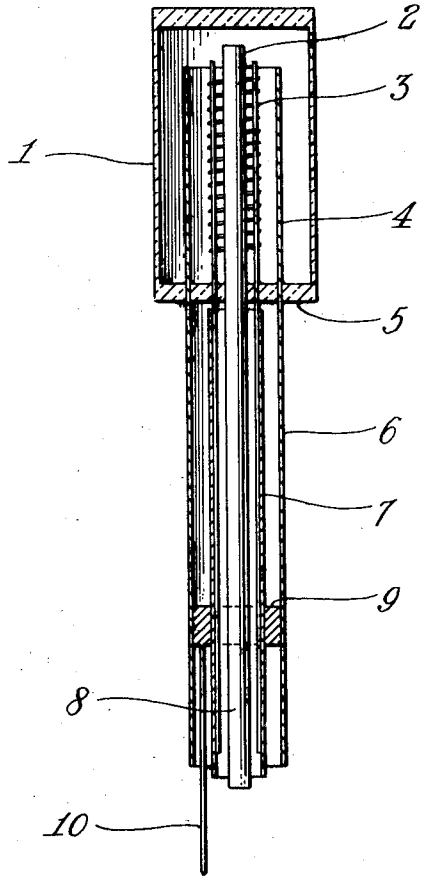
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ELECTRIC DISCHARGE TUBE AND SEAL THEREFOR

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ELECTRIC DISCHARGE TUBE AND SEAL THEREFOR

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The invention relates to a device comprising an electric discharge tube, more particularly for amplifying or generating electrical oscillations of very high frequency. The invention furthermore relates to a tube suitable for being utilized in such a device.

One of the most important problems which arise in the construction of tubes and devices which are to be utilized for high frequencies and short waves, is the problem of the short connections between electrodes and oscillatory circuit.

There are already known, for example, tubes and devices for short-wave purposes with which it has been endeavoured in different ways to make the connections referred to as short as possible in order to be able to utilize these apparatus for very short waves. Thus, for example, it has been proposed to form two electrodes of a discharge tube themselves within the tube as an oscillatory circuit; it is also known to connect or to couple the electrodes either directly or capacitatively with conductors present outside the tube, in which event these conductors form an oscillatory circuit and, when directly connected to the electrodes, may act at the same time as current supply conductors.

These known tubes and devices have several drawbacks; if the oscillatory circuit is formed by the electrodes themselves and is located exclusively within the tube, it is impossible directly to alter the length of the oscillatory circuit at will and thus to modify the wave-range. If the electrodes are connected to conductors located outside the tube, we encounter the drawback that seals are necessary and that it is not simple to utilize continuous conductors which consist of one piece.

It has been proposed to seal the cathode body of an indirectly heated cathode and the supporting members of the grid and the anode as such into a pinch bat. The latter construction required comparatively thin conductors. With the pinches and other members for sealing a discharge tube which were known up to a short time ago, it was impossible directly to seal-in conductors of such thickness that they could act at the same time as constituent parts of an oscillatory circuit.

In a prior patent application the applicant has proposed to seal current supply conductors for electric apparatus, for example for electric discharge tubes, into a body which has a vacuum-tight structure which consists, to the extent of at least 5%, of finely divided cavities and has a specific weight which is at least 5% lower than

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that of the glass present in this body in homogeneous and substantially air or gas free condition. As described in this prior specification, it is thus possible to seal to one another widely different combinations of glass and metal whilst, in addition, a simplification in the manufacture of discharge tubes may be obtained owing to the fact that the electrodes and the supply conductors can at first be brought into their final position and then may be sealed together, if desired, also simultaneously with the bulb.

Building further thereon the applicant has found it to be possible to work out a device and a discharge tube which are particularly suitable for short-wave purposes and with the aid of which the disadvantages set out hereinbefore may be avoided.

A device according to the invention comprises to that end a tube which is closed at at least one end by a member which exhibits a vacuum tight structure which consists, to the extent of at least 5%, of finely divided cavities filled with air or gas, and has a specific weight which is at least 5% lower than that of the glass present in this member in a homogeneous and substantially air or gas free condition and wherein one or more electrodes or parts thereof are sealed as such into the sealing member and are continued outside the tube and form there at the same time the constituent parts of an oscillatory circuit. With the expression "electrode parts" we must think in the first place of the supporting members of the grids or anodes.

With the use of the above-described device the electrodes and the constituent parts of the oscillatory circuit consist of the same material and, owing to the fact that conductors of any desired diameter may be sealed-in, they may also have the same shape throughout the whole length inside as well as outside the tube and also in the interior of the sealing member. It is thus possible to satisfy all the requirements which such tubes and devices have to comply with. In the first place the electrode system may be arranged in close proximity to the sealing member; furthermore the sealing member itself may be thin and finally the capacity of the constituent parts of the oscillatory circuit is the same throughout the whole length since the material and the shape may also be the same.

According to one embodiment of the invention, use is made of a triode wherein the grid rods and the anode are sealed as such into the sealing member and are continued to the exterior as constituent parts of the oscillatory cir-

cuit. In this case it is of importance that the possibility of sealing the whole circumference of the anode extended into the sealing member is attended with great advantages. If it is desired to have exactly the same capacity between the conductors inside and outside the tube, a grid wire may be wound on the grid rods protruding from the tube. Substantially the same result may be obtained by slipping a metal cylinder on these rods. In order to simplify the construction of the tube, more particularly the manufacture thereof, it is also possible to seal the cathode directly into the sealing member. In this case all the constituent parts of the tube and an oscillatory circuit may be made and mounted beforehand, whereupon in a mould suitable for this purpose the sealing-in and, if desired, the connection with the bulb are effected in a single operation.

According to another embodiment of the present invention, the tube and the device are constructed in such manner that they may be utilized in push-pull. To that end the tube comprises two grids and two anodes which are arranged on either side of the cathode. Furthermore the tube is closed at both ends by a member consisting of glass with cavities whilst at the one end the two grids and at the other end the two anodes are sealed-in and are continued as an oscillatory circuit.

According to a further form of construction, use is made of a discharge tube wherein the electrodes are present in reversed arrangement, that is to say that within the system there are one or more anodes which are surrounded by one or more grids which are surrounded in their turn by one or more cathodes. Owing to the fact that the constituent parts of the tube may be sealed-in in any desired thickness, the anode may be constituted by a comparatively thick rod or a hollow tube which can easily be cooled, is sealed, as are the supply conductors of the grid, directly into a sealing member and forms outside of the tube part of the oscillatory circuit. Owing to the fact that the cathode is on the outside, it is easy to obtain heavy currents whilst use can be made of comparatively low voltages, at least in comparison with tubes for generating high-frequency oscillations wherein the electrodes are mounted in the longitudinal direction of the tube as in the case of a cathode ray tube.

A tube in reversed arrangement as described hereinbefore may also be constructed as a multiple tube wherein a plurality of cathodes surround one or more grids and anodes. The arrangement with which a plurality of cathodes surround a grid and an anode may more particularly be utilized if use is made of high-frequency polyphase supply.

The invention will be explained more fully with reference to the accompanying drawing which represents diagrammatically a device and a tube according to the present application. In this drawing 1 denotes the wall of a discharge tube

inside of which are arranged a cathode 2, a grid 3 and an anode 4. At the lower end the tube is closed by a member 5 which consists of glass having small cavities as hereinbefore described and into which are sealed the electrodes or current supply conductors. The anode passes as such through the sealing member and forms at the exterior the part 6 of the oscillatory circuit. The other part 7 of the oscillatory circuit is formed by the directly continued rods of the grid, on to which, outside of the tube, a metal cylinder is slipped. Also the cathode is sealed-in as such and constitutes at the exterior a member 8. The tuning of the oscillatory circuit may be effected with the aid of a contact 9 which is constructed as a so-called tuning piston and may be displaced with the aid of a rod 10, thus regulating the length of the oscillatory circuit and consequently the wave-length.

It is preferable that the member which closes the tube is arranged in a potential node of the oscillatory circuit in order to keep the dielectric losses in this circuit at a low value.

What we claim is:

1. An electric discharge tube having an envelope, a first electrode sealed in a portion of said envelope and extending therethrough and a second electrode, said sealed envelope portion comprising glass having a large number of finely divided cavities, said sealed envelope portion having a density less than 95% of the specific density of the glass thereof.

2. An electric discharge tube having an envelope, a first electrode and a cylindrical anode member sealed in a portion of said envelope, and surrounding said first electrode, said sealed envelope portion comprising glass having a large number of finely divided cavities, said portion having a density less than 95% of the specific density of the glass thereof.

3. A device for generating electrical oscillations comprising an electric discharge tube having an envelope, a unitary anode member sealed in a portion of said envelope and extending therethrough, a grid within said envelope and having supporting members sealed in and extending through said portion, said anode member and said grid supporting members forming an oscillatory circuit, said sealed envelope portion comprising glass having finely divided cavities, said portion having a density less than about 95% of the specific density of the glass of said portion.

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