Charger Lab Report

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Contents

***Abstract*—This manual provides the lab report of realisation of 5V charger using low pass analog filter.**

1 Aim

The aim is to build a working mobile charger. The circuit must output $5V$ DC to charge a mobile phone after taking $230V$ AC as input.

2 Materials Required

- Breadboard
- Printed circuit board (PCB)
- 12-0-12 Tranformer
- 4 diodes
- $100\mu F$ Capacitor
- 7805 Regulator
- Several electrical wires
- Soldering iron and wire
- Multimeter
- Oscilloscope
- Output pin
- USB cable
- Mobile phone

3 Circuit Diagram

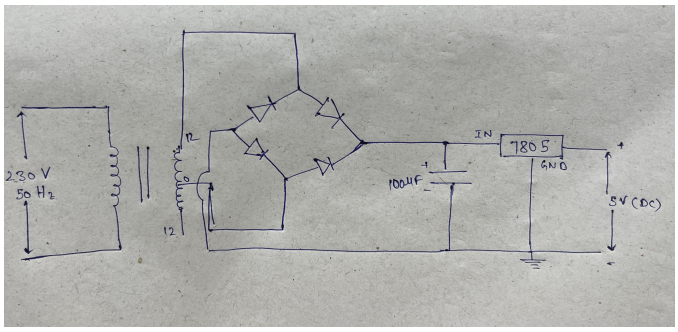

Fig. 0: Circuit diagram of a mobile charger

4 Circuit Explanation

- The transformer steps down the $230V$ AC main supply to $12V$ AC. Note that these are RMS voltages. The peak voltage will thus be $12\sqrt{2} \approx 20V$. The transformed voltage is given by

$$v(t) = 12\sqrt{2}\sin(100\pi t + \phi)V \tag{4.1}$$

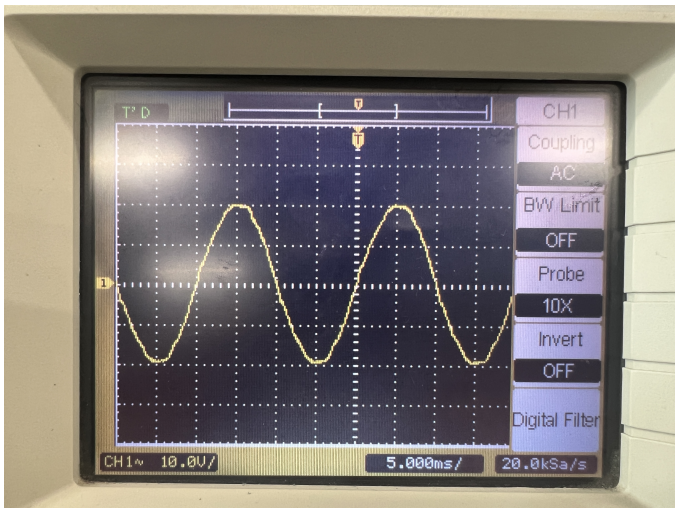

Fig. 0: CRO output after transformer

- The alternating current now passes through a bridge rectifier. The output is a pulsating DC wave whose peak is $12\sqrt{2}V$. The voltage at this stage is given by

$$v(t) = 12\sqrt{2}\,|\sin(100\pi t + \phi)|\,V \tag{4.2}$$

- A capacitor is used as a low-pass filter here

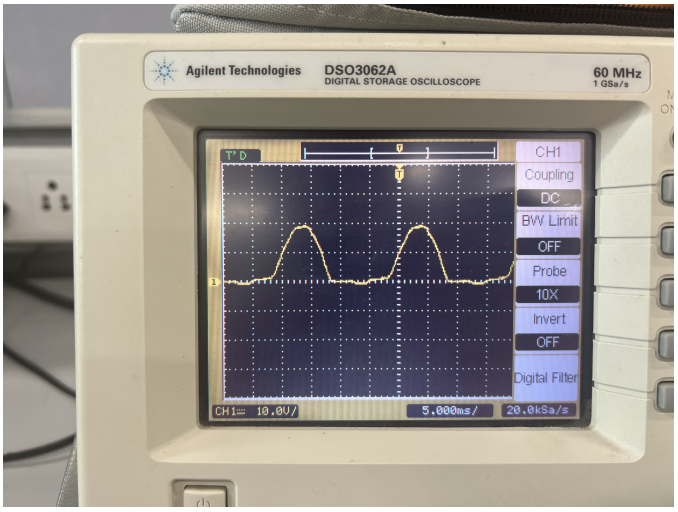

Fig. 0: Half-wave rectified CRO outputs across a single diode

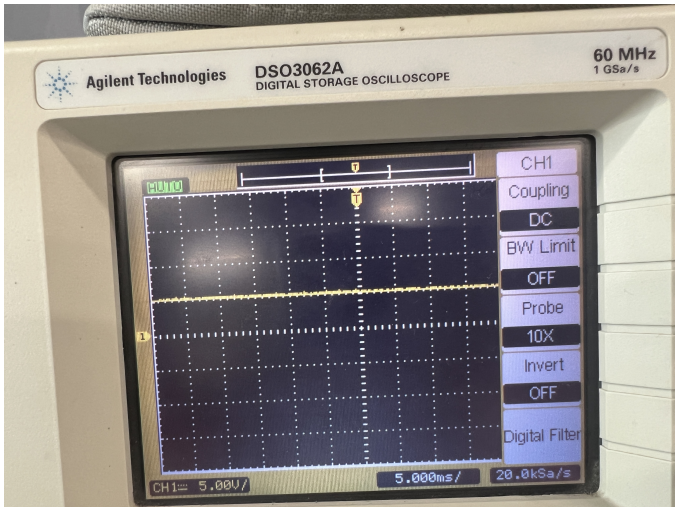

Fig. 0: Regulated CRO output

to choose only the zero frequency component thereby converting the current into pure DC of $12\sqrt{2}V$

$$v(t) = 12\sqrt{2}V \tag{4.3}$$

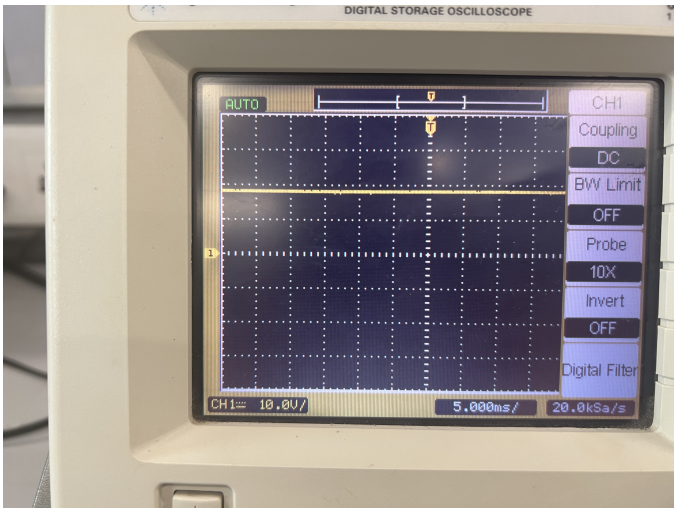

Fig. 0: Filtered CRO output

- Finally, the 7805 regulator stabilizes the output by eliminating noise and converts it into $5V$ DC which is then used to charge the mobile phone.

$$v(t) = 5V \tag{4.4}$$

5 Observations

Using a multimeter, we can verify that the output obtained is indeed $5V$ DC. The same is evident on using a cathode-ray oscilloscope (CRO) too, which shows a constant $5V$ voltage. The CRO can be used to see the waveforms at various other stages in the circuit too.

6 Result

Once we have verified that we are obtaining $5V$ DC output, we can plug in the USB cable into the output pin that is connected across the OUT and GND terminals of the regulator. On connecting the USB cable to the mobile phone and switching on the main supply to which the transformer is connected, we can see that the mobile phone is getting charged successfully.