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G. LEWIS

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VACUUM TUBE

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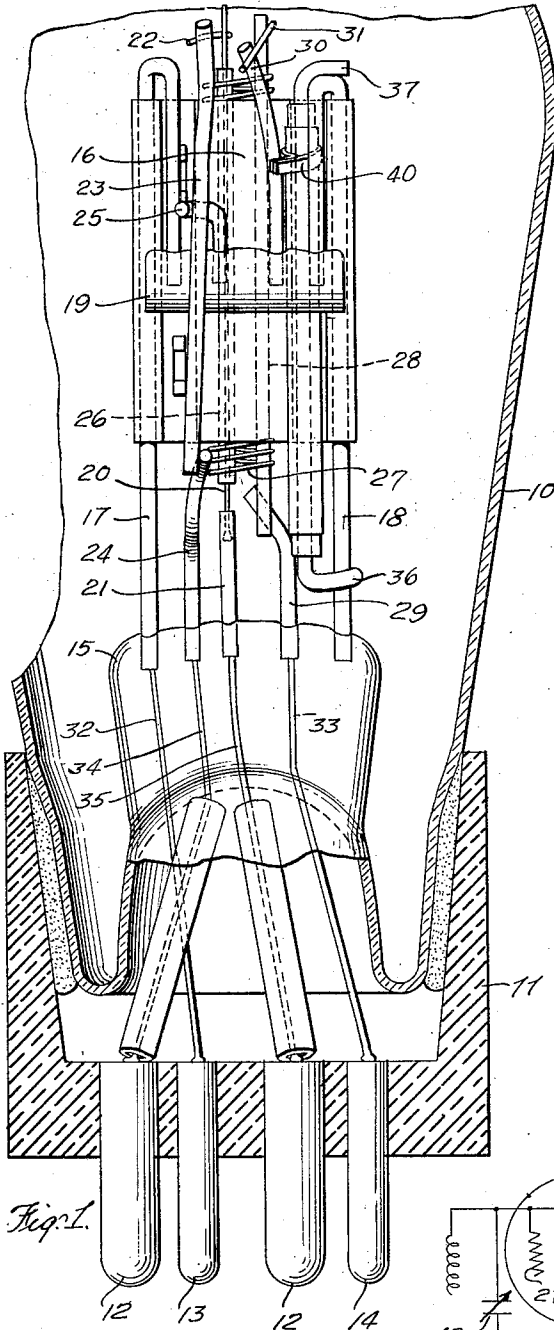


Fig. 1.

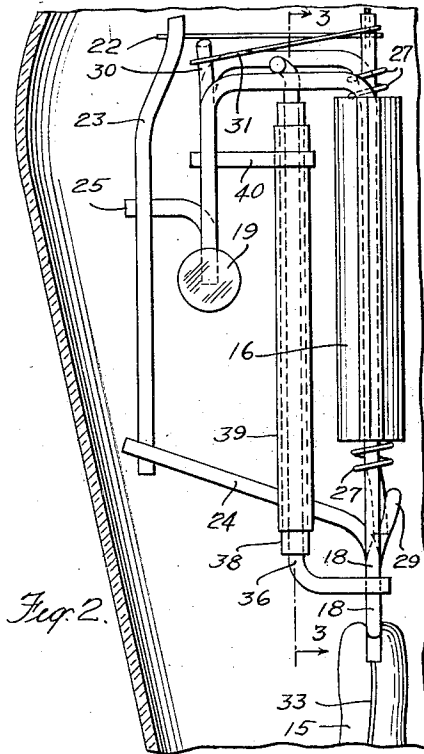


Fig. 2.

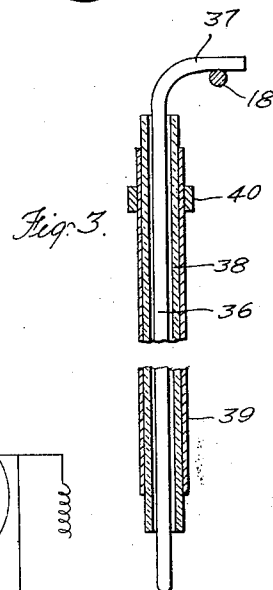


Fig. 3.

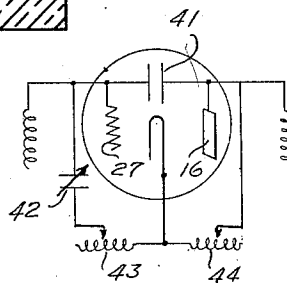


Fig. 4.

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VACUUM TUBE

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This invention relates to thermionic tubes and particularly to a means for maintaining the capacity at a predetermined constant figure between the respective grid and plate of different thermionic tubes manufactured under conditions of mass production.

In certain circuits, such as a neutrodyne, it is essential that the circuit be delicately balanced with respect to the inter-element capacity. This balance is generally made in a radio set at the factory, and if new tubes are placed in the set having a different inter-element capacity from the tubes used when the balance was made, the set is thrown out of adjustment, with the result that the efficiency thereof is impaired. It has been found in practice very difficult to reduce the inter-element capacity to a minimum and maintain it at that figure when producing tubes in large numbers. In other words, the capacity between the grid and plate of one tube may differ from the capacity between the grid and plate of a second tube, although the manufacture of these tubes is substantially the same. This difference is due to a large extent to the capacity between the leads from the elements as they pass through the press of the tube.

It is one of the objects of the present invention, therefore, to provide a tube in which the capacity between the grid and plate of any two tubes will be substantially constant.

Other objects of the invention will be apparent as the description thereof proceeds.

One embodiment of the invention has been shown in the accompanying drawings, in which

Fig. 1 is a sectional side rear view of a vacuum tube.

Fig. 2 is a sectional side view of a portion of a tube showing the elements thereof;

Fig. 3 is an enlarged sectional view of the particular feature of the invention; and

Fig. 4 is a circuit diagram illustrating the effect thereof.

Referring more specifically to the drawings, the invention is shown in connection with a vacuum tube having a glass envelope 10, the usual base 11 carrying the filament contacts 12 and plate and grid contacts 13 and

14 respectively. A press 15 is provided upon which the elements of the tube are mounted.

As shown in the drawings for purposes of illustration, the elements consist of a cylindrical plate 16 which is supported on two vertical supports 17 and 18 which are sealed in the press 15 and which extend upwardly through flanges attached to the plate 16 to which the supports are welded. Above the plate 16 the supports 17 and 18 are bent backwardly and downwardly, terminating in a glass bead 19 which aids in the positioning of the upper ends of the elements. A filament 20 is supported at its lower end by the rod 21 which is sealed in the press 15 and at its upper end by a spring 22 which resiliently holds the filament under tension to provide for variations in length caused by changes in temperature. The other end of the spring 22 is welded to a vertical support 23 spaced in back of the glass bead 19. The lower end of the support 23 is welded to another support rod 24 which passes forwardly and downwardly over the press 15 into which it is sealed. An angular support rod 25 is also welded to the upright 23 and is sealed in the glass bead 19, thereby rigidly positioning the upright with respect to the bead. A cathode 26 is positioned around the filament 20, there being insulating material between the cathode and the filament, whereby the cathode is supported upon the filament, and means (not shown) is provided to form an electrical connection between the cathode and filament to give the cathode a potential preferably corresponding to the average potential of the filament. Surrounding the filament and cathode but inside of the plate cylinder is provided a grid 27 formed of a coil of wire, the separate turns of which are welded to a support rod 28 which is welded at its upper end by means of a connecting member 31 to an upright 30 sealed in the bead 19, and at its lower end is rigidly secured to a short support rod 29 sealed in the press 15.

Plate support 17 is connected by means of a wire 32 to the plate terminal 13 at the base of the tube, and grid support 29 is connected by means of a wire 33 to the grid terminal 14 at the base of the tube, while wires

34 and 35 connect filament supports 24 and 21 respectively with the two filament terminals 12.

As stated above, the capacity between the grid and the plate is caused, to a large extent, by the lead wires passing through the press of the tube. In order to reduce to a minimum the capacity between these lead wires, wires 32 and 33 connecting the plate and grid respectively are removed as far as possible from each other and the elements of the tube are also spaced so as to give a minimum capacity.

As thus described the tube may represent any ordinary three element vacuum tube, and it has been found in one instance in such a tube that the capacity between the plate and grid is equal to substantially five micromicrofarads. With different tubes this figure varies and gives rise to the objections which the present invention is intended to overcome. To accomplish this purpose, an additional rod 36 is welded to the plate support rod 18 and is bent upwardly, passing parallel to the plate but spaced from it, the upper end of the rod being hooked over, as at 37, so that it may be welded to the upper end of the support rod 18, as indicated in Figs. 1, 2 and 3. Threaded upon this rod 36 is a glass tube 38 which is somewhat longer than the plate of the tube and extends to the bends in the rod 36 at the upper and lower ends thereof. A sleeve 39 of metal, preferably nickel, is slipped over the glass tube 38 and is connected by means of a strip 40 to the upright connector 30 which is supported in the glass bead and connected to the grid 27. The strip 40 is welded to both the upright 30 and the sleeve, and forms a means to hold the sleeve in rigid position with respect to the other elements of the tube.

There will then be a capacity between the rod 36 and the sleeve 39 separated by the glass dielectric 38, and this capacity may be absolutely fixed by predetermining the length of the metallic sleeve 39 and the thickness of the dielectric between it and the rod 36. I prefer to make this capacity equal to about five micromicrofarads, although other capacities may be used if desired. If the capacity between the other associated portions of the grid and plate is equal to five micromicrofarads, this makes the total capacity between the grid and plate ten micromicrofarads. Any variation now in the capacity between the leads will create a very much smaller percentage variation in the total capacity between the plate and the grid than would be the case if the fixed condenser were not used. The tube may therefore be used in radio sets which require nice balancing, with the result that other tubes also embodying the invention may be interchanged in the set without causing the set to get out

of adjustment, as the inter-element capacity variation will be only a slight percentage of the total.

Fig. 4 shows diagrammatically a balanced bridge circuit employed in certain receiving sets, wherein the inter-element capacity is indicated at 41 and the adjustable capacity on the other leg of the bridge is indicated at 42. Balanced resistances 43 and 44 complete the bridge circuit.

It will be evident from the above that I have provided a means to very much decrease the inter-element capacity variation in vacuum tubes by the addition of a known fixed capacity between the grid and plate elements. While I have shown the invention in connection with a certain specific type of vacuum tube, it will be evident that it is applicable to any type, and I do not, therefore, desire to limit my invention to the specific disclosure except as defined in the appended claims.

Having thus described my invention, what I desire to secure by Letters Patent and claim is:

1. A vacuum tube comprising a plate element and a grid element, a grid condenser comprising a rod electrically connected to and solely supported by one of said elements, a dielectric sleeve surrounding said rod and a metal sleeve surrounding said dielectric sleeve and electrically connected to and solely supported by the other of said elements.

2. A vacuum tube comprising a plate and a grid, supports for said plate and grid, a rod connected to one of said plate supports, a glass tube upon said rod, a metallic sleeve upon said glass tube, and means connecting said sleeve with said grid support.

In testimony whereof, I affix my signature.

GEORGE LEWIS.