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S. S. BRODY

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VOICE OPERATED INTERCOMMUNICATION SYSTEM

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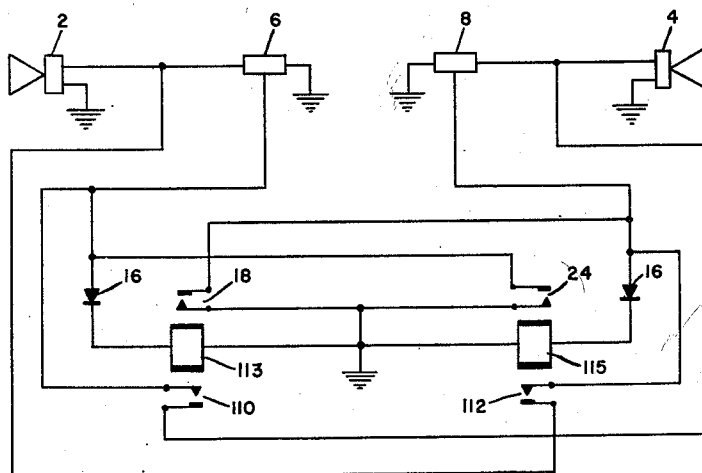
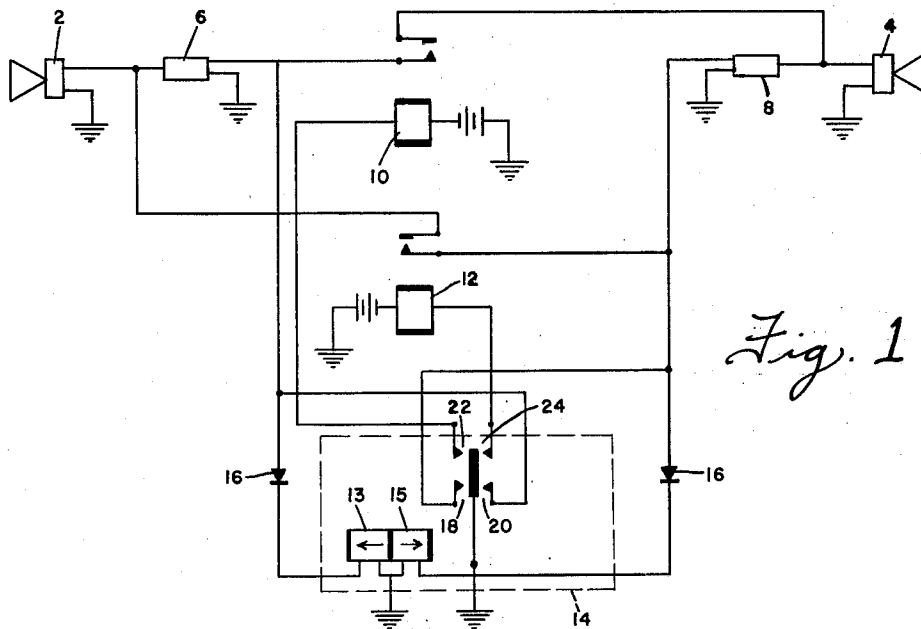


Fig. 2

INVENTOR
STANLEY S. BRODY

BY

R. J. Tompkins
ATTORNEYS

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VOICE OPERATED INTERCOMMUNICATION SYSTEM

Stanley S. Brody, Brooklyn, N. Y.

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The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The present invention relates in general to intercommunication systems and more particularly to an intercommunication system that is controlled by the operator's voice.

Equipment that is utilized to facilitate the exchange of conversation between prearranged locations imposes rigid operational restrictions upon the manufacturers and users of the equipment. One of the major defects of an intercommunication system is the well known effect of feedback with the resultant high pitch noise. All conventional intercommunication systems contain a microphone, an amplifier and a speaker. The audible energy that impinges upon the microphone, is converted into electrical energy. The electrical energy at the output of the microphone is then inserted into an amplifier to increase the level of the electrical energy to a new value without any alteration in the type or the graphic form of the energy wave. The output of the amplifier is then fed to a speaker where the electrical energy is converted back into the original form of audible energy at an increase in energy level. If the output of the speaker were to be inserted into the microphone, the new output would be at a greater energy level. The cycle of increasing the energy input and greater speaker output would continue until the amplifier reached saturation. The end result of the above type of feedback and saturation is a loud high pitch tone that emits from the speaker.

Feedback will occur whenever the speaker and the microphone of a system are in close proximity to each other. The energy wave from the speaker can cause feedback by entering the microphone directly or indirectly.

Numerous methods have been devised to counteract the objectional effect of feedback. They usually encompass complicated, expensive and sensitive equipment and circuit arrangements that result in high initial costs, high failure rate and increased maintenance costs. Many of the devised methods decrease, rather than eliminate, the possibility of feedback.

One of the common methods that is utilized to eliminate the possibility of feedback is the use of a "talk-listen" key that is operated by the user to conform with the act being performed. The operation of a "talk-listen" key is objectional in that the user must develop a certain amount of coordination to carry on a conversation. This type of intercommunication system requires the use of the operator's hand thus preventing him from doing all but the most elementary duties while talking into the intercommunication system.

This invention incorporates two transducers that function as speakers or microphones wherein, when one transducer performs as a speaker, the other transducer performs as a microphone. Each transducer is connected

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to the input of an amplifier and, through a relay, to the output of the other amplifier. A differential relay that is connected to the output of each amplifier through a rectifier, determines the transducer that shall perform as a speaker and the transducer that shall perform as a microphone. At any particular instant during the operation, one amplifier will be operating into a transducer that functions as a speaker while the output of the other amplifier will be grounded to prevent feedback and will be disconnected from all transducers.

To operate, the user talks into one of the transducers. A differential relay that is triggered by the output of the activated amplifier, automatically connects the second transducer to the output of the activated amplifier, grounds the output of the other amplifier and removes the transducer from the output of the grounded amplifier. The differential relay is of the quick-make, slow-break type so that the operating amplifier will remain operative during the short pauses that are common to normal speech.

It is a general object of the present invention to provide an intercommunication system that is completely free of the effect of feedback.

It is another object to present an intercommunication system wherein the switching is performed automatically.

An additional object is to provide an intercommunication system that will allow a two-way conversation without requiring the user to manually operate any control device.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein;

Fig. 1 is a block and schematic diagram of the invention wherein the switching is performed by three relays, one of which is a differential relay and

Fig. 2 is a block and schematic diagram of a modified form of the invention wherein the switching is performed by two relays.

Referring to Fig. 1, permanent magnet speakers or transducers 2 and 4 are of conventional design and construction well known in the art. The amplifiers 6 and 8 are also of conventional design.

Each speaker or transducer 2 and 4 is capable of operation either as a transmitter or as a receiver. Such speakers are old in the art. The voice coil of each speaker is connected to the input of a corresponding amplifier 6 or 8, respectively. The outputs of amplifiers 6 and 8 are each connected to a corresponding speaker through the normally open contacts of the relays 10 and 12, respectively. The relays 10 and 12 connect the appropriate transducer to the output of the proper amplifier at the required instant. The output of the amplifier 6 is also connected to operate one side 13 of a differential relay 14, through a rectifier 16. The differential relay is of the normally open type. The output of the amplifier 6 is also connected directly to ground 3 through the normally open contacts 20 of side 15 of the differential relay 14. The output of the amplifier 8 is connected to operate the other side 15 of the relay 14 through a similar rectifier unit. The output of the amplifier 8 is also connected directly to ground 3 through the normally open contacts 18 of the side 13 of the relay 14. The circuits of the coils of the relays 10 and 12 are completed when connected to ground through another pair of normally open contacts 22 and 24 respectively of the relay 14.

To operate this invention, the amplifiers 6 and 8 are turned on. The transducers 2 and 4 are conveniently located at the desired locations that are usually known as stations. When the apparatus or station is in the

"stand-by" or "ready-to-be-used" condition, all the contacts of relays 10, 12 and 14 are open. At the instant somebody speaks into the transducer or transmitter and receiver 2, the intelligence is converted into electrical energy and amplified by the amplifier 6. The output of the amplifier 6 actuates the side 13 of the relay 14 through the action of the rectifier 16. The closing of the contacts 18 and 22 of the relay 14 grounds the output of the amplifier 8 and actuates the relay 10. The closing of the contacts of the relay 10 connects the output of the amplifier 6 to the other transducer 4. At this instant, the direction of intelligence is from transducer 2 to transducer 4 through amplifier 6. At this point the output of the amplifier 8 is grounded, thus preventing feedback and making the transducer 4 completely serviant to the transducer 2. The transducer 2 is not connected to the output of the amplifier 8 because relay 12 is open at this time, but performs as a microphone for the amplifier 6. The relay 14 is of the quick make, slow break type so that the transducer 2 will retain control during the short pauses that occur during normal conversation. The transducer 4 can never gain control while the transducer 2 has control. The contacts 18 and 22 of the relay 14 and the contacts of the relay 10 open when the flow of intelligence into the speaker 2 stops for a time interval that is equal to or greater than the drop-out time of the relay 14. When this condition occurs, the transducer 2 can regain control, or the transducer 4 can take control and make the speaker 2 the serviant transducer. The relay 12 and side 15 of the relay 14 operate in the same sequence and manner as the relay 10 and side 13 operate.

The form of invention shown in Fig. 1 may be constructed in a modified form, such as shown in Fig. 2. For example, the relay 14 may be in the form of two separate relays 113 and 115 of the quick-make-slow-break type instead of one differential type of relay. The relays 10 and 12 may be eliminated by adding another set of normally open contacts 110 and 112 to the relays 113 and 115. It is also obvious that one of the amplifiers 6 or 8 may be eliminated from the circuit by the utilization of the proper switching means (not shown).

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A voice operated intercommunication system comprising a plurality of transducers of the transmitting and receiving type, a plurality of amplifiers connected to said transducers, means connected to the output sides of said amplifiers to ground the outputs of all but one of the amplifiers to prevent signal generation feedback and means to connect the transducers of the grounded amplifiers to the output of the ungrounded amplifier, said grounding means and said transducer-connection means being actuated by the output of the ungrounded amplifier to form a communication circuit comprising the transducer which receives the voice energy, the ungrounded amplifier and the transducers which are connected to the output of the ungrounded amplifier.

2. A voice operated intercommunication system having a sending and a receiving station comprising a first and a second transducer of the transmitting and receiving type, a first amplifier coupled to receive a signal from said transducers, a second amplifier coupled to receive a signal from said transducers, a ground, and means to couple the output of said first amplifier to said second transducer and the output of said second amplifier to said ground, so that a communication circuit is formed comprising said first transducer acting as a microphone, said first amplifier and said second transducer acting as a speaker, said output-coupling means being actuated by the output of said first amplifier when said first transducer is receiving voice energy.

3. A voice operated intercommunication system having a sending and a receiving station comprising a first transducer of the transmitting and receiving type to generate a signal, a second transducer of the transmitting and receiving type, a first amplifier coupled to receive the signal from said first transducer, a second amplifier coupled to receive a signal from said second transducer, a ground, and a relay coupling the output from said first amplifier to said second transducer and the output of said second amplifier to said ground when said first transducer is receiving voice energy, and coupling the output from said second amplifier to said first transducer and the output of said first amplifier to ground when said second transducer is receiving voice energy, so that speaking into either of said transducers automatically forms a communication circuit comprising the energy-receiving transducer operating as a microphone, its associated amplifier and the other transducer operating as a speaker.

4. A voice operated intercommunication system having a sending and a receiving station comprising a first transducer of the transmitting and receiving type, a first amplifier coupled to said transducer to generate an amplified signal, a second transducer of the transmitting and receiving type, a second amplifier coupled to said second transducer to generate an amplified signal, first and second rectifiers coupled to receive such amplified signals and to convert a portion of such signals to direct current, a ground, and switching means coupled to said first and second transducers and amplifiers, said first and second rectifiers and said ground, said switching means being selectively actuated by the output of either one of said amplifiers, whose associated transducer is receiving voice energy, to ground the output of the other amplifier and to form a communication circuit comprising the energy-receiving transducer operating as a microphone, its associated amplifier and the other transducer operating as a speaker.

5. A voice operated intercommunication system having a sending and a receiving station comprising a first transducer of the transmitting and receiving type, a first amplifier coupled to said transducer to generate an amplified signal, a second transducer of the transmitting and receiving type, a second amplifier coupled to said second transducer to generate an amplified signal, first and second rectifiers coupled to receive such amplified signals and to convert a portion of such signals to direct current, a ground, and a differential relay coupled to said first and second transducers and amplifiers, said first and second rectifiers and said ground, said differential relay being selectively actuated by the output of either one of said amplifiers, whose associated transducer is receiving voice energy, to ground the output of the other amplifier and to form a communication circuit comprising the energy-receiving transducer operating as a microphone, its associated amplifier and the other transducer operating as a speaker.

6. A voice operated intercommunication system having a sending and a receiving station comprising a first transducer of the transmitting and receiving type, a first amplifier coupled to said transducer to generate an amplified signal, a second transducer of the transmitting and receiving type, a second amplifier coupled to said second transducer to generate an amplified signal, first and second rectifiers coupled to receive such amplified signals and to convert a portion of such signal to direct current, a ground, a differential relay coupled to said first and second amplifiers and to said ground to selectively feed the outputs of said amplifiers to ground and means coupled to said differential relay to feed the outputs of said amplifiers to said transducers, said last-named means being actuated by operation of said differential relay which, in turn, is actuated by the output of either one of said amplifiers whose associated transducer is receiving voice energy, so that speaking into either of said trans-

ducers automatically forms a communication circuit comprising the energy-receiving transducer operating as a microphone, its associated amplifier, and the other transducer operating as a speaker, while grounding the output of the other amplifier.

7. A voice operated intercommunication system having a sending and a receiving station comprising a first transducer of the transmitting and receiving type to generate a signal, a first amplifier coupled to said first transducer to receive the generated signal, a first rectifier coupled to the output of said first amplifier to convert a portion of the output signal to direct current, a second transducer of the transmitting and receiving type, a second amplifier coupled to said second transducer, a second rectifier connected to the output of said second amplifier to convert a portion of the output signal to direct current, a ground, a first relay having a coil connected to receive a direct current from said first rectifier and having two sets of normally open contacts, one set connected between the output of said first amplifier and said second transducer and the other set connected between the output of said second amplifier and ground, and a second relay having a coil connected to receive direct current from said second rectifier and having two sets of normally open contacts, one set connected between the output of said second amplifier and said first transducer and the other set connected between the output of said first amplifier and ground, so that speaking into either of said transducers actuates the relay whose coil is connected to the rectifier which receives the output signal of the amplifier associated with the energy-receiving transducer, whereby the output of the other amplifier is grounded and a communication circuit is formed comprising the energy-receiving transducer operating as a microphone, its associated amplifier and the other transducer operating as a speaker.

8. A voice operated intercommunication system having a sending and a receiving station comprising a first amplifier, a first transducer of the transmitting and receiving type coupled to said first amplifier to generate and feed a signal to said first amplifier, a rectifier coupled to the output of said first amplifier to convert a portion of the output signal to direct current, a second amplifier, a second transducer of the transmitting and receiving type coupled to said second amplifier to generate and feed a signal to said first amplifier, a rectifier coupled to the output of said second amplifier to convert a portion of the output signal to direct current, a ground, a differential relay having a pair of coils each connected to one said rectifier and to ground and having two sets of normally

open contacts, a second relay having a coil connected to one of the sets of contacts on said differential relay and having a set of normally open contacts connected between one of said transducers and the output of its non-associated amplifier, a third relay having a coil connected to the other of the sets of contacts on said differential relay and having a set of normally open contacts connected between the other of said transducers and the output of its non-associated amplifier, said differential relay being actuated by the output signal from one of said amplifiers whose associated transducer is receiving voice energy, the actuation of said differential relay in turn actuating said second and third relays, so that speaking into either of said transducers automatically forms a communication circuit comprising the energy-receiving transducer operating as a microphone, its associated amplifier and the other transducer operating as a speaker, while grounding the output of the other amplifier.

9. A voice-operated intercommunication system comprising in combination: at least two transducers of the transmitting and receiving type; at least two amplifiers, each connected to a different one of said transducers; and switching means connected to said amplifiers and said transducers for selectively disabling one of said amplifiers when the transducer associated with the other said amplifier is receiving voice energy and for connecting the non-utilized transducer at that time to the output of the non-disabled amplifier, said switching means being actuated by output signals from the amplifier whose associated transducer is receiving voice energy.

10. A voice-operated intercommunication system comprising, in combination: at least two transducers of the transmitting and receiving type; at least two amplifiers, each connected to a different one of said transducers; and switching means connected to said amplifiers and said transducers for selectively grounding the output of one of said amplifiers when the transducer associated with the other said amplifier is receiving voice energy and for connecting the non-utilized transducer at that time to the output of the ungrounded amplifier, said switching means being actuated by output signals from the amplifier whose associated transducer is receiving voice energy.

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