

June 21, 1932.

W. KUMMERER

1,863,798

CIRCUIT ARRANGEMENT FOR TRANSMITTER TUBES

Filed Jan. 25, 1927

Fig. 1

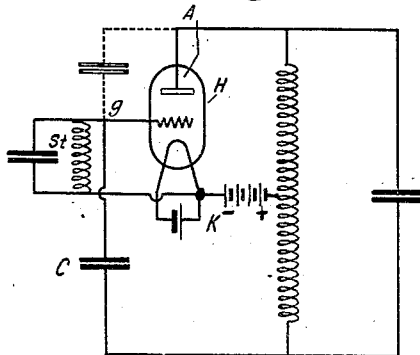


Fig. 2

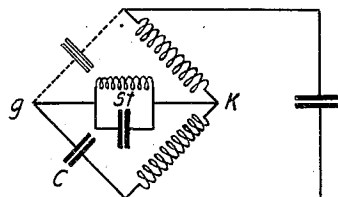


Fig. 3

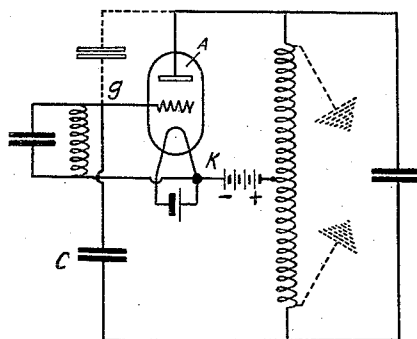


Fig. 4

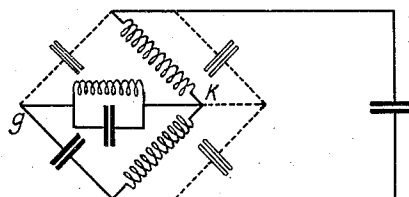


Fig. 5

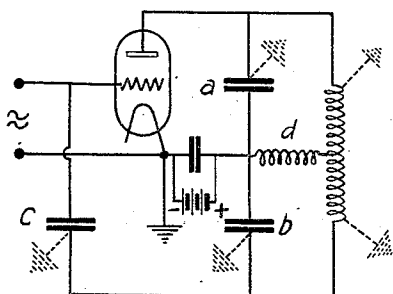
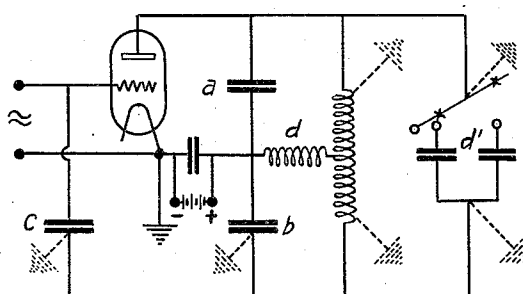


Fig. 6



INVENTOR
WILHELM KUMMERER
BY *Thos. J. Adams*
ATTORNEY

UNITED STATES PATENT OFFICE

WILHELM KUMMERER, OF BERLIN, GERMANY, ASSIGNOR TO GESELLSCHAFT FÜR
DRAHTLOSE TELEGRAPHIE M. B. H., OF BERLIN, GERMANY, A CORPORATION OF
GERMANY

CIRCUIT ARRANGEMENT FOR TRANSMITTER TUBES

Application filed January 25, 1927, Serial No. 163,360, and in Germany February 6, 1926.

The present invention relates to a circuit arrangement for tube type transmitters which is applicable both to tube equipment of the self-excited as well as the separately excited kind. One of the purposes of the present invention is to avoid the high frequency connection of the plate circuit coil with the filament of the thermionic tube.

Other purposes will be apparent upon a reading of the accompanying specification in connection with the drawing in which:

Figs. 1 and 2 represent the present state of the art in connection with long wave transmitters or receivers.

Figs. 3 and 4 represent diagrammatically certain objections occurring in radio circuits when short waves are used.

Fig. 5 shows one preferred embodiment of the invention for correcting the objectionable features above referred to, and,

Fig. 6 shows another preferred embodiment of the invention in which additional tuning elements are provided. A type of arrangement particularly suitable and of the kind heretofore used is illustrated in Fig. 1. This scheme involves a main transmitter tube H which is controlled from a controller tube whose oscillation circuit St (with rest omitted) is connected to the grid and filament of the separately excited tube. In this circuit arrangement, as can be seen, there is provided a separate condenser *c* which serves for balancing the plate-grid capacitance so that reaction by the controlled transmitter on the control transmitter is avoided. A schematic illustration of the idea is shown in Fig. 2 whence it will be seen in what way balancing is obtained. What is involved is a bridge equalizing scheme in which the capacity between plate and grid of the controlled tube is inserted in a bridge arm. This arm is indicated by broken lines. The oscillation circuit of the transmitter tube is inserted in one of the diagonals of the bridge. If the additional condenser *c* is not chosen of as large a value as is required for bridge balancing, reaction will occur between the plate circuit of the tube and the grid circuit, with the result that self oscillation may arise.

Hence, an arrangement of the type shown in

Fig. 1 in conjunction with the controlling transmitter, in the presence of balanced capacities, can be used as a pure separately controlled transmitter, although the arrangement could function also as a self-excited generator, when the condenser is properly proportioned. In this case, of course, the controlling transmitter is dispensed with.

All that is then necessary is to create a path for the grid direct current for the tube. The circuit arrangement here indicated is very useful for long waves. But when it comes to the production of short waves, there arises a drawback in so far as often disturbing stray capacities manifest themselves, especially those between the coils and ground. For instance, the ends of the coil of the plate circuit have capacity to ground as indicated by the condensers shown by broken lines in Fig. 3. The consequence is that for the high frequency the three points, i. e., cathode, the connection point of the coil in the plate circuit, and the grounding point of the coil capacities are connected with one another, for it will be remembered that the heated filament due to the connection of the battery, has a high capacity to ground, so that the K-point is nearly at ground potential. Hence, when indicated in a schematic manner conditions are approximately as shown in Fig. 4. For short wave work where coil capacities play an important part, the control transmitter is loaded by a circuit which comprises the two bridge arms, one of which contains the electrode capacity and the other one the branching of one of the coil parts and the parallel connected coil capacity. Now, these branches cause two effects in so far as (1) the state of balance of the bridge may be disturbed, and (2) the control transmitter is strongly loaded since the impedance for the working wave at the control transmitter becomes very low. The problem which the present invention set out to solve consists in the elimination of the above drawbacks.

The basic idea of the invention is to avoid the high frequency connection of the plate circuit coil with the filament of the thermionic tube. Instead the cathode point for high frequency is connected with the capacitive

branch of the oscillation circuit which is suitably formed of two series connected condensers. In other words, a high frequency connection is established between the cathode point and a point between the two condensers of the capacity branch. However, at the same time a direct current connection must be provided between the cathode point and the coil of the plate circuit in order to create a path for the plate direct current. But this connection should be opaque to high frequency. Hence, connection between the filament and the coil of the plate circuit must be effected through an impedance that is high for high frequency, that is, suitably a choke coil. A circuit arrangement along these lines is shown in Fig. 5. As will be noted, the plate oscillation circuit consists of the coil and the series combination of the two condensers *a* and *b*. The cathode point is connected for high frequency by way of the blocking condenser arranged in parallel to the plate battery with a point between the condensers, while for the direct current there is a path between the cathode point and the coil of the oscillation circuit by way of the battery and a choker *d*. The ground capacities are indicated for the sake of convenience, and it will be noted that they are now situated in parallel with reference to the condensers *a* and *b* in such a way that incidentally no additional paths for high frequency liable to disturb the working conditions are created. Fig. 6 shows another circuit arrangement in which a capacity *d'* is added across the total coil. In the practical construction it is the best plan to choose a row of condensers which are adapted to be inserted in steps or stages in order that in this manner the tuning may be varied without alteration of the balancing elements. Another scheme would be to add another coil in parallel to the oscillation circuit in order that thereby a further chance for variation may be obtained.

Having described my invention, I claim:

1. In a thermionic tube circuit of the kind described means for avoiding high frequency connection of the output circuit coil with the filament of the thermionic tube, comprising an output circuit coil and a pair of serially connected condensers in shunt therewith, a high frequency path and a direct current path between the common point of said condensers and the filament system and a direct current path between said common point and a substantially centrally located point on said output circuit coil.

2. In a thermionic tube circuit of the kind described, an output circuit coil having one end connected to the anode of the tube, a pair of serially connected condensers in shunt with the coil, a balancing condenser connected between the grid and the other terminal of the output circuit coil, a source of direct current potential connected between the filament and

the connecting point between the serially connected condensers and a choke coil connected between said point and a point between the ends of said output circuit coil.

3. In a thermionic tube circuit of the kind described means for avoiding high frequency connection of the plate circuit coil with the filament of the thermionic tube, comprising a pair of condensers in shunt with said coil, a high frequency path between the filament system and a point between said two condensers, and a choke coil connected between said point and a point intermediate the terminals of said plate circuit coil.

4. A vacuum tube circuit, comprising an output circuit and an input circuit, said output circuit comprising a capacitive branch and an inductive branch in parallel said capacitive branch having a pair of condensers in series and said inductive branch comprising an inductance, a choke coil connecting the mid point of said inductance to a point between said condensers and a high frequency path between the filament of said tube and said last named point.

5. An electric circuit arrangement comprising the plate electrode and grid electrode circuits of an electron emission tube, a coil connected between one of said electrodes and the cathode of said tube and a capacity connected in parallel therewith, an auxiliary coil and a capacity connected in series between said mentioned electrode and the grid, a capacity in parallel with said auxiliary coil and in series with said first mentioned capacity, and an inductive impedance connected between each of said capacity elements and said coil and auxiliary coil.

6. An electric circuit arrangement comprising the plate and grid circuits of an electron tube a coil connected between one of said electrodes and the filament of said tube, an auxiliary coil and a capacity connected in series with said first mentioned coil and the grid, means comprising a condenser and a choke coil in series for connecting the filament system of said electron tube to a point between said two first mentioned coils and a high frequency path, comprising a pair of condensers in series, arranged in parallel with said first two mentioned coils and so that a point between said last two mentioned condensers contacts with a point between said mentioned condenser and choke coil.

7. An electric circuit arrangement comprising the plate electrode and grid electrode circuits of an electron emission tube, a coil connected between one of said electrodes and the cathode system of said tube, and a capacity arranged in parallel therewith, an auxiliary coil connected to said first mentioned coil, a capacity in series therewith and connected to the grid of said tube, a capacity in parallel with said auxiliary coil and in series with said first mentioned capacity and a plu-

rality of individually effective capacity elements in shunt with said first two mentioned coils.

8. An electric circuit arrangement for
5 stabilizing electron tube operation and neutralizing capacity coupling between the grid and plate circuits thereof, comprising a coil and a neutralizing capacity connected in series between the plate and the grid of said
10 tube, a circuit comprising, a condenser and a choke coil in series, connecting the filament system of said triode and dividing said coil into two approximately equal parts and a pair of condensers arranged in parallel with
15 said first mentioned coil, a point between said condensers forming a connection with a point between said second mentioned condenser and said choke coil and plate potential means in shunt with said second mentioned condenser.

9. An electric circuit arrangement for
20 neutralizing disturbances in electron tube circuits due to stray capacities therein and neutralizing capacity coupling between the grid and plate circuits thereof, comprising a plate circuit coil, a
25 choke coil, and a condenser all arranged in series between the plate and filament of said tube, a condenser having one terminal connected between said choke coil and first mentioned condenser and the other
30 terminal connected to one end of said first mentioned coil, an auxiliary coil and a neutralizing condenser connected in series with said first mentioned coil and the grid of said
35 tube, and a capacity connecting the point between said choke coil and condensers to one end of said auxiliary coil.

10. An electric circuit arrangement for
40 neutralizing disturbances in electron tube circuits due to stray capacities therein and neutralizing capacity coupling between the grid and the plate circuit thereof comprising a plate circuit coil, a choke coil and a condenser all arranged in series between a cold
45 electrode and the hot electrode of said tube, a source of potential connected in shunt with said capacity element for providing with said coils a direct current path between said hot and cold electrodes, a condenser connecting
50 a point between said choke coil and said first-mentioned condenser to one end of said first-mentioned coil, an auxiliary coil and a neutralizing condenser connected in series with said first-mentioned coil, and a second cold
55 electrode of said tube and a capacity connecting said point between said choke coil and condensers to one end of said auxiliary coil.

WILHELM KUMMERER.