Mobile Charger Lab Report

EE3900: Linear Systems and Signal Processing

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1. Aim

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

2. Materials Required

- Breadboard
- Printed circuit board
- 12-0-12 Tranformer
- 4 diodes
- 100 µF Capacitor
- 7805 Regulator
- Several electrical wires
- Soldering iron and wire
- Multimeter
- Cathode-ray oscilloscope
- Output pin
- USB cable
- Mobile phone

3. Circuit Diagram

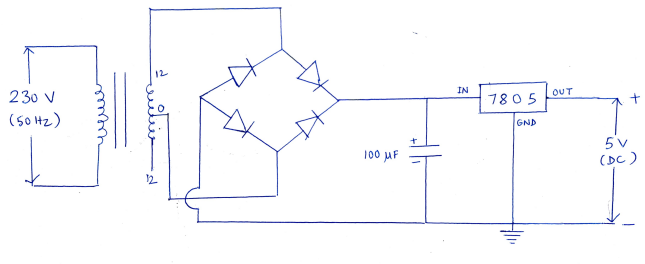


Fig. 3.1. Circuit diagram of a mobile charger

4. Circuit Explanation

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

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

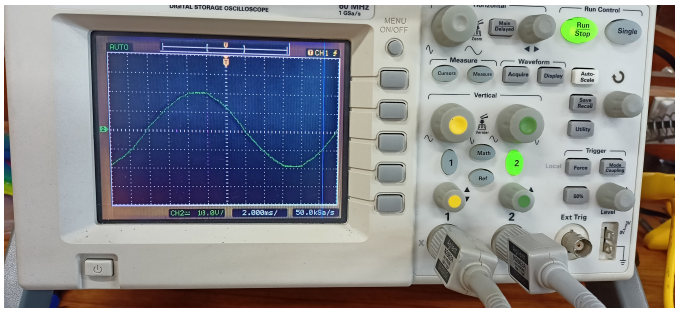


Fig. 4.1. CRO output after transformer

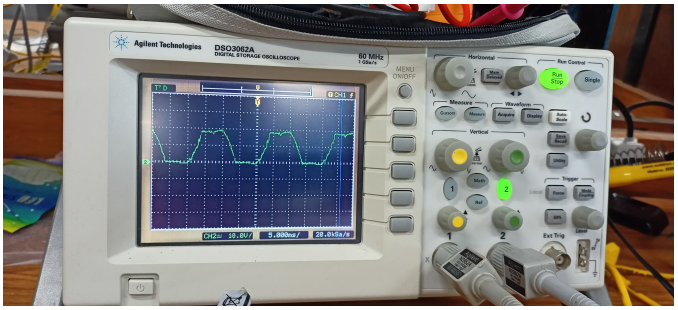
- The alternating current now passes through a bridge rectifier. The output is a pulsating DC wave whose peak is $12\sqrt{2}$ V. The voltage at this stage is given by

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

- A capacitor is used as a low-pass filter here to choose only the zero frequency component thereby converting the current into pure DC of $12\sqrt{2}$ V

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

- Finally, the 7805 regulator stabilizes the output by eliminating noise and converts it into 5 V



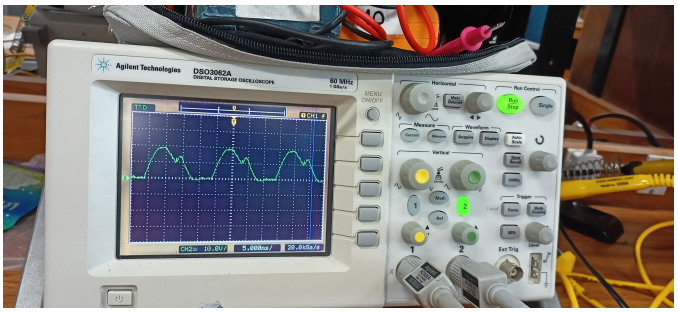


Fig. 4.2. Half-wave rectified CRO outputs across a single diode

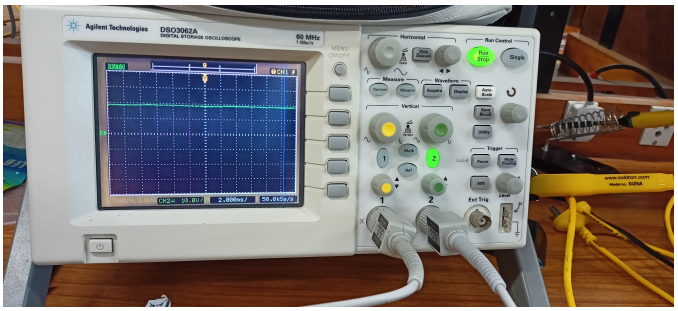


Fig. 4.3. Filtered CRO output

DC which is then used to charge the mobile phone.

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

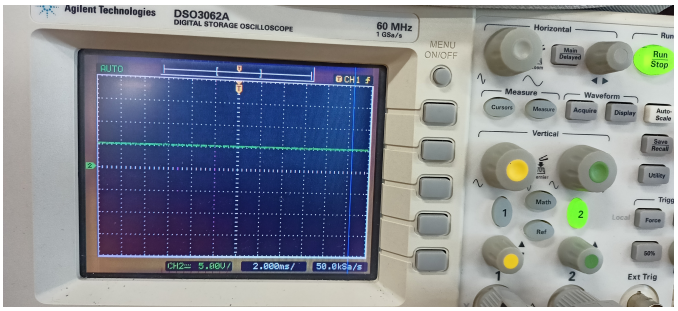


Fig. 4.4. Regulated CRO output

5. Observations

Using a multimeter, we can verify that the output obtained is indeed 5 V DC. The same is evident on using a cathode-ray oscilloscope (CRO) too, which shows a constant 5 V 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 5 V 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.

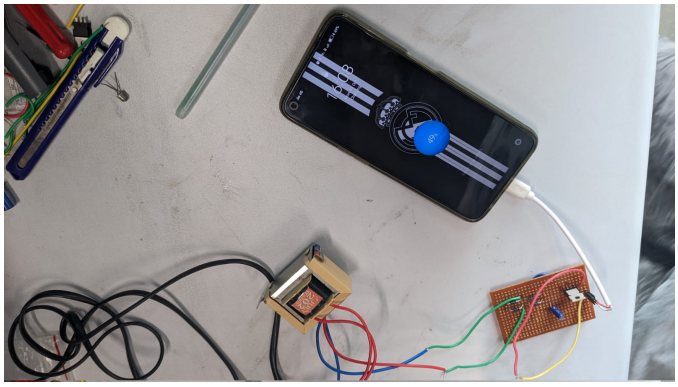


Fig. 6.1. Mobile phone being charged