VARIABLE STABILISED VALVE POWER SUPPLY

170 - 320 VOLTS AT 130mA

INTRODUCTION

This power supply was constructed to power experimental valve circuits. Projects involving thermionic valves are something of a rarity in the 21st century and ready made power supplies are not available reasonably cheaply. It was therefore decided to build this equipment using items to hand in the 'junk box'. The only items which were purchased were the panel meters, the neon indicator lamps, the steel chassis, the wire wound resistors and the small value capacitors.

WARNING

This day and age one must issue warnings for everything. It should be pretty obvious that high voltage electricity is dangerous but even so the reader is warned that this project uses dangerously high voltages at high currents. These voltages can kill if handled carelessly. At points in this equipment voltages of almost 500v are present on unguarded components. These voltages are also present on the output terminals.

Used carefully, sensibly and with regard for the voltages and currents involved this equipment will be safe and is fuse protected against short circuits. When switched off the voltages decay very quickly.

DISCLAIMER

The author will accept no responsibility for any damage to persons building this equipment from this design. You build and use it at your own risk and it will be assumed that if you go ahead and build this equipment you are competent to do so and are familiar with building and using high voltage equipment. The author will also not accept any responsibility for damage to existing equipment which is connected to the constructed power supply. You connect it at your own risk.

SPECIFICATION

Input:	250v AC fused at 1A. The equipment must be earthed
Outputs:	170 - 320v continuously variable and stabilised at 130mA maximum continuous This output is switched and metered and fused at 150mA. The negative terminal is earthed.
	6.3v AC at 6A floating

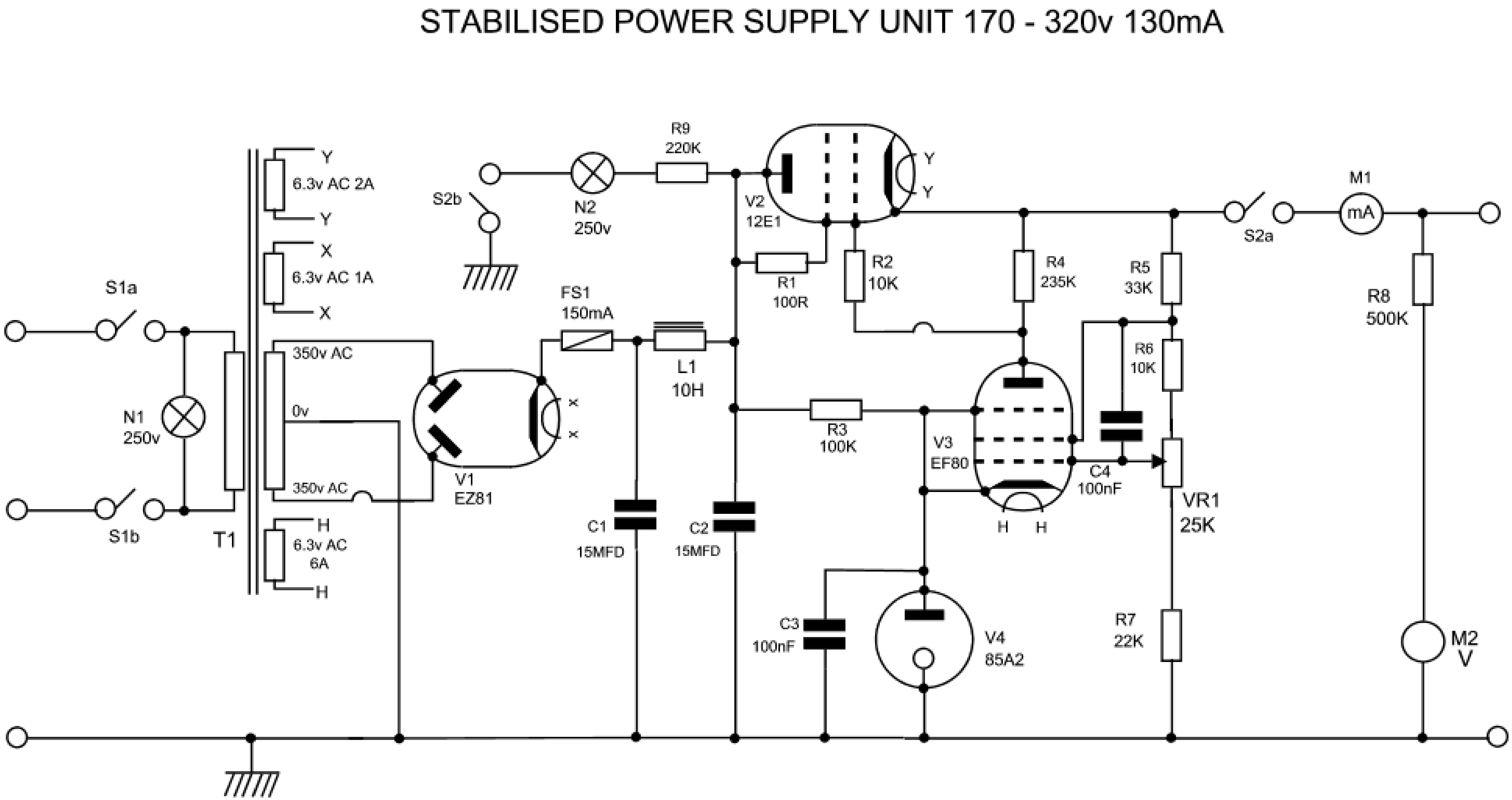
STABILISED POWER SUPPLY UNIT 170 - 320v 130mA
R9
220K
Y
6.3v AC 2A
Y
X
6.3v AC 1A
X
S2b
N2
250v
V2
12E1
R1
100R
R2
10K
R4
235K
R5
33K
S2a
M1
mA
R8
500K
S1a
FS1
150mA
L1
10H
R6
10K
350v AC
N1
250v
0v
V1
EZ81
R3
100K
V3
EF80
C4
100nF
VR1
25K
350v AC
S1b
T1
H
6.3v AC
6A
H
C1
15MFD
C2
15MFD
H
H
C3
100nF
V4
85A2
R7
22K
M2
V

Figure (i)

PARTS LIST

R1	100R carbon ½W	V1	EZ81
R2	10K carbon ½W	V2	CV345 (12E1)
R3	100K wire wound 5W	V3	EF80
R4	2 x 470K carbon ½W in parallel	V4	85A2
R5	33K wire wound 5W		
R6	33K + 10K in parallel 2W	N1	220V neon panel mount green
R7	22 K wire wound 5W	N2	220V neon panel mount red
R8	2 x 1M carbon ½W in parallel		
R9	220K carbon ½W	M1	0 - 300mA Sangmo-Weston (30mA FSD)
C1	15MFD 600V DC oil-filled paper	M2	0 - 500v Sangmo-Weston (1mA FSD)
C2	15MFD 600V DC oil-filled paper		
C3	0.1MFD 630v DC Mylar film	S1	DPST toggle switch 250v 3A
C4	0.1MFD 630v DC Mylar film	S2	DPST toggle switch 250v 3A
FS1	150mA quick blow	T1	Parmeko Neptune Series 250v AC input; 6.3v 1A, 6.3v 2A, 6.3v 6A, 350-0-350 150mA outputs
FS2	1A quick blow (mains fuse)	L1	10H 350mA
		CHASSIS	12"x12" adaptable steel box
VR1	25K wire wound linear 2.5W	TERMINALS	4mm insulated terminal posts (1000v)

None of the components are especially critical. They were what was available in the 'junk box' at the time. Some of the resistors will need to be wire wound and high wattage due to the currents flowing through them, R3 being a case in point.

If a different mains transformer is used it should have at least one isolated 6.3v heater winding at 3A and a separate 6.3v winding for the experimental equipment heaters. A transformer with a 5v winding for a rectifier heater would be OK, in which case the EZ81 should be replaced with a similar 5v heater valve. A mains transformer with a lower secondary voltage of 250v and a lower current output would work but the output voltages will differ from those given in this design.

An EZ80/CV4 valve could be used for V1 if the high voltage secondary current is less than 100mA.

Do not be tempted to replace the rectifier valve with semiconductor diodes. The surge charging current into the smoothing capacitors on switch on would blow the 150mA fuse every time. As the valve warms up the voltage on the capacitors builds slowly and the surge current is avoided.

V2 could be replaced by a range of output valves which can handle the necessary current. For example an EL34 could handle currents up to 100mA or a pair of EL84 valves could be used instead.

C1 and C2 could be replaced by electrolytic capacitors so long as their voltages match the expected rectified voltage. For example for a 250-0-250 secondary C1 and C2 could be 16MFD 450v electrolytic capacitors, which are commonly available.

The 85A2 neon stabiliser could be replaced by high wattage Zener diodes to give the required voltage.

CONSTRUCTION

The first stage in construction was to drill the chassis and front panel. The base of the adaptable box was used as the front panel and this was cut down to 9" on one side. No measurements are given for drilling the chassis as these will depend on the components being used.

All holes in the chassis were drilled to 1/8" initially. Where larger holes were needed these were produced using the appropriate sized taper drill or in the case of the meters a HSS hole cutter;

CV345 valve holder (International Octal)	1"
EZ81 and EF80 valve holder (B9A)	3/4"
85A2 valve holder (B7A)	5/8"
RV1 mounting hole	3/8"
Toggle switches	1/2"
Neon lights	7/16"
Terminal posts	5/16"
Grommet holes	3/8"
Panel meters	2.1" (53mm)
Fuse holders	5/8"

The front panel was held to the main chassis using 4BA bolts.

After drilling the chassis was smoothed down using 200 grade wet and dry paper to key the surface for painting. The front panel was painted white and the chassis orange. The painted chassis is shown in figures (ii) and (iii) below.

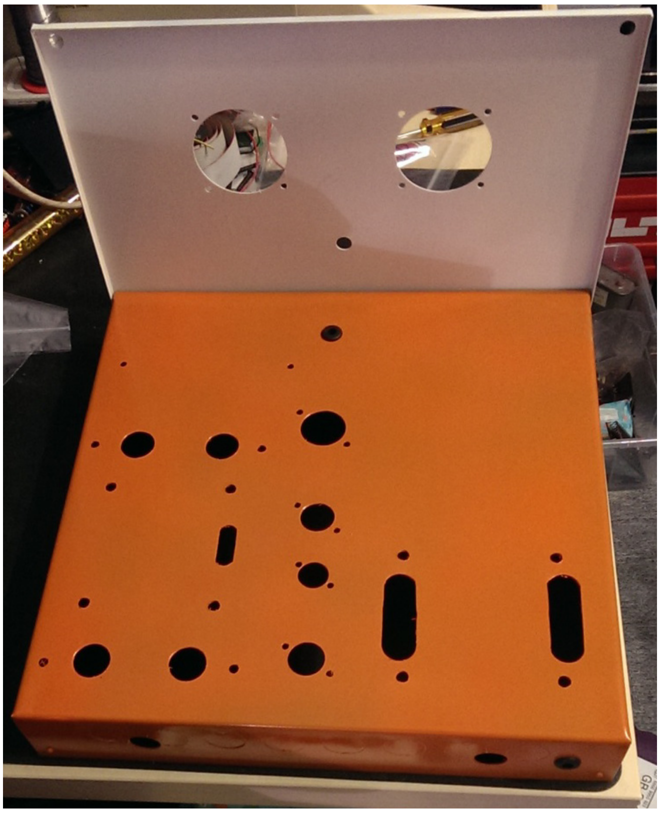

Figure (ii)

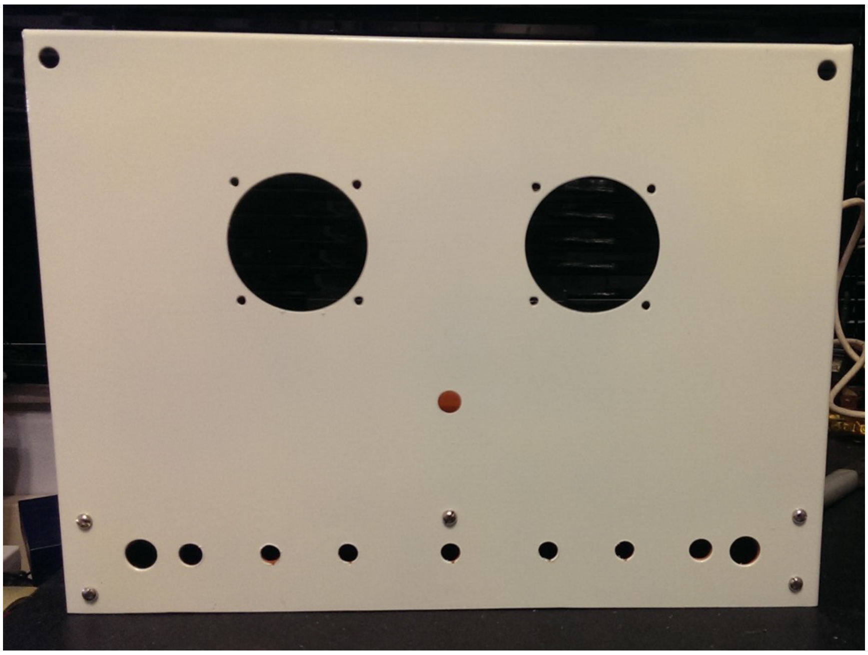

Figure (iii)

The next stage was to fit the smaller mechanical components, grommets, valve holders, switches, neon lamps and terminal posts. Lastly the larger, heavier components were fitted. Figure (iv) below shows the black mains transformer in position.

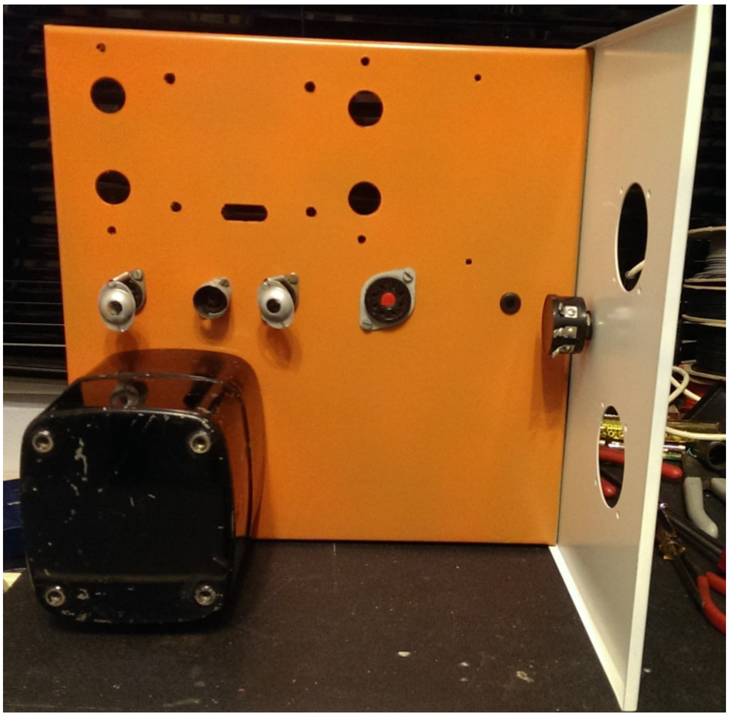

Figure (iv)

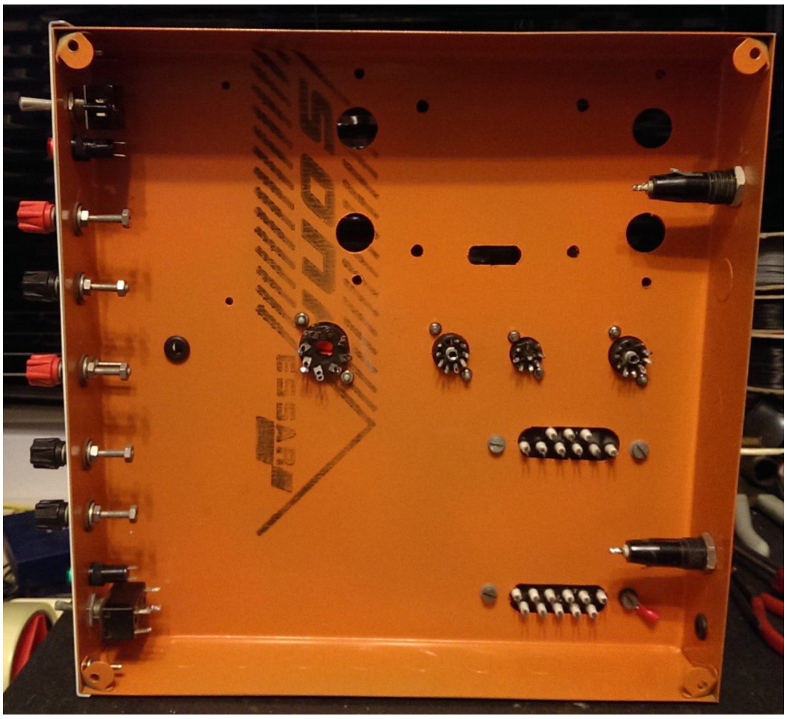

Figure (v)

Figure (v) shows the same stage of construction from an under chassis view and figure (vi) shows a rear view when all the heavy components have been mounted.

Figure (vi)

Figure (vii)

Figure (vii) is the completed mechanical construction viewed from the front.

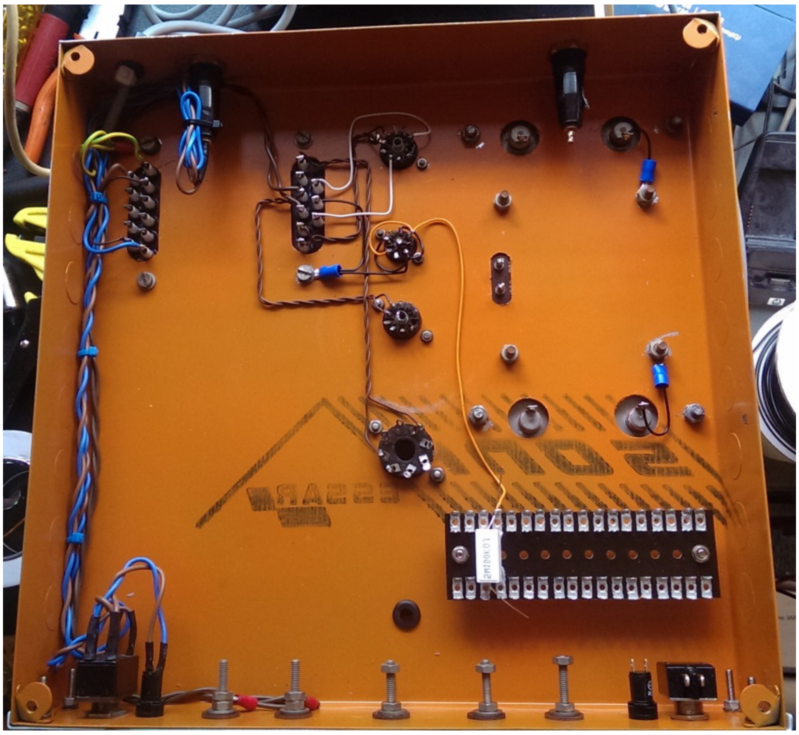

Figure (viii)

The first stage in wiring the unit was to connect the mains wiring to the transformer, fuse and switch and check that the correct voltages appeared at the transformer terminals. After this the heater wiring was connected (the twisted pair brown wires in figure (viii)) and tested with the valves in pace to see that the heaters glowed. When this was checked as working the high voltage secondaries were connected to the rectifier valve anodes and the common terminal was connected to the chassis (the white and black wiring in the photo).

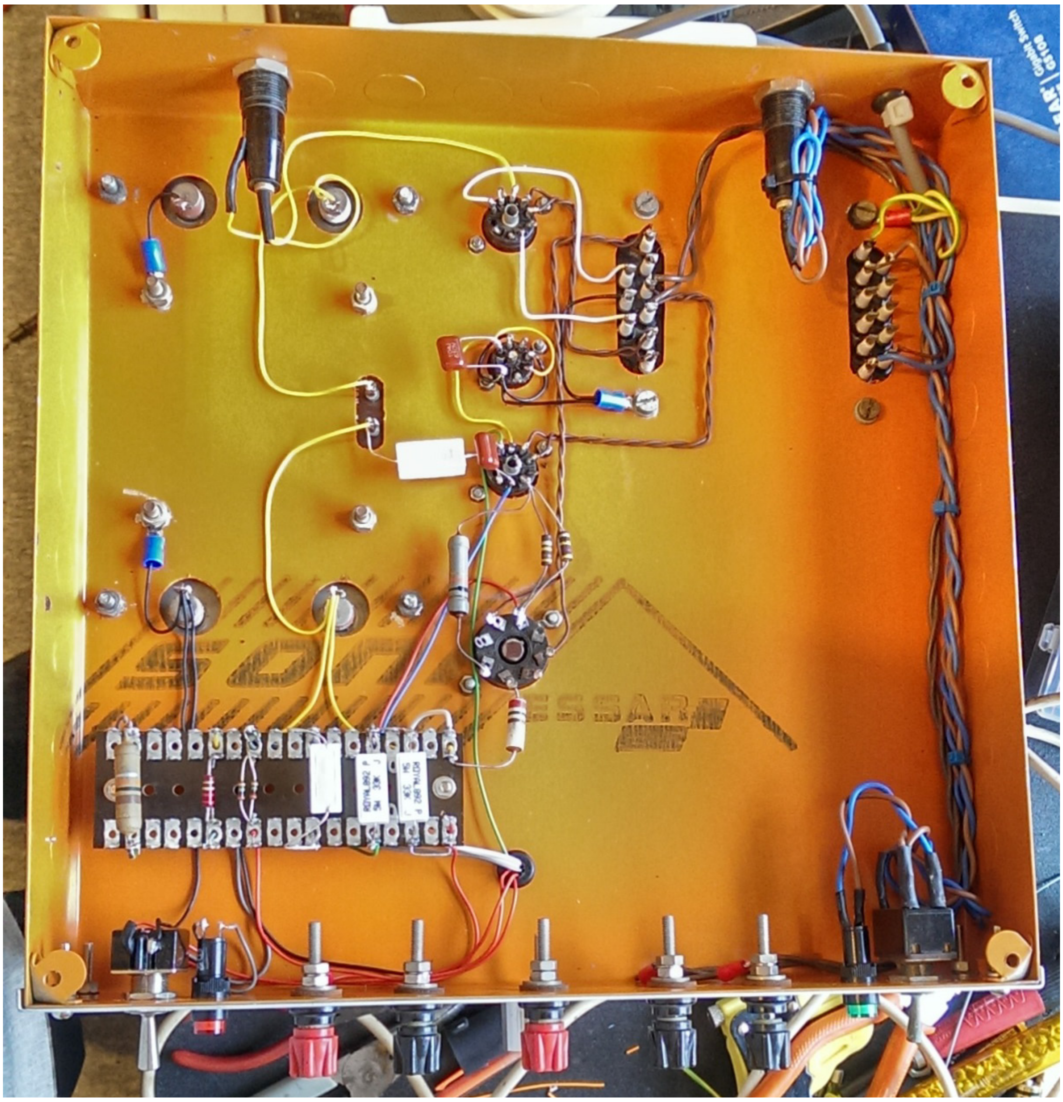

Figure (ix)

Afterwards the wiring was completed methodically. First the rectified output was connected to C1, C2 and L1 and checked to show that it was 490v without load. The quality of the capacitors was checked by measuring the rate of decay of the voltage on them when the unit was switched off. A high rate of decay would indicate leaky capacitors.

The next stage wired was the voltage regulator valve, 85A2, and it was checked that the regulated voltage was 83v. After this the wiring of the CV345 (12E1) and the EF80 was completed and the voltage adjustment and measurement components were wired onto the tag board shown in figure (ix). Switch S2 was wired as was the high voltage on neon.

The final stage was to connect the above chassis components, the anode of the CV345 (12E1), the meters and the voltage adjustment potentiometer (RV1).

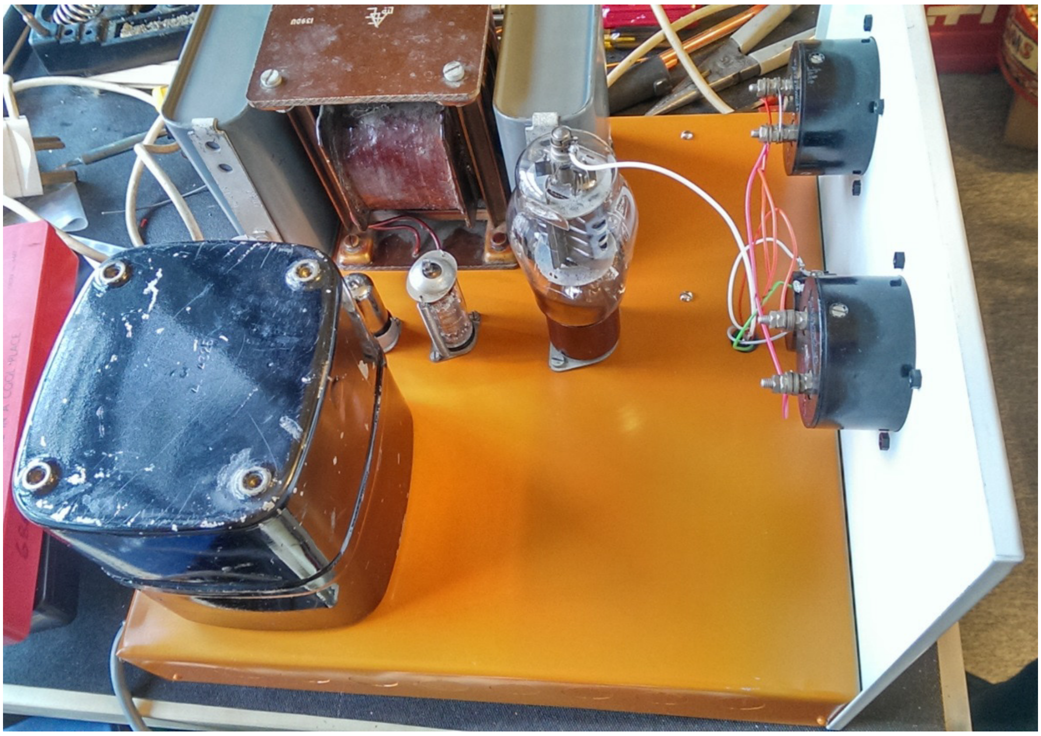

Figure (x)

The above chassis view of the completed unit is shown in figure (x). Once this had been tested and the output voltage range of 170v to 320v established and the regulation shown to be less than 2v from 0mA output to 100mA at 320v output, the wiring was tied together and the valve shield placed over the 85A2.

A case was fabricated from 18mm MDF for this unit to shield the bare high voltage contacts inside. The case was finished in matt black spray paint and fitted with rubber feet and a strap handle. It is a very heavy piece of equipment weighing in at 15.5 kilos (2st 6lb)!

Figure (xi)

Figure (xii)

ADDENDUM

The central red terminal below the voltage control knob is, at the moment, unconnected. This was originally designed to be a high voltage unregulated output of about 480v. During construction it was realised that such an output would not be used.

Other uses for this terminal could be;

1. a dedicated 90v DC low current supply for use with valves from the Mullard D series, for example the DL96 AF output valve; the necessary 1.5v DC heater supplies could be obtained from the 6.3v AC outputs through a solid state rectifier-regulator circuit,

2. an extra 4v AC 6A heater supply for the large number of 4v valves in the 'junk box',

3. a 12v AC 2A supply; this could then allow valves with heater voltages in the ranges 6.3v, 12.6v and 19v to be used as there are many ex-Television valves in the 'junk box' and these are common heater voltages for those valves; if the valve heaters are under-run then valves with 7v, 9v, 16v, 18v and up to 25v could be used; valves with heaters over 25v would need a voltage doubling or tripling rectifier module connecting to the heater outputs but then valves with, say, 50v 100mA heaters could be used,

4. a negative, low current high voltage DC supply obtained from the existing 350-0-350v transformer; this could provide -450v unstabilised for experiments with the vintage CRTs in the 'junk box'.