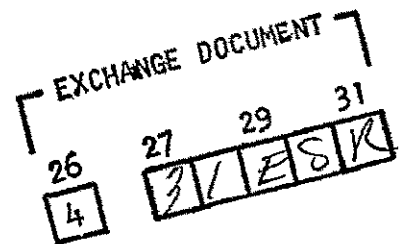




DC REGULATOR FOR LOW PRESSURE MERCURY LAMPS (PEN-RAY)

by *D. Huguenin*
Goddard Space Flight Center
Greenbelt, Maryland, U.S.A.



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<p>ESRO TM-145 Organisation Européenne de Recherches Spatiales ALIMENTATION CONTINUE STABILISEE POUR LAMPES A VAPEUR DE MERCURE BASSE PRESSION ("PEN-RAY") D. Huguenin Janvier 1968 iv + 6 pages</p>	<p>I. Huguenin, D. II. ESRO TM-145 III. Texte en anglais</p>	<p>ESRO TM-145 Organisation Européenne de Recherches Spatiales ALIMENTATION CONTINUE STABILISEE POUR LAMPES A VAPEUR DE MERCURE BASSE PRESSION ("PEN-RAY") D. Huguenin Janvier 1968 iv + 6 pages</p>	<p>I. Huguenin, D. II. ESRO TM-145 III. Texte en anglais</p>
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ORGANISATION EUROPÉENNE DE RECHERCHES SPATIALES
EUROPEAN SPACE RESEARCH ORGANISATION

114, Avenue de Neuilly, 92 Neuilly-sur-Seine, France

ABSTRACT

A new type of power supply is described, which provides a stable DC voltage, free from any 120 cps ripple due to the mains. One possible application is its use in the photometry of very weak light sources.

After a brief general description, the electrical specifications, circuit description and utilisation of the power supply are discussed, and a parts list, together with a schematic diagram, given.

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DC REGULATOR
FOR
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(PEN-RAY)*

D. Huguenin
Goddard Space Flight Center
Greenbelt, Md., U.S.A.

1. GENERAL DESCRIPTION

This power supply provides a stable, ripple-free, DC voltage. It has been designed to replace the AC "Spectroline" transformer when the 120 cps modulation of the light output is a major inconvenience, for instance, in star tracker or photometer test equipments.

2. ELECTRICAL SPECIFICATIONS

Current range:	5 mA to 20 mA adjust by 10 turns helipot
Output voltage:	150 V to 300 V
Ignition voltage:	2 kV
mA - meter:	External. Use a 0-2 V voltmeter connected to the 100 ohm internal shunt (R _i voltmeter \geq 10 k Ω)
DC output resistance:	> 5 M Ω
Line regulation (117 V \pm 10%)	\pm 0.2%

* US Patent Pending

Temperature coefficient	$\pm 0.01\%/^{\circ}\text{C}$
Ripple	$\leq 10 \mu\text{A p-p}$
Heating, power supply	2 minutes
Heating, lamp	15 minutes

3. CIRCUIT DESCRIPTION

The power supply is divided in three subsystems: the rectifier, the ignition circuit, and the regulator.

3.1 THE RECTIFIER

The rectifier provides all the voltages for the lamp, the regulator tube and the solid state amplifier. The DC output voltage is 390 V at full load with a ripple of 300 mV p-p. A Zener diode connected between ground and the negative side of the rectifier provides -6.3 V for the bias of the amplifier. A Zener voltage divider (R_2 , DZ 1-3) supplies +30 V to the amplifier. From this voltage, a second Zener voltage divider (R_6 , DZ5, D6), temperature compensated, gives a very stable reference voltage (6.95 V).

3.2 THE IGNITION CIRCUIT

When the ignition push-button is depressed, a positive half-wave 1550 V RMS/60 cps is superimposed on the normal high voltage. As soon as the lamp ignites, the diode switch D3-5 is held open by the normal lamp current and the ignition voltage is short-circuited, the ignition current being limited by the resistor R_1 . The resistors, R_3-5 , balance the reverse voltage across D 3-5.

3.3 THE REGULATOR

The lamp current, from the + end of the rectifier flows through the lamp, then through the regulator tube VI, through the load balance resistors

R14 and R15, through the Zener diodes DZ 6 and DZ 7 (bias) and passes through the current-sensing resistors R12 and R13. R12 is a precision shunt used for accurate current measurement. The error signal is amplified by the differential amplifier T1-T2-T3. The base current of T2 is extremely low and does not induce a systematic error on the lamp current. The capacitor C2 prevents high-frequency oscillations and overshoot. It is a tantalum capacitor selected for very low DC leakage.

4. UTILIZATION OF THE POWER SUPPLY

Connect the lamp to the power supply. The polarity is indifferent. Turn power on. Wait 10 seconds and depress the ignition push-button for 1 second. Allow a pre-heating of the lamp of one minute, then adjust the lamp current to the desired value with the 10 turns potentiometer. It is recommended to use a current of 10 - 18 mA, giving the most stable discharge. Below 10 mA, the temperature of the lamp is too low and its stability very poor.

To measure the lamp current with the internal 100-ohm shunt, we recommend to use a good voltmeter or a 3-digit digital voltmeter having an input resistance at least 100×100 ohms = 10 k Ω on the 2 V range. Under these conditions, 20 mA of lamp current will give exactly 2.00 V on the voltmeter with an error of 1% or less due to the input resistance of the voltmeter.

NOTE: Both lamp wires are hot. Thus, it is impossible to ground one of them

NOISE: The low-pressure Hg lamp is a wonderful random noise generator. Therefore, it is highly recommended to use the lamp with its aluminum cap well grounded.

5. PARTS LIST

Component	Type	Manufacturer
C1	10 + 10 mF/450 V	Mallory
C2	50 mF/35 V Tantalic	TI (Texas Instruments)
D1 to D5	1N561	TI
D6	1N914	TI
DZ	1N753/1N758	TI
L1	8H/40 mA	Stancor
R1	.10 MΩ, .3 kV, 2 W	RPC
R2	2 × 20 kΩ, 3 W each, WW	Ohmite
R3 to R5	50 MΩ, 1 kV	RPC
R6 to R8	Hi. Stab. metal film, 0.5 W, 1%	
R9 to R10	Carbon 0.125 W, 5%	
R11 to R12	Hi. Stab. metal film, 0.5 W, 1%	
R13 to R17	Carbon 0.125 W, 5%	
T1 to T2	2N930, VBE matched	TI
T3		TI
TR1	PSC 60	Chicago Std. Transf. Co.
TR2	P-8150	Stancor
V1	12 AU7/ECC82	RCA/Philips

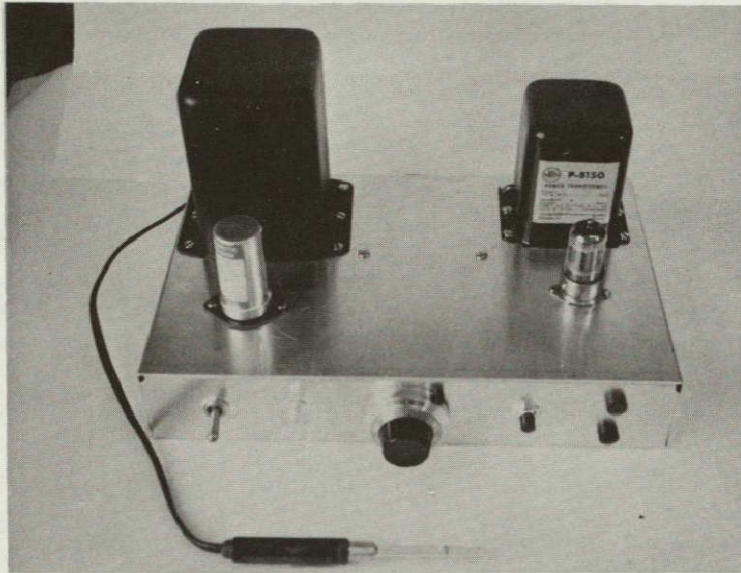


Figure 1.- Power supply and low-pressure mercury lamp.

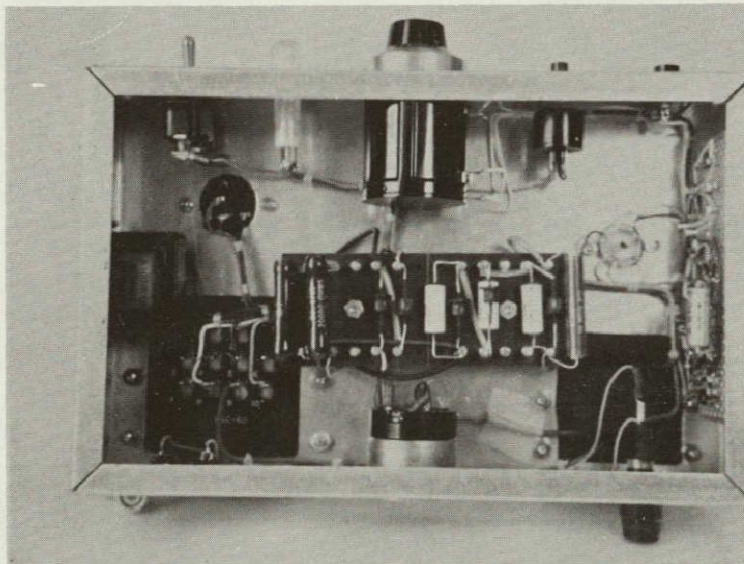


Figure 2.- Bottom view.

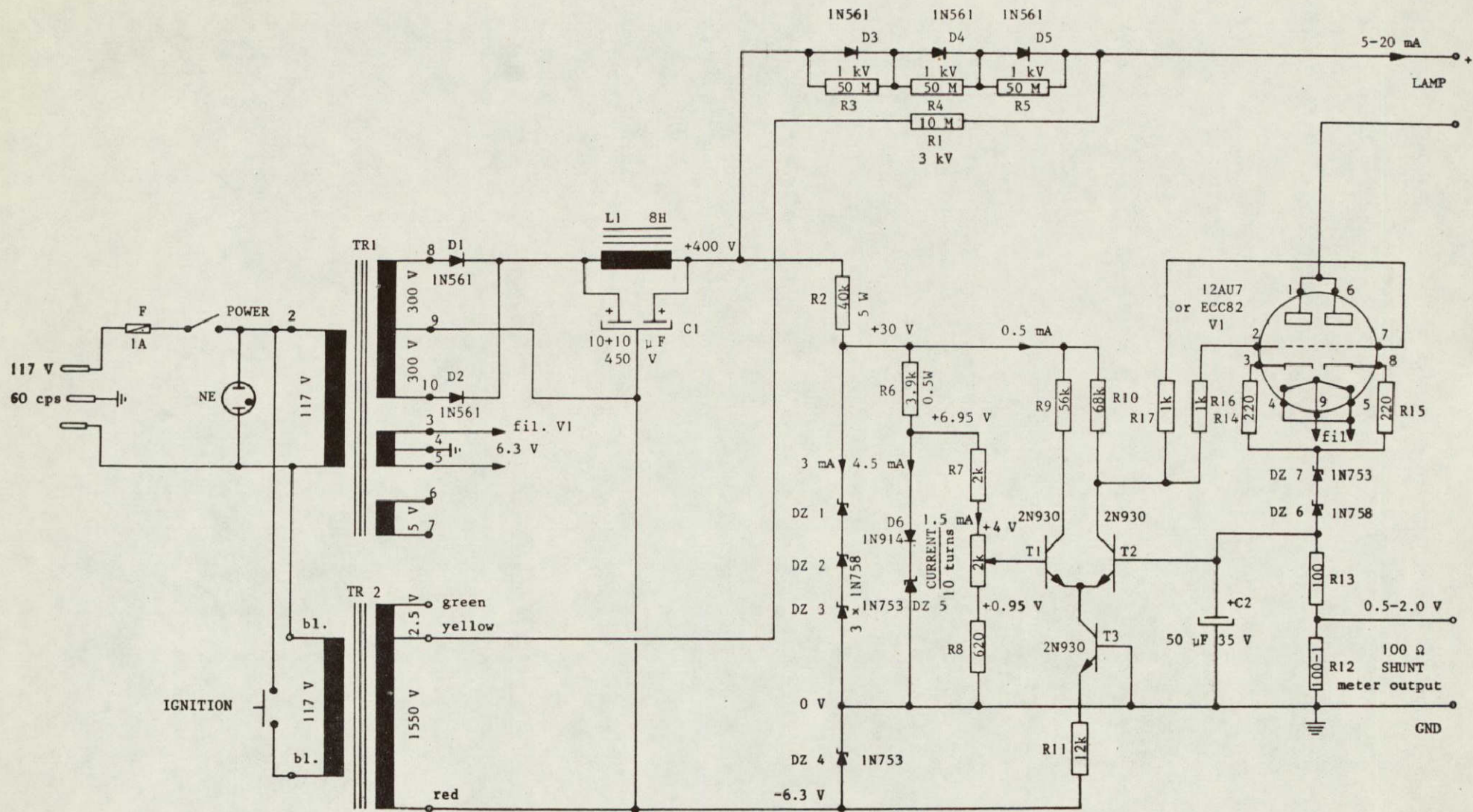


Figure 3.- DC Power Supply for Pen-Ray Lamps (Current Regulated).

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