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**VARIAN ASSOCIATES
ENGINEERING REPORT**

COPY NO. 11
JANUARY 1953

PROGRESS REPORT

DEVELOPMENT OF KLYSTRON

OSCILLATORS V-39 AND V-40

For Period: 1 October to 31 October 1952

Prepared for

Bureau of Ships

Navy Department

on

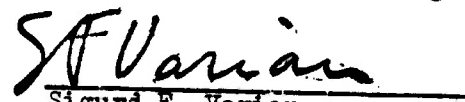
BUSHIPS CONTRACT NObsr-52105
Index No. NE 110244

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PURPOSE

The purpose of the program engaged under BuShips Contract No. N0bsr-52105 is to design and develop two wide-range klystron oscillators, V-39 and V-40, which will comply with the specifications outlined in this contract.

The two oscillators will cover the frequency band from 10 to 21 kmc. One tube will tune over the lower half of the band from 10 to 15.5 kmc, and the other will cover the band from 15 to 21 kmc. Preliminary design tubes of each type, complete with electrical test and characteristic data, will be furnished. In addition, five tubes embodying the final design of each type will be supplied, along with electrical characteristics and test data, final proposed specifications, and manufacturing drawings.

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PROGRESS

During the period covered by this report, the first single plunger, externally tuned tube to cover approximately the frequency range of the V-39 tube was constructed. This tube, shown in Figure 1, was built along the lines of the Varian type V-52 tube (BuShips Contract NObsr-52503). It is a two-window tube, with one of the windows almost as wide as the inside diameter of the tube cavity. This window is coupled to a section of WR-75 waveguide which contains a shorting plunger to tune the tube. The other window is smaller and is used to couple energy to the output waveguide. The half-cavity within the tube is 0.436 inch in diameter and 0.051 inch high. The drift tube is 0.080 inch in diameter.

The tube is designed with an electron gun that has a perveance of approximately 1.5. The tube normally operates at a beam voltage of 750 volts and beam current of 26 ma. In addition, the cathode and reflector have focus rings, the voltage of which can be varied independently to optimize the power output. For the data taken, the reflector focus ring was adjusted for optimum power and the cathode focus ring was at cathode potential. The tube, waveguide portion of cavity, shorting plunger, and tuner used in these measurements are shown in Figures 2 and 3.

This tube initially tuned over a range of 10.3 to 18.6 kmc using various cavity modes and reflector modes. From the data obtained, the cavity and reflector modes were identified. A power of at least 25 mw was obtained over the frequency range from 10.6 to 17.0 kmc, using the 3-3/4 and 4-3/4

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cycle reflector modes and the full-wave cavity mode. In the 3-3/4 cycle reflector mode, 60 mw power output was obtained at 12.4 kmc, and in the 4-3/4 cycle mode, 55 mw was obtained at 15.0 kmc. Power output and tuning curves are shown in Figures 4 and 5 respectively.

Work on the tube with the 0.080-inch drift space and re-entrant reflector shell mentioned in the previous report¹ has been suspended in this program, pending performance results from tubes now under test. Meanwhile, this tube is being investigated under the development program for the V-33 tube (Contract DA 36-039 sc-149).

- - - - -

- 1 Varian Associates Engineering Report, NObsr-52105, 1 September to 30 September 1952.

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PROGRAM FOR NEXT INTERVAL

In November, additional tests will be performed on the tube completed this month. A second tube, similar to this tube, will also be constructed. The latter tube will have, in addition to the focus ring on the cathode and reflector, a cathode which can be moved to center the beam and change the perveance.

Actual expenditures during October 1952:	\$4,625.68
Actual man-hours during October 1952:	419

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FIGURE 1
FIRST SINGLE PLUNCER, EXTERNALLY TUNED V-39 TUBE

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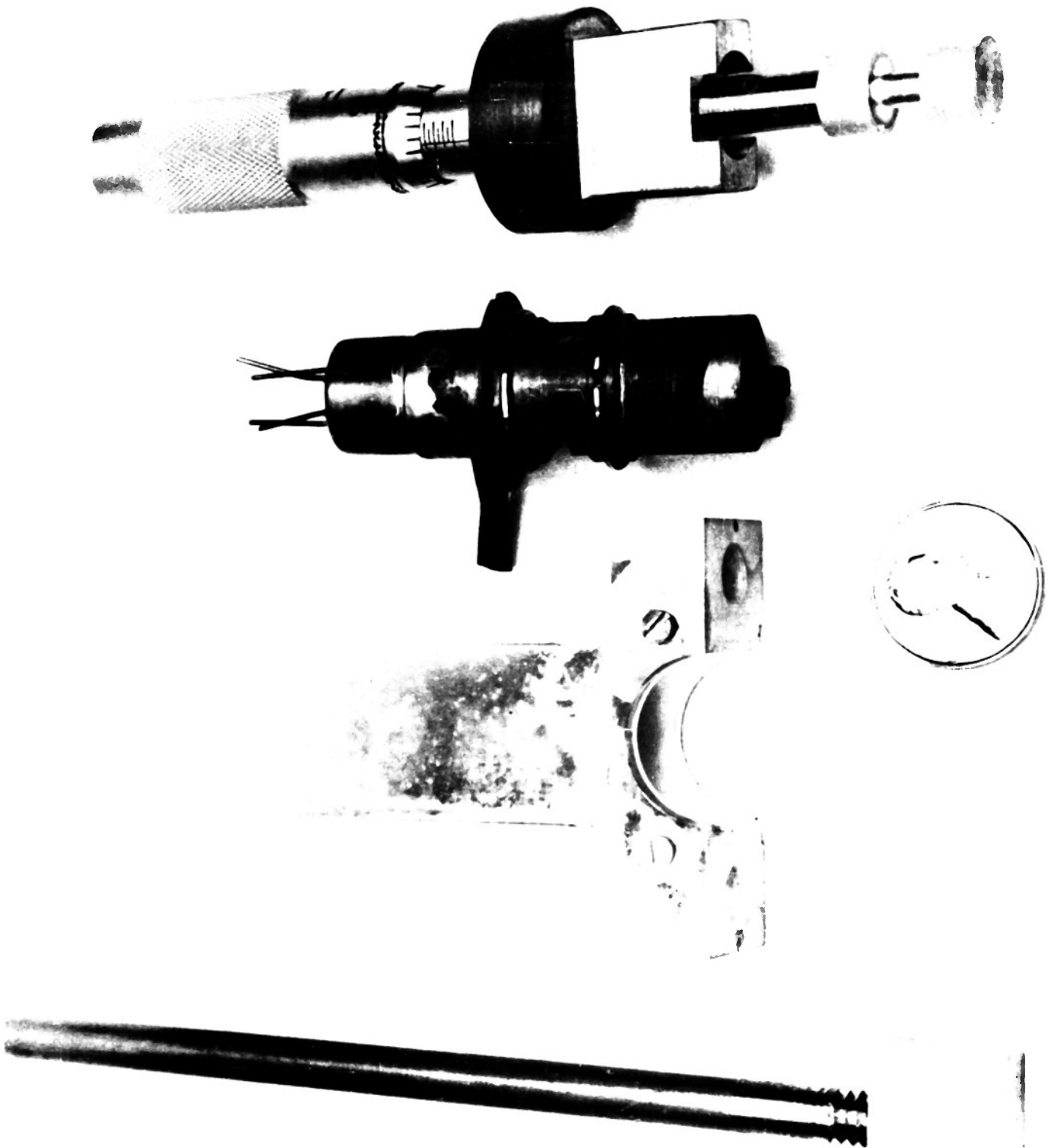


FIGURE 2
SINGLE PLUNGER V-39 TUBE WITH WAVEGUIDE PORTION OF CAVITY, SHORTING PLUNGER, AND TUNER

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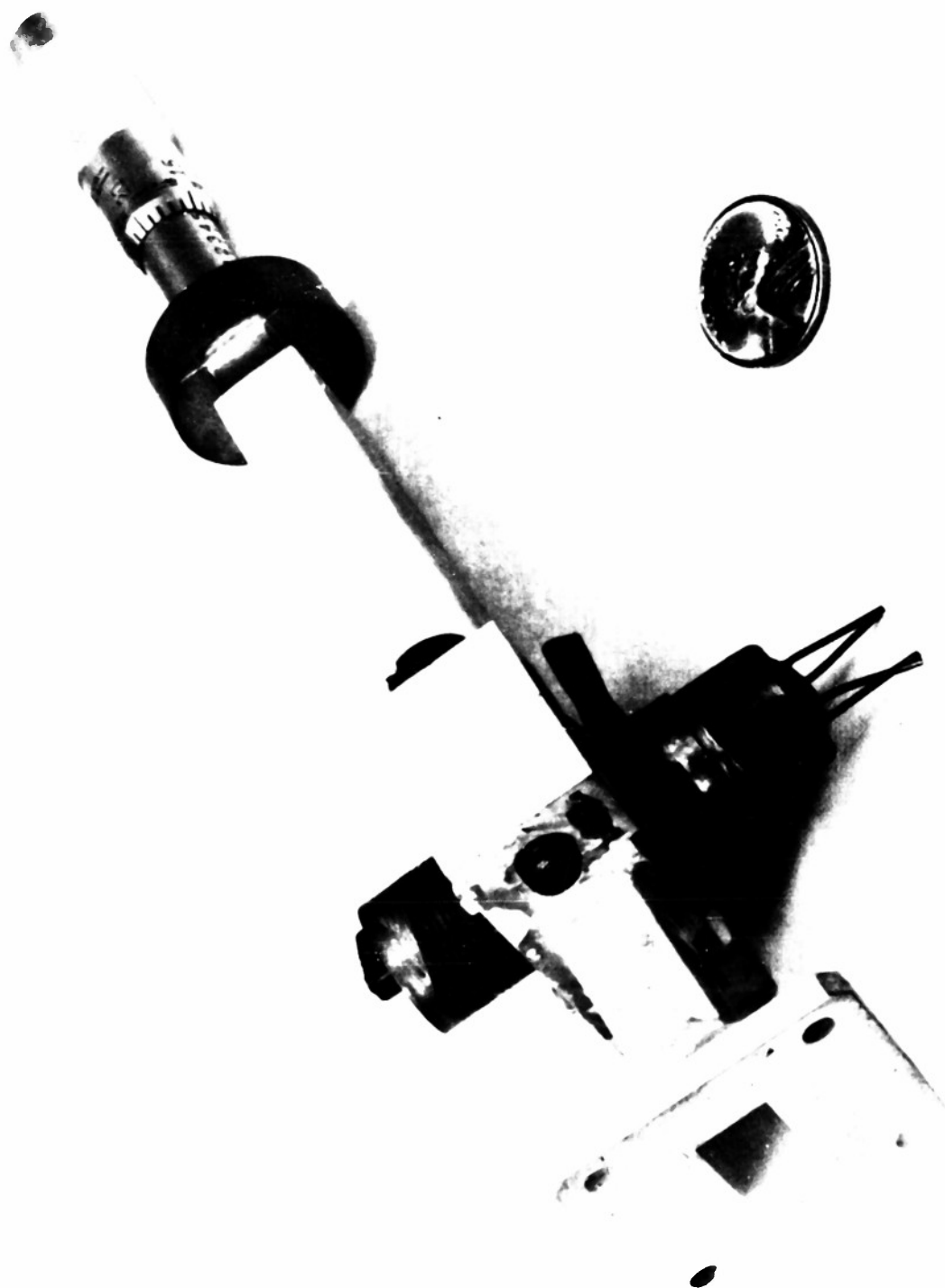


FIGURE 3
ASSEMBLED V-39 TUBE, WAVEGUIDE PORTION OF CAVITY, SHORTING PLUNGER, AND TUNER

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Beam Voltage = 750 v

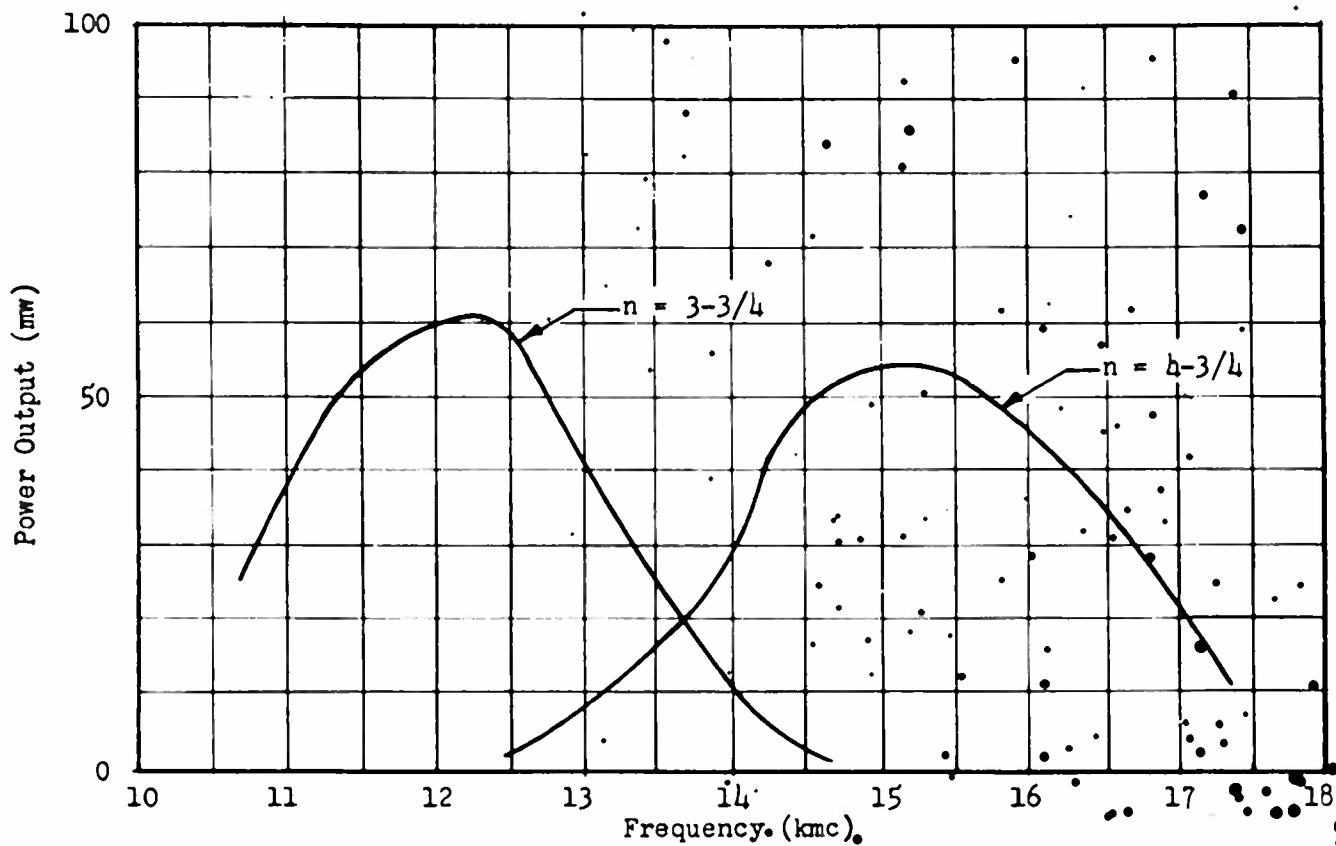


FIGURE 4
POWER OUTPUT vs. FREQUENCY
FOR SINGLE PLUNGER V-39 TUBE

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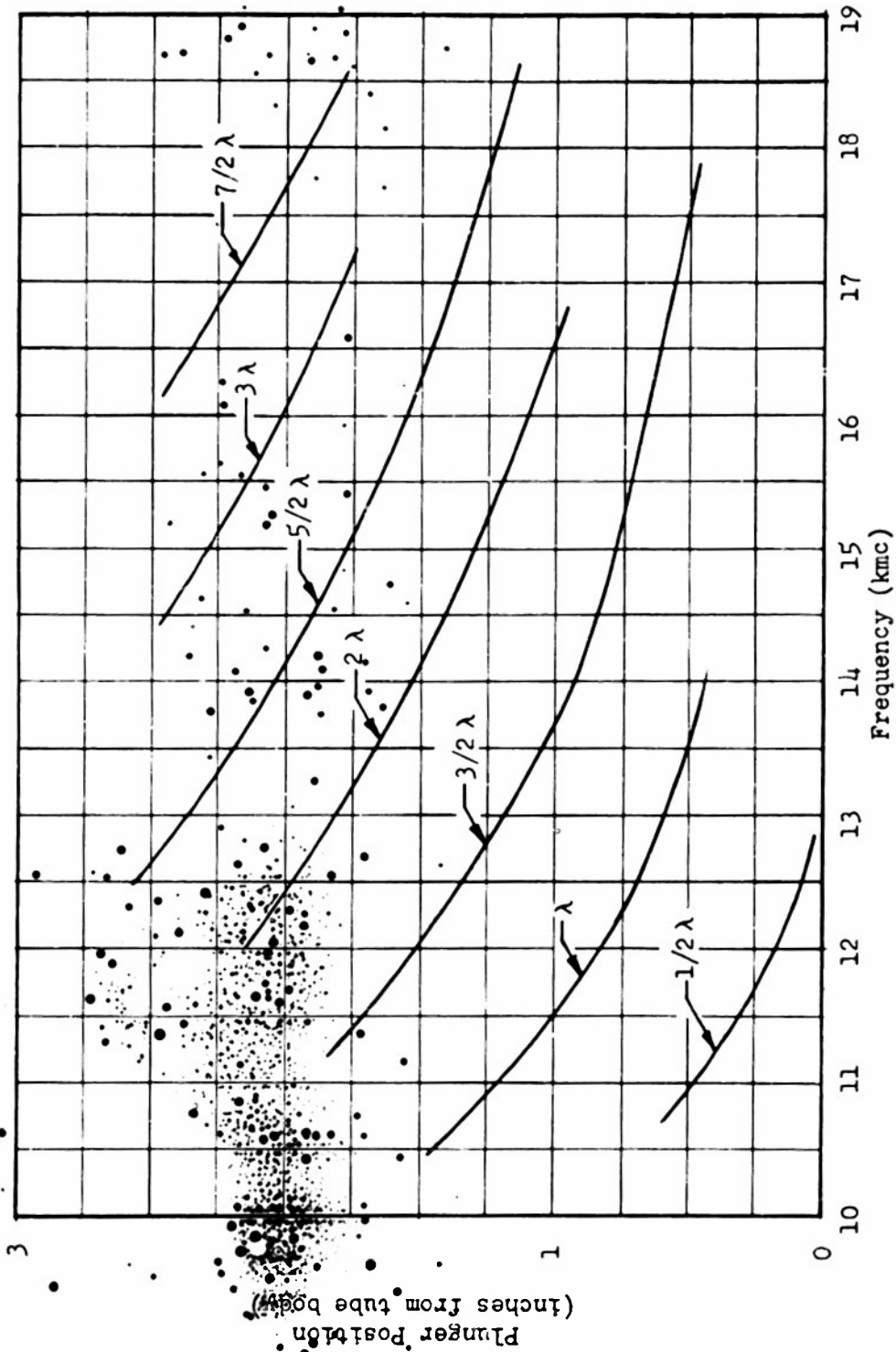


FIGURE 5
TUNING CURVE FOR SINGLE PLUNGER V-39 TUBE

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Contract No. NObsr-52105(1733)- Index No. NE 110244

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Subject: Development of Two Wide Range Reflex Oscillator Tubes V-39, V-40

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