

May 24, 1927.

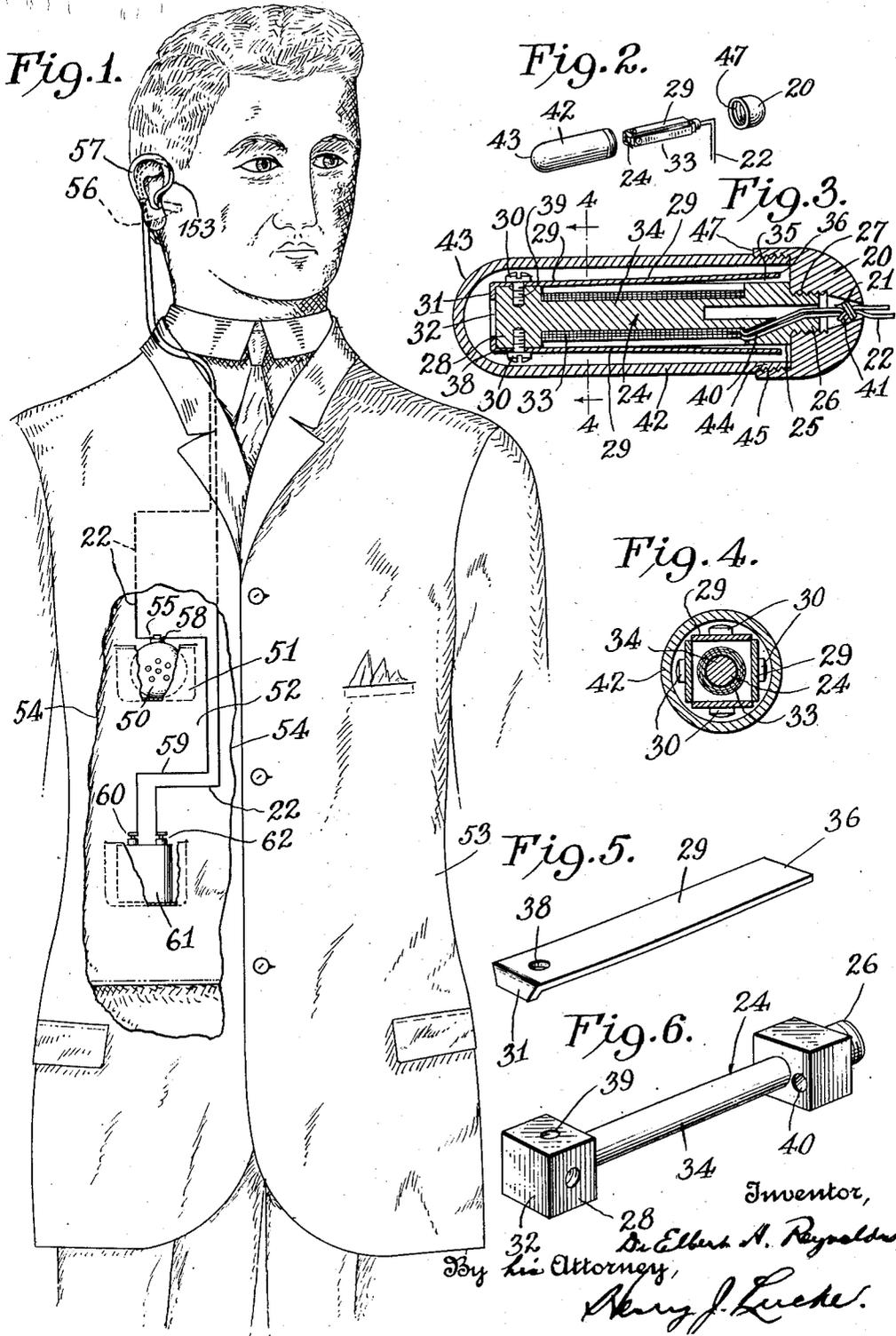
1,630,028

DE ELBERT A. REYNOLDS

EAR PHONE

Filed Jan. 15, 1925

3 Sheets-Sheet 1



May 24, 1927.

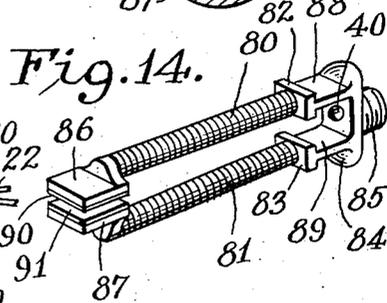
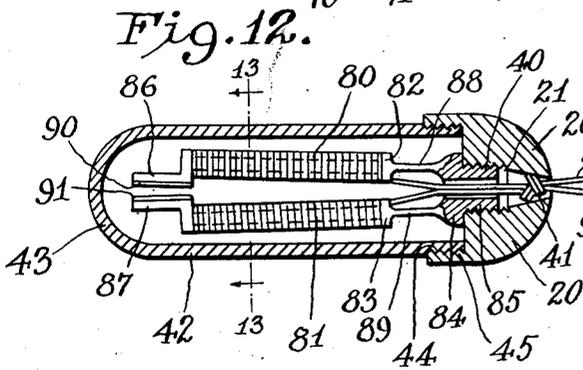
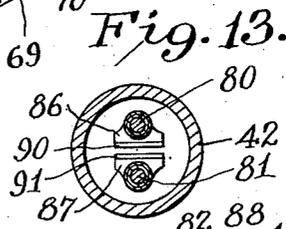
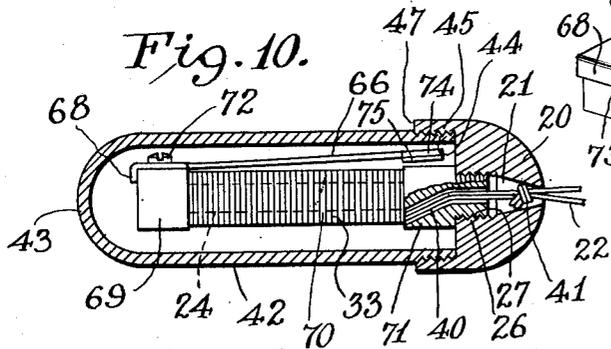
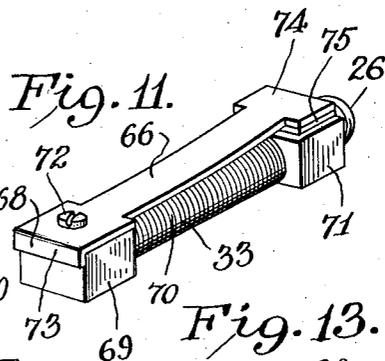
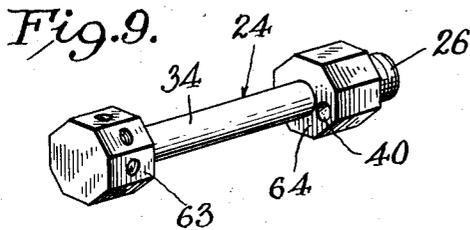
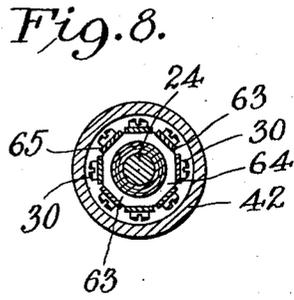
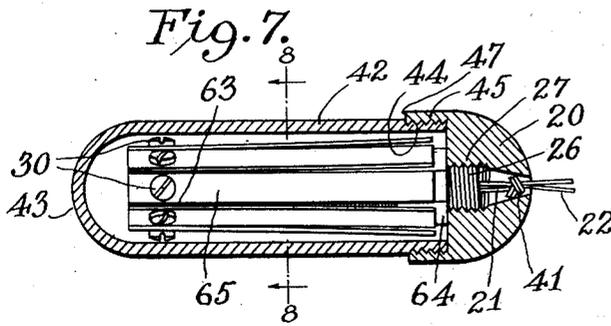
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1,630,028

EAR PHONE

Filed Jan. 15, 1925

3 Sheets—Sheet 2



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May 24, 1927.

1,630,028

DE ELBERT A. REYNOLDS

EAR PHONE

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3 Sheets-Sheet 3

Fig. 15.

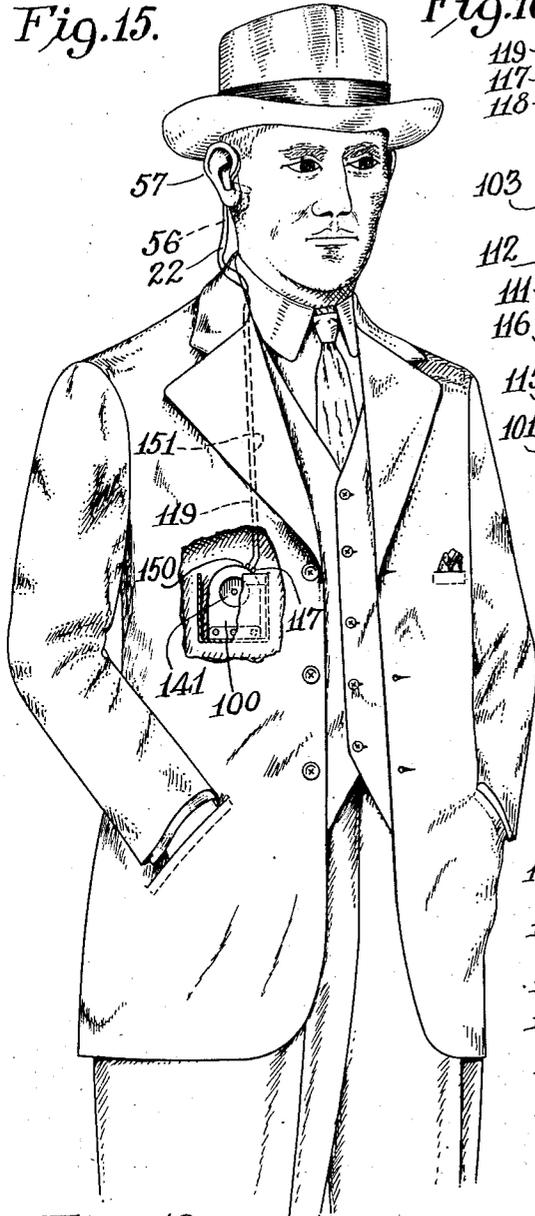


Fig. 16.

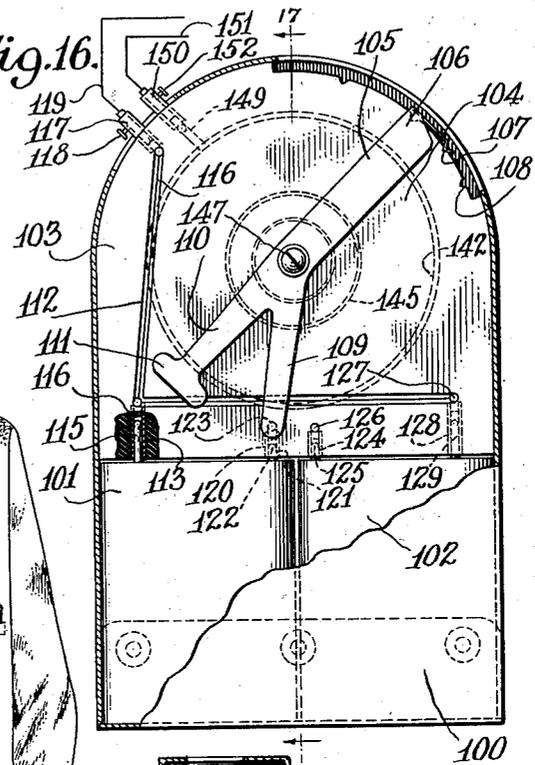


Fig. 17.

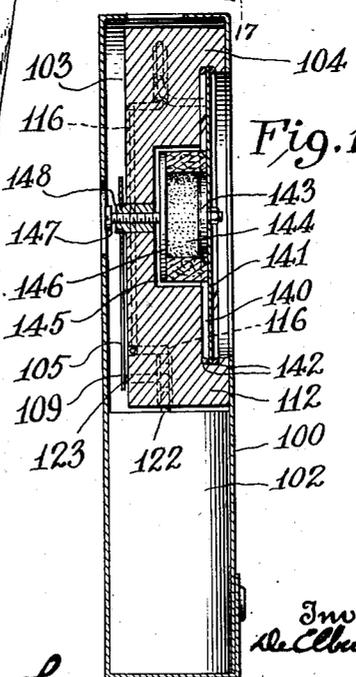
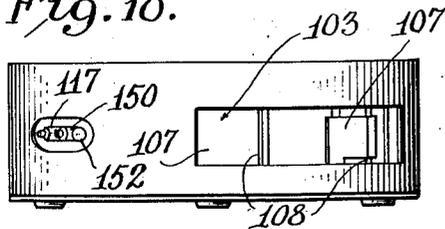


Fig. 18.



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UNITED STATES PATENT OFFICE.

DE ELBERT A. REYNOLDS, OF YONKERS, NEW YORK.

EAR PHONE.

Application filed January 15, 1925. Serial No. 2,555.

This invention relates to ear phones and is particularly applicable for persons having imperfect hearing.

An object of this invention is to provide an improved system for persons of defective hearing comprising a member for insertion in the ear, of a novel construction whereby to transmit the desired communication, notwithstanding the imperfect sense of hearing.

A further object of the invention is to provide a novel form of device for insertion in the ear of the user having imperfect hearing whereby the use of the same tends to stimulate and restore the audition of the user to normalcy.

A further object of the invention is to provide a novel construction of the member inserted in the ear of the user whereby the length, width and thickness of the same are materially reduced as compared with ear receivers as heretofore proposed.

A further object of the invention is a novel combination of a unitary casing for a set of individual batteries and switch member for connecting the same singly or combinedly with the ear-inserted member and of the transmitter.

Pursuant to the preferred forms of the invention, the ear-inserted member comprises a core of iron or like magnetic material, on which is wound a coil, one or more vibratory armatures formed of relatively thin and relatively short thicknesses of steel or other plate of magnetic material, a housing of reduced dimension and preferably of cylindrical form similar to a capsule, within which the aforesaid core, coil and vibratory member or members are securely mounted, and assembled to positively preclude disassembly; a casing containing a pair of dry cells and also containing a switch including contacts and a movable contact arm regulatable exteriorly for connecting the aforesaid batteries singly or combinedly as desired for use with the ear-inserted member and also containing the transmitter.

Further objects and features of the invention will be more fully understood from the following detail description and the accompanying drawings, in which

Fig. 1 is a diagrammatic view of a person showing the ear-inserted member, the transmitter and battery, the ear-inserted member being of materially reduced size made possible by the present invention;

Fig. 2 is an exploded perspective view showing generally the parts of the ear-inserted member embodying my invention and on a substantially full size scale;

Fig. 3 is a central longitudinally sectional elevation of the ear-inserted member of the construction indicated in Fig. 2, but on greatly enlarged scale; Fig. 4 is a sectional elevation on line 4—4 of Fig. 3; Fig. 5 is a perspective view of one of the vibratory members shown in Figs. 3 and 4, on a further increased scale; Fig. 6 is a perspective view of the core of the ear-inserted member shown in Figs. 3 and 4, on a scale corresponding to that of Fig. 5;

Fig. 7 is a longitudinal central elevation of an ear-inserted member of a modified form, the scale of the same being substantially that of Fig. 3; Fig. 8 is a sectional elevation on line 8—8 of Fig. 7; Fig. 9 is a perspective view of the core of the ear-inserted member shown in Fig. 7 and on a slightly increased scale;

Fig. 10 is a longitudinal sectional elevation of a further modification of ear-inserted member embodying my invention; Fig. 11 is a perspective view of the core, coil and single vibratory member as embodied in Fig. 10 and on a slightly enlarged scale;

Fig. 12 is a longitudinal sectional elevation of a still further modification of ear-inserted member embodying my invention; Fig. 13 is a sectional elevation on line 13, 13 of Fig. 12; Fig. 14 is a perspective view of the core and coil as indicated in Fig. 12 and on a slightly enlarged scale;

Fig. 15 is a diagrammatic view illustrating a person using a preferred form of my ear-phone system, including an ear-inserted member of the type similar as hereinabove referred to, and a combined casing for a pair of batteries, switching member and transmitter;

Fig. 16 is a front elevation of the unitary casing, the front cover being partially broken away to show the pair of batteries and the

switching member; Fig. 17 is a sectional elevation on lines 17—17 of Fig. 16; and Fig. 18 is a top plan view of a casing shown in Figs. 16 and 17.

5 Referring to Figs. 2, 3 and 4, the ear-inserted member comprises a base 20, preferably semi-spherical at its outer end and provided with the central opening 21 through which extends the leads 22 of the electrical
10 coil, referred to more particularly hereinafter. In use, the leads 22 are enclosed within an outer covering similar to ordinary electrical cords and by reason of the particular combination of transmitter, source of
15 energy and switching mechanism therefor, together with my novel form of vibratory ear-inserted member, the leads 22 are of very fine wire and the unitary cord is of materially reduced diameter and comparable
20 to the usual silk cord employed with nose glasses.

The core 24, as illustrated in Fig. 3, comprises an enlarged portion 25 having an extension 26 of reduced diameter and threaded
25 to mesh with the threading 27 within the inner, enlarged portion of the opening 21. At the opposite end 28 of the core 24 I provide an enlarged portion for mounting on its lateral faces the respective vibratory elements 29, four, in this instance. Each vibratory
30 member 29 is mounted on the enlarged terminal portion 28 by means of a set screw 30 or equivalent; each member 29 is preferably provided with an angular flanged end 31 snugly abutting the outer face 32 of the enlarged core portion 28.

The increased thicknesses of the respective enlarged portions 25, 28, provide for locating the coil 33 about the central or reduced cylindrical portion 34 of the core 24; the thickness of the enlarged portion 25 is preferably
40 less than the thickness of the enlarged end portion 28 to insure a clearance, such as indicated at 35 in Fig. 3, between the free end
45 36 of each vibratory element 29 and the adjacent lateral face of the enlarged portion 28.

In the construction shown in Figs. 3 and 4, the vibratory elements 29 are four in number and for such purpose the lateral periphery of the enlarged end portion 28 may be square, as is indicated in cross-section in
50 Fig. 4 and in perspective in Fig. 6.

Upon assembling the vibratory elements 29 on the enlarged portion 28 of the core 24 by means of screws 30, see Figs. 3 and 4, passing through the opening 38 in each vibratory element 29 and tapped into the threaded recess 39 of the enlarged portion
55 28, the laterally extending edge 31, see Fig. 5 of each vibratory element 29 is brought into snug engagement with the outer face 32, see Fig. 6, of the enlarged portion 28 upon tightening the screw to final position. As indicated in Fig. 3, the screw 30 secures the

vibratory element 29 to the enlarged portion
65 28, which function is enhanced by the flange extension 31. The flange 31 serves also to restrict the tendency of the vibrations of each vibratory element 29 to unseat its securing
70 screw 30 and also improve the harmonics emitted upon the vibration of the vibratory element 29, ensuing upon excitation by the coil 33.

After the vibratory elements have been assembled upon the core 24, on which
75 has been previously wound the coil 33, the leads 22 of the coil are passed through the angular opening 40 extending through the enlarged portion 25 of the core 24, and the leads are then passed through the opening
80 21 in the base 20. Preferably, a knot 41 is made of the leads 22 at a suitable location to bring the knot 41 into engagement with the sides of the opening 21 and to allow a slight slack of the leads between the knot 41
85 and the ends of the coil 33. The threaded end portion 26 of the core 24 is screwed into the threading 27 of the opening 21 until the front face of the enlarged portion 25 of the core 24 is in tight fit with the abutting
90 face of the inner side of the base 20. The casing 42 preferably of cylindrical contour for its major portion and having a spherical contour indicated at 43 at its outer end, is provided at its inner end 44 with thread-
95 ing 45 for meshing with the threading 45 of the annular extension 47 of the base 20 and upon seating the casing 42 within the base 20, the vibratory elements 29 are supported by the base 20 within the casing 42 with
100 full clearance for the necessary maximum amplitude of vibration of the vibratory elements 29.

In Fig. 2, I have indicated the casing 42, its base or cap 20, the core 24, the coil 33
105 and the vibratory elements 29 of actual size to illustrate the marked reduction in actual size permitting its concealment within the ear and effecting an emission of "vocal" sounds produced upon vibration of the
110 vibratory elements 29, excited by the coil 33, to enable a person of defective hearing to "hear" by the use of the present invention.

In Fig. 1, I have indicated the transmitter
115 50, of suitable construction, to be placed at a suitable location in the clothing of the user, as for example in a pocket 51 of the vest 52; for depicting such use of the transmitter 50 with my invention, I have shown the coat
120 53 broken away by the broken line 54. One terminal 55 of the transmitter 50 is connected to one lead 22 of the cable or pair of leads connected to the coil 33 of the ear-phone 56, indicated as placed within the ear 57 of the
125 user. Preferably the location of insertion of the ear-phone 56 within the ear 57 of the user is within the cavity of the ear and the casing 42 is of such size that it is substan-

tially concealed and is retained by frictional engagement with the inner walls of the ear cavity.

The other terminal 58 of the transmitter 50 is connected by the lead 59 of the cord 22 to one terminal 60 of the battery 61, and the other terminal 62 of the battery 61 is connected to the remaining lead of the cord 22.

In the modification shown in Figs. 7, 8 and 9, the base 20 and its casing 42 are generally of the same construction as the corresponding parts illustrated in Figs. 3 and 4, and the same reference numbers are applied to like parts. However, in this construction, the core 24, see Figs. 8 and 9, is provided with oppositely disposed enlarged portions 63, 64, of octagonal periphery for supporting in uniformly spaced relation the vibratory elements 65, corresponding generally to the vibratory elements 29. The vibratory elements 29 are respectively secured to the outer enlarged portion 63 by means of screws 30 and lateral flanges 31, similarly as in the structure shown in Figs. 3 to 6, inclusive.

In the modification shown in Figs. 10 and 11, but a single vibratory element 66 is employed, secured by the screw 72 in lateral flange 68 to the enlarged end portion 69 of the core 70. Such core 70 may be rectangular at its enlarged end portions 69, 71, similar to the aforesaid core 24, illustrated in Fig. 6. The vibratory element 66 may be secured to the enlarged end portion 69 by means of the screw 72 tapped into a suitable opening 73 in one face of the enlarged end portion 69; the vibratory element 66 may be re-enforced in retention on the enlarged end portion 69 by means of its laterally extending flange 73, similar to the aforesaid flange 31, Fig. 5.

If desired, the vibratory element 66 may be provided with the laterally enlarged free end portion 74, having a width corresponding approximately to the width of the enlarged portion 71, as will appear from Fig. 11. The vibratory element 66 may also be provided with the additional thickness plate 75 of magnetic material secured to the free end of the vibratory element 66 and disposed between the free end of the vibratory element 66 and the adjacent face of the enlarged portion 71.

The coil 33 is similar to the coil 33 of the form of the invention shown in Figs. 3 and 4 and like parts are designated by the same reference numbers.

The modification shown in Figs. 12, 13, and 14 comprises two coils 80, 81 wound on the respective cores 82, 83, either integral with one another or unitarily connected with one another to the base portion 84. The base portion 84 is provided with threading 85 meshing with the threading 46 within the annular flange 47 of the base 20 of the casing

42, similarly as in the modifications hereinabove set forth. The coils 80, 81 may be connected electrically in series with one another, or may be connected in multiple electrical relation, as will be understood. The cores, 82, 83, at their free ends are flattened as is indicated at 86, 87 serving as armatures mutually with one another; the intermediate portions 88, 89 of the cores 82, 83 are of reduced thickness to render the same resilient, whereby excitation of the coils 80, 81 and consequent magnetization, the armatures 86, 87 are correspondingly attracted and detracted to produce vibration of the cores, coils and armatures and thereby set up vibrations corresponding to the "voice" currents passing through the respective coils 80, 81.

If desired, the effective faces of the armature portions 86, 87 may be provided with the auxiliary armature plates 90, 91.

The preferred use of my invention as an entirety is illustrated in Fig. 15, showing the employment of the transmitter having the construction set forth in the pending United States application Ser. No. 240,418, entitled Audiphone, filed June 17th, 1918, a particular feature of which is that the electro-magnetic parts may be adjusted by simple turning of an exteriorly extending screw or the like for setting the sensitiveness of the transmitter: the particular construction of the transmitter is set forth in the aforesaid pending application, and affords the desired degree of sensitiveness for any desired location of the transmitter in the apparel of the user and for all positions assumed by the user, thereby enabling the user to derive full efficiency of the transmitter whether walking, standing still, bending down or in any other usual posture. As a result, the transmitter may be located within a pocket which may be entirely concealed in the clothing of the user and in practice the transmitter is located in an inside pocket of the vest of the user.

In the arrangement shown in Fig. 15, the employment of one or more pairs of batteries as a source of energy is illustrated with provision of improved switching means whereby either of said batteries may be used singularly at any time or the batteries connected together as in electrical multiple or electrical series relation. The movable switch member is readily turned by passing the finger into the pocket in which the casing enclosing the batteries and the switch element is enclosed, and moving the switch arm from one position to another position.

As one form of such unitary casing, for the batteries I have illustrated in Figs. 16, 17 and 18, the casing 100 which is of a width and thickness, see Figs. 16 and 17 to snugly receive the batteries 101, 102 and accordingly the casing 100 may be substantially

rectangular at its lower portion. Within the upper portion 103 of the casing 100 is disposed the switching device 106 which is preferably circular in contour and accordingly the upper casing portion 103 may be circular at its upper end as shown. The switching device comprises the rotary contact member 105 shaped at its one end 106 to engage stops 108 of the arc shaped plate 107 corresponding to the respective positions of contact making, as will be explained more fully hereinafter.

The switch member 105 further comprises the contact arm 109 and the contact arm 110, the latter terminating in the broadened contact piece 111 serving as a bridge contact member as set forth more fully hereinafter.

The base 112, see Figs. 16 and 17, of the switch casing 103 is of insulation and slotted to retain contacts whereby upon removal of either or both batteries 101, 102 the substituted battery or batteries is automatically connected with the conducting elements of the switching device. In the slot 113 is secured the contact tube 114 for electrical contact with the projecting terminal 115 of the battery 101 and to the contact tube 114 is connected the conductor 116 extending to the terminal 117, having the binding screw 118 for connection with the lead 119. Within the seat 120 is located the contact tube 121, at one side receiving the projecting terminal 122, of the battery 101 and at the other side connected to the switch contact 123. The contact tube 124, similar to the contact tube 121, receives the terminal 125 of the battery 102 and the switch contact 126 is connected to the contact tube 124. The switch contact 127 is connected to the contact tube 128 slidably receiving and electrically connecting with the projecting terminal 129 of the battery 102.

Preferably, the casing 100 also encloses the transmitter of the above referred to construction and combined unitarily with the switching device.

As shown in Fig. 17 and indicated in Fig. 16, the transmitter is located on the opposite side of the switch arm 105 of the switching device, as by hollowing the base 112 with an outer and larger circular opening 140, to receive the diaphragm 141 of the transmitter, secured therein by the pair of oppositely disposed gaskets 142, 142. The movable contact button 143 is carried by the diaphragm 141 and the carbon granules 144 are enclosed in the ring 145 of felt or the like, abutting at its one edge against the inner force of the diaphragm 141 and at its opposite edge against the other contact button 146. The contact disk 146 is adjusted by means of the setting screw 147. The general construction and the operation of the aforesaid parts of my transmitter are set forth and claimed in my aforesaid pending application Serial No. 240,418.

In the particular construction shown in Fig. 17, the setting screw 147 is mounted in the bushing 148 of metal or other electrically conducting material, serving also as the pivot support of the movable contact arm 105 of the switching device.

The diaphragm 141 is of conducting material and is connected at one point of its edge to the metal strip 149, electrically connected to the terminal 150, to which the lead 151 is connected by the binding screw 152.

The electrical circuit for the position of the switch arm 105 is as follows: terminal 122 of the battery 101, switch contact 123; switch arm 109; bushing 148; contact button 146; carbon granules 144; contact button 143; diaphragm 141; connection 149 with diaphragm 141; terminal 151; lead 150; coil 33 of ear-inserted member 56; lead 119; terminal 117; wire 116 and thence returning to the opposite terminal 115 of the battery 101.

When the switch arm 105 is shifted to position the contact bridge member 111 over and in contact with the switch contacts 123, 126, the batteries 101, 102 are connected in multiple through the transmitter by the joint connection of the switch contacts 123, 126 with the bridge member 111, arm 110, screw 147, thence through the transmitter and the diaphragm connection 149 and over the circuit including the leads 151, 119, as traced herein above, thence through the conductor 116 to the terminal 115 of the battery 101 and also in multiple through the conductor 127 to the terminal 128 of the battery 102. In such position of the switch arm 105, its top end 106 engages the fixed stop 108 shown uppermost in Fig. 16.

Preferably, the capsule or other member which is inserted within the ear of the user is provided with an extension tube 153, see Fig. 1, of silver or of gold or other appropriate material and preferably of small diameter extending exteriorly of the ear opening, thence in front of and back of the upper lobe of the ear, through which tube passes or is "threaded" the two insulated conductors 22, 22 or the cord of such two conductors 22, 22. If desired, the inner end of the tube 153 may be provided with threading to mesh with corresponding threading within the opening 21 of the head 20 of the ear-inserted capsule or member. Such extension also facilitates inserting the capsule or ear-inserted member in position within the ear.

While I have illustrated and described certain specific embodiments of my invention, it will, of course, be understood that I do not wish to limit myself to the exact construction shown and described as various modifications and changes will readily suggest themselves to those skilled in the art. It is of course, obvious that very good results may be obtained by attaching the

vibratory elements to the outer portion of the core and allow them to vibrate to and from the inner portion of the core; or the vibratory elements may be securely attached to both extremities of the core and vibrate at the center to and from a central portion of the core with windings corresponding to such purposes. It is also true that the vibratory elements may be attached to the central portion of the core, allowing both ends to vibrate, with fairly good results.

I claim:

1. In a telephone receiver for partially deaf persons, a container for insertion within the ear cavity and electrically operated means for vibrating said container to thereby effect audition by the user by contact of said container with an inner portion of the ear of the user, said vibrating means comprising a plurality of vibrating elements disposed within said container and electromagnetic means for vibrating said vibrating elements.

2. In a telephone receiver for partially deaf persons, a container for insertion within the ear cavity and electrically operated means for vibrating said container to thereby effect audition by the user by contact of said container with an inner portion of the ear of the user, said vibrating means comprising a plurality of vibrating elements disposed within said container and electromagnetic means disposed in said container for vibrating said vibrating elements.

3. In a telephone receiver for partially deaf persons, a container for insertion within the ear cavity and electrically operated means for vibrating said container to thereby effect audition by the user by contact of said container with an inner portion of the ear of the user, said vibrating means comprising a plurality of reeds disposed within said container and electromagnetic means for vibrating said reeds.

4. In a telephone receiver for partially deaf persons, a container for insertion within the ear cavity and electrically operated means for vibrating said container to thereby effect audition by the user by contact of said container with an inner portion of the ear of the user, said vibrating means comprising a plurality of vibrating elements disposed within said container and an electromagnet permanently attached to one end of said container.

5. In a telephone receiver for partially deaf persons, a container for insertion within the ear cavity and electrically operated means for vibrating said container to thereby effect audition by the user by contact of said container with an inner portion of the ear of the user, said vibrating means comprising an electromagnet, and a plurality of reeds attached to one end of said electromagnet.

6. In a telephone receiver for partially deaf persons, a container for insertion within the ear cavity and electrically operated means for vibrating said container to thereby effect audition by the user by contact of said container with an inner portion of the ear of the user, said vibrating means comprising an electromagnet permanently attached to one end of said container and a plurality of reeds attached to one end of said electromagnet.

7. In a telephone receiver for partially deaf persons, a container for insertion within the ear cavity and electrically operated means for vibrating said container to thereby effect audition by the user by contact of said container with an inner portion of the ear of the user, said vibrating means comprising an electromagnet having a central body portion of cylindrical form and a plurality of substantially flat surfaces at both ends of said central body portion.

8. In a telephone receiver for partially deaf persons, a container for insertion within the ear cavity and electrically operated means for vibrating said container to thereby effect audition by the user by contact of said container with an inner portion of the ear of the user, said vibrating means comprising an electromagnet having a central body portion of cylindrical form and a plurality of reeds respectively secured to said substantially flat surfaces.

9. In a telephone receiver for partially deaf persons, a container for insertion within the ear cavity and electrically operated means for vibrating said container to thereby effect audition by the user by contact of said container with an inner portion of the ear of the user, said vibrating means comprising a plurality of reeds attuned to a pre-determined frequency within said container and electromagnetic means for vibrating said reeds.

10. In a telephone receiver for partially deaf persons, a container for insertion within the ear cavity and electrically operated means for vibrating said container to thereby effect audition by the user by contact of said container with an inner portion of the ear of the user, said vibrating means comprising a plurality of vibrating elements disposed within and mechanically connected with said container and electromagnetic means for vibrating said vibrating elements.

11. In a telephone receiver for partially deaf persons, a container for insertion within the ear cavity and electrically operated means for vibrating said container to thereby effect audition by the user by contact of said container with an inner portion of the ear of the user, said vibrating means comprising an electromagnet having a central body portion of cylindrical form, a coil wound about said central body portion and

a plurality of reeds respectively secured to said substantially flat surfaces.

12. In a telephone receiver for partially deaf persons, a container for insertion within the ear cavity and electrically operated means for vibrating said container to thereby effect audition by the user by contact of said container with an inner portion of the ear of the user, said vibrating means comprising a vibratable member disposed within and mechanically connected with said container and electromagnetic means for vibrating said vibratable member. 10

In testimony whereof I have signed this specification this 7th day of January, 1925.

DE ELBERT A. REYNOLDS.