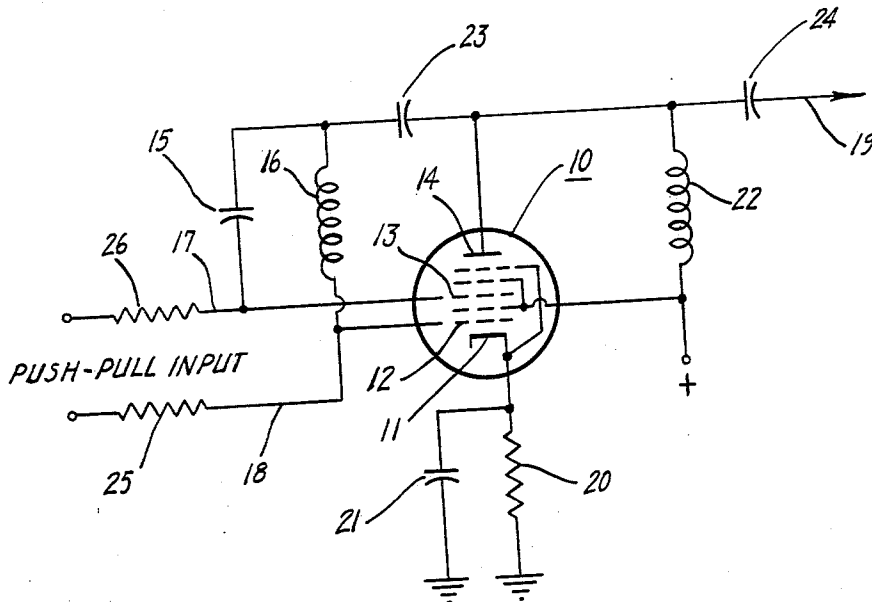


March 1, 1960

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PUSH-PULL REACTANCE TUBE STAGE
Filed Nov. 27, 1956

2,927,286



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PUSH-PULL REACTANCE TUBE STAGE

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Application November 27, 1956, Serial No. 624,625

1 Claim. (Cl. 333—80)

This invention relates to reactance tube stages such as are employed, for example, in automatic frequency control and automatic phase control systems, and more particularly the invention relates to push-pull reactance tube stages which are adapted to produce both capacitive and inductive effects.

A push-pull reactance tube stage, such as heretofore employed, comprises two similar electron tubes having their anodes connected together, and feedback connections such that one tube is made to simulate inductance and the other is made to simulate capacitance. A push-pull signal input is supplied to the control grids of the two tubes, and causes the resultant anode current to lead or lag the anode voltage according to the relative magnitudes of the signal voltages on the control grids.

While such a reactance tube stage has the advantage of push-pull control, it has the disadvantage that it depends for its proper operation upon continuous balance of the two tubes. If the tubes become unbalanced in any way, the stage as a whole will become unbalanced and will not operate properly in push-pull fashion. For example, if the emission of one cathode decreases, or if the transconductance of one tube decreases, the stage becomes unbalanced.

One object of the present invention is to overcome this objection and to provide a push-pull reactance tube stage which is not subject to relative variations of tube components and which will maintain proper push-pull operation.

Another object of the invention is to provide such a stage which is simpler, less expensive and easier to maintain than prior push-pull reactance tube stages.

By this invention, an arrangement is provided whereby a single electron tube is made to simulate either inductance or capacitance in a push-pull reactance tube stage. In accordance with this invention, such stage comprises an electron tube having a cathode, two control grids, and an anode, means for supplying an operating voltage to said anode, means for supplying a push-pull signal input to said control grids to vary the anode current in said tube, and means for causing the anode current to lead or lag the anode voltage according to the relative magnitudes of the signal voltages on said control grids. In the preferred embodiment of the invention, the electron tube is a heptode, the first and third grids of which are the control grids.

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The invention may be clearly understood from the following detailed description with reference to the accompanying drawing wherein the single figure is a schematic diagram of a push-pull reactance tube stage embodying the present invention.

Referring more particularly to the drawing, the push-pull reactance tube stage illustrated comprises an electron tube 10 having a cathode 11, two control grids 12 and 13, and an anode 14, a feedback connection including a capacitor 15 between the anode and the control grid 13, a feedback connection including an inductor 16 between the anode and the control grid 12, input connections 17 and 18 for supplying a push-pull signal input to the two control grids, and an output connection 19 which may extend to a controlled oscillator.

Preferably the electron tube 10 is a heptode, as illustrated, having its cathode connected to ground through a resistor 20 shunted by a capacitor 21, and having its second and fourth grids connected directly to the source of anode voltage supply, to which the anode is also connected through the radio frequency choke coil 22. The elements 23 and 24 are blocking condensers.

From the well known principles of operation of reactance tube circuits, it will be understood that the push-pull signal input applied to the control grids 12 and 13 via resistors 25 and 26 will cause the plate current to lead or lag the plate voltage according to the relative magnitudes of the signal voltages on the control grids. By using a tube with similar characteristics of the two control grids, the system will maintain balance over a reasonable range of supply voltage variations, and it will be unbalanced only by the push-pull signal input.

Thus this system has the advantage that it not only provides push-pull control but it also is free of the deleterious effects of unbalance which can readily occur in a two-tube system. Furthermore, this system is more economical in its use of a single tube.

While a preferred embodiment of the invention has been illustrated and described, it is to be understood that the invention is not limited thereto but contemplates such modifications and other embodiments as may be found useful in the practice of the invention.

I claim:

In a push-pull reactance tube stage, a single electron tube having a cathode, two control electrodes, and an anode, an anode-cathode circuit including a source of anode supply voltage, an output connection extending from said anode, means for supplying a push-pull signal input to said control electrodes, and means comprising inductive and capacitive feedback connections from said anode to the respective control electrodes to cause the anode current to lag or lead the anode voltage, and thus cause said tube to simulate either inductance or capacitance according to the relative magnitudes of the signal voltages on said control electrodes.

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