

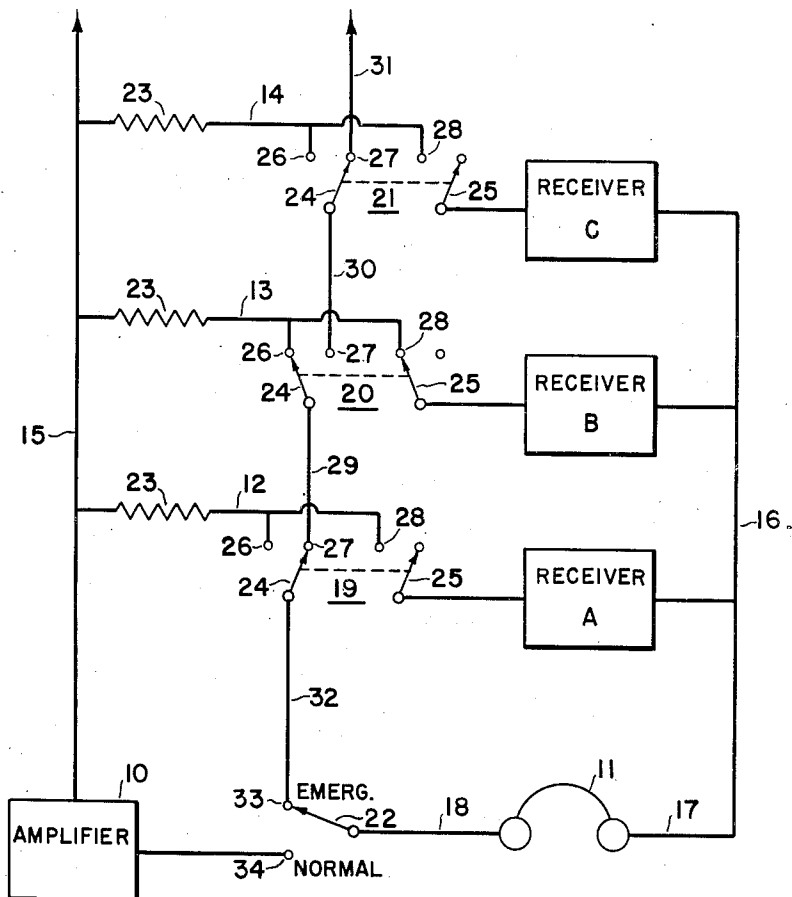
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SWITCHING SYSTEM

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SWITCHING SYSTEM

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This invention relates to an electrical switching system and more particularly to an interlocking switching system which allows a circuit to be selectively completed through any one of a plurality of channels while prohibiting the possibility of its completion through more than one of such channels at one time.

Such a system is particularly useful in an aircraft radio receiving system in which there is incorporated a plurality of receiver channels and listening stations. In military and airline operations of large aircraft it is necessary to make available to a number of crew members the output of a plurality of radio receivers. It is customary to provide four listening stations and for military purposes a larger number may be required. It is desirable to provide facilities by which the crew member at each listening station may select any one of the receiver channels or any desired combination of a plurality of such channels for connection to his head phones. At the same time it is necessary to prevent the generation of cross talk between a plurality of receiver channels connected to a single set of head phones in order to allow unimpaired reception at other listening stations over any of the receiver channels involved.

In order to prevent such tying together of receiver output transformers as would produce unwanted cross talk, a high value attenuating resistor has been placed in series with the audio lead from each receiver. The audio signal is then brought back to its original level by the use of an individual crew member amplifier at each listening station. However, the use of this expedient introduces the danger that failure of an individual amplifier may leave the crew member at the station affected isolated from all radio communication.

It is, therefore, necessary to provide some means of emergency reception at each listening station which will allow the individual amplifier and the attenuating resistances to be eliminated from the receiver circuit, while still precluding the inadvertent tying together of receiver output transformers by the selection of more than one receiving channel by the crew member.

In solving this problem several requirements must be met. Complicated additional wiring and the introduction of long leads with their inherent tendency to introduce cross talk into the system, should be avoided. Extra switches should be avoided, if possible, since these take up valuable space on the mixing panel, and if placed elsewhere may be inaccessible to the crew member

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when needed. Any switching arrangement used should be simple of operation and lend itself to fool proof manipulation in the dark. Any system adopted should allow each crew member the full range of choice of receiver channels.

It is an object of this invention to provide a switching arrangement for the multi-channel radio receiving system which will permit the connection of a listening station to any one of said receiver channels while precluding its connection to more than one of said channels at one time.

It is another object of this invention to provide such a system which requires very little additional wiring and no switches on the mixing panel other than those utilized for conventional receiver channel selection and mixing purposes.

It is a further object of this invention to provide such a system which employs only switches of the two-position variety and which thus can be manipulated in darkness without danger of error.

It is still another object of this invention to provide a switching system which will permit the completion of a circuit through any one of a plurality of available circuit branches while preventing the completion of a circuit through more than one of said branches at one time.

The objects and advantages of the invention are obtained by the use, at each crew member's listening station, of a switching system comprising a double pole, double throw, switch in each of the receiver output circuits. The switches are so connected to each other and to the crew member's head phones, the latter connection being made through an emergency switch connection, that each switch when in its "on" position, connects its respective receiver channel to the crew member's head phones and opens the switch interconnection leading to the next switch in the series of interconnected switches. Thus no receiver channel can be connected to the crew member's head phones unless all the switches in the series of interconnected switches between it and the head phones are in the "off" position. This precludes the possibility of any simultaneous connection being established between the head phones and a plurality of receiver channels.

Other objects and advantages of the invention will become apparent from a consideration of the following specification when taken in conjunction with the accompanying drawings, the single figure of which is a schematic diagram of a circuit embodying the invention.

Referring now more particularly to the drawing, there is illustrated a portion of an aircraft radio receiving system comprising three receivers

A, B and C, an amplifier 10 and a pair of head phones 11. The receivers A, B and C are connected in parallel by the branch circuits 12, 13 and 14 across bus leads 15 and 16. The bus 15 is connected to amplifier 10 and the bus 16 is connected to the head phones 11 by conductor 17. The other side of the head phones 11 is connected by conductor 18 to the output of amplifier 10. Located in the conductor 18 is a single-pole, double-throw switch 22 having terminals 33 and 34. Located in the branch circuits 12, 13 and 14 are double-pole, double-throw switches 19, 20 and 21 respectively. Also located in each of the branch circuits is an attenuating resistor 23.

During the normal operation of the receiving system, with the arm of the switch 22 contacting the terminal 34, the head phone circuit is completed through the amplifier 10 and any of the receivers A, B and C which are, either by choice or inadvertence, connected into the circuit by means of their respective switches 19, 20 and 21. This enables the crew member using the head phones 11 to listen to any or all of the receivers A, B and C as desired. When more than one receiver is being listened to, the tying together of their output transformers, with resultant cross talk as far as other crew members are concerned, is prevented by the provision of the attenuating resistors 23 in the receiver audio output circuits. Each of these resistors is of sufficient value to reduce the signal by a substantial amount, say 25 db. Since tying together of two receiver output transformers can occur only after signal attenuation in two of the resistors, any cross talk which occurs will be below the audible level.

The circuit arrangement and operation thus far described are those pertaining to the normal functioning of the receiving system. However, in the event the amplifier 10 should cease to function, the crew member using headphones 11 and the portion of the circuit thus far described, would be isolated from radio reception.

According to the invention, means are provided for selectively connecting any desired one of the receivers directly to the head phones, which means will now be described.

As far as the operation of the circuit as described above is concerned, single-pole, double-throw switches would suffice for the switches 19, 20 and 21. However, for emergency operation, the double-pole switches are provided as illustrated. Each switch comprises switch arms 24 and 25, front contacts 26 and 28 and a back contact 27. The contacts 26 and 28 are connected to the respective branch circuit in which the switch is installed. The switch arm 25 is connected to the respective receiver in that branch circuit.

The switch 22 is provided with a contact 33 forming a part of the emergency circuit. A conductor 32 connects the contact 33 with the switch arm 24 of the switch 19. The back contact 27 of switch 19 is connected by a lead 29 to the switch arm 24 of the switch 20. The back contact 27 of the switch 20 is connected to the switch arm 24 of the switch 21 by a lead 30. A lead 31 may extend from the back contact 27 of the switch 21 to the switch arm of the next switch, should there be another receiver in the system.

With switches 19, 20 and 21 in the "off" position and the switch 22 in the emergency position, the amplifier 10 and the attenuating resistors 23 are eliminated from the circuit and a series connection is established through the switches

19, 20 and 21. With this circuit established, any one of the receivers may be connected to the head phones 11 by shifting its double-pole switch to the "on" position.

In the drawing the switch 20 is shown in the "on" position, establishing a circuit including the receiver B. Placing the switch 20 in the "on" position breaks the interconnection between switches 20 and 21, thus rendering it impossible to connect receiver C into the circuit by placing switch 21 in the "on" position. Likewise, if switch 19 should be shifted to the "on" position, the interconnection between switches 19 and 20 would be broken, removing receiver B from the circuit.

While the switching system has been shown and described as a part of an aircraft radio receiving system, it should be realized that its use is not confined to such systems, but that it is capable of general application in situations in which it is desired to provide for the selective completion of a circuit through any one of a number of branches, while eliminating the possibility of the establishment of a circuit through more than one of said branches at one time.

Furthermore, while only one embodiment of the invention has been shown and described, changes of circuit arrangement falling within the scope of the invention will suggest themselves to those skilled in the art. It is accordingly to be understood that the scope of the invention is not to be considered as restricted to the embodiment disclosed herein.

What is claimed is:

1. In a wave signal translating system: a plurality of receivers; signal reproducing means; an amplifier in series with said signal reproducing means; said receivers being connected in parallel across said signal reproducing means and said amplifier; an on-off switch in each of said parallel branches; means for disconnecting said signal reproducing means from said amplifier and connecting it to a selected one of said receiver connections; said means comprising series interconnections between said signal reproducing means and said on-off switches, said interconnecting means being so connected to said switches that each switch in its on position interrupts the series inter-connection between said signal reproducing means and said parallel branches more remote therefrom in said series.

2. In a wave signal translating system: a plurality of receivers; signal reproducing means; an amplifier in series with said signal reproducing means; said receivers being connected in parallel across said signal reproducing means and said amplifier; an on-off switch in each of said parallel branches; means for disconnecting said signal reproducing means from said amplifier and connecting it to a selected one of said receiver connections; said means comprising series interconnections between said signal reproducing means and said on-off switches, said interconnections being so connected to said switches that each switch in its off position interrupts its respective parallel branch and conductively joins a pair of said series interconnections.

3. In an electrical circuit comprising a plurality of branches, a circuit portion having a connection to each of said branches, means for selectively establishing a second connection between said portion and one of said branches; said means comprising a plural position switch in each of said branches, said circuit portion being con-

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ected to one of said switches and said switches being interconnected to constitute with said circuit portion a series of circuit elements, each of said switches when in one position completing its branch circuit, connecting thereto the next preceding element of said series, and interrupting the interconnection with the following element of said series, each of said switches when in a second position interrupting its branch circuit and the connection of said preceding element thereto and establishing a connection between the elements of said series adjacent thereto.

4. In an electric circuit comprising a plurality of branches, an interlocking switching system comprising: a double-pole, double throw switch in each of said branches, connecting means including said switches comprising a series circuit, each of said switches in one position completing the circuit of its respective branch, connecting the portion of said series circuit on one side thereof to said branch and interrupting the other portion of said series circuit; said switch in its other position interrupting its parallel branch, disconnecting said series circuit therefrom and completing said series circuit through said switch.

5. In a wave signal translating system: a plurality of receivers; signal reproducing means; an amplifier in series with said signal reproducing means; said receivers being connected in parallel across said signal reproducing means and said amplifier; an attenuating impedance in series with each of said receivers; a switching means

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between each of said receivers and its respective series connected impedance; means disconnecting said signal reproducing means from said amplifier and connecting it to one of said switching means; each of said switching means comprising movable and fixed contacts, a connection between each pair of adjacent switching means, each of said connections extending from a fixed contact of one of said switching means to a movable contact of the other of the pair, whereby said signal reproducing means and said switching means constitute a series of circuit elements, each of said switching means when in one position completing its branch circuit, connecting thereto the next preceding element of said series and interrupting the interconnection between adjacent elements of said series; each of said switching means when in a second position interrupting its branch circuit and the connection of the preceding element of said series thereto and establishing a connection between the elements of said series adjacent thereto.

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