

Stabilizing tubes

Stabilizers are used in all cases where it is necessary to keep the voltage in a receiver or component thereof as constant as possible, so that the latter may be sufficiently independent of the current consumption and of fluctuations in the applied mains or battery voltage; in this way the fixed grid bias of an amplifier or measuring instrument may be stabilized.

The neon stabilizer tube depends for its action on the fact that the current flowing through it rises rapidly as the voltage is increased. When the voltage is applied to the tube through a resistor, the rise in current produces a corresponding increase in the voltage drop across that resistor, thus partly neutralizing the increase in potential; in many instances the internal resistance of the voltage source is sufficient to provide a stabilizing effect, in which case the resistor may be dispensed with.

Fluctuating loads produce voltage variations in the series resistor, which in turn are compensated by variations in current in the neon tube. To ensure effective stabilization, small voltage variations on the tube must occasion the greatest possible variations in current, and the ratio of the voltage increase to the corresponding current increase in the tube is known as the A.C. resistance. The latter should be as low as possible, being actually about 250 ohms in the case of the tube type 4687, so a voltage increase of 2.5 V on the tube will produce an increase in the current of 10 mA. The D.C. resistance indicates the relationship between the current through and the voltage across the tube.



Fig. 1
Arrangement of electrodes in a neon stabilizer tube.

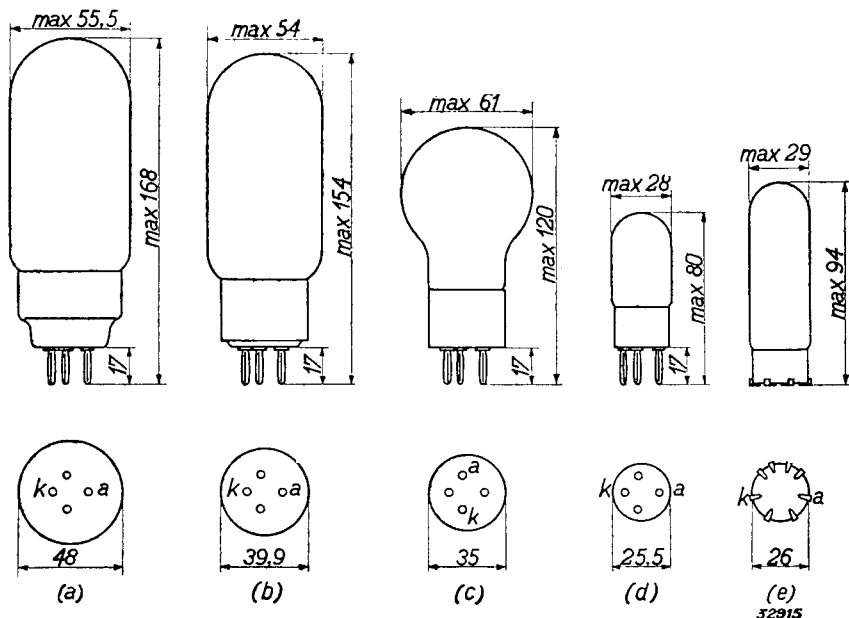


Fig. 2
Dimensions in mm. and base connections of the various Philips Neon Stabilizers.
a) Type 100 E 1 c) Type 4357 e) Type 4687
b) Type 13201 d) Type 7475

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The 4687, with 90 V, will pass a current of 20 mA and the D.C. resistance is therefore 4,500 ohms.

A neon tube has to be "started up" by an "ignition" voltage, which is in every case higher than the normal working voltage, and precautions must be taken to ensure that when the switch is closed the receiver does not take so much current that the voltage drop across the series resistor prevents the tube from igniting. The "quenching" voltage must also be borne in mind; at a given voltage, which is somewhat lower than the working voltage, the discharge is quenched and re-ignition will take place only when the load has decreased to the extent where the voltage on the tube is once more equal to the ignition voltage. When the tube has been quenched, therefore, there will be a period during which no stabilization takes place.

A rectifier provided with one of these stabilizers may be looked upon as a source of voltage of very low internal resistance, since the voltage at the terminals of the stabilizer is independent of the load and remains practically constant. It follows, then, that a stabilized rectifier will tend to reduce R.F. or A.F. coupling through the medium of the internal resistance. Further, the neon tube improves the smoothing

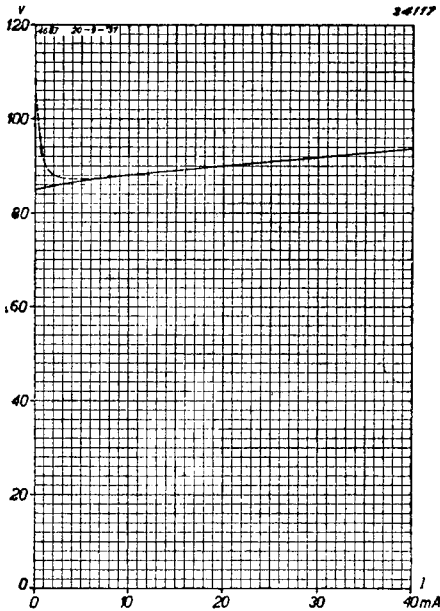


Fig. 3
Voltage-current curve of the 4687.

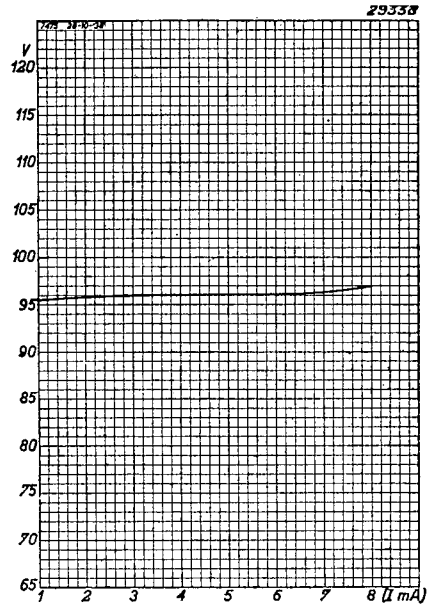


Fig. 4
Voltage-current curve of the 7475.

of the rectified voltage, because voltage variations arising from the ripple are also stabilized.

Admittedly, the A.C. resistance of the neon tube increases with the frequency, but at normal mains frequencies it will not deviate to any great extent from the published value.

If the voltage to be stabilized is very much higher than the tube voltage a number of tubes may be connected in series with each other, in which case, however, at least one of them must be shunted by a fairly high resistor, say 0.1 megohm; otherwise the tubes will not ignite (see Fig. 8).

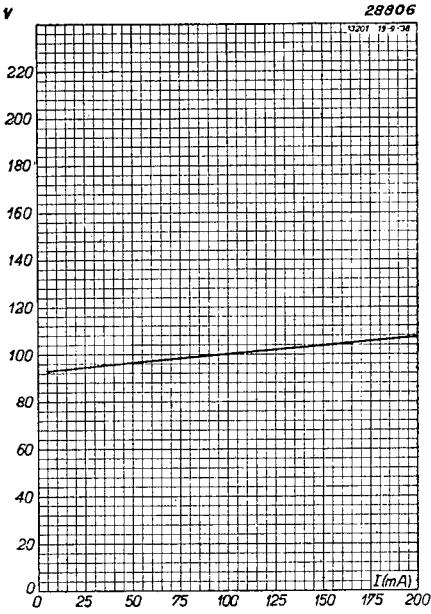


Fig. 5
Voltage-current characteristic of the 13201.

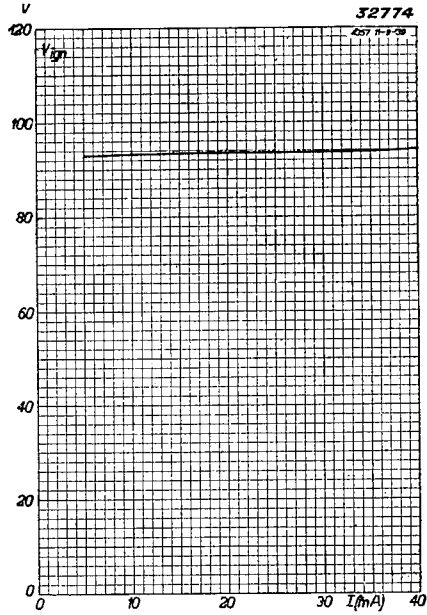


Fig. 6
Voltage-current characteristic of the 4357.

It should be noted here that neon tubes are used for stabilizing D.C. voltages only; further, these tubes must never be connected in parallel to stabilize heavy currents. Owing to the unavoidable circumstance that the ignition voltage varies between one tube and another, the tube having the lowest ignition voltage would start up first

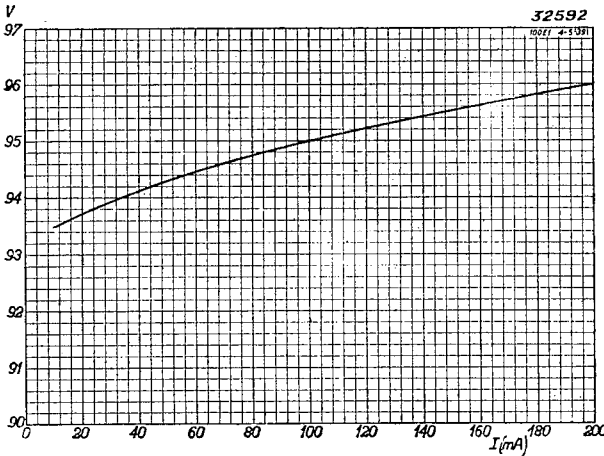


Fig. 7
Voltage-current characteristic of the 100 E 1.

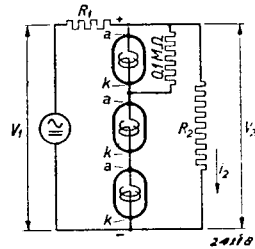


Fig. 8
Three neon tubes connected in series to stabilize approximately 270 V. The output circuit is represented by the resistor R_2 , passing a current I_2 at a voltage V_2 . V_1 is the D.C. voltage source with superimposed alternating voltage (voltage fluctuations), and R_1 is the internal or series resistance of the voltage source. A resistor of 0.1 megohm is connected across one of the tubes to enable ignition to take place.

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and immediately consume current, thus reducing the voltage across the other tubes in parallel with it, which would thus have no further chance of ignition.

Philips make five different types of neon voltage stabilizers suitable for use in large or small equipment and the working values of these tubes have been so selected as to provide a tube for almost any conceivable project. The general data are as given in the following table:

DETAILS OF PHILIPS STABILIZING TUBES

Type	Dim. and Base connections	Base	Operating voltage at stated quiescent current (V)	Maximum starting voltage (V)	Quiescent current ¹⁾ (mA)	Upper current limit for stabilization (mA)	Lower current limit for stabilization (mA)	Max. A.C. resistance (ohms)
4357	Fig. 2c	A 35	85—100	125	20	40	10	75
4687	Fig. 2e	P 26	85—100	115	20	40	10	250
7475	Fig. 2d	A 25.5	90—110	140	4	8	1	700
13201	Fig. 2b	A 48	90—110	140	100	200	15	90
100 E 1	Fig. 2a	A 40	90—105	140	125	200	50	30

¹⁾ To ensure a reasonable life, the specific average value for the current passing through the tube should not be exceeded.

Philips neon stabilizers are "burned" or screened first on A.C. and then on D.C.; it is recommended that the negative pole of the voltage source be connected to the electrode indicated as cathode and the positive pole to the anode.