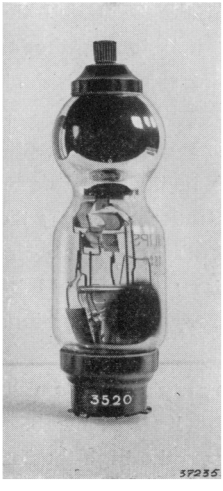
SECONDARY-EMISSION PHOTO-ELECTRIC CELL 3520



CHARACTERISTICS

Cathode				Caesium
Sensitivity	N	=	2·5	mA/lm
Anode-to-cath. capacity	C_{ak}	=	4	pF
First anode voltage	V_{a_1}	=	about 70	V
First secondary-emission cathode voltage	V_{ks_1}	=	about 210	V
Second secondary-emission cathode voltage	V_{ks_2}	=	about 420	V
Third secondary-emission cathode voltage	V_{ks_3}	=	about 560	V
Second anode voltage	V_{a_2}	=	about 630	V
Maximum luminous flux	Ø	=	1/30	lm
Maximum anode current	$I_{a\,max}$	=	100	μA

SPECIAL ADVANTAGES

1. Very high sensitivity
2. Low inherent noise
3. Good high-frequency response

DESCRIPTION

The 3520 is a vacuum cell with amplification by secondary emission. In normal cells of the evacuated type both the photo-electric current and the sensitivity are very low, and in order to obtain higher sensitivity gasfilled cells are adopted for many applications; with this pattern the photo-electric current is up to about seven times greater. An alternative method of amplifying an electronic current is to make use of secondary emission; in that case the electrons released by the cathode are concentrated, accelerated and directed towards an auxiliary cathode; here each bombarding electron liberates several new electrons, and these in turn are concentrated and accelerated; they impinge on a second auxiliary cathode, where the process is repeated. By this means high amplifi-

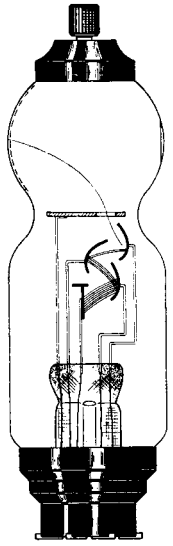
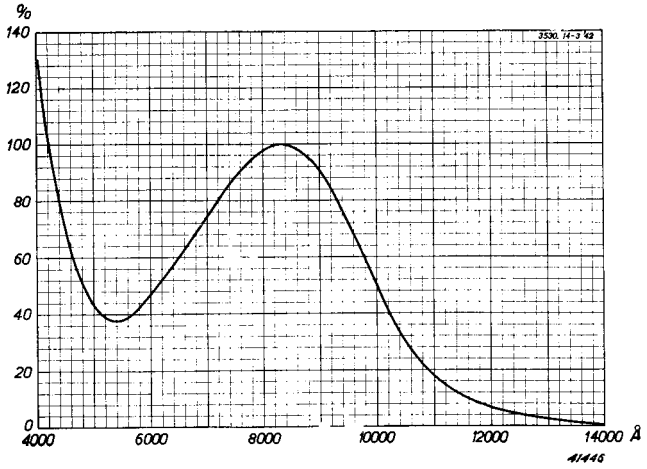


Diagram illustrating layout of the secondary-emission cell.

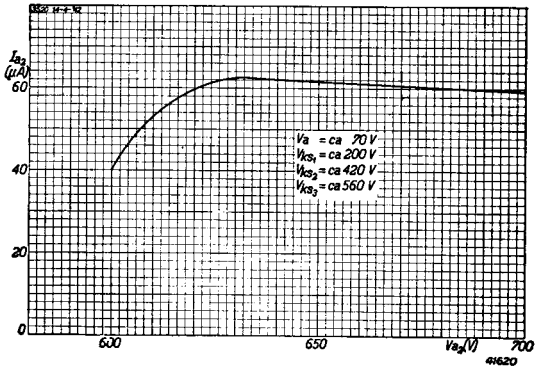
cation may be secured over a series of stages. In early tubes of this so called "electron multiplication" type the electrons were concentrated magnetically, but the present-day method is to control the path of the electrons by electrostatic fields. In the 3520 cell the special shape of the secondary-emission cathodes ensures that the electrons follow the required trajectories.

The electrons from the cathode are admitted to the multiplying system via an aperture in the first anode. Such is the shape of these two electrodes that only the electrons from that part of the cathode facing the window reach the multiplying system; this should be borne in mind when arranging the respective locations of the cell and the light source.

In order that a moderate HT voltage may suffice, amplification has not been carried to the limit in the 3520 photo-cell; the potential available from the high-tension unit of a normal soundfilm amplifier - usually about 630 V, - is adequate. If the voltage at the first anode is



Sensitivity as a function of wavelength; 100% corresponds to a sensitivity of 107 mA/W.



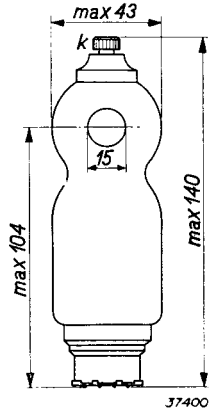
Ia/Va characteristics of the 3520 secondary-emission cell.

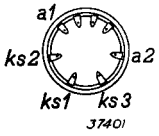
about 70 V, and assuming an average inter-electrode potential of 150 V for each stage of multiplication, the second anode will be about 110 V positive in relation to the last secondary-emission cathode; this voltage is sufficient to ensure that all the electrons released from the last cathode are drawn to the second anode. The optimum operating voltages vary from specimen to specimen and accordingly these are specified on the packing note which accompanies each cell. It is recommended that the electrodes be fed from an adjustable potentiometer. The voltage at the second anode may be increased above the indicated figure without causing a rise of anode current (V_{a_2} max = 700 V); in other words the internal resistance rises. This is advantageous for measuring-instrument applications in which high internal resistance is necessary.

The response curve shows that the 3520 cell is very sensitive indeed to light of long wavelength, and for this reason a cathode of very low emission-energy is necessary. Such a cathode has been obtained by coating a first layer of silver with a second one of specially treated caesium oxide. This latter coating contains readily ionised free atoms of caesium. The sensitivity curve may be used to calculate the sensitivity of any sort of light source; it should be noted that 100% corresponds to a sensitivity of 107 mA/W. This expression for the sensitivity means that through the cell a current of 107 mA will flow, when it is touched by a radiation energy of 1 Watt.

It is very important that the cell should not be exposed to illumination exceeding 1/30 lm, while anode current must never rise to about 100 μA.

The electron paths being determined electrostatically, the 3520 cell is very sensitive to magnetic fields; it is desirable to provide magnetic screening for the tube, and it should not be mounted close to AC leads or the anode-supply unit.





Electrode connections and maximum dimensions in millimetres.