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ARTIFICIAL ACOUSTIC REVERBERATION WITH FEEDBACK  
AND MEANS FOR PREVENTING SOUND DISCONTENUITIES  
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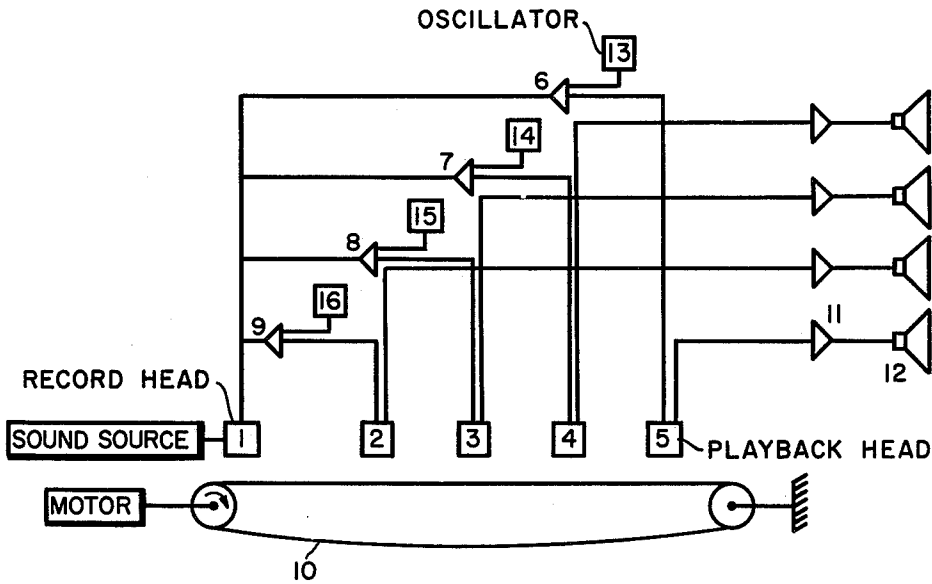


Fig. 1

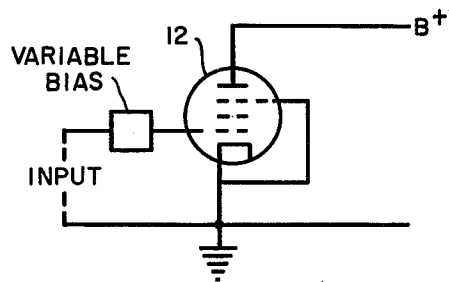


Fig. 2

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**ARTIFICIAL ACOUSTIC REVERBERATION WITH FEEDBACK AND MEANS FOR PREVENTING SOUND DISCONTINUITIES**

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2 Claims. (Cl. 179-100.1)

This invention relates to devices for producing artificial acoustic reverberation by means of a recording head positioned along the path of a moving sound track, followed by a plurality of reproducing heads each of which controls one or a plurality of loudspeakers through an amplifier, with the signal of at least one reproducing head being fed back to the recording head.

Devices of this kind are known and have been manufactured and used by the applicant and others. They have the disadvantage that a discontinuity is distinctly audible in the reverberation produced. Such a discontinuity is heard as an unnatural sound and is due to the fact that the ratio between the output energies of the reproducing heads remain the same for each cycle, resulting in a periodic repetition in the reverberation.

This disadvantage could be obviated by proportioning the said energy-ratio and the degree of feedback so that the intensity of the sound produced decreases perfectly regularly. However, it is difficult to realize this effect in practice.

An object of the invention is to improve the described device producing reverberation so that the disadvantages relating to discontinuities are avoided.

The improvement according to the invention consists in that the amplification factors used for the feedback are made to vary differently relatively to each other.

According to the invention, in a preferred embodiment thereof at least one tube of each feedback amplifier has a mutual conductance which is highly sensitive to small variations in grid voltage, and this mutual conductance is varied by applying to an appropriate grid of the tube a subaudible alternating voltage having a frequency which is different for each tube.

If the invention is applied to a reverberation equipment in which, in the manner already carried out in practice, four reproducing heads are arranged around a wheel provided with a magnetic tape, it is possible, for example, to replace the first tube of the feedback amplifier associated with the said heads by a tube of the type EF 85, a so-called variable-mu tube. The grid of this tube may then have applied to it a sinusoidal bias potential having a frequency located below the audible range, for example of 5 c./sec.

One may proceed similarly for the feedback amplifiers associated with the second, the third and the fourth head while taking care that the frequencies of the bias potentials of these tubes, although likewise lying below the audible range, differ both from one another and from the frequency used for the first amplifier. These frequencies may be, for example, 7 c./sec., 9 c./sec. and 11 c./sec., respectively.

The invention will be better appreciated from the following description with reference to the drawing, wherein:

FIG. 1 is a schematic diagram of one embodiment of a reverberation system embodying the invention; and

FIG. 2 is a schematic diagram of one embodiment of the amplifier which can be utilized.

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As shown in FIG. 1, the reverberation device includes and endless tape 10 composed of magnetic material; this tape, of course, could be a drum or any other rotating medium having magnetic material on or attached to its surface. Coacting with the tape is a recording head 1, to which signals from the sound source are applied as shown, and reproducing heads 2, 3, 4 and 5. Each reproducing head supplies signals to a loudspeaker or a group of loudspeakers after amplification, as shown. For the sake of simplicity, only loudspeaker 12 and amplifier 11, shown coupled to head 5, are labeled in FIG. 1. In addition, to achieve the reverberation effect, the output from each reproducing head 2, 3, 4 and 5 is fed back to recording head 1 through respective amplifiers 9, 8, 7 and 6. According to the invention, to prevent the discontinuities mentioned above, oscillators 16, 15, 14 and 13 may be provided, each one producing a subaudible alternating signal and each one acting to change the amplification factor of the respective amplifiers 9, 8, 7 or 6; the oscillators produce signals at different frequencies. The different oscillators shown in FIG. 1 are representative only and any manner of achieving different subaudible frequencies may be used, so long as these are applied as shown to vary the amplification factor of the amplifiers.

FIG. 2 shows one embodiment of a feedback amplifier; a variable-mu pentode 12 is shown, to the control grid of which are applied an input, which is the output of a reproducing head, and a source of variable bias.

Since the amplification factors of the feedback amplifiers vary with time, but not simultaneously, the troublesome periodic repetition of a constant energy ratio of the reproducing heads as was heard with the prior device is no longer present. Periodic repetition is no longer audible in the reverberation produced by the device according to the invention, this reverberation thus being considerably more natural.

In addition, although the energy ratio between the outputs of the four heads is still bound within certain limits, it is less critical than in the known device in which it did not vary with time.

Control of the reverberation time by varying the value of the mean feedback factor remains possible within wide limits.

It is to be noted that the variable bias potentials applied to the grids of the variable-mu tubes need not necessarily be sinusoidal, but may be replaced by voltages varying according to other functions, provided that such voltages do not contain audible components. It should also be noted that various modifications and variations are possible without departing from the inventive concept, the scope of which is set forth in the appended claims.

What is claimed is:

1. A device for producing artificial acoustic reverberation comprising: a source of sound signals, recording means for recording said signals, a plurality of reproducing means for reproducing the recorded signals, part of the reproduced signals being fed back to said recording means through a plurality of feedback amplifiers, and cyclical bias means for varying the amplification factors of said feedback amplifiers, said bias means cyclically changing the amplification factor of each amplifier, the frequency of the cyclical change being different for each amplifier.

2. A device for producing artificial acoustic reverberation comprising: a source of sound signals, recording means for recording said signals, a plurality of reproducing means for reproducing the recorded signals, part of

the reproduced signals being fed back to said recording means through a plurality of feedback amplifiers each comprising an electron tube having a control electrode and a mutual conductance which is highly sensitive to small variations in the voltage on said control electrode, and a plurality of oscillators generating oscillations of subaudible frequency, each oscillator being coupled to the control electrode of a feedback amplifier, the frequency of said oscillations being different for each oscillator.

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