WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.

THE GRID GLOW TUBE.

4-26-27

THE GRID GLOW TUBE

Description:

The grid controlled glow tube consists essentially of a cylindrical aluminum cathode, an anode of nickel wire and a grid of nickel wire all mounted within a glass tube containing Neon gas at a low pressure. See Fig. 1. The tube is fitted with a standard vacuum tube base and the connections are as follows:- The anode is connected to the F + terminal; the cathode is connected to the P terminal; and the grid is connected to the G terminal. The fourth terminal in the base is not used.

Operation:

The grid glow tube can be used on D. C. and A. C.

The grid glow tube is not in itself a photo-electric device but the tube can be easily controlled by photo-electric means.

The impedance offered to the flow of current from cathode to anode is practically infinite.

The impedance offered to the flow of current from anode to cathode is quite low amounting to about 22,500 ohms at 8 milliamperes. This impedance is not constant but varies inversely with the current. In other words the drop across the glow is constant at about 180 volts.

Since the impedance of the tube is practically infinite in the one direction and quite low in the other, the tube acts as a rectifier when used on A.C., passing current in only one direction.

Since the glow resistance decreases with an increase in current, it is necessary to use a stabilizing resistance in series with the tube to prevent overloading. This resistance should be adjusted to prevent drawing more than 8 milliamperes for continuous operation.

A unique feature of the grid glow tube is the fact that the voltage required to start the glow is subject to control within wide limits by means of the grid electrode.

If the grid be free (thoroughly insulated) about 600 to 900 volts D.C. depending on the particular tube in use, will be required to start the glow. This is due to the fact that under free grid conditions the grid will assume a high negative charge, which if not allowed to leak off, will rise sufficiently to block the tube. The fact that the grid does assume this high negative charge gives rise to one form of control of the breakdown voltage.

Any conducting path placed in the grid to anode circuit will permit the grid charge to leak off and permit the tube to operate.

See Fig. 2. This conducting path may be in the form of a flame, a photo-cell, a selenium cell or any other form of high resistance of the order of 50 to 500 megohms. A typical curve showing the relation between this leakage resistance and the breakdown voltage is shown in Fig. 3.

If the electro-static capacity between grid and anode be increased a charging current will flow to charge the new formed condenser. The charge accumulated upon the grid will flow into the condenser with the result that the total charge upon the grid will have diminished allowing the tube to glow. This can be demonstrated by grounding the anode and connecting the grid to an insulated plate. If the hand be brought near to the insulated plate the tube will be caused to glow.

If a voltage be impressed between the grid and the anode as is shown in Fig. 4, the anode to cathode voltage required to start the glow will be as is shown by the curve in Fig. 5. This curve is a straight line, whose slope is unity and downward in the direction of positive bias. The curves obtained on D. C. and A.C. are similar.

Upon a reduction of voltage as for example, a gradually reduced direct voltage or the falling part of an alternating voltage wave the glow will maintain itself down to a voltage value of 180 volts which as has been previously mentioned in the constant voltage drop across the glow. Accordingly the breakoff voltages (voltages at which the glow stops) when plotted against grid bias voltages will be as indicated in Fig. 5.

The bias voltage shown in Fig. 4 can be derived from a source of voltage as a battery or transformer or it can also be derived as an ohmic drop across an impedance thru which a current is caused to flow as in Fig. 6.

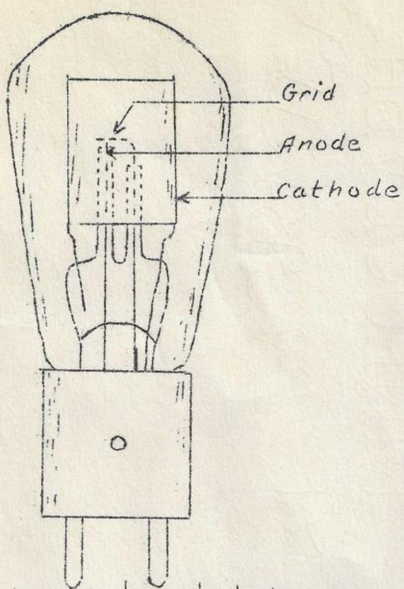
The amount of energy which must be handled by a pair of control contacts placed in series with the leakage resistor in Fig. 2 is a very minute quantity. Accordingly it is important that dirt and dust and moisture be kept out of the tube socket. A good quality socket should be used to avoid leakage in the socket itself. If the sensitivity of such a circuit be thought too great a means of varying the sensitivity as shown in Fig. 7 can be used. For a given value of voltage between anode and cathode the ratio between Z_1 and Z_2 will determine whether or not the tube is to breakdown. The sum of $Z_1 + Z_2$ governs the sensitivity that is--the energy which is lost in the control circuit. By reducing the sensitivity in this manner the effects of extraneous leakage paths such as socket insulation resistance will be lessened.

Westinghouse Elec. & Mfg. Co.
East Pittsburgh, Pa.

E.O.E. 4/26/27.

Supply Eng. Dept.

Printed in U.S.A.



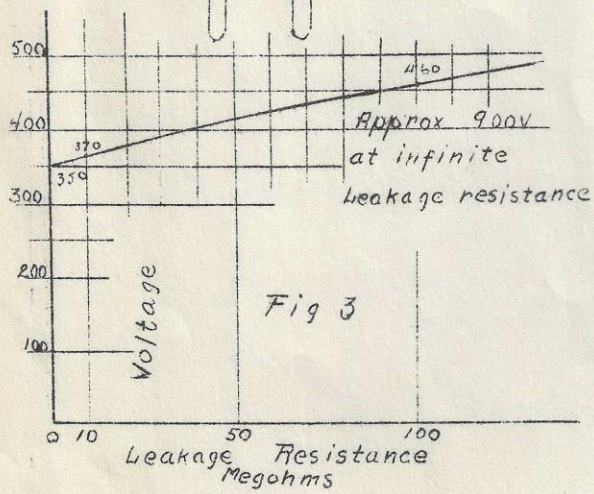


Fig 3

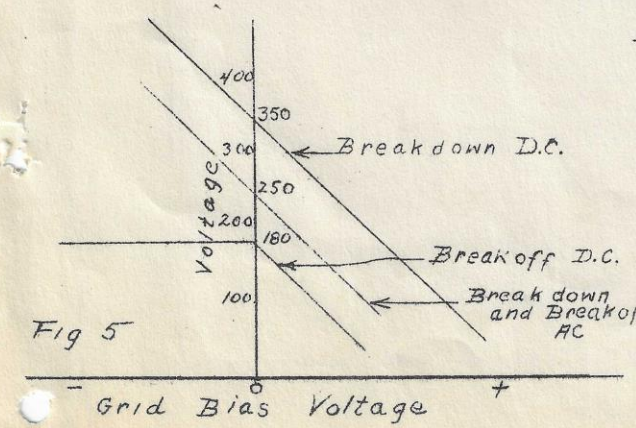


Fig 5

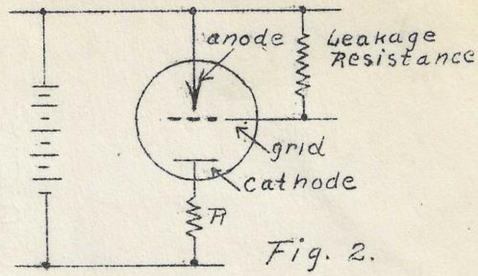


Fig. 2.

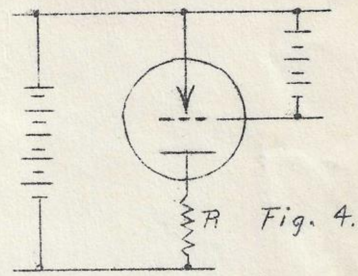


Fig. 4.

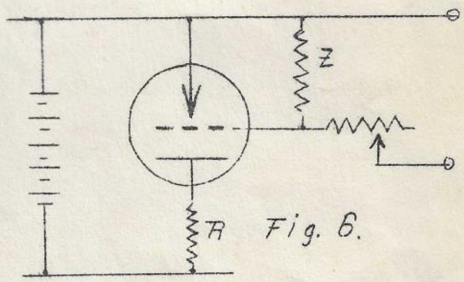


Fig. 6.

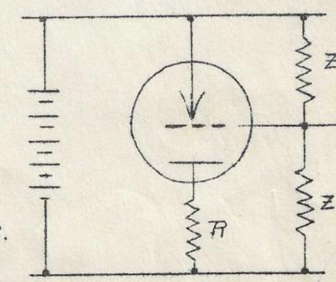


Fig. 7.

Figs. 2,4,6. and 7 operate on both AC and D.C.