

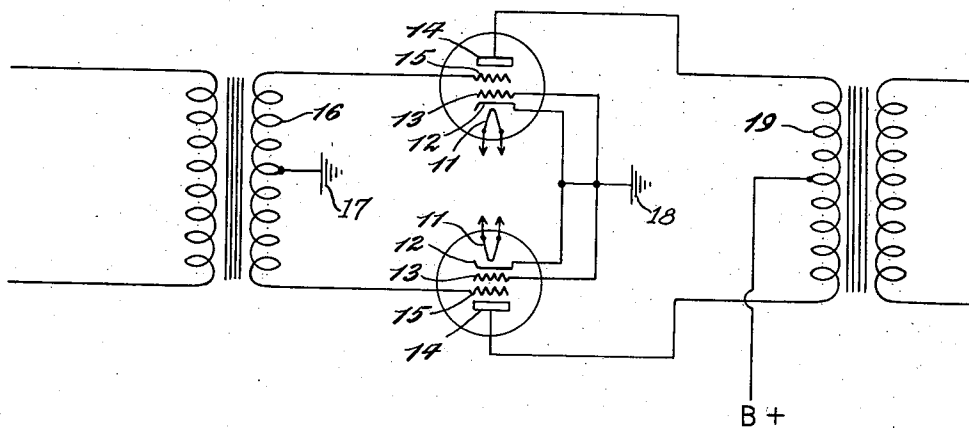
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AMPLIFIER CIRCUIT

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AMPLIFIER CIRCUIT

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4 Claims. (Cl. 179-171)

This invention relates to an amplifier circuit and more particularly to a circuit for operating a tetrode or beam power tube as a zero bias class B amplifier.

The objects and advantages will be apparent from the following description and the accompanying drawing which diagrammatically represents circuit connections embodying the invention.

Referring to the drawing in detail, there is a pair of tetrode tubes 10 connected in a circuit for push-pull or balanced operation. These tetrode tubes 10 are of the type commonly known as beam power tubes, a standard tube of this type being commonly known to the trade as a 6L6 tube. The elements in such a tube are arranged in spaced relation and comprise a heater 11, a cathode 12, a grid 13 adjacent said cathode, a plate 14 and a second grid 15 interposed between the plate 14 and the first-mentioned grid 13. In the ordinary operation of such a tube, the grid 15 located between the plate 14 and the grid 13 normally functions as a screen grid and the grid 13 adjacent the cathode 12 functions as a control grid. However, in accordance with this invention, the grids 15, which are normally the screen grids, in each of the tubes are respectively connected to opposite sides of a balanced input circuit and function as control grids. The input circuit consists of a transformer 16 which has its center tap connected to ground at 17. The cathodes 12 in each of the tubes and the grids 13 adjacent thereto are connected together and then to ground at 18 to establish a zero bias for these elements. The plates 14 of the tubes are connected to an output transformer 19 and to a plate voltage supply B+. The amplifier circuit just described functions in general like a zero bias class B amplifier but has many advantages thereover.

The grids 13 are relatively close to the cathodes 12 and when connected to the cathodes, form a return path to the cathodes for a certain percentage of the electrons which are in the normal space charge region near the cathodes. Since the control grids 15, which are normally the screen grids, are connected to ground through the input circuit, no acceleration of electrons occurs by virtue of these grids. When the tubes are thus connected, a very low plate current will be drawn with plate voltage values up to approximately twice the voltages that would be applied to the tubes when operated in a conventional beam forming manner. With the circuit connections shown, the operation is similar to

that of a zero bias class B triode except that the relatively greater spacing between the control grids 15 and the cathodes 12 than in the triode results in much lower input capacitance. Because of this lowered input capacitance, it is possible to have much greater impedance in the control grid circuits than is possible in an ordinary zero bias class B amplifier.

The increased impedance results in greater independence between the plate current and the plate voltage when excitation is applied to the control grid 15 and it is possible for the plate impedance to vary considerably without introducing serious distortion or loss of power. Also, a much higher plate voltage can be applied to these tubes without exceeding the limits of normal plate dissipation than is possible when the tubes are operated as beam power tubes.

When the tubes are connected in the manner shown, there is practically no heat dissipated in the grid structures because a steady voltage is not applied to the grids. In the push-pull arrangement shown, the polarity of the grids reverses during each alternation of the input signal. Thus, failures, due to improper grid alignment and emission resulting from high operating temperatures, are eliminated.

In practice, this circuit has been found to operate with very little power input and with grid impedances as high as 40,000 ohms. Very good overall efficiency has been obtained and the circuit possesses the advantages of low mu class B triode operation without the necessity of supplying the critical bias voltage necessary in such operation with triodes.

Tube life at double the plate voltage normally applied in beam operation has been increased to three times the normal beam tube operating life with no measurable change in the tube characteristics. The power output obtained has been found to be somewhat greater than with the same tubes connected for beam operation. The simplification in apparatus and power supply equipment resulting from this type of operation is considerable.

Distortion measurements indicate that the distortion is substantially less than is obtained, either with zero bias class B operation or with beam operation. With zero bias class B operation, distortion is apt to be high at low levels of output. In the circuit described, the combined characteristics of the tubes, which are connected for push-pull operation, are substantially linear even at low levels of operation so that very low values of distortion result at low

levels as compared with an ordinary zero bias class B amplifier. The general operating characteristics as regards stability and distortion are similar to those obtained in the operation of class A triodes.

While the invention has been shown and described in connection with a preferred embodiment, it is not to be limited to the exact form shown and described as it will be apparent to those skilled in the art that certain modifications and changes may be made without departing from the scope of the invention.

We claim:

1. A zero bias class B amplifier circuit including a pair of beam power tubes connected for push-pull operation, said tubes being tetrodes, each having as elements a heater, a cathode, a grid adjacent said cathode, a plate and a second grid located between the first-mentioned grid and the plate, means for establishing a zero bias on the cathodes of said tubes and their adjacent grids, an input circuit connected to the second-mentioned grids and an output circuit connected to the plates.

2. A circuit for operating a beam power tube as a zero bias class B amplifier comprising a pair of beam power tubes, said tubes being of the tetrode type, each having a heater, a cathode, a

grid adjacent the cathode, a plate and a second grid interposed between the first-mentioned grid and the plate, a circuit connecting the cathodes and the grids adjacent thereto to ground, a balanced input circuit connected to the second-mentioned grids and an output circuit connected to the plates.

3. An amplifier circuit including a pair of beam power tubes connected for push-pull operation, each of said tubes having as elements a heater, a cathode, a grid adjacent said cathode, a plate, and a second grid located between the first grid and the plate, a balanced input circuit connected to the second grids, an output circuit connected to the plates, and a circuit connecting the first grids and the cathodes to ground.

4. An amplifier circuit including a pair of beam power tubes connected for push-pull operation, each of said tubes having as elements a heater, a cathode, a grid adjacent said cathode, a plate, and a second grid located between the first grid and the plate, a balanced input circuit connected to the second grids, an output circuit connected to the plates, and means for establishing a zero bias on the cathodes and their adjacent grids of each of the tubes.

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