COMPACT POWER UNIT

by K. Adkins

A USEFUL adjunct to a workshop bench is a d.c. power source that has a general purpose appeal to the majority of valve circuit applications. The beginner, attempting the construction of mains-operated equipment for the first time, should find little difficulty in making this unit. It will provide a valuable exercise in wiring commonly used components.

INTRODUCTION

The unit was originally designed to provide power for a small amateur radio station, comprising a home built receiver and transmitter for top band. The usual heater supply of 6·3 volts at a few amps was required, together with an h.t. supply of 250 volts at 60 to 70mA. The receiver and transmitter were not intended to draw h.t. at the same time!

Also, and most important, there was very little room available on an already crowded table top, and so the unit had to be physically small.

Thus this unit was evolved, using a chassis 7in × 5in × 2½in. It was constructed as far as possible with components that were to hand.

CIRCUIT

It can be seen from Fig. 1 that the circuit employs full wave rectification, with the usual capacitor and choke smoothing and filtering arrangement.

A double pole switch S1 is incorporated in the mains input, thus ensuring complete isolation from the mains when S1 is off. The unit is equipped with fuses to protect it from overload conditions.

An EZ81 was used as the double diode rectifier. This valve has a 6·3 volt heater which is supplied by the 6·3 volt 1 amp transformer winding with one side taken to chassis. A pilot lamp LP1 is fitted and connected across the same winding.

After rectification, the supply is smoothed by the π-filter made up of C1, L1, and C2. On no load the reservoir capacitor C1 is charged to about 350 volts. On full load of 65mA the output is reduced to 250 volts.

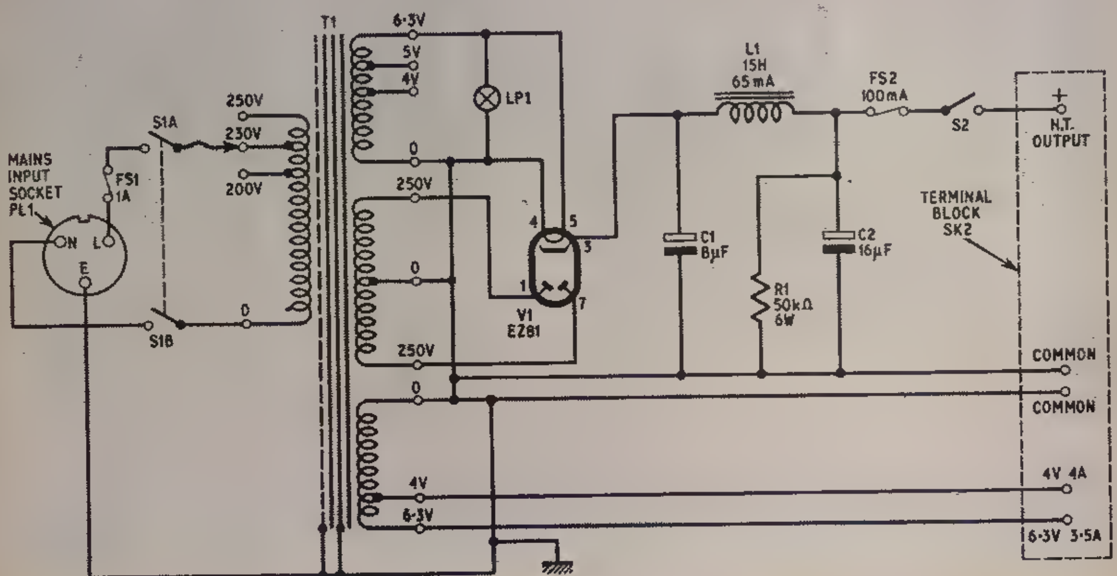


Fig. 1. Circuit diagram of the complete power unit

SPECIFICATION . . .

A.C. INPUT	200 to 250 volts, 50c/s mains
D.C. OUTPUT	250 volts, 65mA
A.C. OUTPUT	6·3 volts, 3·5 amp
	or
	4 volts, 4 amp

It is a characteristic of this type of power unit, where the regulation is poor, that the output voltage will vary between the limits given, dependent on the load current drawn.

The ripple fundamental frequency of 100 c/s is reduced by the factor $L_1C_2\omega^2 - 1$. This was measured and found to have an r.m.s. value of less than 0·5 volts which can be neglected for many practical applications.

A single "canned" electrolytic, 8 + 16μF at 500V working was used for capacitors C1 and C2, the latter being shunted by a "bleeder" resistor R1, the function of which is to discharge C1 and C2. This is a rather important feature since it prevents the possibility of shocks should the h.t. line be touched immediately after switching off the unit. An h.t. switch, S2, is incorporated after the "bleeder" resistance so that the h.t. may be switched off independently of the 6·3V heater supply.

There is one other heater winding made available on the unit giving either 4 volts 4 amp, or 6·3 volts 3·5 amp. It will be seen from the circuit diagram that one side of each 6·3V heater winding is connected to chassis. In the wiring of the output side of the transformer, all tags marked "0", including the tag marked screen should be taken to a common point on the chassis.

All the output voltages at the terminal block are quoted as being relative to "0" or "chassis". If the valve heaters of an external piece of equipment connected to the unit are connected to chassis on one side, it is important that both earth lines are made common, otherwise the heater winding will be short-circuited.

The 1 amp fuse gives transformer protection, but prudence should be exercised in all cases. It is worth mentioning at this point that the common line should be connected to earth at the power unit end only, otherwise hum may arise from earth loops.

COMPONENTS . . .

Resistor
R1 50kΩ 10% 6W wirewound

Capacitors
C1 8μF elect. 500V } in the same can
C2 16μF elect. 500V }

Choke
L1 15H 65mA

Transformer
T1 Primary 200-230-250 volts
Secondary 1: 250-0-250V, 80mA;
2: 4V 4A or 6·3V 3·5A;
3: 4V, 5V 2A, or 6·3V 1A
(Douglas mains transformer type MT 1 AT)

Valve
V1 EZ81 (Mullard)

Switches
S1 Double-pole, on-off, toggle switch
S2 Single-pole, on-off, toggle switch

Fuses
FS1 1A (cartridge type with panel mounting fuseholder)
FS2 100mA (cartridge type with panel mounting fuseholder)

Plugs and Sockets
PL1, SK1 Chassis mounting mains connectors 3-pin (Bulgin type P73 or similar)
SK2 Terminal block, at least 5-way (see photographs)

Lamp
LP1 6·5V, 0·15A with red indicator mounting

Miscellaneous
Chassis 7in × 5in × 2½in (H. L. Smith & Co. Ltd., 287 Edgware Road, London W2); 89A valveholder; Five-way tag strip, centre tag chassis mounting; Grommets for ⅜in dia. mounting hole; P.V.C. covered wire; Nuts and bolts 4B.A. and 6B.A., ½in long; Expanded metal 16in × 14in for protective cover.

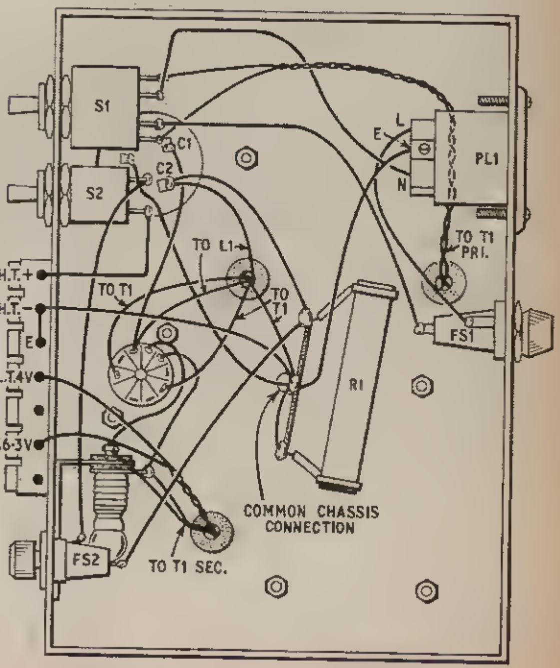


Fig. 2. Underside view of the chassis

CONSTRUCTION

The chassis of 16 s.w.g. aluminium sheet, was bought. It is a commonly available size and no difficulty should be found in acquiring one (see components list).

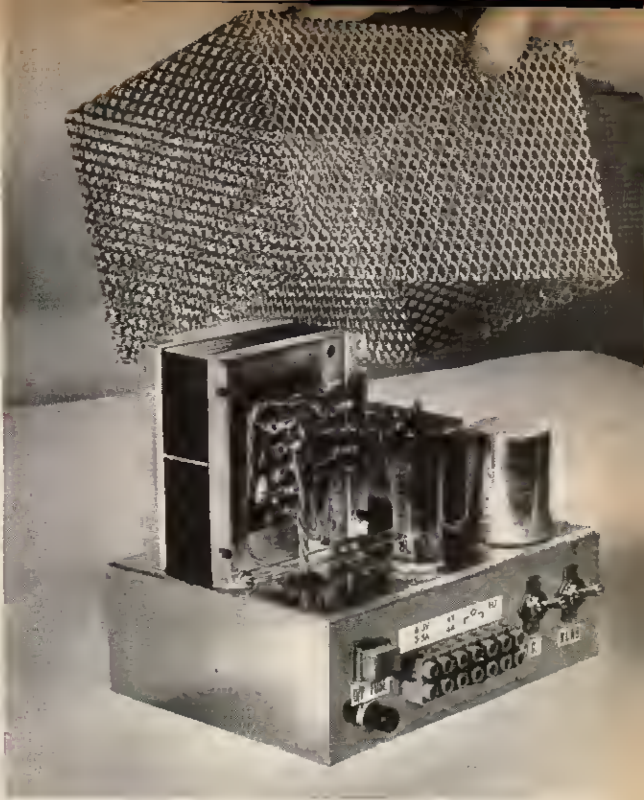
The mains supply is connected via socket SK1 to the mains fuse and mains windings of T1. Make sure that the correct mains tappings are used to suit the mains supply voltage. The chassis drilling details in Fig. 3 conform to the components specified and these should be followed if the small physical size of the whole unit is to be maintained.

Leads are taken from the transformer and choke to the underside of the chassis, through rubber grommets fitted to the chassis, to the valveholder tags and capacitors. R1 is mounted on the tag strip, the mounting tag of this strip is the common connection for all leads going to chassis.

All leads carrying a.c. should be twisted, to reduce the risk of hum pick-up. The wire used for the 6·3V and 4V supplies should not be too thin if several amperes are to be carried (18 s.w.g. will suit all heater wiring here). The outputs are taken by way of five holes drilled through the front of the chassis. The ends are then bared and held securely by the lower screws of the terminal block. It is important that the holes drilled should be free from burrs to obviate any chance of short circuits due to puncturing the insulation. The use of grommets will also obviate these risks. The output leads should be insulated as far as possible into the terminal block.

When the wiring has been completed it should be thoroughly checked; then the power unit may be tested. No difficulty should be experienced in getting the unit to work as the circuit is quite simple.

In practice, the unit has served its purpose very well, producing virtually no hum and running quite cool with a continuous drain of 70mA from the h.t. terminals. ★



Complete power unit showing the cover made from expanded metal. This cover can be attached to the chassis with self-tapping screws

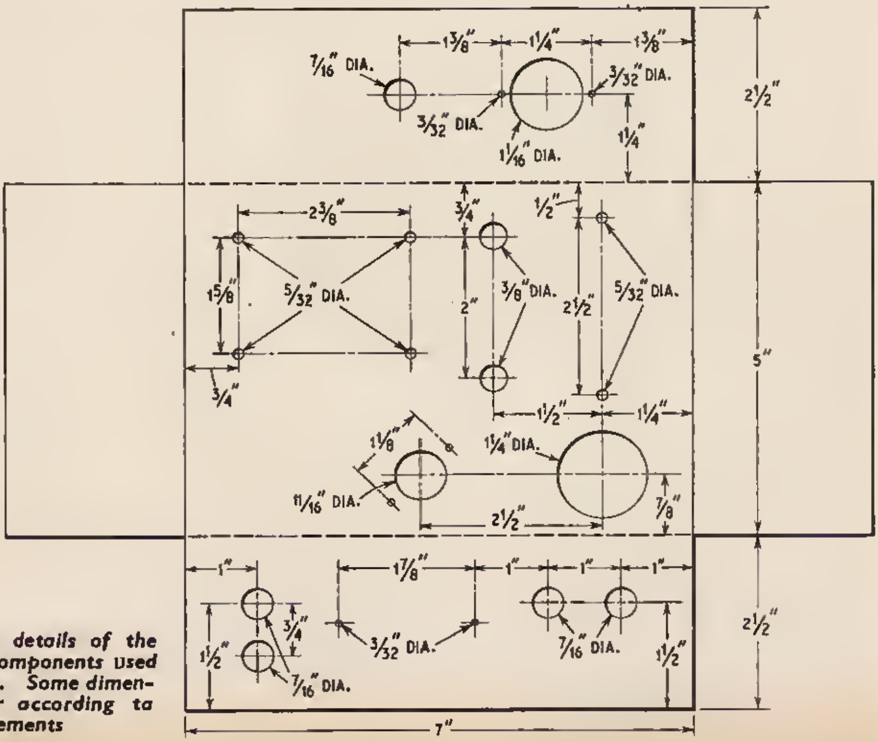


Fig. 3. Drilling details of the chassis for the components used in the prototype. Some dimensions may differ according to individual requirements