United States Patent

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[54] **PLUG-ACTUATED TRANSDUCER MEANS**
9 Claims, 11 Drawing Figs.

[52] **U.S. Cl.** ..... **179/1 SW,** 179/1 ST, 179/1 VE, 200/51.09
[51] **Int. Cl.** **H04r 1/00**
[50] **Field of Search** ..... 179/1 ST, 1 VE, 1 SW, 1 B, 1 G, 29, 1 PC, 182 A, 158, 161, 165; 181/24, 18; 251/212; 200/51.09

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ABSTRACT: A transducer for supplying compressional wave energy to a user in which the operation of the transducer is directly under the control of the user through application of compressional wave energy conveying apparatus to the transducer whereby the user is substantially unaware of the presence of compressional wave energy until the sound conveying apparatus has been disposed intermediate the user's auditory canals and the compressional wave energy transducer. The transducer is adapted to receive a plug which is operative, upon engagement with means in the transducer, to convey compressional wave energy from within the interior of the transducer assembly through the plug and suitable sound or compressional wave energy conducting apparatus, to the ear canal of the user. The transducer is further adapted to be selectively responsive to one or more plug members having a configuration adapted to cooperatively cause selective operation of the transducer with respect to two or more sources of signal.

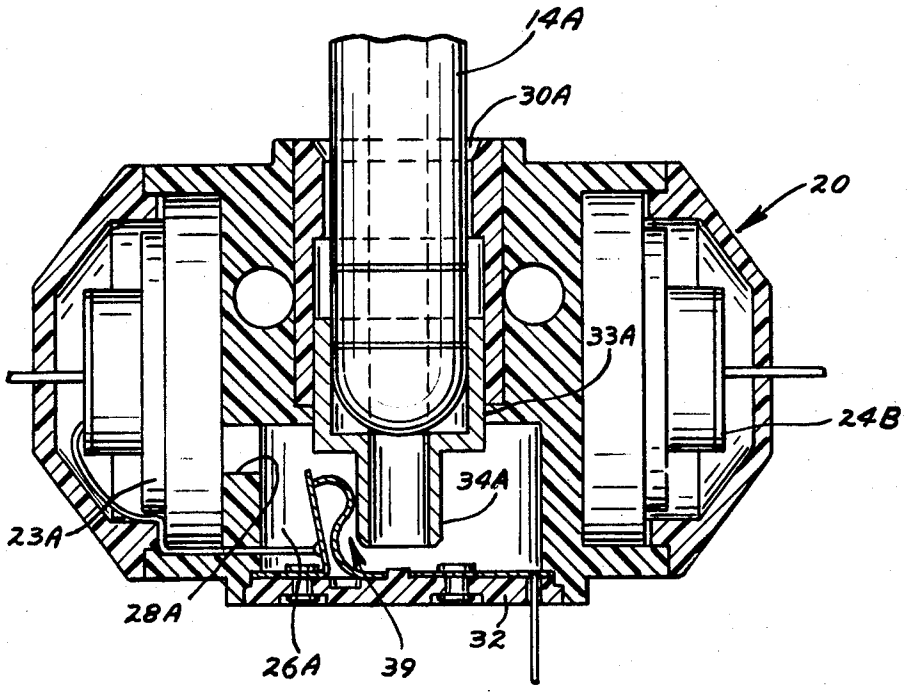


FIG. 1

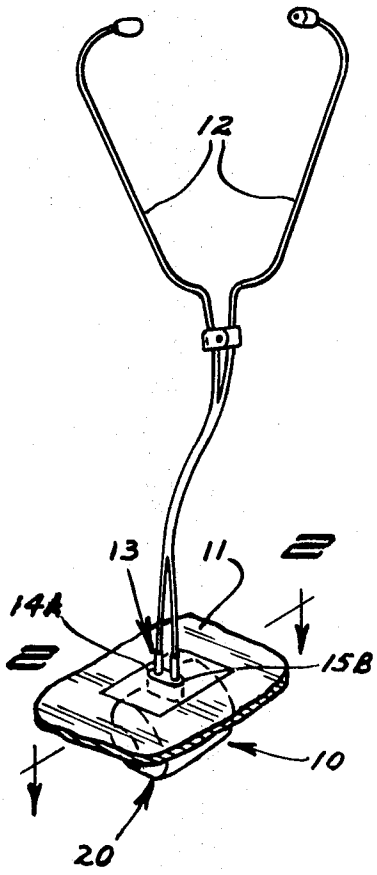
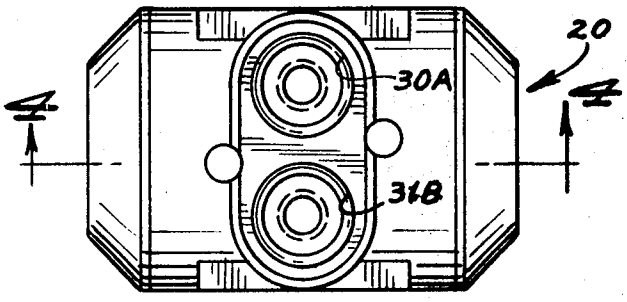


FIG. 2



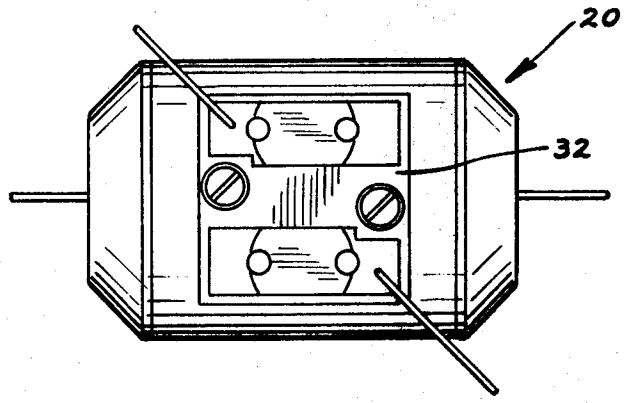
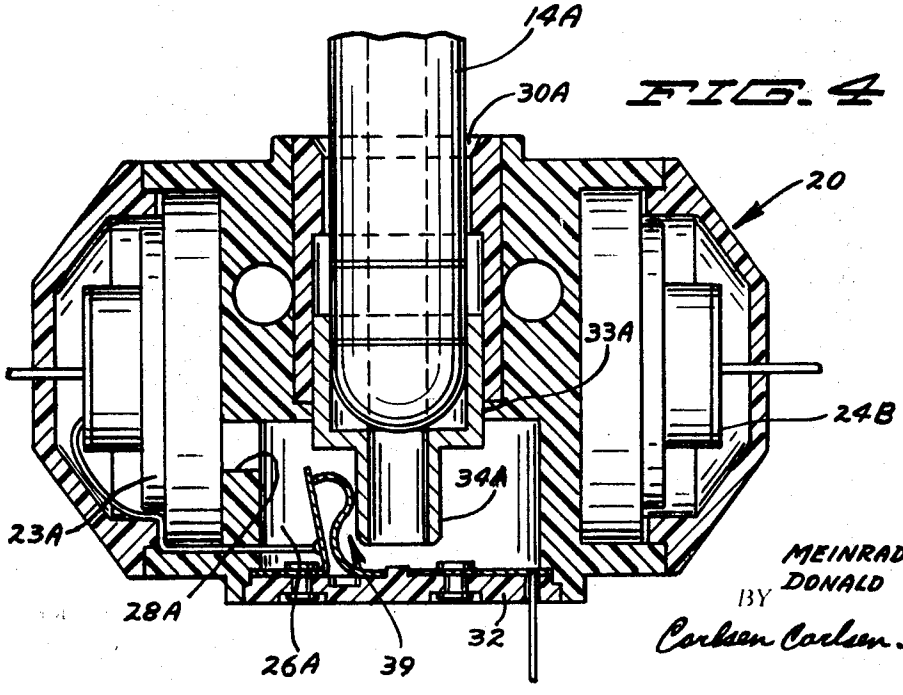


FIG. 3

FIG. 4



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FIG. 5

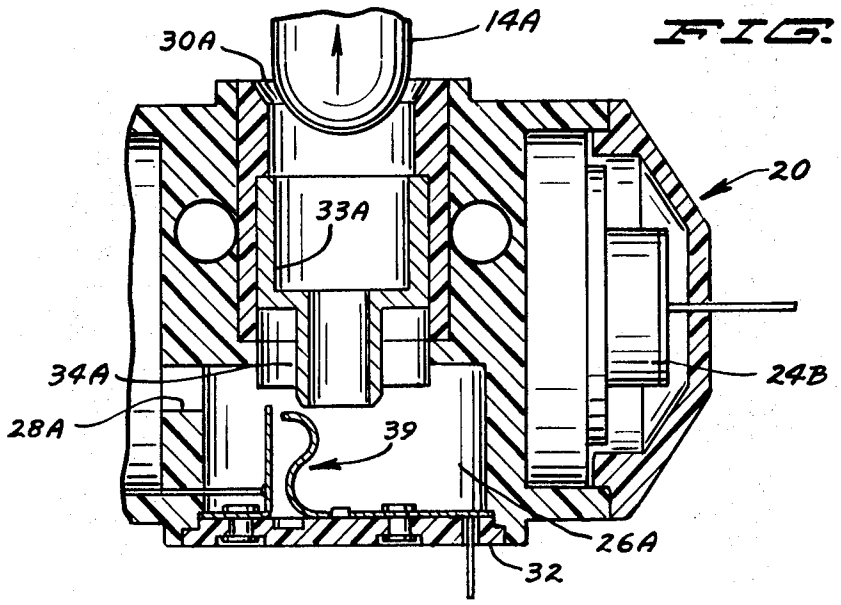
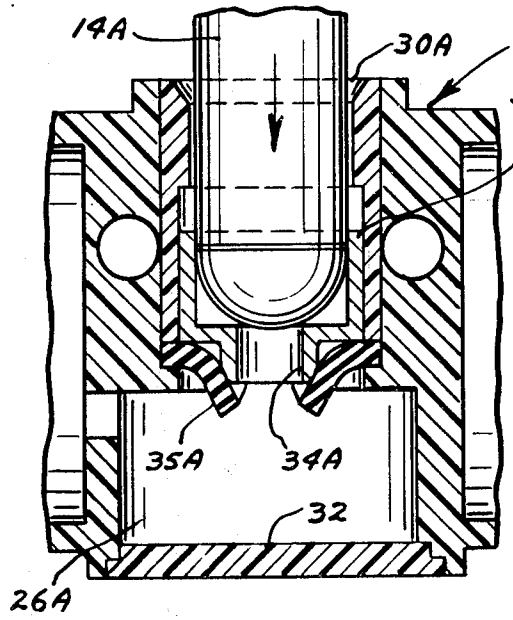


FIG. 6



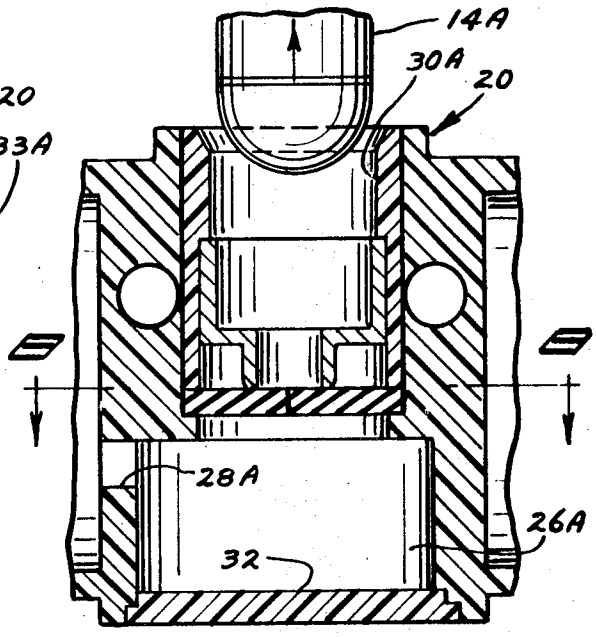
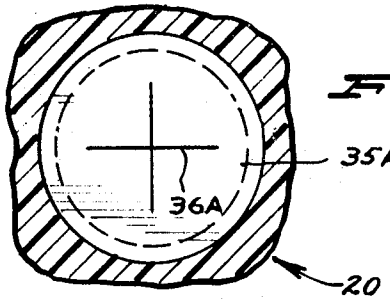


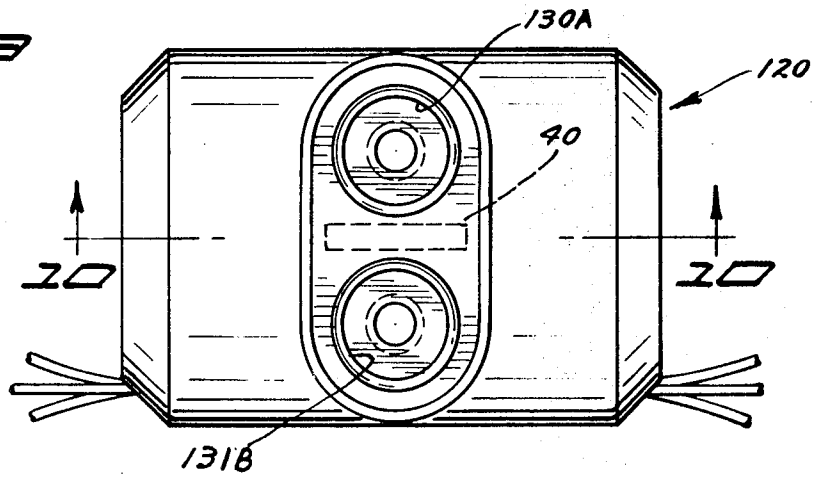
FIG. 7

FIG. 8



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FIG. 9



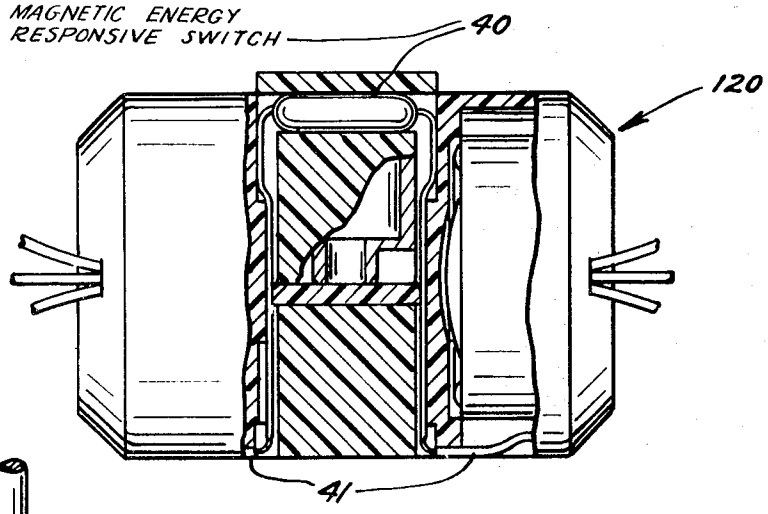


FIG. 10

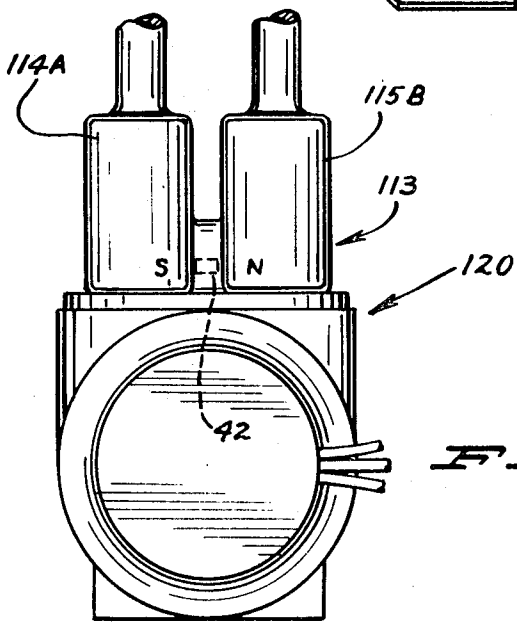


FIG. 11

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PLUG-ACTUATED TRANSDUCER MEANS

This invention is concerned with the classes of systems wherein a signal in the form of electrical energy may be selectively applied through suitable switching means to a plurality of signal responsive compressional wave energy transducing means whereat the electrical signal is converted to a compressional wave signal. The signal is to be selectively conveyed from the transducer to the auditory sense organs of the user. In such systems, it is desirable that the user, or others in proximity to the transducing means, be unaware of the existence of a compressional wave signal.

It is also desirable under certain circumstances of operation, for the operation of the transducer to be selectively controlled in such a manner whereby one of a plurality of sources of signal to be transduced, e.g. from electrical to compressional wave energy, is ordinarily excluded but, when a particular circumstance prevails, the signal may be applied to the transducer for conversion and subsequent transmission to the auditory sense organs of a user.

It is therefore an object of our invention to provide transducing apparatus which is operative in response to the desires of a user to selectively provide a signal to the auditory sense organs of such user.

Another object of this invention is to provide an improved transducing apparatus which is operative upon engagement with a means for conveying compressional wave energy to the auditory sense organs of a user to selectively communicate one of a plurality of signals to a user.

A still further object of our invention is to provide transducing apparatus which is operative in response to a source of switching signal for selectively communicating a source of compressional wave energy to the auditory sense organs of a user.

A still further object of our invention is to provide transducing apparatus that is responsive to engagement with compressional wave energy communications apparatus to energize such compressional wave energy communications apparatus with selected signals from a plurality of sources signals.

With these and other objects of our invention in mind, reference is made to the appended specification, claims and drawing, in which

FIG. 1 is a fragmentary perspective view of apparatus embodying the principles of our invention;

FIG. 2 is a plan view of a transducer embodying the principles of our invention;

FIG. 3 is a bottom view of the apparatus shown in FIG. 2 of the drawings;

FIG. 4 is an enlarged sectional view taken along section line 4—4 on FIG. 2 of the drawings;

FIG. 5 is an enlarged sectional view like that of FIG. 4 and illustrating the relative position of the elements of our invention in a different mode of operation;

FIG. 6 is an enlarged sectional view of a portion of another embodiment of our invention including construction common to that shown in FIGS. 2, 3 and 4;

FIG. 7 is an enlarged sectional view illustrating section disposition of the elements of FIG. 6 in a different mode of operation;

FIG. 8 is a fragmentary sectional view taken along section 8—8 on FIG. 7;

FIG. 9 is a plan view of a further embodiment of a transducer embodying the principles of our invention;

FIG. 10 is a sectional view taken along section line 10—10 on FIG. 9 of the drawings; and

FIG. 11 is an end elevational view of the apparatus shown in FIGS. 9 and 10.

Referring now to the drawings, reference to FIG. 1 of the drawings will show a generalized form of a transducer which is illustrated as a program source 10 which has been mounted in, for example, the seat arm 11 (shown in fragmentary section) of an aircraft. Program source 10 would be capable of providing a variety, or a plurality of programs which may be monaural or stereo in program content and which may also relate to motion pictures to be depicted on suitable screens disposed within the normal view of the seat occupant. A headset assembly is comprised of a pair of compressional wave energy transmitting tubes, 12, adapted at one end to be disposed in the auditory canals of a user. The other end, 13, includes a dual plug assembly comprised of plugs 14A and plug 15B to be disposed in operative compressional wave energy transmitting relationship with program source 10 shown further as comprising generally a housing 20.

Housing 20 is preferably of generally symmetrical construction having a top and bottom surface and left and right ends A and B containing transducers A and B disposed in similar chambers A and B connected to passages A and B which communicate with chambers A aNd B disposed below jack receptacles A and B. It may be recognized by one skilled in the art that the A and B element designation may correspond to the two channels normally associated with programs of stereo content, one to be applied to each ear of a user so as to recreate the effect to be obtained from a stereo program source.

For the sake of clarity, reference characters have been omitted from many of the elements which are duplicated in the overall assembly so that the description to follow will be concerned primarily with a single channel since it is believed reasonable to assume that one skilled in the art will be able to readily understand our invention as it may pertain to the second channel.

Referring to FIGS. 2, 3, 4 and 5, housing 20 is shown generally symmetrical about horizontal and vertical planes passing therethrough. Housing 20 is shown having a pair of receptacles or jacks 30A and 31B extending inwardly thereinto from the top portion and having a bottom cover plate 32 which closes first and second substantially identical chambers 25B (not shown) and 26A disposed directly underneath jack members 30A and 31B and which further carries a pair of identical switching contact assemblies 39 which will be controlled in a manner to be described below. The left-hand end of FIG. 4 shows a transducer 23A, which may be selectively connected to a plurality of sources of program material at the discretion of a user, (the showing of apparatus for connecting to various sources of electrical signal has been omitted but is believed readily ascertainable or determinable by those skilled in the art). Transducer 23A is shown having an output passage 28A, in communication with chamber 26A disposed immediately below jack 30A. Jack 30A is shown in FIG. 4 in engagement with plug 14A on dual plug assembly 13.

Jack 30A includes a slidable concentrically disposed compressional wave transmitting and plug engaging member 33A which, in FIG. 4, is shown as having been downwardly depressed so that end 34A engages a movable contact on switch contacts 39 to effect closure of the contacts. FIG. 5 shows the respective elements in their disengaged positions whereat slidable member 33A has been retracted upwardly whereby end 34A is no longer in engagement with switch contact assembly 39 and transducer 23A is deenergized.

Referring now to FIGS. 2, 6, 7 and 8 of the drawings, it may be seen that the overall construction of this embodiment with regard to the chambers for the various elements is substantially the same and hence like reference characters have been used where appropriate. Jacks 30A and 31B have a bottom portion of resilient material intermediate the jacks and the chambers formed therebelow. One of such members has been identified by reference character 35A, and is provided with a pair of slits 36A which, when in the position shown in FIG. 7 of the drawings, are closed to present an effective barrier to the communication of compressional wave energy therethrough.

When a plug member 14A is inserted into jack 30A and moved downwardly, the center of member 35A will be engaged by the downwardly extending end 34A of slidable member 33A and slits 36 will be opened to allow compressional wave energy to proceed from the chamber upwardly into plug 14A and thence to the auditory sense organs of a user.

It has been observed that the above described operation of jack 30A, with respect to members 33A and 35A, results in a rapid, effectively complete, opening of slits 36A when engaged by end 34A to provide a complete acoustic connection, Very little displacement is necessary once the leading portion of end 34A has contacted member 35A. Actual operative devices have demonstrated that displacement of less than one hundredth of an inch is sufficient. With this feature in mind, it is possible to eliminate ineffective, poor quality acoustic connections as may be caused, for example, by failure to completely insert the plugs into the jacks, Member 33A may be suitably dimensioned to be actuated downwardly as a plug is initially inserted into jack 30A.

In the embodiment just described, the respective transducers may be continuously energized from a suitable selective source of a signal and the application of the compressional wave conducting portions of the headset 12 to the assembly will serve to control the flow of compressional wave energy to the auditory sense organs of the user.

In the embodiment illustrated in FIGS. 9,10 and 11 of the drawings, a further magnetically responsive switch 40 is shown connected to conductors 41. Switch 40 is intended to be invisible to the user but magnetically operable in the sense, for example, that source of magnetic energy 42, which may be imbedded in dual plug 113 comprised of plug 114A and plug 115B may be utilized to energize switch 40 and thereby actuate the same. Those skilled in the art should readily understand that various forms of magnetic circuits may be utilized in the regard.

In FIGS. 9, 10, and 11 the housing has been identified by reference character 120, the jacks are identified by reference characters 130A and 131B while plug members are identified by reference characters 114A and 115B and the dual plug is identified by reference character 113. The reader will readily see the similarity of the overall apparatus and it is intended that the embodiments shown in FIGS. 4 or 6 may be usable in connection with the apparatus shown in FIGS. 9, 10 and 11. Again, the specific switching arrangement which might be utilized with a plurality of selectable sources of electrical signal to which the plurality of conductors, including conductors 41 in FIGS. 9, 10 and 11, might be connected, is left to the discretion of those skilled in the art. It might be noted, however, that the three conductors emanating from each end of housing 120 on, for example FIG. 10, would be associated with suitable switching means whereby one conductor would be common to each of the transducers and the other two conductors would be selectively connected to the desired sources of signal and switch 40 would be operative to control a further source of signal to which the other conductors might be selectively connected.

The operation of the apparatus is believed readily apparent from a consideration of the description set forth above and as it might be seen from the drawings. However, briefly, the transducing apparatus is effectively inoperative with respect to transmitting any intelligible signal to the auditory sense organs of a user in the absence of engagement by a cooperating plug member which is operative to engage the slidable portions of the jacks disposed within housing 20 or 120, to effectively energize headset 12 from the chambers disposed immediately below jacks 30A and 31B or 130A or 131B. In the embodiment shown in FIGS. 9, 10 and 11 of the drawings, a further concealed switching apparatus may be utilized to provide additional discretionary control over the sources of signal available for connection to the transducing apparatus.

Having now therefore fully illustrated and described our invention, what we claim to be new and desire to protect by Letters Patent is:

1. Apparatus of the class above described comprising in combination;
   a. transducing means;
   b. a housing therefor, said housing including a chamber connected to receive compressional wave energy from said transducer;
   c. a receptacle in said housing and connected to receive compressional wave energy from said chamber, said receptacle including a slidable plug receiving member, said member including an end portion to be inserted into said chamber;
   d. and means disposed in the chamber in said housing, said last named means being operative in response to engagement with the end of said plug receiving member to energize said transducing means and thereby transmit compressional wave energy from said chamber to said receptacle.

2. The apparatus of claim 1 in which the means disposed in the chamber is comprised of switching means operable to connect the transducing means to a source of signal.

3. The apparatus of claim 1 in which a further member is disposed intermediate the receptacle and the chamber, said member being comprised of resilient material and including slit portions adapted to be opened upon engagement with the end of the slidable plug.

4. The apparatus of claim 2 in which the switching means is comprised of normally open contact members that are moved to a closed, current conductive position upon engagement with the end of the slidable plug.

5. The apparatus of claim 1 in which the housing includes a pair of transducing means, a pair of receptacles and a pair of chambers disposed intermediate said transducing means and means responsive to engagement with the ends of the plug receiving members in each of the jacks for effecting compressional wave energy communication intermediate said receptacles and said chambers.

6. The apparatus of claim 5 in which magnetic flux responsive switching means connected to the transducing means and a source of signal, are disposed in the housing in proximity to the receptacles and a source of magnetic flux therefor is disposed in a plug to be inserted in said receptacles whereby said transducers may be selectively energized.

7. In apparatus of the class above-described, the combination comprising; a hollow housing including, a source of compressional wave signal, a pair of jacks and magnetic flux responsive switching means operable upon energization from a source of magnetic flux to selectively energize said source of compressional wave signal; and a headset, including plug members adapted to be inserted into said pair of jacks, said headset including a source of magnetic flux, whereby connection of said headset to said housing energized said signal responsive switching means.

8. The apparatus of claim 7 in which a further member is disposed intermediate the jacks and the inside of the housing, said further member being comprised of resilient material and including slit portions adapted to be opened upon engagement with the end of the plug members.

9. In apparatus of the class above-described the combination comprising; a hollow housing including a source of compressional wave energy in the form of transducing means to be energized form a source of signal and a pair of jacks for receiving a like pair of plugs for conducting compressional wave energy to a headset, said jacks including a compressional wave energy seal at the inner ends thereof, said seal comprised of resilient material and including slit portions operative in response to engagement by a plug to effect compressional wave energy transmission therethrough.