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SOUND REPRODUCING SYSTEM

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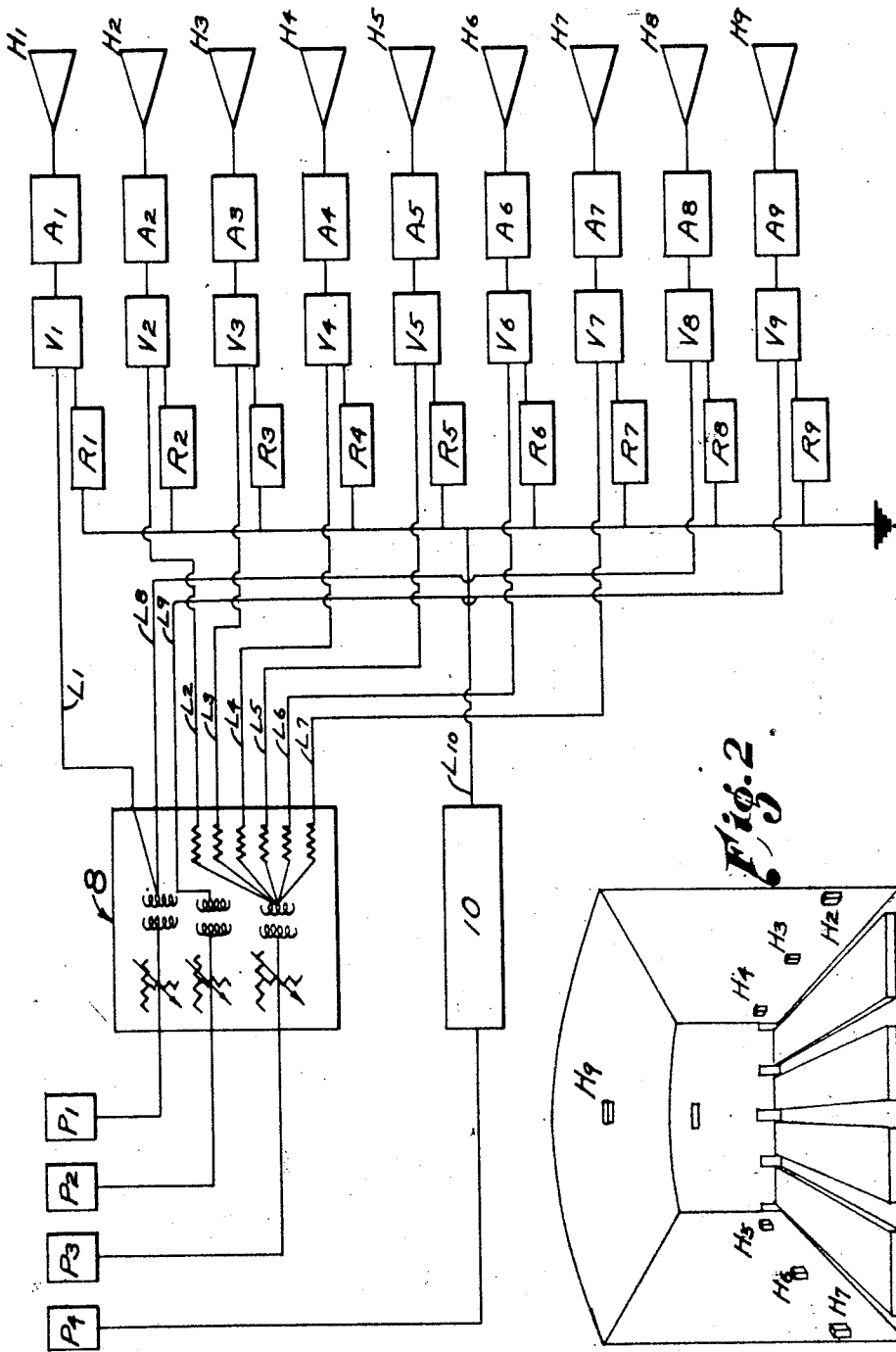


Fig. 1

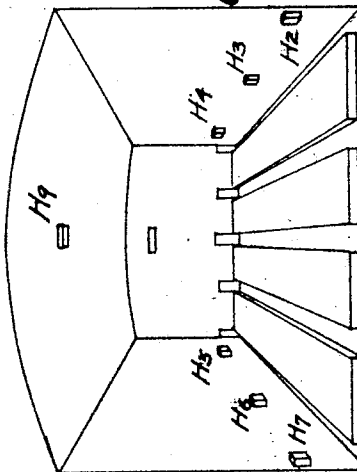


Fig. 2

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SOUND REPRODUCING SYSTEM

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7 Claims. (Cl. 179—100.3)

This invention pertains to methods of creating novel sound effects in theatres, and to combinations and arrangements of elements whereby various highly desirable and novel sound effects may be readily and automatically produced in a theatre or other amusement center, either with or without the conjoint presentation of photoplays.

Ordinarily, the exhibition of photoplays and the like is accompanied by the reproduction of sounds which are either synchronized with the objects being presented on the screen (as, for example, dialogue sound) or is accompanied by the reproduction of music and so-called special effects which form the desired background to the play or other pictures being exhibited. Usually reproduction of such accompanying sound takes place from loud speaking means located behind the projection screen and the output level of each loud speaking means (if more than one is employed) is substantially uniform. Attempts have been made in the past to create a binaural effect by employing two loud speaking means, both located in back of the projection screen but horizontally spaced from each other.

In such attempted binaural systems the output level of the two speakers would vary so that if the picture of the speaker actually uttering words appeared on the left half of the projection screen, the recorded sound of that speaker's voice would be reproduced from the speaker behind the left portion of the screen, and similarly, in the event the projected image on the right of the screen were to speak, then the speaker positioned behind the right side of the screen would reproduce the sound. In such binaural systems, two separate sound tracks were often employed, each speaker operating on its particular sound track. Attempts have been made to provide an automatic switching means so that the two speakers could suitably and alternately respond from a single sound track in accordance with notches or the like cut in the edge of the film carrying the sound track.

The present invention distinguishes from these earlier attempts in that it is not directed to binaural systems or systems in which the two speakers are supplied with sound recording slightly out of phase with one another but instead is directed to a method of reproduction in which one or more program sound recordings may be reproduced in accordance with intelligence carried by a control track from a plurality of loud speaking means positioned in the side walls, ceiling, front and back of a theatre so as to virtually

encircle the audience in the amusement reception center of the theatre.

A number of novel effects can be obtained by the use of the methods and arrangements described herein. For example, stereophonic effects may be obtained by permitting the reproduction of sound to move from one side of a theatre to the other. Furthermore, whenever the camera is moved toward the characters or other pictorially depicted objects so that during reproduction these objects appear to move toward the audience, or where the audience is moving toward the objects, sound may be caused to travel from front to back of the theatre and thereby cause the audience to be more deeply conscious of the relative movements and more intensive field of dramatic effect of the scene.

Another form of effect may be obtained by causing the reproduction of one or more elements of the program sound to travel around the theatre. The buzz of a bumblebee may be caused to swing from one loud speaking means to another completely around the theatre so as to create the effect of a bee buzzing around the head of each person in the audience.

Moreover, the methods of this invention contemplate the placement of certain specific desired components of the program sound in predetermined positions so that off-stage effects or sounds may be reproduced from loud speaking means positioned at the appropriate side of the theatre while the rest of the program emanates from the customary "back of screen" position. Solo portions or arias may be reproduced from ceiling horns, etc.

Generally stated, the present invention is directed to the reproduction methods and devices but prefers to employ a control track system produced in the manner described in a co-pending application Serial No. 348,615. As there stated, the control means comprises modulated frequencies recorded upon a control track, each of the frequencies being adapted to control the output of a given loud speaker means. In this manner, a control track bearing a mixture of predetermined frequencies varying in amplitude is produced while program sound tracks are being reproduced through the loud speakers; the response characteristics of the various loud speakers being controlled by manually adjusting a variable attenuation network which modulates the amplitude of frequencies allocated to each of the loud speaking means. The control track is not dependent upon the positional characteristics of the sound at the time of recording and differs

in characteristics from the program records. Details of the system employed in producing the control track need not be given here since they appear in the co-pending application aforesaid.

Another object of the present invention therefore, is to provide a method of creating novel sound effects in theatres and other enclosures.

A further object is to provide means whereby one or more program sound recordings may be automatically reproduced from one or more loud speaking means positioned in multiplanar relation to each other in a theatre or similar entertainment enclosure.

Other objects will become apparent to those skilled in the art from the description given hereinafter. In order to facilitate understanding, reference will be had to the appended drawing, in which:

Fig. 1 is a diagrammatic representation of the arrangement of elements entering into the system.

Fig. 2 exemplifies an arrangement of loud speakers in a theatre, this view being taken from the stage of the theatre.

By referring to Fig. 2, it will be noticed that the walls of the theatre are provided with loud speakers indicated at H2, H3, H4, H5, H6, and H7. H2 and H7 are towards the front of the theatre whereas H4 and H5 are in the rear of the theatre. A loud speaking means H9 is positioned in the ceiling. Two loud speaking means H1 and H8 (although not shown in the drawing) are positioned back of the projection screen.

By referring to Fig. 1, the arrangement of loud speaking means H1 to H9 is shown at the right. Each of these loud speaking means is shown connected to a power amplifier, these being numbered A1 to A9 respectively. The method of controlling the output characteristics of these various loud speaking means positioned as stated will now be described.

In the exemplary form shown, program sound tracks recorded in any convenient manner are simultaneously passed through suitable program sound pick-ups, such as P1, P2 and P3. Although three program sound pick-ups are shown, it will be understood that one or more of such sound tracks and program pick-ups may be used, depending upon the complexity of the effect which it is desired to produce. The output of these program pick-ups is supplied to a program divider 8 containing attenuation devices. It will be understood that amplifiers may be inserted in the lines between the program pick-ups and the divider panel. The divider panel may be of any desired arrangement capable of dividing the incoming program sound so as to supply the same to one or more loud speaking means. In the form shown, it will be seen that sound program pick-up P1 is sent through lines L1 and L8 leading to variable gain amplifiers V1 and V8, the program output of such amplifiers being connected to power amplifiers A1 and A8 respectively. The program sound carried by P2 is connected to line L9, which leads directly to variable gain amplifier V9, power amplifier A9 and the ceiling horn or loud speaker H9. Program sound from pick-up P3 is split between lines L2, L3, L4, L5, L6 and L7, these lines being connected with variable gain amplifiers V2 to V7 respectively.

Means have been provided, therefore, for supplying program sound to each of the loud speaking means H1 to H9.

In accordance with the present invention, 75

means are also provided for automatically controlling the reproduction of the program sound from predetermined loud speaking means and for varying the amplitude response of such loud speaking means. A control track bearing control intelligence is passed through the control pick-up P4 at the same time that program sound tracks are passing through P1, P2 and P3. As previously stated, the control track passing through P4 carries a plurality of control tones. These various controlled tones are of different frequencies, and in choosing the frequency for a controlled tone system, it is desirable that the second and third harmonics of any tone shall fall outside of the passing band of all high frequency tone channels. Control tone frequencies which have been successfully used are those in which each frequency represents an approximately constant percentage increase above the next lower frequency. A series of control tones or frequencies of the character herein referred to may be said to consist of members of a logarithmic type progression. In an illustrative example, the control tones or frequencies may comprise the following: 160, 250, 400, 630, 1000, 1600, 2500, 4000 and 6300 cycles. It is to be noted that each frequency is the next lower multiplied by about 1.6, but 2.5, 4 or any suitable number may be used to provide the most economical equipment production tolerance requirements for the number of control tones needed.

The control tones passing through pick-up P4 amplified by amplifier 10 and then routed by line L10 to a bus having branch lines leading to the elements R1 to R9. These elements R1 to R9 may comprise band pass filters and rectifiers. Amplifiers or a stage of amplification may be embodied in each of the elements R1 to R9. Each of these elements R1 to R9 is associated with a corresponding variable gain amplifier of the series V1 to V9, each of said variable gain amplifiers being connected with a separate sound channel as previously described. Each combination of variable gain amplifier and its corresponding band pass filter and rectifier may be termed a variolossor. For example, the units R2 and V2 taken jointly constitute a variolossor and the term as used hereinafter shall refer to any variable gain type amplifier or other device capable of introducing a variable transmission loss into an audio channel, which device is not manually operated. Each of the variolossors may then be connected with a separate amplifier from the series A1 to A9, each of these amplifiers being then connected to a separate loud speaking means or reproducing means from the series H1 to H9. The purpose and position of the loud speaking means diagrammatically illustrated in the drawing has been previously described.

In operation a control tone track made in the manner discussed in the pending application above identified is passed through the pick-up P4 simultaneously with the passage of suitable program tracks through the pick-up P1, P2 and P3. The control track may be a single track containing the various control frequencies in superimposed relation. The program tracks may be either on separate strips of film or on a single strip of film, the latter method being particularly effective since absolute synchronization of the various program tracks or elements can be attained by having all of the program elements or tracks on one strip of film. The control tones are amplified at 10 and are sent to the bus bar leading to the various elements R1 to R9, the

band filters in these elements being so arranged as to select and admit only that predetermined control tone or frequency which controls and is correlated to the effect to be reproduced through the corresponding speaker. For example R1 may contain a band pass filter admitting only the 160 cycle control tone, R2 may admit only the 250 cycle tone, etc.

The program sounds after passing through the program divider 8 are supplied by lines L1 to L9 to the various variable gain amplifiers V1 to V9. The gain on these variable gain amplifiers is regulated by the bias from the corresponding unit R. The outputs of these amplifiers V is then fed to the power amplifiers A and reproduced through the loud speaker means H.

It may be noted at this point that in the event the gain control characteristics of the variolossers R and V are not straight line functions, the R units may be designed to give an inverse characteristic to that of the amplifiers in response to the tone signal volume input. In this manner, the combined influence of R and V may then produce a change in program level which is equivalent, in decibels, to the change in control tone level. In other forms of these units, particularly when it is desired to expand the volume beyond the volume ordinarily carried by the program sound record, the units R may be so designed as to cause a larger expansion of amplification of the program sound than the variation in level of the control tone, as by including a variable gain amplification stage in the R unit before its output is caused to control V.

It will be understood that the control track passing through P4 has been made in such manner as to be correlated with a photoplay or other predetermined plan of procedure so that during reproduction of the sound through the loud speaking means H, a photoplay may be simultaneously projected in the theatre, the sound effects being then reproduced in precise synchronization with the photoplay, the location or position within or around the theatre from which the sound emanates during reproduction being determined by the control track. It is not necessary to go into considerable detail since those skilled in the art will readily understand the numerous uses to which the method herein described may be put.

During normal sound reproduction, all of the sound may be produced through loud speaking means H1 and H8 located at the rear of the screen upon which the photoplay is projected. If the sound producing images being shown on the screen advance toward and to the left of the audience and pass out of the screen area on the left side, then the program sound may gradually shift from its original reproducing position and pass into loud speaking means H2, H3 and then H4, creating the desired effect and realistically depicting the movement of the sound producing operation from the screen in front of the audience to the left and rear of the audience. The volume of the program sound thus moved may be controlled by a function of the frequency carried by the control track, as for example by the amplitude of such frequency. Off-stage sounds may be properly reproduced in a theatre or other enclosure by having such off-stage sounds reproduced from loud speakers positioned either in the ceiling as H9 or at the sides of the theatre as H3 and H6, while the on-stage sounds continue to be reproduced through the loud speaking means H1 and H8.

The various modifications and adaptations of the method and arrangement herein disclosed will depend somewhat upon the effect desired, the plot or story being depicted by the photoplay, etc. The method may be used to great advantage in the pictorial representation of classic music, arias and solos being selectively reproduced from any desired location within the theatre or other enclosure in which the entertainment is being given.

We claim:

1. A method of creating novel sound effects in a theatre in timed relation to the presentation of photoplays, which comprises: positioning loud speaking means in the side walls, ceiling and in rear of the screen of the theatre to virtually aurally encircle the amusement reception center of such theatre; projecting a photoplay; passing a plurality of program sound records through a reproducing pick-up and simultaneously passing a control track bearing control intelligence through a control pick-up; selectively supplying sound record oscillations from one or more of said program sound records from said reproducing pick-up to predetermined loud speakers in accordance with intelligence carried by the control track; and varying the amplitude response of said speakers in accordance with a function of said control intelligence.

2. A method of creating novel sound effects in a theatre, which comprises: positioning loud speaker means at multiplanar points in a theatre whereby said loud speaker means substantially encircle the audience in such theatre, passing a program sound record through a reproducing pick-up, simultaneously passing a control track carrying a plurality of modulated frequencies thereon through a control pick-up, each of said frequencies being adapted to control the output of a given loud speaker means, and automatically controlling the reproduction of the program sound record through said loud speaker means in accordance with the modulations of frequencies carried by said control track.

3. A method of creating novel sound effects in a theatre provided with a projection screen, which comprises: positioning loud speaking means in the side walls, ceiling and in rear of the screen of the theatre to virtually aurally encircle the amusement reception center of such theatre, passing a plurality of program sound records through a reproducing pick-up, and simultaneously reproducing a control record bearing a plurality of frequencies of varying amplitude; separating said reproduced control record into separate frequency parts; controlling the positional response of the loud speaking means in accordance with the existence of predetermined frequency parts, and simultaneously controlling the amplitude response of individual loud speaking means by the amplitude characteristics of such control frequency parts.

4. A method of creating novel sound effects in a theatre provided with a projection screen, which comprises: positioning loud speaking means in the side walls, ceiling and in rear of the screen of the theatre to virtually aurally encircle the amusement reception center of such theatre, passing a plurality of program sound records through a reproducing pick-up, and simultaneously reproducing a control record bearing a plurality of frequencies of varying amplitude; selectively supplying sound record oscillations from said reproducing pick-up to predetermined loud speaking means in accordance with frequencies

carried by the control track, and varying the amplitude response of said speakers in accordance with the function of said frequencies.

5. In a method of reproducing programs in a theatre provided with a projection screen, the steps of: positioning loud speaker means at multiplanar points in a theatre whereby said loud speaker means substantially encircle the audience in such theatre, projecting a visual picture record upon the screen of such theatre, passing a program sound record through a reproducing pick-up, simultaneously receiving control intelligence differing from the positional character of program sound at the time of recording of such sound, dividing such control intelligence into parts; controlling the positional response of the loud speaking means by parts of said control intelligence.

6. A reproducing system comprising a plurality of loud speaker means positioned in the side walls, ceiling and in the rear of the screen of a theatre, a variolossier associated with each of said loud speaking means, a program sound channel connected to each variolossier, a control tone

supply connected to each variolossier, each variolossier including means for automatically separating a desired and different control tone from said control tone supply and for varying the response of its associated loud speaking means in accordance with a function of such desired control tone.

7. A reproducing system comprising a plurality of loud speaker means arranged in multiplanar relation with respect to an amusement reception center, a variolossier associated with each loud speaking means, a control tone pick-up appropriately associated with each of said variolossers, a plurality of program pick-ups, sound channels connecting said pick-ups with each of said variolossers, each variolossier including means for automatically separating a desired and different control tone from said control tone pick up and for varying the response of its associated loud speaking means in accordance with a function of such desired control tone.

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