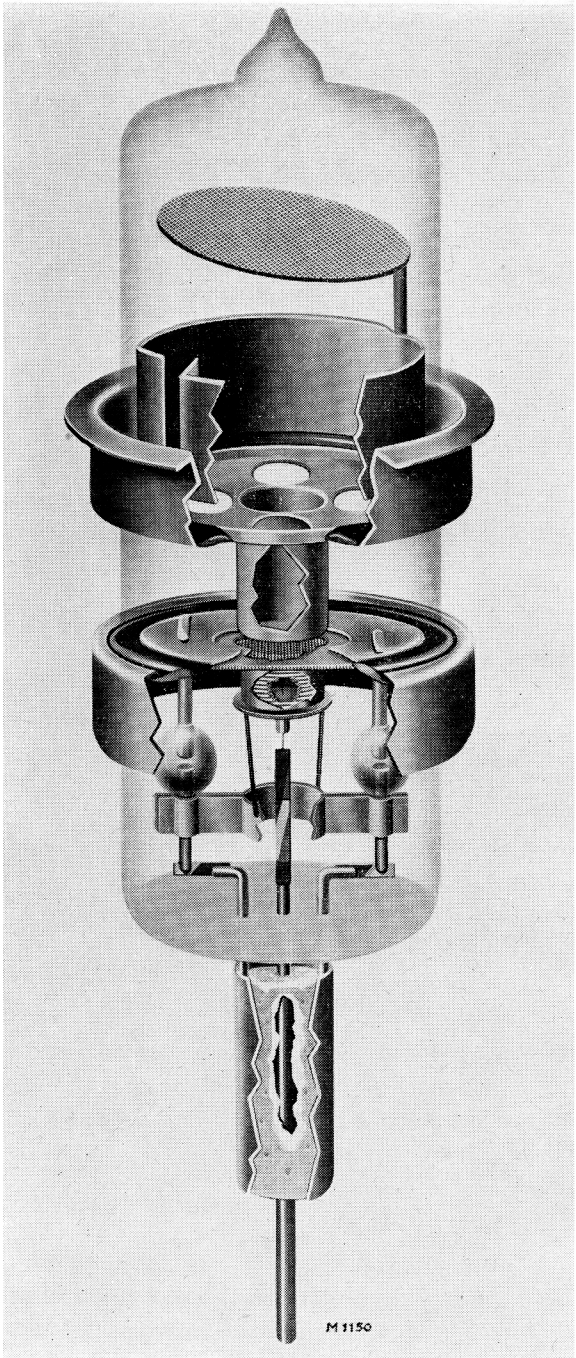


*Fig. 28. Greatly enlarged representation of the EC 55.*

# U.H.F. DISC-SEAL TRIODE EC 55

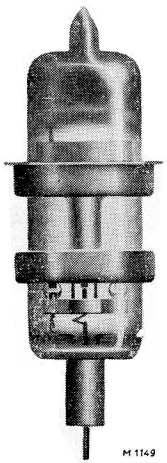


*Fig. 27. Photograph of the EC 55 (actual size).*

The EC 55, a disc-seal triode, has been developed for use in receivers and small transmitting installations working in the ultra-high frequency band. The mutual conductance amounts to 6 mA/V at an anode current of 20 mA, and the amplification factor is 30.

The applications of the EC 55 are manifold both in transmitting and receiving. In receivers, the tube can be used as a high-frequency amplifier and local oscillator, and in transmitters as a self-excited, controlled and impulse-modulated transmitting tube.

The EC 55 is mainly intended for use in coaxial line circuits, for which purpose the electrode connections have been given a special shape. When the tube is used as an oscillator in a coaxial line circuit, the output power with an anode input of 10 watts is about 2.8 W at 1000 Mc/s ($\lambda$ = 30 cm), about 1.4 W at 2000 Mc/s ($\lambda$ = 15 cm) and about 0.5 W at 3000 Mc/s ($\lambda$ = 10 cm).

The resistance and self-inductance of the electrode leads have been reduced to a minimum, thanks to the copper discs fused into, and protruding beyond the envelope. The outer parts of these discs have been shaped in a special way, permitting the tube to be easily inserted in coaxial line circuits. The grid is composed of stretched wires, to prevent buckling due to heating, thus keeping frequency drift to a minimum. Moreover, the grid and the disc to which it has been attached, function as a screen between the anode and the cathode, so that the coupling between the input and output circuits is very small.

Cooling of the anode is achieved mainly by thermal conduction to the line circuit. In order to limit the anode seal temperature, and also its rate of change, it is necessary for the mass of metal in close thermal contact with the anode disc to be not less than 60 grammes of brass or its equivalent.

## TECHNICAL DATA

HEATER DATA

Heating: indirect by a.c. or d.c.: parallel supply

| | | | |
|---|---|---|---|
| Heater voltage . . . . . | $V_f$ | = | 6.3 V ± 5% |
| Heater current . . . . . | $I_f$ | = | 0.4 A |

CAPACITANCES (measured with tube cold)

| | | | |
|---|---|---|---|
| Capacitance between grid and cathode . . . | $C_g$ | = | 1.8 pF |
| Capacitance between grid and anode . . . | $C_{ag}$ | < | 1.3 pF |
| Capacitance between anode and cathode . . . | $C_a$ | = | 0.03 pF |

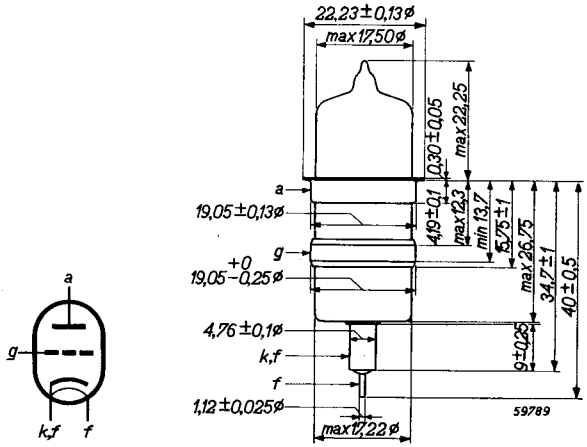


*Fig. 29. Electrode arrangement, electrode connections and maximum dimensions in mm.*

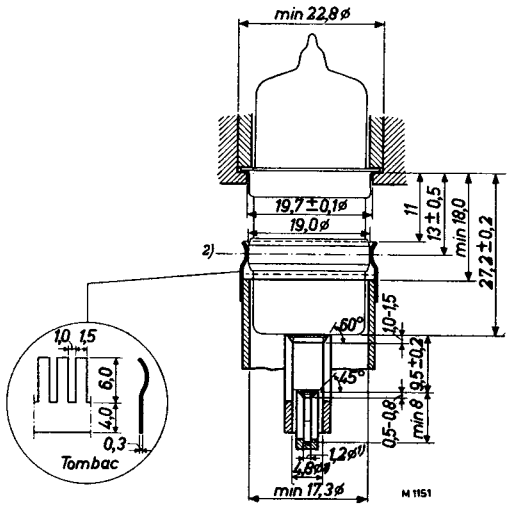


*Fig. 30. Excentricity. Distance between axes of the electrodes:*
*g-a max. 0.38 mm;*
*k-a max. 0.38 mm;*
*f-k max. 0.12 mm.*

[1]) In order to make good contact, these sockets should be split.

[2]) Line of contact.

TYPICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Anode voltage | $V_a$ | = | 250 V |
| Grid bias | $V_g$ | = | −3.5 V |
| Anode current | $I_a$ | = | 20 mA |
| Mutual conductance | $S$ | = | 6 mA/V |
| Amplification factor | $\mu$ | = | 30 |

LIMITING VALUES (absolute maxima)

| | | | |
|---|---|---|---|
| Anode voltage | $V_a$ | = max. | 350 V |
| Anode dissipation | $W_a$ | = max. | 10 W |
| Cathode current | $I_k$ | = max. | 40 mA |
| Anode seal temperature | $T$ | = max. | 140 °C |
| Grid dissipation | $W_g$ | = max. | 0.1 W |
| Grid voltage | $-V_g$ | = max. | 50 V |

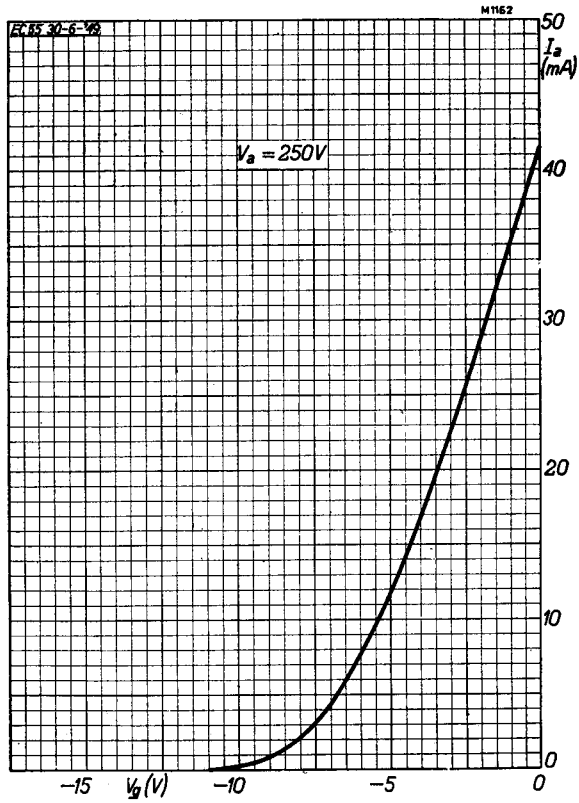


*Fig. 31. $I_a/V_g$ characteristic of the EC 55 at an anode voltage of 250 V.*

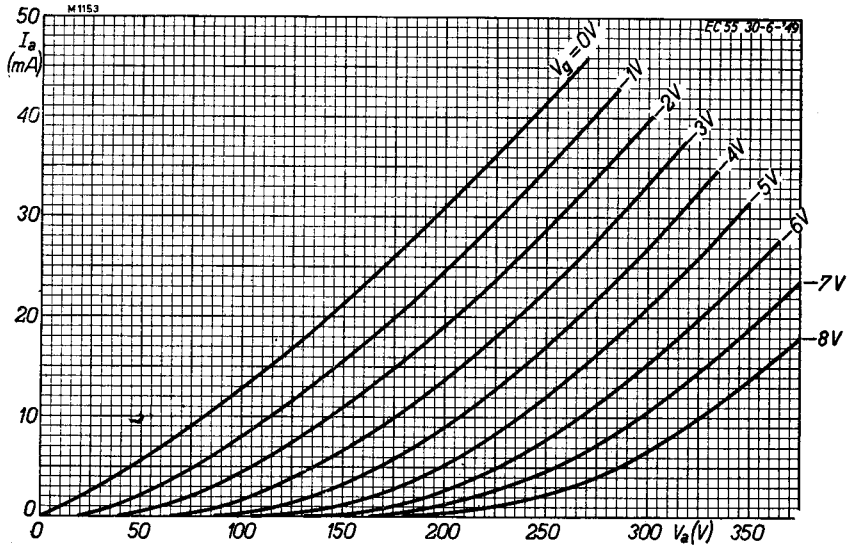


*Fig. 32. $I_a/V_a$ characteristics of the EC 55.*

## OSCILLATOR WITH THE EC 55 OPERATING BETWEEN 730 and 1350 Mc/s

A practical oscillator with the tube EC 55 and its assembly are shown in figs 33 to 35. The anode-grid and grid-cathode circuits are coaxial lines, the grid tube being common to both circuits. The circuits are tuned by means of movable shorting plungers. In this way every desired value of the imaginary portion of the admittance between grid and anode (grid and cathode) can be adjusted.

This circuit arrangement is known as the grid separation circuit or grounded anode circuit, and is outlined in fig. 9. To achieve oscillation, capacitive feedback is applied by means of a probe, which is screwed in the outer wall of the anode tube and "peeps" towards the cathode through an opening in the grid tube.

The oscillation frequency is mainly determined by the grid-anode circuit. The optimum value of the feedback depends on the position of the shorting plunger in the cathode-grid circuit and the value of the capacitance between cathode and anode. The cathode, grid and anode having different voltages, have to be insulated from each other against direct voltage. This is done by inserting separating capacitors in the moving bridges. It is also possible to use a separating capacitor near the anode, in order to keep the outer wall at earth potential.

The heater lead is fed through the cathode tube and is decoupled by two capacitors in order to avoid parasitic oscillations.

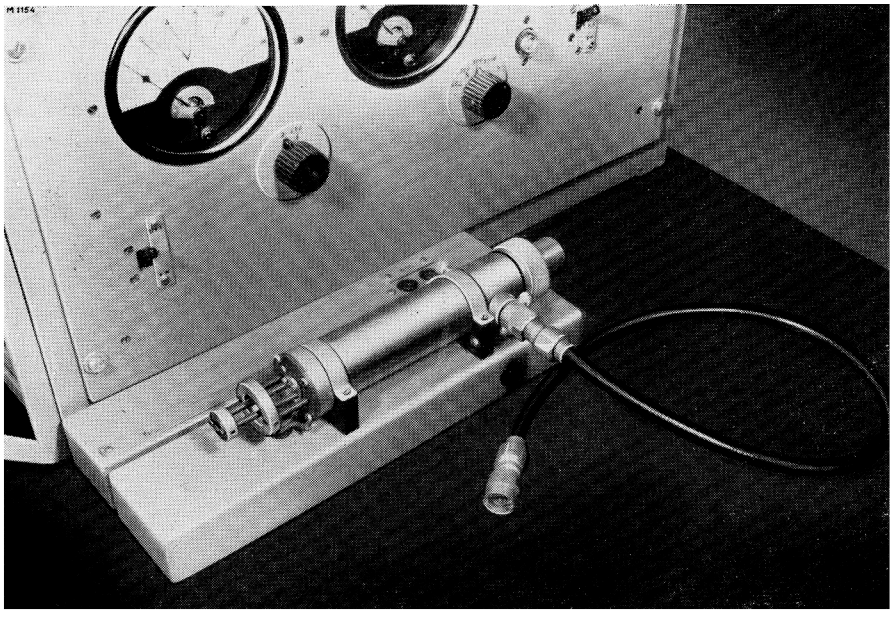

*Fig. 33. Photograph of an oscillator with the EC 55; frequency range from 730-1350 Mc/s.*

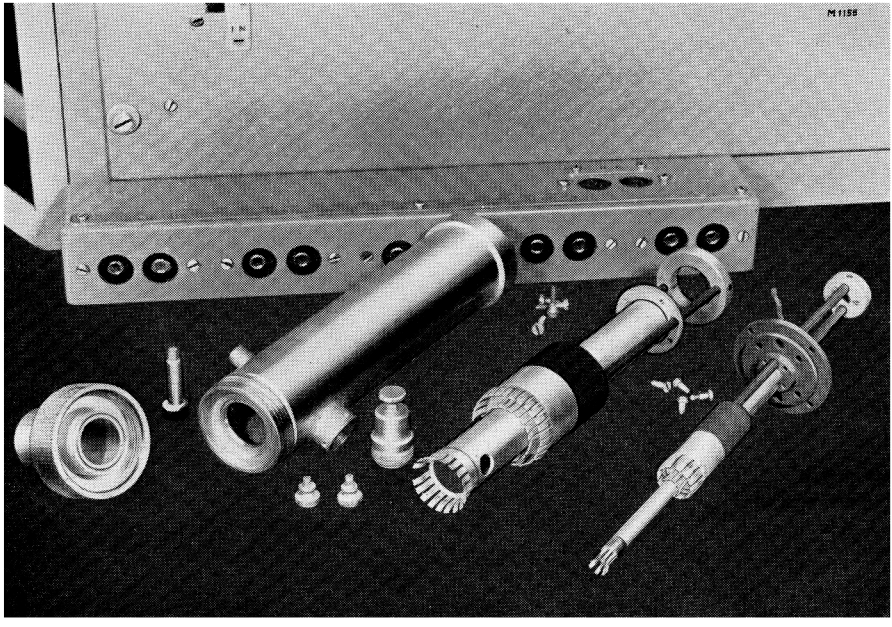

*Fig. 34. Photograph of the parts of the coaxial line circuit of the oscillator of fig. 33.*

The oscillator operates in the so-called ¼-¼ mode, i.e. the length of both the two coaxial lines is about ¼ of a wavelength.

The material used for the cylinders and flanges is brass; phosphorous bronze is used for the contact springs. After assembling and soldering of the parts, the resonators have been silver-plated. The assembly of the circuits can be seen clearly in figs 33 and 34.

The rods operating the shorting plungers are made from insulating material, in order to avoid parasitic effects upsetting the tuning itself. Conducting rods would also have some radiation due to leakage from the tuned circuit, thus introducing additional losses.

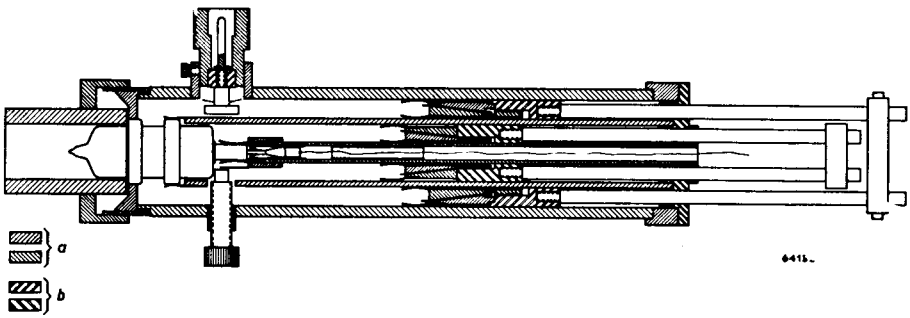


*Fig. 33. Cross section through the oscillator of fig. 33.*
*a = metal; b = insulation.*

The feedback is applied by means of a screw, effecting a capacitive coupling between anode and cathode. The capacitive coupling of the output to the anode-grid circuit can be adjusted by moving the cable connector in its socket.

The osillator can be adjusted between 730 and 1350 Mc/s (wavelength 41-22 cm). The upper frequency is limited by the outer plunger being blocked by the capacitive coupling between anode and cathode; the lower frequency is limited by the length of the system.

The above-mentioned circuit has also been used as an impulse-modulated oscillator, for which purpose negative pulses with a duration of 4 $\mu$sec were applied to the cathode. The duty cycle was about 0.016, the oscillator frequency 1000 Mc/s. It showed that the EC 55 is able to supply H.F. pulses with a peak output power of about 225 watts (average value during each pulse about 165 W) and an efficiency of 36%. These results were obtained with an anode voltage pulse of about 1300 volts peak value (average value during each pulse about 950 volts), an anode current pulse of about 435 mA (average value during each pulse) and an average anode dissipation of 4.5 watts.