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NOISE RESPONSIVE AUTOMATIC SOUND VOLUME CONTROLLING SYSTEM

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Fig. 1

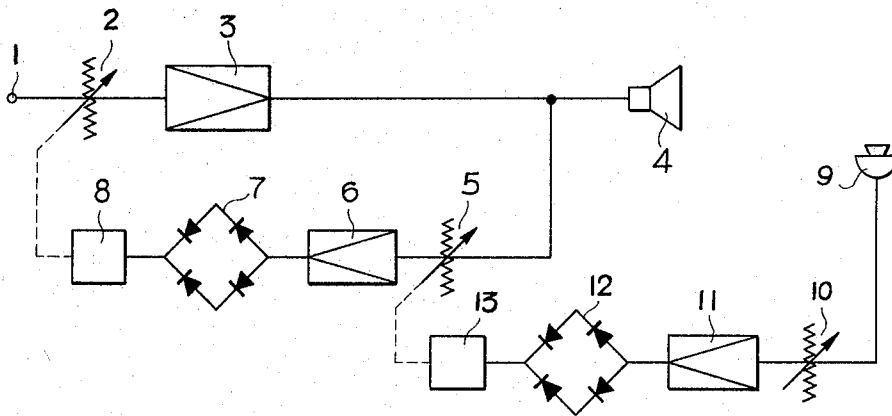
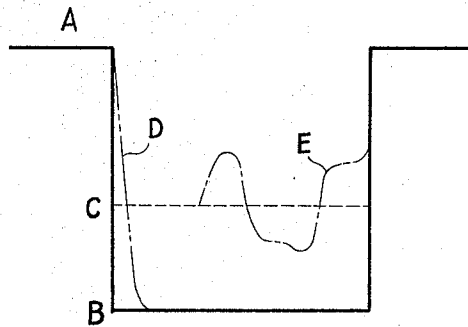


Fig. 2



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1 Claim. (Cl. 179—1)

This invention relates to a noise responsive automatic sound volume controlling system wherein, when a fixed signal input is applied to a device attached to loud speaking amplifying apparatus, the sound volume will be automatically controlled within a set range in response to the noise in the place where a loud speaker is set.

In this kind of automatic sound volume controller, there has been known a method wherein the background noise is collected by a microphone and is amplified and the input to a loud speaker is controlled by this signal. However, in such method, there are defects that such signal as a music from the speaker will be also simultaneously collected, the level of such signal as a music will rise with the rise of the noise level and thus, when a sound is issued from a speaker, its signal will be further collected by the microphone, a positive feedback loop of the microphone→amplifier→speaker→microphone will be formed and oscillated and the sound issuing level of the speaker will rise to the maximum sound volume. Therefore, it has been difficult to practice such method. In order to eliminate such defects, there has been adopted a method wherein the quality difference between such signal as a music coming out of the speaker and the background noise of the operating chamber is detected, only the noise signal is taken out and the input to the speaker is controlled by said signal. However, according to such method, there are defects that the operation will be influenced by the wave form, phase and frequency difference between such signal as a music and the noise signal and that no expected effect can not be attained.

A principal object of the present invention is to provide an automatic sound volume controller wherein, independently of the wave form or phase difference between such signal as a music coming out of a loud speaker and a background noise signal, only the volume corresponding to the noise volume is taken out and the input to the speaker is controlled so that a sound level automatically at a constant ratio to the noise volume may be always obtained.

FIGURE 1 is a system diagram showing the formation of the present invention.

FIGURE 2 is a diagram showing the attenuation of a signal.

The formation of the present invention shall be explained with reference to the system diagram.

1 is a signal input terminal. 2 is a signal volume regulating variable resistance. 3 is a main amplifier having a proper degree of amplification. 4 is a loud speaker. 5 is a feedback volume regulating variable resistance. 6 is a feedback amplifier having a proper degree of amplification. 7 is a full-wave rectifier for rectifying the output of the feedback amplifier 6. 8 is a driving mechanism operated by the output of the full-wave rectifier 7 so as to drive the signal volume regulating variable resistance. 9 is a noise volume collecting microphone provided in a proper position in the place where the loud speaker is set. 10 is a collected sound regulating variable resistance. 11 is a collected sound amplifier. 12 is a full-wave rectifier for rectifying the output of the collected sound amplifier 11. 13 is a driving mechanism operated by the output of the full-wave rectifier 12 so as to drive

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the feedback volume regulating variable resistance 5 by proper means.

The present invention has such formation as is described above. Its operation shall now be detailed. When a proper signal input is given to the signal input terminal 1, the signal input will operate the loud speaker 4 through the signal volume regulating variable resistance 2 and the main amplifier 3 and a signal will be sounded from said loud speaker 4. However, a part of the output of the main amplifier 3 will be separated through the feedback volume regulating variable resistance 5 and the feedback amplifier 6, will have the influences of the phase and wave form removed by the full-wave rectifier 7, will operate the driving mechanism 8 formed of proper means and will control the signal volume regulating variable resistance 2.

In this arrangement, the circuit formation is set at such proper value that the driving mechanism 8 may be operated by the feedback signal of the so-called feedback circuit separating a part of the output of the main amplifier 3 and the resistance value of the signal volume regulating variable resistance 2 may increase with the increase of the signal input. Therefore, the moment the signal input level applied to the signal input terminal 1 varies, due to said feedback circuit, the signal volume regulating variable resistance 2 will elevate its resistance value and therefore increase the amount of attenuation with the rise of the signal input level but will reduce the resistance value and therefore decrease the amount of attenuation with the fall of the signal input level.

Thus there is formed an automatic signal output level controlling circuit wherein the amount of attenuation is always controlled by the signal input level and the loud speaker 4 sounds at a constant signal level within a range set in the circuit formation.

In such formation, the noise level in the place where the sound collecting microphone 9 is set and the sound from the loud speaker 4 are collected by said microphone and are regulated to be made a proper collected sound signal by the collected sound regulating variable resistance 10, said collected sound signal is amplified by the collected sound amplifier 11 having a proper degree of amplification in the circuit operation, its output is rectified by the full-wave rectifier 12 so as to have the influences of the wave form and phase removed, is applied to the driving mechanism 13 having a proper mechanism so as to operate it and the feedback volume regulating variable resistance 5 is made to elevate the resistance value (increase the amount of attenuation) in response to the increase of the collected sound signal level by proper means so that the sound level from the loud speaker may be increased by the noise level.

The present invention is of such formation and operation as are described above. The effects of the operation shall be described now.

In case the circuit formation is properly set and arranged and such signal input as from a fixed sound source is fed to the signal input terminal so that a sound may be issued from the loud speaker 4, if the collected sound regulating variable resistance 10 is regulated and set in response to the noise level in the place where the loud speaker 4 is set, the sound collecting microphone 9 provided in a proper position in the place where the loud speaker 4 is set will collect the noise and the sound issued from the loud speaker 4.

Therefore, in case the volume of the noise has increased, the sound level issued from the loud speaker 4 will remain as it is, the noise will be added thereto, the collected sound signal from the sound collecting microphone 9 will increase, will drive the driving mechanism 13 through the sound collecting circuit and will ele-

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vate the resistance value of the feedback volume regulating variable resistance 5, the feedback volume will decrease and the feedback signal separated from the output of the main amplifier 3 will be fed less than before. Therefore, the driving mechanism 8 will be driven through the feedback circuit, the resistance value of the signal volume regulating variable resistance 2 operated by proper means will reduce and the signal input will increase, will be fed to the loud speaker 4 through the main amplifier 3 and will raise the sound level

At the same time, the feedback signal portion separated from the main amplifier 3 will also increase, will be fed back more to the feedback volume regulating variable resistance 5, will operate to elevate the resistance value of the signal volume regulating variable resistance 2 driven through the feedback circuit and will therefore operate until the balance is kept within a set range.

With the rise of the noise level in the place where the loud speaker 4 is set, the driving mechanism 13 will be driven through the collected sound amplifying circuit and the resistance value of the feedback regulating variable resistance 5 will be increased by the amount corresponding to the noise volume. Therefore the feedback volume will decrease and will be applied to the feedback amplifier 6. Thus its output will decrease the resistance value of the signal volume regulating variable resistance 2 by the driving mechanism 8 through the feedback amplifying circuit and the amount of attenuation of the signal input will become so small that the signal input will increase by the noise volume and will be sounded from the loud speaker 4.

Further, the sounded signal portion corresponding to the noise volume plus the noise portion will be collected by the sound collecting microphone 9, will drive the driving mechanism 13 through the collected sound amplifying circuit and will act to further decrease the resistance of the feedback volume regulating variable resistance 5.

In such case, the feedback signal portion separated from the output of the main amplifier 3 will also increase at the same time and will be added to the feedback regulating variable resistance 5. Therefore, the increased portion of the feedback signal and increased portion of the collected sound signal will be cancelled with each other. As a result, the signal output will be controlled in response to the varied portion of the noise volume.

This operation is as shown in the diagram in FIGURE 2. The diagram shows the attenuation displacement in the input condition of the main amplifier 3. If A is a signal input, when the noise volume is zero, the signal volume regulating variable resistance 2 will take the maximum resistance value, the signal input will attenuate to B as represented by the curve D and a low sound volume will be issued from the loud speaker 4.

However, if the collected sound regulating variable resistance 10 is so set that a proper sound volume C may issue from the loud speaker in response to the noise condition in the place where the loud speaker 4 is set, the amount of attenuation will vary between A and B as represented by the curve E in response to the noise level and the sound level issued from the speaker will vary.

The above mentioned operating condition shall be explained more particularly. Now, if any noise is applied to the sound collecting microphone 9, said microphone will collect the sound issued at a constant level from the loud speaker. This collected signal will operate the driving mechanism 13 through the collected sound regulating variable resistance 10, collected sound amplifier 11 and full-wave rectifier 12, will adjust the feedback volume regulating variable resistance 5 and will decrease the feedback volume to the feedback amplifier 6.

Therefore, with the decrease of the feedback volume, the signal volume regulating variable resistance 2 will operate and its resistance value will decrease. Thus the

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signal entering the main amplifier 3 will increase and thereby the sound level from the loud speaker 4 will increase. This increased portion of the sound level will be again collected by the sound collecting microphone 9, will operate the driving mechanism 13 in the same manner as in the above, will adjust the feedback volume regulating variable resistance 5 and will increase the resistance value of the feedback volume regulating variable resistance 5 so as to decrease the feedback volume by the increased portion of the sound level.

In such case, the feedback volume to the feedback amplifier 6 will also increase by substantially the same amount as (in fact, a little more than) the increased portion of the sound level in the feedback volume regulating circuit. Therefore, as a result, the variation of the feedback volume due to the increased portion of the sound level will be canceled and balanced.

Now, when the noise portion is applied to the sound collecting microphone, the signal level of the feedback volume regulating circuit will increase by the noise portion, will operate the driving mechanism 13 the same as in the above and will adjust the feedback volume regulating variable resistance 5 so as to decrease the noise portion by the feedback volume. Therefore, with the decrease of the feedback volume the signal regulating variable resistance 2 will operate and the resistance value will decrease. Thus the signal entering the main amplifier 3 will increase and thereby the sound level issued from the loud speaker 4 will increase. This increased portion of the sound level will be to be again collected by the sound collecting microphone 9 but will be, as described above, canceled with the increased portion of the feedback volume. Therefore, as a result, it will balance in a state wherein the sound will issue from the loud speaker at a level elevated by the noise portion.

In case the noise volume varies, it will operate as described above and, in response to the variation of the noise volume, the sound level from the loud speaker will vary.

As the present invention operates as described above, its difference from the conventional control system is that it is not to discriminate and control only the noise level by canceling the signal from the loud speaker with the phase but is to drive the signal volume regulating variable resistance 2 with the output by the differential combination of the output of the sum of the noise and signal portion and the output of the signal feedback portion and to operate to deduct the signal portion from the mixed combination of the noise and signal.

In such case, the signal portion to be removed is to be made somewhat larger than the signal portion contained in the mixed and combined level of the noise and signal so that the feedback volume to drive the signal volume regulating variable resistance may be made entirely the noise portion only and the operation may be stable. Further, as the outputs of the feedback amplifier 6 and collected sound amplifier 11 are full-wave-rectified by the full-wave rectifiers 8 and 13, respectively, they will not be influenced by the phase and wave form. Therefore, the control signal will not be limited. By inserting time constant circuits in proper places, the pulsating noise can be removed and a stable operation will be made. Such photoconductive resistance body as a cadmium sulfide element may be used for the regulating variable resistance and may be operated as opposed to a driving mechanism in which is used an electric lamp or the like varying in brightness in response to the output.

As the present invention has such operations and effects as are mentioned above, the control range can be freely set by giving a proper formation. Thus the field of utilization of the present invention is very large.

What is claimed is:

A noise responsive automatic sound volume controlling system comprising a main circuit consisting of a signal volume regulating variable resistance to be given an input

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signal, a main amplifier to be given an output from said signal volume regulating variable resistance and a loud speaker to be given an output from said main amplifier, a feedback circuit consisting of a feedback volume regulating variable resistance to be given a part of an output from said main amplifier, a feedback amplifier to be given an output from said feedback volume regulating variable resistance, a full-wave rectifier for rectifying an output from said feedback amplifier and a signal volume regulating variable resistance driving means operated with an output from said full-wave rectifier and a feedback volume regulating circuit for the feedback circuit consisting of a noise volume collecting microphone, a collected sound regulating variable resistance to be given an output from said microphone, a collected sound amplifier to be given an output from said collected sound regulating variable resistance, a full-wave rectifier for rectifying an output from said collected sound amplifier and a feedback volume regulating variable resistance driving means operated with an output from said full-wave rectifier so that the signal input may be sounded from the loud speaker through the main amplifier, a part of an output from said main amplifier may be fed back,

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the signal volume regulating variable resistance may be driven with a feedback output, the signal input volume may be regulated to be decreased to a proper level, the sum of the noise and the sound signal may be made a collected sound signal by the sound collecting microphone and may be amplified by the collected sound amplifier, the feedback volume regulating variable resistance may be controlled with an output from said collected sound amplifier, the feedback volume of the feedback circuit may be varied, the feedback rate of the feedback circuit may be varied by the signal volume, thus the output level may be made constant irrespective of the variation of the input level and the standard value of the output level to be made constant may be determined to be a value corresponding to the noise volume by controlling an input for the feedback circuit with a collected sound level from the sound collecting microphone.

No references cited.

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