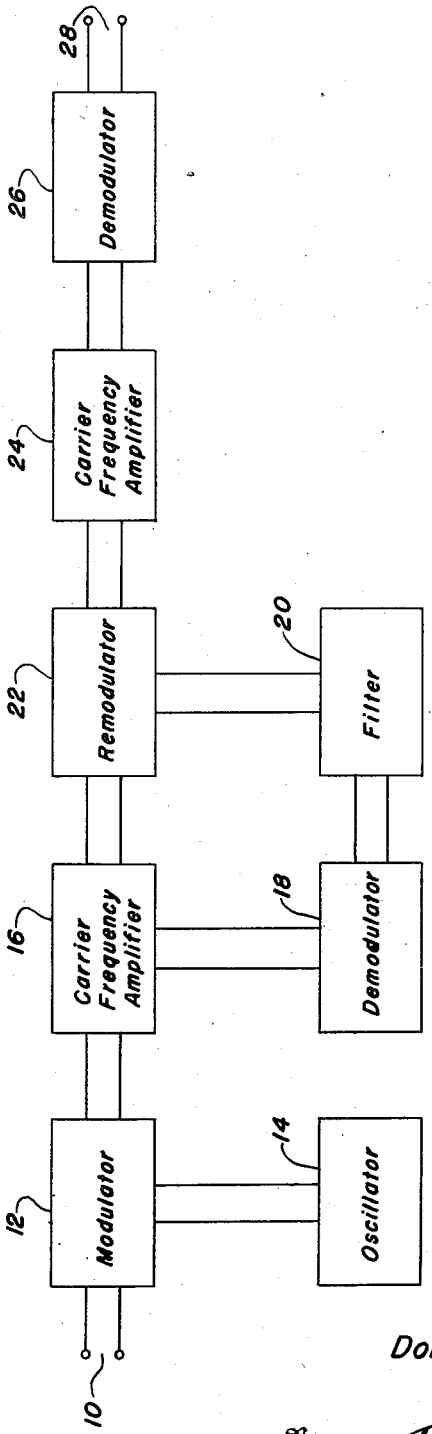
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WIDE-RANGE AUDIO-FREQUENCY AMPLIFIER

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WIDE-RANGE AUDIO-FREQUENCY AMPLIFIER

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4 Claims. (Cl. 179—171)

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This invention relates to audio-frequency amplifiers.

More particularly, this invention relates to audio-frequency amplifiers having a linear response regardless of the amplitude of the input signals.

Various systems have been proposed for obtaining amplified output voltages which are proportional to audio-frequency input voltages of small amplitude. One system for this purpose is the conventional direct-coupled amplifiers which may be used for all low input signal frequencies, including direct-current signals. In this type of amplifier, the desired linear response may be achieved by providing sufficient gain to raise low-amplitude input signals to the proper level without appreciably loading any stage. These amplifiers, however, are not entirely satisfactory due to the fact that their output is rather seriously affected by changes in the supply voltages applied to the tubes used therein, and by changes in filament voltage that have a particularly undesirable effect.

Another system for amplifying small audio-frequency signals includes means for modulating a very stable carrier with the input signal, means for amplifying the modulated carrier at the carrier frequency, and a demodulator by means of which the amplified signal is recovered. The amplification of the input signal obtainable in this system is limited by the available plate voltage used in the carrier-frequency amplifier. In order to obtain linear response in this system, normal input signals must modulate the carrier with a low-modulation factor, and under this condition, it may be impossible to sufficiently amplify the low-amplitude input signals using any reasonable plate voltage in the amplifier. Thus a compromise must be made between linear response and available output.

The present invention provides means for increasing the available output of the carrier-type audio-frequency amplifier mentioned above without necessitating any increase in the applied plate voltage of the amplifier and without necessitating reduction of the linearity of response of the system. There is provided, therefore, in accordance with the present invention, means in combination with a carrier-type audio-frequency amplification system for increasing the modulation factor of the modulated carrier prior to its amplification.

A primary object of this invention is to provide an audio-frequency amplifier having a linear response to input signals regardless of their amplitude.

A further object of this invention is to provide

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an audio-frequency amplifier with means of modulating a very stable carrier frequency, and means of amplifying and demodulating that modulated carrier frequency to provide the desired linear response.

A further object of this invention is to provide an audio-frequency amplifier capable of increasing the modulation factor of a modulated carrier frequency signal.

Other objects and advantages of this invention will be apparent from the following description and illustration in which the figure of the drawing is a block diagram of an audio-frequency amplifier in accordance with the invention.

Referring to the figure of the drawing, the audio-frequency input signal of small amplitude is applied through input terminals 10 to a modulator 12, by means of which a carrier frequency supplied by an oscillator 14 is modulated. In order to obtain response for input signals varying over a wide range in amplitude, the modulation factor of the modulated carrier wave must be relatively low for normal signals. It is this condition which limits the useful output of the conventional carrier-type low-frequency amplifier. Accordingly, means are provided for increasing the modulation factor of the modulated carrier prior to its amplification and demodulation.

The modulated-carrier output of modulator 12 is amplified at carrier frequency by amplifier 16 to bring it to a convenient level for demodulation. The output of amplifier 16 is applied to a demodulator 18, the modulation output of which is filtered by a filter 20 to remove any carrier-frequency components. The modulation signal thus obtained is applied to a modulator 22, wherein it is employed to remodulate a portion of the modulated carrier appearing at the output of the amplifier 16. The effect of the remodulation process is to increase the amplitude of the modulation on the carrier without correspondingly increasing the carrier itself. This results in an increased modulation factor, the magnitude of which may be varied substantially at will.

The output of the modulator 22 is then applied to a carrier-frequency amplifier 24 by means of which the remodulated signal is amplified as desired. The output of the amplifier 24 is demodulated in a demodulator 26 to recover the amplified input signal which appears between the terminals 28.

It will be understood that the available useful output produced by this system for a given amplifier plate voltage is substantially greater than that which could be obtained with the same plate

voltage using a conventional carrier-type, low-frequency amplifier, this gain in output being due to the increased modulation factor. While a complete audio-frequency amplifier system has been described, it will be understood that the method of increasing the modulation factor is of general application and may be used in other systems in which the normal input to the demodulator is an amplitude-modulated signal of low modulation factor. Thus, in certain types of systems, a low-modulation factor for normal signals is a necessity if linear response is to be obtained for input signals of greater than normal amplitude. In these cases, the use of the system of the invention provides means for obtaining a demodulator-output signal of reasonable level without resorting to direct-coupled amplifiers and their attendant difficulties.

What is claimed is:

1. In an amplifier, comprising: means for modulating a stable carrier with an input signal, including input terminals; first amplifying means for amplifying the output of said modulating means; means for demodulating a portion of the output of said first amplifying means; means for remodulating the remaining portion of the output of said first amplifying means by the output of said demodulating means; second amplifying means for amplifying the output of said remodulation means; and second demodulating means for demodulating the output of said second amplifying means, including output terminals.

2. In the apparatus as set forth in claim 1 and filtering means for suppressing any carrier frequency components in the output of the demodulating means.

3. In a device for increasing the modulation factor of an amplitude-modulated carrier, comprising: first amplifying means for amplifying an amplitude-modulated carrier, including input terminals; means for demodulating a portion of the output of said first amplifying means; means for remodulating the remaining portion of the output of said first amplifying means by the output of said demodulating means; and second amplifying means for amplifying the output of said remodulation means, including output terminals.

4. In the apparatus as set forth in claim 3 and filtering means for suppressing any carrier frequency components in the output of the demodulating means.

DONALD G. C. HARE.

No references cited.

Certificate of Correction

Patent No. 2,455,332 November 30, 1948

DONALD G. C. HARE

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 2, line 20, after the word "obtain" insert *linear*;

and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 24th day of January, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.