Nov. 11, 1969 B. P. HOOTEN, JR 3,478,293

TWO DIRECTIONAL SWITCH

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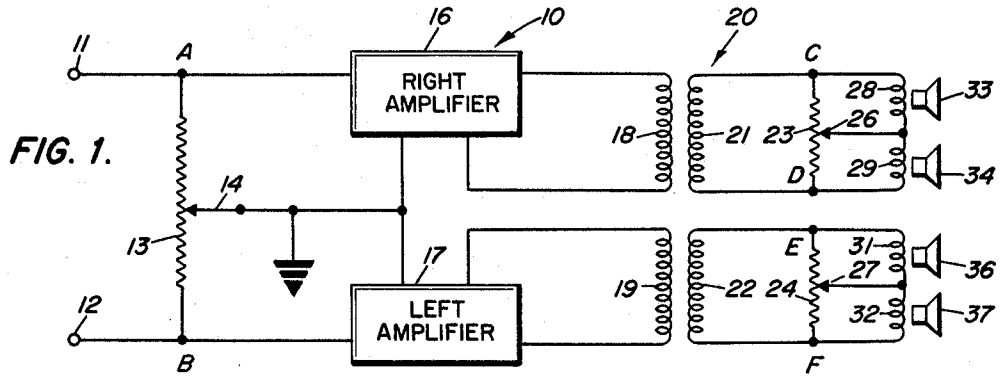


FIG. 1.

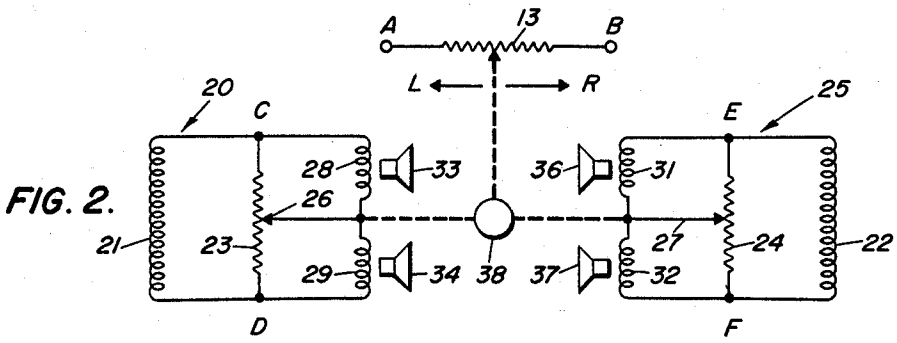


FIG. 2.

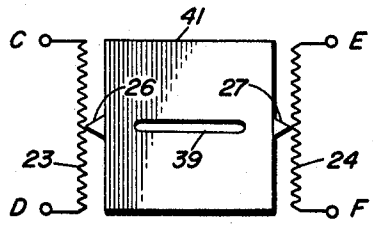


FIG. 3a.

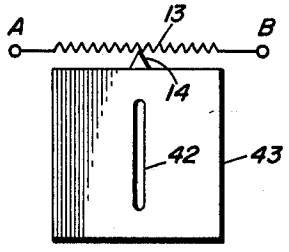


FIG. 3b.

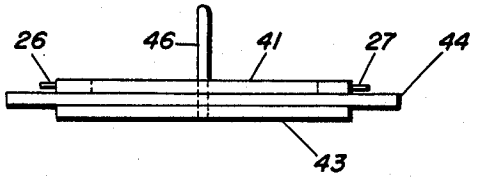


FIG. 4.

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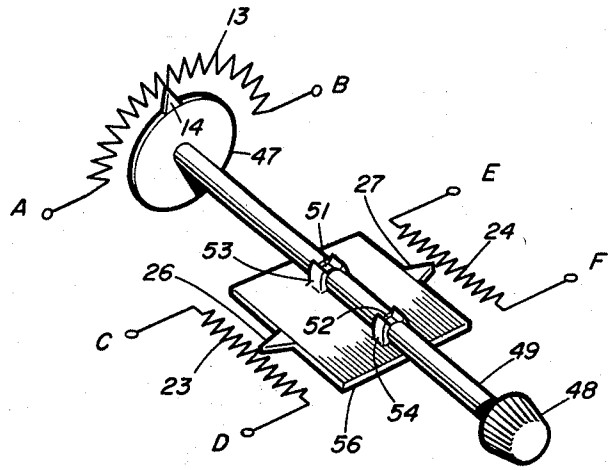
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FIG. 5.



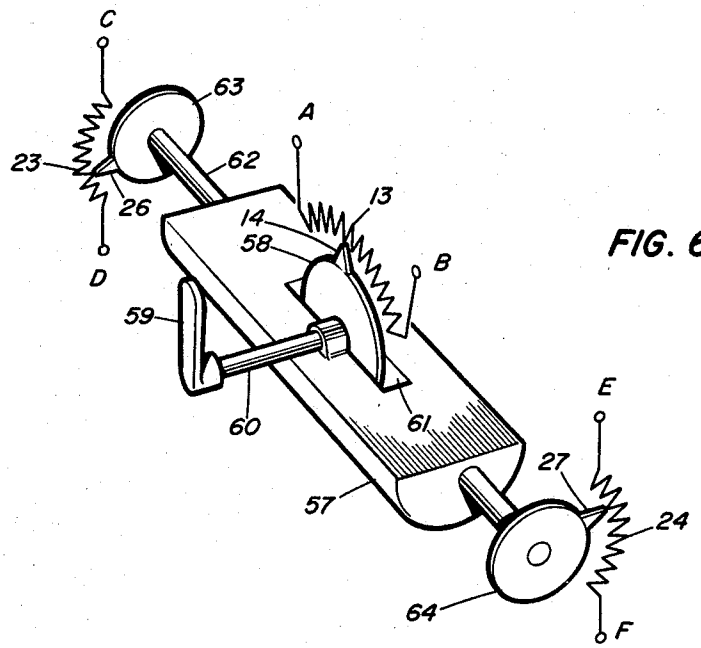


FIG. 6.

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TWO DIRECTIONAL SWITCH

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U.S. Cl. 338—128 10 Claims

ABSTRACT OF THE DISCLOSURE

This invention describes a system for simultaneously balancing the two individual channels of a stereophonic system and also equalizing, or changing, the desired outputs from several speakers contained within each of the individual channels. The device is constructed such that one motion, for example rotary motion, will change the balance between the two channels of the stereo system. A second motion, for example a lateral motion, will change the acoustical output of the speakers contained within the individual channels. The second function is accomplished in a manner such that the speakers within both channels are simultaneously changed to insure an equalized output in the stereophonic system. The device is quite useful in automobile radios or tape systems wherein two channels, ordinarily identified as right and left channels, each contain front and rear speakers. In such systems it is necessary to be able to balance the right and left channels such that the acoustical output from both channels is substantially equal in order to insure pleasant listening. Such systems should also be constructed such that the operator can select an output from either the front or rear speakers or a combination of both. The instant invention is directed toward a device by which a rotary motion will enable the operator to balance the right and left channels and a lateral motion will enable the operator to selectively fade the front or rear speakers.

Sterephonic systems employing two speakers in each channel require balancing between the two channels and also fading between the speakers contained within the separate channels in order to enable the operator to achieve the output he desires. Existing systems employing these two functions ordinarily contain two controls. One control is used to balance the two channels of the stereophonic system, while the other control is used to select the output from the speakers within each of the two channels. The use of two controls is both cumbersome and inconvenient in addition to the fact that it complicates the equipment and renders it more expensive to build. This invention therefore describes a device which is capable of simultaneously balancing the two channels of a sterophonic system and fading the speakers contained within the individual channels.

It is therefore an object of this invention to provide a device which enables the simultaneous balancing of separate channels and fading of the output of the speakers within the channels.

It is another object of this invention to provide such a device in which the balancing function is achieved by a rotary motion and the fading function is provided by a lateral motion of the adjusting device.

It is another object to provide such a device in which the fading function is accomplished in both channels simultaneously to therefore maintain the balanced acoustical output from the two individual channels.

Further objects, features and advantages falling within the scope of the invention as defined by the appended claims will become apparent to one skilled in the art by making reference to the hereinafter presented detailed description and attached figures, wherein like numerals indicate like or equivalent parts and in which:

FIG. 1 shows a simplified block diagram of a stereophonic system employing the instant invention.

FIG. 2 is a schematic diagram showing the mechanical connections and physical orientation of the elements.

FIGS. 3*a* and 3*b* show a disassembled first embodiment of the instant invention.

FIG. 4 is an end view of the assembled embodiment shown in FIGS. 3*a* and 3*b*.

FIG. 5 shows a second preferred embodiment utilizing both rotary and linear motion.

FIG. 6 shows a third preferred embodiment using two rotary motions.

In FIG. 1 the simplified diagram of the stereophonic system **10** contains two input terminals **11** and **12**. Input terminal **11** receives the audio signal from the right channel of the stereophonic system and input terminal **12** receives the audio input from the left channel of the stereo system. The inputs received from input terminals **11** and **12** are amplified in amplifiers **16** and **17** respectively. The output of the right channel amplifier **16** is received by coil **18** and by inductive action is received by coil **21** where it serves to produce an output signal in speakers **33** and **34**. The output of left channel amplifier **17** is similarly received on coil **19** ultimately resulting in an output on speakers **36** and **37**. In an actual usage of the inventive system the speakers **33** and **34** would respectively appear in the front and rear portions of the right side of an automobile, while speakers **36** and **37** would respectively appear in the front and rear portions of the left side of an automobile. Because the system develops two acoustical outputs it is necessary to enable the operator to effect a change of output in the right and left portions of the system. This is accomplished by use of potentiometer **13**. The gains of amplifiers **16** and **17** can be changed by moving arm **14** along potentiometer **13**. This is done by the operator until the balance of the right and left channels is pleasant to his individual ear. The exact nature and detailed circuitry required for adjusting the gains of amplifiers **16** and **17** is well known in the art and therefore further details need not be presented here. The presence of two speakers in each of the channels results in the requirement of the operator being able to select the output from either the front or rear speakers, or both, at his desire. This is accomplished in the right channel by using the potentiometer **23** and contact arm **26**. By moving arm **26** along potentiometer **23** the outputs of the individual speakers **33** and **34** can be adjusted. The same is true of the left channel wherein the acoustical outputs of speakers **36** and **37** can be varied by moving contact arm **27** along potentiometer **24**. The outputs of output circuits **20** and **25** can therefore be balanced by adjustment of potentiometer **13**. The outputs of speakers **33** and **34** can be adjusted by potentiometer **23** and the outputs of speakers **36** and **37** by potentiometer **24**.

FIG. 2 schematically shows that the fading function useful in adjusting the acoustical outputs between the speakers in the two individual channels is accomplished simultaneously by mechanical connection of contact arms **26** and **27**. This is desirable because the operator has previously balanced the two channels and therefore does not want to disrupt this balance when adjusting the front and rear speakers. FIG. 2 also shows that the same control knob **38** is used to balance the two channels of the stereophonic system and also to fade the speakers in the two channels. Potentiometer **13** is shown connected between electrical points A and B as shown also in FIG. 1. Potentiometer **23** contained within output circuit **20** is shown connected between points C and D also as shown in FIG. 1. Potentiometer **24** contained within output cir-

cuit 25 is shown connected between points E and F also as shown in FIG. 1. The lettered connections A through F are used as a convenience in observing how the various elements are connected into the basic circuit shown in FIG. 1. This letter designation is also carried out through FIGS. 3 through 6. FIG. 2 shows that right to left movement of control knob 38 will result in the balancing of the two output circuits by the movement of arm 14 along potentiometer 13. Alternatively, an up and down, as shown in the figure, motion of control knob 38 can be used to change the positions of arms 26 and 27 respectively on potentiometers 23 and 24 to fade the outputs of the front or rear speakers. The two motions can be accomplished simultaneously so that the two channels of the stereo system can be balanced while the outputs from the speakers in the front and rear positions are selected.

FIG. 3*a* and FIG. 3*b* together show a preferred embodiment of the instant invention in a disassembled relationship. In FIG. 3*a* an insulated plate 41 has both contact arms 26 and 27 rigidly attached thereto. Arms 26 and 27 are connected along the center line of plate 41, such that the two potentiometers 23 and 24 are equally adjusted as plate 41 is moved linearly between the two potentiometers. Plate 41 contains a slot 39 which is used to effect the motion of the plate by use of a lever 46, shown in FIG. 4.

Another portion of the preferred embodiment is shown in FIG. 3*b*. In this figure potentiometer 13 is shown coupled between points A and B. A second plate 43 is shown containing a slot 42. Plate 43 has rigidly attached thereto arm 14 which is used to effect the balancing of the two stereophonic channels as shown in FIG. 1. Slot 42 is used to cause motion of plate 41 by movement of lever 46. It should be noted that slots 39 and 42 are perpendicular to the line of motion of their respective plates.

The structural correlation and physical arrangement of plates 41 and 43 is best seen by viewing FIG. 4. In this figure a third plate 44 is shown sandwiched between plates 41 and 43. The plates are positioned such that slots 39 and 42, contained respectively in plates 41 and 43, are perpendicular to one another. In this arrangement the slots will create a hole which receives a lever 46. Lever 46 is pivotally attached to plate 44 such that it can be pivoted in any direction. By pivoting lever 46 in a direction parallel to slot 39 a lateral motion of plate 43 will be realized but plate 41 will not move. This motion will result in the sliding of contact 14 along potentiometer 13 and therefore will change the balancing of the two sides of the stereophonic system. Motion of lever 46 in a direction parallel to slot 42 will result in a linear motion of plate 41 between potentiometers 23 and 24 while plate 43 remains stationary. This motion results in the movement of arms 26 and 27 along potentiometers 23 and 24, respectively, and therefore results in a fading of speakers 31 through 34. It is therefore evident that the acoustical outputs of the right and left channels and also of speakers 33 through 37 can be adjusted by use of the single device as shown in FIG. 4.

A second preferred embodiment of the invention is shown in FIG. 5. In this embodiment plate 41 of the FIG. 3 embodiment has been replaced by plate 56. Plate 56 is identical to plate 41 with the exception that slot 39 has been eliminated in the FIG. 5 embodiment. Plate 43 is replaced by a shaft 49 containing two grooves 51 and 52. Shaft 49 is restrained from lateral movement with respect to plate 56 by use of straps 53 and 54 which are contained within grooves 51 and 52 and are rigidly fastened to plate 56. One end of shaft 49 contains a knob 48 which is used to rotate the shaft 49 and also to move it laterally between potentiometers 23 and 24. The other end of shaft 49 contains a disk 47. Contact 14 is rigidly attached to disk 47 such that rotation of shaft 49 results in the movement of contact 14 along potentiometer 13. In the FIG. 5 embodiment it is therefore evident that rotation of shaft 49 results in the balancing of the two sides of the stereophonic system while linear motion of shaft 49 results in the fading of the speakers within the two channels. It should be noted that potentiometer 13 must be physically attached to plate 56 such that it has a lateral movement along with said plate. This is required in order to prevent the contact 14 from being moved away from potentiometer 13 when a lateral adjustment is made.

A third preferred embodiment of the invention is shown in FIG. 6. In this figure a semi-circular right cylinder 57 is rigidly attached to shaft 62 such that it rotates therewith. A disk 63 is attached to one end of shaft 62. Contact 26 is rigidly attached to disk 63 such that rotation of shaft 62 results in a change of the output of potentiometer 23. A second disk 64 is rigidly attached to the other end of shaft 62. Contact 27 is rigidly attached to disk 64 so that the setting of potentiometer 24 is simultaneously adjusted along with the adjustment of potentiometer 23. Cylinder 57 contains a slot 61 into which is inserted a rotatable disk 58. Disk 58 is mounted on a shaft 60 to rotate within slot 61. Contact 14 is permanently fastened to disk 58 such that rotation of disk 58 effects an adjustment of potentiometer 13. Potentiometer 13 is physically attached to cylinder 57 such that contact is made between arm 14 and potentiometer 13. Preferably potentiometer 13 could be contained within slot 61, where it would be less likely to suffer physical damage. The figure is an illustrative showing only. Disk 58 is connected to lever 59 through a shaft 60. Movement of lever 59 in a plane parallel to the longitudinal axis of cylinder 57 therefore results in an adjustment of the setting of potentiometer 13. Movement of shaft 59 in a direction perpendicular to the longitudinal axis of cylinder 57 results in rotation of shaft 62 and the simultaneous adjustments of potentiometers 23 and 24.

It is now evident, from viewing the three preferred embodiments of the invention, that the simultaneous adjustment of the balance of a stereophonic system and the fading of the speakers within the system can be accomplished by use of all lateral motion, all rotary motion, or a combination of lateral and rotary motion.

Although this invention has been described with reference to particular embodiments thereof it is not to be so limited as changes and modifications can be made therein within the scope of the invention as defined by the appended claims.

The invention claimed is:

1. A device for simultaneously adjusting three potentiometers comprising: motion control means; first and second contacts; said first and second contacts being similarly coupled to said motion control means by first coupling means so that movement of said motion control means in a first direction effects equal movement of first and second contacts; a third contact; said third contact being coupled to said motion control means by second coupling means so that movement of said motion control means in a second direction effects movement of said third contact.

2. The device of claim 1 wherein said first coupling means includes a first plate having said first and second contacts located along an axis of symmetry of said first plate; a first slot in said first plate; and wherein said second coupling means includes a second plate having said third contact attached thereto; a second slot in said second plate; and means for maintaining said first and second plates in a substantially parallel relationship.

3. The device of claim 2 wherein said first and second slots are perpendicularly oriented and said motion control means is a lever extending into said first and second slots.

4. The device of claim 3 wherein said means for maintaining is a third plate between said first and second plates; and said lever is pivotally attached to said third plate, and said first and second directions are perpendicular to each other.

5. The device of claim 1 wherein said first coupling means includes a plate having said first and second contacts located along an axis of symmetry; and wherein said second coupling means include a shaft rotatably supported by said plate; a disk attached to said shaft; said third con-

tact being supported by said disk so that rotation of said shaft effects movement of said third contact and linear movement of said shaft effects movement of said first and second contacts.

6. The device of claim **5** wherein the axis of rotation of said shaft is perpendicular to said axis of symmetry; and wherein said axis of symmetry is a center line of said plate.

7. The device of claim 6 wherein said motion control means is a knob attached to said shaft.

8. The device of claim **1** wherein said first coupling means includes a member rigidly attached to a first rotatable shaft; a first disk attached to one end of said shaft; said first contact being supported by said first disk; a second disk attached to the other end of said shaft; said second contact being supported by said second disk; and said second coupling means is attached to said member.

9. The device of claim **8** including an opening formed in said member; and wherein said second coupling means includes a second rotatable shaft located in said opening; a third disk attached to said second shaft; said third contact being supported by said third disk.

10. The device of claim **9** wherein said member is a semicircular cylinder; and said second shaft is perpendicular to said first rotatable shaft; and said motion control means is a lever attached to said second shaft so that a force applied to said lever in a direction perpendicular to said first rotatable shaft causes movement of said first and second contacts and a force on said lever in a direction parallel to said first shaft causes movement of said third contact.

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200—6; 323—43.5; 338—91