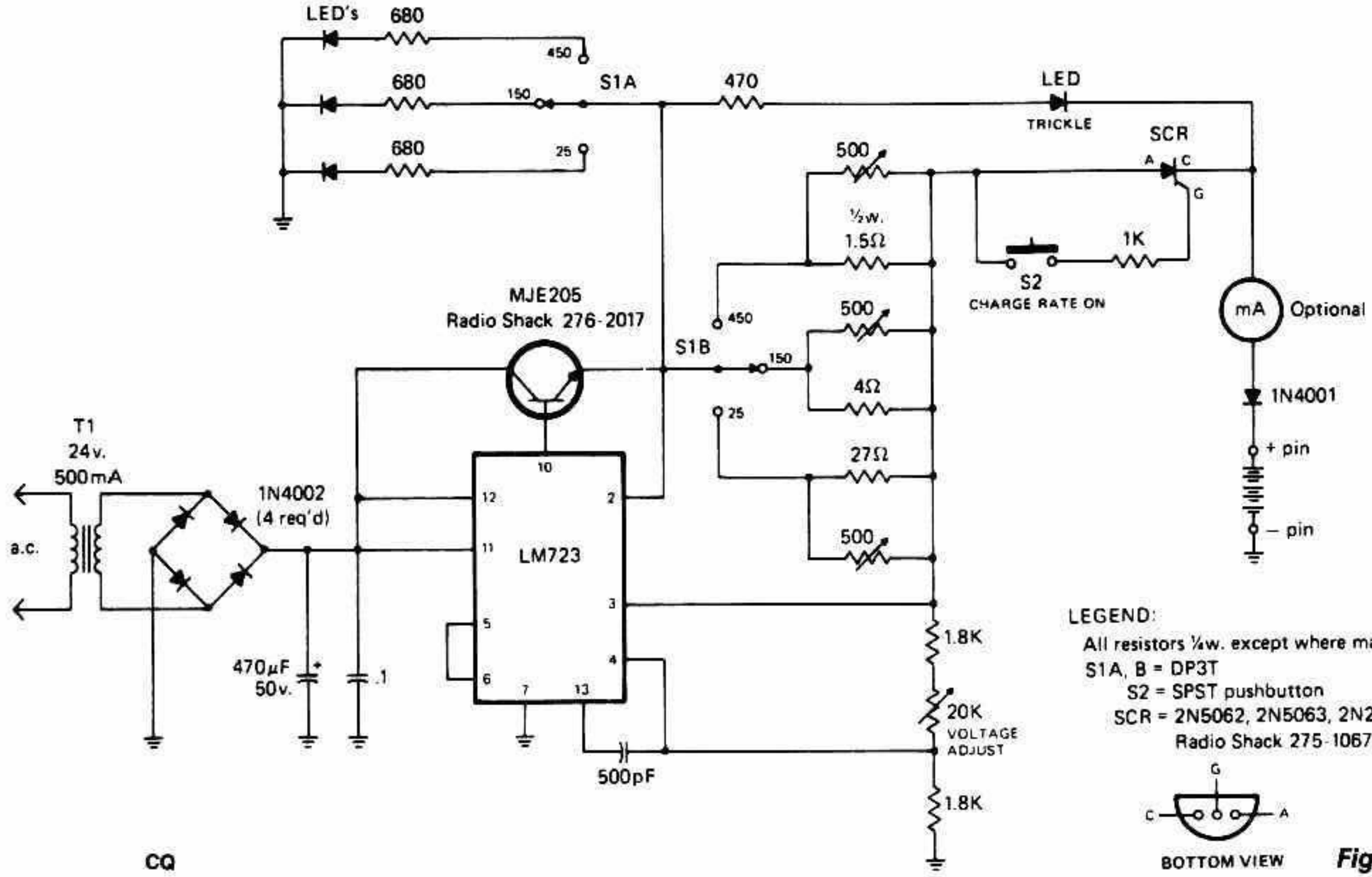
# RAPID BATTERY CHARGER FOR ICOM IC-2A

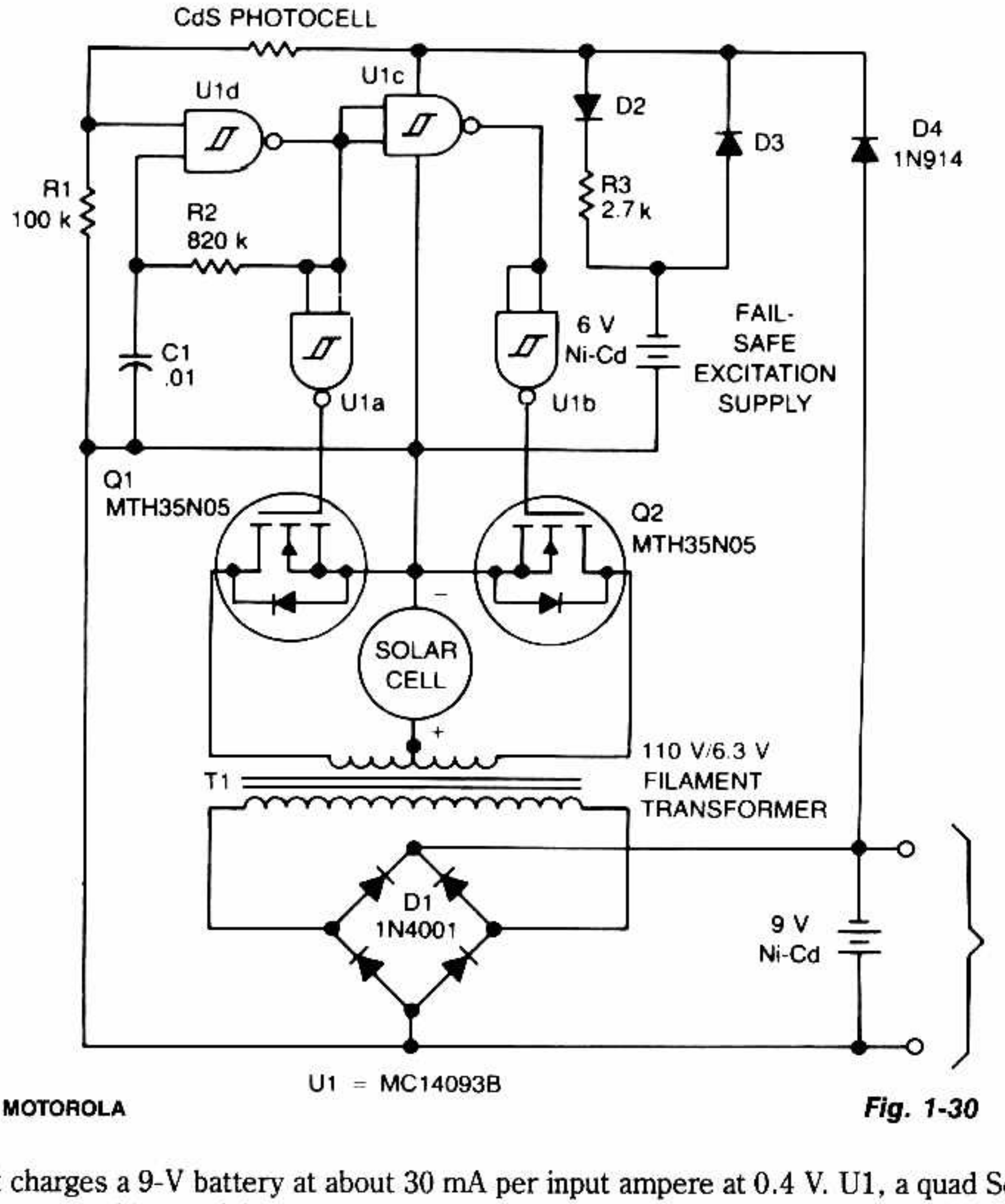



CQ

*Fig. 1-29*

Rectified and filtered voltage from the 24-Vac transformer is applied to the LM723 voltage regulator and the npn pass transistor set up for constant current supply. The 470-Ω resistor limits trickle current until the momentary pushbutton (S2) is depressed, the SCR turns on, and current flows through the previously determined resistor network, which limits the charging current. The SCR will turn off when the thermal cutout circuit inside the battery pack opens up.

## BATTERY CHARGER OPERATES ON SINGLE SOLAR CELL




U1 = MC14093B

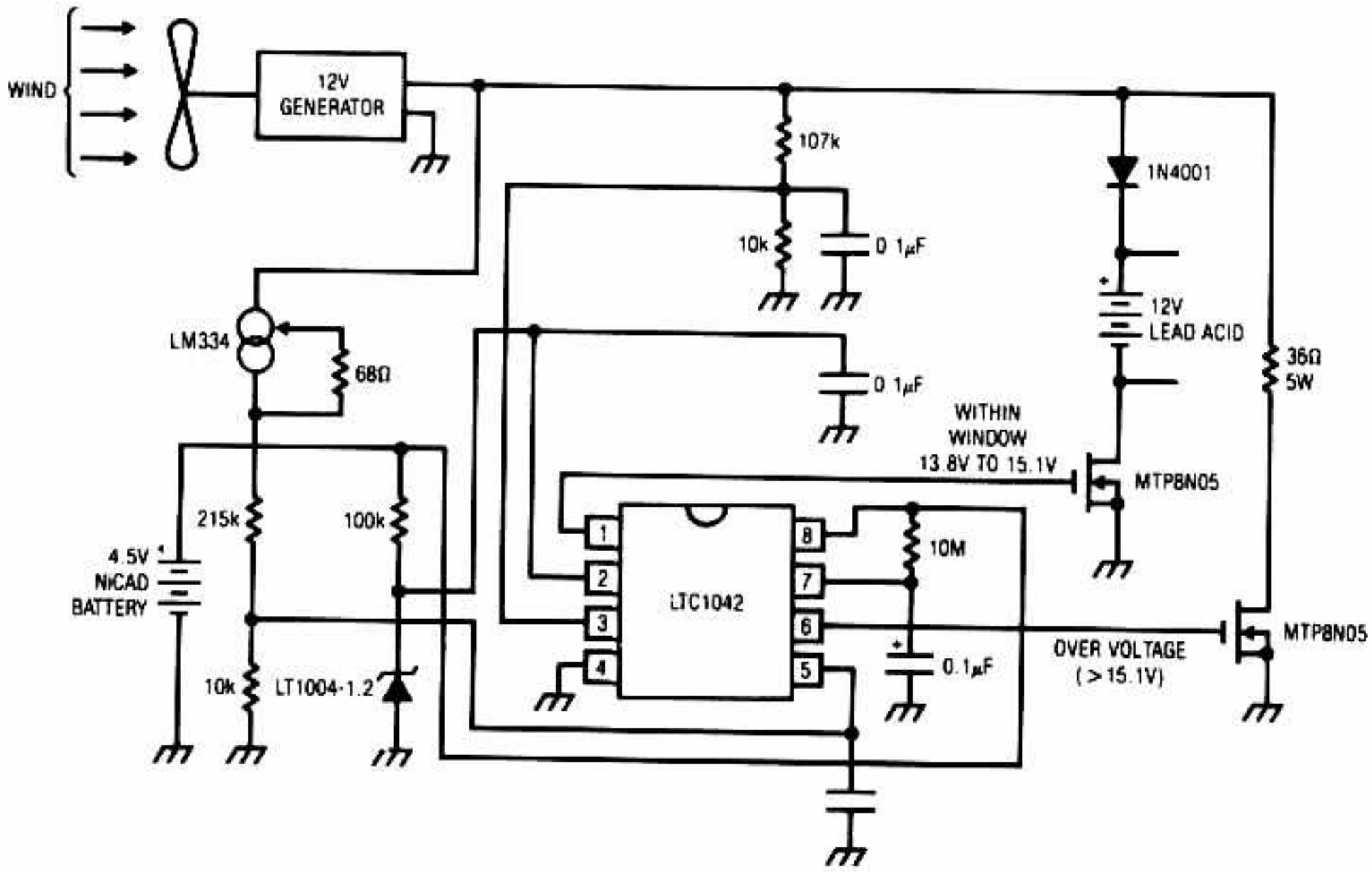
MOTOROLA

*Fig. 1-30*

The circuit charges a 9-V battery at about 30 mA per input ampere at 0.4 V. U1, a quad Schmitt trigger, operates as an astable multivibrator to drive push-pull TMOS devices, Q1 and Q2. Power for U1 is derived from the 9-V battery via D4; power for Q1 and Q2 is supplied by the solar cell. The multivibrator frequency, determined by R2/C1, is set to 180 Hz for maximum efficiency from a 6.3-V filament transformer, T1. The secondary of the transformer is applied to a full-wave bridge rectifier, D1, which is connected to the batteries being charged. The small NiCad battery is a fail-safe excitation supply to allow the system to recover if the 9-V battery becomes fully discharged.

A CdS photocell shuts off the oscillator in darkness to preserve the fail-safe battery during shipping, storage, and prolonged darkness.

# WIND-POWERED BATTERY CHARGER




LINEAR TECHNOLOGY

*Fig. 1-31*

The dc motor is used as a generator; the voltage output is proportional to its rpm. The LTC1042 monitors the voltage output and provides the following control functions.

1. If generator voltage output is below 13.8 V, the control circuit is active and the NiCad battery is charging through the LM334 current source. The lead-acid battery is not being charged.
2. If the generator voltage output is between 13.8 and 15.1 V, the 12-V lead-acid battery is being charged at about 1-amp/hour rate (limited by the power FET).
3. If generator voltage exceeds 15.1 V (a condition caused by excessive wind speed or when the 12-V battery is fully charged), then a fixed load is connected, which limits the generator rpm to prevent damage.

This charger can be used as a remote source of power where wind energy is plentiful, such as on sailboats or at remote radio repeater sites. Unlike solar-powered panels, this system will function in bad weather and at night.

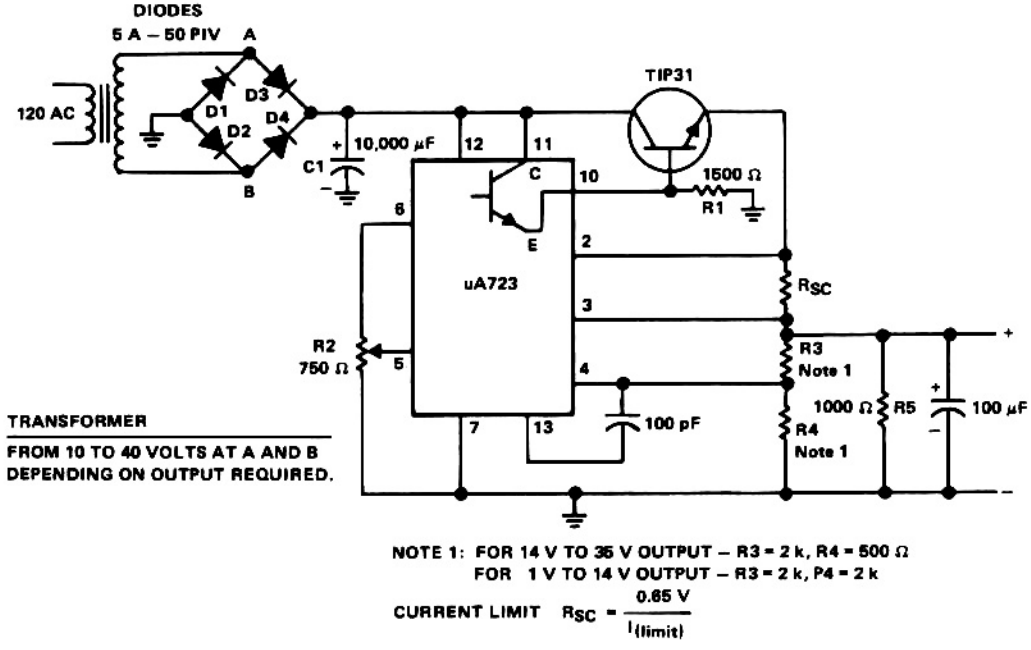
# 2

# Power Supplies—Fixed

The sources of the following circuits are contained in the Sources section, which begins on page 125. The figure number in the box of each circuit correlates to the source entry in the Sources section.

Basic Single-Supply Voltage Regulator
8-A Regulated Power Supply for Operating Mobile Equipment
Low-Voltage Regulators with Short-Circuit Protection
High-Stability 1-A Regulator
High-Current Inductorless Switching Regulator
200-kHz Switching Regulator
5-V 0.5-A Power Supply
3-W Switching-Regulator Circuit
Regulated Split Power Supplies from a Single Supply
Switching Step-Down Regulator
Single-Ended Regulator
± 50-V Push-Pull Switched-Mode Converter
5-V/0.5-A Buck Converter
Slow Turn-On 15-V Regulator
ac Voltage Regulator
Uninterruptible +5-V Supply
Stand-By Power For Nonvolatile CMOS RAMs
5-V Supply With Stabilized Momentary Backup
Uninterruptible Power Supply for Personal Computers
90-Vrms Voltage Regulator Using a PUT
Switch-Mode Power Supply
Micropower Bandgap Reference Supply
± 50-V Feed-Forward Switch-Mode Converter
Traveller's Shaver Adapter
100-V/0.25-A Switch-Mode Converter
Voltage Regulator
Dual-Polarity Power Supply
5.0-V/6.0-A/25-kHz Switching Regulator With Separate Ultra-Stable Reference
Mobile Voltage Regulator
Negative Switching Regulator
Positive Switching Regulator
Positive Floating Regulator
Negative Floating Regulator
Negative Voltage Regulator
−15-V Negative Regulator
Slow Turn-On 15-V Regulator
High-Stability 10-V Regulator
5-V/1-A Switching Regulator
15-V/1-A Regulator with Remote Sense
Increasing the Power Rating of Zener Diodes
Voltage Regulator
Zener Diode Regulator
12- to 14-V Regulated 3-A Power Supply
dc-to-dc SMPS Variable (18 to 30 V Out at 0.2 A)
SCR Preregulator Fits Any Power Supply
Off-Line Flyback Regulator
500-kHz Switching Inverter for 12-V Systems
10-A Regulator with Current and Thermal Protection
Bipolar Power Supply For Battery Instruments
Power Supply for 25-W Arc Lamp
Power-Switching Circuit
100-V/0.25-A Switch Mode Converter
Radiation-Hardened 125-A Linear Regulator
Supply Voltage Splitter
3- to 5-V Regulated Output Converter
Memory-Save On Power-Down
100-Vrms Voltage Regulator

## GENERAL-PURPOSE POWER SUPPLY




TEXAS INSTRUMENTS

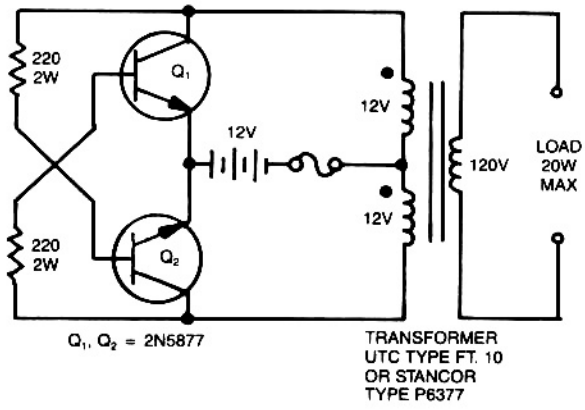
*Fig. 2-1*

The supply can be used for supply output voltages from 1 to 35 V. The line transformer should be selected to give about 1.4 times the desired output voltage from the positive side of filter capacitor C1 to ground. Potentiometer R2 sets the output voltage to the desired value by adjusting the reference input. $R_{SC}$ is the current limit set resistor. Its value is calculated as:

$$R_{SC} = \frac{0.65\ \text{V}}{I_L}$$

For example, if the maximum current output is to be 1 A, $R_{SC} = 0.65/1.0 = 0.65\ \Omega$. The 1-kΩ resistor, $R_S$, is a light-loaded resistor designed to improve the no-load stability of the supply.

## 12-Vdc BATTERY-OPERATED 120-Vac POWER SOURCE



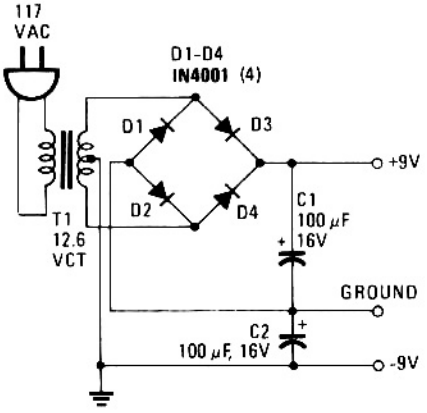

EDN

*Fig. 2-2*

A simple 120 V: 24 V, center-tapped control transformer and four additional components can do the job. This circuit outputs a clean 200-V pk-pk square wave at 60 Hz and can supply up to 20 W. The circuit is self-starting and free-running.

If Q1 is faster and has a higher gain than Q2, it will turn on first when you apply the input power and will hold Q2 off. Load current and transformer magnetizing current then flows in the upper half of the primary winding, and auto transformer action supplies the base drive until the transformer saturates. When that action occurs, Q1 loses its base drive. As it turns off, the transformer voltages reverse, turning Q2 on and repeating the cycle. The output frequency depends on the transformer iron and input voltage, but not on the load. The frequency will generally range between 50 to 60 Hz with a 60-Hz transformer and car battery or equivalent source. The output voltage depends on turns ratio and the difference between input voltage and transistor saturation voltage. For higher power, use larger transformers and transistors. This type of inverter normally is used in radios, phonographs, hand tools, shavers, and small fluorescent lamps. It will not work with reactive loads (motors) or loads with high inrush currents, such as coffee pots, frying pans, and heaters.

## SIMPLE POWER SUPPLY



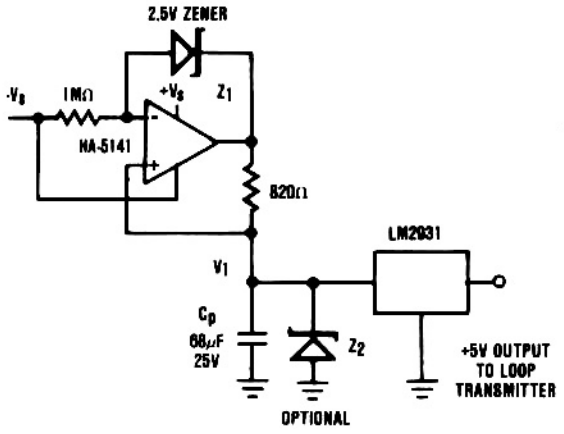

HANDS-ON ELECTRONICS

*Fig. 2-3*

This power supply delivers plus and minus 9 V to replace two 9-V batteries. The rectifier circuit is actually two separate full-wave rectifiers fed from the secondary of the transformer. One full-wave rectifier is composed of diodes D1 and D2, which develop +9 V, and the other is composed of D3 and D4, which develop −9 V.

Each diode from every pair rectifies 6.3 Vac, half the secondary voltage, and charges the associated filter capacitor to the peak value of the ac waveform, $6.3 \times 1.414 = 8.9$ V. Each diode should have a PIV, Peak Inverse Voltage, rating that is at least twice the peak voltage from the transformer, $2 \times 8.9 = 18$ V. The 1N4001 has a PIV of 50 V.

## CHARGE-POOL POWER SUPPLY



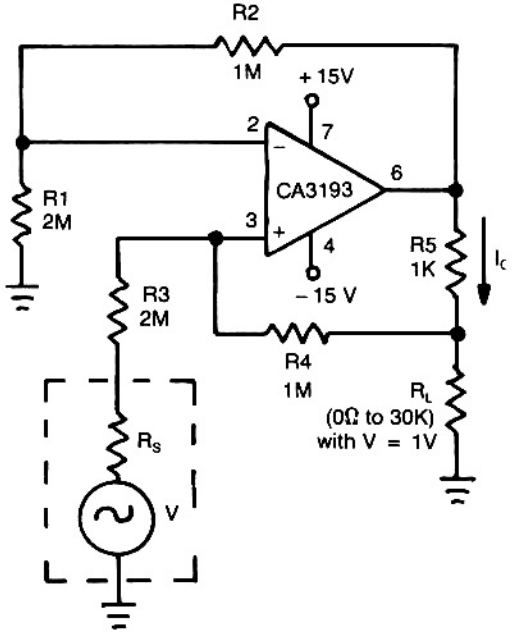

HARRIS

*Fig. 2-4*

It is usually desirable to have the remote transmitter of a 4- to 20-mA current loop system powered directly from the transmission line. In some cases, this is not possible because of the high-power requirements set by the remote sensor/transmitter system. In these cases, an alternative to the separate power supply is still possible. If the remote transmitter can be operated in a pulsed mode where it is active only long enough to perform its function, then a charge pool power supply can still allow the transmitter to be powered directly by the current loop. In this circuit, constant current $I_1$ is supplied to the charge pool capacitor, CP, by the HA-5141 (where $I_1 = 3$ mA). The voltage $V_1$ continues to rise until the output of the HA-5141 approaches $+V_s$ or the optional voltage limiting provided by Z2. The LM2931 voltage regulator supplies the transmitter with a stable +5-V supply from the charge collected by CP. Available power supply current is determined by the duration, allowable voltage drop on CP, and required repetition rate. For example, if $V_1$ is allowed to drop 4.4 V and the duration of operation is 1 ms, the available power supply current is approximately:

$$= CP\frac{dV_1}{dt} = 68\ \mu\text{F} \times \frac{4.4\ \text{V}}{1\ \text{ms}} = 30\ \text{mA}$$

## BILATERAL CURRENT SOURCE




This circuit uses a CA3193 precision op amp to deliver a current independent of variations in $R_L$. With R1 set equal to R3, and R2 approximately equal to R4 + R5, the output current, $I_L$, is: $V_{IN}$ (R4)/(R3) (R5). 500-$\mu$A load current is constant for load values from 0 to 3 Ω.

ALL RESISTORS ARE 1%
ALL RESISTANCE VALUES ARE IN OHMS
IF R1 = R3 AND R2 ≈ R4 + R5 THEN

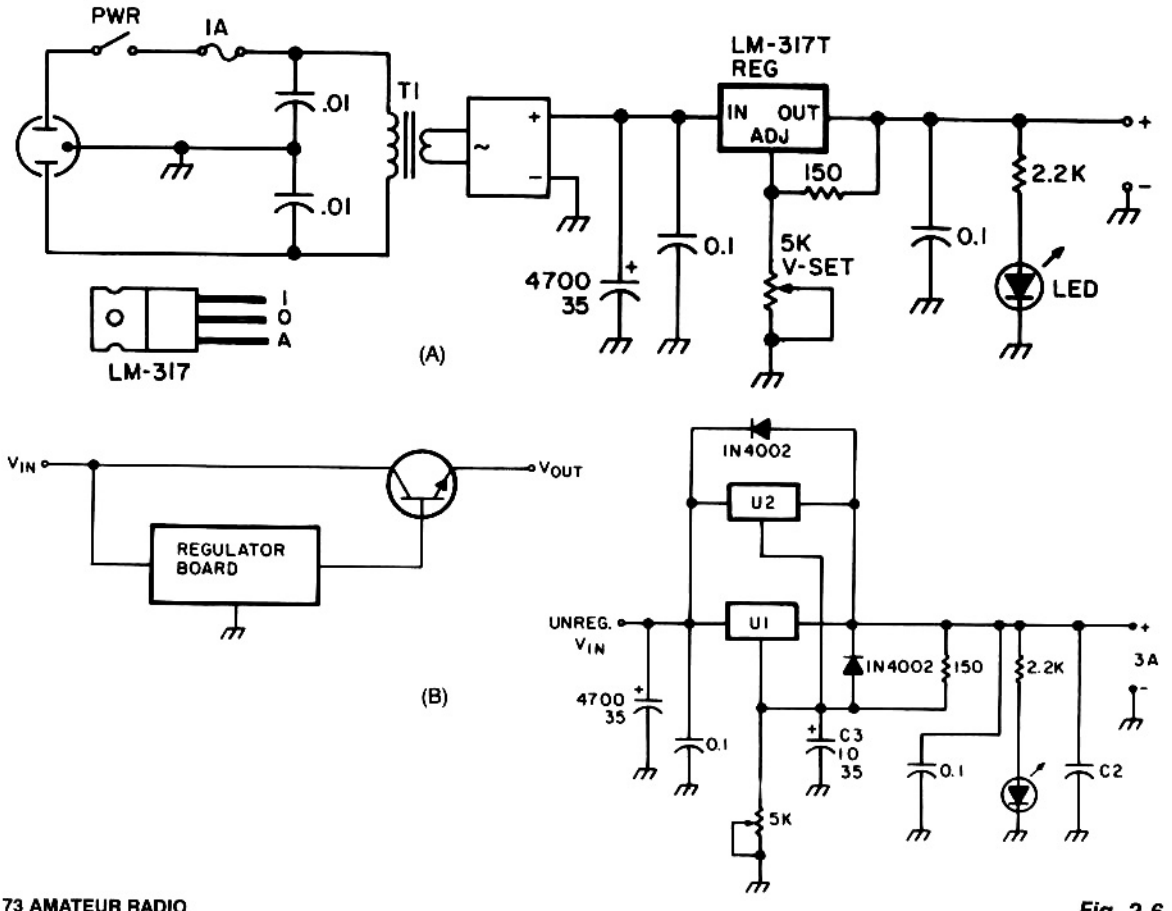
$I_L$ IS INDEPENDENT OF VARIATIONS IN $R_L$
FOR $R_L$ VALUES OF 0Ω to 3KΩ WITH V = 1V

$$I_L = \frac{V\ R4}{R3\ R5} = \frac{V\ 1M}{(2M)(1K)} = \frac{V}{2K} = 500\mu A$$

GE/RCA

*Fig. 2-5*

## 3- to 30-V UNIVERSAL POWER-SUPPLY MODULE



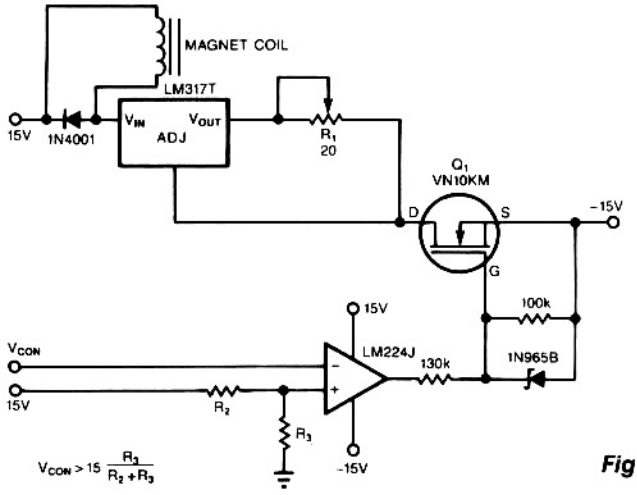

73 AMATEUR RADIO

*Fig. 2-6*

U1, an LM317 adjustable regulator provides short-circuit protection and automatic current limiting at 1.5 A. The input voltage to the regulator is supplied by DB1, a 4-A 100 PIV full-wave bridge rectifier. Capacitor C1 provides initial filtering. U1 provides additional electronic filtering as part of the regulating function. The output level of the regulator is set by trim-pot R1. Bypass capacitors on the input and output of U1 prevent high-frequency oscillation. The current rating of the transformer must be at least 1.8 times the rated continuous-duty output of the supply. This means that a 1.5-A supply should use a 2.7-A transformer. For light or intermittent loads, a smaller 2.0-A transformer should suffice.

Wiring a second LM317, U2, in parallel with U1 is a quick and clean way to increase the current-limiting threshold to 3 A without sacrificing short-circuit protection. When more than 3 A is required, the regulator module can be used to drive the base of one or more pass-transistors (see Fig. 2-6B).

## REGULATOR/CURRENT SOURCE

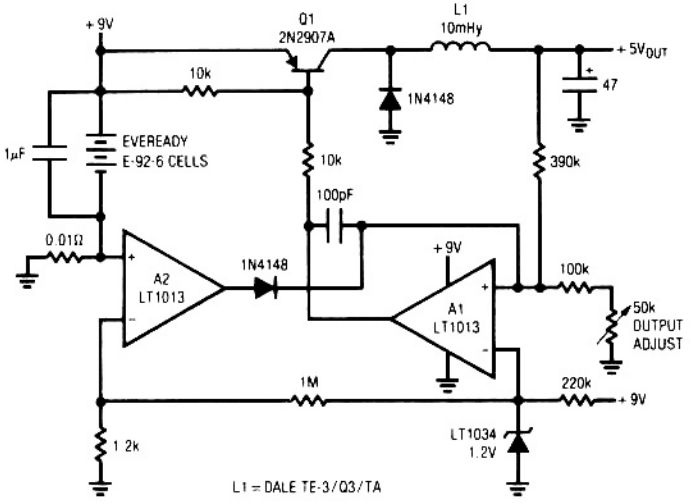



EDN $V_{CON} > 15 \frac{R_3}{R_2 + R_3}$

*Fig. 2-7*

The circuit powers the load via the regulator's input instead of its output. Because the regulator's output sees constant dummy load R1, it tries to consume a constant amount of current, no matter what the voltage across the actual load really is. Hence, the regulator's input serves as a constant-current source for the actual load. Power the circuit with any one of the commonly available ± 15- or ± 12-V supplies. The voltage dropped across the regulator and dummy load decreased the total compliance voltage of the circuit. You set the load's current with R1. The current equals 1.25 A/Ω × $R_1$.

## LOW-POWER SWITCHING REGULATOR




LINEAR TECHNOLOGY CORP.

*Fig. 2-8*