

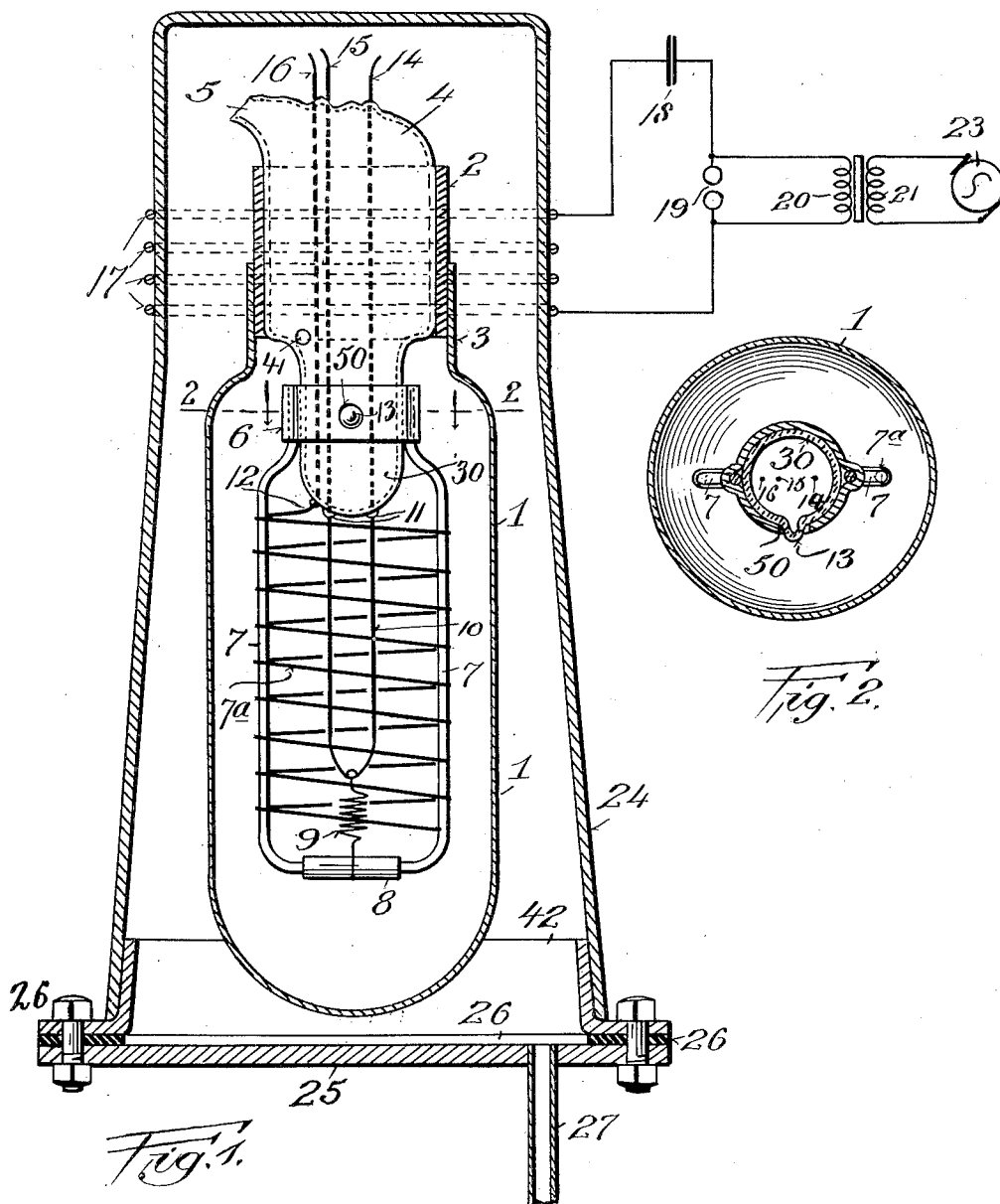
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METALLIC OSCILLION AND METHOD OF CONSTRUCTING SAME

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## UNITED STATES PATENT OFFICE.

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METALLIC OSCILLION AND METHOD OF CONSTRUCTING SAME.

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This invention relates to an oscillion for the generation of high frequency current and to the method of constructing the same.

The object of the invention is to provide an oscillion tube which is simple in construction, economical of manufacture, and efficient in operation, and wherein exceedingly high power can be generated.

A further object of the invention is to provide a novel method for the construction of a tube of this character.

Further objects of the invention will appear more fully hereinafter.

The invention consists substantially in the construction, combination, location, and relative arrangement of parts, and the method employed in the fabrication of the completed structure, all as will be more fully hereinafter set forth, as shown by the accompanying drawing, and finally pointed out in the appended claims.

Referring to the drawing,—

Fig. 1 is a view in vertical section of an oscillion constructed in accordance with my invention.

Fig. 2 is a sectional view taken on the line 2, 2, Fig. 1, and looking in the direction of the arrows.

The same part is designated by the same reference numeral wherever it occurs throughout the several views.

Reference numeral 1 designates a metallic bottle, that is, a bottle or similar receptacle of steel or nickel, or the like, either spun or stamped into shape, preferably, cylindrical in cross section, and provided with the narrow neck 3. 2 designates a cylinder of highly refractory metal, preferably tungsten, which is welded into the neck of the metal bottle 1. Reference numeral 4 designates a glass stem sealed to the tungsten, and is formed of a glass which has essentially the same coefficient of expansion as tungsten. The lower end of the glass tube 4 projects down through the neck of the metal bottle and terminates in a seal 30, through which the three lead-in wires 11 and 12 (which are similarly preferably of tungsten) are sealed. A thin band of suitable refractory metal, preferably of molybdenum 6, is strapped around the glass stem 4 in the portion thereof that protrudes into the metal bottle 1. This band contains a hole 50 therein through which protrudes a wart 13 formed on the inner seal of the stem 4 which prevents the band from falling or turning

when once positioned. To the band 6 are attached grid supporting members 7 which at their lower ends carry a tube of quartz, glass, or other heat resisting and insulating material 8, to which is attached a fine spiral spring 9 or other suitable anchorage for the loop portion of the hair-pin filament 10. To these supports 7 are welded the grid wires 7<sup>a</sup>, preferably in the form of a helix surrounding the filament as shown. The two leads 11 to the filament 10, and the lead 12 to the grid 7<sup>a</sup>, are led through the lower glass seal of the glass stem 4, and up through other seals at the upper end of the closed glass tube 4, preferably emerging as leads 14, 15 and 16. The glass tube is closed at its upper end and terminates in a tubulation 5 for sealing onto an air-pump for final exhaustion of the oscillion in the manner customary with exhausted glass vessels. An orifice 41 in the lower wall of the glass stem gives access to the interior of the bottle for exhausting the air from the same.

In the construction and assembling of the metal oscillion I proceed as follows: The tungsten cylinder 2 is inserted into the neck 3 of the metal bottle 1. I then insert between these two a thin ring of metal having a lower fusing point than either of the metals of the bottle 1 and the cylinder 2, such for example, as nickel or copper, to act as a flux therebetween. The assemblage is now put into a vacuum furnace for welding, as it is essential to weld the tungsten to the neck 3 of the bottle 1 in an atmosphere free of oxygen. Hydrogen, nitrogen, etc., gas, may be used, but in practice I prefer a vacuum, or as near a vacuum as is possible. Such a furnace is shown as a closed tube 24 made preferably of quartz, terminating in a metal flange 42, to which it is very tightly cemented, as for example, by means of a mixture of glycerine and litharge, or other suitable cement. To this metal flange 42 is bolted the end of a plate or cap 25 made air-tight by a suitable gasket 26 of lead or other suitable substance. An exhaust air-pump is connected to the chamber thus formed in any suitable manner, for example, through a pipe 27. Now, when the chamber has been exhausted of air, high frequency electric currents are passed through coil 17 surrounding the neck portion of the bottle therein to the end that high frequency currents of great intensity are induced in the metal and tungsten cyl-

inders within the furnace 24, causing the fluxing metal to melt and forming a perfect unoxidizable weld between the tungsten cylinder and the metal bottle. To supply high frequency current to the coil 17, the coil is connected in series with a condenser 18, and a spark or other form of discharge gap 19 and supplied with electric energy from any suitable source, for example, from the secondary coil 20 of a step up transformer, the primary coil 21 of which is fed from a suitable source of current, for example, an alternator 23. I find that from two to three kilowatts supplied by such generator will produce ample high frequency current in the cylindrical neck of the bottle to produce a perfect welding between the metals thereof.

After cooling air is admitted into the furnace 24, the metal bottle is removed therefrom, and the glass stem or tube carrying at its lower end the grid or filament structure, which prior thereto had been assembled, is then inserted through the neck of the bottle.

The tungsten tube is then put in a glass blower's flame, and the glass tube sealed thereto. It is sometimes preferable before inserting the grid and filament structure carried by the glass tube to subject the inner surface of the tungsten cylinder to a flame until a proper oxide of tungsten is obtained to effect a union between the glass and the tungsten after the glass is inserted in place and the glass blower's flame applied thereto. The glass tube is then tubulated, sealed onto a high vacuum pump, the bottle exhausted with the filament lighted to thereby drive all gas out of the grid electrode by bombardment and the tubulation finally sealed off.

After the glass has been sealed to the tungsten neck, I usually prefer to heavily electroplate the exterior of the metal bottle

and the tungsten outer cylinder with copper, nickel, or both, to make it perfectly impervious and non-porous so that no air can enter into the thin metal walls.

If the bottle is of copper, then plating may not be necessary, but a sintered tungsten tube is liable to be somewhat porous, and it should carefully be plated as above described to prevent leakage.

Many modifications and changes in details will readily occur to those skilled in the art without departing from the spirit and scope of my invention as defined in the claims. But having now set forth the object and nature of my invention, and having shown and described a structure embodying the principles thereof, and the method therein involved, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent, is,—

1. The process of manufacturing thermionic tubes which comprises mounting a glass electrode support in a ring of tungsten and positioning the same in the neck of a metal vessel with a flux therebetween and subjecting said parts to induced current to effect an airtight joinder therebetween, the said joinder being effected in an atmosphere substantially free of oxygen.

2. The process of manufacturing thermionic tubes which comprises mounting an electrode support in a ring of metal fusible with glass, and positioning the same in the neck of a metal vessel with a flux therebetween and subjecting said parts to induced high frequency current to effect an airtight joinder therebetween, the said joinder being effected in an atmosphere substantially free of oxygen.

In testimony whereof I have hereunto set my hand on this 14 day of December, A. D. 1920.

H. S. COYER.