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AUTOMATIC VOLUME CONTROL
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1,998,617

FIG. 1.

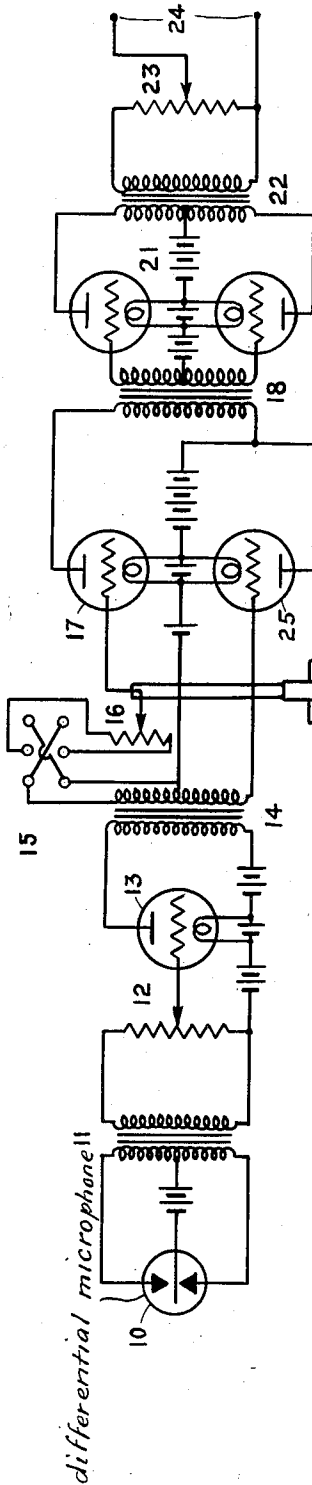


FIG. 2.

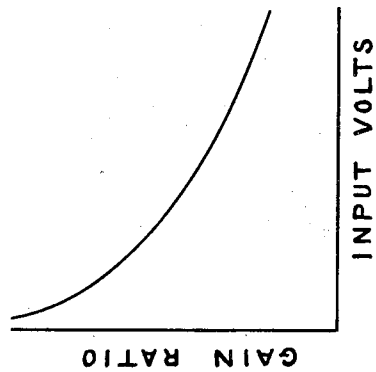
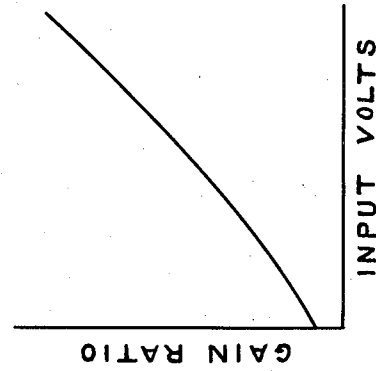


FIG. 3.



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AUTOMATIC VOLUME CONTROL

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5 Claims. (Cl. 179—100.4)

This invention relates to amplifying systems and more particularly to an improved means for controlling the amount of amplification of a system in accordance with the strength of the applied energy.

The invention provides a means of controlling the input to a space discharge amplifier in accordance with the strength of the applied signal.

The invention relates particularly to a system of amplification in which a greater ratio of amplification or gain is produced for impressed signals of high intensity than for impressed signals of low intensity.

This invention also provides a system of amplification in which the ratio of amplification or gain may be decreased as the intensity of the impressed signals is increased.

The invention also consists in certain new and original features of construction and combinations of parts hereinafter set forth and claimed.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, the mode of its operation and the manner of its organization may be better understood by referring to the following description taken in connection with the accompanying drawing forming a part thereof, in which

Fig. 1 illustrates diagrammatically a system constructed in accordance with this invention.

Figs. 2 and 3 are curves illustrating the operation of the system.

Like reference characters denote like parts in the several figures of the drawing.

In the following description and in the claims, parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

Referring more particularly to the drawing, Fig. 1 shows a microphone 10 which is connected in the primary circuit of a transformer 11, the secondary of which is connected to a potentiometer 12. This potentiometer is connected in the input circuit of a space discharge amplifier 13, in the output circuit of which is the primary of a transformer 14. One-half of the secondary of this transformer is connected through a reversing switch 15 to a potentiometer 16. This potentiometer is connected in the input circuit of a space discharge amplifier 17, the output circuit of which is connected to the primary of a transformer 18. The secondary of this transformer is connected to the in-

put circuit of a push-pull amplifier 21, the output circuit of which is connected to the primary of a transformer 22. The secondary of this transformer is connected to a potentiometer 23, the other side of which is connected to output terminals 24. These terminals may be connected to any suitable device such as a loud speaker.

The other half of the secondary winding of the transformer 14 is connected to the input circuit of a space discharge amplifier 25 in the output circuit of which is the primary of a transformer 26. The secondary of this transformer is connected to a rectifying device 27 which consists of two rectifiers 31 and 32 which are connected in series with a resistance 33. This resistance is also in the input circuit of a space discharge means 34. In the output circuit of this device is a solenoid 35, the core of which is connected to the movable contact of the potentiometer 16. The solenoid is normally held in the raised position by a spring 35a. The filament and plate currents for the space discharge means 34 are obtained from a transformer 36 which is supplied with alternating current from a source 37.

In the operation of the form of the invention shown in Fig. 1, the energy received by the microphone 10 controls the flow of current through the transformer 11. The current from the secondary of this transformer 11 passes through the potentiometer 12 from which any desired amount of energy may be fed to the input circuit of the space discharge amplifier 13, where it is amplified and fed to the transformer 14.

Part of the energy in the secondary of this transformer passes through the reversing switch 15 to the potentiometer 16. The energy picked up by this device is then fed to the input circuit of the space discharge means 17. The rest of the energy from the secondary of the transformer 14 passes to the input circuit of the space discharge amplifier 25 where it is amplified and passes through the transformer 26 to the rectifier circuit 27. Here the current is rectified and passes through the resistance 33 in the direction of the arrow. This causes a potential difference to be built up across this resistance which is dependent upon the strength of the current flowing in it. If no energy is being received, there will be no current flowing through this resistance, and the grid of the space discharge means 34 will have no negative bias. This space discharge means acting as a rectifier will then pass a maximum amount of current through the solenoid 35, thus moving the contact of the potentiometer 16 to its farthest down position. As the energy re-

ceived increases and the current in the resistance 33 also increases, the negative potential on the grid of the space discharge means 34 will be increased thereby increasing the impedance of this device, which will cause a decreased amount of current to flow through the solenoid 35 thus allowing the contact of the potentiometer 16 to move upward under the action of spring 35a in the solenoid 35. It is thus seen that the setting of the potentiometer 16 will depend upon the amount of energy received by the microphone 10.

If the switch 15 is thrown to the right, an increase of energy received by the microphone 10 will cause a decrease in the ratio of the received energy to that applied to amplifier 17 by the potentiometer 16. This decrease of ratio with respect to the input volts is shown by the curve in Fig. 2. From this it is seen that by properly designing the elements, including potentiometer 16, it is possible to vary this ratio so as to limit the output of the space discharge means 17 to a predetermined value.

The controlled output from the amplifier 17 then passes through the transformer 18 to the push-pull amplifier 21, where the energy is amplified and fed through the transformer 22 to the potentiometer 23 where the amount of energy passed to the output circuit 24 may be controlled manually. In this way it is possible to maintain the strength of the output signals within certain definite limits so as not to overload the reproducing apparatus, and to prevent distortion of the output of this system.

If the switch 15 is thrown to the left, the ratio of the energy fed to the input circuit of the space discharge means 17 with respect to the input energy will be increased as the energy received by the microphone 10 increases. This is shown by the curve in Fig. 3. In this way it is possible to expand the range of a received signal so that it produces a greater variation in the volume of the output signal than was present in the volume of the input signal.

It is to be noted that in the above described system the various space discharge devices are operated at all times at their point of maximum efficiency and minimum distortion. The variation in volume in the output is obtained by controlling the ratio of the impressed signal to the energy applied to one of the stages of amplification. The amplification factors of the various discharge devices themselves remain constant at all times. The system is accordingly free from distortion and other undesirable effects which would be present if the operating characteristics of the space discharge devices themselves were altered to vary the impedance thereof and thereby control the amplification factor.

It is to be understood that the term "amplification ratio of the amplifier" used herein, refers to the system as a whole and not to the various space discharge devices themselves, or to the single stages of amplification, each of which have a constant amplification factor. The above system is useful, as for example, in reproducing sound from a phonograph record in which the volume range is normally suppressed. A greater volume range can be obtained in the output of the amplifier, whereby the signal is caused to more nearly approximate that of the original sound being reproduced. For this purpose the system is so operated that an increase in signal causes an increase in the ratio of the energy applied to the amplifier.

The system may also be used to prevent overload of the amplifying devices, for which purpose the potentiometer is so connected that an increase in signal strength causes a decrease in the ratio of energy applied to the amplifier. In obtaining both of the above results the space discharge devices are at all times operated at their point of minimum distortion, that is, the center of their characteristic curves.

It is to be understood that the potentiometer 16 may have any suitable type of winding which may differ according to the use to which it is applied. For example, it may be desirable to have a different type of winding when the potentiometer is used for decreasing the volume range of the system than when it is used for increasing the volume range.

It is also to be understood that while the system is shown as receiving its energy from a microphone, it is not limited to this device, but may receive its energy from other sources such as a photoelectric cell used in connection with talking moving pictures, or from a phonographic pick-up device.

Although only one of the various forms in which this invention may be embodied have been shown herein, it is to be understood that the invention is not limited to any specific construction, but might be embodied in various forms without departing from the spirit of the invention or the scope of the appended claims.

What is claimed is:

1. In a system for use with a sound record, a sound record, an energy transfer device associated therewith, a translating device, means between said energy transfer device and said translating device controlled by the sound energy for varying the dynamics of the sound, and means selectively to affect said dynamics either by expanding the volume ratio or by compressing the volume ratio of the sound.

2. In a system for transferring sound between a translating device and a sound record, a translating device, a sound record, an energy transfer device associated therewith, an amplifier between said translating device and said energy transfer device, said amplifier comprising an amplifier tube and a voltage varying device, a control circuit governed by the average sound energy for determining the voltage of said voltage varying device, and means for reversing the action of said voltage varying device with respect to said control circuit.

3. In a system for transferring sound between a translating device and a sound record, a translating device, a sound record, an energy transfer device associated therewith, an amplifier between said translating device and said energy transfer device, said amplifier comprising an amplifier tube having a potentiometer in its input circuit, a reversing switch for reversing said potentiometer with respect to said amplifier tube, a solenoid for operating the movable contact of said potentiometer, and a control circuit operated by sound energy for adjusting said potentiometer in accordance with the average sound energy.

4. In a sound reproducing system, a sound record, a pick-up device therefor, an amplifier fed by said pick-up device, a loud speaker fed by said amplifier, said amplifier comprising a potentiometer fed by said pick-up device and an amplifier tube fed by said potentiometer, a solenoid controlling the adjustable contact of said potentiometer, a control circuit fed by said pick-up

device having means for adjusting said solenoid according to the average intensity of the sound picked up by said pick-up device, whereby said amplifier tube operates with a constant amplification factor and the gain ratio of said amplifier varies according to the average intensity of the sound picked up by said pick-up device.

5. In a system for use with a sound record, a sound record, an energy transfer device associated therewith, an amplifier, means between said energy transfer device and said amplifier for

varying the dynamics of the sound energy without changing the amplification factor of said amplifier, means for deriving from said amplifier the energy thus varied and translating said energy, means for deriving from said energy transfer device a component of energy proportional to the sound energy, and means for utilizing said last mentioned component to control the means for varying the dynamics of the sound energy.

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