

S. L. CAMPBELL.
TELEPHONE REPEATER.

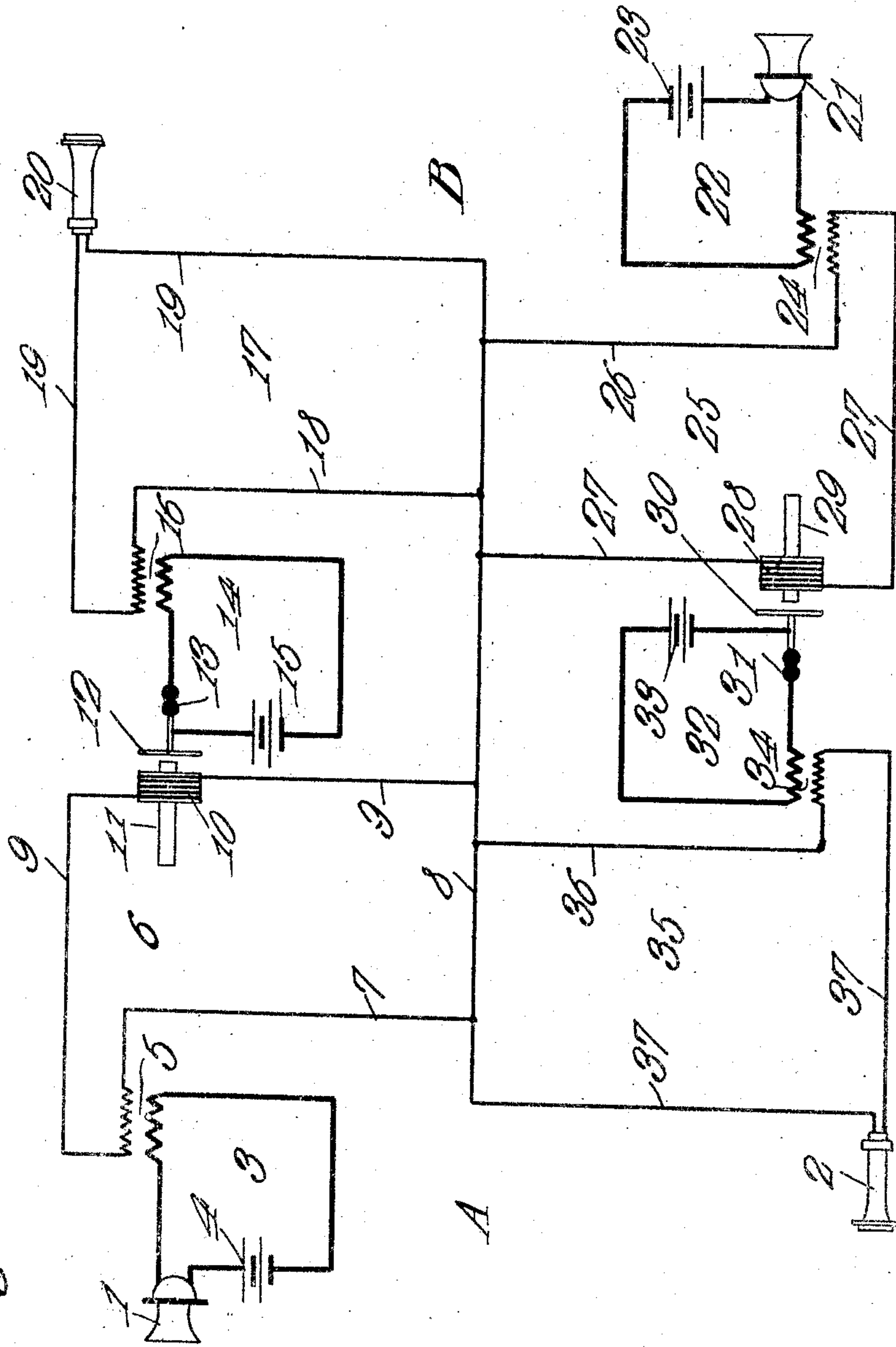
APPLICATION FILED OCT. 29, 1903. RENEWED MAR. 3, 1910.

975,933.

Patented Nov. 15, 1910.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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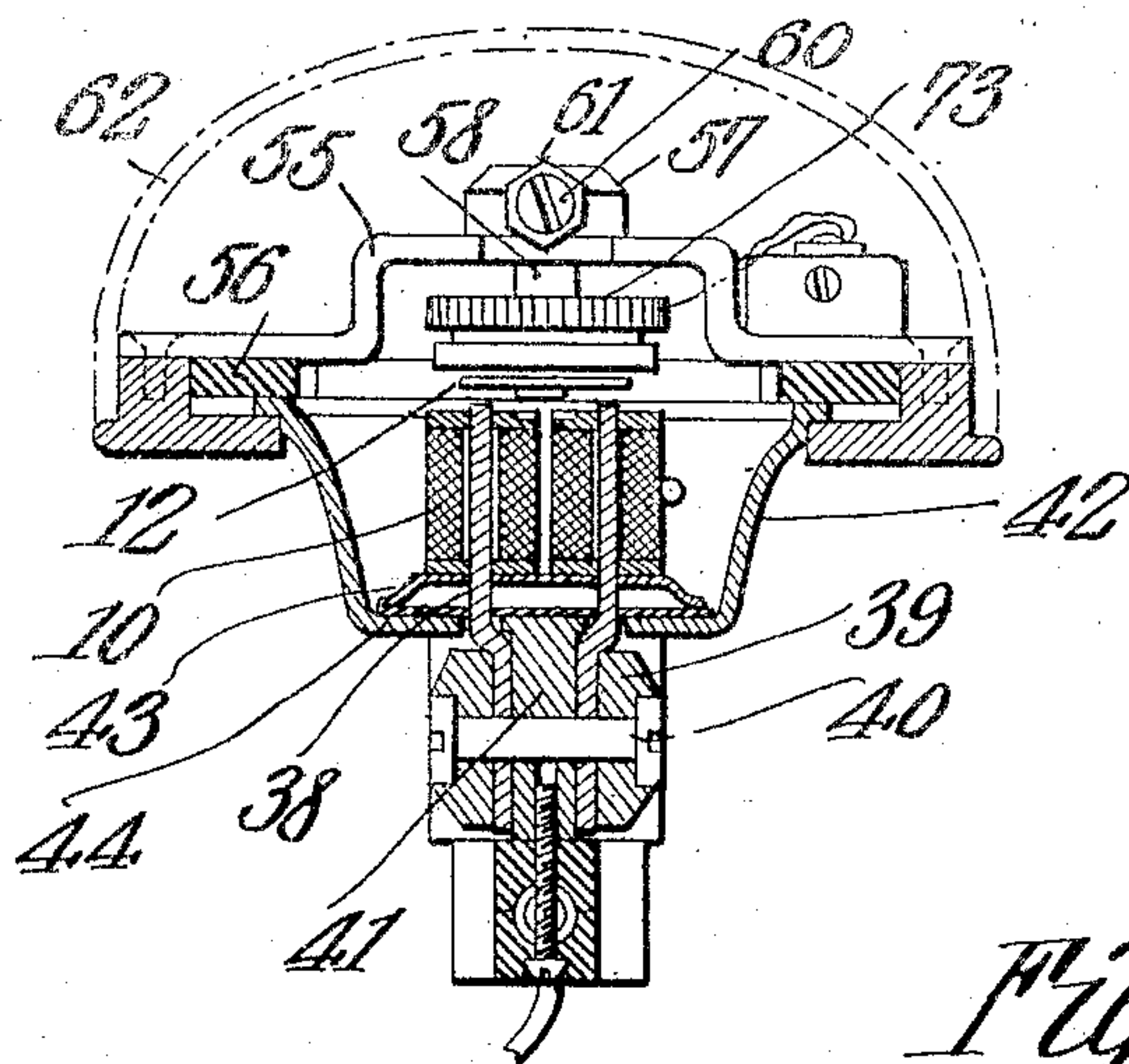


Fig. 2.

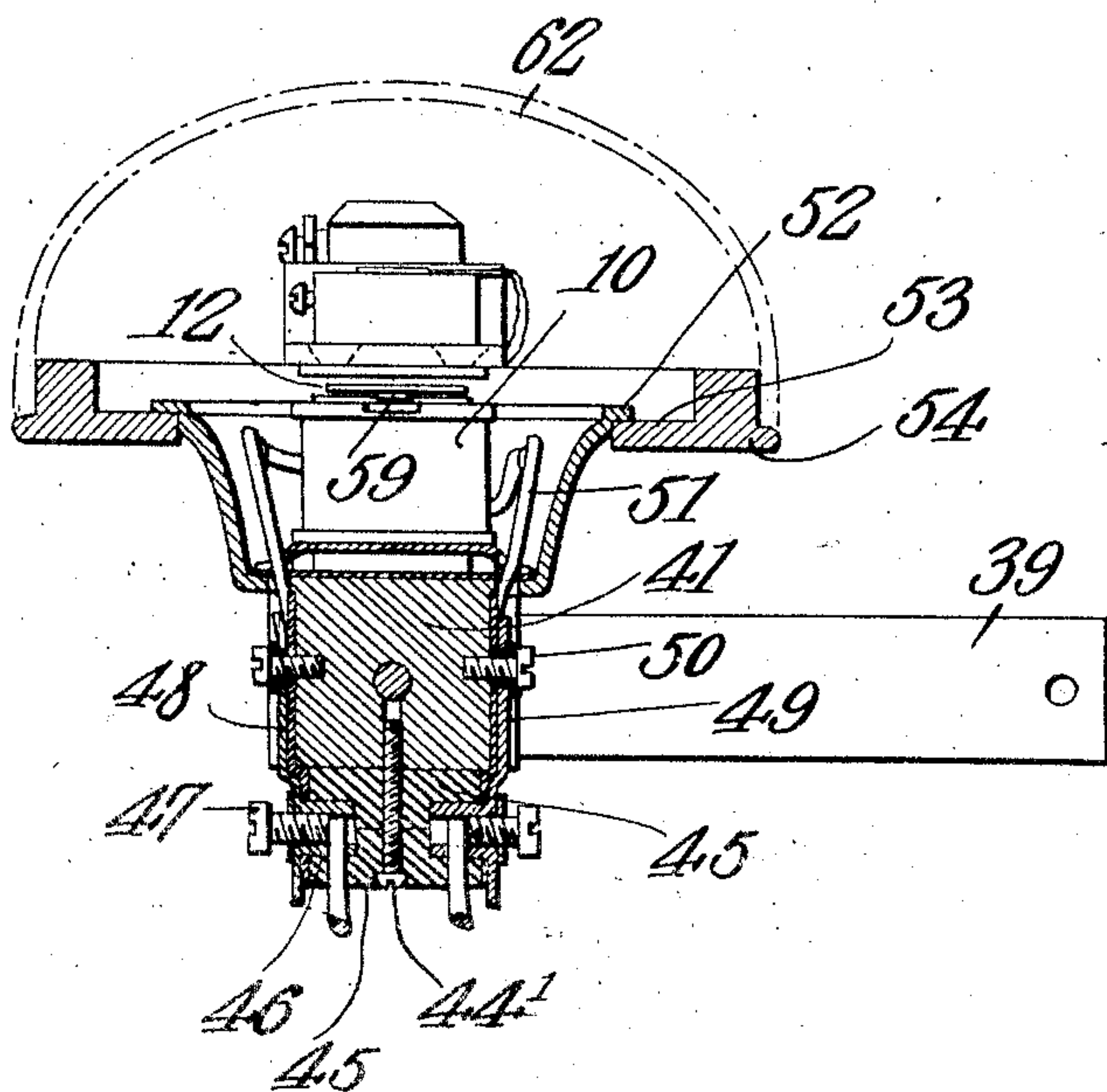


Fig. 3.

Witnesses

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UNITED STATES PATENT OFFICE.

SAMUEL L. CAMPBELL, OF PRAIRIE CITY, OREGON.

TELEPHONE-REPEATER.

975,933.

Specification of Letters Patent. Patented Nov. 15, 1910.

Application filed October 23, 1908, Serial No. 460,108. Renewed March 3, 1910. Serial No. 547,125.

To all whom it may concern:

Be it known that I, SAMUEL L. CAMPBELL, a citizen of the United States, residing at Prairie City, in the county of Grant and State of Oregon, have invented a new and useful Telephone-Repeater, of which the following is a specification.

This invention has reference to improvements in telephonic repeaters and is designed to provide a means whereby the range of telephonic transmission may be largely increased.

In accordance with the present invention, the transmitting station is provided with the ordinary microphonic unit and local circuit and by this means electrical impulses corresponding to sound waves are transmitted to a line. At the distant end of the line is a receiver element, to the armature of which is attached a microphonic element in a local microphonic circuit, which in turn is in operative relation, inductively, to another transmitting line leading to the distant receiving point, where there is located a telephonic receiver. The distant receiving point is also provided with a telephonic transmitter inductively related to another transmission line leading to the original transmitting station, where there is also located a telephonic receiver. The system thus includes a complete transmitting circuit and a complete receiving circuit at each station and at intermediate points these circuits include a telephonic repeater. If the line be excessively long, then a number of repeaters may be included one after the other at proper intervals in the line.

The invention will be best understood from a consideration of the following detail description taken in connection with the accompanying drawings forming a part of this specification, in which drawings,

Figure 1 is a diagrammatic representation of a complete transmitting and receiving circuit connecting two distant stations, and including in each circuit a telephonic repeater. Fig. 2 is a central section through the repeater element or unit embodying the invention. Fig. 3 is a similar section at right angles to that of Fig. 2.

Referring to the drawing there is shown at one station, which for convenience will be designated station A, a microphonic transmitter and a telephonic receiver. The microphonic transmitter is designated by the reference numeral 1, and the receiver

by the reference numeral 2. The transmitter 1 is in a local transmitter circuit 3 including a battery 4 or other source of electrical energy, and a telephonic induction coil 5, the primary winding of which is in the circuit 3. The secondary winding of the coil 5 is in the line circuit 6, one branch 7 of which, leads to a common return conductor 8, if the system be an all metal system, or this conductor 8 may lead to ground. The other branch 9 of the circuit 6 includes the winding 10 of a telephonic receiver 11, and this conductor 9 also leads to the common return 8 or to the ground as the case may be.

In operative relation to the receiver magnet 11 is an iron armature 12 controlling a microphonic element 13 of any suitable type, but particularly of a delicate type, responsive to weak vibrations of the armature 12. The microphonic element is in a local circuit 14 including a battery 15 or other source of electric current, and the primary winding of a telephone induction coil 16. The secondary winding of the coil 16 is in a line circuit 17, one member 18 of which is connected to the common return 8 or is grounded as the case may be, and the other member 19 of which includes a telephonic receiver 20.

For convenience of description, the receiver 20 will be assumed to be at the receiving station, and this station is designated in the drawings by the letter B. At station B there is a microphonic transmitter 21 included in a local microphone circuit 22 which circuit is supplied with current from a suitable source of electric energy such as the battery 23, and also includes the primary winding of a telephone induction coil 24. The secondary winding of the coil 24 is in a line circuit 25, one side 26 of which is connected to the common return 8 or to ground and the other side 27 of which is also connected to the common return 8 or ground and includes the coil 28 of a telephonic receiver 29. In operative relation to the active ends of the receiver magnet is an armature 30 controlling a microphonic element 31 in a local microphone circuit 32 in which is included a battery 33 or other source of electric current, and the primary winding of a telephone induction coil 34. The secondary winding of the coil 34 is in another line circuit 35, one side of which is connected to the common return 8 or to the

ground as the case may be, and the other side 37 of which is also connected to the common return or ground and includes the receiver 2 before referred to at the station A.

5 The two stations A and B are thereby coupled together by two distinct circuits in each of which is a microphonic transmitter at one end and a telephonic receiver at the other end, and each of these circuits includes
10 a relay or repeater operative to telephonic currents. Let it be supposed that the distance between the stations A and B is so great that telephonic communication is practically impossible because of the weakening
15 of the current over such long transmission lines. Let it also be assumed that the repeater circuit 14 or 32 is at an intermediate point between the two stations A and B. The distance from station A to the repeater
20 circuit 14, or from the station B to the repeater circuit 32 is such that the receiver 11 or 29 as the case may be is still vigorously actuated by the telephonic current coming from the respective stations. The currents
25 actuating the receiver 11 or 29 as the case may be will cause fluctuations of the currents in the circuits 14 or 32, through the microphonic element 13 or 31, and since the batteries 15 or 33 furnish new or additional
30 energy in the circuit 14 or 32 respectively, greatly strengthened telephonic currents are thrown upon the receiver circuit 17 and 35 and the result is that the receivers 20 or 2 as the case may be are strongly actuated
35 and telephonic messages which would be imperceptible or heard with difficulty over the distance between the stations A and B are heard at the receivers 2 and 20 strongly and distinctly. It will be understood of course,
40 that if the distance between the stations A and B be too great for proper transmission with a single repeater, then additional repeater circuits may be interspersed between these stations. The armatures 12 and 30 are
45 of such thickness as to prevent any distortion or buckling of the metal, but move as a whole under the impulses of the receiver magnets, thus communicating all the movement to the microphonic element. The armature is not connected to any part of the
50 mechanism other than the carbon box or variable resistance medium.

In Figs. 2 and 3 there is shown a practical form of telephone repeaters. In these figures the coils 10 are shown as of the type
55 usually employed in connection with telephone receivers, and these coils are provided with soft iron pole pieces 38, connected to the polar end of a permanent magnet 39
60 by means of a screw bolt 40 of non-magnetic material, the pole pieces being held apart and in magnetic engagement with the polar ends of the magnets 39 by a spacing block of non-magnetic material. Between the
65 magnet 39 and the coils 10 the pole pieces 38

pass through slots in the base of a cup 42, designed to inclose and protect the coils 10 and between the inner face of the base of the cup and the coils there is a dished supporting disk 43, resting on another disk 70 44 of some soft non-resonant material, such for instance as felt. Made fast to the ends of the blocks 41 remote from the coils 10, by means of a screw 44' are two insulating blocks 45, 45, recessed at their ends to receive binding posts 46, each binding post 75 being provided with a binding screw 47 and a perforation through its wall for the reception of one end of the line conductors, the outer block 45 being perforated in line 80 with the perforation of the binding post for this purpose. Each binding post 46 is fast to or clamped to a conducting strip 48 between it and the insulating blocks 45 and this conducting strip also lies along the 85 block 41, from which, if the latter be of metal, the strip is insulated by a layer 49 of insulating material. The strip 48 is further held to the block 41 by a screw 50, which, when the block 41 is of metal, is insulated from said strip. The strips 48 lie 90 between the legs of the magnet 39 and the ends thereof remote from the binding posts 46 are connected by conductors 51 to the respective ends of the coils 10, these conductors being suitably insulated where necessary. The cup 42 is formed at its open end with an annular flange or ledge 52, overriding the free edge of an inwardly directed annular flange on a ring 54. Extending dia- 100 metrically across the ring 54 is a bridge 55, secured at each end to the ring and between this bridge piece and the ledge 52 of the cup 42 are spacing blocks 56, serving when the bridge 55 is in place, to firmly clamp the 105 ledge 52 of the cup 42 against the flange 53 of the ring 54. The central portion of the bridge 55 is formed with a boss 57 receiving the stem 58 of the microphonic element 13 or 31, as the case may be. 110

The microphonic element is not shown in the drawings in detail, since its structure may be similar to that usually employed in connection with microphonic transmitters, but it should be of as powerful and delicate 115 a type as possible. The movable member of the microphonic element carries the diaphragm 12 or 30, as the case may be, and this diaphragm is made of a small but rigid piece of metal, only large enough to bridge 120 the space between the two pole pieces 38 and to overlie the free ends of the latter. The diaphragm is supported only by the stem 59, and its movements are entirely free and all imparted to the movable member of 125 the microphonic element, when the diaphragm is actuated by magnetic impulses generated in the pole pieces 38 by the telephonic currents circulating through the coils 10 or 28, as the case may be. 130

The cup 42 and the ring 54, as clamped together by the ring 55 and spacing blocks 56, form a rigid support for the coils 10 or 28, as the case may be, and the microphonic element may be very delicately adjusted into operative relations with the said coils and be ultimately clamped into position by a set screw 60 in the boss 57 and a clamp nut 61. In order to inclose the working parts of the repeater there may be provided a cap 62, indicated in dotted lines in Figs. 2 and 3, and this cap is applied to the ring 54. The cup 42, together with the heavy ring 54 and bridge piece 55, forms a very rigid support for very accurately maintaining the receiver coils and the microphonic element in relative position one to the other during the operation of the structure.

What is claimed is:

1. A telephone repeater system comprising a local microphone circuit at one station, a line circuit in inductive relation to the microphone circuit, a repeater unit at a distant point in said circuit comprising receiver coils and a magnet, an inclosing cup carried thereby, a flanged ring receiving and engaged by the cup, a bridge piece on the ring

and clamping the cup to the ring, a microphonic element carried by the bridge piece, a free armature carried by the microphonic element in operative relation to the free ends of the receiver magnet pole pieces, a circuit controlled by the last named microphonic element, and a circuit in inductive relation to the last named circuit and containing a receiver.

2. A telephone repeater unit comprising receiver coils and a magnet, an inclosing cup carried thereby, a flanged ring receiving and engaged by the cup, a bridge piece on the ring and clamping the cup to the ring, a microphonic element carried by the bridge piece, and a free armature carried by the microphonic element in operative relation to the free ends of the receiver magnet pole pieces.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

SAMUEL L. CAMPBELL.

Witnesses:

H. S. BOWER,
M. C. BOWER.