RCA RADIOTRON COMPANY, INC.

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ENGINEERING SERVICE DIVISION

APPLICATION NOTE No. 41

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APPLICATION NOTE ON THE 1C6

The 1C6 is a pentagrid converter of the two-volt filament type. It is particularly designed for use in two-volt, battery-operated, superheterodyne receivers in which it performs the functions of mixer and oscillator.

This tube which is similar to the 1A6 although not directly interchangeable with it, requires twice the filament current of the latter but offers the feature of an extended operating range at the shorter wavelengths. This feature is of particular value in the design of multirange receivers, since the oscillator section of the 1C6 has sufficient mutual conductance to function at frequencies as high as 25 megacycles. In order to cover this same range of operation, the 1A6 requires for frequencies above 10 megacycles the use of a triode connected in parallel with the oscillator section. The 1C6 is, therefore, to be preferred for multirange receivers, since these may be designed to cover frequencies from about 20 megacycles to 150 kilocycles or lower.

The oscillator section of the 1C6 has a mutual conductance of 1000 micromhos (when not oscillating) and an anode-grid current of 4.9 milliamperes, whereas the 1A6 has corresponding values of 425 micromhos and 2.3 milliamperes, respectively. This comparison is made under the voltage conditions of 180 plate volts, 67.5 screen volts, 135 anode volts (no dropping resistor), and zero oscillator-grid volts.

Figure 1 shows conversion transconductance and also total cathode current versus oscillator-grid current (I_{c1}). The maximum conversion transconductance is obtained with an oscillator-grid current of slightly less than 0.2 milliampere. This value should be borne in mind when the oscillator-grid and plate coils, L_2 and L_3 of Figure 3, are wound. Their coupling should be adjusted to make I_{c1} approximately 0.2 milliampere when a grid condenser of 250 μμf and a grid leak of 50,000 ohms are used.

Figure 2 shows the conversion transconductance and also plate resistance versus control-grid voltage E_{c4}. The control grid is of the remote cut-off type. This characteristic may be employed to supplement the control on the amplifier stages. These r-f and i-f stages should use the 34, a tube also of the remote cut-off type which can be connected to receive AVC voltage for volume control. For the 34, cut-off occurs at -22.5 volts with 67.5 volts on the screen and for the 1C6, at -14 volts with 67.5 volts on grids 3 and 5.

Figure 3 shows a typical circuit for the 1C6 as a pentagrid converter. Typical operating voltages and currents for converter service follow.

Plate Voltage	180 max.	Volts
Screen (Grids #3 and #5) Voltage	67.5 max.	Volts
Anode-Grid (Grid #2) Voltage	135 max.	Volts
Anode-Grid Supply*	180 max.	Volts
Control-Grid (Grid #4) Voltage	-3 min.	Volts
Total Cathode Current	9 max.	Milliamperes

Typical Operation:			
Filament Voltage (D.C.)	2.0	2.0	Volts
Filament Current	0.12	0.12	Amperes
Plate Voltage	135	180	Volts
Screen (Grids #3 and #5) Voltage	67.5	67.5	Volts
Anode-Grid (Grid #2) Supply	135*	180*	Volts
Control-Grid (Grid #4) Voltage	-3	-3	Volts
Oscillator-Grid (Grid #1) Resistor	50000	50000	Ohms
Plate Resistance	0.55	0.75	Megohm
Conversion Conductance	300	325	Micromhos
Conversion Conductance at -14 Volts Bias on Grid #4	4	4	Micromhos
Plate Current	1.3	1.5	Milliamperes
Screen Current (approximate)	2	2	Milliamperes
Anode-Grid Current	2.6	3.3	Milliamperes
Oscillator-Grid Current	0.2	0.2	Milliamperes
Total Cathode Current (Approximate)	6.5	7	Milliamperes

*Applied through 20000-ohm dropping resistor.

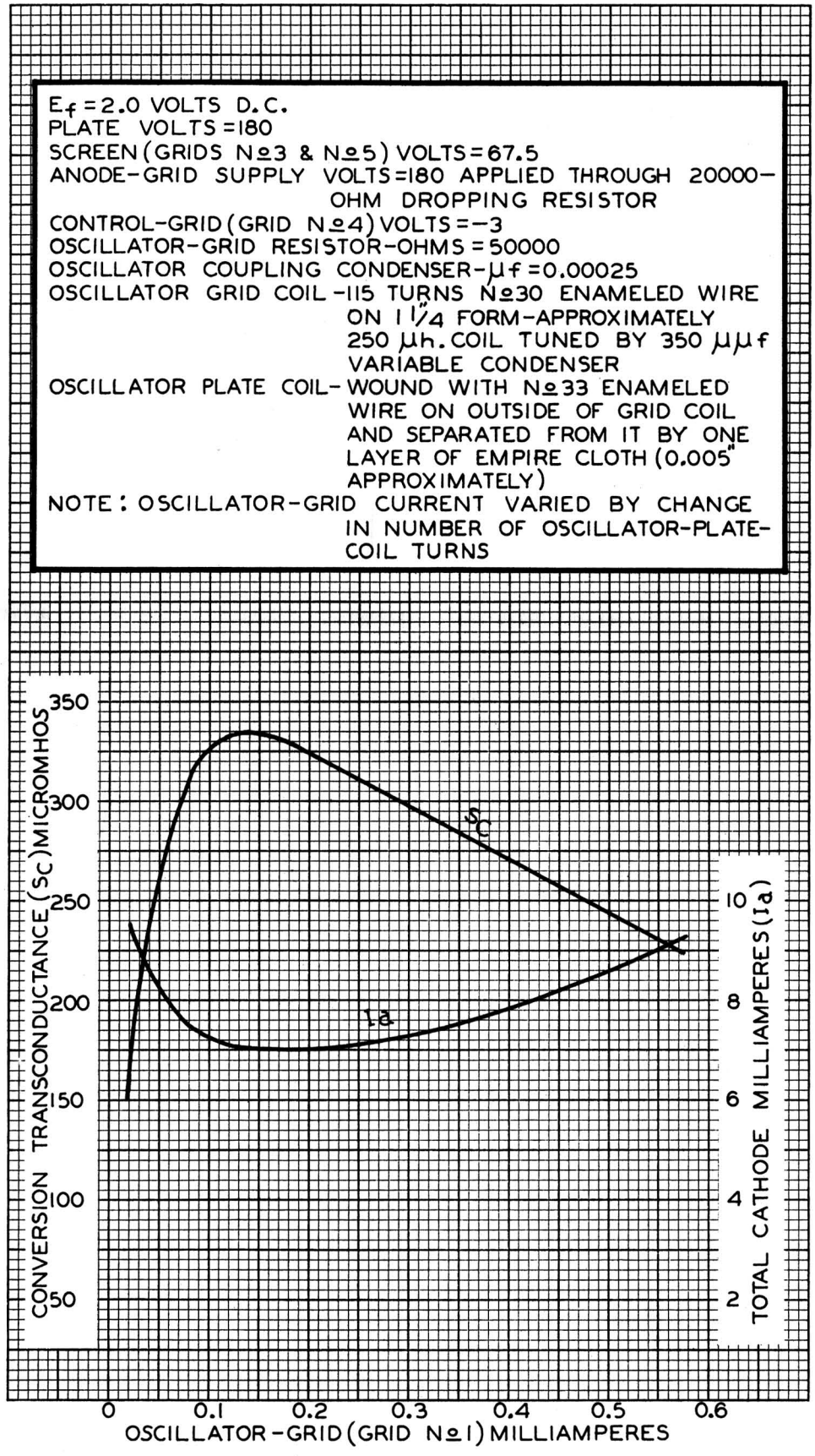
Direct Interelectrode Capacitances (Approx.):			
Grid #4 to Plate	(With shield-can) 0.3		uuf
Grid #4 to Grid #2	(With shield-can)	0.3	uuf
Grid #4 to Grid #1	(With shield-can)	0.15	uuf
Grid #1 to Grid #2		1.5	uuf
Grid #4 to all other Electrodes (R-F input)		10	uuf
Grid #2 to all other Electrodes (Osc. output)		6	uuf
Grid #1 to all other Electrodes (Osc. input)		6	uuf
Plate to all other Electrodes (Mixer output)		10	uuf

RCA Cunningham Radiotron RADIO TUBES

RCA-1C6

OPERATION CHARACTERISTICS

E_f = 2.0 VOLTS D.C.
PLATE VOLTS = 180
SCREEN (GRIDS No 3 & No 5) VOLTS = 67.5
ANODE-GRID SUPPLY VOLTS = 180 APPLIED THROUGH 20000-OHM DROPPING RESISTOR
CONTROL-GRID (GRID No 4) VOLTS = −3
OSCILLATOR-GRID RESISTOR-OHMS = 50000
OSCILLATOR COUPLING CONDENSER-μf = 0.00025
OSCILLATOR GRID COIL - 115 TURNS No 30 ENAMELED WIRE ON 1 1/4 FORM - APPROXIMATELY 250 μh. COIL TUNED BY 350 μμf VARIABLE CONDENSER
OSCILLATOR PLATE COIL - WOUND WITH No 33 ENAMELED WIRE ON OUTSIDE OF GRID COIL AND SEPARATED FROM IT BY ONE LAYER OF EMPIRE CLOTH (0.005" APPROXIMATELY)
NOTE: OSCILLATOR-GRID CURRENT VARIED BY CHANGE IN NUMBER OF OSCILLATOR-PLATE-COIL TURNS



JUNE 18, 1934

FIG. 1

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RCA Cunningham Radiotron RADIO TUBES

RCA-1C6

OPERATION CHARACTERISTICS

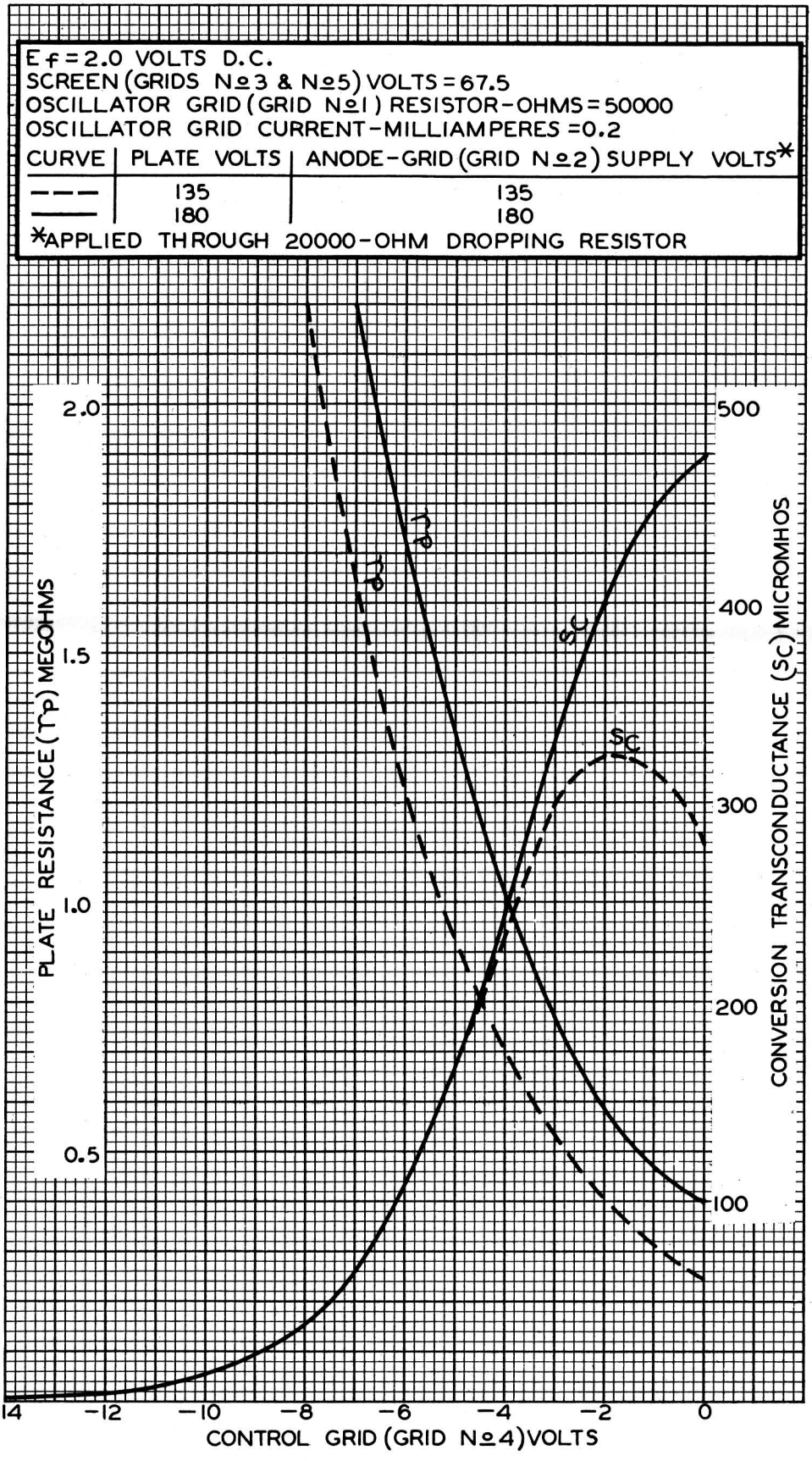

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FIG. 2

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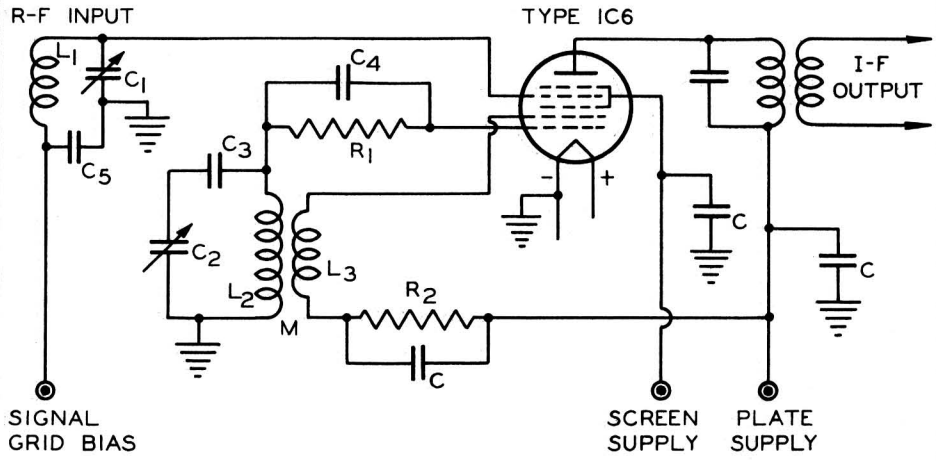
RCA Cunningham Radiotron RADIO TUBES

RCA-IC6

TYPICAL PENTAGRID CONVERTER CIRCUIT



C = 0.1 μf.
C1 = } GANGED VARIABLE CONDENSERS
C2 = }
C3 = PADDING CONDENSER
C4 = GRID CONDENSER – 250 μμf.
C5 = BLOCKING CONDENSER – 0.05 μf.
L2 = OSCILLATOR GRID INDUCTANCE
L3 = OSCILLATOR PLATE INDUCTANCE
M = MUTUAL INDUCTANCE OF L2 AND L3
R1 = OSCILLATOR GRID RESISTOR – 50000 OHMS
R2 = VOLTAGE DROPPING RESISTOR – 20000 OHMS

NOTE: VOLTAGE APPLIED TO ANODE-GRID (GRID Nº 2) SHOULD BE HIGHER THAN THAT ON SCREEN (GRIDS Nº 3 & Nº 5)

FIG. 3