

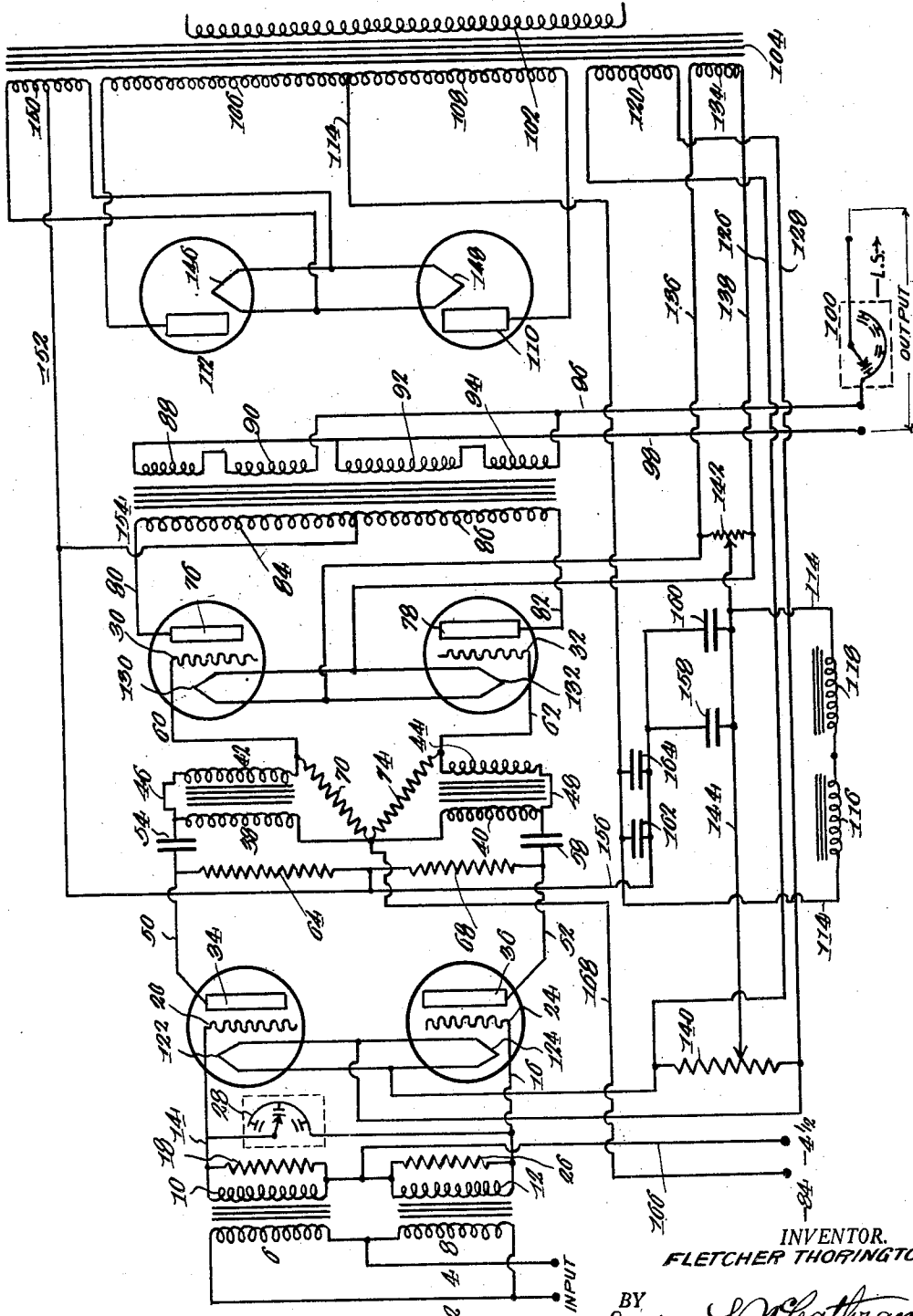
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PUSH-PULL AMPLIFIER CIRCUIT

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PUSH-PULL AMPLIFIER CIRCUIT

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The present invention relates to an improved push-pull amplifier circuit.

One object of the invention is to provide an amplifier circuit which has an undistorted output greater than that which would be available from a single tube in the power stage.

Another object of the invention is to design a push-pull amplifier circuit which requires no external field supply for the loud speaker.

A further object of the invention is to provide a push-pull circuit which will permit the power tubes to operate at full capacity without distortion.

And a still further object of the invention is to provide a circuit arrangement which will permit the control of the low frequency together with the high frequency for adjusting the tone quality of the instrument to any desired conditions.

In carrying my invention into effect the input from the phone pick up or radio is connected to two audio transformers having their primaries connected in parallel and their secondaries in series. A 250,000 ohm resistor is shunted across the secondaries of each transformer. The secondary terminals of the input transformers are connected to the grids of the first stage tubes which are connected in push-pull. The second stage tubes which are likewise in push-pull arrangement are coupled to the first stage by two transformers each having their primaries and secondaries connected in series and being of the same type as the first stage transformers. The primaries and secondaries of each transformer of the second stage are connected in series and to the output circuit of the first stage. The secondaries are connected to the grids or input circuit of the second stage. The output circuit of the second stage is connected to an output transformer with tapped secondary winding to properly match the impedance of different speakers to the output of the amplifier. A plurality of small capacity condensers are connected across the grids of the first stage. Similar condensers are also connected in se-

ries with the secondary circuit of the output transformer and the voice coils.

The features of my invention which I consider novel are pointed out with particularity in the appended claims. The invention itself, however, both as to its arrangement and method of operation together with further objects and advantages thereof will be best understood by reference to the following description taken in connection with the accompanying drawing which is a diagrammatic representation of the connections.

The input is connected by the conductors 2 and 4 to the primaries 6 and 8 which are connected in parallel. The secondaries 10 and 12 of the first stage transformer are connected in series and to the grids 20 and 24 of the first stage tubes which are arranged in push-pull by means of conductors 14 and 16. Resistors 18 and 26 of substantially 250,000 ohms are shunted across each of the secondaries 10 and 12. A variable capacity condenser 28 consisting of a plurality of small capacity condensers is shunted across the grids 20 and 24. This permits extremely high frequencies to be cut down to any desired level.

The second stage tubes which are arranged in push-pull have their grids 30 and 32 coupled with the plates 34 and 36 of the first stage tubes by means of a pair of transformers of the type as used in the first stage. The primaries 38 and 40 of each second stage transformer are connected respectively in series with their secondaries 42 and 44 by means of external jumpers 46 and 48. The primaries 38 and 40 are connected in series and the plates 34 and 36 of the first stage tubes are connected by means of conductors 50 and 52 through condensers 54 and 58 to the primaries 38 and 40 at the point of external connection between the primary and secondary windings of the transformers. Secondaries 42 and 44 are each respectively connected to grids 30 and 32 of the second stage tubes by conductors 60 and 62.

Two substantially 100,000 ohm resistors 64 and 68 are connected in series and across the plates 34 and 36 of the first stage tubes. The voltage change across these resistors causes a

corresponding signal to be transmitted to the second stage transformers which act as an auto transformer with a high step up ratio of amplification. Resistors 70 and 74 of substantially 100,000 ohms are connected respectively across the primary and secondary of each of the second stage transformers in order to stabilize the amplifier and improve the tone quality. The plates 76 and 78 of the second stage tubes are connected by means of conductors 80 and 82 to the primary windings 84 and 86, respectively, of the output transformer. The secondary windings 88, 90, 92 and 94 of the output transformer are connected to match the impedance of the number of speakers used. The secondaries of the output transformer are connected to a loud speaker or the like by means of conductors 96 and 98 in series with a variable capacity condenser 100 which consists of a plurality of small capacity condensers. The variable capacity condenser 100 which is connected in series with the voice coils of a dynamic speaker permits the controlling of the lower frequencies and enables the operator to prevent the lower bass notes from entering the horn and causing a deep, barrel tone sound.

It is obvious that the amplifier may be supplied with alternating or direct current. However, in the drawing, an alternating current source of supply is utilized. An alternating current source of supply, is connected to the primary 102 of the power transformer 104. The power transformer 104 has a plurality of secondary windings. Secondary windings 106 and 108 are connected in series and to plates 110 and 112 of the two rectifier tubes. A conductor 114 connects the windings through choke coils 116 and 118 to the center taps of the filaments. These choke coils may consist of from one to four of the field coils of a dynamic speaker unit or units. Secondary windings 120 supply the filaments 122 and 124 of the first stage tubes with current through conductors 126 and 128. Filaments 130 and 132 of the power tubes of the second stage are supplied with current from the secondary windings 134 of the power transformer through leads 136 and 138. The resistances 140 and 142 are connected together by means of a conductor 144 which is connected to the negative B source of supply through conductor 114.

Filaments 146 and 148 of the rectifier tubes are connected to the secondary winding 150 of the power transformer 104. Secondary winding 150 at its midpoint is connected by means of conductor 152 to the plate circuit of the first stage tubes at the midpoint of the connection of resistors 64 and 68 which are connected across the plates 34 and 36. Conductor 154 which is connected to the conductor 152 is connected at the

midpoint of the output transformer and supplies the plates 76 and 78 of the second stage tubes with power. The midpoint of the series connected resistances 64 and 68 which are connected across the plates 34 and 36 of the first stage tubes is connected by means of a conductor 156 through condensers 158, 160, 162, and 164 to conductor 114.

The negative $4\frac{1}{2}$ volt C bias is connected to the grids 20 and 24 of the first stage tubes by conductor 166 and the negative 84 volt C bias is connected to the grids 30 and 32 of the second stage tubes by conductor 168.

This amplifier while of a very simple and compact design requires no external field supply for the speaker units and operates the second stage power tubes in push-pull arrangement at a very high capacity without distortion. While I have described my invention with particular reference to the two stage amplification circuit, I do not wish to be limited to the use of the particular circuit connections shown and described, as it will be apparent that my system may be utilized in other manners to advantage for amplification and that many modifications in the connections used may be made without departing from the scope of my invention as set forth in the appended claims.

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

1. In a two stage cascade amplifier circuit, a pair of transformers in said first stage having their primary windings connected in reverse parallel and their secondary windings connected in series, high resistances connected in shunt with each of said secondary windings; a pair of transformers in the second stage having the secondary windings of each transformer connected in series and the primary windings of each transformer connected in series and to the output circuit of the first stage tubes, a pair of high resistances connected in series and across the output circuit of said first stage tubes and high resistances connected across the windings of each of said second stage transformers.

2. A two-stage cascade amplifying circuit comprising a pair of transformers having their primaries connected in reverse parallel and their secondaries in series, said primaries being adapted to be connected to an input circuit, a pair of power tubes having their grids connected to the secondaries of said transformers, high resistances shunted across each of the secondaries of said transformer, a variable capacity condenser consisting of a plurality of small capacity condensers connected in shunt with said secondaries of said transformers, a second pair of transformers each having their windings connected in series, said primary windings of said transformers being connected in

series and to the plate circuits of said pair
of power tubes, condensers connected in cir-
cuit with said plates and said primary
windings of said transformers, a pair of high
5 resistances connected across the plates of
said tubes, resistances connected across the
windings of each of said second pair of
transformers, a second pair of tubes, the
10 grids of said second pair of tubes being con-
nected to the secondary windings of said
second transformer, an output transformer
having its primary winding connected to the
output circuit of said second pair of tubes,
15 the secondary winding of said output trans-
former having a plurality of windings, a
variable capacity condenser consisting of a
plurality of small capacity condensers con-
nected in series with said secondary wind-
20 ings of said output transformer, and means
connected to said amplifier circuit for sup-
plying it with power.

In testimony whereof I affix my signature.
FLETCHER THORINGTON.

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