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(54) **Receiving apparatus**

(57) A receiving apparatus having an automatic volume control device for automatically controlling the volume in response to ambient noises and adapted to stop the operation of the automatic volume control device according to the level of the received signal radio wave.

FIG. 1

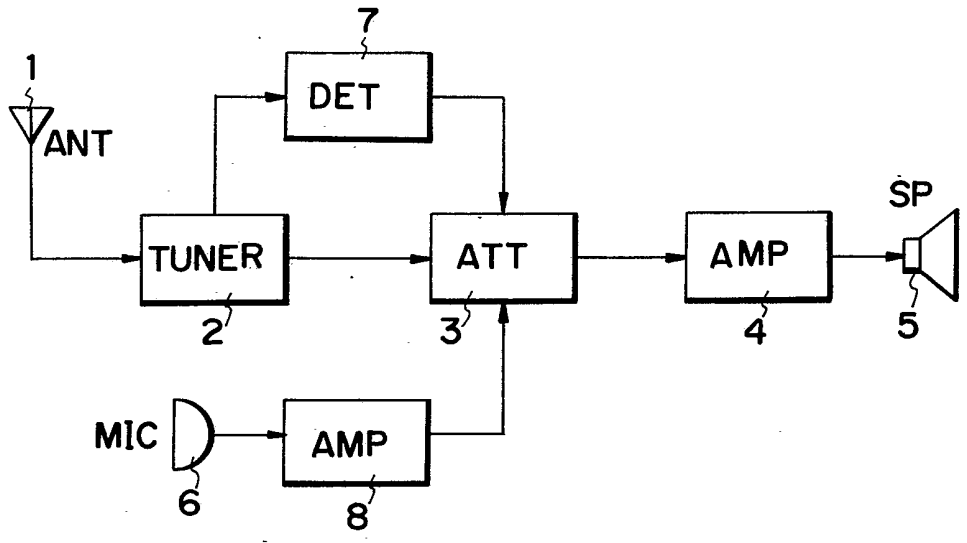

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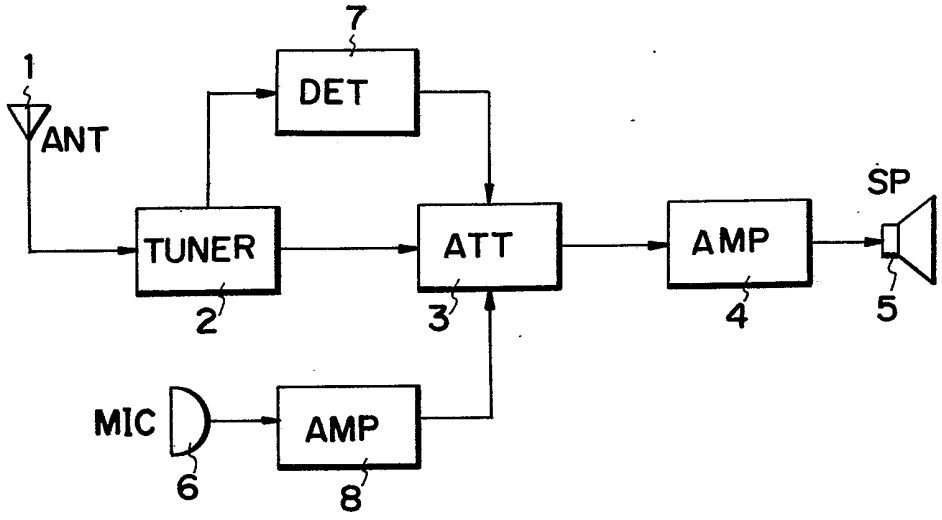
FIG. 1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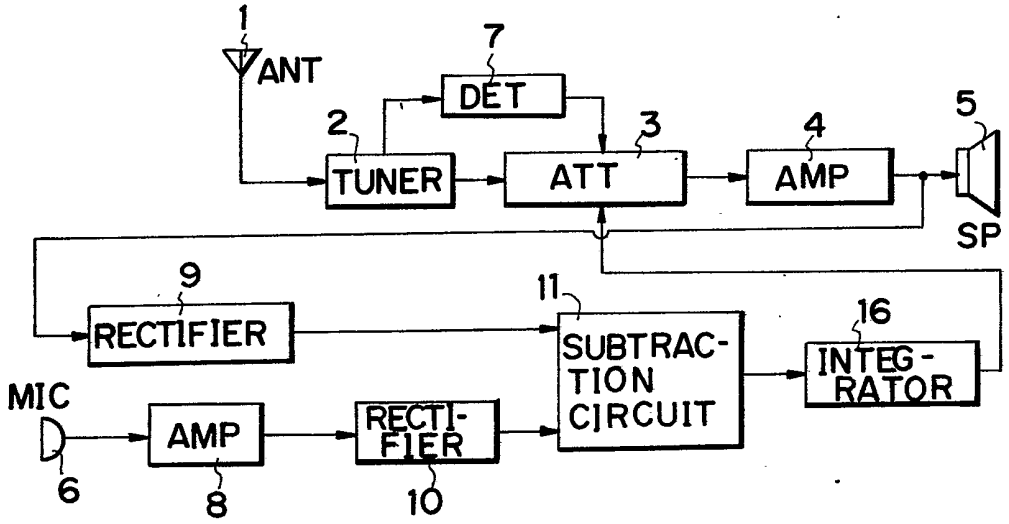
DET
TUNER
2
ATT
3
AMP
4
SP
5
MIC
6
AMP
8

FIG. 2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ANT
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DET
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TUNER
3
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AMP
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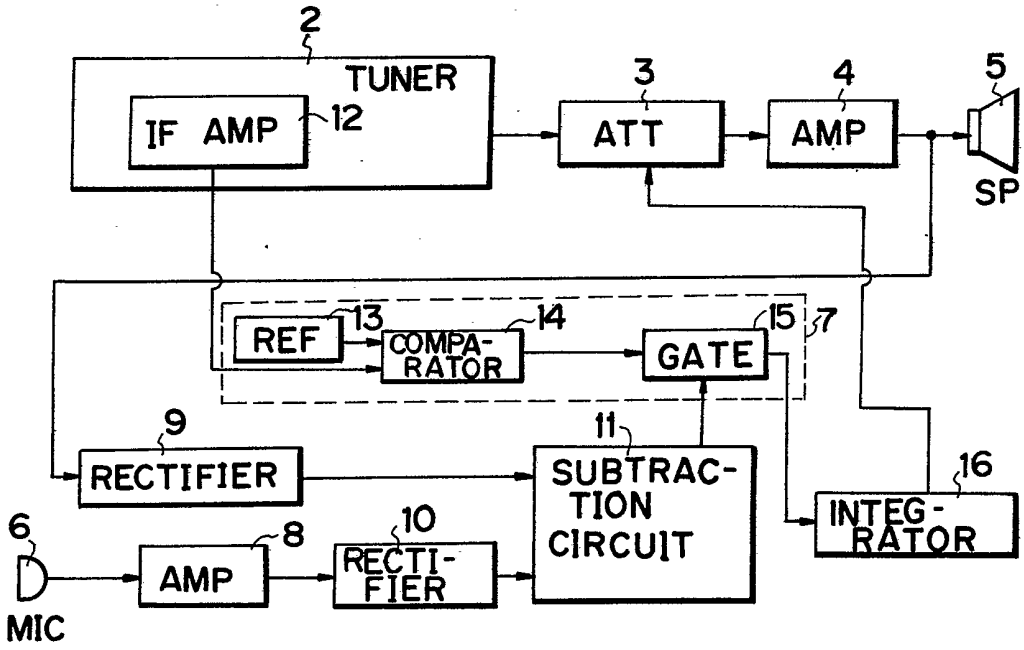
SP
9
RECTIFIER
11
SUBTRAC-
TION
CIRCUIT
16
INTEG-
RATOR
MIC
6
AMP
8
RECTI-
FIER
10

FIG. 3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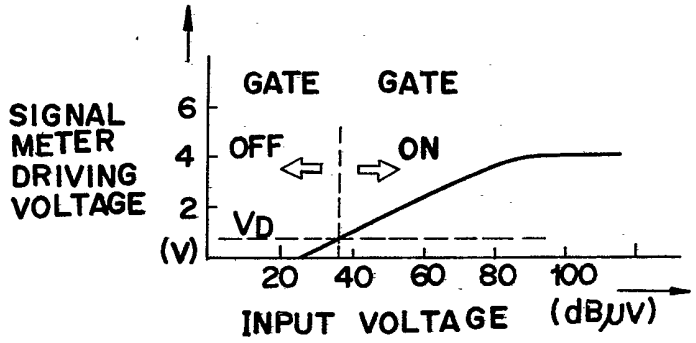
TUNER
IF AMP
12
3
ATT
4
AMP
5
SP
REF
13
COMPA-
RATOR
14
GATE
15
7
9
RECTIFIER
11
SUBTRAC-
TION
CIRCUIT
16
INTEG-
RATOR
6
MIC
AMP
8
10
RECTI-
FIER

FIG. 4


SIGNAL
METER
DRIVING
VOLTAGE
6
4
2
(V)
GATE
OFF
GATE
ON
VD
20
40
60
80
100
INPUT VOLTAGE (dBμV)

SPECIFICATION

Receiving apparatus

This invention relates to a receiving apparatus such as a radio receiver, tranceiver, etc. provided with an automatic volume control device, and more particularly to a receiving apparatus which is capable of stopping the operation of the automatic volume control device when the level of a received signal radio wave is lower than a predetermined level, for preventing amplification of noises increased at the time of receiving the weak signal radio wave.

A conventional automatic volume control device operates in such a manner that a microphone thereof detects ambient noises, the volume of a loudspeaker is automatically controlled according to the ambient noises thereby to prevent voice output from the loudspeaker from being masked by the ambient noises and to enable the voice output to be heard stably.

However, in the radio receiver or the tranceiver which receives a signal radio wave and outputs, in the form of voice, from a loudspeaker after amplification, there may possibly be caused a problem when the signal radio wave is weak. More specifically, when passing through a tunnel, bridge, etc., ambient noises are increased so that the automatic volume control device operates to increase a loudspeaker output. However, a received signal radio wave is extremely weak due to screening of the radio wave by buildings etc. and a ratio of a noise component to a signal component is increased so that the prevailing noises are amplified by and output from the loudspeaker.

It is therefore an object of the present invention to provide a receiving apparatus which is capable of obviating the disadvantages involved in the conventional apparatus.

In accordance with the present invention, there is provided a receiving apparatus which comprises:

a radio tuner means;

a volume control means for attenuating an audio signal output from said radio tuner means;

a control means for controlling an amount of attenuation by said volume control means according to an ambient noise; and

a stop means for stopping an operation of said volume control means when a received signal has a level lower than a predetermined level.

Fig. 1 is a block diagram of one embodiment of the present invention;

Figs. 2 and 3 are block diagrams of further embodiments of the present invention, respectively; and

Fig. 4 is a diagram showing an operation of the embodiment illustrated in Fig. 3.

Referring now to the drawings, there is illustrated a preferred embodiment of the present invention.

In Fig. 1, 1 is an antenna, 2 is a radio tuner, 3 is an automatic volume control device comprised of an electronic attenuator, 4 is a power amplifier, 5 is a loudspeaker, 6 is a microphone, 7 is a signal radio wave level detecting circuit, and 8 is a microphone amplifier.

A signal radio wave received by the antenna 1 is selected by a radio tuner 2 and converted into an audio signal. This audio signal is suitably attenuated by the automatic volume control device 3, amplified by the power amplifier 4 and output from the loudspeaker 5. An amount of attenuation by the automatic volume control device 3 is controlled so that it may be maximum when an ambient noise entering the microphone 6 is zero and it may be small when the ambient noise is large. Therefore, output voice from the loudspeaker 5 increases or decreases according to the increase or decrease of the ambient noise and a voice output having a volume sufficient to prevent masking by the ambient noise is output by the loudspeaker 5.

The signal radio wave detecting circuit 7 receives, as an input, a level of a received signal, e.g., an intermediate frequency (IF) signal from the radio tuner 2 and applies to the automatic volume control device 3 a signal to stop an operation of amplifying the voice output from the loudspeaker 5, i.e., an operation of lowering the attenuation amount, when the level of the IF signal is lower than the predetermined level.

Therefore, when the signal radio wave is weaker than the predetermined value, the operation of the automatic volume control device 3 is stopped, so that voice volume increase causing undesired relation between a signal component and a noise component can be avoided. In particular, this arrangement is effective for a car radio receiver etc. wherein the level of the signal radio wave is varied violently due to the directivity of the antenna relative to the running direction of a car or ambient conditions of buildings. etc. In this case, a desired sound field can be maintained without increasing the volume of the inner noise of the radio receiver.

Fig. 2 is a block diagram of another embodiment of the present invention. In Fig. 2, 9 and 10 are rectifier circuits, 11 is a subtraction circuit and 16 is an integrator A signal responsive to the loudspeaker 5 and a signal deriving from an ambient noise which is detected by the microphone 6 are converted into DC voltages by the rectifier circuits 9 and 10, respectively, and applied to the subtraction circuit 11. At this subtraction circuit 11, an output from the rectifying circuit 9 is subtracted from an output from the rectifying circuit 10 so that a speaker sound is cancelled from the detection output from the microphone to detect a signal voltage based on real ambient noise magnitude. This detection voltage is applied to and averaged in the integrator 16. The volume control device 3 is automatically controlled according to the averaged voltage.

Fig. 3 is a block diagram of a further embodiment of the present invention, showing a specific formation of a signal radio wave level detecting circuit 7. In Fig. 3, 12 is an intermediate frequency amplifier in the tuner 2, 13 is a reference signal voltage generator, 14 is a comparator circuit and 15 is a gate circuit.

In the arrangement illustrated in Fig. 3, the intermediate frequency amplifier 12 includes a signal meter for indicating, for example, a level of a received signal radio wave. Since a DC voltage for

driving the meter indicates the level of the received signal radio wave, the DC voltage E is applied to the comparator circuit 14 together with a reference signal voltage E_R obtained by the reference signal voltage generator 13. The gate circuit 15 is turned on or off according to the comparison result to control the operation of the volume control device 3 (to increase or decrease the attenuation amount).

Fig. 4 is a characteristic diagram of the voltage of the signal meter in the intermediate frequency amplifier 12. The abscissa indicates a received input voltage and the ordinate indicates a meter driving voltage E. If the reference voltage is set at the value V_D of the intermediate frequency converting DC voltage E, the gate circuit 15 is turned on when a signal voltage of normal electric field exceeding the value V_D is input to the comparator circuit 14 and the gate circuit 15 is turned off when a signal voltage of weak electric field lower than the value V_D is input.

In a car radio having the volume control device as described above, when a broadcasting signal is momentarily cut off during passing through a tunnel etc., since the DC voltage from the intermediate frequency amplifier 12 has a weak radio field, an input voltage lower than the reference voltage value V_D is applied to the comparator circuit 14, and the comparator circuit 14 is inverted to turn off the gate circuit 15. Upon turning off of the gate circuit 15, which is disposed between the subtraction circuit 10 and the integrator 11, a detection voltage based on the ambient noise amount from the subtraction circuit 11 is not conveyed to the integrator 16 and, as a result, the operation of the volume control device 3 is automatically stopped. Therefore, if a large noise is produced in the surroundings, the volume is not amplified and such a misoperation that the noise of the receiver is increased can be prevented.

Since the gate circuit 15 is provided before the integrator 11, it can be avoided that the automatic volume control device 3 responds to a momentary operation of the gate circuit 15, which is desirable to improve hearing feeling.

As apparent from the foregoing description, according to the present invention, the operation of the automatic volume control device is stopped when the received signal radio wave is weak, so that it can be prevented to increase the volume of voice having an undesired ratio of a signal component to a noise component.

CLAIMS

1. A receiver apparatus which comprises:
a radio tuner means;
a volume control means for attenuating an audio signal output from said radio tuner means;
a control means for controlling an amount of attenuation by said volume control means according to an ambient noise; and
a stop means for stopping an operation of said volume control means when a received signal has a level lower than a predetermined level.

2. A receiving apparatus according to claim 1, wherein said control means includes a means subtracting said audio signal from a signal responsive to the ambient noise, said amount of attenuation by said volume control means being reduced according to a signal output from the subtracting means.

3. A receiving apparatus according to claim 1, wherein said control means includes a microphone, a first rectifying means for rectifying an output from said microphone, a second rectifying means for rectifying said audio signal, and a subtracting means for subtracting a rectification output from said second rectifying means from a recification output from said first rectifying means, said amount of attenuation by said volume control means is reduced according to a signal output from said subtracting means.

4. A receiving apparatus according to claim 3, wherein said control means further includes an integrating means for averaging the output from said subtracting means.

5. A receiving apparatus according to claim 1, wherein said stop means includes a reference signal generating means, a comparator means for comparing a reference signal output from said reference signal generating means and a signal responsive to the level of the received signal and a gate means adapted to be turned on or off according to an output from said comparator means, an output from said control means being applied to said volume control means through said gate means.

6. A receiving apparatus according to claim 5, wherein said radio tuner means includes at least an intermediate frequency amplifier and said comparator means compares a signal-meter driving signal from said amplifier and said reference signal.

7. A receiving apparatus as claimed in claim 1 substantially as hereinbefore described with reference to the accompanying drawings.

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