

(No Model.)

C. H. ARNOLD.
TELEPHONE RELAY OR REPEATER.

No. 542,618.

Patented July 16, 1895.

Fig. 1.

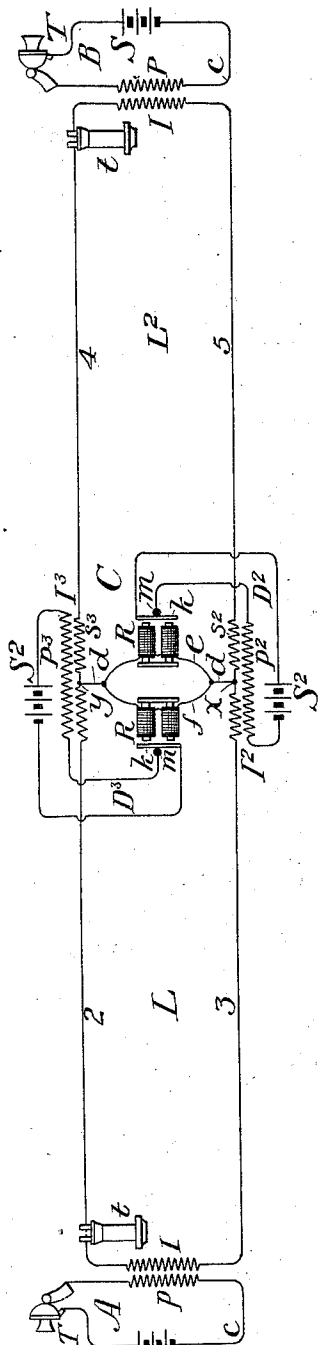
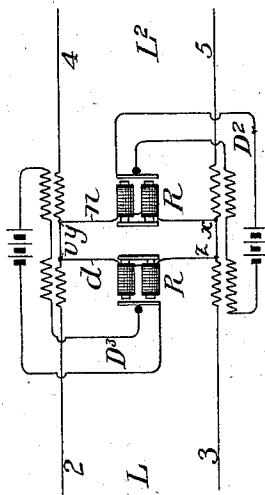


Fig. 2.



Witnesses.

W. R. Edelson.

Inventor.
Charles H. Arnold
by J. J. Edelson,
his attorney.

UNITED STATES PATENT OFFICE.

CHESTER H. ARNOLD, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE
AMERICAN BELL TELEPHONE COMPANY, OF SAME PLACE.

TELEPHONE RELAY OR REPEATER.

SPECIFICATION forming part of Letters Patent No. 542,618, dated July 16, 1895.

Application filed March 16, 1895. Serial No. 542,058. (No model.)

To all whom it may concern:

Be it known that I, CHESTER H. ARNOLD, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Telephone Relays or Repeaters, of which the following is a specification.

The object of this invention is to provide a relay or repeater at the junction of two telephone-circuits, whereby voice-currents originated and circulating in one of the circuits may be repeated with reinforced strength into the other, so that transmission can be effected over lines of great length, which relay is automatically reciprocal in its action and which shall be so disposed in connection with the circuits that, while fully responsive to currents originated in either circuit by the transmitters of outlying stations, the current generated by the repeater or due to its operation shall not react upon its own electromagnetic coils.

The invention consists in combining with the two circuits concerned two local or repeating circuits and two relay or repeater magnets, the said two magnets being in parallel bridges or in parallel branches of the same bridge between the two main conductors of the compound main circuit and each arranged to act upon one of the local circuits and thereby upon the circuit which at any moment is receiving, both electromagnets, moreover, being responsive to the varying currents of the circuit which at any moment is transmitting.

In the drawings which accompany and form a part of this specification, Figure 1 is a diagram of my invention incorporated in a system of two main circuits joined up to form a compound circuit with the relay or repeater organized, as stated above, at the central or intermediate or repeating station. Fig. 2 is a diagram of a modified mode of arranging the connection of the receiving repeater-magnets.

L and L² are the two original main telephone-lines concerned, joined up at the central or repeating station C to form a compound through circuit extending between the two terminal stations A and B and provided therein in the usual way with a transmitter T and a receiver t, the former being preferably associated, as usual, with an induction-coil I, whose primary winding p is connected together with

the variable-resistance medium of the transmitter T in the local circuit c of the battery or other generator S, and whose secondary winding is included in the main line-circuit.

The main circuits L and L² are shown as being metallic circuits, since these are now considered the more desirable, but it is evident that my invention is equally applicable to earth-completed circuits. The circuit L has therefore two conductors 2 and 3 and the circuit L² also has two—4 and 5. At the central station the circuits L and L² have their respective ends united for through communication, and in that condition they may be regarded either as two independent circuits entering the same station from different directions, arranged with interposed apparatus, whereby each is enabled to repeat into the other, or as a single compound circuit with repeating apparatus placed at an intermediate station, whereby the current of either terminal station is reinforced at the middle of the circuit. Adopting the latter view and considering the organization as a single compound circuit a bridge d is arranged between the two mains at the points x and y at the central station C, the said bridge being split or divided into branches e and f. In each of the said branches e and f is connected a receiving, relay, or repeating electromagnet R. Two local or repeating circuits D² and D³ are associated with the said repeating-magnets, respectively, and they each contain a source of electrical energy S² and a variable resistance medium or relay-transmitter m. Two induction-coils I² and I³ are also associated with the relay-circuits, the primary winding p² of I² being included in circuit D² and the primary p³ of I³ in the circuit D³. The secondary winding s² of I² is split or centrally divided, one-half being connected on each side of the bridge-junction point x in the conductors 3 and 5, respectively, and the secondary winding s³ of I³ is similarly divided and in like manner connected in the two opposite conductors 2 and 4 of the said two lines on each side of the bridge-point y.

The variable-resistance medium m of the repeating-circuit D² is mounted in operative relation to one of the repeating-magnets R and is controlled by the vibrations of the armature or diaphragm k thereof, the said vi-

brations being produced in response to voice-currents developed by the transmitters at A or B and traversing either L or L², as either may be the message-originating circuit. The variable-resistance medium *m* of the repeating-circuit D³ is mounted to be actuated or operated by the other relay-magnet in like manner and by a similar mode.

Supposing A to be transmitting, voice-currents traverse circuit L and pass through the bridge *d*, varying the strength of both repeater-magnets R. These exercise a corresponding variable attraction on their armatures *k*, and thereby operate the two repeating-transmitters *m*. The said transmitters in turn throw the currents flowing in the local circuits D² and D³ into undulations, which are transferred by the induction-coils I² and I³ to the main circuits. Since each induction-coil secondary winding is split and the bridge is connected between the two halves of both, it follows that the currents thrown on the main line by the repeater are balanced with respect to the bridge, which, in other words, joins equipotential points of the circuit so far as the relayed currents are concerned, while it is so placed as to be at all times fully responsive to the transmitter-currents due to the operation of the instruments at either end station.

The only point which Fig. 2 represents as a modified arrangement is that of the bridge connection. Instead of having but one bridge *d*, divided into two branches *ef*, Fig. 2 represents an arrangement in which there are two independent bridges *d* and *n*, joining the points *zv* and *xy* of the two main conductors, respectively, one of the relay-magnets being in each bridge.

I claim—

1. In a telephone relay or repeater system, a compound main line circuit; a double bridge between the conductors of the said main line circuit, each branch thereof containing a repeating or receiving magnet; two local repeating circuits, controlled by the said two receiving magnets respectively; and induction coils having their secondary windings in the two main line conductors respectively, one half on either side of the bridge, and their primaries, included together with variable resistance repeating transmitters in the said local circuits respectively, substantially as described.

2. In a telephone repeating system, the combination of two main telephone circuits; two local repeating circuits each including a variable resistance repeating transmitter and a source of current; and two induction coils, having their secondary windings interposed between the two ends of the said two main circuits respectively, so that a compound circuit is formed with a secondary winding in each of its conductors; with a bridge between the said two conductors uniting points at the centers of the said two secondary windings, and divided into two parallel branches; and a receiving or repeating magnet in each branch, placed in operative relation to the two repeating transmitters respectively, and adapted to control the same, substantially as described.

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

CHESTER H. ARNOLD.

Witnesses:

GEO. WILLIS PIERCE,
JOSEPH A. GATELY.