

Feb. 23, 1937.

R. M. HEINTZ

2,071,630

MULTIPLE ELECTRODE THERMIONIC TUBE

Filed July 18, 1932

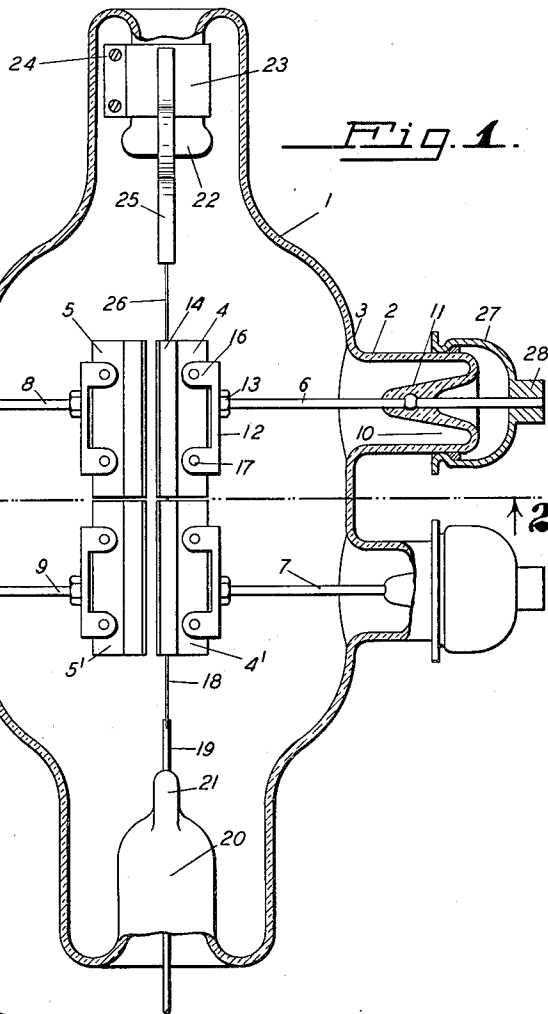


Fig. 1.

Fig. 3.

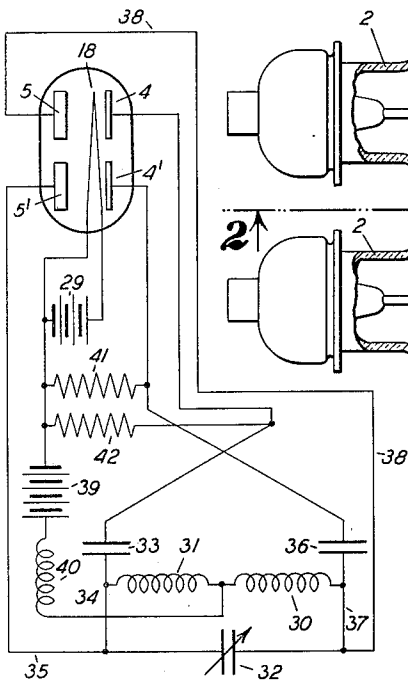
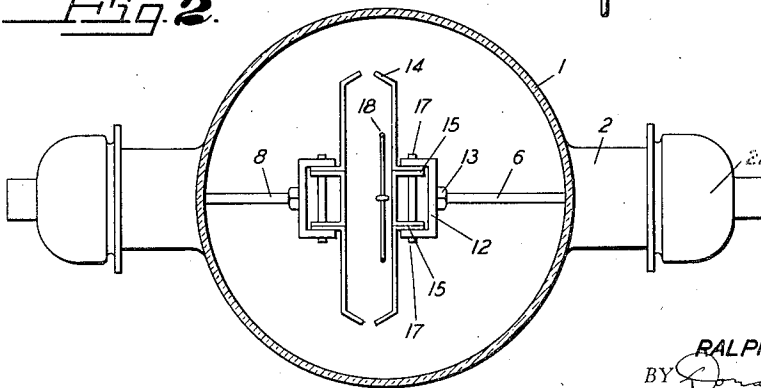


Fig. 2.



INVENTOR,
RALPH M. HEINTZ.
BY *Donald H. Lippincott*
ATTORNEY.

UNITED STATES PATENT OFFICE

2,071,630

MULTIPLE ELECTRODE THERMIONIC TUBE

Ralph M. Heintz, Palo Alto, Calif., assignor to
Heintz & Kaufman, Ltd., San Francisco, Calif.,
a corporation of Nevada

Application July 18, 1932, Serial No. 623,139

1 Claim. (Cl. 250—27.5)

My invention relates to a thermionic tube having a plurality of anodes and a plurality of control electrodes, and more particularly to a tube interposed between the anodes and the cathodes, the tube being used as a generator of electric oscillations at high frequency for the transmission of radio telegraph and telephone signals.

The objects of my invention are: To provide a thermionic tube of simple manufacture having multiple anodes and control electrodes; to provide a thermionic tube which combines the functions of two tubes when used in a balanced oscillator circuit; to provide a thermionic tube combining the functions of several tubes for use in aircraft and other locations where space is limited; and to provide a single thermionic tube which is simple to manufacture, and which may be substituted for a plurality of tubes in special circuits.

Other objects of my invention will be apparent or will be specifically pointed out in the description forming a part of this specification, but I do not limit myself to the embodiment of my invention herein described, as various forms may be adopted within the scope of the claim.

Referring to the drawing:

Figure 1 is a view showing a longitudinal section of the device.

Figure 2 is a cross sectional view taken in the plane indicated by the line 2—2 of Figure 1.

Figure 3 is a simplified diagram of a balanced oscillator circuit employing the tube of my invention.

In balanced oscillator circuits or others having like requirements, two tubes are customarily employed, each tube having similar characteristics. Such circuits are efficient, and except for the amount of space and weight taken by the tubes and their connections, would be desirable for use in aircraft or for other locations where space and weight are at a premium.

Broadly speaking my invention comprises two or more pairs of opposing electrodes, having a single cathode located between the members of each pair. One electrode of each pair is placed close to the cathode and is used as a control electrode, having the opposing electrode cooperating as an anode. All of the anodes are coplanar as are all of the control electrodes. The electrodes are all substantially alike in size and shape, and when two pair are connected to a balanced oscillator or like circuit, in conjunction with the common filament, the equivalent effect of two separate tubes each having like characteristics is obtained.

Referring to the drawing, the preferred em-

bodiment there delineated comprises a refractory envelope 1 of borosilicate or glass of like characteristics which is provided with four side stems 2 fused to the side walls at the seal 3.

The stems carry four electrodes, the control electrodes 4 and 4' on one side, and the anodes 5 and 5' directly opposite. As the mounting, size and shape of all the electrodes are identical, with the exception that the control electrode support rods 6 and 7 are longer than the anode support rods 8 and 9, the description of one such electrode and its mounting will suffice.

The stem 2 is provided with a reentrant portion 10 which positions the support rod 6 by means of the electrode seal 11. The inner end of the support rod is threaded into a yoke 12 and held in place by a lock nut 13. The electrodes 4, 4', 5 or 5', all identically formed from a refractory plate material such as tantalum or tungsten are provided with edge flanges 14, and center stiffening ribs of folded metal 15, which are longitudinally placed on the major plane surface of the electrode. Arms 16 slide over the ribs 15, and pins 17 passing through the arms and the ribs, lock the electrode securely to the yoke.

A filamentary cathode 18 passes through the axial plane of the tube, supported at one end by the cathode leads 19 which are sealed through the stem 20 at the pinch 21. While the cathode may be of V or M shape according to the output desired, a single V filament is here shown. The opposite end of the device is provided with a dummy stem 22 which carries a sleeve 23 frictionally held in place by the lock screws 24. This sleeve has a filament support frame 25 welded to it, and hook 26 supports the apex of the filament and keeps it under tension by springs within the filament support frame (not shown).

The electrodes on each side are mounted in coplanar relationship with their opposing edges closely adjacent. The electrodes in each pair are directly opposite each other and, due to the extra length of the supports 6 and 7, one member of each pair is close to the central, common filament. The closer electrodes are used as control electrodes, the more distant electrodes as anodes.

After all assembly adjustments have been made, the tube is exhausted in the usual manner and sealed off the pumps. Connection caps 27 are then placed over the stems 2, cemented in place and electrically connected to the supports by weld 28. The tube is then ready for use.

Figure 3 represents diagrammatically and re-

duced to its simplest terms, a balanced oscillator circuit in which the tube of my invention may be employed.

The oscillator comprises the tube as above described, having the common cathode 17 heated by current from a battery or other suitable source 29. The anode 5 of the tube is connected to the anode 5' through an oscillating circuit comprising similar inductance coils 30 and 31 in series, the coils being shunted by a variable condenser 32, by means of which the circuit is tuned. The two coils are preferably arranged for zero mutual inductance, either shielded from one another, or positioned so that their fields are at right angles.

The control electrode 4 of one of the pairs comprising an opposed anode and control electrode is connected through a blocking condenser 33 and leads 34 and 35 with the anode 5' of the other pair. The control electrode 4' of the last mentioned pair is, in like manner, connected with the anode 5 of the first mentioned pair through a blocking condenser 36 and leads 37 and 38.

Plate current is supplied to both anodes from a suitable source 39 through a choke coil 40. This choke coil has as high an impedance as is practical, preferably in excess of that of the tuned circuit 30, 31 and 32, so that its point of attachment to the oscillating circuit does not materially change the potentials thereon. Therefore, although this coil is shown connected at the junction of the two inductors 30 and 31, the circuit will operate equally well if the connection be made at the plate of either tube.

Both control electrodes are provided with grid

leaks 41 and 42 having resistance suitable to the characteristics of the tube.

Power may be withdrawn from the oscillating circuit by any desired coupling means, and supplied to an antenna, amplifier or other load.

The single tube as described operates exactly as would two separate tubes, in the same circuit, but due to the natural advantage of having all elements in one tube, and the uniformity of space current obtained by using a common cathode, balancing is automatic and smooth, steady oscillations occur at a wavelength determined by the constants of the connected oscillatory circuit.

A large saving in space is accomplished, weight is reduced, and the expense of manufacture is less than when two separate tubes are involved. It will also be obvious that the tube as described will be suitable in other circuits where two tubes are in balanced relation, and the need for exact similarity of characteristics important.

I claim:

A thermionic tube comprising an envelope enclosing a filamentary cathode and a plurality of separate coplanar plate electrodes on each side of said cathode, portions of each plate on one side being disposed in parallel relationship with portions of each plate on the other side, each of the electrodes on one side having one edge thereof lying in close proximity with one edge of another of the electrodes on the same side, and each of said electrodes on one side having not less than two edges lying in close proximity with the edges of one plate on the other side.

RALPH M. HEINTZ.