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NASA TECH BRIEF

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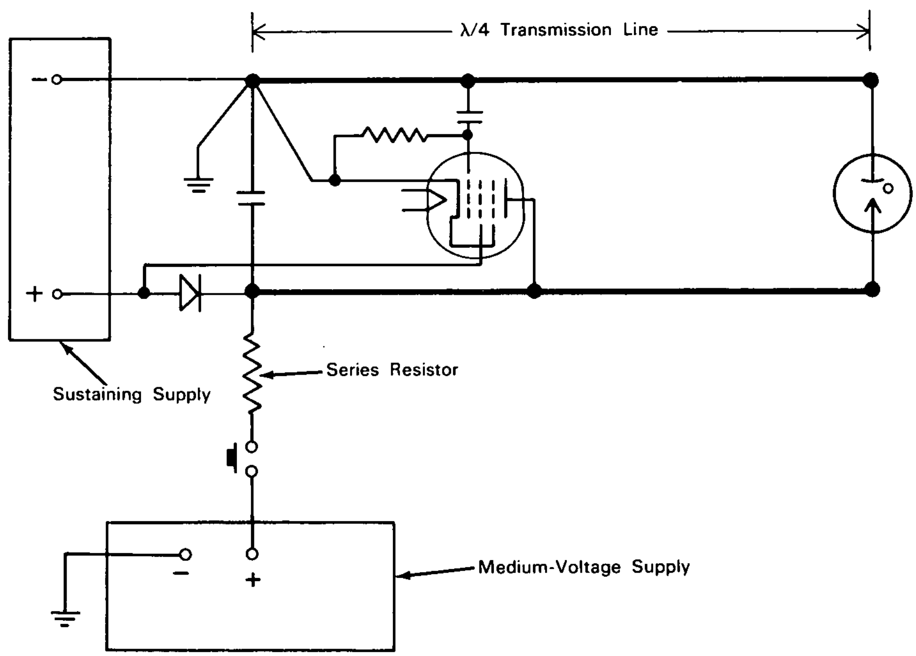
Igniting System for Mercury Vapor Lamps Protects Transistorized Sustaining Supply



The problem: To devise a high-voltage igniting system for short-arc mercury-vapor lamps that protects a transistorized high-current, low-voltage power supply for the lamps.

The solution: A power supply that incorporates a low-voltage (40v), direct-current (0–10a.) sustaining supply set to the specified current for a particular lamp; a medium-voltage (450v), direct-current (190ma.) supply; and a linear transmission-line oscillator.

How it's done: The diagram shows the entire system in its simplest form, without any switching or indicating circuits which may be desirable.

Two terminals of the transmission line, consisting of a quarter-wave shorted stub, are connected to the medium-voltage power supply. The two opposite terminals of the transmission line are connected to the mercury-vapor lamp. Since the lamp in the nonionized state presents a very high impedance (on the order of 10^{10}ohms), it merely adds a small capacitance to the circuit, without affecting the operation of the oscillator. Grid and plate leads of a pentode are connected to appropriate points along the line to permit proper feedback for maintaining oscillation and to provide the proper impedance match for the pentode.

(continued overleaf)

To ignite the vapor lamp, the pushbutton is closed to apply voltage from the medium-voltage supply to the pentode and thus cause the circuit to oscillate at a frequency determined by the length of transmission line. As soon as oscillation begins, a high radiofrequency voltage appears across the ends of the transmission line connected to the vapor lamp. This high-voltage oscillation causes the vapor in the lamp to ionize and thus effectively short-circuit the transmission line. As a result, the radiofrequency oscillations cease. Since the vapor lamp is now at a relatively low impedance, current from the medium-voltage supply begins to flow through the lamp, and its impedance continues to decrease. Most of the voltage drop therefore occurs across the series resistor as the current demand of the vapor lamp continues. When the voltage across the lamp falls to a value just below that of the sustaining supply, the diode ceases to be reverse biased and thus allows the sustaining supply to begin discharging through the vapor lamp. Initiation of current from this supply is evidenced by a sharp increase in brightness of the lamp, and at this time the pushbutton may be released to disconnect the medium-voltage supply.

Notes:

1. Since almost all of the current from the sustaining supply flows through the vapor lamp and there are no resistors in series with this supply, except for the forward resistance of the diode, the power is efficiently used.
2. Additional typical values for the power-supply system include a 300-ohm, 12-foot-long twin transmission line carrying a 10-mc starting current at approximately 2 kilovolts to the vapor lamp, a 30-inch grid-to-cathode transmission-line section, and a 39-inch cathode-to-plate transmission-line section.
3. For further information about this invention inquiries may be directed to:

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   Reference: B63-10262

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