

No. 609,374.

Patented Aug. 16, 1898.

J. S. STONE.  
TELEPHONE REPEATER OR RELAY.

(Application filed Dec. 29, 1897.)

(No Model.)

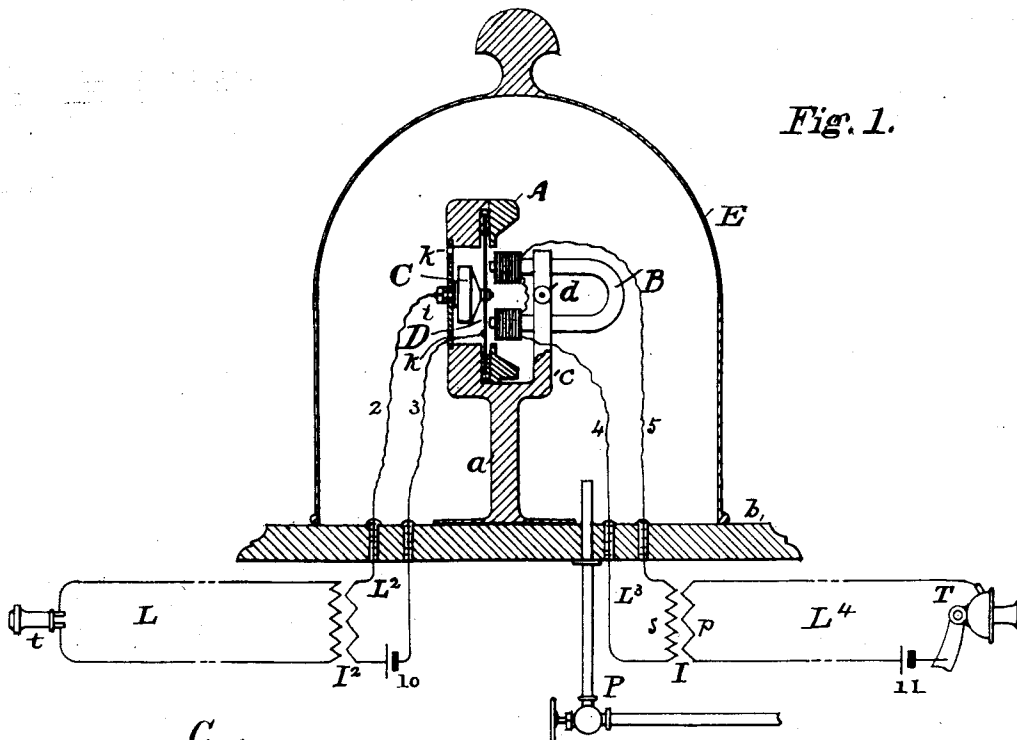


Fig. 1.

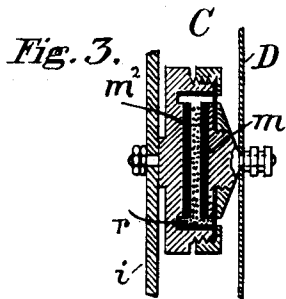


Fig. 3.

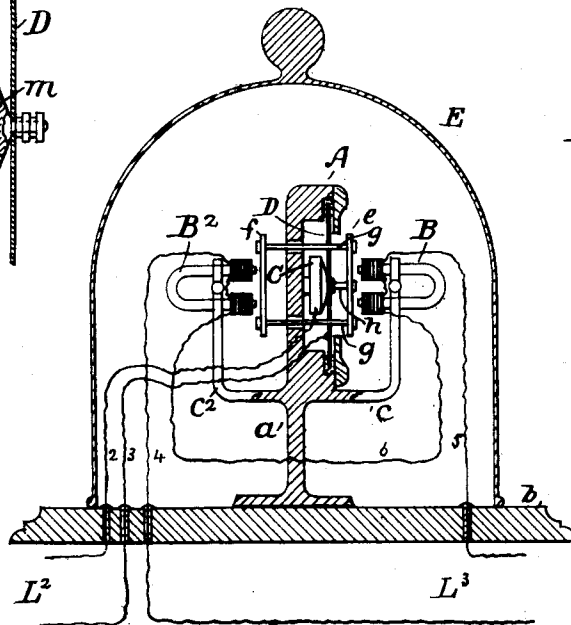


Fig. 2.

Attest.

Frank C. Lockwood.  
Bernillo Pence

Inventor,

*J. S. Stone*

# UNITED STATES PATENT OFFICE.

JOHN STONE STONE, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE  
AMERICAN BELL TELEPHONE COMPANY, OF SAME PLACE.

## TELEPHONE REPEATER OR RELAY.

SPECIFICATION forming part of Letters Patent No. 609,374, dated August 16, 1898.

Application filed December 29, 1897. Serial No. 664,414. (No model.)

*To all whom it may concern:*

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

This invention relates to telephone repeaters or relays. In apparatus of this class it is usual to combine in a single instrument the  
10 variable-pressure contacts of a microphone-transmitter, the electromagnet of a magneto-receiver, and a diaphragm or vibratory plate, these members being so organized that in operation the said diaphragm shall vibrate in  
15 response to the talking-currents traversing one telephone-circuit and manifesting themselves in the action of the receiving-magnet thereof and shall communicate its vibrations to the said transmitting-contacts, producing  
20 thereby similar talking-currents in a second telephone-circuit, with which such transmitting-contacts are connected.

The object of my invention is to accomplish such relayed transmission more accurately  
25 with higher efficiency and generally in a more satisfactory manner than heretofore has been found practicable.

The invention is an improved telephone-relay adapted to be placed at the junction of  
30 two telephone-circuits extending from different terminal stations for the purpose of automatically repeating the conversation transmitted over one circuit into the other, and comprises as its essential elements a telephone  
35 receiving or repeating magnet in one circuit, transmitting-electrodes or microphonic contacts in another circuit, a diaphragm common to the said magnet and transmitting-electrodes placed in operative relation to both,  
40 so as to act as a receiving-diaphragm for one circuit and a transmitting-diaphragm for the other, and a vacuum-chamber or exhausted receiver containing and inclosing the said receiving-magnet, transmitting-electrodes, and  
45 diaphragm.

When a telephone-relay constructed in accordance with my invention is employed, the messages automatically transferred by it from one circuit to another are reproduced in the  
50 receiving-telephone of the second circuit with a well-defined gain in volume or loudness and

without any substantial distortion or offsetting loss in clearness of articulation.

Figure 1 of the drawings represents a telephone relay or repeater embodying the invention and having the circuits of its receiving  
55 and transmitting elements connected up in two main telephone-circuits, respectively. Fig. 2 illustrates a similar relay, in which the diaphragm is balanced and its strain equalized by employing two receiver-magnets, one  
60 on either side. Fig. 3 illustrates in vertical section the transmitting-button shown in Figs. 1 and 2.

Referring to the drawings, B is an electro-  
65 magnet whose poles are in proximity to the diaphragm hereinafter referred to.

C is the button of a variable-resistance transmitter containing the transmitting-electrodes—in this instance two plates  $m$  and  $m^2$ , with  
70 granulated carbon  $r$  between them, the plate  $m$  being secured to the diaphragm and vibrating with it and the plate  $m^2$  being rigidly secured to the frame or back plate; D, the common diaphragm, and E the vacuum-chamber,  
75 of my improved telephone-relay. The said magnet, electrodes, and diaphragm are inclosed in the vacuum-chamber, and the whole is mounted on a base  $b$ .

The support  $a$ , secured to the base  $b$ , has  
80 an opening through its upper part, provided on one side with a shoulder or offset forming a seat for the diaphragm, which is held in place by the cap-piece A, or in any preferred manner. The transmitting-button placed in  
85 the said opening is attached on one side to the center of the diaphragm D and on the other side to the plate or bar  $z$ , which, if of such shape as to close the said opening, is perforated with the holes  $h$ , so that the atmos-  
90 phere on both sides of the diaphragm shall be of the same density.

The receiving or repeating magnet B is mounted, as shown, upon an arm  $c$  of the support  $a$ , being adjustably clamped thereto  
95 by a screw  $d$ , and its poles are brought into operative proximity to the outer face of the diaphragm, which is thus placed between the said magnet and the transmitting-electrodes.

The exciting-coils of the magnet B are connected with the conductors 4 and 5, which form  
100 the instrument portion of a telephone-cir-

cuit extending either directly or inductively by means of the induction-coil I and two circuit-sections  $L^3$   $L^4$  from a subscriber's transmitter T. In the latter case 11 is the transmitter-battery,  $p$  is the primary helix of the said induction-coil in the circuit-section  $L^4$ , and  $s$  is the secondary helix, placed in the circuit-section  $L^3$ . The transmitting-electrodes C are similarly connected by means of the conductors 2 3 in a second telephone-circuit  $L^2$ , which extends to the receiving-telephone  $t$ , this circuit also being shown as having two sections  $L^2$  and  $L$  united by an induction-coil  $I^2$ .

The vacuum-chamber or exhaust-receiver E may be of glass, and since in the normal operation of the relay it is required that the transmitting electrodes and diaphragm shall be surrounded by a rare medium less dense than air at atmospheric pressures a pipe P passes through the base  $b$  to connect with an air-exhausting pump (not shown) for the purpose of producing a vacuum or of rarefying the air within the chamber E to the degree required. The passages through which the electrical connection wires 2, 3, 4, and 5 and the exhaust-pipe  $p$  enter the chamber E are of course sealed, packed, or otherwise made air-tight.

To more perfectly attain the desired result of highly-efficient relayed transmission, the diaphragm D may be balanced or subjected to like normal attractive strain in both directions. This may be accomplished, as shown in Fig. 2, by employing two receiving-mag-

nets B and  $B^2$ , mounted on the two sides, respectively, of the said diaphragm on the supporting-arms  $c c^2$ . The coils of these magnets are placed in the same circuit  $L^3$  by the conductors 4 5 6 and are so relatively connected up that the same current impulse which strengthens the attraction exercised by one of the magnets upon the diaphragm shall weaken that of the other, so that the two magnets will uniformly work together, each aiding the other in producing all of the appropriate diaphragm vibrations. When two magnets are employed in this way, it is convenient to associate with the diaphragm two soft-iron armatures  $e f$ , one for each magnet, these being mechanically united to one another by the light metal rods  $g$  and to the diaphragm by the rod  $h$ .

I claim—

A telephone-relay comprising an electromagnet in one circuit, transmitting-electrodes in a second circuit, a diaphragm common to both said electromagnet and said transmitting-electrodes, and a vacuum-chamber enclosing said magnet, electrodes, and diaphragm, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 22d day of December, 1897.

JOHN STONE STONE.

Witnesses:

GEO. WILLIS PIERCE,  
JOSEPH A. GATELY.