

June 2, 1936.

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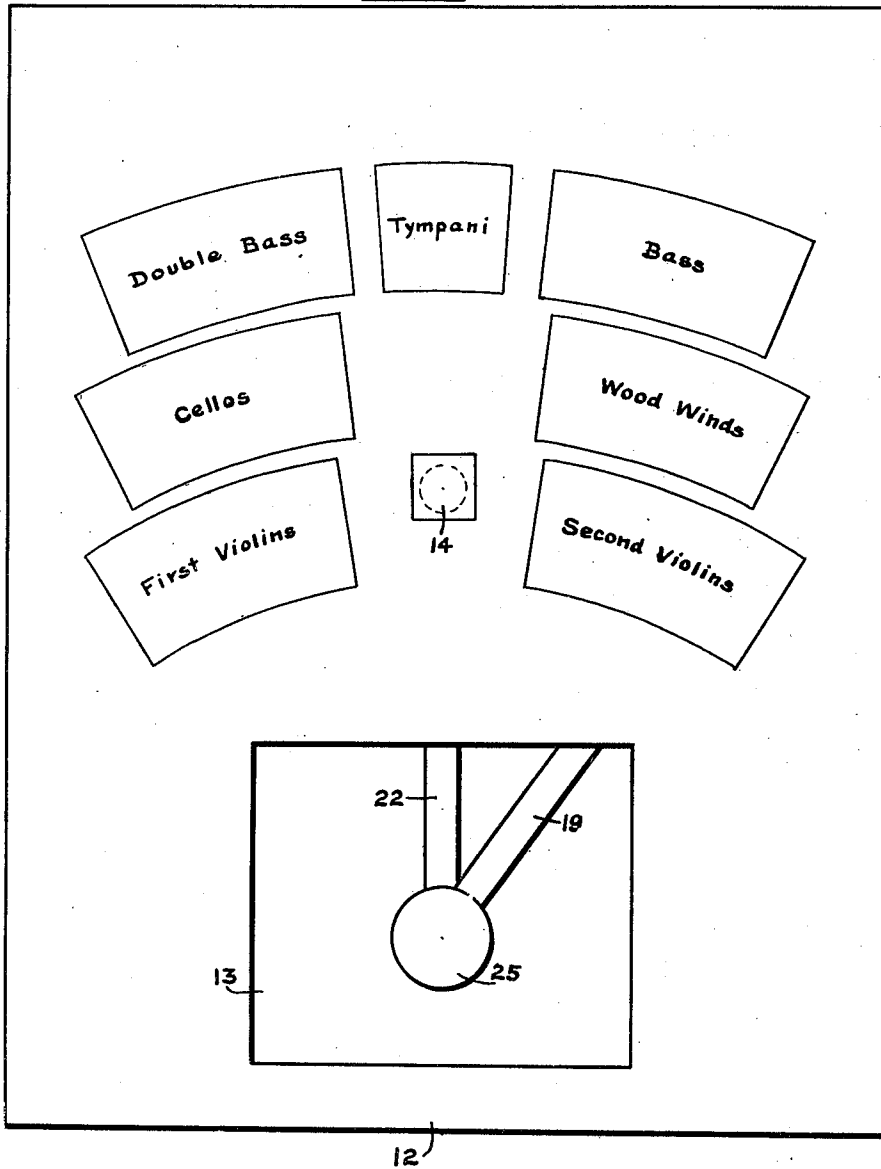
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SOUND SYSTEM

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Fig. 1.



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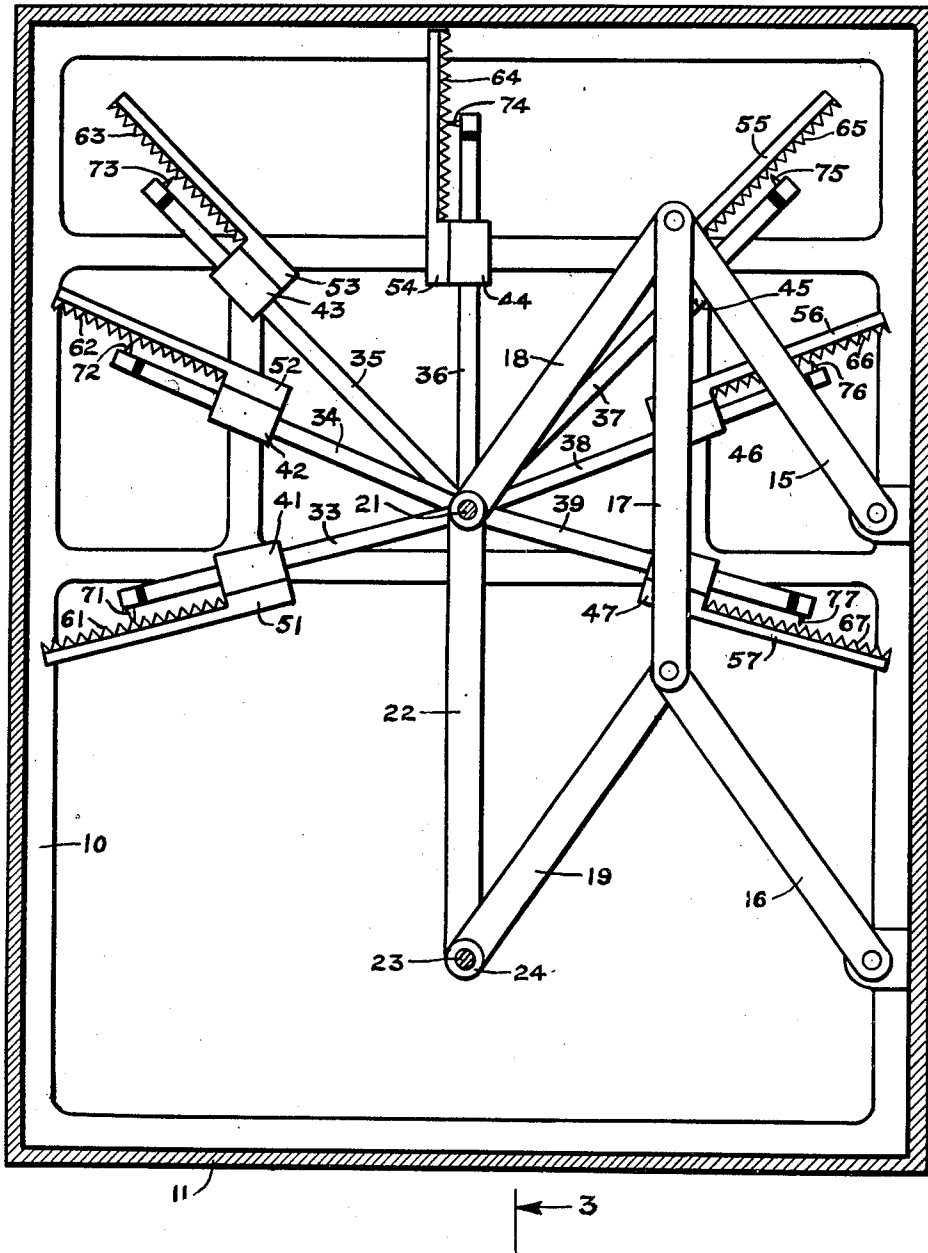
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Fig. 2. ← 3



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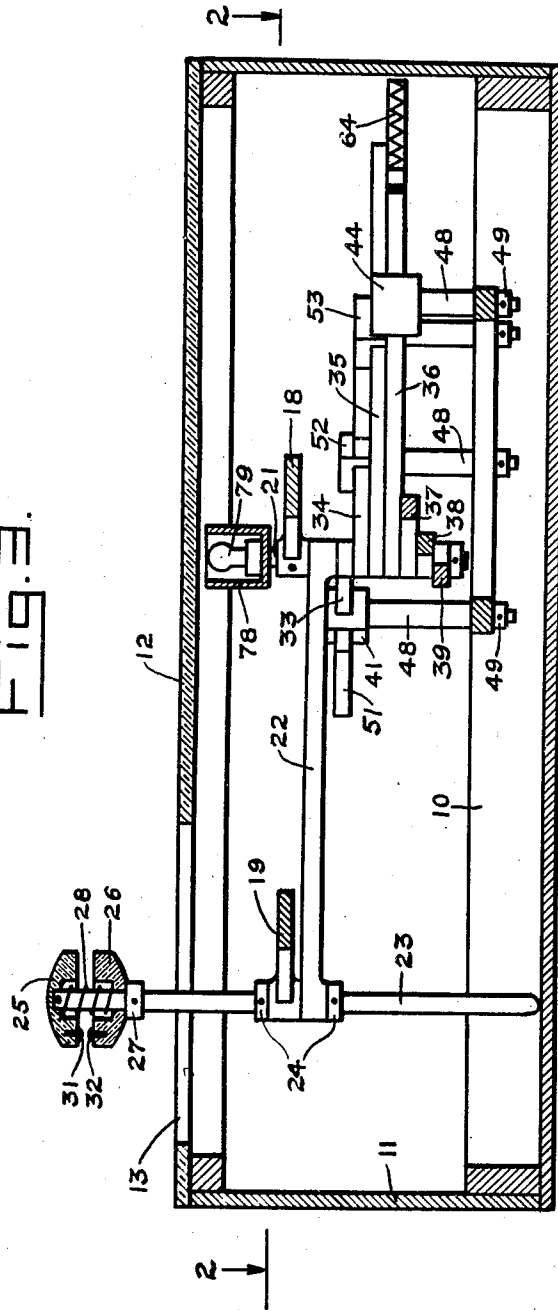
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Fig. 3.



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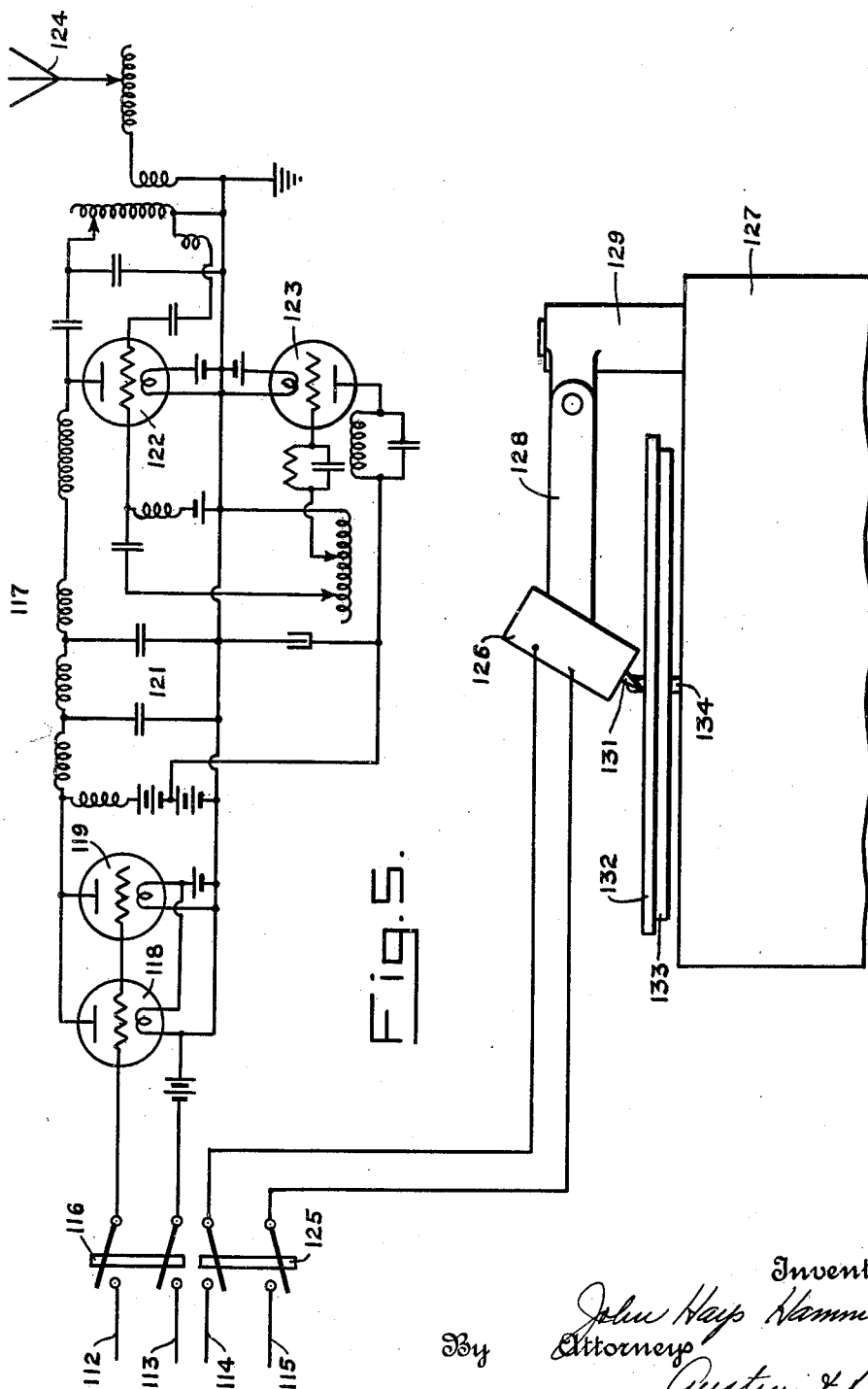
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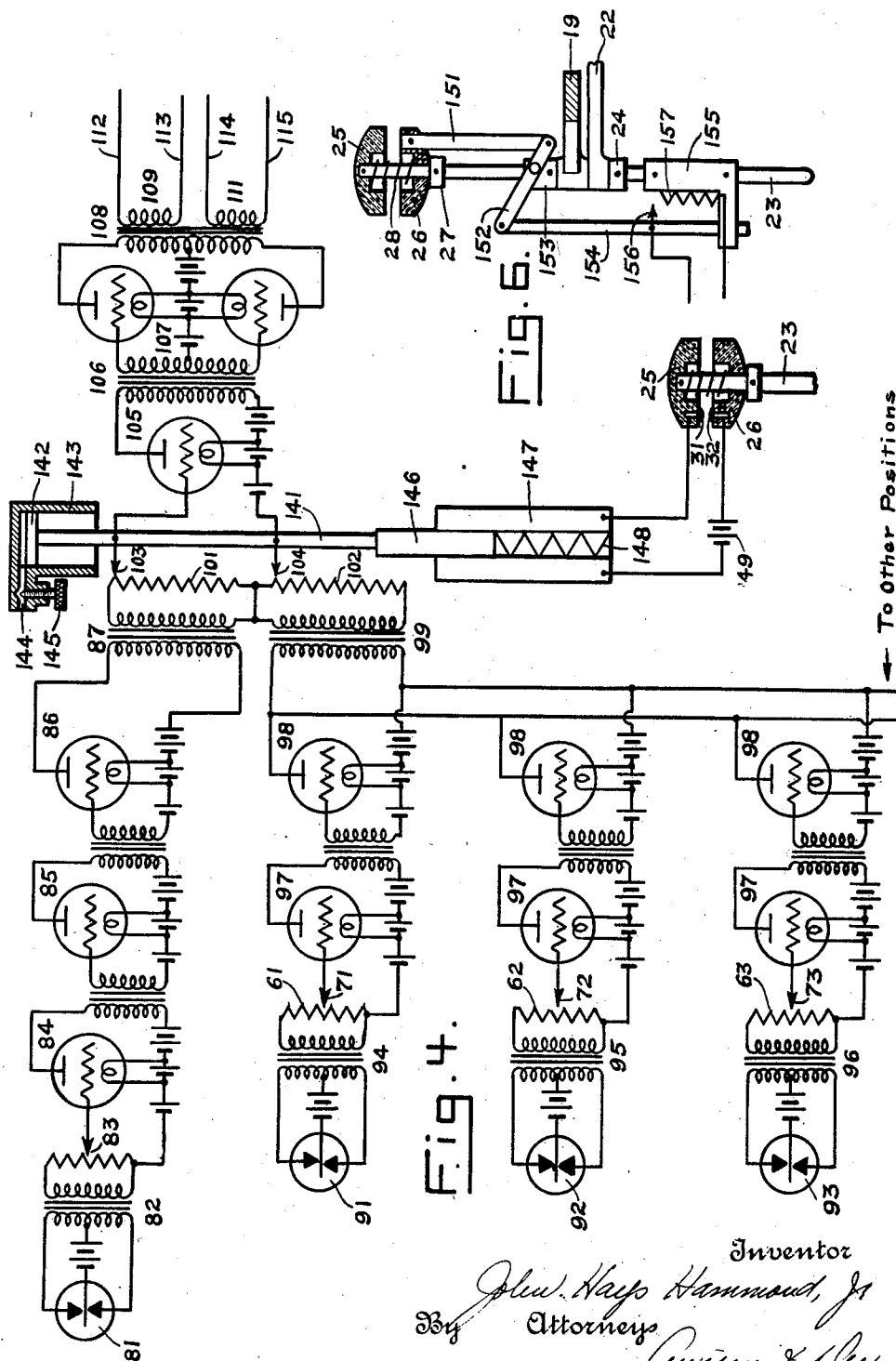
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SOUND SYSTEM

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UNITED STATES PATENT OFFICE

2,042,990

SOUND SYSTEM

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Application December 23, 1933, Serial No. 703,825

16 Claims. (Cl. 179-1)

The invention relates to acoustics, and more particularly to systems for rendering sound programs from a number of different sound sources simultaneously.

5 The invention relates to systems for improving the effects of orchestras by modifying the amounts of sound emanating from the various instrument groups. The invention is also applicable to other sound originating systems, such as those used for making talking moving pictures.

According to a preferred form of the invention, a single primary or main pick-up is located centrally of the orchestra to pick-up the entire orchestra in the usual manner. In addition, a plurality of secondary or auxiliary pick-ups are provided, one pick-up for each musical instrument or group of musical instruments. Suitable devices are provided for proportioning the relative intensities from the several secondary or auxiliary pick-ups. Further arrangements are provided for proportioning the amount of sound from the main or primary pick-up with respect to the secondary or auxiliary pick-ups taken as a whole.

25 The invention further contemplates a mechanical, multiple potentiometer arrangement under the control of the orchestra leader for proportioning the sounds picked up from the several secondary pick-ups. This control may be accomplished by a single knob or handle cooperating with a diagram indicating the layout of the orchestra. By moving the handle in position corresponding to the instrument groups in the diagram, the desired instruments may be emphasized correspondingly. The potentiometer arrangement may be such as to maintain the total amount of sound picked up from the secondary pick-ups substantially constant. A further mechanical device may be provided for proportioning the relative sound between the primary and secondary pick-ups, operable preferably after the setting of the multiple potentiometer arrangement.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, the mode of its operation and the manner of its organization may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof, in which

Fig. 1 is a top plan view of a mechanism constructed in accordance with this invention.

Fig. 2 is a sectional plan view taken on line 2-2 of Fig. 3.

Fig. 3 is a sectional elevation taken on line 3-3 of Fig. 2.

Fig. 4 illustrated diagrammatically the pick-up devices with their associated circuits.

Fig. 5 illustrated diagrammatically a transmitter and a recording system used in connection with the circuits shown in Fig. 4.

Fig. 6 shows a modified form of control handle. Like reference characters denote like parts in the several figures of the drawings.

In the following description and in the claims, parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

Referring more particularly to the form of the invention shown in Figs. 1 to 3 a framework 10 is mounted in a casing 11 which is provided with a top 12 of translucent material such as ground glass. This top is provided with an opening 13. Etched, or otherwise marked on this plate, are the locations of the various groups of instruments of the orchestra such for example as the violins, cellos, etc. Also, a square 14 denoting the location of the orchestra leader.

Pivoted to the frame 10 are two links 15 and 16 the ends of which are connected together by a link 17, to the ends of which are pivoted links 18 and 19. Pinned to the end of the link 18 is a shaft 21 upon which is rotatably mounted one end of a link 22 in the other end of which is rotatably mounted a shaft 23, the rounded lower end of which rests on the casing 11. This shaft is also rotatably mounted in the end of the link 19. Two collars 24 are pinned to the shaft 23 for holding the links 18 and 22 in their proper positions. Pinned to the upper end of the shaft 23 is a knob 25 made of insulating material. Below this is slidably mounted a second knob 26 also made of insulating material which normally rests against a collar 27. Between these two knobs is a spiral spring 28 which normally holds them apart. Located in each knob is a contact 31 and 32 respectively.

Rotatably mounted on the shaft 21 are seven square rods 33 to 39. These rods slide in sleeves 41 to 47 which are mounted on shafts 48. These shafts are rotatably mounted in the frame 10 and have collars 49 secured to their lower ends. Secured to the sleeves 41 to 47 are seven strips of insulating material 51 to 57, on which are mounted seven resistances 61 to 67. Attached

to but insulated from the rods 33 to 39 are seven contacts 71 to 77. Attached to the upper end of the shaft 21 is a cylindrical casing 78 in which is mounted a lamp 79 which is supplied with current from any suitable source, not shown.

Referring more particularly to the wiring diagram shown in Figs. 4 and 5 a primary microphone 81 is located in a suitable position with respect to the entire orchestra so that it will pick up the sounds from all the instruments. This microphone is connected through a transformer 82 to a potentiometer 83 the other side of which is connected to the input circuit of a group of amplifiers 84, 85, and 86, the output circuit of which is connected to the primary of a transformer 87.

A plurality of microphones some of which are indicated at 91, 92, and 93 are located with one microphone over each group of instruments of the orchestra, such for example, as the first violins, cellos, etc. The microphones 91, 92, and 93 etc. are connected through transformers 94, 95, 96, etc. to the resistances 61, 62, 63, etc., engaging these resistances are the slidable contacts 71, 72, 73, etc. which are connected to the input circuit of groups of amplifiers, 97 and 98, the output circuits of which are connected in parallel to the primary of a transformer 99. The secondaries of the transformers 87 and 99 are connected to resistances 101 and 102. Cooperating with these resistances are slidable contacts 103 and 104 which are connected to the input circuit of a space discharge amplifier 105, the output circuit of which is connected through a transformer 106 to the input circuit of a push-pull amplifier 107 the output circuit of which is connected to the primary of a transformer 108. This transformer is provided with two secondaries 109 and 111. The secondary 109 is connected by two conductors 112—113 to one side of a double-pole single-throw switch 116, the other side of which is connected to a radio broadcast transmitter 117 which is of standard and well known construction and which includes two modulator tubes 118 and 119, a filter circuit 121, a power amplifier 122, and an oscillator 123. The output circuit of the power amplifier 122 is connected to an antenna 124.

The secondary 111 is connected by two conductors 114 and 115 to one side of a double-pole single-throw switch 125, the other side of which is connected to the engraving mechanism 126 of a phonograph recorder 127. The engraving mechanism 126 is mounted on an arm 128 which is pivotally connected to a shaft 129. The engraving mechanism 126 is provided with an engraving tool 131 which engraves the upper surface of a record tablet 132. This tablet rests upon a disk 133 which is secured to a shaft 134 which is driven by the phonograph mechanism. This mechanism also drives the shaft 129 at a very slow rate so that the engraving tool 131 cuts a spiral track on the upper surface of the record tablet 132.

The slidable contacts 103 and 104 are mounted upon a rod of insulating material 141 to the upper end of which is secured a piston 142 slidably mounted in a cylinder 143. This cylinder is provided with a vent 144, the size of which is adjusted by means of a knurled knob 145. The other end of the rod 141 is attached to the core 146 of a solenoid 147. This core is pressed outward by means of a spring 148. The winding of the solenoid 147 is connected through a battery 149 to the contacts 31 and 32 in the knobs 25 and 26.

In the operation of the form of the invention shown in the accompanying figures the music

from the orchestra is picked up by the primary or main microphone 81 and amplified by the amplifiers 84 and 85 and 86. This amplified current then passes through the transformer 87 to the resistance 101 where normally all of this energy is picked up by the contacts 103 and 104 and fed to the amplifier 105 and push-pull amplifier 107. The energy then passes either to the broadcast transmitter 117 or to the phonograph recording mechanism 127 depending upon whether the switch 116 or 125 is closed. If the switch 116 is closed, the music is transmitted from the antenna 124 by the broadcast transmitter 117 in a well-known and standard manner which need not be more fully described herein. If the switch 125 is closed, the engraving tool 131 will cause a sound record to be made on the tablet 132 as it is rotated under this tool.

The sound picked up by the microphones 91, 92, 93, etc. will be amplified by the groups of amplifiers 97 and 98, but will not be fed to the amplifier 105 as the contact 104 is normally so set that no energy will be picked up from the resistance 102. If the orchestra leader desires to accentuate a certain group of instruments in the orchestra, such as the cellos for example, he first moves the knob 25 upward and to the left until the light 79 is moved toward the position marked cellos on the cover 12. In doing this the rod 34 will be moved to the left thus causing the contact 72 to slide over the resistance 62 in a direction to cause an increased pick-up from this resistance. Thereby the amount of resistance 62 in the input circuit of tube 97 will be increased. At the same time the contacts 71 and 73 will be moved a smaller amount over their resistances in the same direction and the contacts 75, 76, and 77 will be moved various amounts over their resistances in the opposite direction. The adjustment of knob 25, as above described, of itself causes no effect on the music.

To put the accentuation of the cellos into effect the orchestra leader squeezes the knobs 25 and 26 together, thus closing the circuit through the solenoid 147. This causes the core 146 together with the rod 141 to be moved downward, the speed of this motion being determined by the dash pot action of the piston 142 and the cylinder 143, the speed of this being controlled by the size of the opening of the vent 144.

This causes the contacts 103 and 104 to move downward over the resistances 101 and 102 at a predetermined rate of speed. As they do so, the amount of energy picked up from resistance 101 decreases and that picked up from resistance 102 increases. In this way the amplified energy from the primary microphone 81, which is fed to the amplifier 105, is gradually decreased and the amplified energy from the microphones 91, 92, and 93, etc., which is also fed to the amplifier 105, is increased. It is thus seen that by this mixing device it is possible to combine the amplified energy of the two systems of pick-up so that the total amount of energy fed to the amplifier 105 is maintained approximately constant. The energy from this amplifier is then amplified by the push-pull amplifier 107 and fed to the radio broadcast transmitter 117 or to the phonograph recording mechanism 127, as desired.

If the orchestra leader desires to accentuate the brasses, he moves the knob 25 to the right and upward so that the light 79 is moved in this direction, this motion being apparent to the orchestra leader by the bright spot of light traveling over the ground glass 12 toward the posi-

tion marked Brasses on the glass. This will cause the contact 75 to move over the resistance 65 so that more energy will be picked up from the microphone located over the brasses. The orchestra leader then squeezes the knobs 25 and 26 together thus reproducing the operation already described.

It is thus seen that by moving the knob 25 in various directions it is possible to adjust the pick-up systems to give the same effect as if the main pick-up device were moved toward whichever group of instruments it is desired to accentuate. In this way it is possible to reproduce the effect of the listener moving to various locations in the orchestra, this location being indicated by the spot of light on the ground glass plate 12.

It is well known that in making sound records the recording means does not always record all instruments and sounds in their original volume relationship. Hence the final record may be somewhat imperfect with some instruments perhaps barely perceptible while others are over-emphasized. With the present invention it is possible for the director, by adjusting the setting of the potentiometers before recording starts and leaving the adjustment constant during the recording of a selection, to compensate for these faults in the recording system and to bring the weakly recorded instruments up to their normal volume.

Although in the form of the invention shown, the system for recording is shown in connection with the recording of ordinary phonograph records it is to be understood that it is not limited to this method, but may be used with other forms of recording, such as for making a sound record on a moving picture film in any well-known manner.

In the modified form of the invention shown in Fig. 6 the mechanism is similar to that described in connection with the previous figures, with the exception of that associated with the knobs 25 and 26. In this form the contacts 31 and 32 are eliminated and a rod 151 is attached to the lower knob 26. This rod is pivoted to an arm 152 which is rotatably mounted upon a collar 153 which is pinned to the shaft 23. The other end of this arm is pivoted to a rod of insulating material 154 which slides in a member 155 also made of insulating material which is pinned to the shaft 23. Secured to the rod 154 is a contact 156 which is connected to one side of the winding of the solenoid 147. Mounted on the member 155 is a resistance 157, one end of which is connected to one side of the battery 149.

The operation of the modified form of the invention shown in Fig. 6 is similar to that described in connection with the previous figures. When the orchestra leader squeezes the knobs 25 and 26 together, the rod 151 is moved upward, thus rotating the arm 152 in a counter-clockwise direction, which in turn moves the rod 154 downward, thus causing the contact 156 to move over the resistance 157; as it does so the current passing through the solenoid 147 will be gradually increased until it is at its maximum value when the two knobs 25 and 26 are in contact. In this way it is possible for the orchestra leader to adjust the current passing through this solenoid to any desired value by suitably manipulating the knobs 25 and 26. He can thus determine the final positions of the contacts 103 and 104 which in turn will determine the amount of energy picked up from the resistances 101 and 102. The or-

chestra leader can, therefore, determine the relative amount of energy which is picked up from the two systems. He thus not only has the means to accentuate any desired section of the orchestra, but also a means for grading this accentuation as desired.

Although only a few of the various forms in which this invention may be embodied have been shown herein, it is to be understood that the invention is not limited to any specific construction, but might be embodied in various forms without departing from the spirit of the invention or the scope of the appended claims.

What is claimed is:

1. In an orchestral pick-up system, means for picking up sound from different parts of an orchestra in variable proportions, control means for varying said proportions, a surface marked out to simulate the space relationship of the parts of said orchestra and an indicator moved by said control means over said surface to give by its position a visual indication of the relative proportions for which said control means is set.

2. An orchestral pick-up system comprising a plurality of microphones located respectively over the various groups of instruments, a plurality of channels including variable transmission devices connected respectively to said microphones, said transmission devices being located in the same spaced relationship as said microphones and manual means for adjusting all of said variable transmission devices simultaneously and differently.

3. In a system for translating sounds emanating from a plurality of sources into electrical energy, a means for simulating the output of a single sound pick-up device movable among said sound sources comprising a plurality of sound pick-up devices distributed among said sound sources, means for combining the energy outputs of said pick-up devices, and a proportioning device for variously proportioning said outputs, said proportioning device including means for maintaining the relative proportions of said outputs the same as that of the energy which would be received from said sources by said single sound pick-up device as it is moved with respect to said sources.

4. In a system for translating sounds from a plurality of sources into electrical energy, a pick-up device located near each said source of sound, means for combining the energy outputs of said pick-up devices, and means for variously proportioning said energy outputs, said last means being adapted to automatically maintain predetermined relative proportions between said outputs.

5. A potentiometer control mechanism comprising a plurality of sliding contact potentiometers, a control rod associated with each of said potentiometers, longitudinal motion of each said rods being adapted to vary the setting of its associated potentiometer, a pivot member, all said rods being pivoted thereon, and a control member for moving said pivot member about over a predetermined area.

6. In a sound pick-up system, a plurality of pick-up devices distributed in space, a circuit for combining the outputs of said devices in various proportions, a proportioning device for varying said proportions, a translucent screen marked to simulate the space relationship of said pick-up devices, a light source behind said screen, and means for controlling the position of said light source responsive to the setting of said propor-

tioning device whereby the proportions of said outputs are visually indicated on said screen.

7. In a sound pick-up system, a plurality of pick-up devices distributed in space, a circuit for combining the outputs of said devices in various proportions, a proportioning device for varying said proportions, an indicator adapted to be moved in various directions to simulate the space relationship of said pick-up devices, and means for controlling the position of said indicator responsive to the setting of said proportioning device whereby a visual indication of the proportions of said outputs is obtained.

8. In a sound pick-up system, a plurality of pick-up devices distributed in space to separately pick up energy from a plurality of sources, a circuit for combining the outputs of said devices in various proportions, a proportioning device for varying said proportions, an index arranged to simulate the space relationship of said pick-up devices, an indicator cooperating with said index, and means for controlling the position of said indicator responsive to the setting of said proportioning device whereby the proportions of said outputs are visually indicated on said index.

9. An orchestral pick-up system comprising a plurality of microphones located respectively over the various groups of instruments, a plurality of channels including variable transmission devices connected respectively to said microphones and a single control means adapted to simultaneously and differentially adjust all of said devices so as to obtain any desired proportion of the energy from each individual microphone.

10. An orchestral pick-up system comprising a plurality of microphones located respectively over the various groups of instruments, a plurality of channels including variable transmission devices connected respectively to said microphones and variously disposed about a center and a central control means pivotally connected to each of said devices and adapted to simultaneously and differentially adjust said devices according to the direction of movement thereof.

11. An orchestral pick-up system comprising a plurality of microphones located respectively over the various groups of instruments, a plurality of channels including variable transmission devices connected respectively to said microphones and variously disposed about a center and a central control means pivotally connected to each of said devices and adapted to simultaneously and differentially adjust said devices so as to obtain any desired ratio of the energy from the various microphones.

12. In a sound pick-up system, a plurality of pick-up devices distributed in space to separately pick up energy from a plurality of sources, a circuit for combining the outputs of said devices

in various proportions, a proportioning device for varying said proportions, a pick-up device adapted to pick up energy from all of said sources, a utilization channel actuated by the combined outputs of said first pick-ups and by the output from said last pick-up and means to inversely vary the influence of said outputs on said utilization channel.

13. In a sound pick-up system, a plurality of pick-up devices distributed in space to separately pick up energy from a plurality of sources, a circuit for combining the outputs of said devices in various proportions, a proportioning device for varying said proportions, a pick-up device adapted to pick up energy from all of said sources, a utilization channel actuated by the combined outputs of said first pick-ups and by the output from said last pick-up, means to preset said proportioning device and means to gradually reduce the influence of said last pick-up and to increase the influence of said first pick-ups on said utilization circuit.

14. In a sound pick-up system, a plurality of pick-up devices distributed in space to separately pick up energy from a plurality of sources, a circuit for combining the outputs of said devices in various proportions, a proportioning device for varying said proportions, a pick-up device adapted to pick up energy from all of said sources, a utilization channel actuated by the combined outputs of said first pick-ups and by the output from said last pick-up, a control handle to preset said proportioning device and means actuated by said control handle for progressively reducing the influence of said last pick-up and progressively increasing the influence of said first pick-ups on said utilization circuit.

15. In a sound pick-up system, a plurality of pick-up devices distributed in space to separately pick up energy from a plurality of sources, a circuit for combining the outputs of said devices in various proportions, a proportioning device for varying said proportions, a pick-up device adapted to pick up energy from all of said sources, a utilization channel actuated by the combined outputs of said first pick-ups and by the output from said last pick-up and change-over means to change the utilization circuit from said last pick-up to said first pick-up.

16. A control mechanism comprising a plurality of sliding contact devices, a control rod associated with each of said devices, longitudinal motion of each said rod being adapted to vary the setting of its associated device, a pivot member, all said rods being pivoted thereon, and a control member for moving said pivot member about over a predetermined area.

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