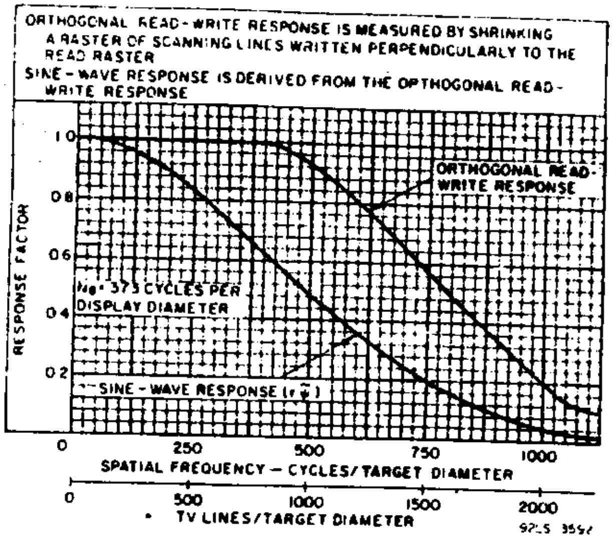
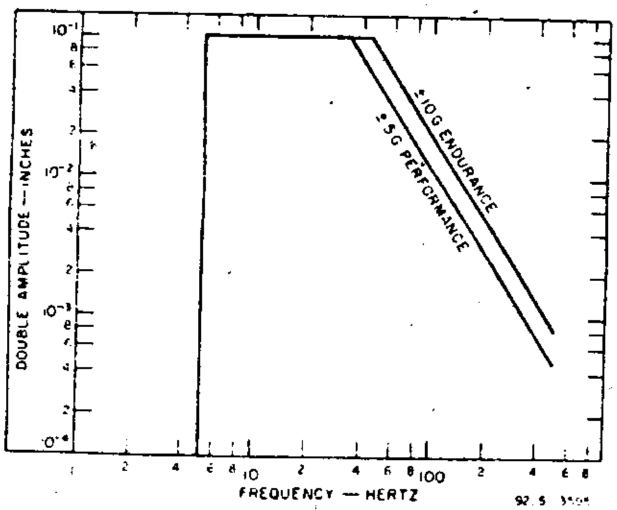
FREQUENCY RESPONSE CHARACTERISTICS



VIBRATION LEVELS



6499

RADECHON

CHARGE STORAGE TUBE

SINGLE-BEAM, BARRIER-GRID TYPE

NON-EQUILIBRIUM WRITING   CAPACITANCE-DISCHARGE READING

DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to all other electrodes	9	μμf
Deflecting electrode DJ₁ to all other electrodes	13	μμf
Deflecting electrode DJ₂ to all other electrodes	13	μμf
Deflecting electrode DJ₃ to all other electrodes	11.5	μμf
Deflecting electrode DJ₄ to all other electrodes	11.5	μμf
DJ₁ to DJ₂	3	μμf
DJ₃ to DJ₄	3	μμf
Grid No.5 to backing-electrode	800	μμf
Grid No.5 and backing-electrode to collector	4	μμf
Collector to all other electrodes & external cylindrical shield	See Curve	
Focusing Method	Electrostatic	
Deflection Method	Electrostatic	
Overall Length	11-27/32" ± 3/8"	
Greatest Diameter of Tube	3.30" ± 0.05"	
Minimum Useful Storage-Surface Diameter	2-1/4"	
Mounting Position	Any except those positions where the dihepta l base is up and the tube axis is at an angle of less than 60° from the vertical.	
Weight (Approx.)	1 lb	
Base: On large end of tube	Small-Button Twentyninar 8-Pin (JETEC No.E8-19)	

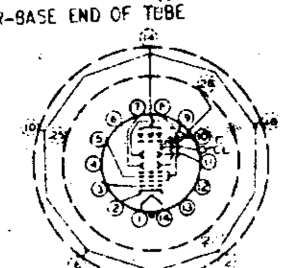
VIEW OF TWENTYNINAR-BASE END OF TUBE

Pin 2, Pin 6, Pin 10, Pin 14, Pin 18 — Multiple Connections to Backing-Electrode. Only One Need be Used

Pin 21 – No Connection

Pin 25 – No Connection

Pin 28 – Grid No.5



PINS 2,6,10,14,18: ON 1-7/8" DIA. PIN CIRCLE

PINS 21,25,28: ON 7/8" DIA. PIN CIRCLE

SOLID-LINE CIRCLES DEPICT DIHEPTAL BASE; BROKEN-LINE CIRCLES DEPICT TWENTYNINAR BASE

RCA 6499 RADECHON

On small end of tube. . . . . . Small-Shell Diheptal 14-Pin (JETEC No.B14-45)

VIEW OF DIHEPTAL-BASE END OF TUBE

- Pin 1 - Heater
- Pin 2 - Cathode
- Pin 3 - Grid No.1
- Pin 4 - Internal Connection—Do Not Use
- Pin 5 - Grid No.3
- Pin 6 - No Connection
- Pin 7 - Deflecting Electrode DJ_4
- Pin 8 - Deflecting Electrode DJ_3
- Pin 9 - Ultor (Grids No.2 & No.4)
- Pin 10 - Deflecting Electrode DJ_2
- Pin 11 - Deflecting Electrode DJ_1
- Pin 12 - No Connection
- Pin 13 - Same as Pin 4
- Pin 14 - Heater
- C,CL - External Conductive Coating, Collector, Internal Shield, Flange between Neck and Large Part of Tube

All voltages are with respect to cathode unless otherwise specified

Maximum Ratings, *Absolute Values:*

BACKING-ELECTRODE-TO-GRID-No.5 (BARRIER-GRID) VOLTAGE:		
Backing-electrode positive with respect to grid No.5	100 max.	volts
Backing-electrode negative with respect to grid No.5	100 max.	volts
COLLECTOR-TO-GRID-No.5 VOLTAGE:		
Positive value	100 max.	volts
Negative value	0 max.	volts
ULTOR* VOLTAGE	1500 max.	volts
GRID-No.3 VOLTAGE	500 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	200 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts

Equipment Design Ranges:

*For any ultor voltage (E_{c_4}) between 1000 and 1500 volts**

Backing-Electrode-to-Grid-No.5 Voltage	See Note 1	
Collector-to-Grid-No.5 Voltage	0 to 50	volts
Grid-No.3 Voltage for Focus with grid-No.1 volts = 0	14% to 26% of E_{c_4}	volts
Grid-No.1 Voltage for collector-current cutoff	-2.5% to -4.7% of E_{c_4}	volts
Collector Current for grid-No.1 volts = 0	20 to 50	μamp
Max. Cathode Current for grid-No.1 volts = 0	See Curve	
Deflection Factors:		
DJ_1 and DJ_2	85 to 105 v dc/in./kv of E_{c_4}	
DJ_3 and DJ_4	78 to 96 v dc/in./kv of E_{c_4}	
Spot Position	See Note 2	
Signal-Uniformity Ratio	See Note 3	

Examples of Use Design Ranges:

For ultor voltage of	*1000*	*volts*
Grid-No.3 Voltage for Focus with grid-No.1 volts = 0	140 to 260	volts
Grid-No.1 Voltage for collector-current cutoff	-25 to -47	volts
Deflection Factors:		
DJ_1 and DJ_2	85 to 105	v dc/in.
DJ_3 and DJ_4	78 to 96	v dc/in.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting-Electrode Circuit•	1.0 max.	megohm

* The "ultor" in a storage tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the 6499, the ultor function is performed by grid No.4. Since grid No.4 and grid No.2 are connected together within the 6499, they are collectively referred to simply as "ultor" for presenting data.

*: See next page.

* In general, the recommended minimum ultor voltage should not be less than 1000 volts. Signal output and resolution decrease with decreasing ultor voltage. Secondary emission characteristics of the dielectric layer limit the maximum ultor voltage to 1500 volts.

• It is recommended that all deflecting-electrode-circuit resistances be approximately equal.

Note 1: The backing-electrode, grid No.5, and ultor are usually operated at the same dc potential. During the writing cycle, the backing-electrode may be pulsed to 160 volts with respect to grid No.5.

Note 2: The undeflected focused spot will fall within a circle having a diameter equal to 10% of the minimum storage-surface diameter and having its center coincident with the center of the storage surface.

Spot position is calculated as follows: with heater voltage of 6.3 volts, ultor voltage of 1000 volts, grid-No.5 voltage of 1000 volts, collector voltage of 1050 volts, grid-No.3 voltage adjusted to give focus, grid-No.1 voltage adjusted for 15 microamperes peak collector current, each deflecting electrode connected through a 1-megohm resistor to ultor, and the tube shielded from all extraneous fields, the voltages

Note 3: See next page.

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RADECHON

required to displace the beam from its undeflected position to the edge of the storage surface in the direction of each deflecting electrode are recorded as a for DJ_1, b for DJ_2, c for DJ_3, and d for DJ_4.

Spot Position in % of Storage-Surface Diameter

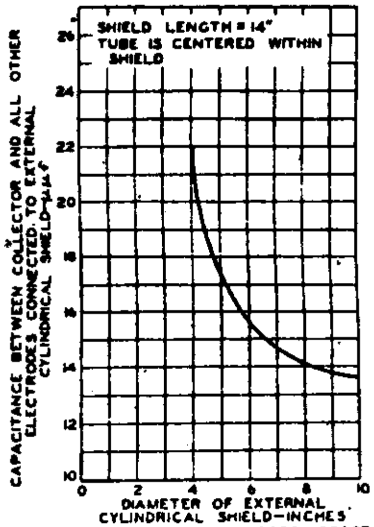
$$= 1/2\sqrt{\left(\frac{b-a}{b+a}\right)^2 + \left(\frac{d-c}{d+c}\right)^2} \times 100$$

Note 5: With voltages as specified in Note 2, and with a signal written into storage by applying a series of well-formed symmetrical square waves to grid No.1 such that a series of 25 equally spaced stored elements are written across a single line scan, the ratio of the maximum to minimum signal amplitude observed as the single line scan is moved across the storage surface will not exceed 1.35.

OPERATING CONSIDERATIONS

Shielding. The use of a magnetic shield of high-permeability material surrounding the tube is recommended. This shield prevents the effect of stray fields in causing unwanted deflection of the electron beam.

INDICATED CAPACITANCE VS. SHIELD DIAMETER



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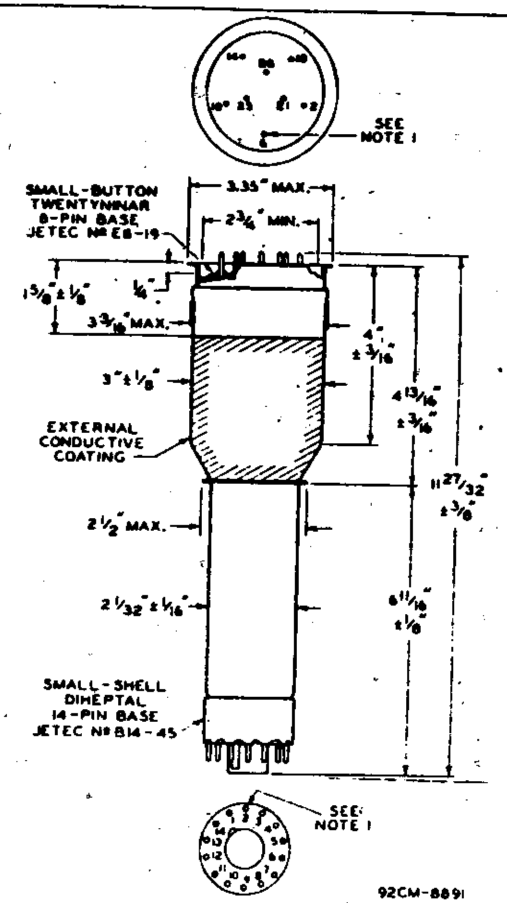
RADECHON



92CM-8891

NOTE 1: THE ANGLE BETWEEN PLANE THROUGH PIN 6 OF TWENTY-NINAR BASE AND TUBE AXIS, AND PLANE THROUGH PIN 2 OF DIHEPTAL BASE AND TUBE AXIS WILL NOT EXCEED 10°. THE INDICATED PINS ARE BOTH ON THE SAME SIDE OF THE TUBE.

NOTE 2: DEFLECTING ELECTRODES DJ_1 & DJ_2 ARE NEARER THE TARGET. DEFLECTING ELECTRODES DJ_3 & DJ_4 ARE NEARER THE DIHEPTAL BASE.

NOTE 3: ANGLE BETWEEN DJ_1 & DJ_2 DEFLECTION PATH AND DJ_3 & DJ_4 DEFLECTION PATH IS 90° ± 3°.

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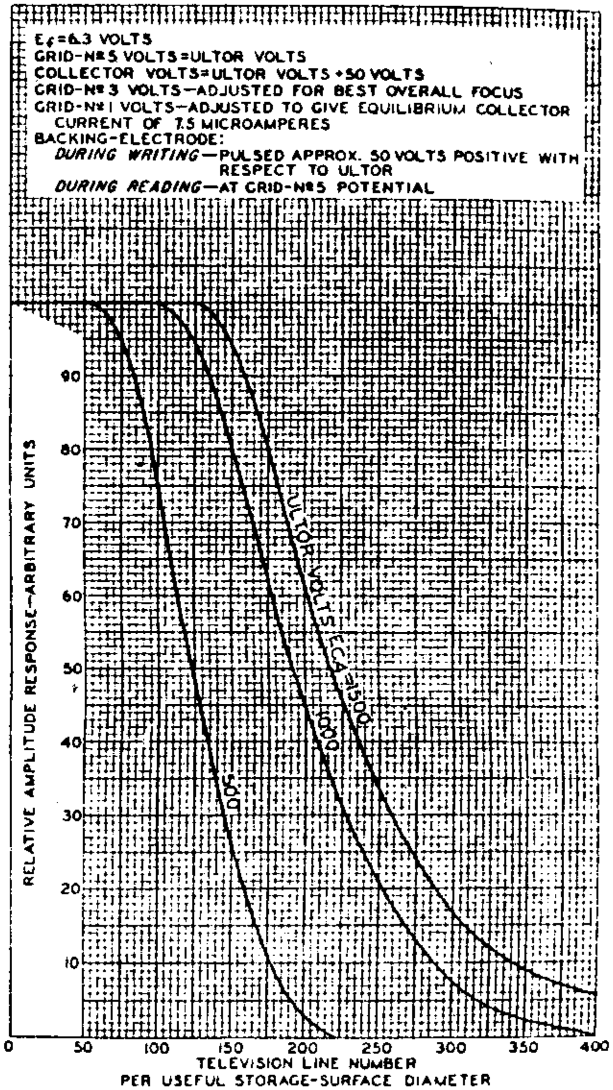
RESOLUTION CHARACTERISTICS



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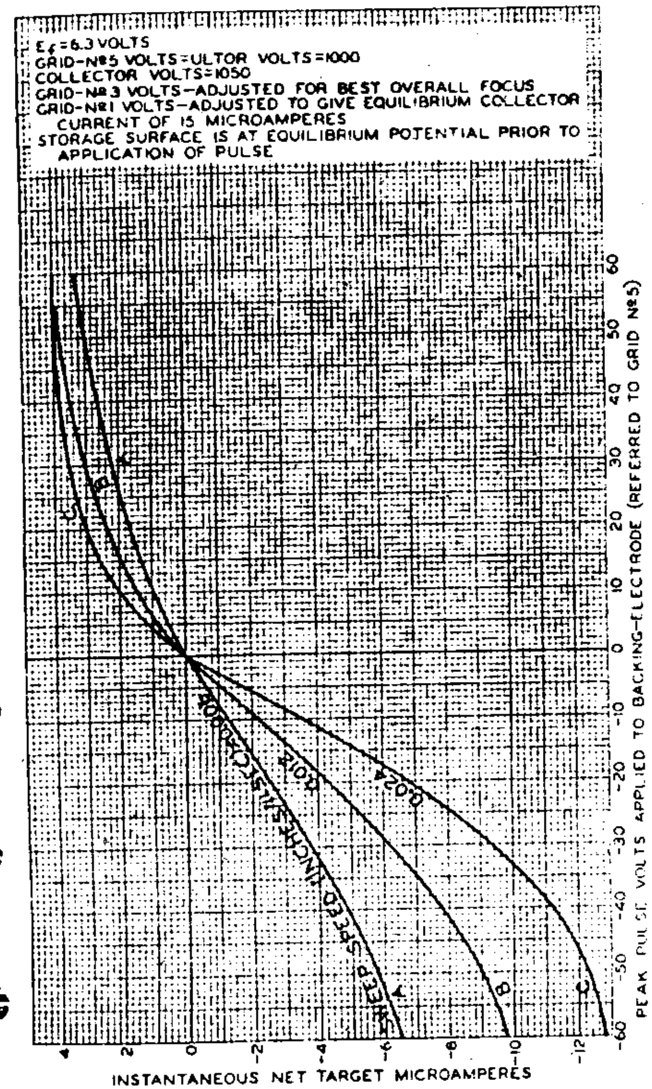
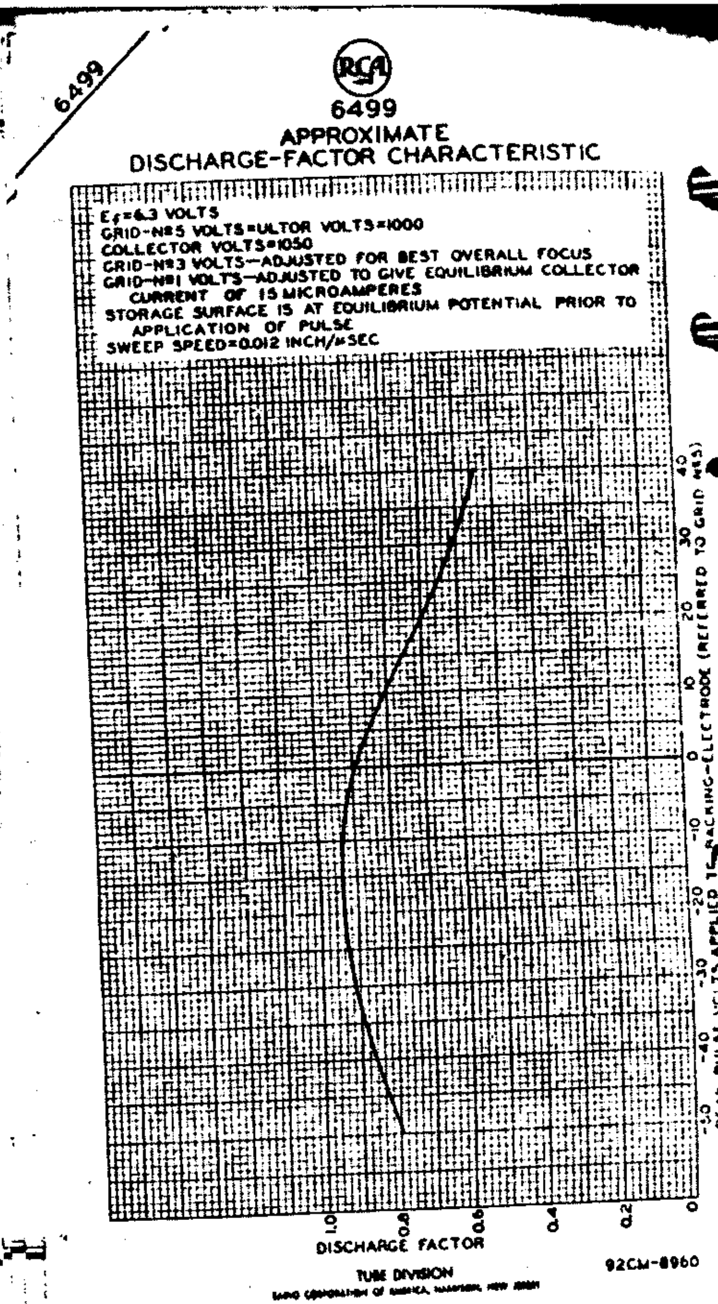
TYPICAL TARGET CHARACTERISTICS



TUBE DIVISION 92CL-8961

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY



6866

DISPLAY STORAGE TUBE

DIRECT-VIEW TYPE
4"-DIAMETER DISPLAY
NON-EQUILIBRIUM WRITING GRID-CONTROL READING (VIEWING)

DATA

General:

	Writing Section	Viewing Section	
Heater, for Unipotential Cathode:			
Voltage (AC or DC)	6.3	6.3	volts
Current	0.6	0.6	amp
Minimum Cathode Heating Time before other electrode voltages are applied	–	30	sec
Direct Interelectrode Capacitances (Approx.):°			
Grid No.1 to all other tube electrodes	6	18	μμf
Cathode to all other tube electrodes	4.2	6.5	μμf
Deflecting electrode DJ_1 to deflecting electrode DJ_2	1.8	–	μμf
Deflecting electrode DJ_3 to deflecting electrode DJ_4	1.8	–	μμf
DJ_1 to all other tube electrodes	7.5	–	μμf
DJ_2 to all other tube electrodes	8	–	μμf
DJ_3 to all other tube electrodes	6	–	μμf
DJ_4 to all other tube electrodes	7	–	μμf
Focusing Method	Electrostatic	None	
Deflection Method	Electrostatic	None	
Deflecting-Electrode Arrangement	*See Dimensional Outline*	–	
Phosphor	–	High-Visual-Efficiency Type, Aluminized	
Fluorescence	–	Yellow	
Phosphorescence	–	Yellow	

Minimum Useful Screen Diameter . . . . . 4"
Maximum Overall Length . . . . . 15-1/2"
Seated Length . . . . . 14" ± 3/8"
Maximum Tube Radius . . . . . 3-5/32"
Bulb-Flange Diameter . . . . . 5-1/8" ± 1/16"
Greatest Bulb Diameter . . . . . 5" ± 1/16"
Bulb Terminals: . . . . . Recessed Small Cavity (JETEC No.J1-21)
Caps (Two) . . . . . *See Dimensional Outline*
Flange . . . . . *See Dimensional Outline*
Flexible Cable . . . . . -65° to +100 °C
Ambient-Temperature Range . . . . . Any
Mounting Position . . . . . [illegible]
Weight (Approx.) . . . . . Alden Part No.435SBA, or equivalent
[illegible] . . . . . Small-Button Thirtyfivar 31-Pin (JETEC No.E31-[illegible])
Base . . . . .

° Without external shield.

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CHAPTER III

Signal Converter Devices (Electrical–Electrical)

A. CAPACITY-DISCHARGE ELECTRON-BEAM READING TYPES

1. Single-Gun Tube† With Barrier Grid (Radechon)‡

a. Introduction

The Radechon was one of the first charge-storage tubes commercially developed for operation with electrical input and output signals. The term "Radechon" has become associated with a tube design in which the storage target has a fine mesh or barrier grid in contact with the surface and which is operated under $\delta > 1$ conditions. Originally, the tube was intended for signal-comparison purposes where the output indicated the difference between successive sequences of time-varying signals. It has since found numerous other applications, such as the storage of binary information [4, 5, 8], the improvement in signal-to-noise ratio of repetitive signals [3, 7], the storage of single frames of a transient image, and coordinate transformation of stored pictures, for example, from PPI to raster scan.

The basic tube (Fig. III-1) consists of a single gun, a collector cylinder, and a storage target consisting of a metal backplate, a thin insulating sheet, and a fine-mesh barrier grid in contact with the insulator surface. Depending on the mode of operation, input signals may be applied to the control grid of the gun (storage of single-frame pictures), to the backplate (signal comparison), or to a combination of both (digital storage). The output signal may be taken

† A somewhat similar earlier tube with a single gun but without a barrier grid, developed for television applications, is described by Krawinkel *et al.* [16]. Another early tube of similar structure, but including a mesh grid near the target, intended for binary storage, is described by Forrester [2]. A brief description of both of these tubes is given by Knoll and Kazan [14].

‡ The reference list for this subsection appears on p. 141.

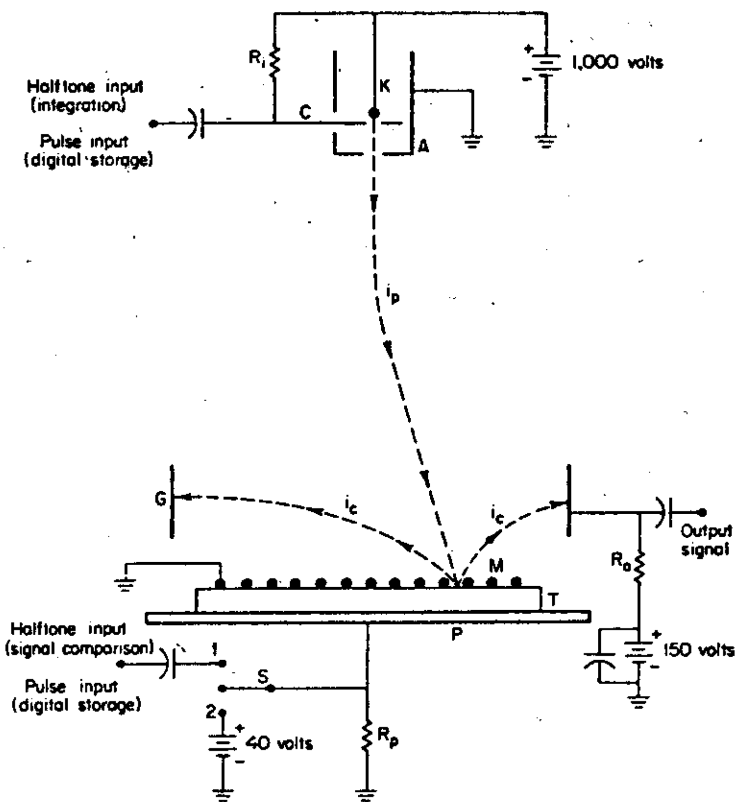

FIG. III-1. Single-gun tube with barrier grid (Radechon). A, accelerating anode; C, electron-gun control grid; G, collector cylinder; K, cathode; M, barrier grid; P, backplate; R_i, input resistor; R_o, output resistor; R_p, backplate load resistor; S, write-read switch; T, insulating target; i_p, primary current; i_c, collector current.

from the collector cylinder as shown in Fig. III-1, or from the barrier-grid–backplate structure.

b. Methods of Operation

(i) *Signal Comparison.* (*Equilibrium Writing, Capacity-Discharge Reading*).

Writing. In this method of operation the input signal is applied to the backplate (switch, S, in position 1) while the target is scanned by the unmodulated electron beam. The input signals, which may range for example, between 0 and ± 10 V, produce corresponding time-varying potentials on the target surface by capacitive coupling. Since the bombarding energy of the primary electrons is about 1000 eV, operation is under the condition $\delta > 1$.

Sufficient beam current is assumed so that during the bombarding time of a single element its potential is shifted to the equilibrium potential, V_{eq}, approximately equal to that of the barrier grid, which is the effective collector. This shift is in opposition to the instantaneous signal voltage capacitively coupled to the surface. At the end of a single scan, therefore, with the backplate returned to ground potential, a pattern of potential variations will be left on the target surface equal to the capacitively-coupled signal at the target surface, but opposite in polarity.

Reading. If the writing process described above is repeated with a new input signal that differs from the original signal, the above process will be repeated and a pattern of potential variations will be established on the target surface equal and opposite to the new signal, regardless of the previous potential pattern. The net charge added or subtracted by secondary emission from each element, however, will depend on the potential shift the element has undergone in changing from its previous potential to the new potential. As the successive elements are scanned, the varying net target current to the insulator surface will produce opposite polarity variations in the total collected current. Although the barrier grid is the effective collector, a fraction of the secondary electrons (those with higher emission velocity) will escape through the barrier-grid holes and reach the collector cylinder. The variations in this current, i_c, reaching the collector cylinder thus produce an output signal across the resistor, R_o, indicating the difference between the two input signals.

By this process, input signals applied during any two successive scans will produce an output signal corresponding to the difference between these inputs. In the special case that identical time-varying signals are applied to the backplate during successive scans, no variation will result in the collected current, i_c. However, if during successive scans the input signals differ at certain portions of the scan, signals will be observed in the output only at the moment of scanning these target elements.

Erasing. In this mode of operation, the process of writing a new signal automatically erases the previous potential pattern. Separate erasing action is therefore not required.

(ii) *Digital Storage With Random Access (Equilibrium Writing, Capacity-Discharge Reading).*

Writing. In this type of operation, binary information is stored on the target surface in the form of one of two potentials, for example, zero and a specified negative potential. Before writing, the desired element is first selected by applying suitable potentials to the deflection plates (not shown in Fig. III-1) with the primary beam cut off. Following this, the primary beam is momentarily switched on by applying a pulse to the control grid of the gun. During the time of this current flow, the backplate is either left at ground potential or shifted positive, for example, by applying a pulse of +50 V to the backplate (switch, S, in position 1). In either case the primary beam is assumed sufficient to bring the surface to the collector-stabilized equilibrium potential, V_{eq}. If no pulse was applied to the backplate, the surface of the selected element will be left at the potential, V_{eq}, after bombardment. If a positive pulse was applied to the backplate, capacitively coupling a positive potential to the insulator surface, at the termination of the pulse the surface of the bombarded element will be left with a negative potential equal to the positive capacitive shift. The information is said to be a "0" in the first case and a "1" in the second case. By successive selection and bombardment of other elements, "0" or "1" information can be stored at other locations of the target.

Reading. For reading, the backplate is maintained at ground potential (switch, S, in position 1) with no pulse voltages applied. Deflection voltages are applied to select a target element, and the primary beam is then pulsed on. If the bombarded element has a "0" stored, being at equilibrium potential, it will receive no net charge during bombardment. The total collected current will equal the primary current, the secondary current dividing between the barrier grid and the collector cylinder. If the interrogated element has a "1" stored, being at a negative potential, it will be shifted positive during bombardment to the equilibrium potential. During this process the total collected secondary current will exceed the primary current ($\delta_c > 1$) so that the output current at the collector will be correspondingly higher than for a stored "0." By use of a suitable amplitude discriminator in the output, the storage of a "0" or "1" can be distinguished. (As mentioned below, for practical reasons it may be desirable to take the output signal from the backplate–barrier-grid combination instead of the collector to improve the distinguishability between the "0" and "1.")

Regeneration. The reading process described above acts to erase information stored as a "1," since it shifts the surface to the equilibrium potential. For computer applications it is frequently necessary to retain the stored information; in such applications, immediately after the readout of information from a given spot, the same information is written back at this element in a process similar to writing.

(iii) *Recording of Halftone Images and Signal Integration (Nonequilibrium Writing, Capacity-Discharge Reading).*

Writing. As a result of previous erasing, the target surface is assumed to be uniformly charged to the grounded backplate potential. For writing, the backplate potential is then switched to a potential such as +40 V (switch, S, in position 2), shifting the target surface capacitively positive, away from the equilibrium potential. The target is now scanned by the primary beam, whose current is modulated by the input signal applied to the control grid of the gun. The primary current is kept at a low level so that the bombarded elements shift only partially toward the collector-stabilized equilibrium potential, V_{eq}. Since the target is at all times substantially positive with respect to the barrier grid, essentially no secondaries can leave the target ($\delta_c = 0$) and the net current to the target is equal to the instantaneous primary current. A halftone potential or charge pattern can thus be established on the target surface in a single scan. (A similar charge pattern of opposite polarity can be stored if the backplate is shifted negative during writing.)

In some cases it is desirable to repetitively scan the target a number of times so that a charge pattern corresponding to an integrated signal is created. In this case the primary current may be reduced still further so that the total or integrated potential shift of the target elements is sufficiently below the equilibrium potential (i. e., maintaining $\delta_c = 0$, so that the charge added during each scan is approximately proportional to the primary-beam current).

For halftone storage of single frames or for signal integration, an alternative method of applying the input signal is to modulate the backplate voltage (switch, S, in position 1) while the target is scanned with the unmodulated primary beam. In this case use is made of the fact that the effective secondary-emission ratio or collected-current ratio δ_c varies approximately linearly with target-potential deviations from equilibrium if these potential deviations are small, i. e., operation is restricted to the portion B–C–D of the δ_c curve of Fig. I-7. The amount and polarity of charge stored on an element in a single scan, therefore, is approximately proportional to the backplate signal voltage.

Reading. For reading, the target backplate is maintained at ground potential (switch, S, in position 1). With no signals applied to the backplate or control grid, the target is scanned by the unmodulated beam. Assuming sufficient beam current, each element will be shifted to the equilibrium potential in a single scan. The time-varying change in charge at the target surface will thus produce corresponding variations in the collector current, generating an output voltage across R_o. (In applications of this type it is frequently preferable to obtain the signal output from the barrier grid and collector tied together.) Because of the complete discharge of the target elements, the output signal will reproduce the halftone potential variations stored on the surface. Multiple output frames can also be produced if the reading is carried out with reduced beam current, only partially discharging the target in a single scan. Although as many as 20 frames, for example, can be read out before the target is shifted to equilibrium, the signals have a reduced halftone content.

Erasing. The above reading process tends to automatically shift the target to the collector-stabilized equilibrium potential. If complete erasure is not obtained in reading because of insufficient beam current or number of reading scans, it may be necessary to further scan the target with the unmodulated primary beam with the backplate grounded.

c. Design Considerations and Operating Details

Commercial Radechon tubes are about 3 in. in diameter with a usable target diameter of about 2.5 in. Although deflection and focusing are usually electrostatic they may also be magnetic. The target insulator is usually a mica sheet, about one mil thick [5], but may also consist of aluminum oxide [3]. The barrier grid is made of a stainless-steel woven mesh with wires about 1 mil in diameter and about 230 to 400 mesh holes per linear inch [8, 9]. If the barrier grid is too thin (high ratio of mesh opening to thickness) negative charges on the target will produce electric fields extending around the outside of the screen which will inhibit secondary emission from the adjacent areas of the target (coplanar grid effect). For this reason it is desirable to use a woven mesh or a thick electroformed mesh so that the above ratio is less than 2. In the case of the 1-mil woven mesh, the effective distance of the mesh wires from the target surface is about 20 μ [10].

The capacitance between the backplate and barrier grid is of the order of 1000 $\mu\mu$f. Because of the ratio of the capacitance between the backplate and insulator surface to the average capacitance between the insulator surface and barrier grid, a fraction such as about 60% of the voltage applied between backplate and barrier grid is coupled to the target surface [8]. Because of the high backplate–to–barrier-grid capacitance, the capacitive impedance of the backplate at video frequencies is of the order of 100 Ω or less, a factor that must be considered when input signals are applied between the backplate and barrier grid.

In practical tubes, disturbance signals may be produced in the output because of (a) large-area nonuniformities in secondary emission of the target or localized blemishes, (b) nonuniformities in secondary emission of the barrier grid, (c) variation in barrier-grid transmission ratio, and (d) variations due to the beam position relative to the mesh holes when the beam covers few holes. By evaporation of a thin layer of MgF_2 on the mica target [13], the secondary emission can be made more uniform. At the same time the secondary-emission maximum occurs at a higher beam energy (2000 eV), which is desirable for reducing the spot size. By treatment of the barrier grid to make its maximum secondary-emission ratio equal to unity, disturbances caused by (b) can be minimized. By using barrier grids of sufficiently small mesh size, so that the primary beam covers a sufficient number of mesh holes, variations in output due to (d) can be minimized.

Another source of signal or background variation is shading due to defocusing of the deflected primary beam by the cylindrical lens action of the electrostatic deflection plates. This can be compensated by dynamic focusing signals applied to the focusing electrodes [8]. Additional improvement in focusing has also been obtained by making the control apertures of the gun (double-focusing type) elliptical in shape, with their major axes at right angles [5]. Another cause of shading is the finite angle of incidence of the primary beam at the target edges, causing charges to accumulate under the barrier-grid edges where secondaries cannot escape [8]. When the output is obtained from the collector, an additional form of shading occurs since the fraction of secondary electrons which reaches the collector varies over the target, causing variations in the output signal [8]. Further shading due to nonuniform collection of secondaries may also occur if the signal collector is surrounded by other anodes (not shown in Fig. 1), which are sometimes added to shield the collector [11] from deflection or input signals applied to the backplate.

For digital storage, experimental tubes have been operated with a capacity of about 16,000 bits with random access to each bit [5, 8]. A complete cycle of random access, reading, and regeneration at a particular spot has been accomplished in 2.5 μsec (400 kHz repetition rate). In applications where reading and regeneration are carried out many times at one spot, the fact that the primary beam has a bell-shaped Gaussian distribution of current density with respect to radius [8] gradually modifies the charge stored at neighboring elements because of the landing of low-level current from the primary beam. The degree to which this occurs is given by the "read-around number," which indicates the number of times reading and regeneration operations can be performed at a given element without destroying the stored information at an adjacent spot. (See Section A of the Appendix for a definition of this term.)

In digital-storage applications there may be certain advantages in obtaining the output signal from the target electrodes rather than the collector cylinder as shown in Fig. III-1. In collector reading, the output from a stored "0" and a "1" are of the same polarity, with the "1" producing a signal 30 to 50% larger [5]. In addition, because of shading effects that produce a variation in the "0" level, discrimination between the "0" and "1" may be further reduced. This problem can be avoided if the output signal is taken from the barrier-grid–backplate electrodes as discussed by Hines *et al.* [8] and Jensen [9]. In such a reading method, the net output current in reading a "0" is close to zero, while a much larger current is obtained in reading a "1," making the discrimination between the two more reliable.

It is important to note that in equilibrium writing (for example, signal-comparison applications) complete shift of target elements to equilibrium is frequently not obtained even with relatively high beam currents, since the net current reaching the target decreases as the equilibrium potential is approached (i. e., $\delta_c \rightarrow 1$). A measure of the degree to which equilibrium is reached is given by the "discharge factor" (see Sections II,A,2 and II,B,2), which depends on factors such as the scanning speed, beam current, and target capacitance, as well as the target potential before bombardment. In the Radechon the "discharge factor" may vary from 0.6 to 0.95, for example, depending on the operating conditions, so that the signal output and operation which would occur under idealized equilibrium writing conditions may be significantly modified.

Typical commercial Radechons are the following: RCA 6499; Westinghouse 7225, 7566; E.M.I. 9511A; DuMont K1326, K1327, and K1584.

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