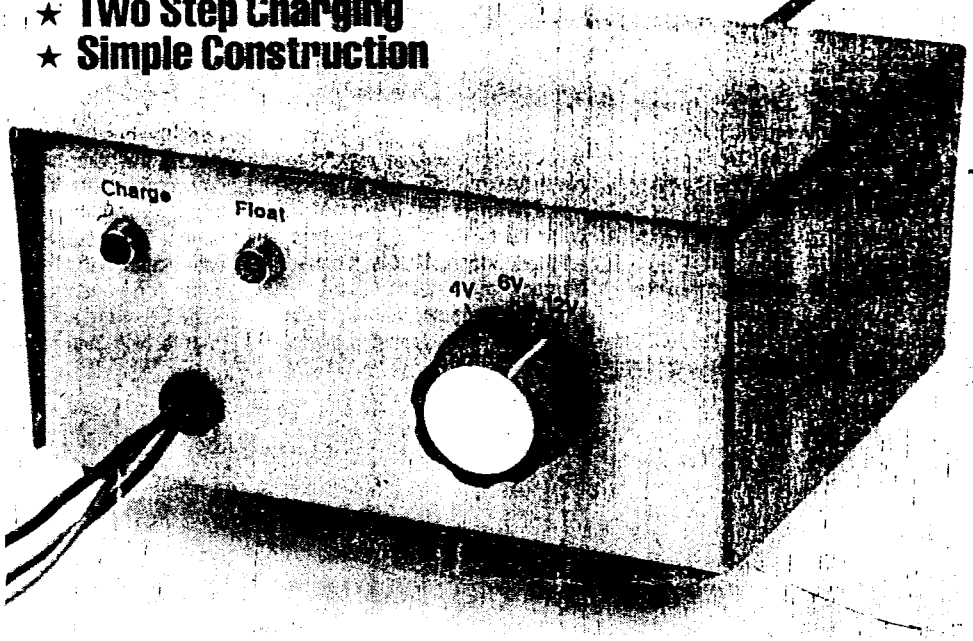
Properly charging sealed lead-acid batteries is very important for long trouble free battery service. The circuit shown in Figure 1 is capable of quickly and safely charging lead-acid batteries, and features temperature compensation in addition to two charging levels (with automatic switchover).

★ Two Step Charging
★ Simple Construction



Circuit Description

Temperature compensation in a charger is important to prevent over-charging, especially if the battery is subjected to wide temperature variations. A temperature coefficient of −5mV/°C/cell at the output of the charger is provided by IC1, a current mode temperature sensor which is either located near the battery, or if high charging currents are involved, it could be attached directly to the battery.

The two-step charging feature provides a higher initial charging voltage

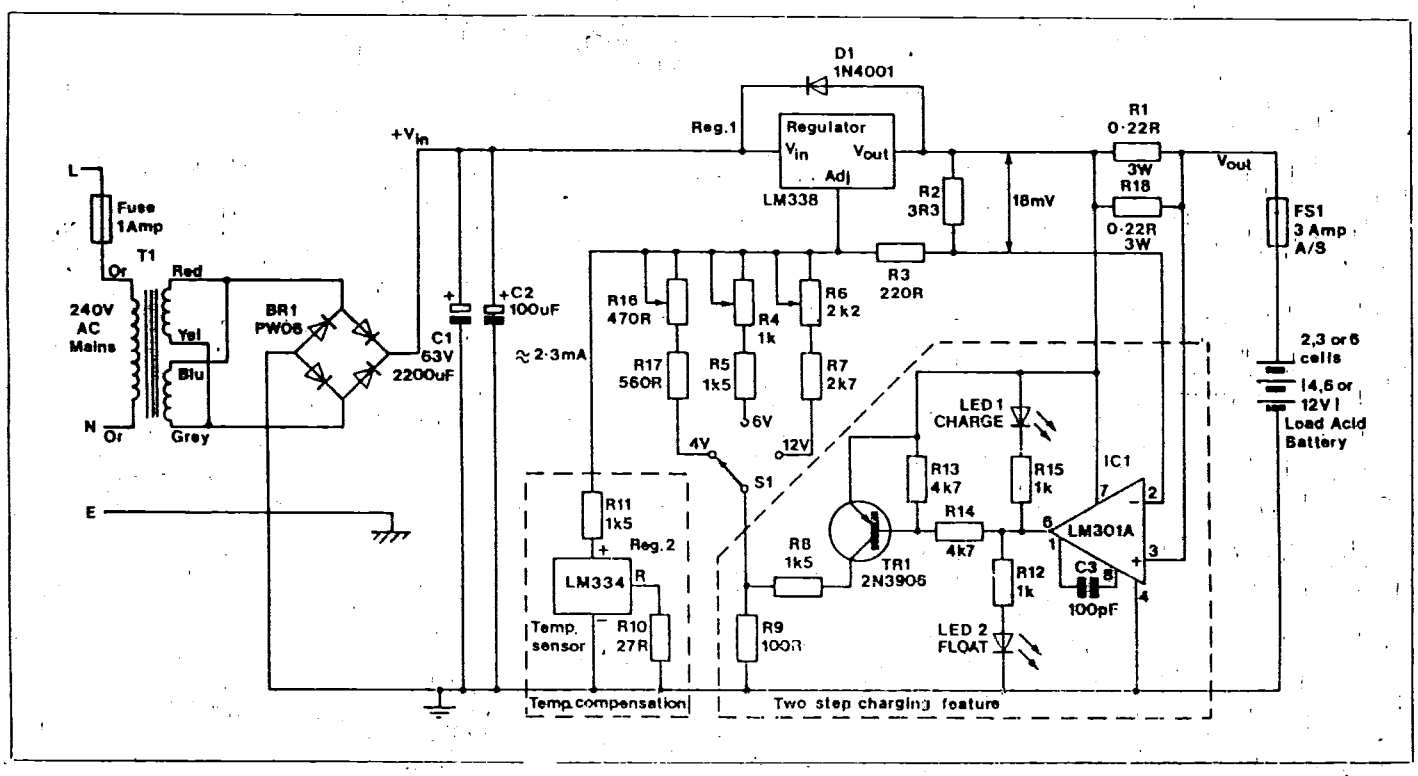
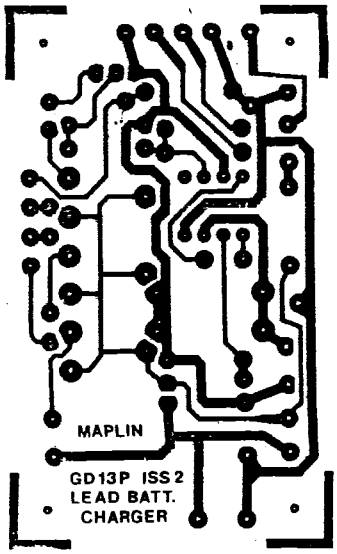
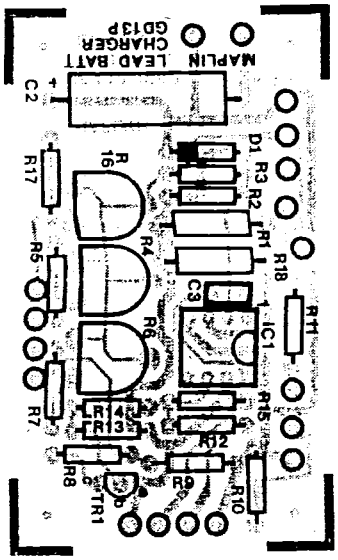
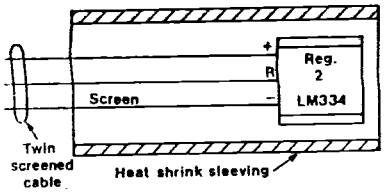


Figure 1. Circuit Diagram





ure 2. PCB Layout and Legend



igure 3b. Fitting REG 2

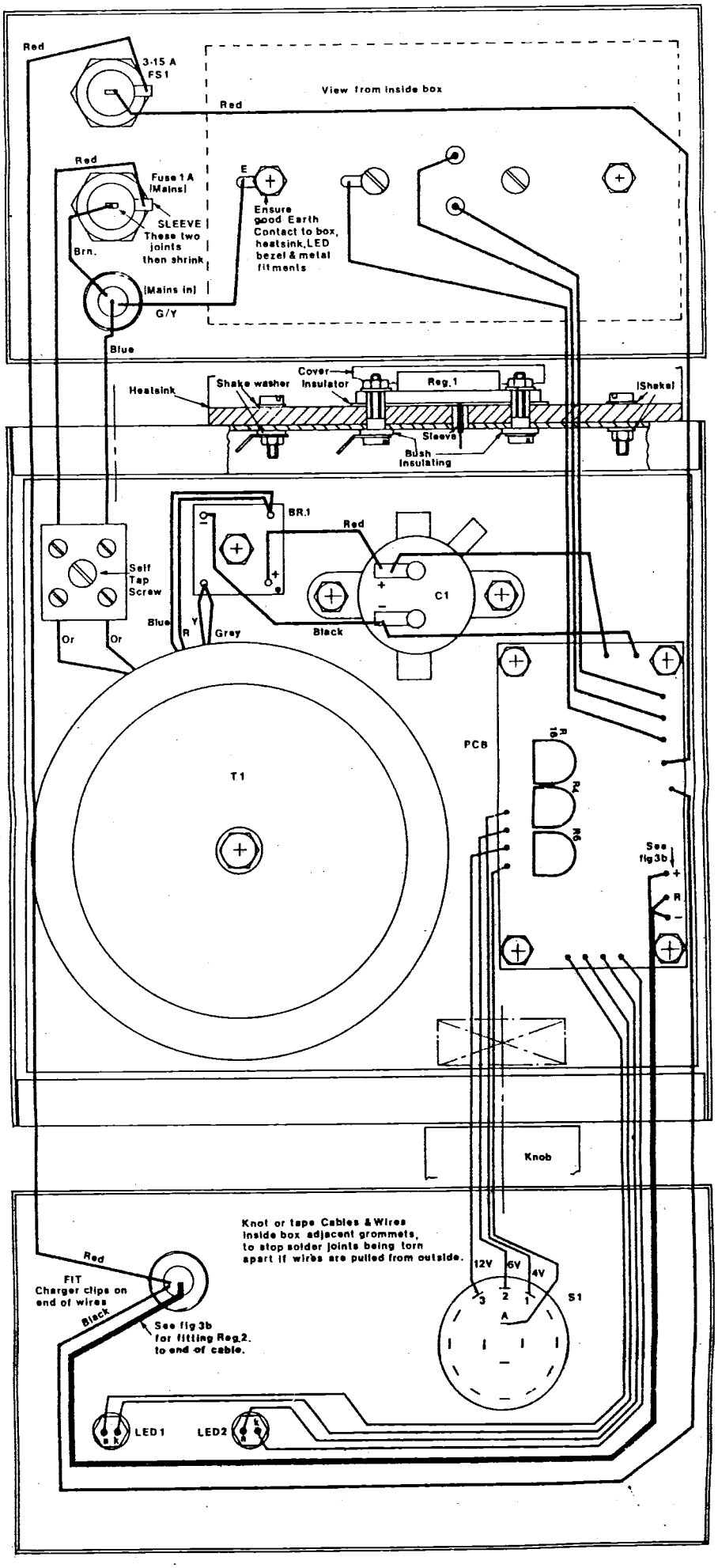


Figure 3a. Wiring Diagram

)nto the heatsink, using the mounting provided. Referring to Figure 3, wire the pcb to S1, LED 1 and 2, IC1, and G 1 respectively, and also the nsformer/ rectifier etc. Figure 4 shows lling details of a suggested case.

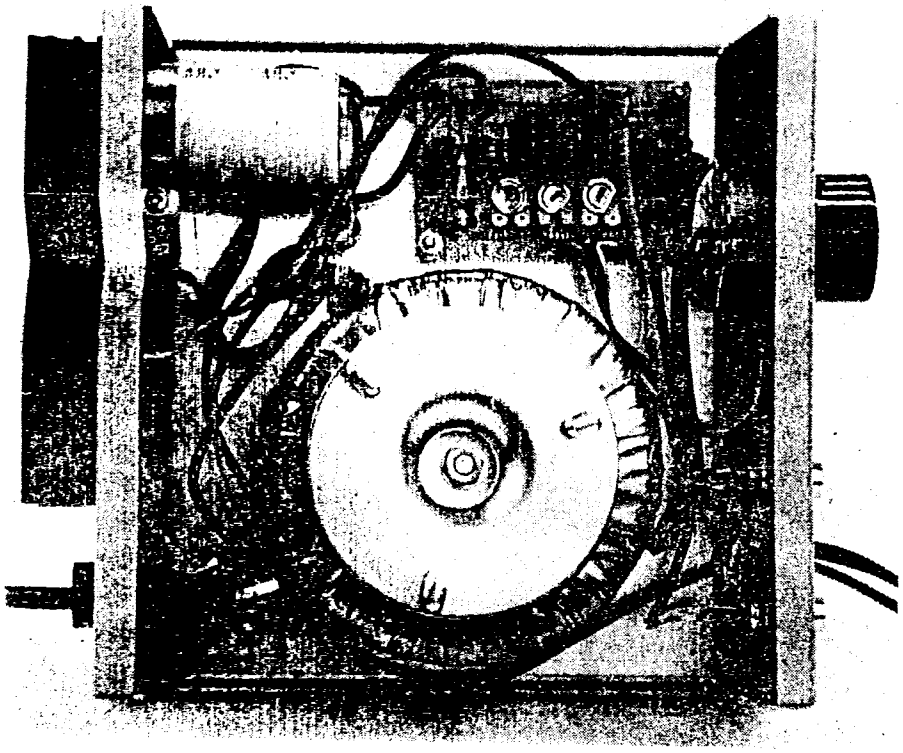
Testing and Use

The accuracy of a digital voltmeter is really required here in order to carry out the following procedure. Apply power to the circuit and connect the digital voltmeter across the output leads. Set S1 to 4V, and adjust R16 for a 4.5V output. Set S1 to 6V, and adjust R4 for a 7.05V output. Set S1 to 12V, and adjust R6 for a 14.1V output. Now connect the output leads to a partially discharged lead-acid battery, first selecting the appropriate voltage setting at S1, and via a multimeter set to read current up to a minimum f.s.d. of 5A. Check the direction of current flow, (if the battery is discharging, you have a problem: re-check your wiring, etc). *Under NO circumstances should the current exceed 5A.*

The red 'charge' LED should be on and should remain on until the charge current falls below ≈ 180mA, at which point the green 'float' LED should light, indicating that the charge cycle has finished and the charger is in trickle charge mode.

Lastly, if the temperature sensor is held between finger and thumb, the charge current should start to drop, indicating that the temperature compensation is functioning correctly.

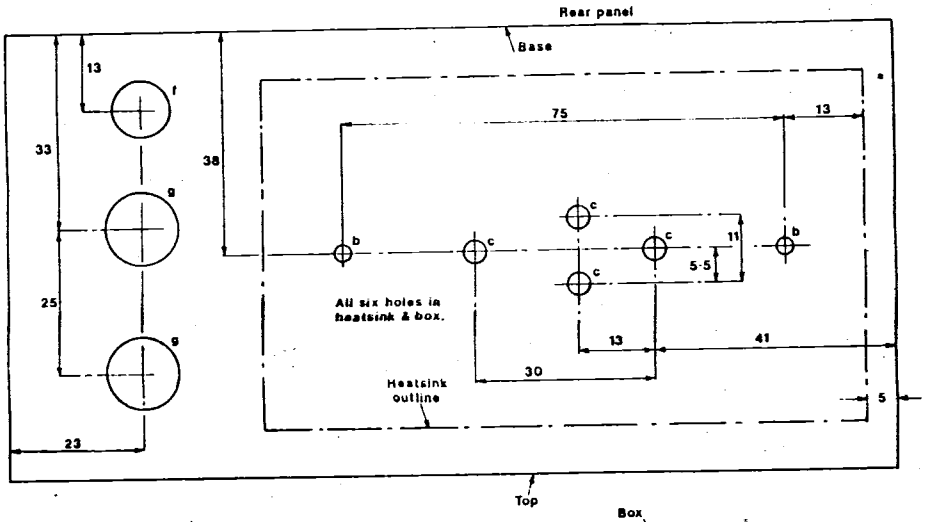
NOTE: When using the charger, you should ensure that correct polarity of the battery connections is always observed and that prolonged short circuit of the output leads is avoided. It is also worth bearing in mind that if the mains supply is removed from the charger whilst it is connected to a battery, the battery will commence to slowly discharge through the charger, so always disconnect the battery before switching off at the mains.

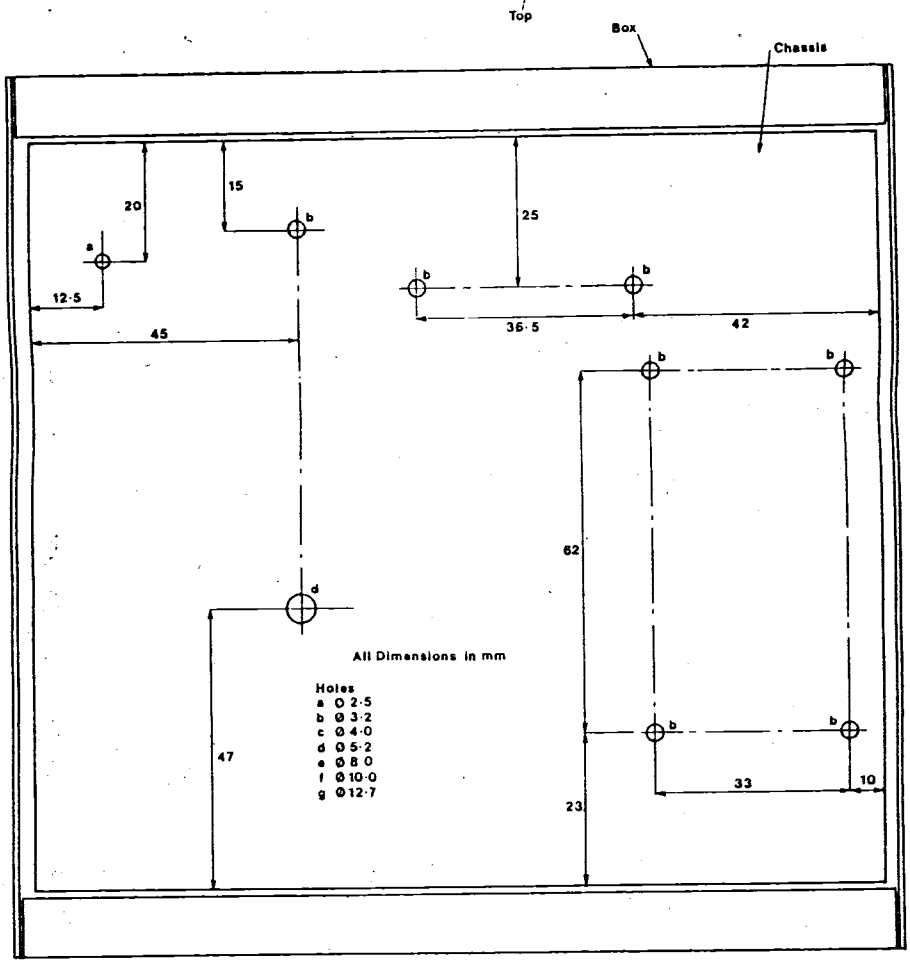


LEAD ACID BATTERY CHARGER PARTS LIST

RESISTORS: All 0.6W 1% Metal Film unless stated			
R1,18	0.22Ω 3W 5% Wirewound	2	(W0.22)
R2	3Ω3	1	(M3R3)
R3	220Ω	1	(M220R)
R4	1k Hor. S. Min. Preset	1	(WR55K)
R6	2k2 Hor. S. Min. Preset	1	WR56L)
R7	2k7	1	(M2K7)
R8,5,11	1k5	3	(M1K5)
R9	100Ω	1	(M100R)
R10	27Ω	1	(M27R)
R13,14	4k7	2	(M4K7)
R12,15	1k	2	(M1K)
R16	470Ω Hor. S. Min. Preset	1	(WR54J)
R17	560Ω	1	(M560R)
CAPACITORS			
C1	2200μF 63V Can Electrolytic	1	(FF22Y)
C2	100μF 63V Axial Electrolytic	1	(FB51F)
C3	100pF Ceramic	1	(WX56L)
SEMICONDUCTORS			
TR1	2N3906	1	(QR42V)
IC1	LM301A	1	(QH36P)
REG1	LM338K	1	(RA88V)
REG2	LM334	1	(WQ32K)
LED1	Chrome LED Large Red	1	(YY60Q)
LED2	Chrome LED Large Green	1	(QY47B)
BR1	PW06 Bridge Rectifier	1	(WQ58N)
D1	1N4001	1	(QL73Q)
MISCELLANEOUS			
T1	Transformer Toroidal 80VA 18V	1	(YK17T)
	Safuseholder 20	2	(RX96E)
FS1	Fuse 3.15A 20mm Anti-Surge	1	(RA11M)
FS2	Fuse 1A 20mm	1	(WR03D)
	Heatsink 4Y	1	(FL41U)
	Insulator Kit T03	1	(WR24B)
	Transistor Cover	1	(FL56L)
	Grommet Small	2	(RW59P)
	Terminal Block 5A	1	(HF01B)
S1	Switch Rotary SW3B	1	(FF76H)
	Blue Case 231	1	(XY44X)
	Knob K7C	1	(YX03D)
	P.C. Board	1	(GD13P)
	Spacer 6BA x ½in.	1 pkt	(FW33L)
	Bolt 6BA x ½in.	2 pkt	(BF06G)
	Nut 6BA	2 pkt	(BF18U)
	Washer 6BA	1 pkt	(BF22Y)
	Tag 6BA	1 pkt	(BF29G)
	Washer Shake 6BA	1 pkt	(BF26D)
	Self Tap No. 6 x ½in.	1 pkt	(BF67X)
	Extra Flex Black	2 mtrs	(XR40T)
	Extra Flex Red	2 mtrs	(XR44X)
	Heat Shrink Sleeving CP48	1 mtre	(BF89W)
	Ribbon Cable 10-Way	1 mtre	(XR06G)
	Lapped Twin Screened Cable	2 mtrs	(XR20W)
	3 Core Mains Black	2 mtrs	(XR01B)
	Charger Clip	2	(HF26D)

A complete kit of all parts is available for this project:
Order As LM01B (Lead Acid Battery Charger)
The following item in the above kit list is also available separately, but is not shown in the 1986 catalogue:
Lead Acid Battery Charger PCB **Order As GD13P**
A ready built version of this project will be available soon – check future issues for details.





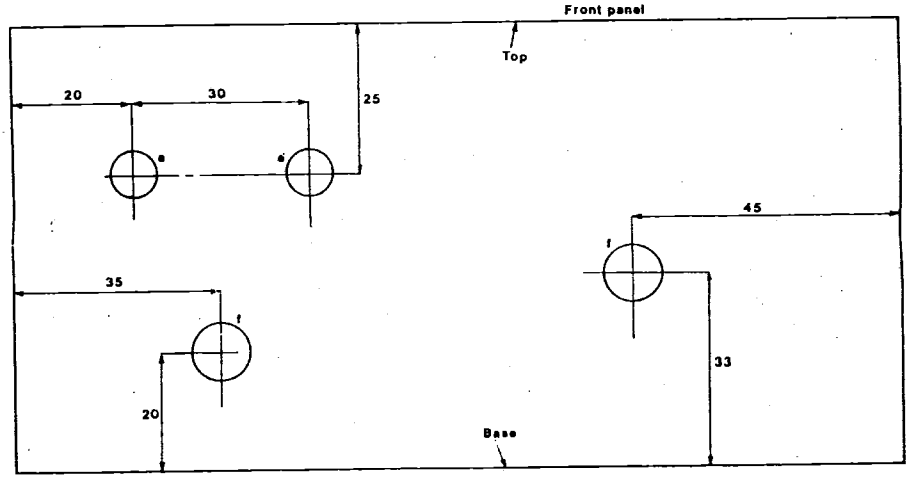
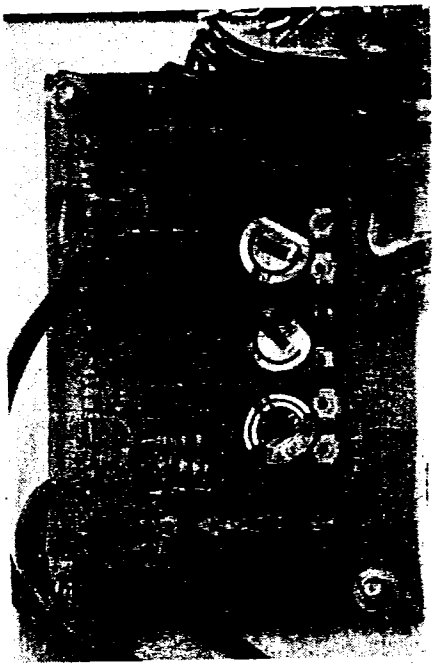


Figure 4. Box Drilling Details



(2.5 Volts/cell @ 25°C) to rapidly bring a discharged battery up to near full charge The amount of charging current is determined by the amount of charge remaining in the battery and the current limit of the regulator, REG 1. As the battery approaches a fully charged condition, the current begins to decrease. When it drops below a predetermined level (≃180mA) the charger's output voltage drops to a float condition voltage of 2.35 Volts/cell @ 25°C, which maintains the battery in a fully charged condition. This float voltag prevents the battery from becoming overcharged, which can seriously shorten its life.

R1/R18 and R2 determine the curre level when the charger switches from a charge mode to a float mode, while R8 and R9 set the amount of voltage change The LED's indicate which mode the charger is in (charge or float). The amount of temperature compensation is controlled by the value of resistor R10.

A unique feature of this charger is that it provides the correct temperature coefficient and the correct amount of charge-mode voltage boost for each cel regardless of the number of cells being charged.

Construction

Insert all veropins from the track side of the board (shown in Figure 2), a push them home firmly with a soldering iron. Solder the pins into place. Now insert all resistors and capacitors, notin the polarity of C1, and solder the component leads in place. Insert and solder the IC socket, ensuring that the end notch is at the same end as the whi bar on the legend; then TR1, referring t the legend for correct orientation. Plug IC2 into the DIL socket with the notch o the IC aligned with the cutout on the socket, and/or pin 1 (marked with a dot) adjacent to the '1' on the legend. Bolt RE