



Patented Aug. 30, 1927.

# UNITED STATES PATENT OFFICE.

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## AMPLIFYING SYSTEM.

Application filed November 14, 1925. Serial No. 69,200.

My invention relates to apparatus for amplifying voltage impulses and applying them to a sound reproducing device such as a loud speaker, and has for its principal object the provision of an improved amplifying system that may be operated by alternating current supplied from a house lighting circuit or the like.

In the operation of a sound reproducing device provided with operating and field windings adapted to produce vibration of a diaphragm, it is customary to apply the voltage impulses to the operating coil through an amplifying system. This involves the application of different potentials to the cathode heating and anode circuits of the amplifiers and to the field winding of the reproducing device. In order to simplify the operation and control of the apparatus it is desirable that these potentials be applied through a single source, that the number of amplifiers be reduced to the smallest number capable of effecting the proper operation of the reproducing device, and that the excitation of the device be independent of variation in the current supplied to its operating coil. In accordance with my invention, these results are accomplished by an arrangement wherein the voltage impulses are amplified through a single amplifier and wherein the excitation of the sound producing device is produced by means of field windings connected in series and shunt with the valve.

My invention will be better understood from the following description when considered in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

Referring to the drawing, the single figure shows an amplifying system wherein my invention has been embodied.

This figure shows a sound reproducing device 1 wherein a diaphragm is operated by means of an operating coil located in a strong magnetic field produced in an annular air gap between poles 3 and 4 of a core member 5 by current transmitted through series and shunt field windings 6 and 7 respectively. For convenience of illustration the diaphragm has been omitted from the drawing and the core member 5 has been shown diagrammatically.

Voltage impulses from a suitable source are applied to the control circuit of an ampli-

fier 8 through a transformer 9 and a negative bias resistor 10 which is connected between the cathode 11 and grid 12 of the amplifier 8 and is shunted by a condenser 13 provided for by-passing high frequency currents. A transformer 14 is provided with a primary winding 15 adapted to be connected to a lighting circuit, a secondary winding 16 adapted to supply the heating current of the cathode 11, a secondary winding 17 for supplying the cathode heating current of a thermionic rectifier 18, and a secondary winding 19 for supplying the exciting current of the reproducing device 1 and the output current of the amplifier 8. It will be observed that the cathode 11 and the anode 20 of the amplifier 8 are interconnected through a circuit comprising the secondary circuit 16, resistor 10, winding 19, rectifier 18, secondary circuit 17, series field coil 6 and the primary circuit 21 of a transformer 22. The secondary circuit 23 of this transformer is connected to the operating coil 2 of the device 1. Pulsation in the current supplied to the anode circuit is prevented by the smoothing condensers 24 and 25 and by the impedances of coil 6.

The operation of the apparatus will be readily understood if it be assumed that current is supplied to the transformer 14 and the voltage impulses to be amplified are applied to the primary circuit of the transformer 9. Under these conditions, the voltage impulses applied to the control or input circuit of the amplifier 8 control the current supplied to the output circuit of the amplifier through the secondary circuit 19 and the rectifier 18. This rectified current is transmitted through the series field winding 6 and the primary circuit 21 of the transformer 22. Its high frequency components are kept out of the field circuit by the condenser 24 and it is therefore incapable of inducing an electromotive force in the secondary circuit 23 of the transformer 22.

Variation in the current transmitted through the amplifier 8 is determined by the voltage impulses applied to the grid 12 through the transformer 9 and these variations are utilized to energize the operating coil 2 and produce operation of the sound reproducing device.

It should be noted that the provision of the shunt coil 7 is of advantage in that the exciting current is not limited by the recti-

fied current transmitted through the amplifier but may be made to have a value high enough to ensure proper operation of the sound reproducing device.

5 The embodiment of the invention illustrated and described herein has been selected for the purpose of more clearly setting forth the principles involved. It will be apparent, however, that the invention is susceptible of  
10 being modified to meet the different conditions encountered in its use and I therefore aim to cover by the appended claims all modifications within the true spirit and scope of my invention.

15 What I claim as new and desire to secure by Letters Patent of the United States is:—

1. The combination of a sound reproducing device comprising a plurality of field circuits and an operating circuit, an amplifier  
20 provided with a grid for controlling the transmission of current between its cathode and anode to cause voltage impulses to be applied to said operating circuit, and current supply means connected between  
25 said anode and cathode through one of said field circuits and to another of said field circuits independently of said amplifier.

2. The combination of a sound reproducing device comprising a plurality of field circuits and an operating circuit, an amplifier  
30 provided with a grid for producing pulsations in the current transmitted between its cathode and anode, means connected between said cathode and anode for transmitting said  
35 pulsations to said operating circuit, a current supply means connected between said anode and cathode through one of said field

circuits and said operating winding and to another of said field circuits independently of said amplifier and operating winding, and impedance means connected to the  
40 terminals of said field windings for preventing pulsations in the current transmitted therethrough.

3. The combination of a sound reproducing device comprising a plurality of field  
45 circuits and an operating circuit, an amplifier provided with a grid for controlling the transmission of current between its cathode and anode to cause voltage impulses to be  
50 applied to said operating circuit, a source of current connected between said anode and cathode through one of said field circuits and to another of said field circuits independently of said amplifier, and means for  
55 transmitting voltage impulses to said grid.

4. The combination of a sound reproducing device comprising a plurality of field  
60 circuits and an operating circuit, an amplifier provided with a grid for controlling the transmission of current between its cathode and anode to cause voltage impulses to be supplied to said operating circuit, current  
65 supply means connected between said anode and cathode through one of said field circuits and said operating winding and to another of said field circuits independently of said valve and operating winding, and  
70 means comprising a bias resistor connected between said cathode and anode for transmitting voltage impulses to said grid.

In witness whereof I have hereunto set my hand this 13th day of November, 1925.

FREDERICK C. BARTON.