Description: Triode pentode; triode section for use as A.F. amplifier; pentode section for use as A.F. output tube.

MECHANICAL DATA

- Cathode: coated, unipotential
- Base: E9-1
- Bulb: T6 1/2
- Outline: 6-4
- Basing: 9EX
- Mounting position: any

TUBE OUTLINE

BOTTOM VIEW

BASE PIN

ELEMENT

<table>
<thead>
<tr>
<th>No.</th>
<th>Triode grid</th>
<th>Pentode cathode and grid No. 3, internal shield</th>
<th>Pentode grid No. 1</th>
<th>Heater</th>
<th>Heater</th>
<th>Pentode plate</th>
<th>Grid No. 2</th>
<th>Triode cathode</th>
<th>Triode plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
</tr>
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<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>5</td>
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</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>7</td>
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<td></td>
<td></td>
<td></td>
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<td>8</td>
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<tr>
<td>9</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

HEATER DATA

- Heater voltage: 32 volts
- Heater current: 150 maams

DIRECT INTERELECTRODE CAPACITANCES

<table>
<thead>
<tr>
<th>Triode section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid to all other elements except plate</td>
</tr>
<tr>
<td>Plate to all other elements except grid</td>
</tr>
<tr>
<td>Plate to grid</td>
</tr>
<tr>
<td>Grid to heater</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pentode section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid No. 1 to all other elements except plate</td>
</tr>
<tr>
<td>Plate to all other elements except grid No. 1</td>
</tr>
<tr>
<td>Plate to grid No. 1</td>
</tr>
<tr>
<td>Grid No. 1 to heater</td>
</tr>
</tbody>
</table>
DIRECT INTERELECTRODE CAPACITANCES (continued)

Between triode and pentode section

<table>
<thead>
<tr>
<th>Capacitance Description</th>
<th>Max. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triode plate to pentode grid No. 1</td>
<td>0.02 µF</td>
</tr>
<tr>
<td>Triode grid to pentode plate</td>
<td>0.02 µF</td>
</tr>
<tr>
<td>Triode grid to pentode grid No. 1</td>
<td>0.025 µF</td>
</tr>
<tr>
<td>Triode plate to pentode plate</td>
<td>0.25 µF</td>
</tr>
</tbody>
</table>

MAXIMUM RATINGS (design center values)

Pentode section

<table>
<thead>
<tr>
<th>Specification Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate voltage without plate current</td>
<td>550 volts</td>
</tr>
<tr>
<td>Plate voltage</td>
<td>250 volts</td>
</tr>
<tr>
<td>Plate dissipation</td>
<td>7 watts</td>
</tr>
<tr>
<td>Grid No. 2 voltage without current</td>
<td>550 volts</td>
</tr>
<tr>
<td>Grid No. 2 voltage</td>
<td>250 volts</td>
</tr>
<tr>
<td>Grid No. 2 dissipation</td>
<td>1.8 watts</td>
</tr>
<tr>
<td>Peak grid No. 2 dissipation</td>
<td>3.2 watts</td>
</tr>
<tr>
<td>Cathode current</td>
<td>50 mamps</td>
</tr>
<tr>
<td>Grid No. 1 circuit resistance with automatic bias</td>
<td>2 megohms</td>
</tr>
<tr>
<td>Grid No. 1 circuit resistance with fixed bias</td>
<td>1 megohm</td>
</tr>
<tr>
<td>Voltage between heater and cathode</td>
<td>200 volts</td>
</tr>
<tr>
<td>Circuit resistance between heater and cathode</td>
<td>20000 ohms</td>
</tr>
</tbody>
</table>

Triode section

<table>
<thead>
<tr>
<th>Specification Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate voltage without plate current</td>
<td>550 volts</td>
</tr>
<tr>
<td>Plate voltage</td>
<td>250 volts</td>
</tr>
<tr>
<td>Plate dissipation</td>
<td>1 watt</td>
</tr>
<tr>
<td>Cathode current</td>
<td>15 mamps</td>
</tr>
<tr>
<td>Grid circuit resistance with automatic bias</td>
<td>3 megohms</td>
</tr>
<tr>
<td>Grid circuit resistance with fixed bias</td>
<td>1 megohm</td>
</tr>
<tr>
<td>Voltage between heater and cathode</td>
<td>200 volts</td>
</tr>
<tr>
<td>Circuit resistance between heater and cathode</td>
<td>20000 ohms</td>
</tr>
<tr>
<td>Grid circuit impedance (freq. = 50 c/s)</td>
<td>0.5 megohm</td>
</tr>
</tbody>
</table>

TYPICAL CHARACTERISTICS

Pentode section

<table>
<thead>
<tr>
<th>Specification Description</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Value 3</th>
<th>Value 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate voltage</td>
<td>100</td>
<td>170</td>
<td>200</td>
<td>200 volts</td>
</tr>
<tr>
<td>Grid No. 2 voltage</td>
<td>100</td>
<td>170</td>
<td>200</td>
<td>200 volts</td>
</tr>
<tr>
<td>Grid No. 1 bias</td>
<td>-6.0</td>
<td>-11.5</td>
<td>-12.5</td>
<td>-16 volts</td>
</tr>
<tr>
<td>Plate current</td>
<td>26</td>
<td>41</td>
<td>35</td>
<td>35 mamps</td>
</tr>
<tr>
<td>Grid No. 2 current</td>
<td>5.0</td>
<td>8.0</td>
<td>6.5</td>
<td>7.0 mAmps</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>----------</td>
</tr>
<tr>
<td>Transconductance</td>
<td>6800</td>
<td>7500</td>
<td>6800</td>
<td>6400 micromhos</td>
</tr>
<tr>
<td>Plate resistance</td>
<td>15000</td>
<td>16000</td>
<td>20500</td>
<td>20000 ohms</td>
</tr>
<tr>
<td>Amplification factor of grid No. 2 with respect to grid No. 1</td>
<td>10</td>
<td>9.5</td>
<td>9.5</td>
<td>9.5</td>
</tr>
</tbody>
</table>

**Triode section**

<table>
<thead>
<tr>
<th>Plate voltage</th>
<th>100 volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid voltage</td>
<td>0 volts</td>
</tr>
<tr>
<td>Plate current</td>
<td>3.5 mAmps</td>
</tr>
<tr>
<td>Transconductance</td>
<td>2500 micromhos</td>
</tr>
<tr>
<td>Amplification factor</td>
<td>70</td>
</tr>
</tbody>
</table>

**OPERATING CHARACTERISTICS** of the pentode section as audio output tube, class A

<table>
<thead>
<tr>
<th>Plate voltage</th>
<th>100</th>
<th>170</th>
<th>200</th>
<th>200 volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid No. 2 voltage</td>
<td>100</td>
<td>170</td>
<td>200</td>
<td>200 volts</td>
</tr>
<tr>
<td>Grid No. 1 bias</td>
<td>-6.0</td>
<td>-11.5</td>
<td>-12.5</td>
<td>-16 volts</td>
</tr>
<tr>
<td>Plate current</td>
<td>26</td>
<td>41</td>
<td>35</td>
<td>35 mAmps</td>
</tr>
<tr>
<td>Grid No. 2 current</td>
<td>5.0</td>
<td>8.0</td>
<td>6.5</td>
<td>7.0 mAmps</td>
</tr>
<tr>
<td>Load resistance</td>
<td>3900</td>
<td>3900</td>
<td>5600</td>
<td>5600 ohms</td>
</tr>
<tr>
<td>Power output at a harmonic distortion of 10%</td>
<td>1.05</td>
<td>3.3</td>
<td>3.4</td>
<td>3.5 watts</td>
</tr>
<tr>
<td>Required input A.F. voltage</td>
<td>3.8</td>
<td>6.0</td>
<td>5.8</td>
<td>6.6 volts (rms)</td>
</tr>
<tr>
<td>Required input A.F. voltage at a power output of 50 milliwatts</td>
<td>0.65</td>
<td>0.59</td>
<td>0.56</td>
<td>0.60 volts (rms)</td>
</tr>
</tbody>
</table>

**MICROPHONY.**
The triode section can be used without special precautions against microphonic effect in circuits in which an input voltage of at least 10 millivolts gives an output power of 50 milliwatts.

**HUM.**

In order to satisfy the hum requirement for the triode section of -60 db at an output power of 50 milliwatts, the input voltage for 50 milliwatts output must be higher than 10 millivolts when the grid circuit impedance at 50 cycles/second \( \leq 0.5 \) megohm. In this case the A.C. voltage between pin 5 and cathode must be zero. When the A.C. voltage between pin 5 and cathode is 12.6 volts, the input voltage for 50 milliwatts output must be at least 20 millivolts.
OPERATING CHARACTERISTICS OF THE TRIODE SECTION AS A.F. AMPLIFIER

<table>
<thead>
<tr>
<th>Eb volt</th>
<th>R_g (megohms)</th>
<th>R_k (ohms)</th>
<th>R_p (megohms)</th>
<th>I_b (amps)</th>
<th>E_o (volts rms)</th>
<th>( \frac{E_o}{E_{sig}} )</th>
<th>Total harmonics</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>3</td>
<td>2200</td>
<td>0.22</td>
<td>0.52</td>
<td>26</td>
<td>52</td>
<td>1.6 (2)</td>
</tr>
<tr>
<td>170</td>
<td>3</td>
<td>2700</td>
<td>0.22</td>
<td>0.43</td>
<td>25</td>
<td>51</td>
<td>2.3 (2)</td>
</tr>
<tr>
<td>100</td>
<td>3</td>
<td>2700</td>
<td>0.22</td>
<td>0.23</td>
<td>15</td>
<td>47</td>
<td>4.0 (2)</td>
</tr>
<tr>
<td>200</td>
<td>22</td>
<td>0</td>
<td>0.1</td>
<td>1.05</td>
<td>24</td>
<td>50</td>
<td>1.5 (3)</td>
</tr>
<tr>
<td>170</td>
<td>22</td>
<td>0</td>
<td>0.1</td>
<td>0.86</td>
<td>19</td>
<td>49</td>
<td>1.4 (3)</td>
</tr>
<tr>
<td>100</td>
<td>22</td>
<td>0</td>
<td>0.1</td>
<td>0.37</td>
<td>8</td>
<td>42</td>
<td>1.3 (2)</td>
</tr>
<tr>
<td>200</td>
<td>22</td>
<td>0</td>
<td>0.22</td>
<td>0.61</td>
<td>25</td>
<td>55</td>
<td>1.4 (3)</td>
</tr>
<tr>
<td>170</td>
<td>22</td>
<td>0</td>
<td>0.22</td>
<td>0.50</td>
<td>20</td>
<td>53</td>
<td>1.4 (3)</td>
</tr>
<tr>
<td>100</td>
<td>22</td>
<td>0</td>
<td>0.22</td>
<td>0.22</td>
<td>9</td>
<td>46</td>
<td>1.5 (2)</td>
</tr>
</tbody>
</table>

1) Measured at small input voltage
2) At lower output voltages the distortion is proportionally lower
3) At lower output voltages the distortion remains approx. constant up to \( V_o \approx 5 \, V_{eff} \). At values < 5 \, V_{eff} the distortion is proportionally lower.
TRIODE

Plate voltage = 200 volts
Plate voltage = 110 volts
Plate voltage = 100 volts

Grid voltage (volts)

Plate current (milliamps)

5.5.1959
TRIODE

Grid voltage (volts)

Transconductance (microhms)

-5
-4
-3
-2
-1

0

500
1000
1500
2000
2500
3000
3500

plate voltage = 200 volts
150 volts
100 volts

8.5.1969