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SHIELDED MULTIPLE DISCHARGE TUBE

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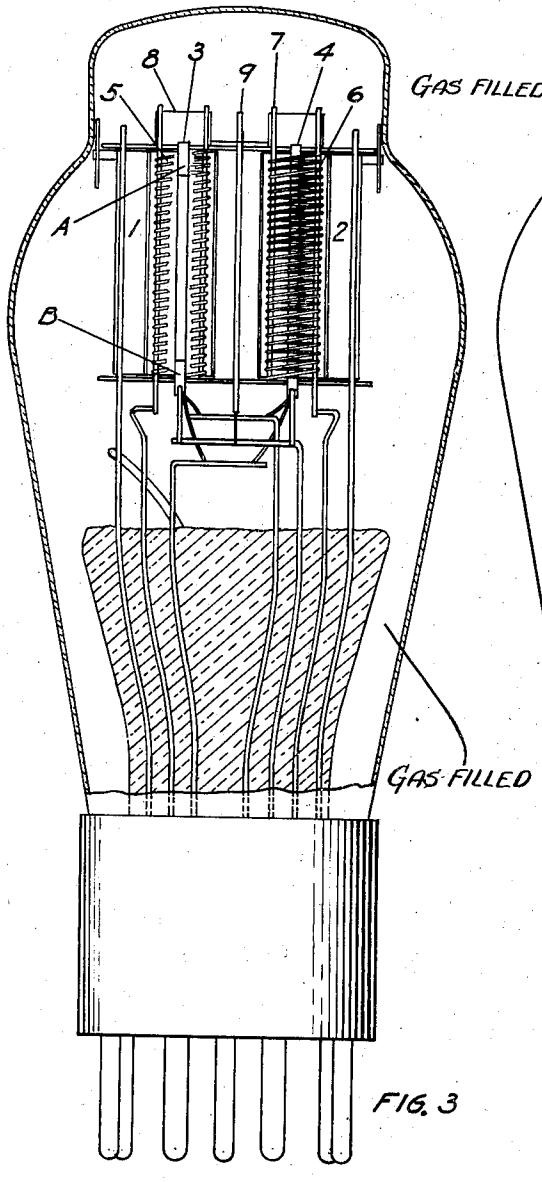


FIG. 3

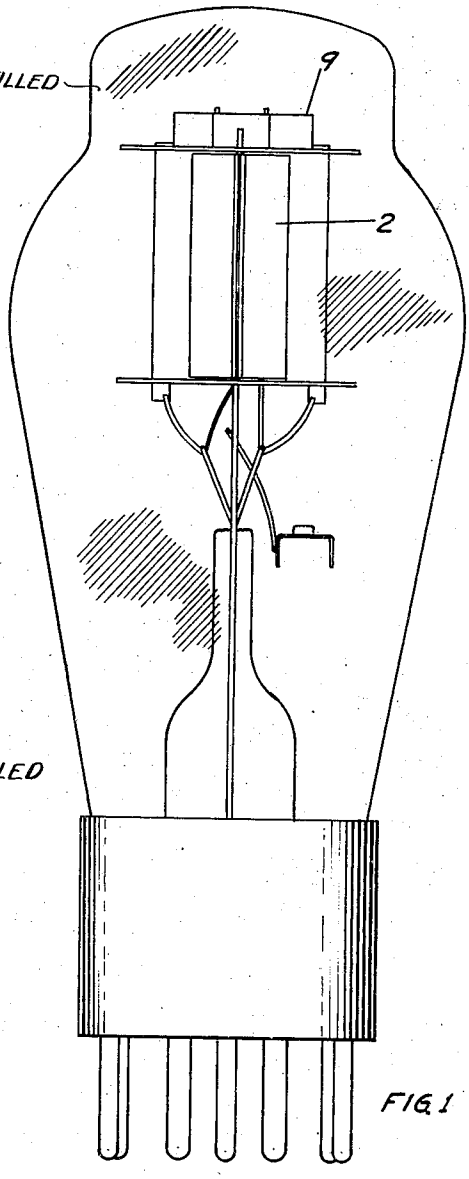


FIG. 1

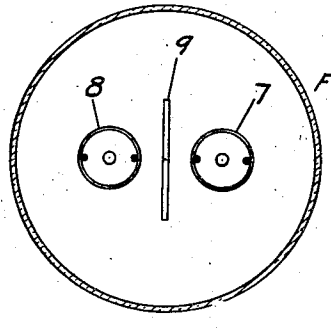


FIG 2

INVENTOR
JOHN F. JORDAN
BY Herschel E. Power
ATTORNEY

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SHIELDED MULTIPLE DISCHARGE TUBE

John F. Jordan, Cincinnati, Ohio, assignor to The Baldwin Company, Cincinnati, Ohio

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1 Claim. (Cl. 250—27.5)

My invention has reference to electrical discharge tubes of the type employed in glow-discharge oscillators and more particularly to these tubes when used in an associated plurality of such oscillators.

A glow-discharge oscillator is of course a well-known arrangement comprising essentially a multielectrode tube containing a gas under low pressure, with which appropriate electrical circuits are associated, and it produces electric oscillations by periodic ionization of the gas in the tube, as influenced and controlled by the associated circuits. The oscillator has been found to be applicable in many devices and accordingly considerable experimental work has been directed toward improving it. A part of this work has been on the tube itself and it has been found that the most satisfactory arrangement is a tube containing three elements comprising a plate, a hot cathode and a grid interposed between the cathode and plate. For reasons obvious to those acquainted with the art an indirectly heated cathode is generally employed.

One of the applications of the glow-discharge oscillator is to electrical musical instruments as a source of electric oscillations for tone production and, because the wave form of the oscillator may be made rich in harmonics, as a means for generating musical tones of a plurality of qualities. In the application of the oscillator to polyphonic musical instruments, it has been a common, and in the past an almost necessary, practice to employ at least one oscillator and its associated tube per note. This has meant of course that there are as many tubes as notes in the instrument and makes for a cumbersome and costly arrangement.

An object of my invention is to reduce the number of tubes required in a polyphonic musical instrument employing glow-discharge oscillators, by providing a multisectional discharge tube (each section consisting of at least a plate, cathode and grid) whereby each tube section may be a part of a glow-discharge oscillator, independent of and unaffected by other tube sections, and whereby a plurality of independent oscillators may have a common tube. By attaining this object, I am enabled to effect an economy in space and cost in polyphonic musical instruments of the class recited and moreover I accomplish a more general object in providing a discharge tube which may be utilized wherever a plurality of glow-discharge oscillators are employed in one application.

The attainment of this object and the means whereby it is accomplished has entailed considerable experimental work and a brief résumé of this work is given below.

In attempting to place more than one tube section in a gas filled envelope, so that each section is operable independent of and unaffected by other sections, certain practical difficulties are encountered. Capacity coupling between plates will often cause one section to ionize when the other ionizes, particularly if the external circuits are of high impedance. An excess of free electrons in the space between plates will cause ionization between plates when they are of sufficiently different potential, and consequently emission of electrons from the cathode must be carefully confined to the particular tube section in order to prevent excursion into surrounding space, particularly towards an adjoining tube section with consequent objectionable cross-ionization effects. These cross-ionization effects cause the external circuits to lose control of the tube.

In overcoming the above difficulties it was necessary to materially shorten the area of the cathode sprayed with electron emissive substance, as shown in the drawing, over normal practice, such that a line drawn from the upper edge of the sprayed area of the cathode across the edge of the plate would miss the adjoining section.

It was necessary to extend the grid beyond the plate and connect the upper end with a concentric shield to assist in preventing electron excursion.

Finally a shield was placed between sections and connected to cathode to eliminate both capacity coupling and cross-ionization between plates of adjoining section.

In the drawing Fig. 1 is a side view of the tube of this invention showing one of two plates 2 and a shield 9 between them.

Fig. 2 is a top view of the tube showing concentric grid shields 7 and 8 and the shield 9 between the aforementioned plates. Concentric shields 7 and 8 are each attached to and supported by the two grid support wires as shown.

Fig. 3 is a side view, at right angles to Fig. 1, and partially in section to show the various elements, in which 7 and 8 are circular shields at the same potential as the grids 6 and 5 (negative with respect to the cathode). Shields 7 and 8 are designed to set-up a negative field to prevent excursion of electrons toward the adjoining tube section. Shield 9 disposed between plates 1 and 2 is tied to the two cathodes 3 and 4 and is designed to prevent capacitive coupling between

plates 1 and 2 as well as to prevent excursion of electrons between the said plates with resulting cross-ionization. The sprayed area of the cathodes 3 and 4 in each section which area emits electrons should be contained within the projected area of the grid and plate as shown in Fig. 3 at A and B in order to help prevent excursion of electrons into adjoining space causing undesired ionization effects.

The invention above described is shown as consisting of a two-section tube. According to the teachings thereof, however, those skilled in the art will be able to construct such tubes in which more than two sections are employed.

Having thus explained and described my invention, I claim:

In a gaseous glow-discharge oscillator tube designed for simultaneous use with a plurality of electrical oscillatory circuits, a gas filled envelope, a plurality of sets of discharge electrodes therein, each set comprising a cathode of the heated type bearing a coating of electron emissive substance, a grid surrounding said cathode, and a plate surrounding said grid, the coated portion of said cathode being confined to an area thereof wholly between the end limits of said plate and said grid being not longer than said plate, a concentric shield attached to and in electrical connection with said grid and extending beyond an end limit of said plate, and a conductive shield of greater area than a lateral projection of said sets of electrodes thereon, between adjacent sets of said electrodes.

JOHN F. JORDAN.