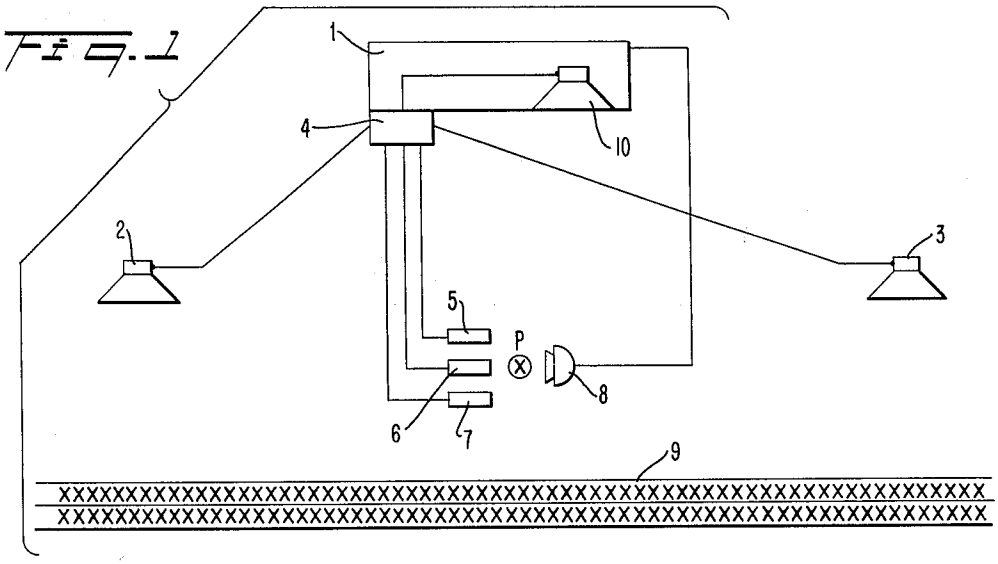
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METHOD AND APPARATUS FOR SELECTIVELY CONTROLLING SOUND EMISSION

Filed Oct. 31, 1960 2 Sheets-Sheet 1

Fig. 1



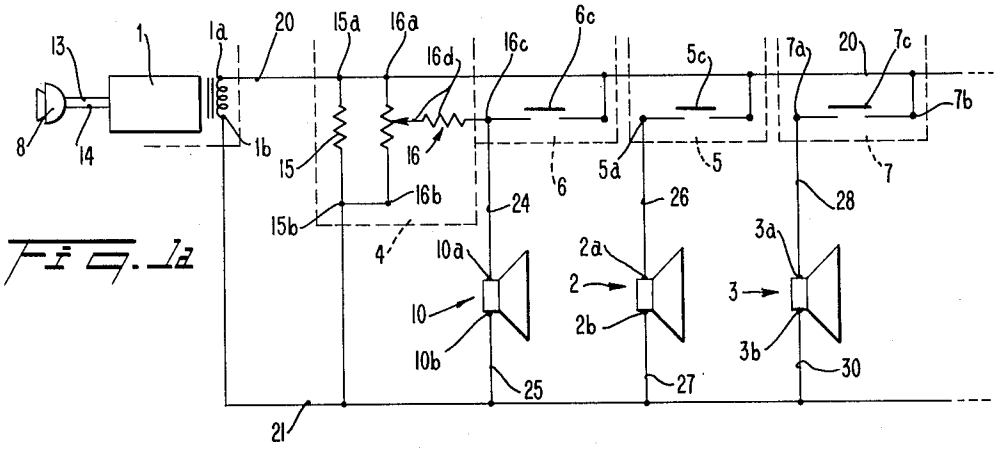


Fig. 1a

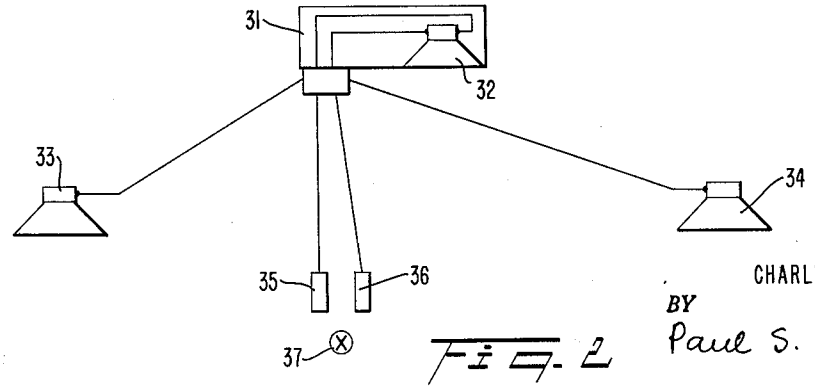


Fig. 2

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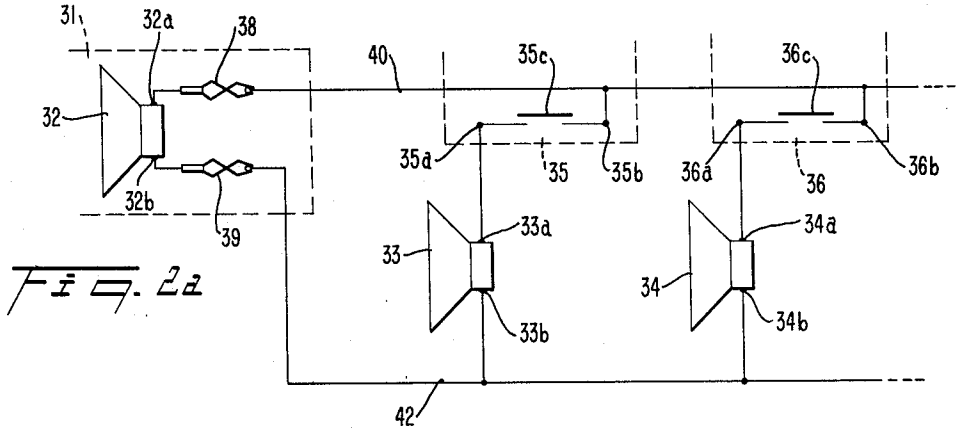


Fig. 2a

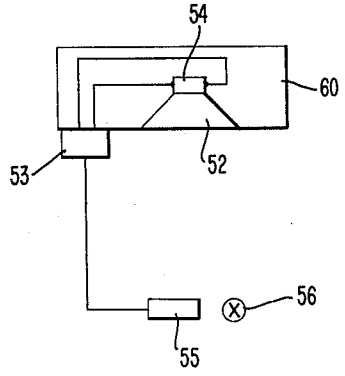


Fig. 3

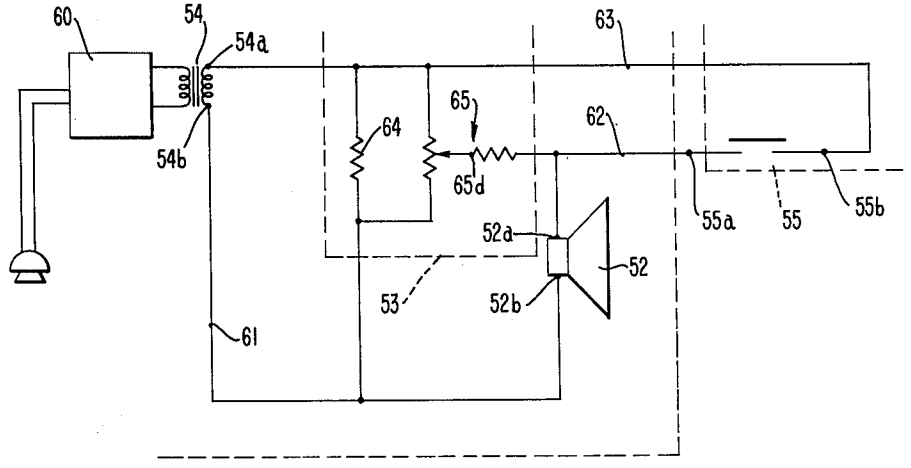


Fig. 3a

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3,156,770

METHOD AND APPARATUS FOR SELECTIVELY CONTROLLING SOUND EMISSION

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2 Claims. (Cl. 179—1)

This invention relates to a method and apparatus for creating a direction-sensing effect in multiple loud speaker systems. More particularly the invention relates to a system for selectively controlling instantaneously and/or momentarily the emission of sound from one or more loud speakers during the reproduction of sound through an electronic amplifier.

Switching devices have been incorporated into previously designed sound systems to enhance the effect of such systems from the standpoint of the listener. However, the systems which have been devised previously have not permitted the listener or the entertainer to control the direction of the sound output or to instantaneously and/or momentarily change the direction of sound to simulate a multiple effect from a single sound source coincidentally with the emission of the sound. Some systems have included pre-recorded switching signals and some have had master switching systems which were not accessible to the entertainer or listener.

An important object of the invention is to make available to an entertainer, such as a soloist, a sound system by which he may direct his output, either voice or musical sounds, through selected loud speakers at all times having complete momentary control over the loud speakers through which the sound output will be delivered. The voice or musical sounds may be emitted under these selective control conditions by controls which are directly accessible to the performer and which can be operated by him. Control as to direction of sound output may be varied with pitch or musical phrasing at the choice of the performer, thus creating novel multiple sound effects from a single sound source, which multiple effects can be selectively and momentarily changed and rearrranged.

Another important object of the invention is to make available to the listener a device under the listener's control to instantaneously and/or momentarily selectively direct the emission of sound as it emerges from multiple loud speakers, thus creating any desired spatial effect from the monaural, achieving a binaural or stereophonic effect according to the listener's selective direction.

Another object of my invention is to make a sound system available to a plurality of musicians having electronically amplified instruments whereby such musicians may share a common amplifier, each having an extension speaker and controls adjacent his respective position whereby each individual musician may "feature" himself, in turn, by operating his own respective control from the common amplifier, momentarily if need be or for longer periods if desired.

Another object of my invention is to make available to a speaker, such as a raconteur or monologist, a device by which he may direct his changes of voice instantly and/or momentarily to different extension loud speakers, placed at pre-selected positions in an auditorium, by means under his own control and without the need of signals or cues to a secondary control agent.

Another object of my invention is to make available to the musician having an electronically amplified instrument a sound system whereby the musician may preset the output level of his amplifier to a modified output level, said output level to be canceled to full level by means of a control adjacent to him which shall be connected to the output source of the emission of sound.

The invention comprises generally a sound system and a method of control of said system and apparatus for such system comprising multiple loud speakers which are spaced apart, means for delivering amplified sound to said loud speakers, and pressure operated automatic break electrical switch means for selectively directing instantaneously and/or momentarily the emission of sound from one or more of said loud speakers.

The invention also contemplates the employment of attenuator means which may also be selectively instantaneously and/or momentarily operated for changing the volume as well as the direction of sound.

For a more complete description of the invention reference is made to the drawings, wherein:

FIG. 1 is a diagrammatic plan view of the physical arrangement of one embodiment of the invention;

FIG. 1*a* is a circuit diagram of the arrangement shown in FIG. 1;

FIG. 2 is a diagrammatic plan view of the physical arrangement of elements of another form of the invention;

FIG. 2*a* is a circuit diagram of the arrangement shown in FIG. 2;

FIG. 3 is a diagrammatic plan view of the physical arrangement of elements of a further form of the invention; and

FIG. 3*a* is a circuit diagram of the arrangement shown in FIG. 3.

In FIG. 1 the system of the invention is arranged on a stage or platform facing an audience **9**. The system shown in FIGS. 1 and 1*a* includes a microphone **8** connected to an amplifier **1** by lines **13** and **14**. A centrally located speaker **10** which may be integral with the amplifier **1**, and two (or more) extension speakers are suitably spaced apart, as shown in FIG. 1. Momentary switching devices **5**, **6** and **7** are provided to control each of the speakers. The momentary switching devices may consist of foot-operated area pad type devices or finger-operated push buttons or levers or other type of pressure-operated automatic release and break. A momentary contact switch is electrically connected to each of the speakers **10**, **2** and **3**. The switches **5**, **6** and **7** may be incorporated into a single unit for convenience. An attenuator **4** to modify or reduce the volume of the sound emitted is shown connected in series to speaker **10**. The attenuator includes a resistor **15** or fixed rating and a variable resistor **16**. The terminal **15***a* of the fixed resistor **15** is connected to the line **20** from the amplifier terminal **1***a* and the terminal **16***a* of the variable resistor **16** is also connected to the amplifier line **20** in parallel with the terminal **15***a*. Terminal **15***b* from the fixed resistor **15** is connected to terminal lead **16***b*. Terminal lead **15***b* is also connected by line **21***a* to line **21**. Lead **16***b* of the variable resistor and lead **16***c* from movable arm **16***d* is connected into the line **24** from the terminal **10***a* of central speaker **10** to complete the connection between the amplifier line **20** and the speaker **10**. It will be noted that the attenuator bypasses the momentary switch **6**, so that the speaker **10** is continuously connected to the amplifier through terminal **10***a*, and the attenuator **4** to line **20** of the amplifier and through terminal **10***b* of the speaker **10**, line **25**, to amplifier line **21** which is connected to amplifier terminal **1***b*. Speaker **10** is connected to the amplifier for full volume output through momentary switch **6** which is closed by switch arm **6***c*.

Speaker **2** is connected to the amplifier **1** through speaker terminal **2***a*, line **26** to switch terminal **5***a*, and switch terminal **5***b* is connected through amplifier line **20** to the amplifier. The speaker **2** is connected through speaker terminal **2***b*, line **27**, and amplifier line **21** to

amplifier 1. It will be noted that the switch 5 which is in series in the line between the speaker terminal 2*a* is normally open so that the speaker is not operative unless the switch 5 is depressed. In the diagrammatic view shown in FIG. 1*a* the switch 5 is operated by applying pressure to the conductor bridge or switch arm 5*c* to close the circuit between the leads from the switch terminals 5*a* and 5*b*. Resilient means normally hold the bridge element 5*c* out of contact. Any suitable make and break pressure actuated switch may be used.

Speaker 3 is connected through its terminal 3*a*, line 28, to the switch terminal 7*a*, and switch terminal 7*b* is connected to amplifier line 20. Speaker terminal 3*b* is connected through line 30 to amplifier line 21.

As in the case of speaker 2, it will be noted that in the connections of speaker 3 the switch 7 is connected in series in the line between the speaker terminal 3*a* and the amplifier line so that the circuit of speaker 3 is normally open, that is, the speaker is not operative unless the switch 7 is closed by operating the conductor bridge 7*c* of the switch 7 to close the circuit.

In the operation of the system shown in FIGS. 1 and 1*a* the speakers 2 and 3 are spaced apart from the central speaker 10, as best shown in FIG. 1. The performer P may position himself between the speaker 10 and the audience in the central portion of the platform or stage, with an electrical transducer such as a microphone 8 easily available to pick up his voice and/or musical sounds produced by him. Also arranged within easy reach of the performer are the switches 5, 6 and 7 so that the performer may readily control the emission of sound from the three speakers 2, 3 and 10, in the following manner. As the performer sings or plays a musical instrument or, in the case of a speaker, as he speaks, he may selectively direct the sound from all three speakers at full level of amplification. This he would achieve by applying pressure to pressure switches 5, 6 and 7. In this manner the circuits of speakers 2 and 3 would be closed, connecting them to the amplifier, and the circuit of speaker 10 would be directly connected to the amplifier through the switch 6, thereby by passing the attenuator 4. If the performer wishes to reduce the volume of the sound he releases the pressure on switches 5, 6 and 7 so that speakers 2 and 3 are disconnected from the amplifier and the bypass through switch 6 to the speaker 10 is disconnected so that speaker 10 is connected to the amplifier only through the attenuator 4, which attenuator permits only a portion of the line total power output from the amplifier to reach speaker 10. The amount of attenuation, or the degree to which the attenuator reduces the line power to the speaker, may be varied by movement of the arm 16*d* of the variable resistor 16. If the performer desires to have a low volume of sound emitted from the speaker 10 and to direct the sound emission from one of the lateral speakers 2 or 3, he would depress only the switch controlling the desired lateral speaker. The switches may be operated in an instantaneous and/or momentary manner. For example, in the case of foot switches they can be operated by a tap of the performer's foot upon the switch or, if they are push buttons, by a tap of his finger. The emission may be thereby synchronized in any manner the performer wishes, for example the location and level of sound emission may be changed in time with the phrasing of the music that is being produced, or any other desired manner to obtain selection of direction and momentary change of sound location and/or level of output. In the case of a monologist or ventriloquist, where separation of the voice of a single performer may be desirable to enhance the performance, ability to direct and select the location of sound is particularly useful. In terms of novelty musical performance in the modern medium, the device is particularly useful in the control of the direction of sound and the level of sound. The effect which can be gained will be more fully understood when it is

appreciated that the output from a single amplifier through the several speakers will have a total sound value at the full line volume which may be emitted through one, two or three of the speakers which, depending upon the selection and arrangement of speakers through which the sound is emitted, will give various sound spatial effects. If the sound is all released through one of the lateral speakers, such as 2, or 3, the sound has a definite directional quality and, to the extent there is no reflection of sound from the walls, the effect is monaural; whereas if the sound is released from the two lateral speakers and/or the central speaker the sound is dispersed and may be described as binaural.

By the system shown in FIGS. 1 and 1*a*, in which the speaker 10 is arranged to emit sound at a controlled variable level, the changing of the sound from one lateral speaker to the other can be achieved without interruption or "dead spots," i.e. blanks in the sound passages, in the event the performer does not actuate the switch for one speaker before releasing the switch for another speaker.

FIGS. 2 and 2*a* show another form of the invention, wherein a listener to a pre-programmed sound reproduction such as a record player, tape reproducer, or radio, may selectively control the sound emission through a plurality of speakers. Referring to FIG. 2, the listener would be located at 37, with momentary actuating switches 35 and 36 directly available to him, which are connected for control of the lateral speakers 33 and 34 respectively. A simplified arrangement for such a system would include removable contact means such as spring clips 38 and 39 which may be connected to the terminals 32*a* and 32*b* of the main speaker of the reproducer or radio 32. The speakers 33 and 34 are connected through lines 40 and 42 to the spring clips 38 and 39. The switch 35 is connected in series in the line from the speaker terminal 33*a* to the line 40 so that the circuit of the speaker 33 is open except when the switch is operated by closing the conductor bridge 35*c*. Similarly this switch 36 is connected in series in the line between the speaker terminal 34*a* and the line 40 so that the line is open unless the conductor bridge 36*c* is operated to close the circuit between the terminals 36*a* and 36*b* of the switch 36.

In operation of the device shown in FIGS. 2 and 2*a*, sound is emitted from the central speaker 32 continuously. By actuation of the switches 35 and 36, the listener may direct the emission of the sound through either or both of speakers 33 and 34 selectively, instantly and/or momentarily, to achieve directional sound emission or dispersion of sound. In the case of a monaural reproduction the listener may selectively shift the emission of sound from one speaker to another to achieve a spatial effect and to vary the effect in accordance with his taste, to simulate binatural or stereophonic effects from the monaural source. The form of the invention shown in FIGS. 2 and 2*a* is a simple but effective embodiment of the invention whereby it is employed with a radio, record player, amplifier or tape reproducer, to provide listener enjoyment and interest in control of the sound direction and spatial effects which may be individually selected at the pleasure and on the initiative of the listener. As the pre-recorded program progresses the listener may direct the emission of sound to either of the lateral speakers, the main speaker continuing to emit sound at all times, so that there is no interruption in the sound. Release of the pressure switches inactivates the lateral speakers 33 and 34. In the form shown there is no control of the volume level of the central speaker; however a control similar to that shown in FIGS. 1 and 1*a* may be included in the system of FIGS. 2 and 2*a*, with a suitable switch means to control such volume. The control of volume level is automatically achieved in the simple system of FIGS. 2 and 2*a* when either lateral speaker is impressed on the total common audio output.

FIGS. 3 and 3*a* illustrate another embodiment of the

invention for handling and controlling the volume of sound emitted from one or more loud speakers. The system shown in FIG. 3 includes a momentarily actuable switch **55**, an attenuator **53** connected in series to one speaker terminal **52***a* of speaker **52** and the output terminal **54***a* of the secondary coil of the output transformer **54** of amplifier **60**. Speaker terminal **52***b* is connected to output terminal **54***b* of the secondary coil through line **61**. The switch **55** is connected in series as a bypass of the attenuator from speaker terminal **52***a* through line **62**, switch terminal **55***a*, switch terminal **55***b*, line **63** to the secondary coil of terminal **54***a*. The attenuator **53** includes a fixed resistor **64** and a variable resistor **65**. The attenuator level may be preset by the user at any desired volume level by shifting the arm **64***d* of the variable resistor **65** and the user may bypass the attenuator to allow full volume of the sound to issue from the speaker by operation of the momentary switch **55**. Release of pressure on momentary switch **55** restores the preset lower volume of output of sound emission.

The device of FIGS. 3 and 3*a* may be used either by a performer or by a listener. In the case of a performer, such as an instrumentalist employing an electronically amplified sound instrument during parts of the performance, the performer would be enabled, without removing his hands from the musical instrument, to selectively control the volume of sound output from the preset attenuated level to full volume, instantly and/or momentarily.

From the foregoing it will be appreciated that the system of this invention includes a method and apparatus which makes available to a performer and/or listener a sound system which is flexible in control of volume and direction of sound to achieve desired directional and sound level effects to emphasize musical phrasing or for the creation of novel multiple sound effects from a single source, which effects can be selectively and momentarily changed and rearranged, the controls for such system being immediately and directly within the selective direction of the performer and/or listener. The system also permits the listener to control and instantaneously and momentarily select the direction of emission of sound and the level or volume of sound to achieve monaural, binaural or stereophonic effects. Furthermore it will be understood that the invention may be employed with a plurality of performers such as a group of musicians, each of whom may share a common amplifier as shown in FIGS. 1 and 1*a*, each controlling an extension speaker adjacent to his respective position, whereby an individual musician may feature himself by operating the speaker adjacent to his position for the period of his featured performance.

The usefulness of the invention for speakers in changing the direction for spatial effect of the voice will be appreciated, and particularly the fact that the speaker can control the direction and volume of the sound emission himself without the need of signals or cues to a secondary control agent.

It will also be appreciated that this invention may be usefully employed by a musician or group of musicians having electronically amplified instruments to change the sound output level from attenuated to full volume.

In accordance with the patent statutes the foregoing description has fully described the invention and the preferred embodiments thereof. However it will be appreciated that other elements and arrangements of parts may be used without departing from the scope of the invention. The following claims define the scope of the invention.

What is claimed is:

1. In a sound reproducing system, a loud speaker, an amplifier connected to said loud speaker, settable attenuator means associated with said speaker for regulating the volume of sound emitted from said speaker, a momentarily actuable switch selectively actuable to by-pass said attenuator and effect a full volume output from said loud speaker, a second loud speaker spatially separated from said first loud speaker and normally disconnected from said amplifier and a second momentarily actuable switch selectively actuable to connect said second loud speaker to said amplifier for effecting sound emission therefrom.

2. The method of controlling the emission of sound from a plurality of spatially separated speakers comprising the steps of energizing one of said speakers from an amplifying means through an attenuator adjusted to correspond to a selected volume for one portion of music, by-passing said attenuator and connecting said speaker directly to said amplifying means to obtain full volume of said speaker for other selected portions of said music, and selectively connecting said other speakers immediately and momentarily to said amplifying means to obtain spaced tonal effects from said other speakers as desired in the music selected.

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