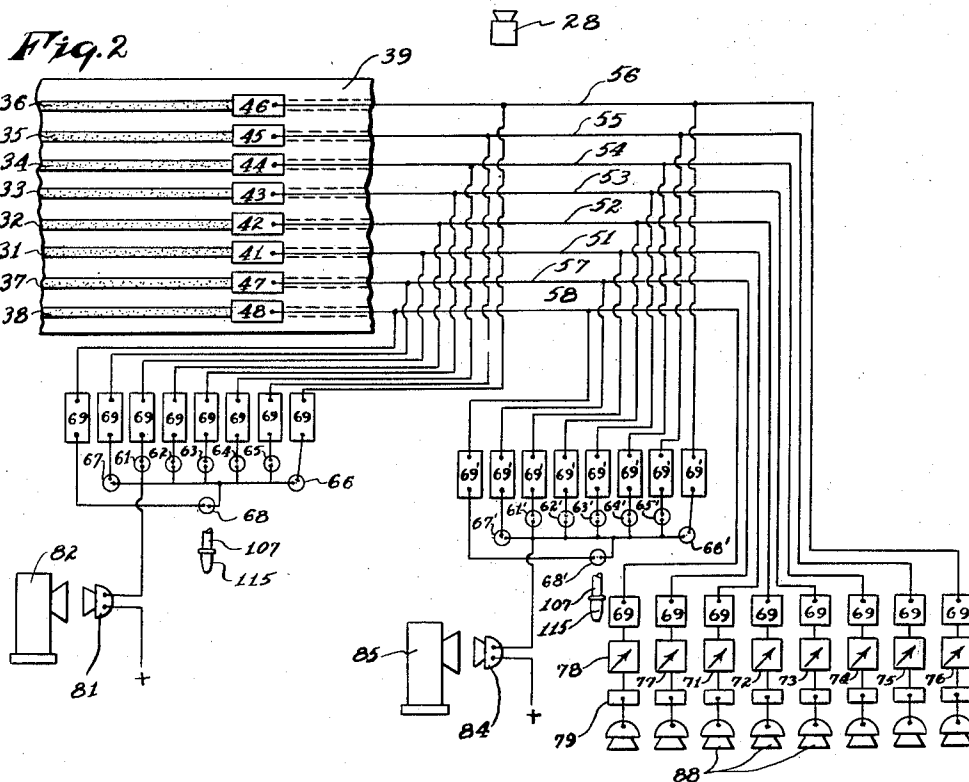


2,899,505

2 Sheets-Sheet 1



Willis Robert Dresser.
BY Emery, Varney,
Whittemore & Dix
ATTORNEYS

Aug. 11, 1959

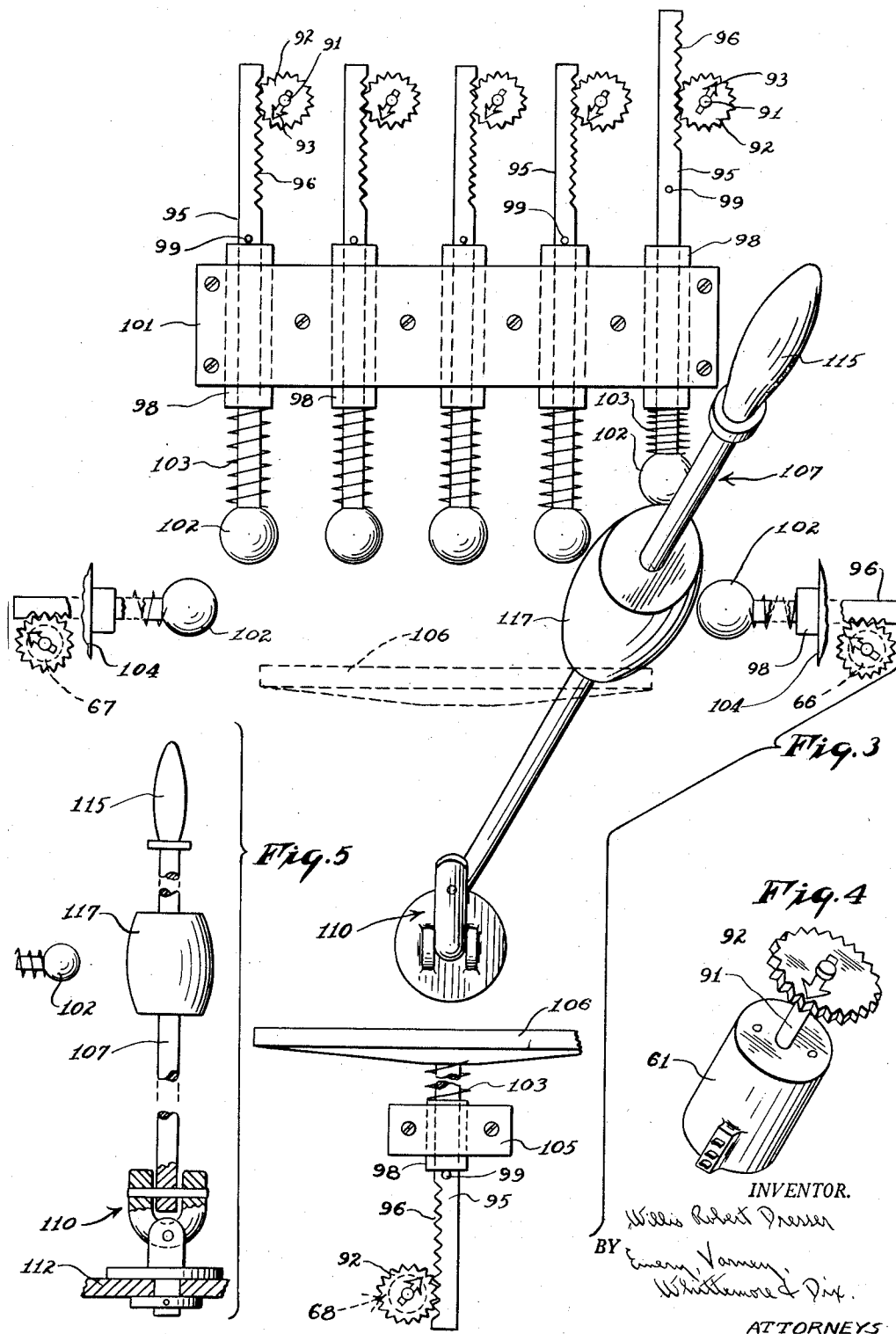
W. R. DRESSER

2,899,505

RE-RECORDING MIXER FOR MULTI-SOUND TRACK RECORDS

Filed Aug. 26, 1953

2 Sheets-Sheet 2



1

2,899,505

RE-RECORDING MIXER FOR MULTI-SOUND
TRACK RECORDS

Willis Robert Dresser, Long Hill, Conn., assignor, by
mesne assignments, to The Prudential Insurance Com-
pany of America, a corporation of New Jersey

Application August 26, 1953, Serial No. 376,553

14 Claims. (Cl. 179—100.1)

This invention relates to apparatus for recording sound on films and relates more particularly to the recording of sound on a plurality of different sound tracks which are used for producing stereophonic effects.

It is an object of the invention to provide improved apparatus for recording sound on different sound tracks and for selecting the particular track or tracks on which the sound is to be recorded at any particular time. Another object is to control the volume of the sound and to control it selectively when recording on more than one track.

Another object is to provide an improved re-recording mixer for producing plural sound tracks that are to be used for stereophonic effects. One feature of the invention relates to control means which the operator moves in the direction from which he wants the sound to come when the sound film is used with speakers located in front of, on both sides, and behind the audience for control by the sound film in the intended manner.

Another feature of the invention relates to the simultaneous recording of different sound effects with movement of the sound effects between different sound tracks independently of other sound effects, and under the control of a different operator, if desired.

Other objects, features and advantages of the invention will appear or be pointed out as the description proceeds.

In the drawing, forming a part hereof, in which like reference characters indicate corresponding parts in all the views:

Figure 1 is a diagrammatic plan view of a theater showing the location of a moving picture screen and showing the location of speakers with respect to the screen and audience;

Figure 2 is a wiring diagram showing the invention used for controlling the recording of sound on different tracks of a sound film;

Figure 3 is a diagrammatic view showing one set of audio-volume control actuators that are used with the apparatus of Figure 2, and showing the manual operating device for the audio-volume control actuators;

Figure 4 is a perspective view of one of the audio-volume controls; and

Figure 5 is an elevation showing the manually operated lever by which the controls are selectively displaced.

Figure 1 shows a theater equipped for showing mosaic pictures on a wide, curved screen 11 which extends across the front of the theater. The seating space in which the audience is located is indicated by the reference characters 12. There are a number of speakers 21—25 located behind the screen 11 at spaced regions across the width of the screen.

There is another speaker 26 located at one side of the audience, some distance back from the screen, and a corresponding speaker 27 is located on the other side of the audience. There is a speaker 28 at the back of the theater.

Ordinarily, the eight speakers shown in Figure 1 are sufficient to produce any desired stereophonic effects, but

2

it will be understood that more speakers can be used if the theater is large and more localized sound effects are desired.

If the scene on the screen 11 shows a motor boat moving from left to right, the sound of the motor will be reproduced first from the speaker 21, and then successively from the speakers 22—25 so that the sound comes from the portion of the scene where the image of the boat is located.

The change in the sound from one speaker to the next is gradual. For example, the entire motor sound may come originally from the speaker 21, and if the boat travels to a location in front of the speaker 22, the volume of sound from the speaker 21 diminishes gradually and the sound from the speaker 22 begins at a low volume and increases progressively to full volume as that from the speaker 21 diminishes to zero. The combined sound from both speakers 21 and 22 is constant if the boat is shown as moving across the screen without getting closer to or further from the audience.

If the boat, or other object, for which the sound is reproduced, is moving away from the audience at the same time that it is moving toward the right, then the total volume of motor noise becomes gradually less as it comes successively from the speakers 22, 23, etc. Conversely, if the object producing the sound is shown on the screen to be approaching closer to the audience, the total sound volume increases.

The speakers 26 and 27 are used to produce sound effects for objects which are about to appear on the screen, or for objects that have passed beyond the limits of the screen while moving toward one side or the other. The speaker 28 is used for sound from an object which is to appear on the screen from above or below; or which moves beyond the limits of the screen by traveling beyond the upper or lower limit of the picture.

The speakers are also used to obtain stereophonic effects for objects which are moving in opposite directions. For example, a train may be shown moving across the screen in a direction from left to right at the same time that an airplane is moving across the screen in the opposite direction. Under these circumstances, the sound effect for the train would progress from the speaker 21 to the speakers 22, 23, 24 and 25, respectively, at the same time that the sound effect for the airplane progressed from one speaker to the other in the opposite order.

The spaced speakers are also used for reproducing sound that does not move, but which is represented as coming from fixed locations in the picture. An example of this would be a conversation between persons located on the screen in the region of the speakers 22 and 24, respectively. The speech of the person in the region of the speaker 22 would come from that speaker, and the speaker 24 would reproduce the conversation from the other location on the screen.

Figure 2 shows the way in which the sound tracks are recorded for controlling the various speakers shown in Figure 1. The sound tracks which control the speakers 21—28 are represented by the reference characters 31—38, respectively. These sound tracks 31—38 extend parallel to one another on a film 39 which is preferably a film having a coating containing colloidal iron for producing a magnetic sound track.

The magnetic sound tracks 31—38 are produced by magnetic recorder heads 41—48, respectively. The sound tracks 31—38 extend longitudinally along the film 39 parallel to one another and at spacings which are generally determined by the physical width of the recorder heads 41—48. The recorder heads 41—48 are connected with electric circuits 51—58, respectively; and these circuits are supplied with signals from audio-volume con-

trols. In the preferred embodiment of the invention there are several sets of audio-volume controls. One group consists of the controls 61—68 which are connected to the circuits 51—58, respectively. Each of these controls supplies signals to its circuit through an amplifier 69. Another group consists of the controls 61'—68', with an amplifier 69 for each of the controls. Another group consists of the controls 71—78, connected to the circuits 51—59, respectively.

The audio-volume controls 71—78 are shown with an amplifier 69 and a preamplifier 79 for each control. It will be understood that the other groups of controls 61—68 and 61'—68' also have preamplifiers.

There is a microphone 81 which supplies sound signals to all of the audio-volume controls 61—68. Each of these volume controls is adjustable down to a zero output level so that it is not necessary to disconnect any control from the microphone 81 when the recorder operated by that control is not in use. In Figure 2 the microphone 81 is used to provide sound effect signals from a sound reproducer 82 which may be a record player supplying the sound of an engine, or train, or any other device which is to be shown moving across the screen at one time during the motion picture.

There is a similar microphone 84 connected with all of the audio-volume controls 61'—68'; and this microphone 84 receives signals from another sound reproducer 85. By having two separate sound reproducers 82 and 85, it is possible to have sound effects for two different objects that are moving across the screen in different directions, or one of which is moving while the other remains stationary, or both of which may be moving across the screen in the same direction, but one of which is shown moving away from the audience so that its sound should decrease in volume. It will be understood that there may be as many microphones connected with audio-volume control groups as are necessary for the particular effects required for the moving picture which the sound record is to accompany.

Each of the controls 71—78 is provided with its own microphone 88. These microphones 88 are preferably located at some distance from one another so that sound can be supplied to any one of them without operating the others. They are intended for sounds which do not move across the screen, and for producing sound signals for persons or instruments which actually move while recording the sound. For example, in re-recording speech, the person speaking may walk from one microphone 88 to the other in accordance with the change in location of an actor on the screen. Similarly, a musical instrument may change from one location to another; and the microphones 88 may be located close enough together so that sounds of large volume, such as an orchestra, can operate all of the microphones 88 simultaneously for playing background music.

Figure 3 shows the apparatus for selectively actuating the various audio-volume controls 61—68, or combinations of them. Each of the audio-volume controls 61—68 has a shaft 91 to which a pinion 92 is secured. The construction for the volume control 61 is shown in Figure 4, and that of the other volume controls 62—68 and 61'—68', is similar. Rotation of the shaft and pinion controls the gain of an amplifier to vary the volume of a sound from a zero level to a predetermined maximum for which the circuit is designed. An arrow 93 on the face of the pinion 92 indicates the position of the volume control.

Each volume control has an actuator comprising a plunger 95 on which there is a rack 96 with teeth that mesh with the pinion 92. The plunger 95 slides in a bearing sleeve 98 and has a stop, such as a pin 99, for limiting the movement of the plunger in one direction.

The bearing sleeves 98 of the actuator for the volume controls 61—65 are at predetermined, transversely spaced

locations from one another along a fixed support 101. At the inner end of each of the plungers 95, there is a head 102. A spring 103 is compressed between the head 102 and the end of the bearing sleeve 98. This spring 103 urges the plunger 95 inwardly until the pin 99 contacts with the other end of the bearing sleeve 98. In the construction illustrated, the heads 102 are spherical, but other shapes can be used. The space between the respective heads 102 is preferably approximately equal to the widths or diameters of the heads.

Each of the volume controls 66 and 67 has an actuator similar to the actuator for the volume controls 61—65, carried by fixed supports 104, but the plungers 95 and bearing sleeves 98 for the actuators of the controls 66 and 67 extend in directions at right angles to the plungers and bearing sleeves of the actuators for controls 61 and 65. The heads 102 of the actuators for the controls 66 and 67 are spaced from the heads of the actuators for the controls 65 and 61, respectively, by a distance substantially equal to the width or diameter of the heads 102.

The actuator for the control 68 is somewhat different from that used for the other controls. It has a plunger 95 with a rack having teeth 96 meshing with the pinion 92 of the audio-volume control 68, as in the case of the other controls. The plunger 95 also has a bearing sleeve 98 carried by a fixed support 105 and has a pin 99 for limiting the plunger's movement, and has a spring 103 urging the plunger 95 in a direction to bring the pin 99 into contact with the bearing sleeve 98.

Instead of the spherical head 102 which is attached to the inner end of each of the other plungers 95, the actuator for the control 68 has a broad plate 106 which extends for a distance which is approximately equal to the distance from a point midway between the heads 102 of the actuators for controls 61 and 62, to a point substantially midway between the heads of the actuators for the controls 64 and 65. The reason for this length of the plate 106 will be understood in connection with the description of the operation of the actuators by a manually operated control lever 107.

Figure 5 shows the lever 107 with a universal joint 110, at its lower end, connected with the floor 112 or some other fixed, underlying support. At the upper end of the lever 107 there is a handle 115 for moving the lever in various directions in accordance with the direction from which it is desired to have the sound come. A collar 117 is secured to the lever 107 at the level at which the heads 102 are located.

All of these heads 102, and the plate 106, are preferably at the same level above the floor but the collar 117 has to be of substantial vertical extent because of the fact that it moves along an arc about the universal joint and changes its height from the floor as it moves away from a vertical position. The peripheral surface of the collar 117 is barrel-shaped, with its radius of curvature approximately equal to the height of its midpoint above the universal joint 110.

The operation of the apparatus is best illustrated in Figure 3. Whenever a particular actuator is to be used to operate one of the volume controls, the lever 107 is pushed in the direction of that actuator, and the collar 117 displaces the actuator by various distances depending upon how far the attendant moves the lever 107 after its collar 117 has come in contact with the head of the actuator. The greater the displacement, the greater the volume of sound.

The diameter of the collar 117 at its point of maximum diameter, or the distance through the collar 117 in the horizontal plane of the heads 102, when the lever 107 is at an angle to the vertical, is greater than the distance between alternate heads 102. For example, it is greater than the distance between the heads 102 of the actuators for controls 61 and 63, or the heads of the actuators for the controls 62 and 64, etc. In measuring the distance between the heads of the actuators, how-

ever, the distance is the actual distance between the nearest points of the heads 102, and not the center-to-center distance between the heads.

The width of the collar 117 is preferably less than the distance between the heads 102 of the actuators for controls 61 and 64, or controls 62 and 65. Thus, the collar 117 is large enough to displace two heads 102 simultaneously for approximately their maximum displacement; or it can displace any head for maximum displacement while displacing the adjacent heads on both sides slightly; or it can displace any one head for a limited distance without displacing the adjacent heads. The collar 117 can also displace the head 102 of either of the end controls 61 or 65 at the same time that it is displacing the actuators for the side control 67 or 66.

Figure 3 shows the plate 106, of the actuator for control 68, located at a substantial distance away from the other actuators in order not to interfere with the illustration of the lever 107 and its mounting. Actually, the plate 106 is located in the position indicated by dotted lines so that the collar 117 can displace the plate 106 at the same time that it is displacing the heads 102 of either of the controls 66 or 67. The reason for having the plate 106 wide enough to be operated by the collar 117 from either end of the apparatus is to make possible an increasing displacement of the control 68 simultaneous with a decreasing displacement of either of the actuators for the controls 66 and 67. This is necessary whenever a sound effect is required in which an object moving along either side of the audience is to be represented as moving progressively to the rear.

In the operation of the apparatus the operator may move the lever 107 so as to roll the collar 117 along the heads 102. This rolling movement may be in a direction to cause greater displacement of successive heads 102, or less displacement, if the object in the picture is moving closer to or further from the audience, or the collar 117 may be moved so as to cause the same displacement of each successive head 102, if the object in the picture remains at substantially the same distance from the audience during its travel across the field of the picture.

The preferred embodiment of the invention has been illustrated and described, but changes and modifications can be made without departing from the invention as defined in the claims.

What is claimed is:

1. Re-recording apparatus for recording a plurality of sound tracks for stereophonic effects, including a group of separate recorders for producing the different sound tracks, a different and independently movable operating element for each recorder including means operable into different positions for progressively changing the volume of the recorded sound, and an actuator that is movable selectively into different positions with two coordinates of motion to actuate one or more of the operating elements of the respective recorders and through different displacements to control the volume of the recorded sound, the number of operating elements actuated by said actuator depending upon the position of the actuator as it is moved with one coordinate of motion, and the extent of movement of the operating elements depending upon the extent of movement of the actuator in its other coordinate of motion.

2. The re-recording apparatus described in claim 1, and in which the actuator has a portion that extends adjacent to and in front of a plurality of the operating elements for the recorders, said operating elements being located side by side along a course, and the actuator being movable into certain positions in which it contacts with and actuates several of the operating elements simultaneously.

3. Re-recording apparatus for obtaining stereophonic effects, said apparatus including different and independently movable operating elements for a plurality of sep-

arate and independent recorders, each of which produces a different sound track, each of the operating elements being movable into different positions to control its recorder, and the operating elements being oriented in accordance with the intended orientation of speakers which the sound tracks are intended to supply, and an actuator movable selectively into different positions to displace different ones of the various operating elements, the actuator including a handle that moves toward the various operating elements to actuate them.

4. Re-recording apparatus, including separate recorders for producing a plurality of sound tracks for operating speakers at different locations in a theater for stereophonic effects, a manually operated actuator, separate and independently movable operating elements for the respective recorders, the operating elements being located side by side, and relatively close together, and in the same orientation as the intended orientation of the speakers which the sound tracks are intended to control, the actuator being movable selectively into positions in front of any selected operating elements or in front of adjacent operating elements at the same time, the actuator being also movable toward said operating elements to displace whatever operating elements the actuator is in front of, each of the operating elements including means for controlling the volume of the recorded sound in proportion to the extent of displacement of the operating element by said actuator.

5. Re-recording apparatus for controlling the recording of a plurality of sound tracks for operating speakers located in a theater to produce stereophonic effects, separate recorders for producing the different sound tracks, different and independently movable controllers for the recorders at different locations spaced transversely from one another along a course and in the same orientation as the intended orientation of the speakers which the sound tracks are intended to control and an actuator for the controllers, bearing means on which the actuator is movable into different positions along said course and into positions adjacent to different ones of said controllers to actuate respective controllers, the said actuator having a portion that contacts with the controllers and that is movable progressively along said course from one controller to the other so as to maintain a continuous actuation of the respective controllers and a resulting progression of the sound from one track to another, each of the controllers including means for varying the volume of the recorded sound in proportion to the extent of displacement of the controller by said actuator.

6. Re-recording apparatus for producing a plurality of sound tracks for controlling speakers located at different places in a theater for stereophonic effects, said apparatus including different recorders for the respective sound tracks, different and independently movable controllers for the recorders located side by side along a course in the same orientation as the intended orientation of the speakers which the sound tracks are intended to control and means for actuating the controllers selectively, individually or in combination with adjacent others of the controllers to continuously record a sound across the different sound tracks, said means including an actuator with bearings on which it is movable along said course and transversely of the course toward the controllers to displace said controllers, each of the controllers including means for varying the volume of the recorded sound in proportion to the extent of displacement of the controller by said means for actuating the controllers.

7. Re-recording apparatus for controlling recorders that produce separate sound tracks for the operation of speakers at different parts of a theater for stereophonic effects, said apparatus including separate recorders for the different sound tracks, different and independently movable operating elements for the various recorders including several operating elements spaced transversely across a control station with the same orientation as

the intended orientation of the speakers which the sound tracks are intended to control, other operating elements located at the ends of the control station for recording sound tracks for supplying speakers at the sides of a theater, and an actuator located at the control station and having a portion that contacts with the operating elements of the separate recorders, and a mounting on which the actuator is movable toward and from all of the operating elements to selectively regulate the extent of displacement of the respective operating elements, the contacting portion of the actuator being wider than spacing of the operating elements and having a surface that displaces successive operating elements progressively as the actuator is moved from one operating element to the next to shift the recording of a sound from one sound track to another without interruption or diminution of volume, each of the operating elements including means for controlling the volume of the recorded sound in proportion to the extent of displacement of the operating element of said actuator.

8. Re-recording apparatus for controlling the recording of a plurality of sound tracks for stereophonic effects, including different control means for controlling the recording of the respective sound tracks, a common actuator movable into different positions to actuate various of said controls, the different control means being located close to one another and said actuator having a center portion that contacts with and actuates any control selectively depending upon the position of the actuator, the actuator also having a side portion that extends in front of the next adjacent controller when the center portion is in contact with one of the controls, the controls having means displaced by the actuator to control the volume of the recorded sound in proportion to the displacement, and the controls having abutment surfaces in the path of said side portion of the actuator and contacted by said side portion when the actuator is moved into position to move the center portion of the preceding control into position for high volume whereby the operation of one control for high volume automatically displaces the next adjacent control to record at least a low volume of the same sound.

9. In recording apparatus for making a plurality of sound tracks for operating speakers at different locations in a theater for stereophonic effects, separate recorders for the different sound tracks including volume controllers for determining the relative amplitude of the sound obtained from the respective tracks, separate operating elements for the respective recorders located close together at a control station, each of the operating elements including a part movable through different displacements to operate the volume controller for an associated sound track, the operating elements being in positions around the control station corresponding to the intended positions, in the theater, of the speakers controlled by the sound tracks made by the recorders of the respective operating elements, and said operating elements including one at each end of the control station for making sound tracks for speakers located at the sides of the theater, a common actuator located at the control station and movable selectively toward and from all of said operating elements and movable for different distances to displace the operating elements by different displacement to control the volume of sound recorded by the separate recorders, the actuator being movable transversely in any direction to selectively and progressively displace any of the operating elements by predetermined and selected amounts.

10. The recording apparatus described in claim 9, characterized by an actuator which includes a stick extending with a vertical component, a universal mounting at one end of the stick, and a collar on the stick having a

peripheral surface that bears against the operating elements, said surface having a vertical height sufficient to provide contact with the operating elements at regions of the control station where the stick is inclined at different angles to the vertical, and said peripheral surface being curved to compensate for variations in the obliquity of the stick when moved into position to bring the collar into contact with operating elements at different distances from the mounting of the stick.

11. Apparatus for recording a plurality of separate sound tracks for operating speakers in different parts of a theater for stereophonic effects, said apparatus including separate volume controllers for the recorders that make the sound tracks, a separate operating element for each of the volume controllers movable into different positions to regulate the volume of the sound track controlled by each volume controller, the operating elements being located at a control station in the same orientation as speakers which the sound tracks are intended to supply, a plurality of operating elements spaced transversely across the front of the control station, at least one operating element at each side of the control station, and at least one operating element at the back of the control station, an actuator at the control station including a stick having a collar thereon with a peripheral surface, the actuator being movable in different positions to contact the peripheral surface selectively with any one or several adjacent operating elements, and a mounting by which the stick is supported, said mounting including a universal joint about which the stick swings into contact with any of the operating elements, the peripheral contacting surface of the collar being generally barrel-shaped and having a diameter wider than the spacing between two successive operating elements but of less width than the space between three successive operating elements.

12. Re-recording apparatus including a plurality of recorders for making separate sound tracks for controlling speakers at different locations, separate controllers for the recorders at different locations at a controlling station, each of the controllers having an element movable into different positions, an actuator movable along the controllers for shifting the movable elements to progressively control the operation of the recorders, other controllers for the recorders, said other controllers located at a second control station, each of said other controllers having an element movable into different positions, and a second actuator movable along the other controllers for shifting the movable elements to change the operation from one sound track recorder to the next independently of the operation of the first actuator.

13. The re-recording apparatus described in claim 12, characterized by other controls for the recorders but operated independently of the controls which are responsive to the actuators.

14. Re-recording apparatus for controlling a plurality of separate recorders which make sound tracks for operating speakers at different locations, a separate operating element for each recorder, including a part movable to control the volume of the recorded sound in accordance with the displacement of the movable part of the operating element, an abutment on the movable part of each operating element, said abutments being located at a control station in proximity of one another, and an actuator having an abutment surface thereon and movable selectively into different positions in which its abutment surface contacts with the abutments of the operating elements to operate them progressively as the abutment surface is displaced in one direction, said abutment surface of the actuator being wider than the spacing of said abutments at the control station whereby it spans

several of the abutments simultaneously and said abutment surface having a cam face to first displace the abutments progressively and then permit progressive return to their original positions as the abutment surface of the actuator is moved along the abutments of the operating elements, and means urging the operating elements in a direction opposite to that in which they are displaced by the abutment surface of the actuator. 5

References Cited in the file of this patent

UNITED STATES PATENTS

1,711,931	Farrington	May 7, 1929
1,876,287	Gilbert et al.	Sept. 6, 1932
1,909,370	Mallina	May 16, 1933
2,249,606	Friebus	July 15, 1941
2,343,471	Nixon	Mar. 7, 1944