Dec. 7, 1948. C. B. McCULLOCH 2,455,691

SOUND TRANSMISSION CONTROL SYSTEM

Filed Dec. 22, 1945 3 Sheets-Sheet 1

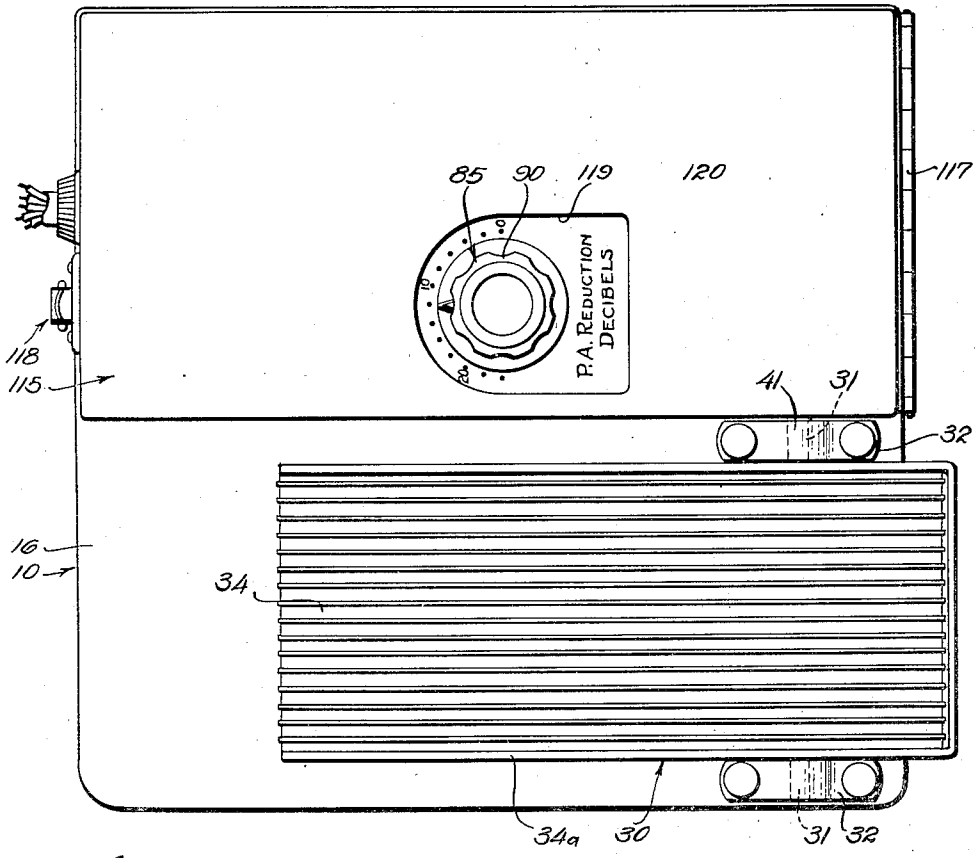


Fig. 1.

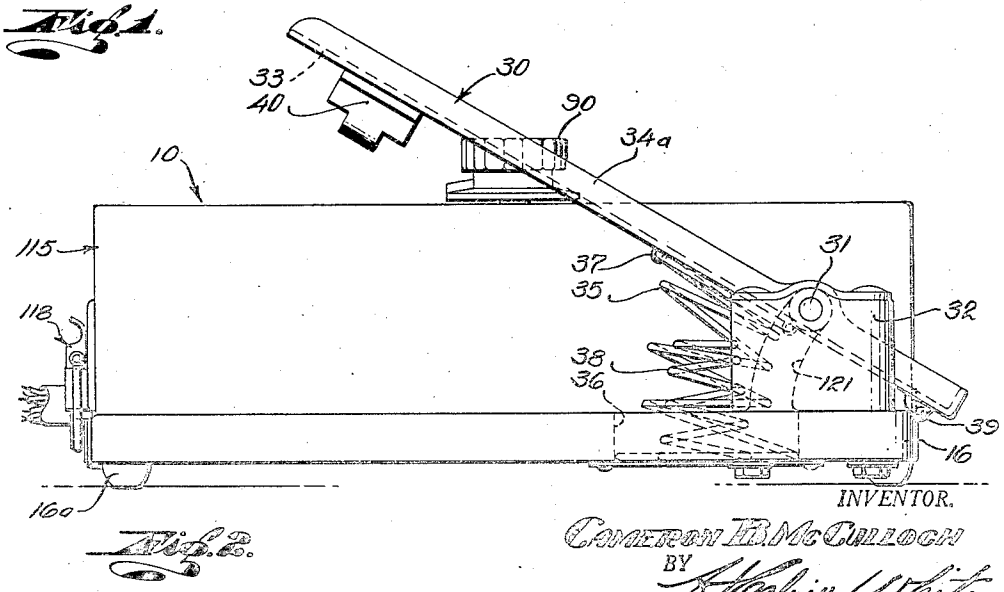


Fig. 2.

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Filed Dec. 22, 1945 3 Sheets-Sheet 2

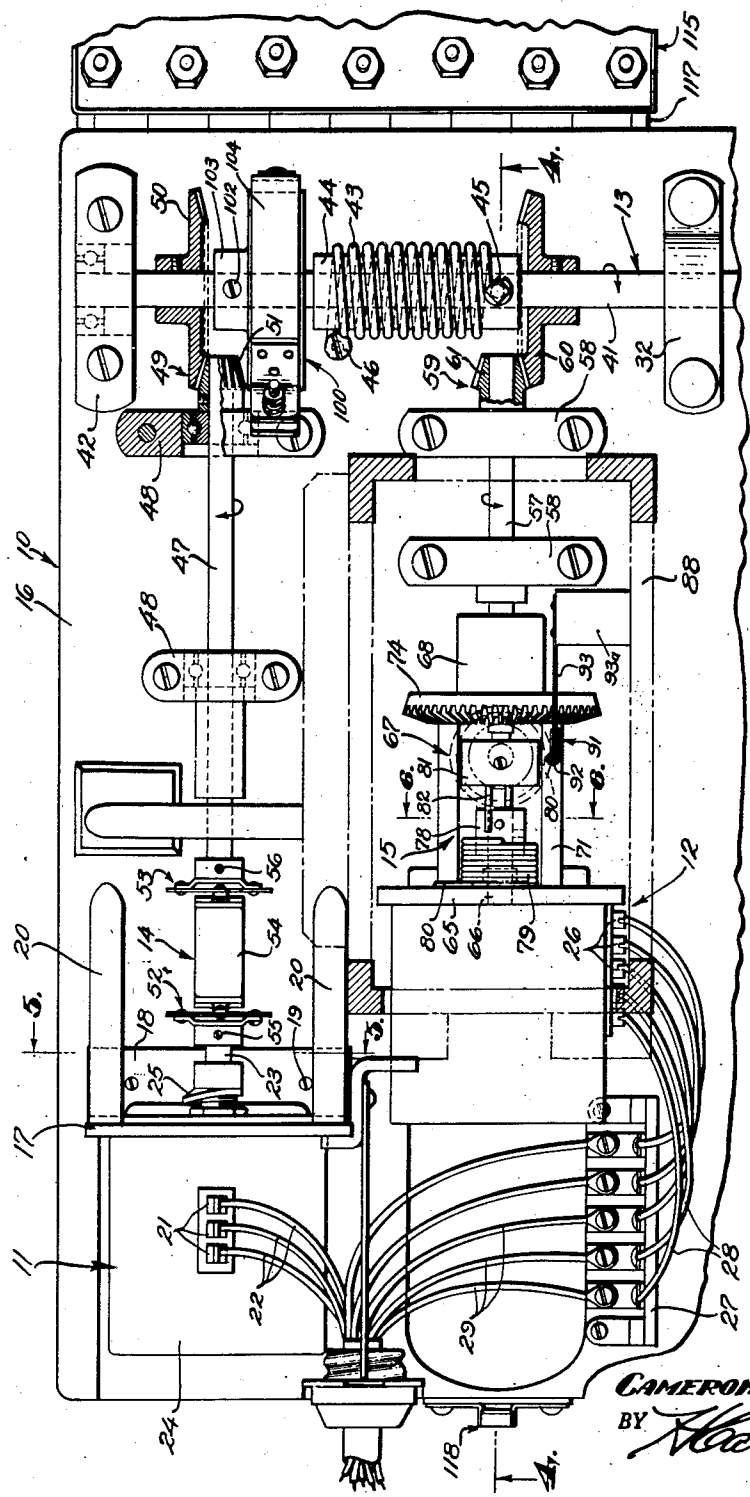


Fig. 3.

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Dec. 7, 1948. C. B. McCULLOCH 2,455,691

SOUND TRANSMISSION CONTROL SYSTEM

Filed Dec. 22, 1945 3 Sheets-Sheet 3

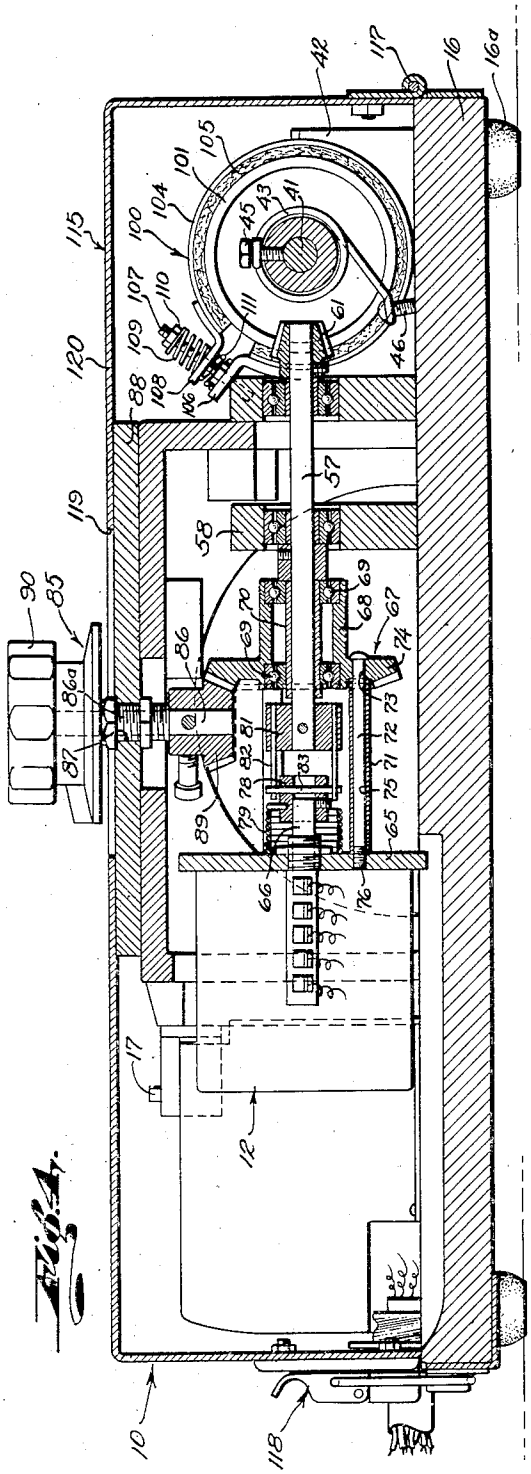


Fig. 4.

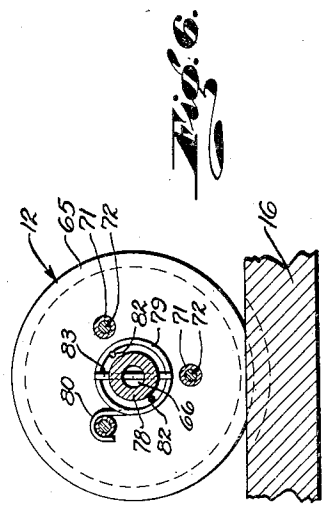


Fig. 6.

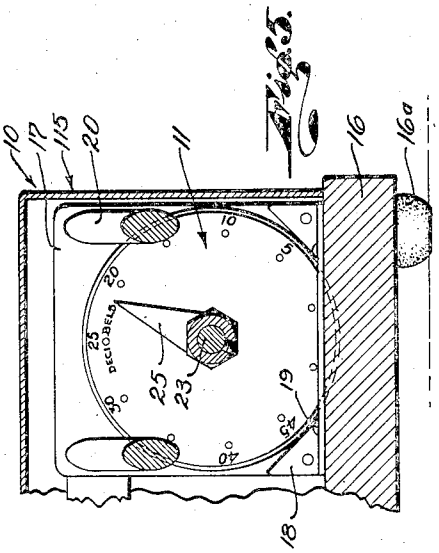


Fig. 5.

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UNITED STATES PATENT OFFICE

2,455,691

SOUND TRANSMISSION CONTROL SYSTEM

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Application December 22, 1945, Serial No. 636,927

6 Claims. (Cl. 179—1)

1

This invention has to do generally with sound control equipment for radio broadcasting, and is concerned particularly with improvements in equipment for controlling the transmission and intensity of so-called audience reaction and the radio program simultaneously being broadcast.

The customary practice in broadcasting a program being presented before a studio audience is to employ one or more microphones through which the audience reaction, e. g. applause, is transmitted to the broadcasting circuit and to one or more studio speakers, controls being used to vary the intensities of the audience reaction sounds as transmitted to the studio speakers, and such intensities relative to the program proper as transmitted to the same speakers. Heretofore the controls used have been hand operated and one has functioned independently of the other so that, for example, the effecting of progressive increase in the transmitted intensity of the audience sounds simultaneously with a progressive decrease in the transmitted intensity of the program sounds, has depended upon the skill and judgment of the operator in manipulating the independent controls. Necessarily, by reason of the nature of the controls, the complete efforts of the operator are required for and during the time of audience reaction transmission.

One of my major objects is to provide an improved control characterized by its capacity for foot manipulation so that the operator is left free to make adjustments of hand controls simultaneously with the regulation of the dual program sound and audience reaction control system as later described. Preferably I associate and interconnect with the audience reaction control a program sound transmission control so that automatically and in selected or predetermined relation, a progressive change in the transmitted intensity of the audience sounds is accomplished by an opposite change in the transmitted intensity of the program sounds. Thus by foot manipulation, the operator is given complete and proper control of simultaneous sound transmissions from both sources.

A further important feature and object is the provision of a dual control whereby, assuming a given range of audience sound range variation, the transmission of varying intensity program sounds may be selected or predetermined to occur within any interval or range relative to the audience sound range variation. Thus I may employ a pair of potentiometers, one for controlling the audience sound transmission and movable within a certain range, a second interconnected potentiometer movable simultaneously to control the program sound transmission, and an adjustment whereby initial actuation of the sound potentiometer may be made to occur at any of

2

various intervals following the starting movement of the first potentiometer.

Other objects of the invention have to do with such features as the details of the operating interconnections between the potentiometers, their adaptation to foot pedal operation, and the general assembly of parts normally enclosed in a case structure at the outside of which is arranged the foot pedal.

All the above mentioned, as well as additional features and objects of the invention will be more fully understood and explained to better advantage from the following detailed description of the accompanying drawings showing the invention in a typical embodiment. In the drawings:

Fig. 1 is a plan elevation of the control unit;

Fig. 2 is a side elevation of the control unit illustrating the foot pedal in its normal or up position;

Fig. 3 is a fragmentary plan elevation with the housing or cover swung open and showing portions of the control in cross section;

Fig. 4 is a vertical detailed sectional view taken on line 4—4 of Fig. 3 with the cover in a closed position;

Fig. 5 is a fragmentary transversed sectional view taken on line 5—5 of Fig. 3; and

Fig. 6 is a fragmentary transversed sectional view taken on line 6—6 of Fig. 3.

The invention contemplates the use of one or more variable potentiometers operated by a foot pedal for controlling operation of a public address system and/or radio broadcast. The particular control unit 10 illustrated in the drawings is intended for use in a radio broadcasting studio where the studio audience reaction is broadcast along with the program and where the program and audience reaction are simultaneous'y sent through the audience speaker. Referring to Fig. 3 the unit 10 includes two spaced potentiometers 11 and 12 controlled by a foot pedal operated drive means 13 through individual couplings 14 and 15 with their respective potentiometers.

The potentiometer 11 may be connected in the audience microphone circuit, while the potentiometer 12 may be connected in the audience speaker circuit, operation of the potentiometers being in direct opposite. That is, the potentiometer 11 in the audience microphone circuit normally operates at a minimum while the potentiometer 12 in the audience speaker circuit operates at a maximum, and actuation of the foot pedal means 13 causes an increase in the audience microphone pick-up and a decrease in the audience speaker volume. This arrangement allows for maximum pick-up of audience reaction to be broadcast without overloading the audience speaker, and prevents its squeaking or rattling, as well as acoustic feed back disturbances.

The control unit 10 has a suitable base 16 pro-

vided with rubber buttons 16a for preventing slipping of the unit on the floor or support. The potentiometer 11 is mounted on the base by a suitable up-standing plate 17 attached to the base by angle bracket 18 through screws 19. The upper end of the plate 17 may be braced by angularly disposed supports 20. Taps 21 of the potentiometer 11 may be connected to suitable leads 22 in the studio audience microphone circuit. The potentiometer may be of any standard make procurable on the market. The particular potentiometer illustrated in the drawings is of the type manufactured by Cinema Engineering Company of Burbank, California, model #3856, and includes the usual shaft 23 rotatably carried by its housing 24, and a suitable indicating means 25 showing the setting of the potentiometer.

The potentiometer 12, connected in the studio audience speaker circuit, may be of a type made by the same manufacturer, model #1021 B, having its taps 26 connected with a terminal post 27 through suitable flexible leads 28, the terminal post 27 being connected in the audience speaker circuit through suitable leads or connections 29. This potentiometer is rotatably mounted on the base 16 of the control unit 10, and will be subsequently described in connection with the drive means 13.

The foot pedal operated drive means 13 includes generally a pedal 30 pivotally mounted on the base 16 through trunnions 31 journaled in upstanding bearing supports 32. The pedal 30 includes a plate 33 covered by rubber tread 34, and a peripheral flange 34a for locating the operator's foot on the pedal. Suitable spring means provided in connection with the pedal 30 to normally hold the pedal in its raised position illustrated in Fig. 2, may include a coil spring 35 received in a socket 36 in the base 16 and engaging the underside of the plate 33 to be secured thereto by loops 37. A second spring 38 may be located inside of the spring 35 for giving the operator an indication of the location of the pedal at a predetermined point before the pedal has reached its full actuation, as at a condition of average operation of the control. If the operator requires an extreme condition, the spring 38 will yield allowing full pedal actuation. Stop 39 at the heel of the pedal engages the base 16 when the pedal is in its normal or raised position, and stop 40 at the toe of the pedal engages the base 16 when the pedal is in its down or actuated position.

The pedal operated drive means 13 further includes an extension shaft 41 projecting from one of the trunnions 31 and extending to the other side of the base 16 to be rotatably supported in a bearing post 42. A torsional spring 43 on the shaft 41 assists the spring 35 in raising the pedal and returning the control to its normal position. The spring 43 surrounds a sleeve 44 on the shaft 41 and has one end connected with a set screw 45 which locks the sleeve to the shaft. The other end of the spring 43 is connected with a screw 46 threaded in the base 16.

The drive means 13 further includes a shaft 47 carried for rotation by spaced bearing posts 48 and connected with shaft 41 through a bevel gear connection 49. The latter includes a bevel gear 50 on the shaft 41 and a pinion 51 on the shaft 47 which is connected with the rotatable shaft 23 of the potentiometer 11 through its coupling means 14. Typically the coupling means may be in the form of a pair of flexible couplings 52 and 53 connected together by a spacer 54, the former being attached to the shaft 23 by set screw 55, while the coupling 53 is connected with the shaft 47 by set screw 56. The coupling thus provides for free rotation of the shafts 23 and 47 in the event of their misalinement.

A right angle shaft 57 connecting with the potentiometer 12 is rotatably carried by spaced bearing supports 48 projecting upwardly from the base 16. The shaft 57 has with the shaft 41 a gear connection 59, including a bevel gear 60 meshing with a pinion 61. The different between the connections 49 and 59 is that the bevel gears 50 and 60 are at opposite sides of their respective pinions 51 and 61. This arrangement provides a reverse rotation of the shaft 47 relative to the shaft 57 for reasons to be hereinafter described.

The potentiometer 12 is rotatably mounted on the shaft 57, see Fig. 4, and is secured to plate 65 to have its shaft 66 projecting towards the shaft 57. The potentiometer is rotatably mounted on the shaft 57 with its shaft 66 in axial alinement therewith by means of a spider 67 comprising a collar 68 carried by spaced anti-friction bearing 69 surrounding a sleeve 70 on the shaft 57. Spacers 71 separate the collar 68 from the plate 65, and are connected together by screws 72 extending through openings 73 in a ring gear flange 74 of the collar 68; the screws passing through openings 75 in the spacers 71 to be threaded at 76 into the plate 65. This spaced relation between the potentiometer 12 and the ring gear collar 68 is provided to accommodate the coupling means 15 between the drive 13 and the potentiometer 12.

The coupling means 15 in the form of a slack connection between the shaft 57 and the shaft 66 of the potentiometer, includes a collar 78 fixed to the shaft 66 and connected to one end of a torsional spring 79; the other end of which may engage one of the spacers 71 at 80, see Fig. 6. Spring 79 acting through the collar 78 tends to rotate shaft 66 of the potentiometer 12 in a clockwise direction, holding the rotor of the potentiometer against its built-in stop, not shown, where the potentiometer has a maximum output.

The coupling 15 further includes a collar 81 on the shaft 57 carrying spaced pins 82 for engaging a pin 83 extending radially through collar 78, pins 82 cooperating with the opposite ends of the pin 83, transfers rotation from the shaft 57 to the shaft 66. The position of the pins 82 with respect to the pin 83 regulates the amount of rotative slack between the shaft 57 and the shaft 56. Control 85, provided to vary the amount of slack in the coupling means, includes a shaft 86 rotatably mounted in a sleeve 86a fixed in an opening 87 in a suitable bracket or support member 88 carried by the base 16. The shaft 86 carries a pinion 89 on its lower end which meshes with ring gear 74 of the collar 86 described above. The upper end of the shaft 86 may be provided with a control knob 90. It will be apparent that rotation of the knob 90 causes rotation of the body of the potentiometer 12 through the spider 67. Rotation of the potentiometer 12 by the control 85 regulates the spacing of the pin 83 relative to the pins 82, and controls the amount of cut-back in the potentiometer 12 during the actuation of the pedal operated control means 13.

The control 85 further includes a detent 91 for holding the control 85 in any selected set position. The detent comprises a roller 92 carried on a spring arm 93 supported by a block 93a on the bracket 88. The roller 92 cooperates with the teeth on the pinion 89 to hold the control 85 in any selected position.

To afford smoother control, the pedal operated drive 13 may further include a self-energizing brake 100, comprising a drum 101 fixed to the shaft 41 by a set screw 102 threaded in the hub 103 of the drum 101. The brake band 104, carrying a suitable lining 105 for frictionally engaging the drum 101, has one end 106 anchored to one of the spaced bearing supports 48 by means of a stud 107 threaded into the bearing support. The other end 108 of the band 104 is yieldingly urged towards the anchored end 106 by a spring 109 and an adjustable nut 110 on the stud 107. Actuation of the pedal 30 causes rotation of the drum 101 in a counter-lock-wise direction which tends to wrap the band 104 tighter about the drum 101. This retards or dampens any jerking or sudden actuation of the pedal. A second spring 111 may be arranged between the ends 106 and 108 of the bands 104 to prevent the brake 100 from completely stopping actuation of the pedal 30. By adjusting nut 110 brake 100 may be regulated to provide the required amount of braking action to give the control a smooth operation.

A cover or housing 115 encloses the potentiometers 11 and 12, their drive 13 and the couplings 14 and 15 to protect the various parts and the electrical connections in the control unit 10. The housing is shown as a box-like cover 116 hinged at one end 117 to the base 116 and provided with a latch 118 to releasedly hold the cover closed. The cover is provided with a top hole 119 to allow for opening of the cover without removal of the control knob 90, and an accurate side slot 121 to pass the shaft 41.

Considering the operation of the control unit, actuation of the pedal 30 causes rotation of the shaft 41 and its ring gears 50 and 60 to produce rotation of pinions 51 and 61, and therefore shafts 47 and 57, in opposite directions, and corresponding turning of the potentiometer shafts 23 and 66 through their couplings 14 and 15. The potentiometer 11 controlling the studio audience microphone is normally set at a minimum output, while the potentiometer 12 controlling the studio audience speaker circuit normally may be set at a maximum output. Opposite rotation of the potentiometer shafts 23 and 66 automatically results in a cut-back in the studio audience speaker simultaneously with the increase in the studio audience microphone pick-up. The further the control pedal is depressed, the greater becomes the potential created in the microphone circuit and the greater the cut-back in the studio speaker circuit, with resultant prevention of squealing or undesirable noises in the speaker.

I claim:

1. An audience reaction sound control system comprising a potentiometer including an element rotatable to vary the intensity of audience sound transmission, a rotatable actuating shaft connected to said element, a housing enclosing said potentiometer and shaft, a foot pedal positioned outside and horizontally offset from said housing, and a hinge attachment to said housing whereby the housing may be swung upwardly and independently of the pedal to openly expose the potentiometer and shafts.

2. An audience reaction sound control system comprising a potentiometer element movable to vary the intensity of audience sound transmission, a shaft rotatable to actuate said element, friction means restraining free rotation of said shaft, and means for adjusting said friction means to vary its restraint of the shaft.

3. A sound control system comprising a first potentiometer element movable within a predetermined range to vary the intensity of sound transmission from a first source, a second potentiometer element movable to vary the intensity of sound transmission from a second source, means for simultaneously actuating said elements to increase the intensity of the sound transmission from said first source while decreasing the intensity of the sound transmission from said second source, and means for limiting the starting movement of said second potentiometer element at different intervals relative to the starting movement of said first potentiometer element to correspondingly delay the actuation of said second element following actuation of said first element.

4. A sound control system comprising a first potentiometer element movable within a predetermined range to vary the intensity of sound transmission from a first source, a second potentiometer element movable to vary the intensity of sound transmission from a second source, means interconnecting said elements for simultaneous operation to increase the intensity of the sound transmission from said first source while decreasing the intensity of the sound transmission from said second source, means for limiting the starting movement of said second potentiometer element at different intervals relative to the starting movement of said first potentiometer element, and a foot pedal operatively connected to said interconnecting means.

5. A sound control system comprising a first potentiometer element movable within a predetermined range to vary the intensity of sound transmission from a first source, a second potentiometer element movable to vary the intensity of sound transmission from a second source, means interconnecting said elements, and means for limiting the starting movement of said second potentiometer element at different intervals relative to the starting movement of said first potentiometer element to correspondingly delay the actuation of said second element following actuation of said first element.

6. A sound control system comprising a first potentiometer element movable within a predetermined range to vary the intensity of sound transmission from a first source, a second potentiometer element movable to vary the intensity of sound transmission from a second source, means interconnecting said elements, means for limiting the starting movement of said second potentiometer element at different intervals relative to the starting movement of said first potentiometer element to correspondingly delay the actuation of said second element following actuation of said first element, and a foot pedal operatively connected to said interconnecting means.

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