June 30, 1959 D. D. JONES 2,892,889

ACOUSTIC EQUIPMENT FOR AUDITORIUM SOUND SYSTEMS

Filed Nov. 1, 1957 2 Sheets-Sheet 1

FIG. 1

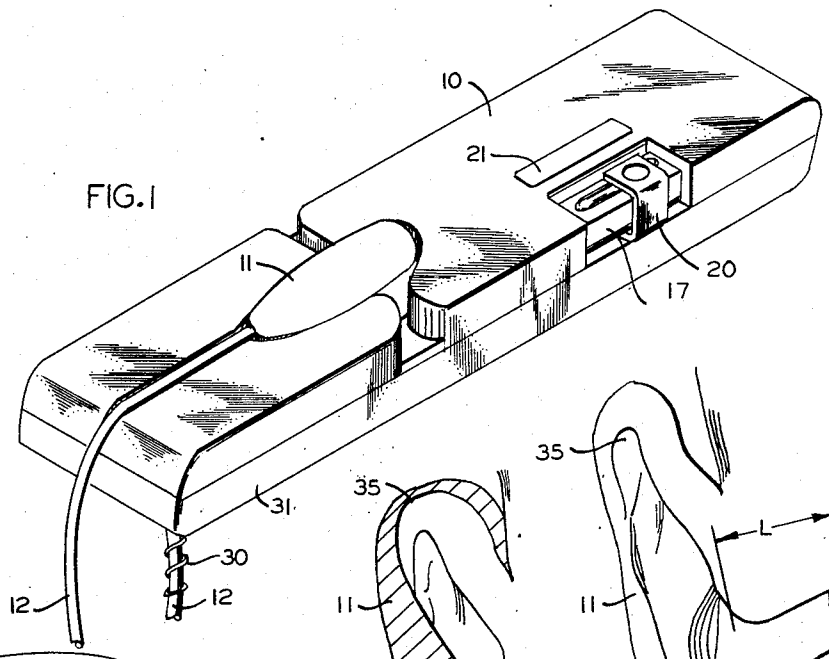


FIG. 2

FIG. 3

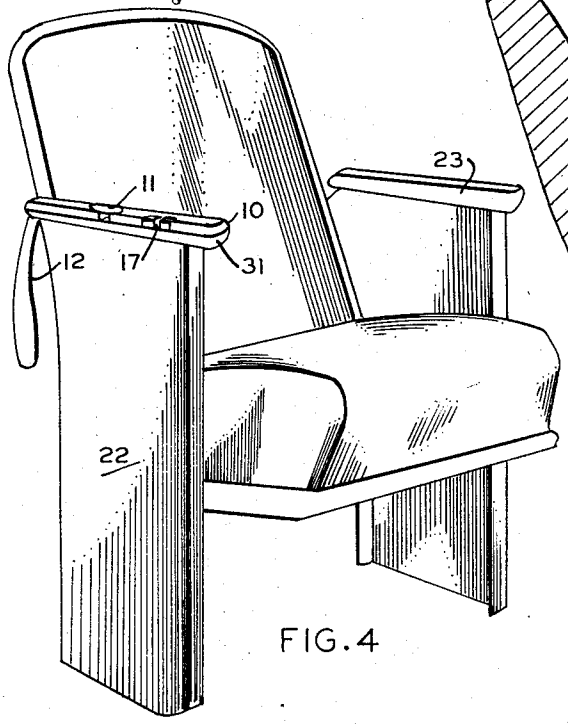
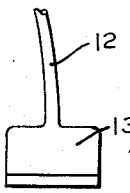


FIG. 4



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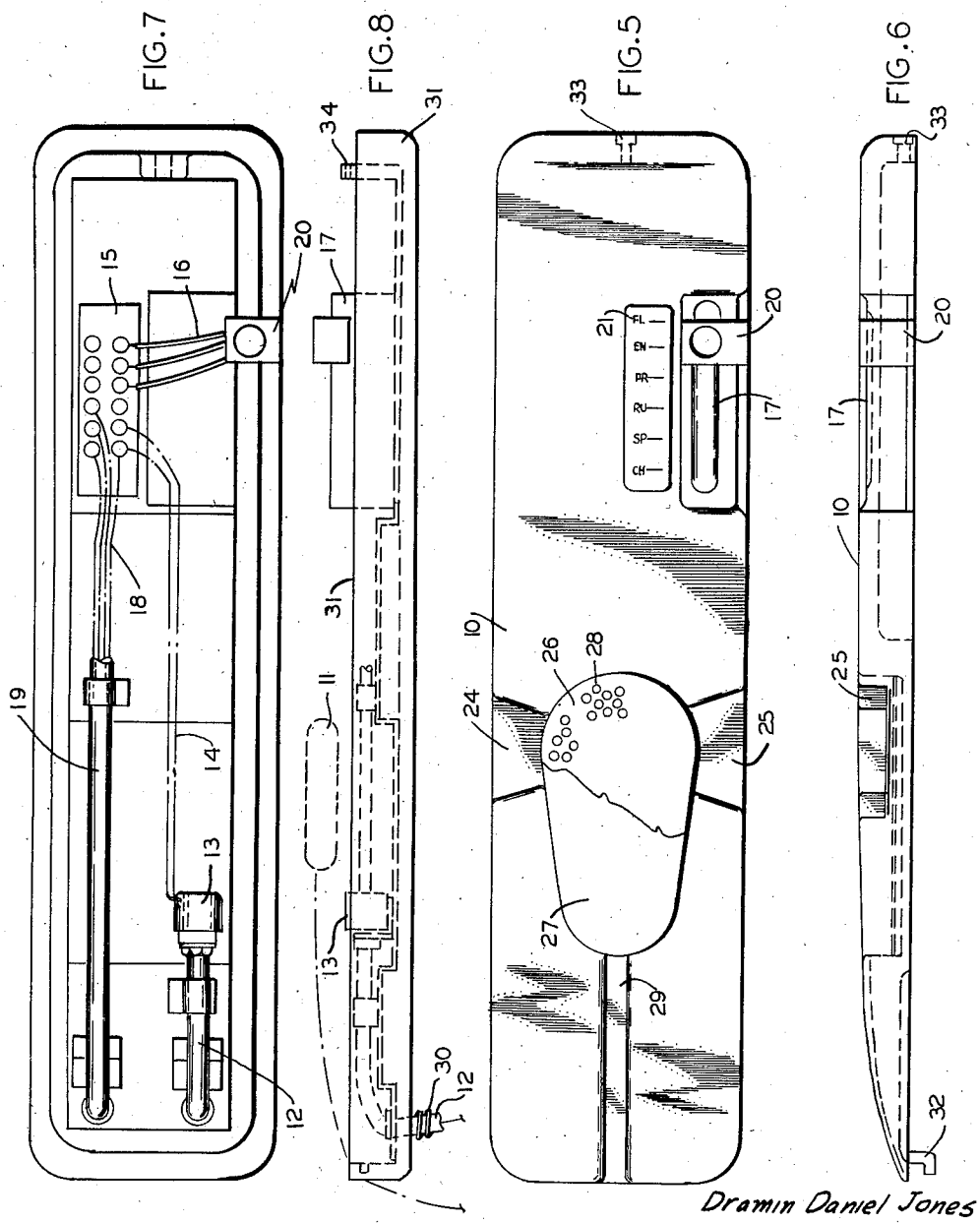
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June 30, 1959 D. D. JONES 2,892,889

ACOUSTIC EQUIPMENT FOR AUDITORIUM SOUND SYSTEMS

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ACOUSTIC EQUIPMENT FOR AUDITORIUM SOUND SYSTEMS

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Application November 1, 1957, Serial No. 694,000

3 Claims. (Cl. 179—1)

This is a continuation in part of my patent application, Serial No. 432,523, filed May 26, 1954, and relates to improvements in acoustic earset for conference application and specifically it refers to an improved acoustic earset which eliminates the old-style head phones.

Sound distribution within conference rooms equipped with facilities for simultaneous interpretation is usually accomplished by means of a wired audio system. These conference rooms, which are primarily used in the field of international diplomacy, may have capacities of from a few hundred to several thousand seats to accommodate delegates, spectators and members of the press. To provide full interpretation services, each seat must be quipped with terminal apparatus which includes headphones, channel selector switches and, in some instances, individual headphone volume controls.

Experience has shown that unless special care is exercised in the design of these terminal facilities, the acoustical operating conditions may not prove satisfactory and the physical shocks and stresses to which publicly used equipment is ordinarily exposed will result in excessive repair and replacement costs and quite possibly inferior service. Practically every contemporary simultaneous interpretation installation utilizes headphones of conventional design as listening equipment. But such headphones are not well adapted to this class of service. For example, they can not easily be integrated into the architectural scheme which may include several types of auditorium chairs and many shapes and kinds of conference tables. Conventional headphones also have too many parts which are vulnerable to loss, breakage and abuse. As a rule they are too heavy and the pressure exerted by the steel head bands against the ears is too great, causing discomfort and early fatigue to the wearer. In addition, the relatively large, unstretched and resonant diaphragm in most headphones is effectively loaded by air at frequencies above 800 cycles, and the resulting air coupling from unused but energized headphones leads to annoying acoustic residuals, air-borne crosstalk and an unfavorable acoustical environment.

A new approach to this problem has been needed, and the acoustic earset with related components disclosed in this invention are believed to have solved all the previous difficulties. The various problems mentioned have been solved by means as will be hereinafter described.

This invention rests upon a principle which in itself is old and well known, viz., the acoustic transmission of sound through tubes. Among early applications of this principle were the first mechanical phonograph and the clinical stethoscopes. The use of this old method, however, was only possible by the creation of new and novel components and new mode of operation as will be detailed in the subsequent specification and claims.

The main object of my invention is thus to provide an acoustic earset of such design that it can easily be built into existing furniture in conference rooms.

Another object of my invention is to provide an acoustic earset with related components in a simple assembly

which is adapted to replace one of the conventional arm rests of an auditorium chair.

Still another object of my invention an arm rest for auditorium chairs with built in audio receiving components and earset, acoustic or magnetic, of similar size and contour as the conventional arm rest.

An ancillary object of my invention is to provide a system of multiple built-in audio listening equipment which can be manufactured at low cost and which is rugged, simple in operation and reasonably tamper proof.

A further object of my invention is to provide an effective audio listening post in an arm rest of each chair in an auditorium, said listening equipment being of such simple construction that it will not obstruct the movement of people and that it can be easily serviced and replaced.

Other objects and advantages of my invention will be apparent during the course of the following specification and claims.

In the accompanying drawings forming a part of this specification, and in which like numerals designate like parts throughout the same,

Figure 1 represents an arm rest with built-in earset and related components embodying my invention,

Figure 2 represents a partial cross section of a human ear,

Figure 3 is a cross section through an ear with an acoustic earset attached,

Figure 4 represents an auditorium chair with an arm rest embodying my invention,

Figure 5 shows a plane view of the arm rest proper with the head set removed,

Figure 6 shows a side view of the arm rest shown in Figure 5,

Figure 7 represents a plane view of the inside of an arm rest with audio components in accordance with my invention, with the top cover removed, and

Figure 8 shows a side view of the arm rest shown in Figure 7.

In the drawings, wherein for the purpose of illustration is shown a preferred embodiment of my invention, the arm rest shown in Figure 1 has a top cover designated by the numeral **10**. An acoustic earset **11** is fitted into a recess in the arm rest **10** and an acoustic tube **12** leads from the headset **11** to a driver unit **13** mounted inside the arm rest **10**, see Figure 7. Wires **14** lead to a terminal block **15** from which wires **16** lead to a sliding type selector switch **17** which is also recessed into the arm rest **10**. Wires **18** being part of cable **19** lead back to the common amplifying equipment of the room.

The selector switch **17** has a sliding handle **20** and an engraved dial plate **21** which indicates the various languages to be selected. In Figure 4 is shown a typical auditorium chair **22** which has removable arm rests **23**. The installation of the audio listening equipment in accordance with my invention consists merely in removing one of the arm rests of each chair and replacing same with my device which is thereupon wired back to the common amplifier through a modular system of wiring such as described in my U.S. Patent No. 2,798,172, if the installation is of a temporary nature, or through regular cables and conduits if the installation is permanent. The arm rest **10** has a central recess of the shape and size of the headset **11** where the same may be nested and normally kept when not in use. The central recess has two side ports **24** and **25** to enable the user to conveniently grip the headset **11** when removing or replacing same. A central, longitudinal groove **29** leads rearwardly from the central recess and is provided to keep the acoustic tube **12** when the headset **11** is not in use.

To avoid air-borne crosstalk and annoying acoustic

residuals the bottom of the central recess in the arm rest **10** is lined with a sound energy absorbing acoustic felt **27**, over which is placed a perforated metal plate **26** with holes **28**. The perforations **28** should preferably remove about 80% of the metal. The acoustic tube **12** is protected by a metal spring **30** from breaking at the point where it enters the arm rest.

The arm rest **10** forms the cover of a lower part or wiring box in which the driver unit **13** is located and where also the selector switch **17**, terminal strip **15** and various connections are located. The top part **10** is fastened to the lower part **31** by means of the rear catch **32** and a screw **33** which is recessed into cover **10** and threaded into the projecting lip **34**. The cover **10** is preferably a molded plastic part while the lower box **31** may be either molded or made from formed metal.

In Figure 2 is shown a partial cross section of a human ear **35** with the auditory canal **36** of length "L" and diameter "D" and with the ear drum **37**. The average ear drum of a grown-up person is 0.8 cm.^{2} in area and has a diameter of 0.7 cm. while the average length of the auditory canal is 2.7 cm. with a volume of 4.0 cm.^{3}. The design of the earset shown in Figure 3 is based upon these values which makes it possible to fit all normal ears and get efficient coupling between the outlet horn of the acoustic tube **12** and the auditory canal **36**.

The operation of my invention is as follows: The audio program is sent out from a multi-channel amplifier in the customary manner and is distributed through cables to the individual chairs where the cable **19** is terminated in a terminal strip **15** from which leads connect to the selector switch **17** and the driving unit **13** which produces the sound. The sound originating in the driving unit **13** is led through the acoustical tube **12** which is dimensioned such as to give the most desirable characteristics. The tube **12** terminates in the earset **11** which is molded to conform to the average ear and which has a horn-like outlet communicating with the auditory canal of the ear. During conferences it is the practice to use simultaneous interpretation and to have as many channels as there are languages. The listener then only has to pick-up an earset from the arm rest of his chair and place same over his ear. If he is unfamiliar with the first language he hears he slides the selector switch **20** to a position where he hears the language he prefers.

It is obvious to one skilled in the art that one could substitute a magnetic earset of a similar form to the acoustic earset shown here and obtain similar results. It should be noted however that a magnetic earset would be many times heavier than the light molded acoustic unit. The user would, therefore, soon tire of the magnetic earset which would weigh heavily upon his ear. It is to be understood that the form of my invention, as here disclosed, is to be taken as a preferred example of the same and that various changes in shape, size and arrangement of parts may be resorted to, without departing from the spirit of my invention or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. An acoustic earset comprising a light, molded ear piece in combination with an acoustic tube fastened with one end to said earset; an audio driver unit fastened to the other end of said acoustic tube; a selector switch connecting said driver unit to a multi-conductor cable; a two-piece arm rest having on its top a central recess for receiving said earset, the lower part forming a housing for said driver unit and selector switch.

2. The combination of an acoustic earset comprising a light, molded ear piece, of a size and contour to fit the average human ear, and having a miniature acoustic horn capable of being efficiently coupled to the auditory canal; an acoustic tube connected to the smaller end of said miniature acoustic horn; an audio driver unit connected to the other end of said acoustic tube; a selector switch connecting said driver unit to a multi-channel audio circuit; a two-piece arm rest having on its top a central recess for receiving said earset, said recess being lined with sound absorbing acoustic material, the lower part of said arm rest forming a housing for said driver unit and selector switch.

3. The combination of an acoustic earset comprising a light, molded ear piece, of a size and contour to fit the average human ear, and having a miniature acoustic horn capable of being efficiently coupled to the auditory canal; an acoustic tube connected to the smaller end of said miniature acoustic horn; an audio driver unit connected to the other end of said acoustic tube; a selector switch connecting said driver unit to a multi-channel audio circuit; a two-piece arm rest having a removable top with a central recess for receiving said earset, said recess having a pair of side ports and having its bottom lined with sound absorbing acoustic material, said sound absorbing material being covered with a perforated plate, the lower part of said arm rest forming a housing for said audio driver unit and selector switch.

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