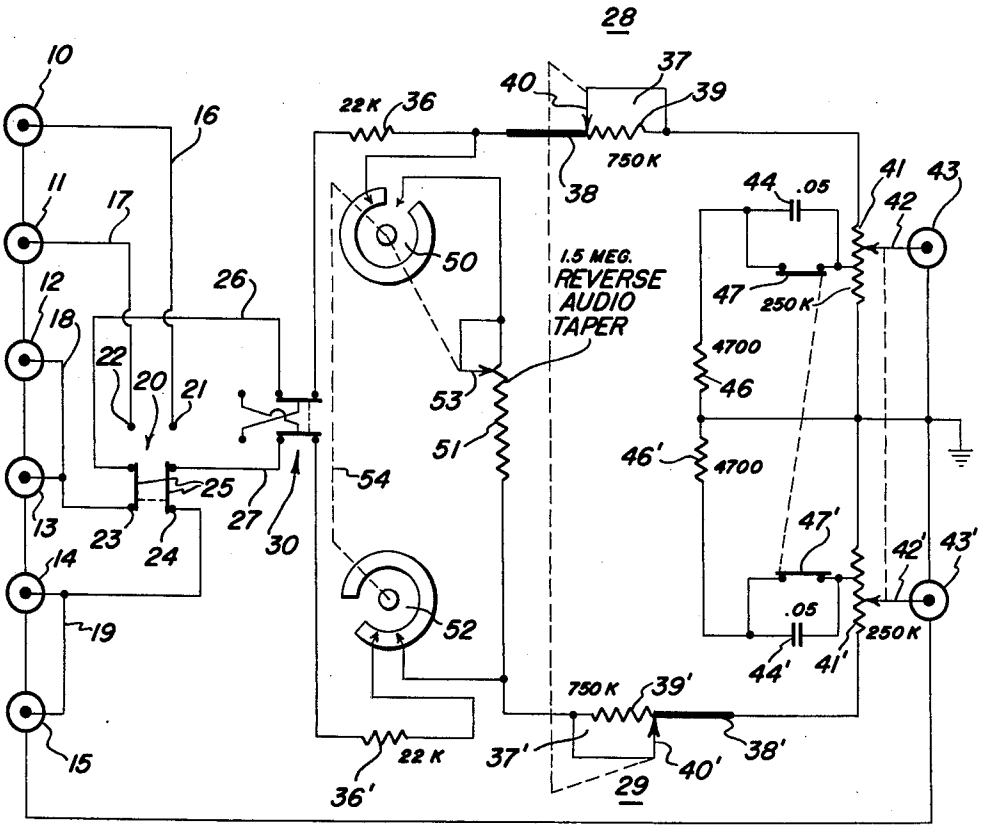
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STEREOPHONIC BLEND CIRCUIT

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STEREOPHONIC BLEND CIRCUIT

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The present invention relates generally to a control circuit for stereophonic reproduction systems, and more particularly to a control circuit for stereophonic reproduction systems which includes provision for controllably blending signals existent in separate stereophonic channels, for balancing the channels, for controlling the amplitudes of signals in the separate channels and for testing for correct balance of the channels.

Briefly describing a preferred embodiment of the present invention, two audio control channels are provided, for coupling separate stereophonic signal sources to separate preamplifiers of a stereophonic audio amplification and acoustic transducer system. The control channels include a reversing switch connected to the input terminals of the channels, so that "left" stereophonic signals may be applied at will to either of the channels, and "right" stereophonic signals to the other channel. Each channel then proceeds to a relatively high isolating resistance, following which the channels are directly interconnected by a variable blend resistance, in series with a switch. Following the blend resistance the channels each include a variable balance control resistance, the latter being inversely ganged and arranged to have ranges of values for which zero resistance may be introduced in one channel, while finite resistance is being introduced in the other. For a center setting of the ganged balance resistance, zero balance resistance is introduced into both channels. Changing the balance control setting in opposite senses from its center setting serves to introduce resistance into one or another of the channels only. The channels then proceed through inversely ganged output potentiometers, the junction of which is grounded, and the latter operate as ganged volume controls for the two channels.

The blend control permits controllable mixing of the signals in the two channels, the control extending from open switch condition, for which full stereophonic output is available, to zero resistance condition, for which the output of the system is monaural, in the sense that both channels carry the same signals. An additional switch position permits opening one input source so that the other input appears through both channels.

Since interchannel mixing is controllable, the listener is enabled to fill the "hole" which is subjectively present in stereophonic acoustic radiation when speakers are too far apart, or when the reproduced signal derived from microphones which were too far apart.

The isolation resistances prevent loading of one channel by the other, due to the blending, and are arranged to add less than 0.5 db of insertion loss into each channel.

The blend resistance utilizes inverse logarithmic taper, i.e., about 90% resistance change for the first 50% of rotation, to provide suitable aural effect on blend adjustment. With the blending switch closed and for full blend resistance in circuit, 20 db of separation is introduced.

Balancing of the channels is accomplished by adjusting the blend resistance to full blend condition, and listening for a condition of equal output as the balance is varied. Equality of audible output is not the indication of correct balance for stereophonic signals since they have different elements in each channel; but the blended output permits this simple means of balancing.

It is, accordingly, a primary object of the present invention to provide a novel control unit for controlling stereophonic reproduction.

It is another object of the invention to provide a novel blend circuit for stereophonic channels.

Another object of the invention resides in the provision of a blend control for stereophonic channels which consists of a single variable resistance interconnecting the channels, the resistance being in series with a switch.

A more specific object of the invention resides in the provision of a blend control circuit for stereophonic channels employing isolation between inputs of the channels, and controllable intermixing of the signal content of the channels, which employs one inverse logarithmically tapered resistance connected between the channels.

It is another object of the invention to provide a balancing device for facilitating balancing of stereophonic channels, and for testing for balance condition.

The above and still further objects, features and advantages of the present invention will become apparent upon consideration of the following detailed description of one specific embodiment thereof, especially when taken in conjunction with the accompanying drawings, wherein:

The single FIGURE is a schematic circuit diagram of a preferred embodiment of the present invention.

Referring now more particularly to the accompanying drawings, the reference numerals **10**, **11**, **12**, **13**, **14** and **15** identify co-axial fittings, arranged in order from top to bottom of the drawings. The fitting **10** constitutes a "right" tape "in" terminal and the fitting **11** a "left" tape "in" terminal. The outer conductors of the several fittings **10–15**, inclusive, are interconnected and grounded. The inner conductors of fittings **10** and **11** are connected to leads **16**, **17**, respectively. The inner conductors of fittings **12** and **13** are directly interconnected by a lead **18** and constitute "left" tape "out" and "left" tape "in" terminals. The inner conductors of fittings **15** and **14** are directly connected by a lead **19** and constitute "right" tape "in" and "right" tape "out" terminals.

A double-pole double-throw switch **20** is provided. The poles **21**, **22** on one side of the switch are connected, respectively, to leads **16**, **17**, while the remaining poles **23**, **24** are connected to the leads **18** and **19**, respectively. The movable contacts **25** of switch **20** are connected to leads **26** and **27** constituting input leads to separate stereophonic channels, **28** and **29**.

When switch **20** is in its "up" position, as viewed in the drawings, terminals **10** and **11** are connected to channels **29** and **28**, respectively, and the "left" tape supplies signal to lead **26**, while the "right" tape supplies signal to lead **27**. In the "down" position of switch **20**, as seen in the drawings, terminals **13** and **14** supply "left" and "right" tape signals to leads **26** and **27**, respectively, and in addition the tape signals may be derived from output terminals **12** and **15**, respectively.

The leads **26**, **27** are connected to channels **28** and **29**, respectively, via a reversing switch **30**, of the double-pole, double-throw type, which serves to interchange the connections of the channels to the tapes, and which is also employed in balancing the channels **28**, **29**, in a manner hereinafter described.

The channel **28** includes in series an isolating resistance **36** (22K), a balance rheostat **37** having a zero resistance section **38**, a 750K resistance section **39** and a slider **40**. The latter is controlled by a rotary knob which places slider **40** at the junction of sections **38**, **39** for its mid-position. The rheostat **37** accordingly provides zero resistance in series with channel **28** for less than 50% rotation, and a gradually increasing resistance thereafter to 100% rotation.

Potentiometer 41 is connected in series with rheostat 37 to ground, and is provided with a slider 42 which connects to an output co-axial fitting 43. Connected across about half of potentiometer 41 is a network consisting of a condenser 44 (.05 mfd.) and a resistance 46 (4700Ω), the condenser 44 being shunted by a switch 47. When switch 47 is closed half the resistance of potentiometer 41 (250K) is shunted by resistance 46. When switch 47 is open condenser 44 is in series with resistance 46. The RC network 44, 46 introduces compensation for Fletcher-Munson affect when switch 47 is open.

The channel 29 duplicates channel 28 and the corresponding elements are therefore identified by primed reference numerals, the same numerals being employed in the separate channels to identify corresponding elements.

Connected between the load sides of isolating resistances 36, 36' is, in series, a first switch 50, a variable blend resistance 51 and a further switch 52. The switches 50, 51 and the variable slider 53 of blend resistance 51 are gauged by mechanical elements indicated by dotted lines 54. The blend resistance 51 has a reverse audio taper, i.e., is inversely logarithmic, and such that 90%–95% of risistance change occurs for the first 50% of rotation of a control knob (not shown) which actuates the slider 53. When the knob is initially rotated it closes switch 50, connects blend resistance 51 into circuit, and maintains the latter in circuit thereafter. Initially the blend resistance 51 introduces about 20 db of blending. When slider 53 passes the entire resistance 51, i.e., on full rotation, 100% mixing occurs, and a full monophonic condition exists, i.e., both channels feed both output terminals. Still further rotation operates switch 52, which is normally closed, to open channel 29. Thereby signals from one input channel are fed to both output terminals. The input channels can be selectively connected by operating reversing switch 30.

Balance rheostats 37 and 37' are inversely ganged, so that for the center position of their control knob (not shown) no balance resistance is inserted in either channel. Turning the knob in alternate directions selectively brings resistance 39 and 39' into circuit, in channels 28 and 29, respectively.

The balance rheostats 37 and 37' form voltage dividers with output potentiometers 41, 41', and serve to attenuate signal in one channel or the other, selectively, without affecting the remaining channel. About 18 db of attenuation variation is attainable in this manner.

For balancing, the system is set for full blend, with switch 52 closed. The balance rheostats 37, 37' actuated until no difference in sound can be detected in the output of the two channels by a listener in the normal listening position.

Once the system is balanced the blend rheostat 51 may be actuated until maximum stereophonic effect is attained without "hole" effect.

While I have described and illustrated one specific embodiment of my invention, it will be clear that variations of the general arrangement and of the details of construction which are specifically illustrated and described may be resorted to without departing from the true spirit and scope of the invention as defined in the appended claims.

I claim:

1. In a stereophonic channel control system, a first channel, a second channel, means for applying a first audio signal to said first channel, means for applying a second audio signal to said second channel, said signals being stereophonically related, and a blend control for said channels, said blend control consisting of a variable resistance and a switch connected in series between said channels, a movable control for controlling the value of said variable resistance, said control being movable over a predetermined range, said variable resistance being tapered to provide a logarithmic variation reduction of resistance in response to the motion of said movable control over said predetermined range.

2. In a stereophonic channel control system, a first channel, a second channel, means for applying a first audio signal to said first channel, means for applying a second audio signal to said second channel, said signals being stereophonically related, and a blend control for said channels, said blend control consisting of a variable resistance and a switch connected in series between said channels, said variable resistance being substantially logarithmically tapered.

3. In a stereophonic channel control system, a first channel, a second channel, means for applying a first audio signal to said first channel, means for applying a second audio signal to said second channel, said signals being stereophonically related, and a blend control for said channels, said blend control consisting of a variable resistance and a switch connected in series between said channels, a rotatable control knob for adjusting said resistance, and means for opening said switch in response to predetermined rotation of said control knob.

4. In a stereophonic channel control system, a first channel, a second channel, means for applying a first audio signal to said first channel, means for applying a second audio signal to said second channel, said signals being stereophonically related, and a blend control for said channels, said blend control consisting of a variable resistance and a switch connected in series between said channels, wherein said variable resistance is logarithmically tapered, a rotatable control knob for said resistance arranged to introduce approximately 90% of resistance change for an initial rotation of said knob of 50% in one direction, and means responsive to full rotation of said knob in said one direction to open said switch, said switch being normally closed.

5. In a stereophonic channel control system, a first channel, a second channel, means for applying a first audio signal to said first channel, means for applying a second audio signal to said second channel, said signals being stereophonically related, and a blend control for said channels, said blend control consisting of a variable resistance and a switch connected in series between said channels, wherein said variable resistance is logarithmically tapered, a rotatable control knob for said resistance arranged to introduce approximately 90% of resistance change for an initial rotation of said knob of 50% in one direction, and means responsive to full rotation of said knob in said one direction to open said switch, said switch being normally closed, wherein is provided a further switch connected for opening only one of said channels in response to predetermined rotation of said knob in a direction opposite to said one direction.

6. A stereophonic control arrangement, comprising a first input terminal, a second input terminal, a first channel connected to said first input terminal, a second channel connected to said second input terminal, said first channel including a first series isolating resistance connected directly to said first input terminal, said second channel including a second series isolating resistance connected directly to said second input terminal, a first variable balance resistance in series with said first isolating resistance, a second variable balance resistance in series with said second isolating resistance, ganged adjusting means for simultaneously varying said balance resistances so that at most only one of said balance resistances inserts substantial resistance into either of said channels for any possible adjustment of said adjusting means, first and second ganged output potentiometers connected in series between said balance resistances and means for connecting the junction of said output potentiometers to a point of reference potential.

7. The combination according to claim 6, further comprising means for at will interchanging the connection of said first and second terminals to said first and second channels, and means for at will coupling the junc-

tion of said first isolating resistance and said first balance resistance with the junction of said second balance resistance and said second isolating resistance in a path of negligible resistance.

8. The combination according to claim 7, further comprising means for inserting a variable resistance network between the last-named junctions.

9. The combination according to claim 8, wherein said variable resistance network consists of resistance connected in series circuit only and extending only between said last-named junctions.

10. A stereophonic control system comprising a first channel, a second channel, said first channel including a first output potentiometer connected between said first channel and a point of reference potential, a second output potentiometer connected between said second channel and said point of reference potential, each of said potentiometers including a sliding contact, means for gang actuating said sliding contacts in relatively opposite senses, and a blend control comprising a resistive network interconnecting said channels, said resistive network consisting of a variable logarithmically tapered resistance and a switch in series therewith extending directly between said first channel and said second channel and being connected only to said channels.

11. The combination according to claim 10, further comprising an isolating resistance in each of said channels, each isolating resistance being connected in its channel antecedent to said resistive network.

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