RCA-19X8 is a multi-unit tube of the 9-pin miniature type containing a medium-mu triode and a sharp-cutoff pentode in one envelope. It is designed primarily for use as a combined oscillator and mixer tube in "transformerless" AM/FM receivers. The 19X8 has a 150-milliampere heater which permits series-string heater operation with other tubes having 150-milliampere heaters.

The pentode mixer unit of the 19X8 provides low grid-No.1-to-plate capacitance as compared with a triode mixer and also has low output capacitance. The low value of capacitance between grid No.1 and plate minimizes feedback problems often encountered in mixer circuits operating into high-impedance plate loads. The low value of output capacitance enables the tube to work into a high-impedance plate circuit with resultant increase in mixer gain.

The 19X8 offers versatility to designers of AM/FM receivers. In the AM section, the pentode unit may be used as a pentode mixer to provide high gain; in the FM section, the pentode unit may be used either as a pentode mixer or as a triode-connected mixer depending on signal-to-noise considerations. Because triode mixers have relatively low equivalent noise resistance, they are preferred for receiver designs which do not include an rf stage. For receiver designs with an rf stage, a pentode mixer not only provides higher gain but better performance because in such designs the noise introduced by the mixer is negligible. For both the AM and the FM sections, the triode unit of the 19X8 makes a satisfactory oscillator.

**GENERAL DATA**

**Electrical:**
Heater, for unipotential Cathode: 16.9 volts
Voltage (AC or DC) 1.15 ampere

Direct interelectrode Capacitances:

<table>
<thead>
<tr>
<th>Without External Shield</th>
<th>With External Shield#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triode Unit: Grid to Plate</td>
<td>1.4 ( \mu )f</td>
</tr>
<tr>
<td>Input:</td>
<td>2.0 ( \mu )f</td>
</tr>
<tr>
<td>Output:</td>
<td>0.5 ( \mu )f</td>
</tr>
<tr>
<td>Pentode Unit: Grid No.1 to Plate:</td>
<td>0.09 max. ( \mu )f</td>
</tr>
<tr>
<td>Input:</td>
<td>4.3</td>
</tr>
<tr>
<td>Output:</td>
<td>0.7</td>
</tr>
<tr>
<td>Pentode Grid No.1 to Triode Plate:</td>
<td>0.045 max. ( \mu )f</td>
</tr>
<tr>
<td>Pentode Plate to Triode Plate:</td>
<td>0.040 max. ( \mu )f</td>
</tr>
</tbody>
</table>

**Direct Interelectrode Capacitances (Cont’d):**

<table>
<thead>
<tr>
<th>Without External Shield</th>
<th>With External Shield#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input:</td>
<td>3.0 ( \mu )f</td>
</tr>
<tr>
<td>Output:</td>
<td>1.6 ( \mu )f</td>
</tr>
</tbody>
</table>

**Characteristics:**

**Triode Unit:**
Plate Voltage: 100 volts
Cathode-Bias Resistor: 100 ohms
Amplification Factor: 40
Plate Resistance (Approx.): 6900 ohms
Transconductance: 5800 \( \mu \)hos
Grid-No.1 Bias (Approx.): 8.5 ma
For Plate Current of 10 \( \mu \)amp: -10 volts
Plate Current: 8.5 ma

**Pentode Unit:**
Plate Voltage: 250 volts
Grid No.3 (Suppressor) Connected to Cathode at Socket
Grid-No.2 Voltage: 150 volts
Cathode-Bias Resistor: 250 ohms
Plate Resistance (Approx.): 7500 ohms
Transconductance: 4600 \( \mu \)hos
Grid-No.1 Bias (Approx.): 7.7 ma
For Plate Current of 10 \( \mu \)amp: 150 volts
Plate Current: 7.8 mA

**CONVERTER SERVICE**

**Maximum Ratings, Design-Center Values:**

**Triode Unit as Oscillator**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>250 max. volts</td>
</tr>
<tr>
<td>Grid Voltage (Positive bias value)</td>
<td>40 max. volts</td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td>1.5 max. watts</td>
</tr>
<tr>
<td>Grid Input</td>
<td>0.5 max. watt</td>
</tr>
<tr>
<td>Peak Heater-Cathode Voltage</td>
<td>110 volts</td>
</tr>
</tbody>
</table>

**Pentode Unit as Mixer**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>250 max. volts</td>
</tr>
<tr>
<td>Grid-No.3 (Suppressor) Voltage</td>
<td>0 max. volts</td>
</tr>
<tr>
<td>Grid-No.3 Supply Voltage</td>
<td>250 max. volts</td>
</tr>
<tr>
<td>Grid-No.2 Supply Voltage</td>
<td>See Fig.1</td>
</tr>
<tr>
<td>Grid-No.1 (Control-Grid) Voltage: Negative bias value</td>
<td>40 max. volts</td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td>0.0 max. watts</td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td>2.0 max. watts</td>
</tr>
<tr>
<td>Grid-No.2 Input</td>
<td>0.4 max. watt</td>
</tr>
<tr>
<td>Peak Heater-Cathode Voltage: Heater negative with respect to cathode</td>
<td>100 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>100 max. volts</td>
</tr>
</tbody>
</table>

**TUBE DEPARTMENT**

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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19X8-5-52
Pentode Unit as Triode-Connected Mixer

Plate Voltage: 250 max. volts
Grid No. 1 (Control-Grid) Voltage: Positive bias value: 40 max. volts
Negative bias value: 0 max. volts
Plate Dissipation: 2.4 max. watts
Peak Heater-Cathode Voltage:
Heater negative with respect to cathode: 100 max. volts
Heater positive with respect to cathode: 100 max. volts

Typical Operation:

Triode Unit as 250-Ne Oscillator:
Plate Voltage: 150 volts
Grid Resistor: 2700 ohms
Plate Current: 13 ma
Grid Current: 3.6 ma
Power Output (Approx.): 0.5 watt

Pentode Unit as Mixer:
Plate Voltage: 150 volts
Grid No. 3 (Suppressor): Connected to Cathode at Socket
Grid No. 2 Voltage: 150 volts
Mixer Grid-No. 1 Supply Voltage: -3.5 volts
Oscillator Voltage at Grid No. 1: 2.6 rms volts
Mixer Grid-No. 1-Circuit Resistance: 120000 ohms
Conversion Transconductance: 2100 \mu mhos
Plate Current: 6.2 ma
Grid-No. 2 Current: 1.8 ma
Grid-No. 1 Current: 2.0 \mu mmp

Pentode Unit as Triode-Connected Mixer:
Plate Voltage: 150 volts
Grid-No. 1 Supply Voltage: -3.5 volts
Oscillator Voltage at Grid No. 1: 2.6 rms volts
Grid-No. 1-Circuit Resistance: 120000 ohms
Conversion Transconductance: 2800 \mu mhos
Plate Current: 7.8 ma
Grid-No. 1 Current: 2.0 \mu mmp

Maximum Circuit Values:
Grid-No. 1-Circuit Resistance:
For fixed-bias operation: 0.1 max. megohm
For cathode-bias operation: 0.5 max. megohm

* According to RTMA Standard ET-109A with external shield No. 315 tied to cathode.
▲ Grid No. 3 connected to cathode; grid No. 2 connected to plate.
★ With separate excitation and triode unit grounded.
● In FM receivers, it is generally desirable to operate the oscillator with less power input than shown in the tabulated data in order to avoid over excitation and excessive oscillator radiation.

Operating Considerations

The maximum ratings in the tabulated data for the 1928 are working design-center maximums established according to the standard design-center system of rating electron tubes. Tubes so rated will give satisfactory performance in equipment designed so that these maximum ratings will not be exceeded when the equipment is operated from ac or dc power-line supplies whose normal voltage including normal variations fall within ± 10 per cent of line-center voltage value of 91 volts.

When the 1928 is used as the converter in AM broadcast receivers, it is important that the tuned plate-load impedance of the first if coil does not exceed 25000 ohms. Any higher value will cause excessive degeneration due to the feedback in the pentode mixer unit.
Fig. 1 - Grid-No. 2 Input Rating Curve of Type 19X8.

Fig. 2 - Average Plate Characteristics of 19X8 Triode Unit.
Fig. 3 - Average Plate Characteristics of 19X8 Pentode Unit.

Fig. 4 - Average Plate Characteristics of 19X8 Pentode Unit Connected as Triode.
Fig. 5 – Operation Characteristic with Separate Oscillator Excitation of 19X8 Pentode Unit.

Fig. 6 – Operation Characteristic with Separate Oscillator Excitation of 19X8 Pentode Unit.
Fig. 7 - Average Characteristic of 19X8
Pentode Unit Connected as Triode.