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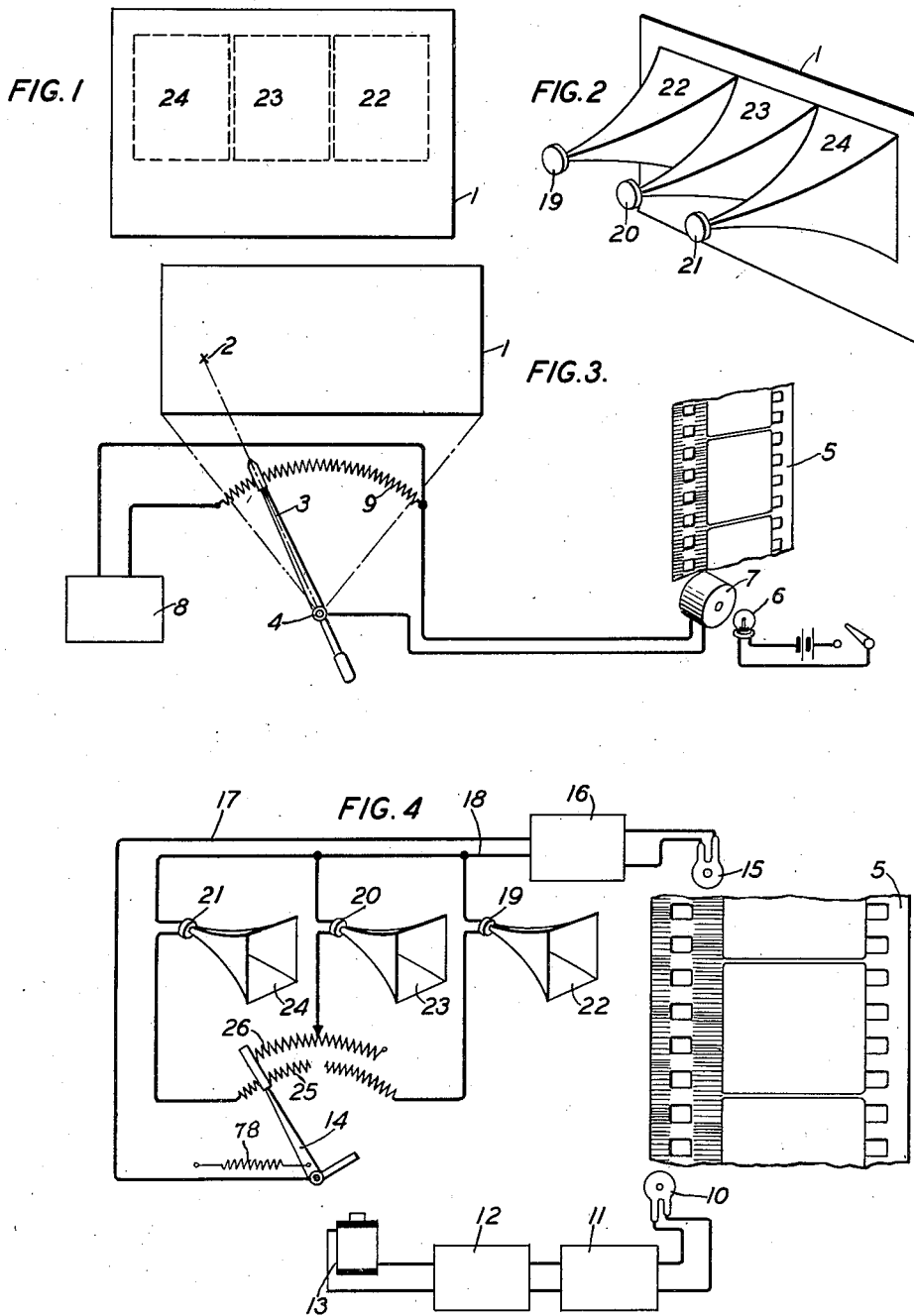
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1,909,370

SOUND RECORDING AND REPRODUCING SYSTEM

Filed Nov. 24, 1930

4 Sheets-Sheet 1



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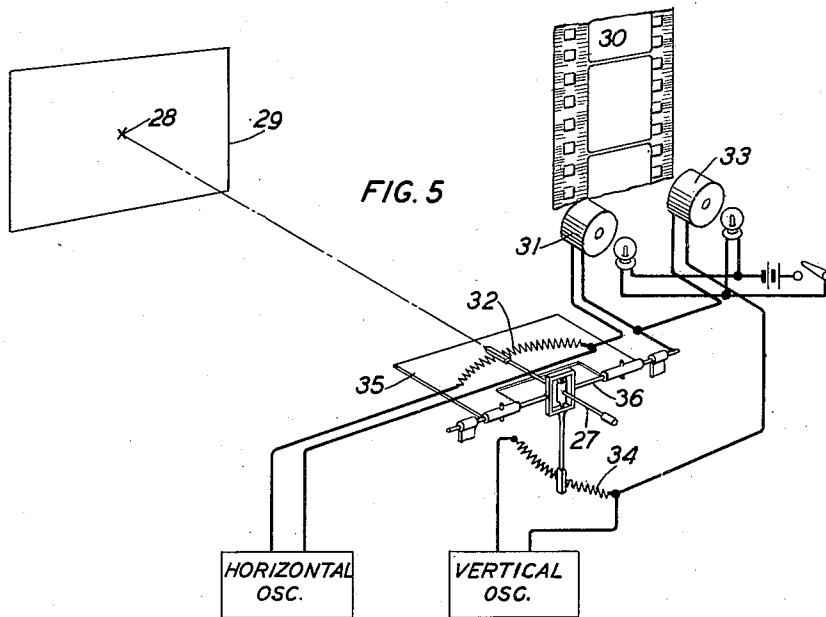
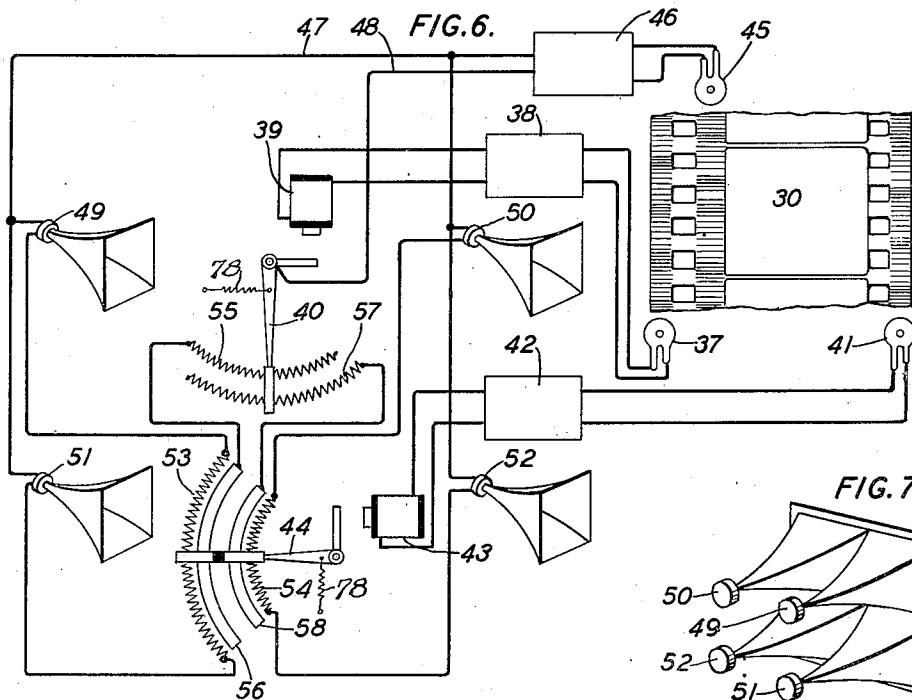
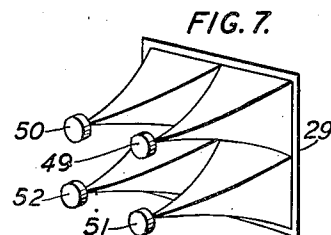
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4 Sheets-Sheet 2



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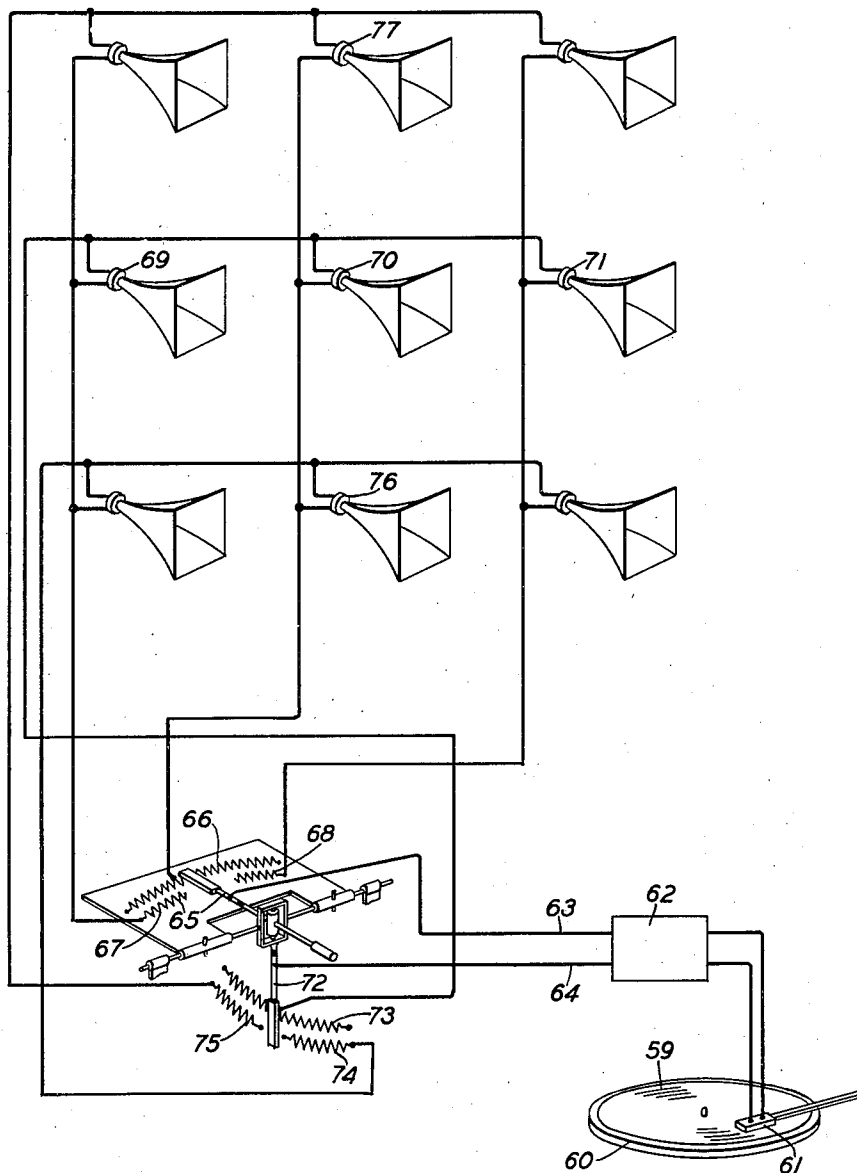
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FIG. 8.



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SOUND RECORDING AND REPRODUCING SYSTEM

Application filed November 24, 1930. Serial No. 497,763.

This invention relates to sound recording and reproducing systems and is particularly useful in sound picture systems.

5 The object of the invention is to produce the sound effect at different points within the area of movement in location of a sound producer, changing the point of apparent emission with the change in location of the apparent sound reproducer.

10 Another object of the invention is to keep the volume of the sound effect constant as the point of apparent emission is moved about within the area of action.

15 A further object of the invention is to change the point of apparent emission of the sound effect without introducing extraneous sounds due to switching operations.

20 A feature of this invention is a pointer which may be trained on a sound producer or an apparent sound producer and which will control the switching in and out of the various sound reproducers in such a manner that the apparent point of emission of the sound will be located at the spot on which the pointer is trained.

25 Another feature of the invention is a means for variably controlling the sound reproducers so that each is actuated substantially in proportion to its distance from the location of the apparent sound producer, the available energy being divided among several reproducers in such proportions.

30 In accordance with another feature a manually trained pointer is used to directly control the sound reproducers. In accordance with another feature the manually trained pointer exercises an indirect control over the sound reproducers. In this case the pointer controls means for making a record on a light sensitive surface, which record later is used to control an electromagnetic pointer having direct control over the sound reproducers.

35 In one form of the invention the change in location of the sound producer is translated into a one-dimensional movement, while in another form a two-coordinate system is used. It should be understood that from a practical consideration the first form above stated using a small number of sound repro-

ducers is sufficient to create a realistic illusion, while from a theoretical standpoint, the second form using a large number of sound reproducers is desirable. In the drawings,

Fig. 1 is a diagram representing a sound picture screen and showing the location of three sound reproducers placed in the rear thereof;

Fig. 2 is a diagrammatic representation of three sound reproducers showing how the horns could be placed behind a screen to cover a required area;

Fig. 3 shows a simple system for recording on a light sensitive surface the movement in location of a sound reproducer;

Fig. 4 shows a simple system for reproducing sound effects and changing the location of the point of apparent emission by means of a record that has been previously made through the use of the system shown in Fig. 3;

Fig. 5 shows a two-coordinate system working on the same general principles as disclosed in Fig. 3;

Fig. 6 shows a means for reproducing sound effects in a two-coordinate system under control of directional records made through the use of the system shown in Fig. 5;

Fig. 7 is a diagram showing how four sound reproducers may be placed behind a screen.

Fig. 8 shows a system using a larger number of sound reproducers in which the manually trained pointer directly controls the action of the reproducers.

Fig. 9 shows a system for reproducing sound in a two-coordinate system under control of a pointer manually trained upon the actual sound producer.

Let us suppose that the rectangle 1 represents the area of movement in location of a sound producer. In Fig. 3 we will say that the cross mark 2 represents the location of the sound producer at any particular moment. This area of movement of the sound producer may be a stage or it may be a screen, for the record of the movement of a sound producer may be made either while a motion picture is being taken or it may be made later while

the motion picture is being projected on a screen. The sound producer may be a singer, a speaker, a player of musical instruments, or even a mechanical contrivance. The sound producer being at the point 2, a pointer 3 pivoted at point 4 may be trained on this spot, as shown. 5 represents a moving film herein termed a light sensitive surface. The device 6 is a source of light which throws a ray on the outer left-hand edge of the film 5 as it moves forward. The device 7 is a light valve for controlling the tray of light from the source 6. The light valve 7 is actuated by an oscillator 8 and its operation is modified by the potentiometer comprising the resistance 9 and the electrical circuit established through the pointer 3. As the pointer 3 is trained on different spots within the area 1, the value of the energy from the source 8 to the light valve 7 is changed, so that a corresponding record is made on the outer edge of the film 5.

In Fig. 4 the film 5 is shown with the record on the outer left-hand edge, effecting a light sensitive device 10 which, through appropriate connections to a tuned amplifier 11 and a rectifier 12, will effect a magnet 13 to move the pointer 14 under control of the spring 78. Thus, the record made on the film 5 through the apparatus of Fig. 3 will cause the pointer 14 to move in the same manner that the pointer 3 was originally moved. Another record on the film 5 will effect a light sensitive device 15 which, through an appropriate amplifier 16, will deliver energy for creating sound effects to the pair of conductors 17 and 18. The conductor 18 is multiplied to each of three sound reproducers 19, 20 and 21. If these sound reproducers with their horns 22, 23 and 24 are placed behind the screen 1, they will produce a sound effect whose apparent point of emission comes from a spot on which the pointer 3 was originally trained and on which we can say the pointer 14 is trained. The conductor 17 leads to the arm of pointer 14 whereby a circuit is completed through an impedance 25 and thence through sound reproducer 21 to conductor 18 and in parallel therewith through an impedance 26 to sound reproducer 20 to conductor 18. In this manner the impedance shown between the pointer 14 and reproducer 21 being much less than the impedance shown between the pointer 14 and reproducer 20, the resultant activity of these two reproducers will be substantially in proportion thereto with the result that the apparent point of emission will be located at a spot designated 2 in Fig. 3. If the pointer 14 is moved to its extreme left-hand position, then reproducer 21 alone will be actuated, whereas if the pointer 14 assumes a position directly in the center of its area of movement, then the reproducer 20 alone will be actuated. At intermediate points, such as that actually shown, two reproducers may be actuated in

such a manner that the total volume of sound coming therefrom will remain constant over the entire range of movement of the pointer 14.

Fig. 5 shows a two-coordinate recording system. The pointer 27 may be trained on one spot, such as 28, within the area of movement of the sound producer 29. Movement in the horizontal direction is recorded on the outer left-hand edge of the film 30 through the use of light valve 31 controlled by impedance 32 and movement in the vertical direction is recorded on the outer right-hand edge of film 30 through the use of light valve 33 controlled by impedance 34. The pointer 27 may be moved in a horizontal direction to effect impedance 32 and may be moved in a vertical direction to effect impedance 34. During the vertical movement of pointer 27 the shelf 35 moves with the shaft 36 so as to keep the pointer 27 in continuous contact with the impedance 32.

In Fig. 6 the record made on the outer left-hand edge of film 30 may be translated by a light sensitive device 37 and its amplifier and rectifier 38 and the magnet 39 into a movement of pointer 40. In the same manner, the record made on the outer right-hand edge of film 30 may be translated by light sensitive device 41 and its amplifier and rectifier 42 and the magnet 43 into a movement of pointer 44. The sound effect recorded on the inner left-hand edge of film 30 is translated by the light sensitive device 45 and its amplifier 46 into energy for producing the sound effects delivered to conductors 47 and 48. The conductor 47 is multiplied to each of four sound reproducers 49, 50, 51 and 52. The other terminals of reproducers 49 and 51 are connected each to one terminal of an impedance 53 and in like manner the other terminals of reproducers 50 and 52 are connected to either end of an impedance 54. The conductor 48 is connected to pointer arm 40 from whence a circuit may be traced in one direction through an impedance 55 to segment 56 associated with impedance 53 and in the other direction through impedance 57 to segment 58 associated with impedance 54. With the two arms 40 and 44 in the positions shown in Fig. 6 each of the four amplifiers 49 to 52 will receive an equal amount of energy from the amplifier 46. If these sound reproducers are placed behind a screen 29 in the manner shown in Fig. 7, then the apparent point of emission of the sound effect will be at the center of the screen or at the point 28 shown in Fig. 5. As the points 40 and 44 are caused to assume different positions, it is believed to be obvious that the four sound reproducers shown will receive varying amounts of energy. Since it is believed that the apparent point of emission of a sound effect coming from a plurality of reproducers is located at a theoretical point depending on their rela-

tive volumes, then it will be understood that as the pointers 40 and 44 move in accordance with the records on the film 30, the apparent point of emission will follow the spot on which pointer 27 was trained, while these records are being made.

In Fig. 8 a disc record 59 on a moving turntable 60 actuates an electrical pick-up 61 which through the use of an amplifier 62 delivers energy to the conductors 63 and 64. The conductor 63 is connected to a pointer 65 and through connections to the impedances 66, 67 and 68 is effectively connected to the various vertical rows of reproducers such, for instance, as reproducers 70, 76 and 77. The conductor 64 is connected to arm 72 and thence through impedances 73, 74 and 75 to the various horizontal rows of reproducers, such for instance, as the row comprising reproducers 69, 70 and 71. With the pointer 65 and the arm 72 in the positions shown only reproducer 70 will be actuated. As the pointer 65 is trained on an apparent source of sound, it will be easily understood how the various reproducers will be actuated, so that the apparent point of emission will coincide with the location of the apparent sound producer.

In Fig. 9 an actual producer of sound 80 actuates a microphone 81 which through an amplifier 82 delivers energy to conductors respectively connected to pointer 85 and arm 92. The pointer 85 may be connected through impedances 86, 87, 88 to the vertical rows of reproducers such as reproducers 89, 90 and 91. The arm 92 may similarly be connected through impedances 93, 94, 95 to the horizontal rows of reproducers, such as reproducers 90, 96 and 97. With the pointer 85 and arm 92 in the position shown only reproducer 90 will be actuated and the sound will be emitted from the area marked X. As this area is directly in line with the sound producer 80 the amplified sound will appear to be emitted by the sound producer 80. As the sound producer 80 moves about the area outlined by the reproducers, it will be apparent that if the pointer 85 is at all times trained on the sound producer 80, that the area of emission of the amplified sound will shift and the sound will appear to be emitted at all times by the sound producer 80.

What is claimed is:

1. In a sound reproducing system, means for reproducing sounds at different locations following the movement in location of a sound producer, comprising a pointer following the movement of said sound producer, a plurality of sound reproducers spaced within the area of movement of said sound producer and means controlled by said pointer for selectively actuating said sound reproducers.

2. In a sound reproducing system, means for reproducing sounds at different locations following the movement in location of a

sound producer, comprising a pointer following the movement of said sound producer, a plurality of sound reproducers spaced within the area of movement of said sound producer, and means controlled by said pointer for rendering those of said sound reproducers nearest the location of said sound producer most active, others of said sound reproducers near the location of said sound producer less active and others of said sound reproducers distant from the location of said sound producer inactive.

3. In a sound reproducing system, means for reproducing sounds at different locations following the movement in location of a sound producer, comprising a pointer following the movement of said sound producer, a plurality of sound reproducers spaced within the area of movement of said sound producer, and volume control potentiometers controlled by said pointer for rendering the one of said sound reproducers nearest the location of said sound producer most active, others of said sound reproducers near the location of said sound producer less active and others of said sound reproducers distant from the location of said sound producer inactive.

4. In a sound recording and reproducing system, means for reproducing sounds at different locations following the movement in location of a sound producer, comprising a pointer following the movement of said sound producer, a plurality of sound reproducers spaced within the area of movement of said sound producer, and means controlled by said pointer for rendering those of said sound reproducers nearest the location of said sound producer most active, others of said sound reproducers near the location of said sound producer less active, and others of said sound reproducers distant from the location of said sound producer inactive, said last means being further constructed and arranged to maintain the total volume of sound from said sound reproducers constant during the movement of said pointer.

5. In a sound recording system, means for recording on a light sensitive surface the movement in location of a sound producer, comprising a pointer following the movement of said sound producer, a ray of light directed upon said light sensitive surface and means controlled by said pointer for controlling said ray of light.

6. In a sound recording system, means for recording on a light sensitive surface the single dimensional movements in location of a sound producer, comprising a pointer movable in a single plane following the movement of said sound producer, a ray of light directed upon said light sensitive surface and means controlled by said pointer for controlling said ray of light.

7. In a sound recording system, means for recording on a light sensitive surface the two

dimensional movements in location of a sound producer, comprising a pointer movable in two coordinate planes following the movement of said sound producer, a ray of light for each coordinate plane directed upon said light sensitive surface and means controlled by said pointer for controlling said rays of light.

8. In a sound recording system, means for recording on a light sensitive surface the two dimensional movements in location of a sound producer, comprising a pointer movable in two coordinate planes following the movement of said sound producer, a ray of light for recording movements in one coordinate plane, a ray of light for recording movements in another coordinate plane, said rays of light being directed each on a different part of said light sensitive surface, and separate means simultaneously controlled by said pointer for controlling said rays of light.

9. In a sound recording system, means for recording on a light sensitive surface the movement in location of a sound producer, comprising a pointer following the movement of said sound producer, a ray of light directed upon said light sensitive surface and a variable impedance device for controlling said ray of light under control of said pointer.

10. In a sound reproducing system, a plurality of sound reproducers spaced within the area of movement in location of a sound producer, a source of sound for actuating said sound reproducers, means for variably connecting said source of sound with said sound reproducers to render said sound reproducers active substantially in proportion to their distance from the location of said sound producer, a pointer for controlling said variable connection means, and means for causing said pointer to follow the movements in location of said sound producer.

11. In a sound reproducing system, a plurality of sound reproducers spaced within the area of movement in location of a sound producer, a source of sound for actuating said sound reproducers, means for variably connecting said source of sound with said sound reproducers to render said sound reproducers active substantially in proportion to their distance from the location of said sound producer, a pointer for controlling said variable connection means, and means associated with said source of sound for causing said pointer to follow the movements in location of said sound producer.

12. In a sound reproducing system, a plurality of sound reproducers spaced within the area of movement in location of a sound producer, a source of sound for actuating said sound reproducers, means for variably connecting said source of sound with said sound reproducers to render said sound reproducers active substantially in proportion to their dis-

tance from the location of said sound producer, said means being further constructed and arranged to maintain the total activity of said sound reproducers constant, a pointer for controlling said variable connection means, and means associated with said source of sound for causing said pointer to follow the movements in location of said sound producer.

13. In a sound reproducing system, a plurality of sound reproducers spaced within the area of movement in location of a sound producer, a source to deliver energy to said sound reproducers, and means to utilize said sound reproducers either singly or in desired combinations while maintaining a substantially constant load on said source and a substantially constant volume of emitted sound, said means including an adjustable impedance matching network.

In witness whereof, I hereunto subscribe my name this 20th day of November, 1930.

RUDOLPH F. MALLINA.