United States Patent

Kahn

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[54] HEADSET WITH CIRCUIT CONTROL

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[73] Assignee: **Kahn Research Laboratories, Inc.**, Freeport, Long Island, N.Y.

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[21] Appl. No.: **65,170**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 672,513, Oct. 3, 1967, abandoned, which is a continuation-in-part of Ser. No. 599,770, Dec. 12, 1966, abandoned.

[52] **U.S. Cl.** .....**179/156,** 179/1 P, 179/168, 325/361

[51] **Int. Cl.**.....**H04m 1/05**

[58] **Field of Search** .....179/167, 168, 156, 1 P; 325/16, 22, 111, 118, 361

[56] **References Cited**

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Primary Examiner—William C. Cooper

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[57] **ABSTRACT**

A headset for receiving sound derived from electrical currents. In addition to the usual earphones, the headset includes two single-pole, single-throw mercury switches which are connected in series with portions of the circuit supplying the earphones. The earphones are provided with foam plastic covers to shield the user from ambient noise. The mercury switches are mounted on the headset spring band and are operated by tilting the head of the user to the right or left side.

13 Claims, 4 Drawing Figures

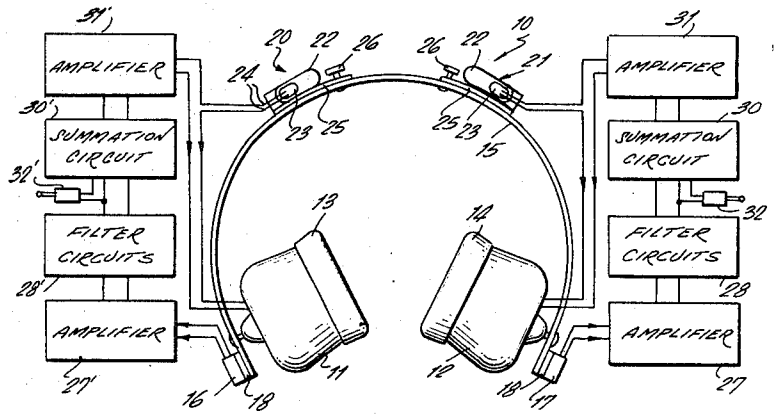


FIG. 1

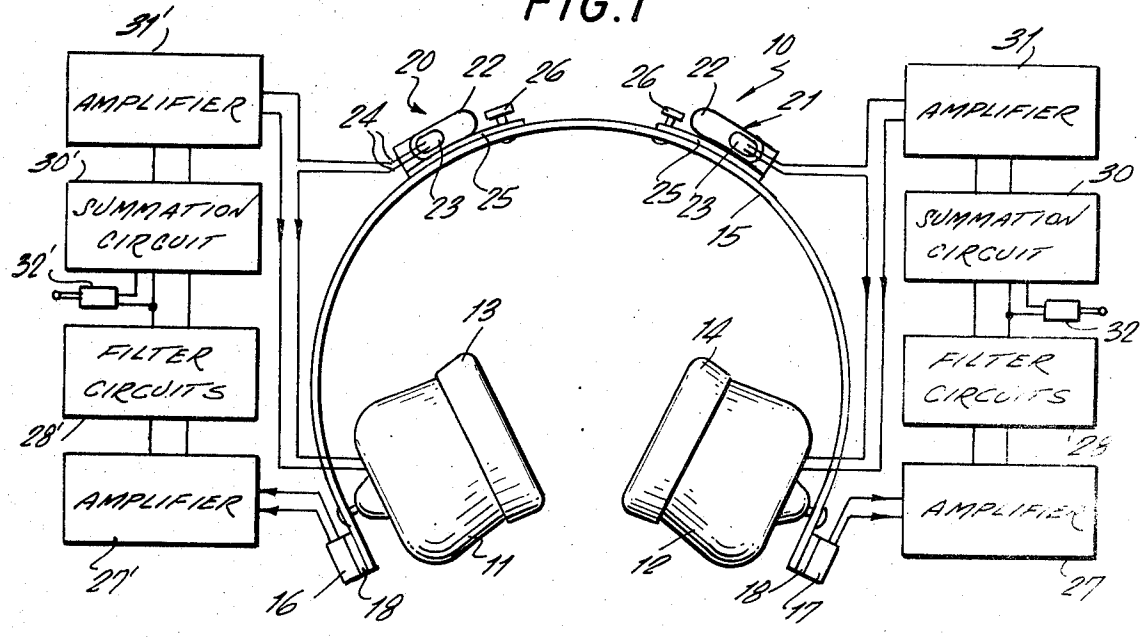


FIG. 2

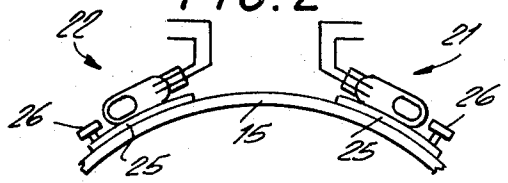
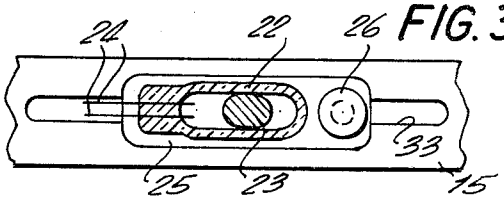


FIG. 3



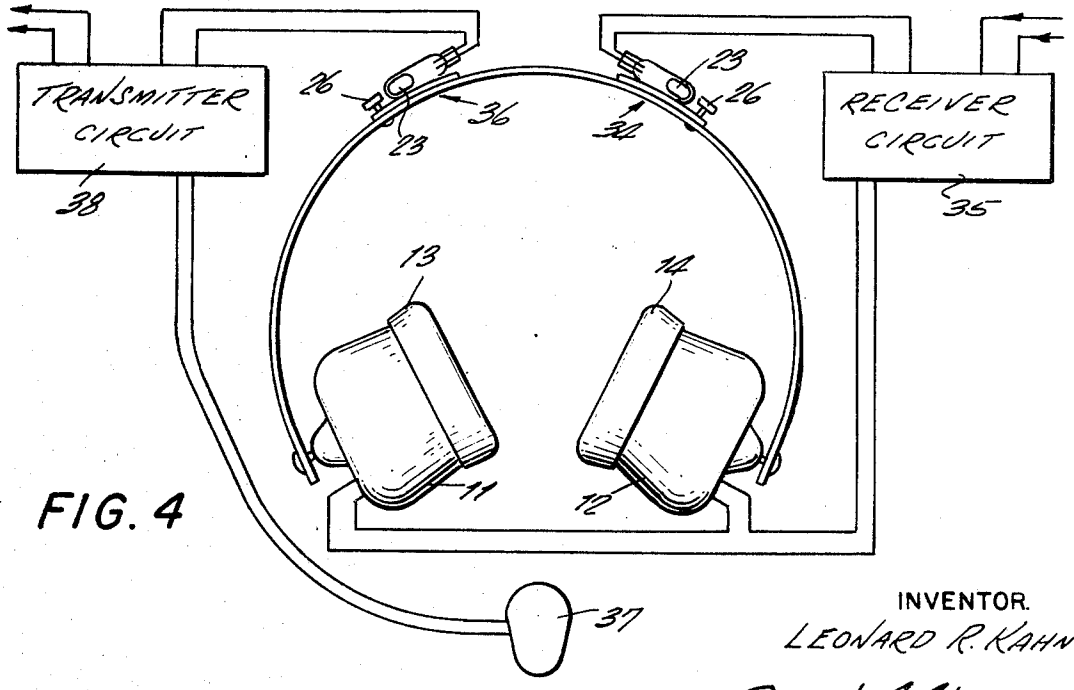


FIG. 4

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HEADSET WITH CIRCUIT CONTROL

This application is a continuation-in-part of my copending application Ser. No. 672,513, titled "Head Mounted Circuit Control System" filed Oct. 3, 1967 now abandoned, which in turn is a continuation-in-part of application Ser. No. 599,770 filed Dec. 12, 1966, also abandoned.

BACKGROUND OF THE INVENTION

In my copending U.S. application, Ser. No. 579,770, there is disclosed a hearing control system which includes filter circuits for suppressing loud ambient sounds which might be damaging to the ears or distracting to a worker engaged in serious activity. At the same time unwanted sounds are suppressed, other sounds, such as low level voice instructions can be amplified and heard. The present invention includes the filtering circuits and the microphones disclosed in the above identified application and in addition a system of head operated mercury switches is disclosed which permits the user to switch from one circuit to another by simply tilting the head to the right or left. Such an arrangement permits the user to use both hands to operate machinery, carry heavy objects, or to write a report. The filtering means may include a band pass filter which restricts the transmitted sound to a band of about 300 to 1,800 cycles per second. Such a transmitting system allows voice frequencies to pass from a microphone to an earphone with only minor frequency distortion and permits the user to understand what is being said. The filtering means may also include a narrow band twin-T filter, sometimes called a "notch" filter, for suppressing a particular frequency, such as the hum resulting from a motor or transformer.

Other modifying circuits may include a clipper circuit for limiting the amplitude of any signal applied to the earphones. This type of circuit may include two backbiased diodes which form an effective double limiter but do not distort normal volume speech sounds.

In order to converse with a person while wearing the headset disclosed herein, a pair of microphones are positioned on the headband adjacent to the earphones. The use of two microphones, one for each ear, gives the user a sense of direction of sound similar to normal hearing. By using filtering means and amplification the headset may be made to be quite sensitive to desired aural frequencies.

One of the features of the present invention is a set of two inclined mercury switches which, in one form enable the user to tilt his head to the right and thereby switch on the amplifier channel on the right. The user may tilt his head to the left and turn on the amplifier channel on the left side. Or, the user may keep his head erect and hear through both right and left channels.

Another feature of the invention include the right and left channel switching means as described above but when the head is held erect, both right and left channels are cut off (see FIG. 4), and the headset serves to keep out ambient noise.

Another feature of the invention resides in the use of the two mercury switches to turn on a transmitting circuit (line or wireless) when the head is tilted to one side, and then turn on a receiving circuit when the head is tilted to the other side. When the head is held erect, both transmitting and receiving circuits are off. A single microphone is added to this circuit and is secured to a curved support, fastened to either the headset or to a pad on the chest.

For a better understanding of the present invention, together with other details and features thereof, reference is made to the following description taken in connection with the accompanying drawings.

FIG. 1 is a side view of the headset showing the position of the two mercury switches both in the "on" position, and showing the associated circuits in block.

FIG. 2 is a side view of a portion of the headset showing two mercury switches both in the "off" position.

FIG. 3 is a plan view of one of the mercury switches, to an enlarged scale, indicating the attachment means to the spring band of the headset.

FIG. 4 is a side view of an alternate use to which the headset may be employed.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. 1, 2 and 3, the headset **10** includes the usual earphones **11** and **12** provided with soft, yielding caps **13, 14** which conform to the surface of the head and keep out almost all of the ambient noise. Inside the earphones **11, 12** are the usual magnetic coils and diaphragms which convert electrical energy into sound. The earphones are secured to the ends of a spring headband **15** which enables the user to apply the headset to his head with the caps **13, 14** positioned over each ear.

Also secured to the headband are two microphones **16** and **17**, each mounted adjacent to an earphone. The microphones are for picking up ambient noise and sending the resultant electrical vibrations to circuit means and the earphones. In order to reduce the possibility of vibrational feed-back, the microphones **16, 17** should be mounted on a sound-deadning support **18**, such as felt or sponge rubber.

A pair of mercury switches **20, 21** are mounted on the headband **15** near the center thereof but separated by a space which insures that the switches will normally lie at an angle to the horizontal. Each switch includes a glass enclosure **22** holding a small quantity of mercury **23**. Two conductive wires **24** (see (FIG. 3) are sealed in the glass wall and comprise the switch leads. Each switch is mounted on a base **25** and the base is held in position by a nut and bolt **26**. In FIG. 1, the switches are mounted with the conductors lower than the other end of the glass envelope. This mounting insures that both switches **20, 21** will be closed when the head of the operator is held erect. The head of the operator may be moved through a considerable angle without disturbing the liquid mercury drops as long as the head is not tilted to the right or left. The operator may move his head forward to read a report held in the hand or he may look up to read a sign posted on a wall. The mercury switches still remain closed. When the operator tilts his head to the right, the mercury globule **23** moves to the right hand side of the glass envelope and the circuit through the switch is broken. A simmilar action occurs when the operator's head is tilted to the left and switch **21** is opened.

With the sponge caps **13** and **14** arrange to eliminate all ambient sound, means must be provided to pick up sound vibrations, transform them to electric waves, and

then apply the waves to the earphones. The microphone **17** is connected to a preamplifier **27**, then to a collection of filter circuits **28** where certain unwanted frequency waves are eliminated, then to a summation circuit **30** and finally to an amplifier **32** which boosts the currents to values that are most desirable for the earphone **12**. The wiring diagram shown in FIG. **1** has switch **21** connected in series between the second amplifier **31** and the earphone **12**. This position is preferred because there is less noise generated when the switch **21** is opened and closed. However, the switch **21** may be placed anywhere in the electric circuit and, if desired, connected so that it opens and closes one of the power supply conductors in the amplifier circuits.

The use of earphones for suppression of ambient noise permits the connection of the amplifier circuit to other electrical lines of communication. For this purpose, a jack **32** is provided. This jack **32** can be plugged into a telephone line, a broadcast radio receiver set, or an interoffice interphone system, all without removing the headset. The summation circuit **30** is designed to join the electrical currents from each source in an efficient manner. The summation circuit may include a transformer or a series of resistors.

The filtering circuits shown in block **28** are of two kinds. One is the well known band-pass type which eliminates all the frequencies below 300 hertz and above 2,500 hertz. Frequencies between these limits are passed to the earphone and permit the user to understand what is being said. This restricted band may eliminate some of the natural quality of the spoken words but they will not be understood. Another type of filter which can be used in this circuit is the twin-T or "notch" filter. This circuit uses only resistors and capacitors and can be designed to suppress a single narrow band of frequencies. If the user is in a space or locality where there is a steady loud hum from a motor or revolving machine, the notch filter can be tuned to suppress it. Even if the hum has a frequency within the desired range of 300 to 2,500 hertz, it can be eliminated by a notch filter without degrading the quality of speech too much because the notch filter removes only a very small band of frequencies from the spectrum. Further details of the twin-T filter may be found in *REFERENCE DATA FOR RADIO ENGINEERS* published by International Telephone and Telegraph Corp., 1964, page 270.

The left earphone **11** is connected to the same circuit elements as the right earphone **12**. The microphone **16** picks up the sound and it is amplified and filtered as described above, then applied to earphone **11**. Tipping the head to the left removes the globule of mercury **23** in switch **21** and the person can then hear only through the left circuit system.

FIG. **3** shows one way of mounting the mercury switch. A slot **33** is cut in the spring band **15** and the switch may be moved along the slot by opening the nut **26**. Moving the switches closer to the top of the head lowers the angle at which the head must be tilted in order to open and close the switches. If its is desired to reverse the switches as shown in FIG. **2**, then when the head is erect, both switches are open and the user hears nothing. By tilting the head to the right, the left switch is closed and the user hears through the left electrical system. Tilting the head to the left activates the right hand system.

The system of mercury switches can be adapted to other switching means. FIG. **4** illustrates an application where the headset can be tilted to the left and switch **34** closed to activate a receiver circuit **35**. This receiver circuit **35** may be connected to a demodulator and radio antenna or it may be a local wire line. During the time that the user is receiving signals from circuit **35**, the mercury switch **36** is open. When the operator wishes to send a message, the headset is tilted to the right, closing switch **36** and opening switch **34**. The operator now talks into a microphone **37** and the sound waves are transformed into electric waves, then used to modulate a carrier wave and finally sent out to a distant location by means of a transmitter circuit **38**. The same filtering and summation circuits as described in connection with FIG. **1** can be used with the system shown in FIG. **4**.

It will be apparent that the head movements employed in the present invention are easily controlled side to side movements which are not tireing and do not interfere with activities such as writing, reading etc. In addition, various arrangements of the switches and circuits are possible without departing from the spirit of the invention. For example, a single mercury switch could be used to receive messages when the head is tilted and to permit all ambient sound to be cut off by the headset when the user's head is erect.

Having thus fully described the invention, what is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A headset which includes two earphones comprising: two mercury switches mounted on the headset and arranged to open and close when the headset is tilted to the right or left by a person having the headset mounted on his head; a first transmission circuit connected to one of the earphones and one of the mercury switches for energizing the first circuit when the switch is closed; a second transmission circuit connected to the other of said earphones and the other mercury switch for energizing the second circuit when the other switch is closed; each of said transmission circuits including at least one amplifier and at least one electrical wave filter for eliminating noise and frequency waves outside a desired frequency pass-band.

2. A headset as claimed in claim **1** wherein two microphones are secured to the headset, each of said microphones being connected respectively to one of said transmission circuits to pick up ambient sounds.

3. A headset as claimed in claim **2** wherein each of said microphones is mounted adjacent to an earphone on a portion of the head band.

4. A headset as claimed in claim **3** wherein each of said microphones is secured to the headband by a sound deadening material to eliminate mechanical vibrational feedback.

5. A headset as claimed in claim **1** wherein said wave filters each pass only frequency waves within the range of 300 to 2,500 hertz.

6. A headset as claimed in claim **1** wherein said transmission circuits each include a suppression type filter for suppressing a sound composed of a narrow band of frequency waves.

7. A headset as claimed in claim 1 wherein one of the transmission circuits is a radio receiving circuit and the other transmission circuit is a radio transmitting circuit.

8. A headset which includes at least one earphone carried by a flexible head conforming band comprising: at least one mercury switch mounted on the headset and arranged to open and close when the headset is tilted to the right or left by the lateral motion of the head of the user, at least one transmission circuit connected to an earphone, and a mercury switch for supplying current to the transmission circuit when the switch is closed, said transmission circuit including at least one amplifier and at least one electrical wave filter for eliminating noise and frequency waves outside a desired frequency pass-band.

9. A headset as claimed in claim 8 wherein each of said mercury switches are adjustably mounted on said flexible band whereby they may be turned from a normally on to a normally off position.

10. A headset as claimed in claim 9 wherein said mercury switches are adjustably mounted on the head band so as to be open when the headset is held erect.

11. A headset as claimed in claim 8 wherein said earphones are each housed in a sound deadening material such as foam rubber to eliminate ambient sounds.

12. A headset as claimed in claim 11 wherein said mercury switches are adjustably mounted on the head band so as to be closed when the head set is held erect.

13. A headset which includes at least one earphone carried by a flexible head conforming band comprising: a mercury switch mounted on the headset and arranged to open and close when the headset is held erect upon the user's head or tilted to one side; a transmitter-receiver circuit connected to the earphone in series with the mercury switch for energizing the receiver portion of said circuit when the head is held erect, and for energizing the transmitter portion of said circuit when the head is tilted to one side.

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