United States Patent

[11] 3,581,146

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[54] **BALLAST FOR A PLURALITY OF PARALLEL GASEOUS DISCHARGES**
6 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **315/180,** 315/302
[51] **Int. Cl.** **G05f 1/06**
[50] **Field of Search** 315/180, 181, 302

[56] **References Cited**

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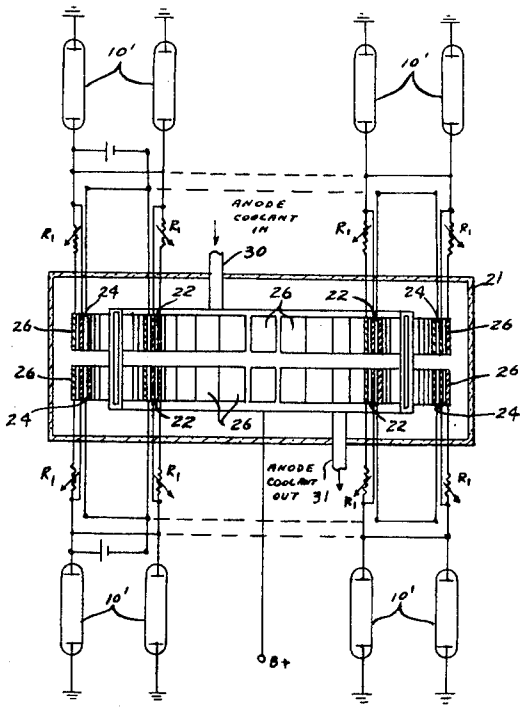
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ABSTRACT: A plurality of gaseous discharge tubes connected to a common power supply has a vacuum tube connected in series with each gaseous discharge tube to provide ballast for the individual gaseous discharge tubes, a water-cooled, heavy duty anode is provided with a plurality of cathodes positioned adjacent the anode. A discharge tube is connected in each of the cathode circuits. Negative feedback is used to limit the current through each discharge tube. Variable feedback resistors permit balancing of the discharge paths.



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SHEET 1 OF 2

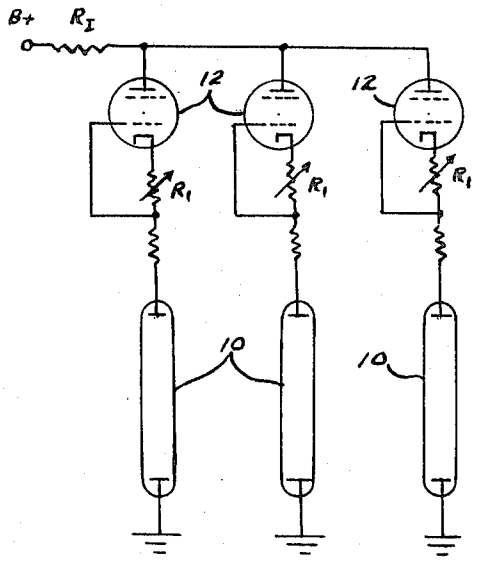


Fig-1

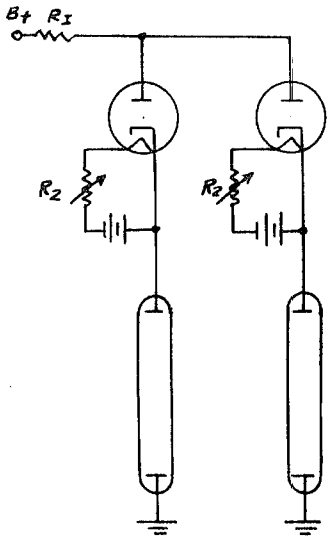


Fig-2

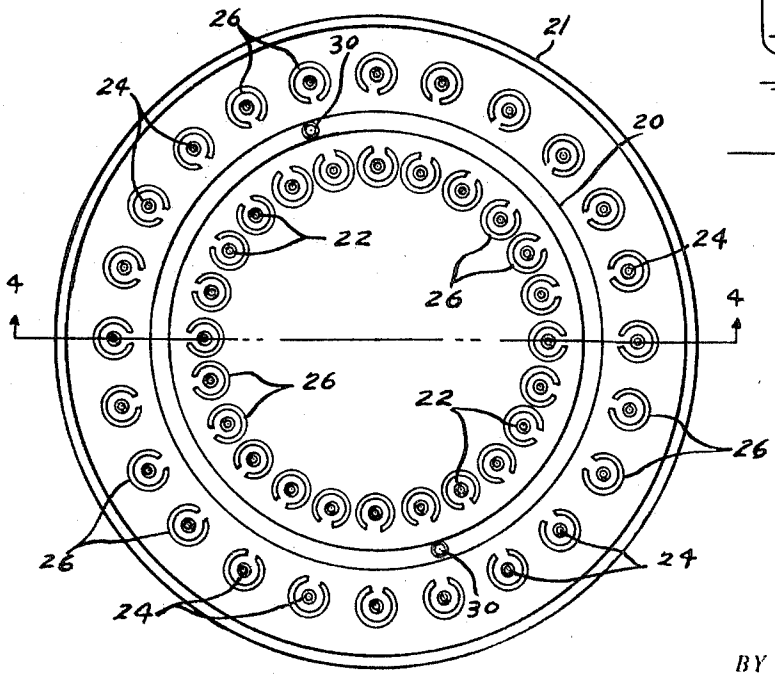


Fig-3

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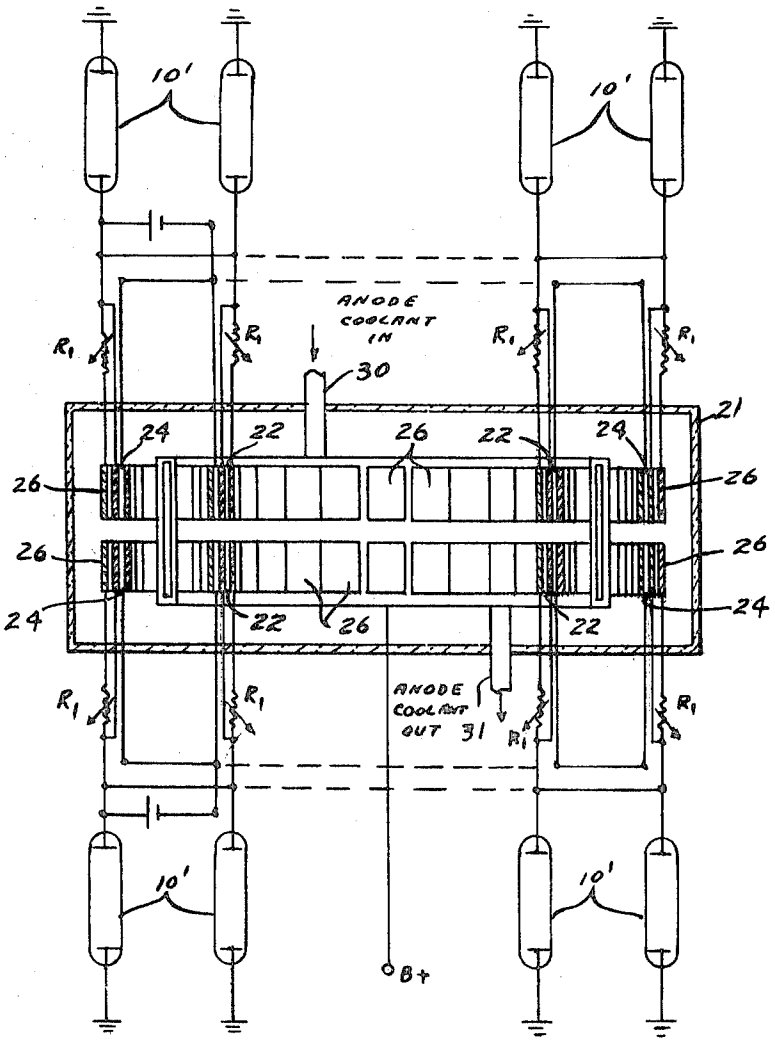


Fig-4

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BALLAST FOR A PLURALITY OF PARALLEL GASEOUS DISCHARGES

SUMMARY OF THE INVENTION

This invention relates to the excitation of parallel gaseous discharge tubes.

When trying to excite more than one discharge tube from a single power source, some difficulty is encountered due to the internal resistance of the power source and connecting circuits owing to the fact that the discharge potential for the discharge tube is much lower than the breakdown potential. Generally, ballast resistors are used to provide independent voltage drop across each tube. In providing individual ballast for a number of independent gaseous discharge tubes, vacuum tubes may be used with control provided either using negative feedback to the grid as shown in FIG. 1 or by thermionically limiting the current by adjusting the filament temperature as in FIG. 2. Instead of providing a separate vacuum tube for each discharge tube, a special electron tube is provided with a single cooled heavy duty anode and with a plurality of independent cathodes positioned adjacent the heavy duty anode. Either negative feedback or current limiting by controlling the filament temperature may be used.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a plurality of gaseous discharge tubes with vacuum tubes with negative feedback providing the ballast for the individual tubes;

FIG. 2 shows a plurality of gaseous discharge tubes with vacuum tubes with thermionic current limiting providing the ballast for the individual tubes;

FIG. 3 is a top plan view of one possible configuration for a tube with a heavy duty anode and plural independent cathodes; and

FIG. 4 is a sectional view of the device of FIG. 3 along the line 4–4;

DETAILED DESCRIPTION OF THE INVENTION

Reference is now made to FIG. 1 of the drawing wherein a plurality of gaseous discharge tubes **10** are excited from a common B+ power source having an internal resistance R_I. Ballast is provided for each discharge tube by a negative feedback vacuum tube **12** in the circuit with each of the discharge tubes. Independent control for the independent gaseous discharge tube circuits is provided by the variable resistors R_1 in the feedback circuits.

FIG. 2 shows a similar circuit wherein the independent control is provided by variable filament temperature control resistors R_2.

In the device of FIG. 3, an annular heavy-duty anode **20** is positioned within an evacuated envelope **21** and has a plurality of cathode elements **22** positioned internally of the anode and a plurality of cathodes **24** positioned externally of the anode. Grid elements **26** surround the cathodes **22** to provide a shield for the cathodes. The negative feedback to the grid for each tube is adjusted by means of variable resistors R_1. Coolant is supplied to the anode **20** through input tubes **30** and removed through tubes **31**, one of each of which is shown in FIG. 4. Additional coolant input and outlet tubes may be provided when needed. Gas discharge tubes **10'** are connected in the cathode circuit of cathodes **22** and **24** as in FIG. 1. While a discharge tube would be connected in each cathode circuit, only a few are shown for clarity. Filament temperature control could be used with the device of FIG. 3 in place of the feedback control.

While the device has been described for use with gaseous discharge tubes, it may be used in any case where plural parallel gaseous discharges are desired.

There is thus provided a compact device for providing ballast for a plurality of parallel gaseous discharges.

I claim:

1. A device for providing ballast in a plurality of parallel discharges, comprising: a DC power supply; an evacuated envelope; and anode within said envelope; means for connecting said anode to a B+ voltage from said power supply; a plurality of cathode elements positioned within said envelope in discharge relation to said anode; a gaseous discharge element connected in the cathode circuit of each of said cathodes; means for limiting the current in the discharges between said cathodes and said anode to thereby provide individual ballast for each of said gaseous discharges.

2. The device as recited in claim **1** wherein each of said cathodes has a filament circuit including means for controlling the temperature of the filament.

3. The device as recited in claim **2** wherein said anode includes a channel therein; means for providing a coolant to the channel in said anode.

4. The device as recited in claim **1** including a grid positioned adjacent each of said cathodes; means for providing negative feedback to the grid to limit the current flowing through the gaseous discharge tube.

5. The device as recited in claim **4** wherein the grids substantially surround the cathodes to thereby provide shielding for the separate cathodes.

6. The device as recited in claim **5** wherein said anode includes a channel therein; means for providing a coolant to the channel in said anode.