

PRL TECHNICAL NOTE TN-88-60

A CONSTANT CURRENT  
POWER SUPPLY

By

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## TECHNICAL NOTE ON CONSTANT CURRENT POWER SUPPLY

### INTRODUCTION

A low voltage, high current power supply capable of supplying a constant current of 40 Amperes has been designed and fabricated in the laboratory. This power supply has been used to strike a mini argon arc source needed in an experiment to study fluorescence from neutral molecules by photon impact. The light source emits a continuum covering the spectral range from 1150 to 3000Å<sup>0</sup>. The details of the constant current power supply have been given in the following pages.

GENERAL DESCRIPTION

This power supply is specially designed to provide a regulated high current variable from 30 Amps. to 50 Amps.

SPECIFICATION

- (1) Output voltage : 56 V DC fixed (56 V)
- (2) Output current : 30 Amps. to 50 Amps. variable with the help of potentiometer.
- (3) Maximum load current : 50 Amps.
- (4) Input power requirement : 440 Volts 50 Hz 3 Phase

OPERATIONAL CONTROLS ON FRONT PANEL

- (1) 3 Phase starter : This is a 15 Amps. starter with overload protection for connecting the 3 phase power to the Transformer and fan.
- (2) Meter M1 : This is 0 to 300 Volts meter connected across the D.C. output to read the DC O/P voltage.
- (3) Meter M2 : This is 0 to 50 Amps. meter connected in between the 0.1 ohms resistance in the emitter of Transistor and negative end of Power Supply for the measurement of current flowing in the Source.

: 3 :

(4) Potentiometer

: This is 10K Pot. connected in the regulator I/C 723 for the variation of current from 30 Amps. to 50 Amps.

(5) Indicator

: 3 Neon indicators are connected on the front panel for the indication of 3 Phase present for rectification.

DESCRIPTION OF THE CIRCUIT

Transformer T1 is a 3 phase Transformer with primary of 440 volts in DELTA connection and secondary STAR connection with 40 volts and 50 Amps. The transformer is of continuous rating and is of air cooled type. The secondary of the transformer is connected to six DIODES as shown in diagram for rectification. The diodes used for rectification are of the rating of 200 volts and 100 Amps. These diodes rectify the 40 volts A/C in to DC with a ripple of 4.5%. The meter M1 is connected in parallel to DC voltage output to show the rectified voltage. In the present case we get 56 volts D.C. This D.C. voltage is connected to +ve end (Anode) of the Argon source through 0.6 ohms 200 watt resistance. This resistance is connected in series to limit the current to less than 100 Amps.

Transformer T2 is a single phase step down transformer, from 230 volts A/C to 12-0-12 volts A/C which is rectified through two diodes (D7 & D8) IN 4007 in the form of full wave rectification. This D.C. voltage of 17 volts through filter is connected to the VCC of the I/C 723 precision Voltage Regulator and the collector of transistor Tr1. Voltage regulator I/C has the adjustable output from 2 volts to 37 volts when VCC is 40 volts. But in our case we are giving 17 volts as VCC. So we are able to vary the voltage from 2 volts to 12 volts for the variation of output current from 30 Amps. to 50 Amps. The 723 is monolithic integrated circuit voltage regulator featuring high ripple rejection, excellent input and load regulation, excellent temperature stability. The circuit consists of a temperature-compensated reference voltage amplifier, an error Amplifier, a 150 mA output transistor, and an adjustable output current limiter so this has been used for the regulation of current of the Argon source. The printed circuit board has been made for I/C 723, transistor Tr1 and transistor Tr2. The transistor Tr2 has been used to isolate the two power sources and can give 400 mA current to drive the transistor Tr3 which will drive all the transistors Tr4 and Tr18. connected in parallel for giving 40 Amps. current to the source. A 0.2 ohms 5 watt resistance has been used in the emitter of transistors Tr4 to Tr18 for the safety of these transistors and equal current flow in them. The

emitter of transistor TR18 is connected to Pin 4 of I/C 723 as an inverted feed back to I/C for proper regulation. The diodes D9 and D10 are used to avoid the reverse feed back in case of Tr2 failure so that regulator I/C 723 does not get damaged. The emitters of the transistor Tr4 to TR18 are connected to common point through 0.2 ohms 5 watt resistance. This common point is connected to current meter M2 through 0.1 ohms 200 watt resistance to the ground of the power supply for the measurement of the current in the circuit.

#### OPERATION

To start the Argon source press the green button of starter on the front panel. As soon as this is pressed the fan will start and the three neon indicators will light up to show all the three phases are present. At the same time meter M1 will also read 56 volts D.C. But the current meter will not read any thing. To strike the source argon gas is passed in the source with the pressure of 85 mm and then auxiliary electrode through through choke and 0.05 ohms 40 watt resistance is inserted in the hole to short the anode for short time. As soon as this is done in Argon gas strikes and the current meter M2 starts reading 40 Amps according to the position of the pot, P1. This current can be adjusted according to our requirement while in our case is 40 Amps. By varying the

potentiometer we are changing the regulated D.C. output from 2 volts to the required voltage for getting 40 Amps. current in the current meter M2.

The fan has been provided on the side panel of equipment for air cooling of transistors and rectifier diodes. The electrical diagram of the equipment is also attached for ready reference. The power supply has been rigorously tested along with the source for continuous operation and have been found working properly.

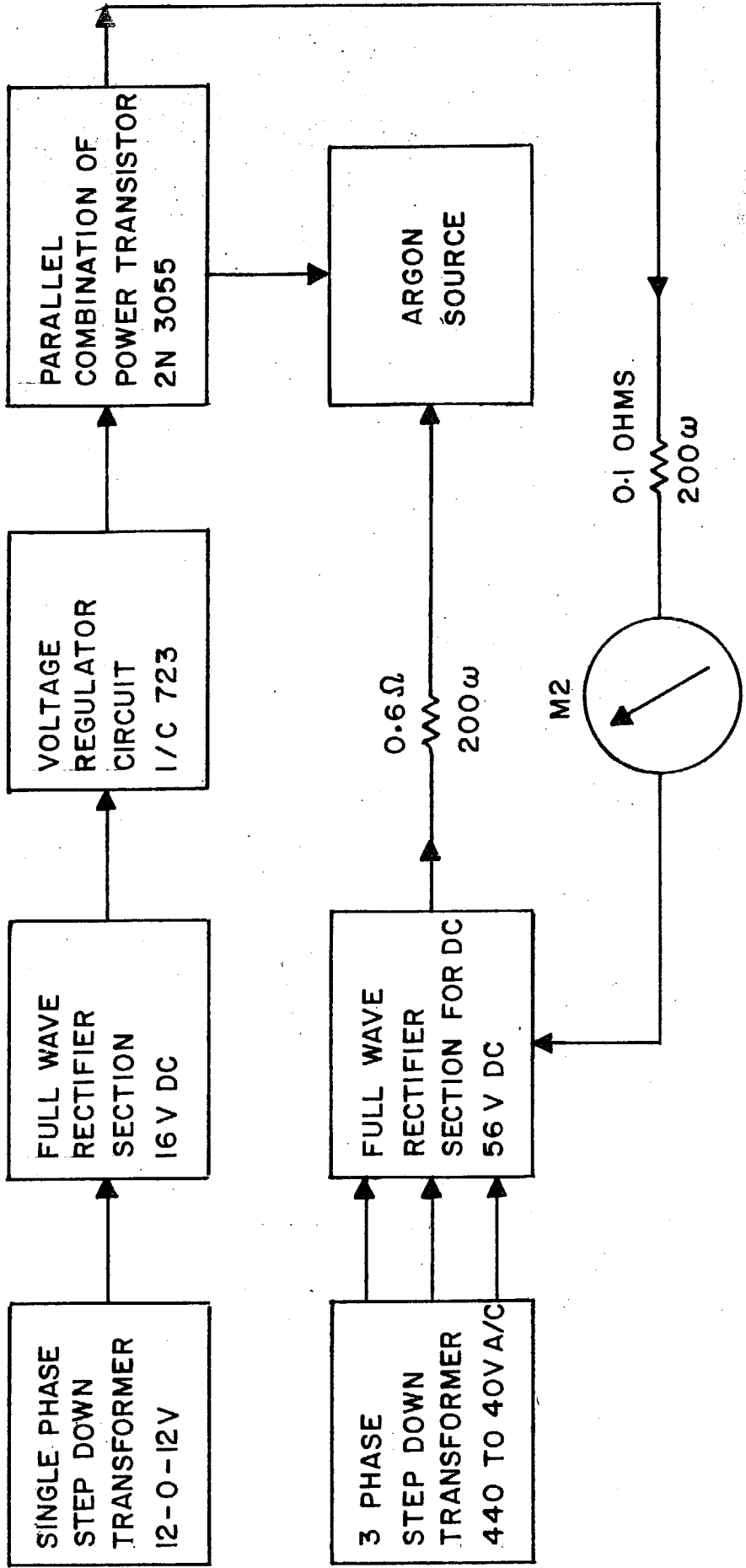
#### ACKNOWLEDGEMENTS

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#### LIST OF ILLUSTRATIONS

1. Block diagram of Constant Current Power Supply.
2. Electrical wiring diagram of the unit.
3. Circuit diagram of the unit.
4. Front panel photograph of the unit.
5. Internal wiring photograph of the unit.
6. PCB layout for voltage regulator.

# BLOCK DIAGRAM OF THE CIRCUIT





# ELECTRICAL WIRING DIAGRAM OF EQUIPMENT

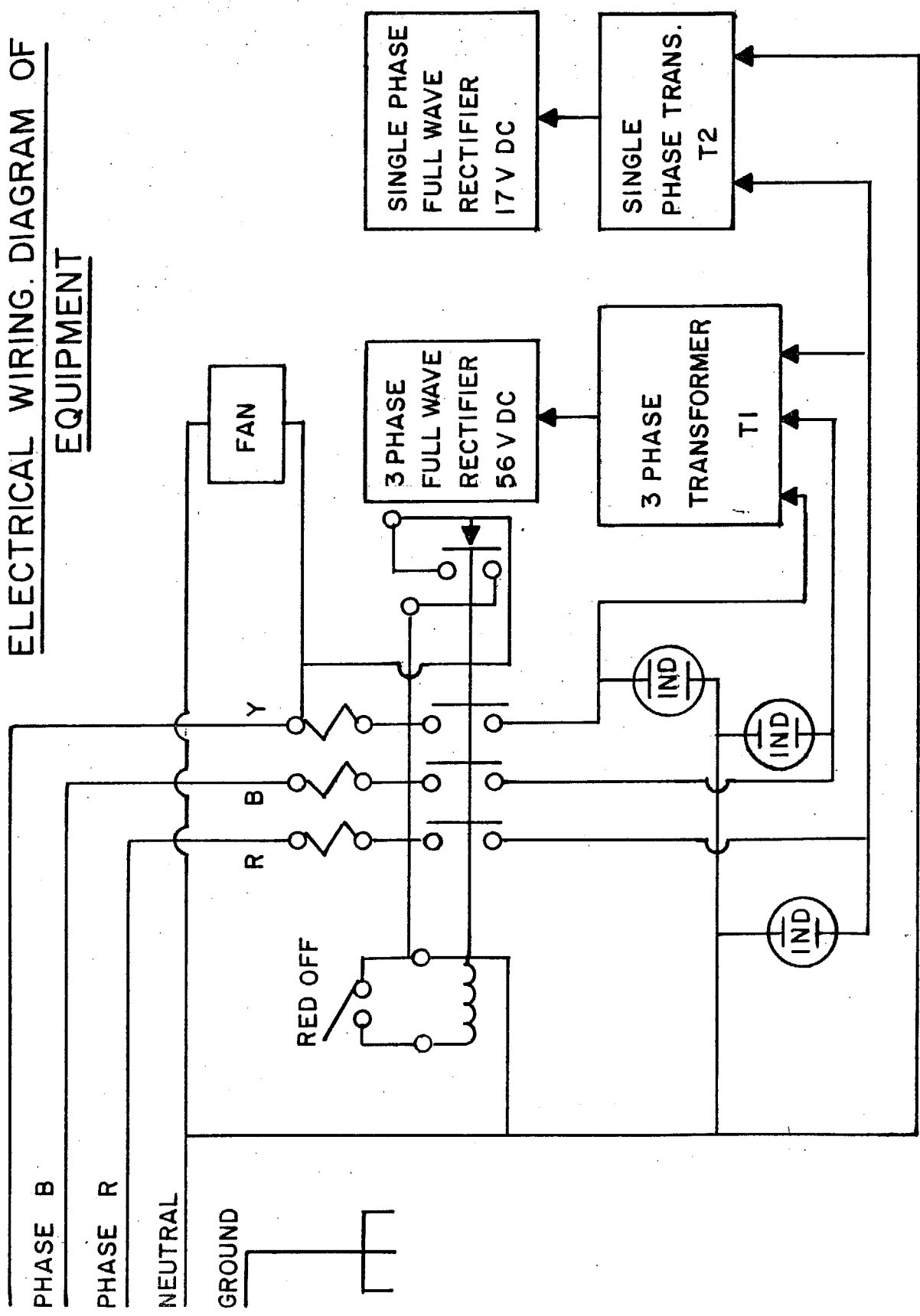
PHASE Y

PHASE B

PHASE R

NEUTRAL

GROUND



SINGLE PHASE  
FULL WAVE  
RECTIFIER  
17 V DC

SINGLE PHASE TRANS.  
T2

3 PHASE  
FULL WAVE  
RECTIFIER  
56 V DC

3 PHASE  
TRANSFORMER  
T1

FAN

RED OFF

Y

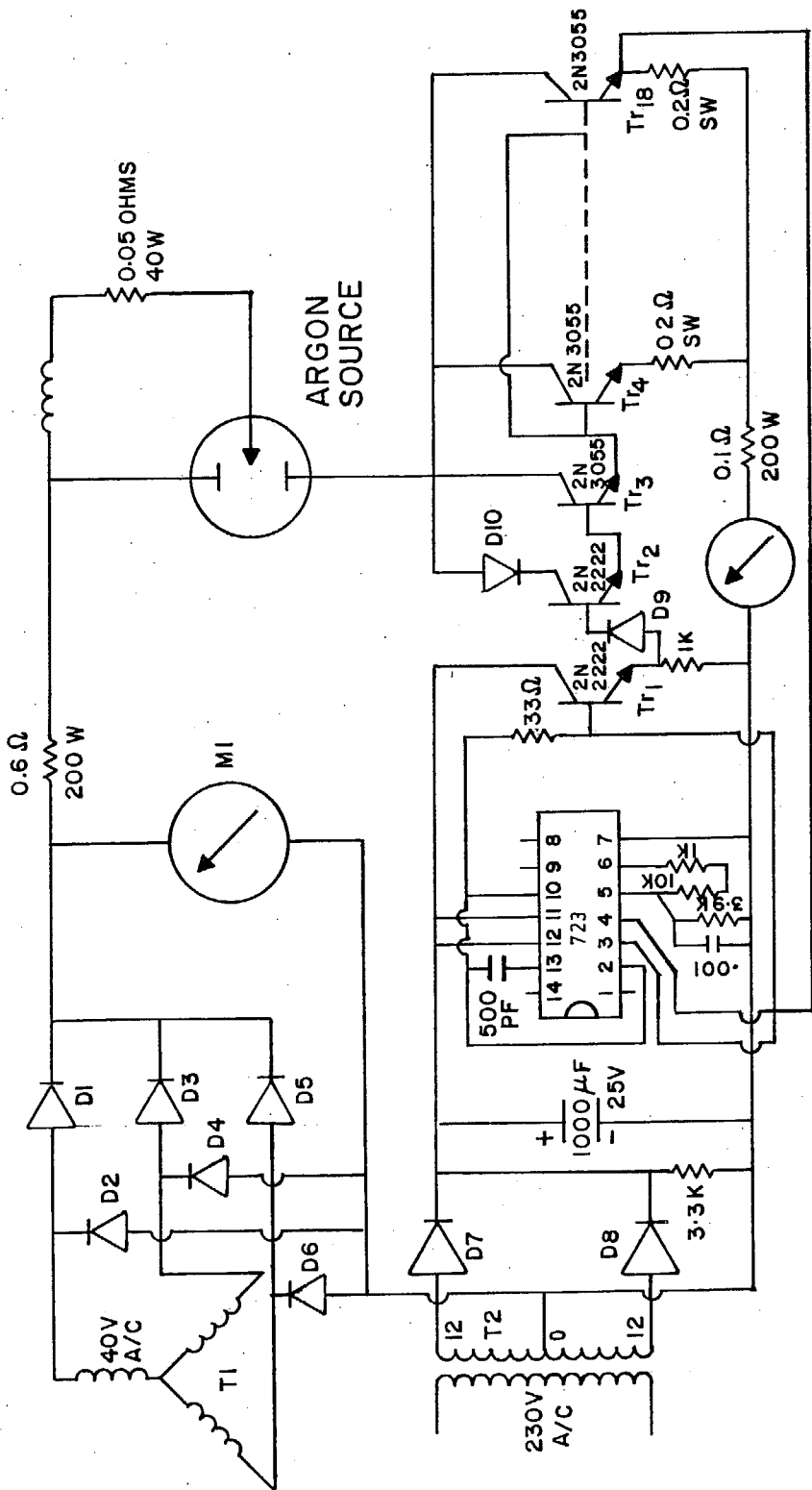
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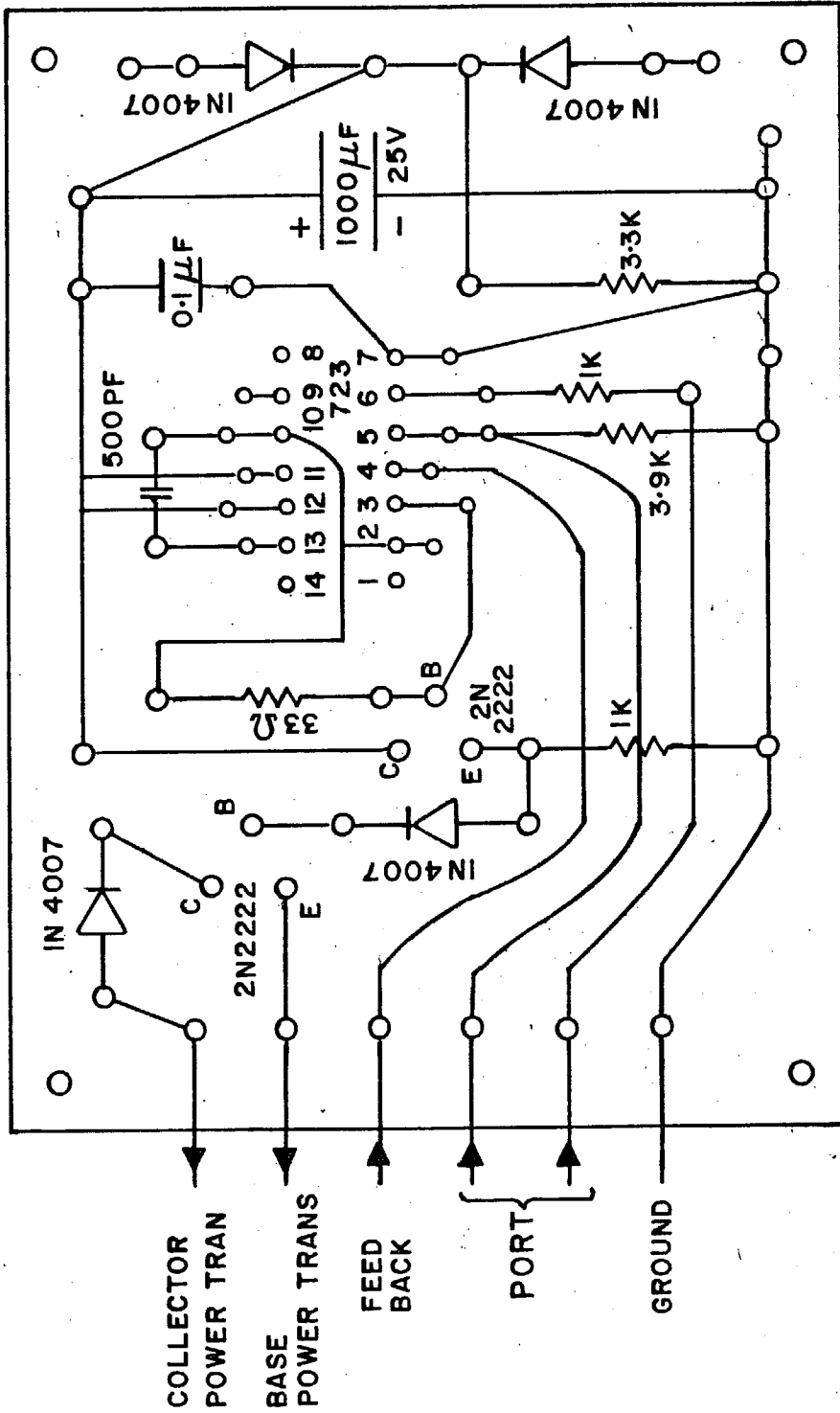
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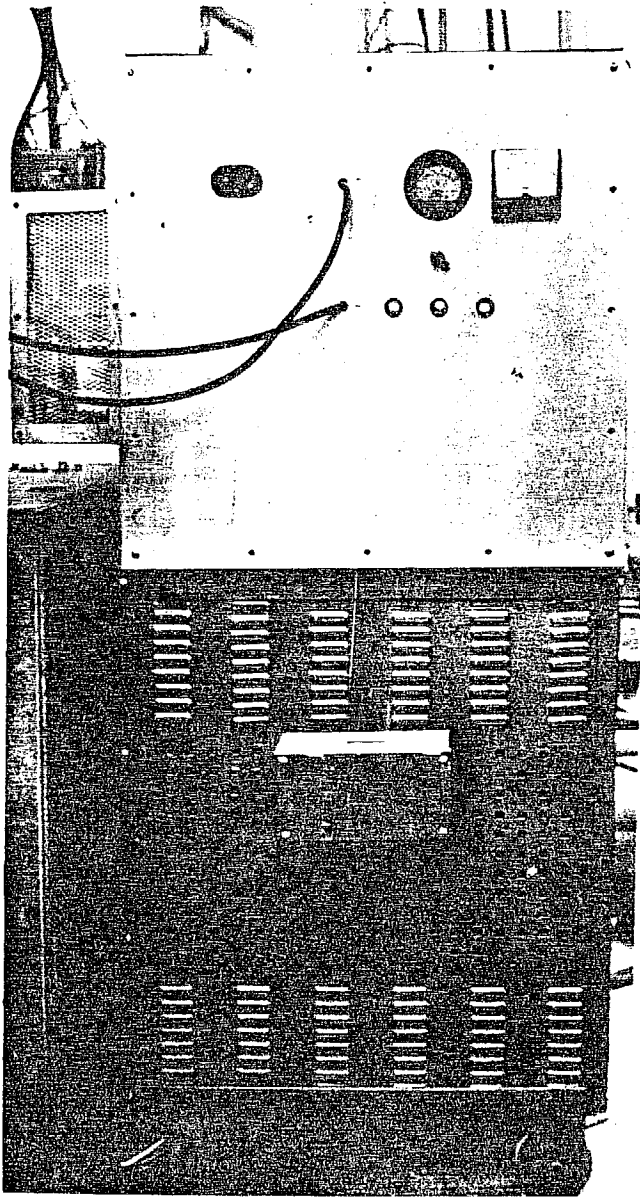
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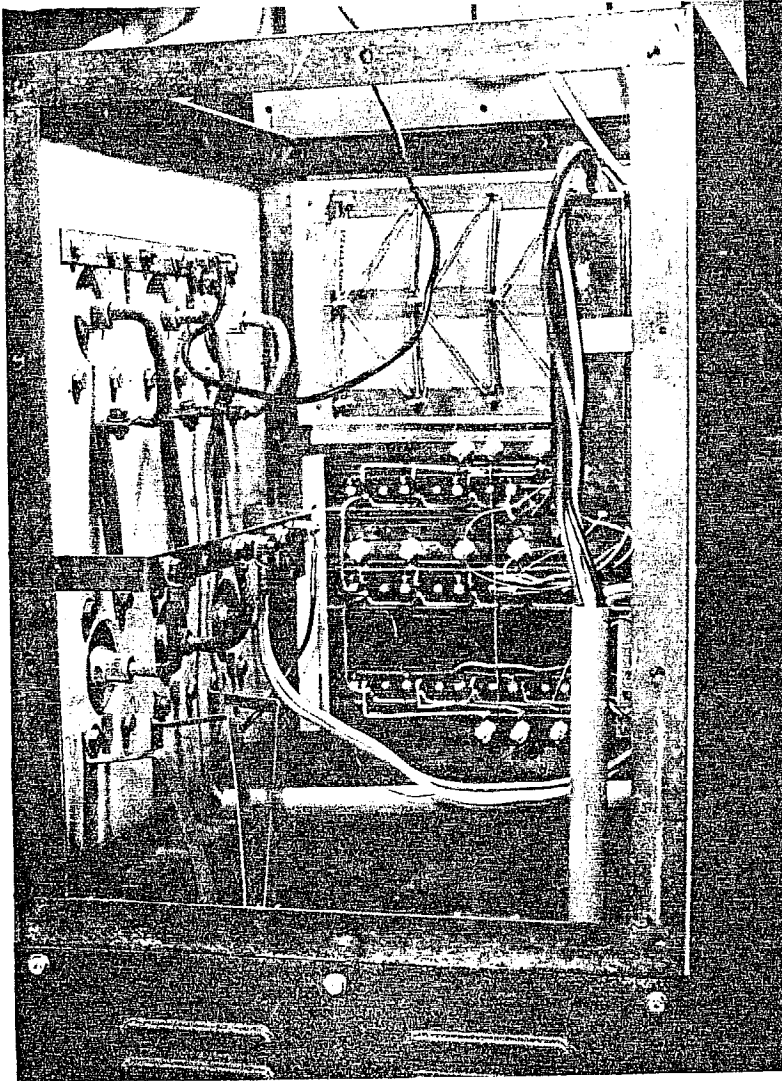


# PCB LAYOUT OF VOLTAGE REGULATOR





FRONT. PANEL. VIEW.



INTERNAL VIEW