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Bench Power Supply

A bench power supply is one of the most useful pieces of equipment for anyone interested in electronic project construction to have around the workshop, even if the supply is only a relatively simple affair, such as the unit described here.

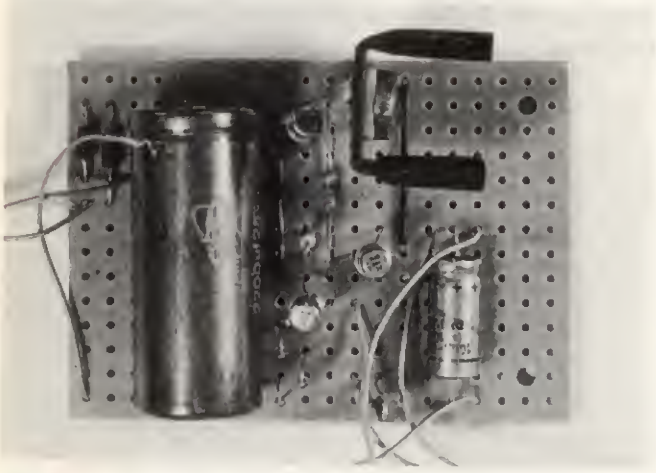

Figure 15.1

Bench power supply

This power supply has an output voltage which can be varied over a range of a little more than 3 to 12V and a maximum output current of 500mA can be provided. The output is very well smoothed and contains an insignificant ripple content. The supply is well regulated and there is little drop in output voltage between zero loading and full loading, especially at low voltages. Regulation efficiency falls away to some extent at higher voltages, but it is still good.

the base of TR1 is connected to the output, and will be switched on when the output reaches a certain potential. About 0.65V is needed across the base and emitter terminals of TR1 to switch this device on, but about 0.65V is developed across each of the three forward biased silicon diodes in the emitter circuit of TR1. Therefore about 2.6V is needed at TR1 base before this component will be biased into conduction.

When the output voltage reaches this figure and TR1 turns on, some of the base bias current for the output stage is diverted to earth through TR1 and D3 to D5. This effectively limits the output voltage to about 2.6V as any rise above this level simply causes TR1 to conduct more heavily and reduce the drive voltage to the output stage. This brings the output voltage back to its original level.

Similarly, if the output voltage should fall for some reason, due to increased loading on the output for instance, TR1 will conduct less heavily and will increase the drive voltage to the output transistors. This brings the output voltage back to its previous level once again. Thus the output potential is stabilised by a negative feedback action.

If the slider of VR1 is taken down its track, the feedback will still operate and stabilise the output voltage, but a higher output voltage will be needed in order to produce 2.6V at TR1 base. The further down the track of VR1 the slider is taken, the higher the output voltage will become. In this way VR1 may be used to vary the output voltage.

R2 and TR3 form the current limiting circuitry, and these limit the current to a maximum level of about 600mA or so. This circuitry will not be described in more detail as it works in precisely the same manner as the NiCad battery charger described in a previous section of this book.

C2 provides final smoothing of the output and FS1 protects the circuit in the event of a short circuit occurring ahead of the current limiting circuit, or if the latter should fail for some reason.

Construction

Most of the circuitry is wired up on a 0.15in matrix stripboard panel having 14 copper strips by 20 holes. Details of this panel are provided in Fig. 15.3. Be careful not to omit any of the seven breaks in the copper strips or either of the two link wires. In fact, great care should be taken not to make any wiring errors as this could very easily result in damage to some of the components.

S1, VR1 and the output sockets are mounted on the front panel of the case. The output sockets can be wander types, or terminal posts, which are ideal for this application, may be used.

T1 and the fuse holder for FS1 are mounted on the base panel of the case. The circuit will work quite well using a 12 – 0 – 12V 500mA component for T1, but for optimum results at output voltages of ten or more a component having a current rating of 1A is to be preferred as this will provide a more adequate loaded voltage. However, for normal amateur requirements a 500mA type will provide adequate results.

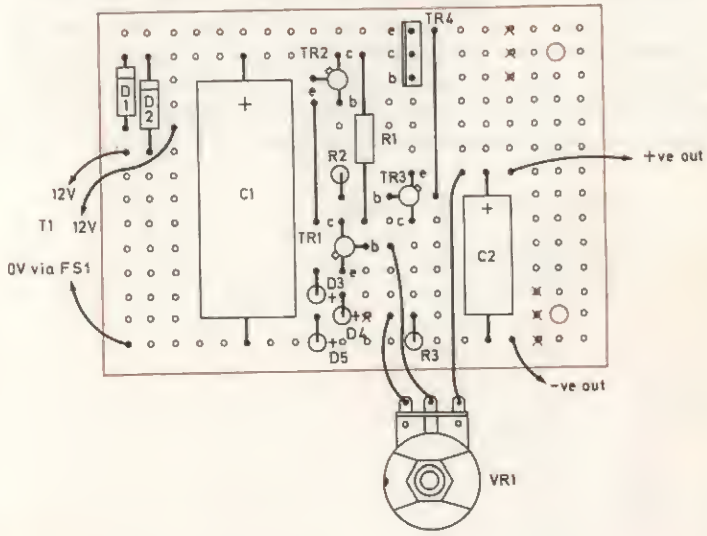

Figure 15.3

Strip board layout of the power supply

A hole for the mains lead is made in the rear panel of the case, and this should be fitted with a grommet. If a metal case is used, the mains earth lead should be connected to the case, and this connection can be achieved via a soldertag on one of the mounting bolts for T1. The mains earth lead also connects to the side of FS1 which connects to the negative rail of the component panel. The remaining wiring is then completed before the component panel is bolted in position on the base panel of the case.

Note that TR4 must be provided with a certain amount of heatsinking. A small commercially produced type was found to be just about adequate on the prototype.

Using the unit

It is recommended that a dial calibrated in output voltage should be provided around the control knob of VR1, and with the aid of a multimeter this is very easily accomplished. If this is not done it will be

necessary to set the output voltage to the required level with the aid of a multimeter each time the unit is used. Of course, an integral meter can be used to monitor the output voltage, and a current meter could also be added if desired, but panel meters are relatively expensive, and the added convenience of built in metering would result in the cost of the project being very considerably increased.

It is a good idea to check that the current limiting circuitry is working by connecting a 10Ω resistor and a multimeter set to read 1A f.s.d. in series across the output with the output voltage set to 7.5V. The meter should register a current flow of about 600mA or so, and if the reading is more in the region of 750mA, this indicates a fault and the relevant part of the circuit should be checked for errors.

Components list for the bench power supply

Resistors (all miniature ¼W, 5%)

R1	4.7kΩ
R2	1Ω
R3	1kΩ
VR1	5kΩ lin. carbon

Capacitors

C1	2200μF, 25V
C2	100μF, 16V

Semiconductors

TR1	BC108
TR2	BC108
TR3	BC108
TR4	TIP41A
D1	1N4001
D2	1N4001
D3	1N4148
D4	1N4148
D5	1N4148

Transformer

T1	Standard mains primary, 12 – 0 – 12V, at 1A or 500mA secondary (see text)

Switch

S1	Two pole rotary mains switch

Miscellaneous

Metal instrument case
0.15in matrix stripboard panel
Heatsink for TR4
Two control knobs
Chassis mounting 20mm fuseholder with 500mA fuse (FS1)
Output sockets and leads
Mains lead, mains plug, connecting wire, solder, etc.