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HIGH FREQUENCY CIRCUIT ARRANGEMENTS

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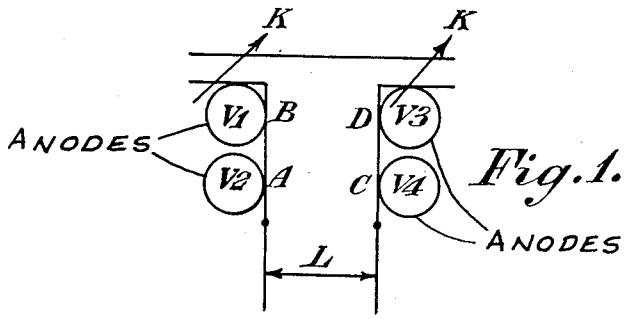

Fig. 1.

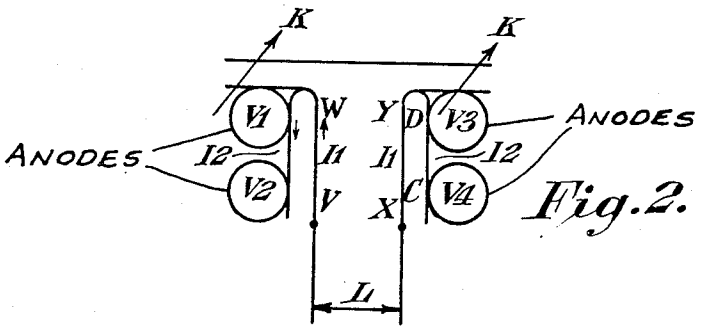

Fig. 2.

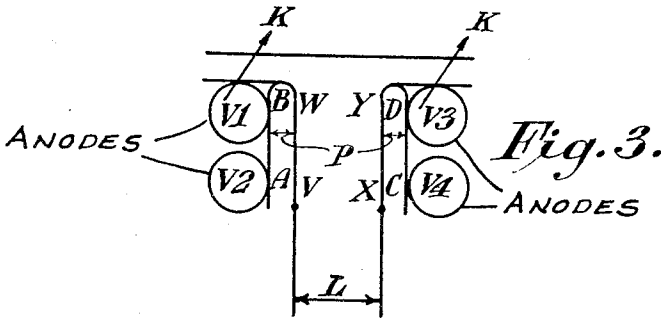

Fig. 3.

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HIGH FREQUENCY CIRCUIT ARRANGEMENTS

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2 Claims. (Cl. 333—6)

This invention relates to high frequency circuit arrangements and has for its object to provide improved arrangements for feeding high frequency currents to points which are required to be at the same radio frequency potential both as regards amplitude and phase but which are, for unavoidable design or other reasons, spaced apart.

Although not limited thereto, the invention is particularly applicable to, and primarily intended for, high frequency amplifiers and oscillators and especially amplifiers and oscillators for high power radio transmitters where it is desired to operate valves in parallel. In such cases it is very important that the corresponding electrodes of the parallel valves shall be at the same radio frequency potential both as to amplitude and phase. Especially is this important as respects the anodes. With low frequencies it is not difficult to satisfy these requirements but at high frequencies, and where the valves are physically large, considerable practical difficulties are experienced by reason of voltage drop in the connecting leads. The present invention seeks to solve these difficulties.

The invention is illustrated in and further explained in connection with the diagrammatic drawings accompanying the provisional specification. In these drawings Fig. 1 represents a typical known arrangement and Figs. 2 and 3 represent arrangements in accordance with this invention.

Referring to Fig. 1, which is provided in order to explain the nature of the problem which the invention seeks to solve V1, V2, V3 and V4 represent the anodes of pairs of valves, the pairs (V1, V2 on the one hand and V3, V4 on the other) being in push-pull and the valves of each pair (V1 and V2 or V3 and V4) being in parallel. L represents an inductance connected at one side of the valve assembly and K a tuning condenser arrangement on the other, connection being made to the anodes by leads (in practice connection bars or strips) which pass through the points A, B, C, D. In this arrangement the size of the valve anodes is such that the distance between their centers is appreciable and there is accordingly an appreciable voltage drop between the points A and B and between C and D. The main high frequency current flows into the assembly from the inductance L and, owing to the inductive voltage drop in AB and CD, the voltage swing of the anodes of the valves V1 and V3 is higher than that of the anodes of valves V2 and V4 with the result that there is unequal loading of the valves.

According to this invention, in a high frequency circuit arrangement in which high frequency current is fed to spaced elements which are required to be at the same potential both as respects amplitude and phase, connection is made to said elements by means including a re-entrant conductor the re-entrant portion of which is in mutual inductance relationship with the outgoing portion, and the said elements are connected to different points in the length of said re-entrant portion. In this way the effect of voltage drop in the outgoing portion of the conductor is substantially compensated by reason of mutual inductance between the outgoing and the re-entrant portions.

If desired, the re-entrant portion may be made longer than is necessary for compensation and a bridge connection, which may be adjustable in position, provided between the outgoing portion and the re-entrant portion so as to enable the best degree of compensation to be obtained in situ by trial and error.

Fig. 2 shows an arrangement like that of Fig. 1 but modified to be in accordance with this invention. Since like references are used for like parts throughout the figures, Fig. 2 will be found largely self-explanatory. As will be seen the straight conductors of Fig. 1 are replaced by re-entrant conductors connected to the valves as shown. The conductor parts VW or XY are in close proximity to the conductor parts AB and CD. The inner conductor parts i. e. VW and XY carry the main circulating current I_1 while the outer parts AB, CD carry a current I_2 which is less than I_1. By adjustment of the spacing between the outgoing and the re-entrant portions, the radio frequency voltage difference between V1 and V2 or V3 and V4 can be made negligible. If L' is the inductance of the part AB or CD and M is the mutual inductance between AB and VW or between DC and XY the voltage difference between V1 and V2 or between V3 and V4 will be

$$L'wI_2 - MwI_1$$

where w is the operating frequency in angular measure.

Fig. 3 differs from Fig. 2 only in that the re-entrant portions AB and DC are longer than is necessary for compensation, correct compensation being obtained by adjusting the position of adjustable bridge connectors P as illustrated.

The invention is, of course, not limited to its application to the connection of valve anodes but may be used for connecting other corresponding electrodes such as grids or cathodes—or, in general, any points—which are required to be maintained at the same radio frequency potential.

I claim:

1. A high frequency circuit arrangement for connecting a pair of similar electron discharge tubes each including an anode comprising high frequency connection means for feeding high frequency waves to said anodes, one in each of said tubes, said high frequency connection means including a conductor having a bent-back portion at one end to which the anodes of said discharge tubes are connected at different and spaced points, input means connected to the end of said conductor remote from said one end, the bent-back portion of said conductor having mutual inductive coupling with the remaining portion of the conductor and being so spaced from the remaining portion of the conductor that the inductive coupling is sufficient to compensate for the difference in the voltage drop along the conductor to the respective anodes.

2. A high frequency circuit arrangement as set forth in claim 1 wherein said bent-back portion has a length substantially exceeding a length sufficient to compensate for the difference in the voltage drop along the conductor to the respective anodes and a conductive bridge connection extending between the bent-back portion and the remaining portion of said conductor for obtaining correct compensation.

References Cited in the file of this patent

UNITED STATES PATENTS

1,778,395	Lindenblad	Oct. 14, 1930
2,147,809	Alford	Feb. 21, 1939
2,158,822	Hill	May 16, 1939
2,497,854	Baller	Feb. 21, 1950

FOREIGN PATENTS

218,570	Great Britain	July 10, 1924
560,129	Germany	Sept. 28, 1932
902,884	France	Jan. 3, 1945