generator flowing in the main circuit. In operation the switch of the circuit which at a given moment is transmitting should be placed to connect the receiving-branch with the main circuit, the transmitting-branch being left open or disconnected, while at the same time the switch of the reversing-circuit is so placed that its circuit connects with the transmitting branch, its relay or receiving branch being then disconnected. To reverse the direction of transmission both circuits reverse the position of their switches.

In connection with each polarized switch I prefer to place an electrostatic shunt-circuit round the electromagnet thereof. This is formed of a condenser and connecting-wires, and its function is to facilitate the passage of voice-currents while retaining the electromagnet in the conductive-circuit for the necessary operation of the switches.

In the drawings which accompany and illustrate this specification, Figure 1 is a diagram of the circuits and apparatus of the system, and Fig. 2 is a detail diagram of the reversing-key connections.

In Fig. 1, C is a central and A and B outlying terminal telephone-stations.

L is a main telephone-circuit extending from A to C, and L² a similar telephone-circuit extending from B to C, and at C these circuits are to be operatively united by means of repeating or relay apparatus. The line-conductor 4 of each circuit, on reaching the station C, leads through the electromagnet *m* of an electromagnetic switch, shown as a polarized relay, and then by the wire *f* to a connection at 12 with the armature *a* of the said magnet, which armature is adapted to be attracted by one pole or the other of the magnet and to move between the contact-stops *s* and *r*. The armature may therefore be regarded as the terminal of the conductor 4. The other main conductor 5 of each main cir-

circuit reaching the central station divides at 6 into two branches, one leading by wire 8 to the switch-contact stop *r* and including the electromagnet of the relays *R*, and the other 5 leading by wire 7 to the contact-stop *s*, through the transmitting device *t*, or, as here shown, through the secondary winding *i* of an induction-coil *I*, whose primary winding *p* is in circuit with a suitable source of electrical energy, such as a voltaic battery *b*, and the variable-resistance medium *l*.

A diaphragm or armature is placed between the receiving-magnet of each line and the juxtaposed transmitter of the other line, and being vibrated in response to the varying attraction of the said magnet it communicates like motion to the variable-resistance medium of the relay as was initially communicated to the transmitter at the original sending-station A or B, and the message is thus repeated 20 by one line into the other, the available force being renewed by bringing a second source *b* into operation.

In operation one of the circuits—say *L*— 25 that which at any given moment is transmitting, is connected by the armature of its polarized switch *m*, which is in contact with the stop *r*, with its receiving-magnet branch 8, the transmitting branch of this circuit being open at the stop *s*; but the switch of the second circuit *L*² must at this time have its armature in contact with the stop *s*, so that it is completed through the secondary coil of its transmitter. Under these circumstances *L* repeats into *L*².

At the outlying stations A and B may be placed reversing-keys *K* controlling the direction of a current which, by the manipulation of either member of said key *k* or *k*², may be impressed on the main circuit. If the member 40 *k* be depressed the positive-pole *y* will be connected to wire 5 and the negative-pole to wire 4, and the direction of the current will be out over conductor 5 and back over conductor 4, and the armature *a* of the polarized switch will 45 move in a given direction, say toward the stop *r*; but if *k*² be pressed the connections are reversed and the direction of the current will be out over the wire 4 and back over 5, in which case the armature will move over to the 50 opposite contact-stop *s*.

Thus the control of the transmitting and receiving branches of each circuit is placed with the outlying stations of such circuit; and when, after the transmission of speech in one direction, it becomes necessary to reverse the direction of such transmission both terminal or outlying stations are required to reverse their switches.

Since the electromagnets *m* of the polarized 60 switches are in the main circuits and would to a certain extent oppose the passage of voice-currents, I provide an electrostatic shunt for such voice-currents round the said electromagnet; this being constructed by interposing 65 a condenser *c* and necessary connections *e* between the points 12 and 13. By this device a path of low impedance is provided for voice-

currents, while a continuous conductive circuit is maintained through the magnet-coils for switching, calling, or other auxiliary currents. 70

At the stations A and B the station-telephones *T* are shown as being connected in a bridge between the points *j* and *j*³ on the mains, but they can of course be connected 75 in any desired and usual way.

The reversing-battery *S* is on open circuit during the transmission of conversation, and, if desired, the loop to the reversing-keys may be opened by turning the switches *s*². 80

Having fully described the invention, I claim—

1. In a telephone relay or repeater apparatus the combination of two main telephone circuits, each having two alternative terminal 85 branches extending respectively through a relay magnet and the secondary winding of an induction coil; an electro-magnetic switch for each circuit controlling the relation of the said circuit to its said two branches; and current changing devices for each circuit, controlling the polarized switch of the said circuit substantially as described.

2. The combination in a telephone repeater, of two main telephone circuits, extending 95 from the two outlying stations to a central station; two branch extensions for each, one containing a transmitting apparatus and the other a receiving apparatus, the transmitting apparatus of each being in operative relation 100 to the receiving apparatus of the other; and a polarized switch in each main circuit responsive to a current reversing device at the outlying station of the said circuit, and acting to transfer the said circuit from either 105 one of its branch extensions to the other.

3. The combination at a central station, of two main telephone circuits entering the said station from distant terminal stations; an extension branch for each containing the secondary winding of a transmitting induction coil; a second extension branch for each containing a relay or receiving magnet; a transmitting apparatus in circuit with the primary winding of the said induction coils, each 115 placed in operative proximity to the relay magnet of the other; a current reversing device such as a reversing key for each circuit, placed at the outlying terminal station thereof; a polarized relay switch in each main circuit controlling the connection of the said circuit with its relay and induction coil windings respectively; and an electro-static shunt round the electro-magnet of each of the said polarized switches, to facilitate the passage of 125 voice currents substantially as specified.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 7th day of March, 1895.

WILTON L. RICHARDS.

Witnesses:

GEO. WILLIS PIERCE,
JOSEPH A. GATELY.