DEPARTMENT OF ELECTRONIC ENGINEERING

PROJECT DESIGN:
24 VDC PSU

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2016 August

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INTRODUCTION

Power supply unit (PSU) form an essential part of very many items of electronics equipment . The most common form takes in AC power from the mains supply and delivers a DC voltage to the item requiring power. Power supply is responsible for maintaining constant output voltage or current despite variations in load current or input voltage.

In this report a conversion of 220 AC voltage to 24 DC voltage supplying One Amp was being investigated, The diagram showing a circuit of the power supply that was being investigated here is shown in figure 2.1. Firstly the chassis that was to contain the circuit board, transformer, potentiometer and other components was constructed accordingly using apparatus such as scribe, steel ruler , engineering square etc. The holes that the components were to be inserted were drilled, depending on the size of the hole the specific drill bit was used but first a hole puncher using a hammer so that the drill wonder not around the whole surface area, reaming to enlarge the hole in case the smaller hole was drilled then burrs were removed using a lager drill to make the surface smooth.

After the chassis was complete then it was anodized changing it color from silver to black when the anodizing stage was complete, the chassis was declared ready for it assigned task. The components were soldered into the circuit board supplied. All other components fitted into the chassis, finally it was tested for operation. The following chapter explain in details the design of this power supply.

DESIGN

HOLE DETAILS

Drilling

Each hole center was squared off with a cross using a scribe. The stock was placed on then hard surface and punched a center hole to assist the drilling accuracy. The stock was clamped to a wooden block and drill each individual hole selecting the relevant bit according to the hole diameter

Punching

Large holes, namely the thirty-nine diameter required for the front panel meter, require hand punching (chassis punch). The process started off by drilling a guide hole to accept the screw of the required punch. Thread the screw through the stock and clamp the punch in a vice and tighten the screw forcing then punch through the stock.

Reaming

Reaming was convenient when expansion of previously drilled hole to a slightly large size was required.

Burrs

Burrs are sharp protruding edge raised on the surface of a metal during drilling. Burrs were easily removed by using a larger drill bit than the hole

CHASSIS CONSTRUCTION

Cutting

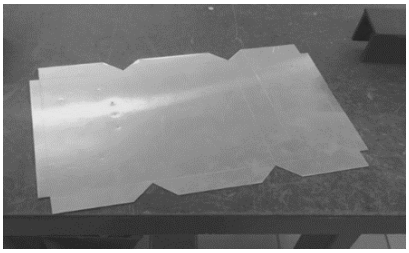

Figure 1

- In figure 1 above, According to the dimensions given the metal was cut, considering the bend allowance in the inside dimensions.

Bending

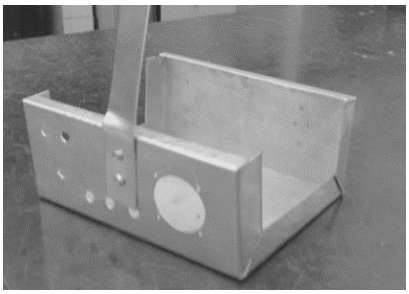

Figure 1.2

- In figure 1.2 above, The metal was bent so that it folds into a rectangle shape thus allowing components to be nicely fitted inside.

Anodizing

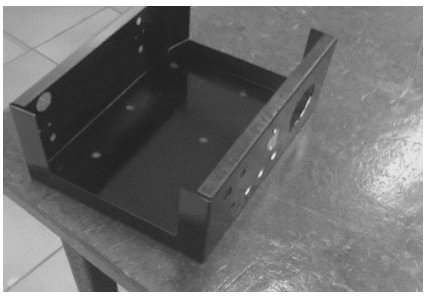

Figure 1.3

- In figure 1.3, The chassis was anodized thus making it weather resistant, environmentally friendly and beautiful finishing

PSU BLOCK DIAGRAM

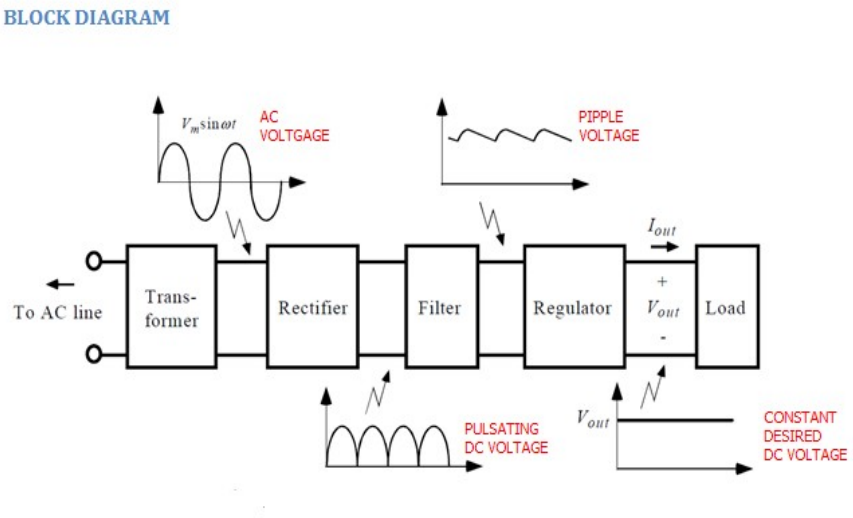

Figure 2 PSU BLOCK DIAGRAM

As shown in the above figure The ac supply voltage is connected to a transformer, which steps that AC voltage down to the level for desired DC output which is 24V in this case. The most convenient way to change alternating to direct current is by means of a rectifier. A rectifier is capable of changing ac into a pulsating form of dc. To smooth the dc voltage an additional filter circuit are required. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator is a circuit is then used to reduce this ripple and also keep the dc value constant even if the input dc voltage changes.

In Figure 2.1 below a circuit diagram of PSU that was being constructed is shown with

- Four capacitors
- Seven diodes
- Three resistors
- One transistor, fuse, switch

- Switch , regulator , lamp and a transformer

PSU CIRCUIT DIAGRAM

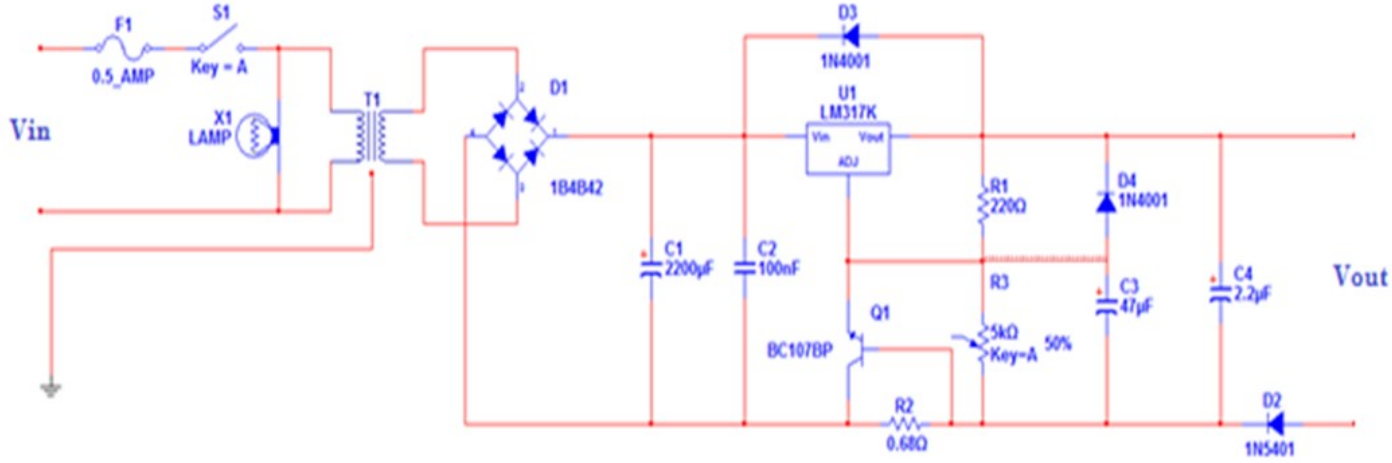

Figure 2.1 PSU CIRCUIT DIAGRAM.

Function of each component in figure 2.1.

Resistors

- R1 and R2 : Resistors as a voltage divider to provide specific voltages to certain parts of . the power supply unit.
- Vadj Potentiometer : Used to vary the voltage output.

Capacitors

- C1 (2200 µF) :Large electrolytic smoothing capacitor
- C2 (100 nF) : minimize the possibility of high frequency oscillation
- C3 (47 uF) : Improve the ripple rejection of the regulator
- C4 (2.2 uF) :prevents oscillation of the output

DIODES (1N 4001)

- D1: Discharge path for C4 in case of an input short circuit
- D2: Discharge path for C3 in case of output short circuit
- D3: Return path for I_{LM317} in case of output short circuit

TRANSISTOR (BC107):

- Control the DC voltage output of the variable supply unit

TRANSFORMER:

- Used to step down a 220 V to 24 V

REGULATOR (LM 317K):

- Three terminal adjustable regulator can get very hot thus a heat sink is mounted

BRIDGE RECTIFIER:

- Rectify the AC power into a pulsating DC waveform

SWITCH:

- Turn the power on and off

FUSE:

- The fuse is in series with primary windings of the transformer to allow suitable primary current.

RESULTS

The power supply was being tested and found not to be functioning as expected as it was not supplying one amp, however it lit the lamp showing that it was On and the thirty volts when potentiometer adjusted to it maximum displayed on the meter. To fix this problem, troubleshooting was performed using a multi-meter first to check if no connection shorted and currents and voltages. Still there was no luck until trouble shooting by eye inspection was done to only to find that the live wire was connected in the neutral wire place and vise versa. When that problem fixed the PSU functioned to it metric expectations.

CONCLUSION

The final piece of the project that was being investigated is shown here in figure 3.1. The outlook has it shortcomings, like the precision points where components were placed, however it does not affect the operation of the PSU in any way as the expected results were obtained. The PSU was found to be worthy when tested.

Figure 3 PSU

In figure 3 above the PSU is shown when all the components were being loaded into the chassis in this figure however the proper harnessing was not yet done.

Figure 3.1 COMPLETE PSU

Figure 3.1 shows the complete PSU with the lid cover

REFERENCES

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http://Conceptselectronics.com/diode-application/block-diagram-power-supply
[Accessed 29 October 2016]