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### An improved power supply for the Sutton tube National Research Council of Canada. Radio Section

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**AN IMPROVED POWER SUPPLY  
FOR THE SUTTON TUBE**

**OTTAWA**

**FEBRUARY, 1942**

**SECRET**

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### AN IMPROVED POWER SUPPLY FOR THE SUTTON TUBE

The type 8 Sutton tube requires a well-regulated supply which will deliver about 5 milliamperes at voltages ranging from approximately 1500 volts to 2500 volts. This wide range is required to cover the frequency range of the Sutton tube. If only a single frequency is used, the voltage range need just be large enough to accommodate the differences in characteristics of individual tubes. Since the variable voltage is applied between ground and the cathode, which draws the total tube current, it is more convenient to make the voltage source variable than to use a voltage divider.

Since the output of the Sutton tube is quite critical with respect to applied voltage, the supply must be regulated to allow for changing line voltages. Moreover, at voltages just above the points of maximum oscillation, the tube has a negative resistance which may amount to -50,000 ohms. To give continuous voltage control, the supply must have an output impedance lower than this value, and preferably much lower.

The power supply circuit shown in Dwg. #226 attached to this report has the following features:

1. Voltage output can be varied, by means of single control, from 1600 volts to 2600 volts.
2. 50 to 1 stabilization. Percentage variation in output due to line voltage fluctuation is  $1/50$  or less of the percentage variation in line voltage. Voltage changes by a factor of 2 in the rectifier output can be controlled. (See Dwg. #227 attached to this report).
3. Dynamic filtering makes the power supply simple in construction. A.C. ripple in the output is less than 1 volt.
4. Output impedance (measured) is 150 ohms. Since the actual cathode-to-anode voltage of the Sutton tube is regulated, this low output impedance is the effective impedance in series with the tube.

The good regulation obtained in this circuit is due to the novel two-tube feedback regulating amplifier which gives high gain with a single voltage source and is designed to pass

a constant-total current through the two tubes. Thus the current through the VR150 tube is independent of the load, and the finite resistance of the VR150 does not affect the regulation.

5. A variable positive voltage is available for the reflector of the Sutton tube. This voltage is necessary for optimum operation.
6. Grid voltage of the Sutton tube is controlled by a potentiometer ganged to the high voltage control in such a way that the beam current is reduced as the high voltage increases, keeping the power dissipation approximately constant. (See Dwg. #228 attached to this report). This makes it impossible to overload the tube. A second independent grid control is provided to reduce the power below the maximum value, if desired.

The following drawings are attached to this report:

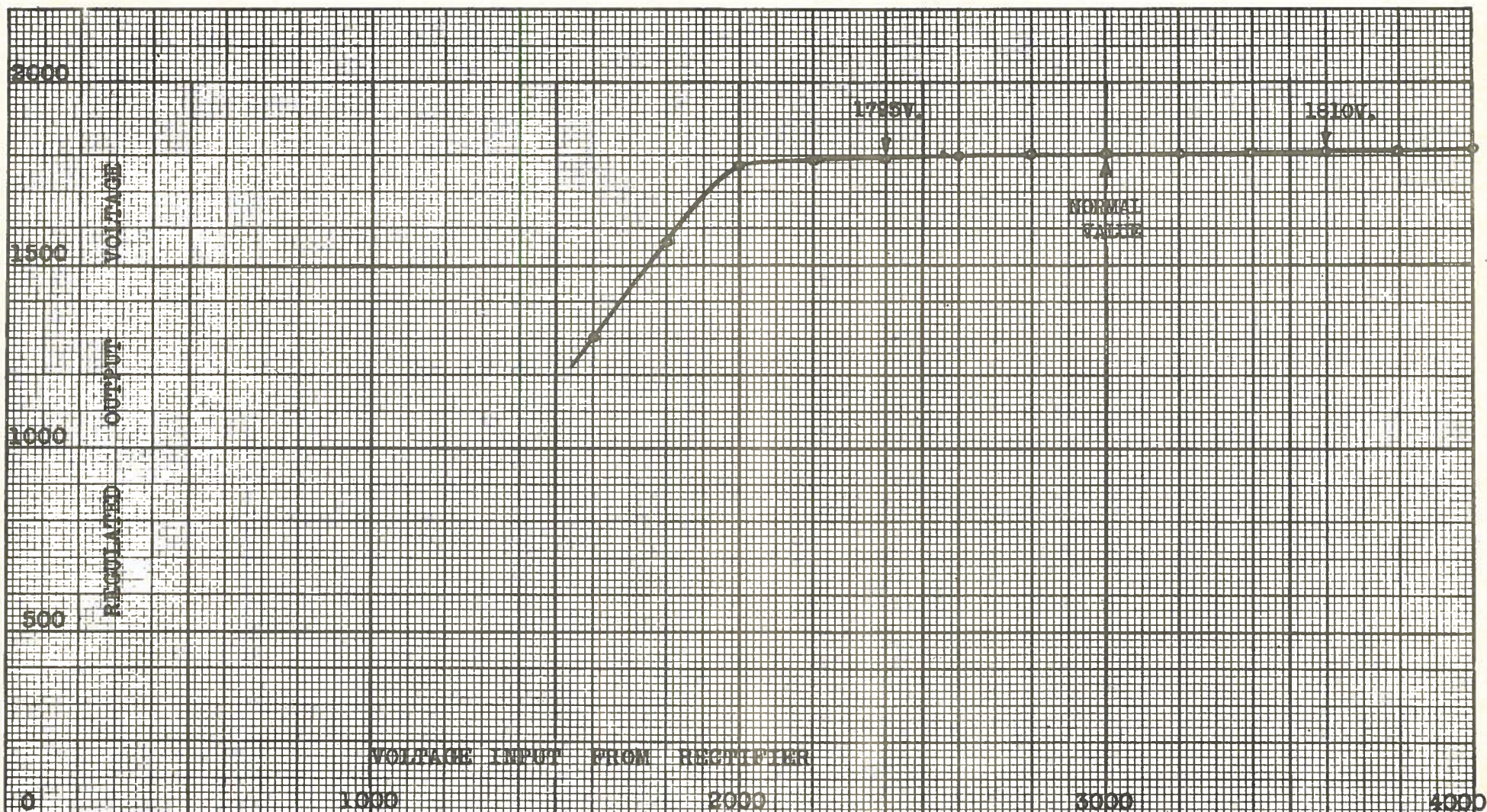
	<u>Ref. #</u>
Sutton Tube Power Supply - Schematic ...	226
Regulation Characteristic .....	227
Regulation of Maximum Beam Current and Power .....	228

R.B. NELSON.



REF. #226





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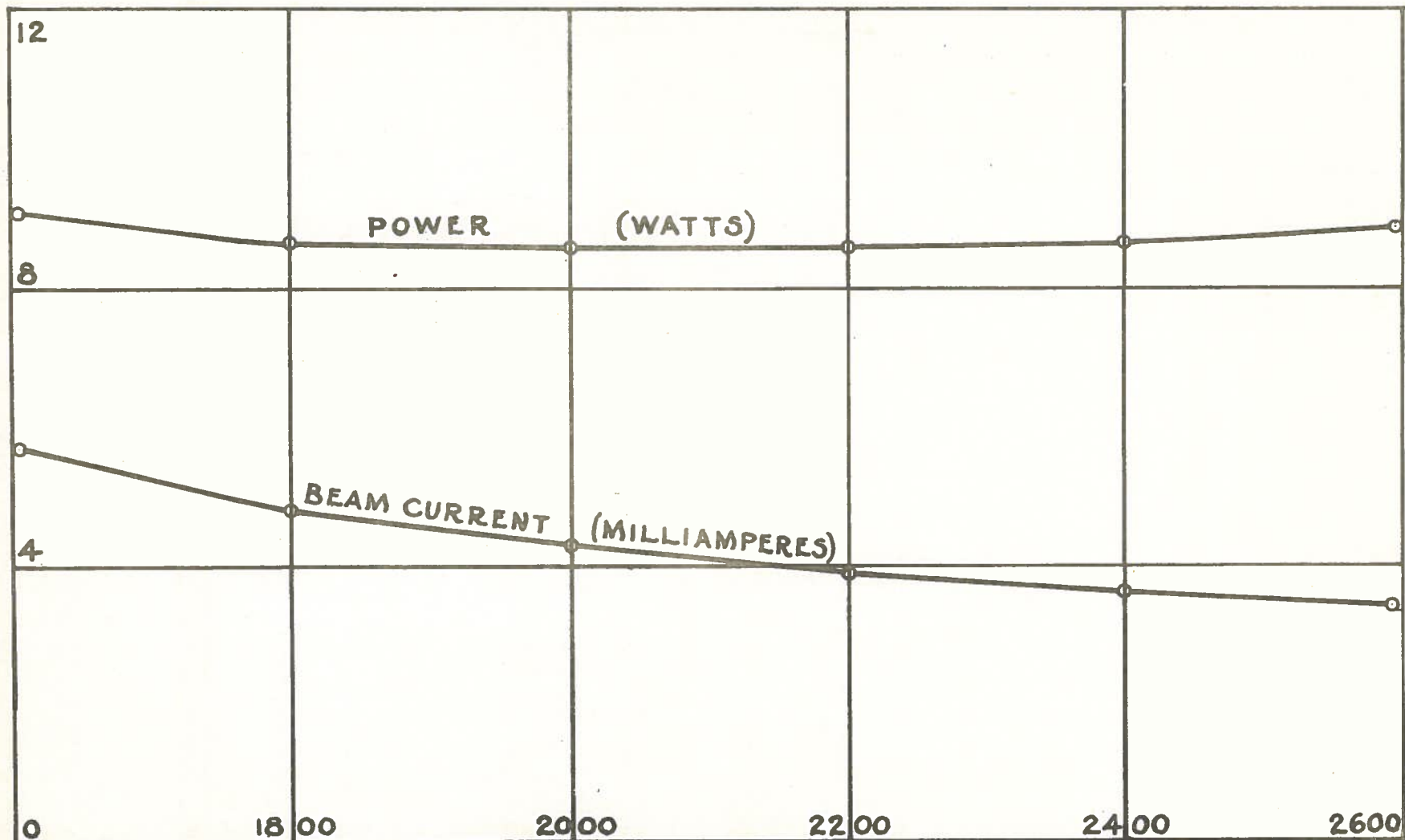
National Research Council - Radio Section  
Ottawa - Canada

Title: REGULATION CHARACTERISTIC  
Approved by: R.B.N.

REF. 4227



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VOLTAGE ON SUTTON TUBE.

National Research Council - Radio Section - Ottawa

Title: REGULATION OF MAXIMUM BEAM CURRENT AND  
POWER.

Approved by *R. B. Nelson*

REF.#228