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A STABILIZED D-C POWER SUPPLY VARIABLE FROM 0-25 VOLTS

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ABSTRACT

A modified design of the low-voltage power supply, previously reported in "A Stabilized Power Supply for Voltages Below Twenty Volts" (ERA-187), is described. An internal impedance of 0.005 ohms has been obtained, with good long-term stability. The output voltage is adjustable from 0.75 to 23 volts. The maximum current obtainable with good regulation varies from 1.5 amperes at the lowest voltage to 0.2 amperes at the highest.

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Introduction

The low-voltage regulated power supply described previously[1] has proven itself extremely useful, and numerous units are in use. Considerable interest has been shown in this device, and it became apparent that increased stability and even lower internal impedance would extend its usefulness.

Method of Operation

The previous design was based on a circuit described by Greenough[2] in which the amplified d-c error voltage controlled the output amplitude of a multivibrator. The multivibrator output was then fed to a power-amplifier stage and rectified. Since the multivibrator operated at about two kilocycles per second, smoothing of the d-c output was considerably simplified.

The present circuit is essentially similar, except that the output of the d-c amplifier controls a driver stage following the multivibrator, thus eliminating a troublesome frequency shift in the multivibrator.

The full d-c output voltage is fed to the cathode of V_1 (Fig. 1), a reference potential is applied to the grid of V_1, and potentiometer P_1 controls the output voltage. V_2 is connected as a diode in series with the grid of V_1 to cancel any contact potential variation in V_1 produced by heater voltage changes[3]. V_3 provides further d-c amplification and is direct-coupled to V_6. V_7 and V_8 comprise a multivibrator, operating at about four kilocycles per second, which can be adjusted to give equal space-mark output by the pre-set potentiometer, P_2. The balanced output of the multivibrator is fed to the push-pull driver stage, V_9, V_{10}. Control of the output of the driver stage is accomplished by V_6.

The output of the driver stage is fed to two Type 6V6 tubes, operating class C. An audio output transformer steps down the voltage and feeds a full-wave selenium rectifier. Smoothing is done with a choke-input filter. The choke consists of a 30-henry 40-milliampere choke rewound with 20-gauge wire.

Switch S_2 selects either of two voltage ranges (0.75 - 12.5, 12.0 - 23 volts) and also selects the voltmeter ranges. Switch S_3 shorts out the current meter to eliminate the voltage drop across this meter when good regulation is required.

Performance Data

Output voltage	0.75 to 12.5 volts and 12.0 to 23 volts
Maximum regulated current (Fig. 2)	1.5 amperes at 1 volt 200 milliamperes at 21 volts
Internal impedance	0.005 to 0.007 ohms

The voltage output is constant over the range of line voltages from 90 to 117 volts (Fig. 3). The variation of ripple with load current is shown in Fig. 4.

During a warm-up period of six hours the output was observed to drift 0.06 volt; the voltage then remained constant to ±0.003 volt for a period of fifty hours at a load current of 200 ma.

Comments

Larger regulated currents may be obtained readily by increasing the power handling capacity of the output tubes and the selenium rectifier. The circuit may be easily adapted to a constant-current supply by taking the control voltage from a small resistance in series with the load.

References

1. "A stabilized power supply for voltages below twenty volts", P. A. Redhead, ERA-187, July, 1950.

2. "A regulated low voltage d-c supply for electrolysis and other uses", M. L. Greenough, N. E. Williams, Jr., and J. R. Taylor, Rev. Sci. Instr. 22:482, 1951.

3. "Vacuum Tube Amplifiers", Radiation Laboratory Series, Vol. 18, p. 421, McGraw-Hill.

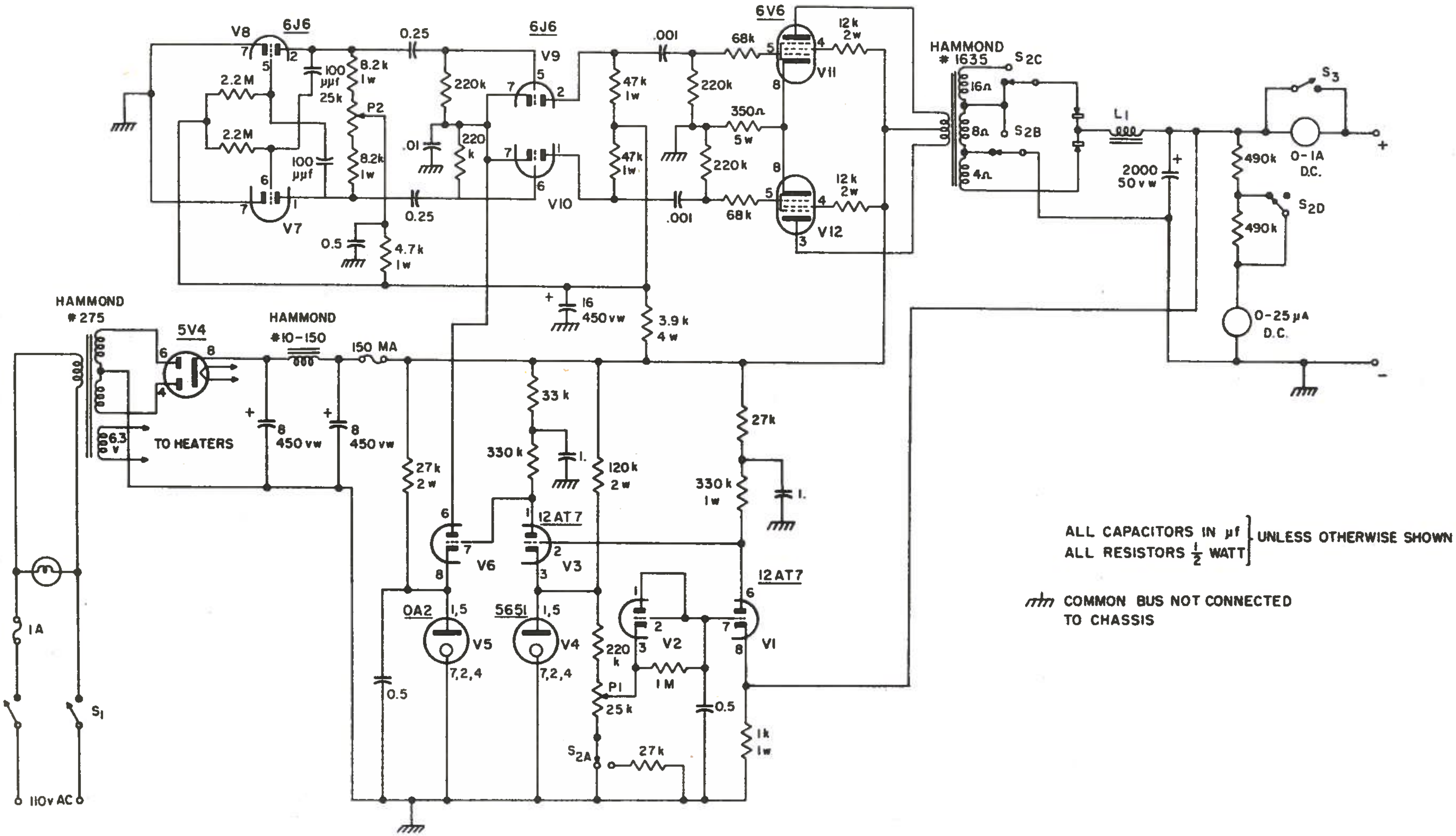

FIG. 1

CIRCUIT DIAGRAM

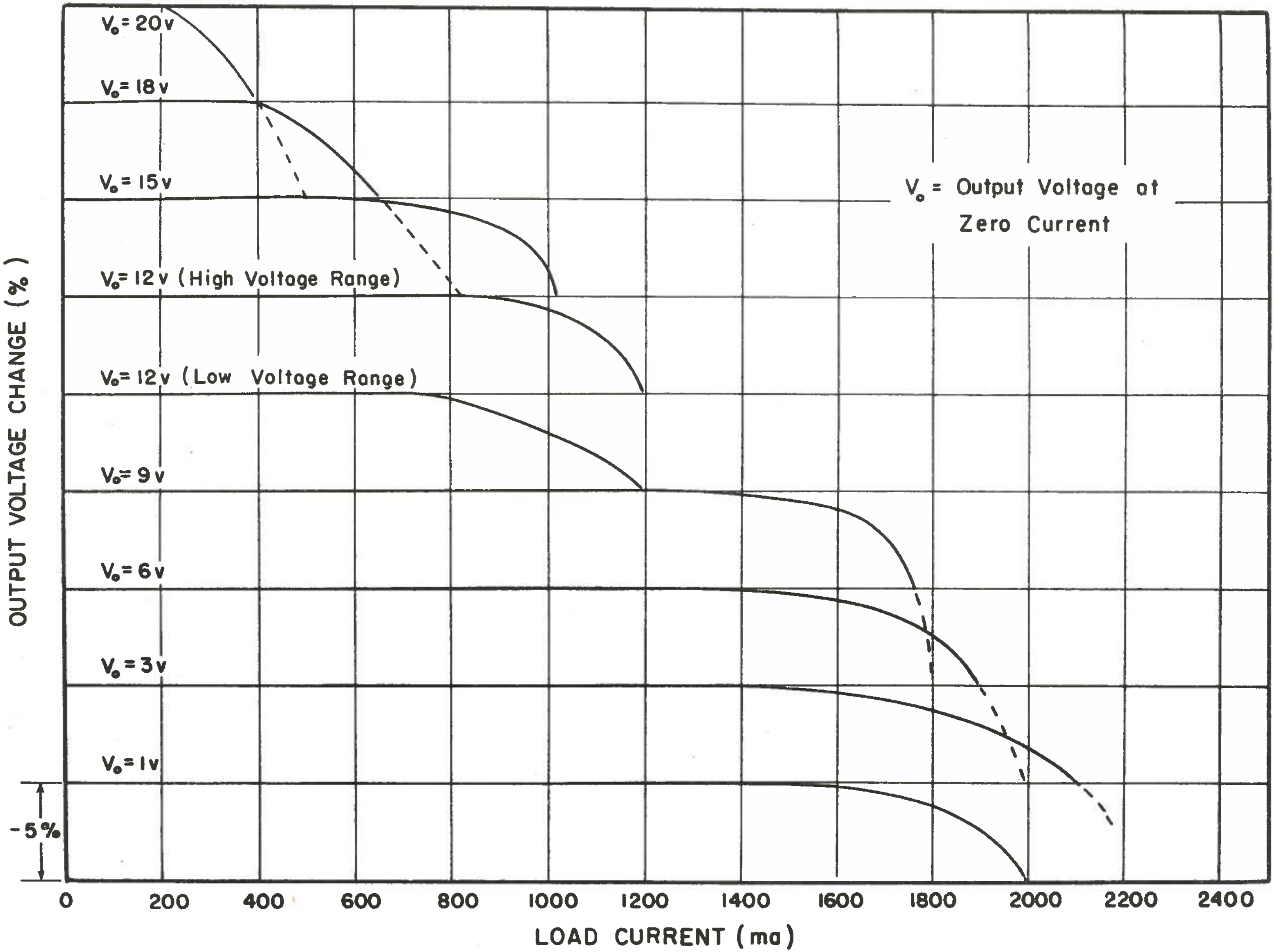

FIG. 2
REGULATION CURVES

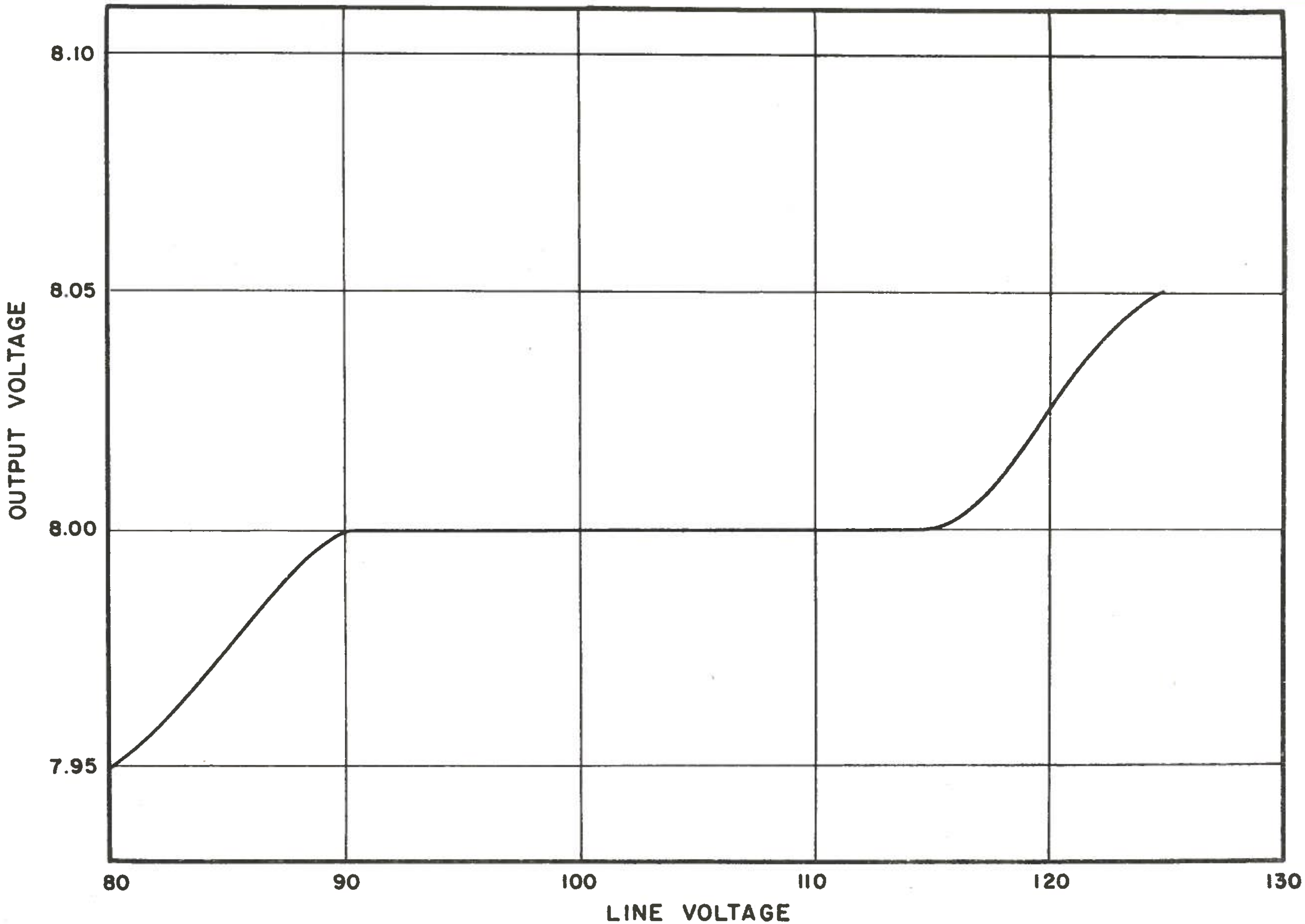

FIG. 3
OUTPUT REGULATION WITH LINE VOLTAGE VARIATION

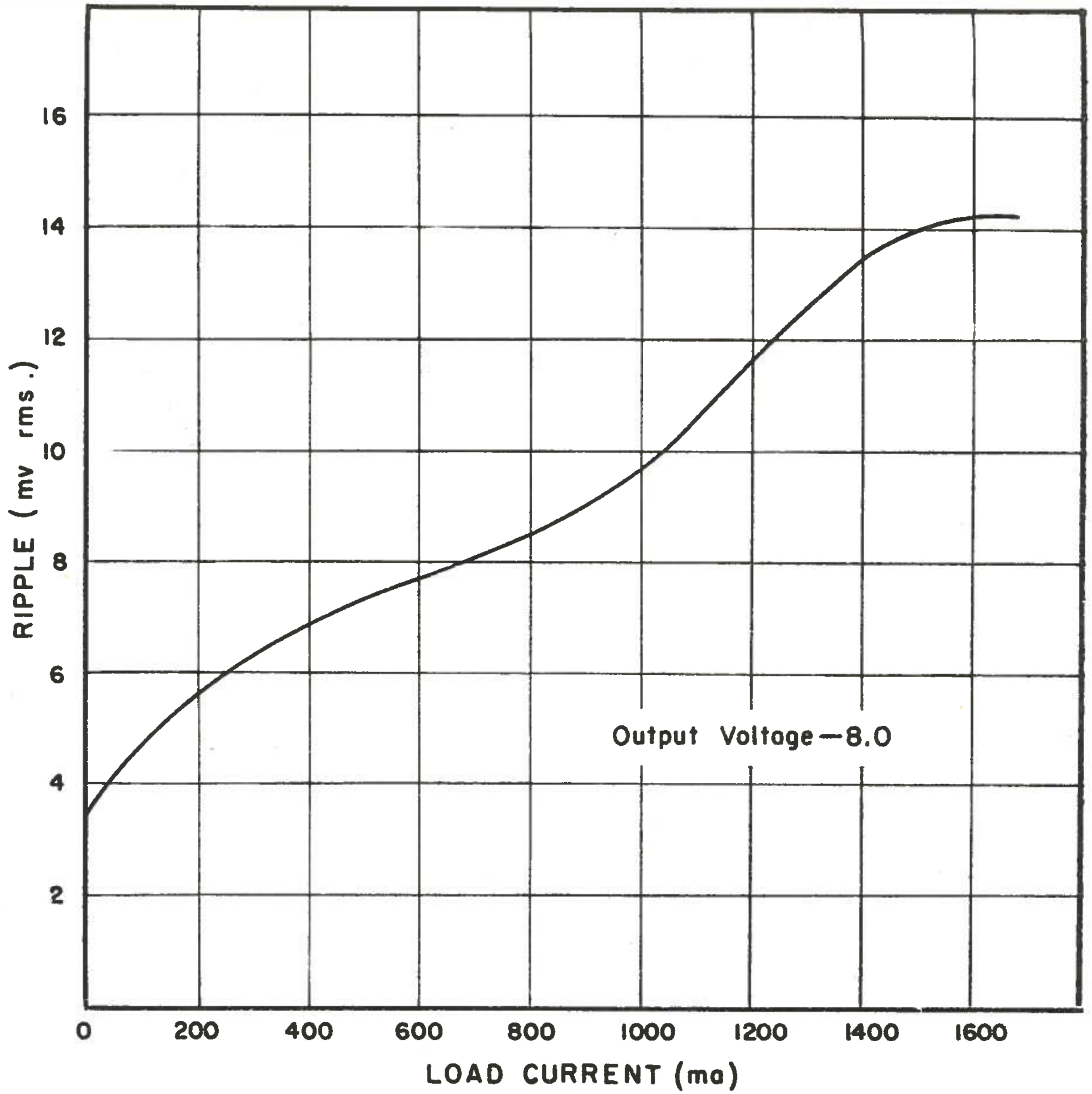

FIG. 4
VARIATION OF RIPPLE WITH LOAD CURRENT