

Project Report

“To investigate the Battery based Heater”

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Experiment Name:

To investigate the Battery based Heater.

Falstad Experiment link:

<http://tinyurl.com/y6lcl5mp>

Objective:

To investigate the Battery based Heater.

Purpose of this project :

We want to create a wireless battery operated water heater. It will heat the water without wasting electricity. If the heater is rechargeable then even without electricity it will heat up the water. The electricity bill will be saved. This 12V battery heater can ease up our day to day life in winter. It can replace the electric Geysers.

Theory:

Heater, mainly a device, works as a converter which can convert electric energy into heat energy. Electric energy is current. So, current provided by the voltage source which is converted into heat.

In this circuit when the voltage source as battery is turned on in the circuit then transistors drive the power and heat pass to the inductors which are mainly coils and work as a heater.

NPN transistors have electrons as the majority charge carrier. Here the transistor generates and passes power (current) as a form of heat to the inductor.

Capacitors store the power supply from resistors and transistors and provide a decent supply of electricity to inductors as the form of heat.

The LED works as a duty cycle in this circuit. Which means it operates intermittently rather than continuously.

The inductor allows DC current ,when electricity flows into the inductor from the left to the right, this will generate a magnetic field in the clockwise direction.This magnetic field can create energy which is stored by it and convert into heat.If we add more inductors we can get more heat.

Circuit diagram:

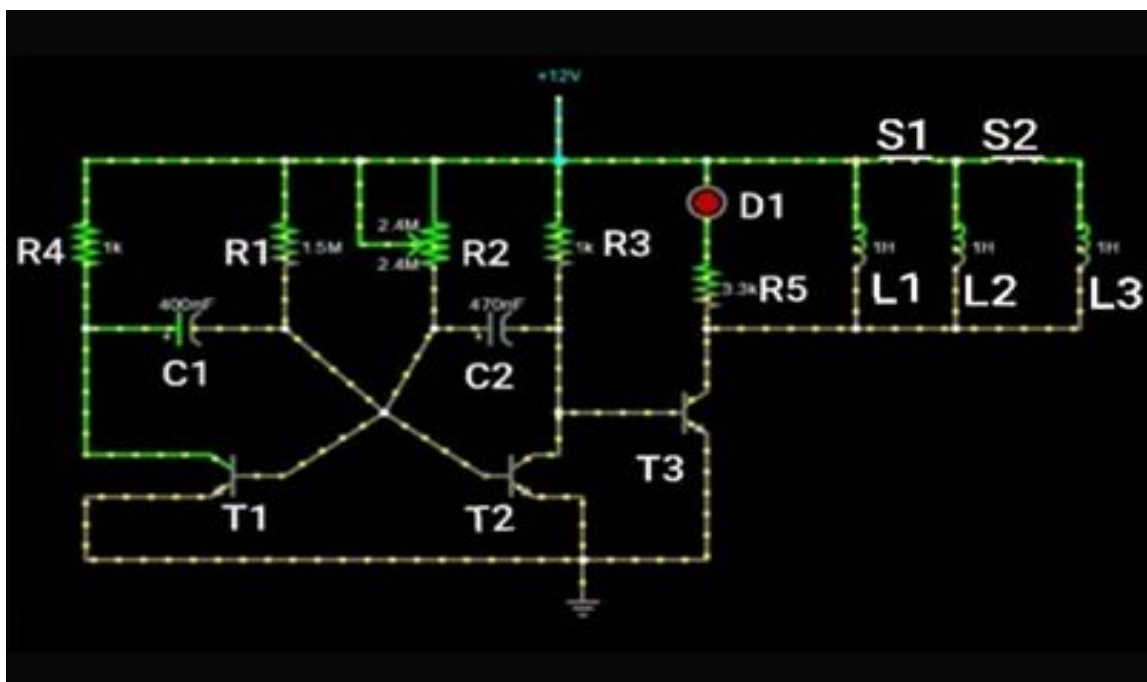
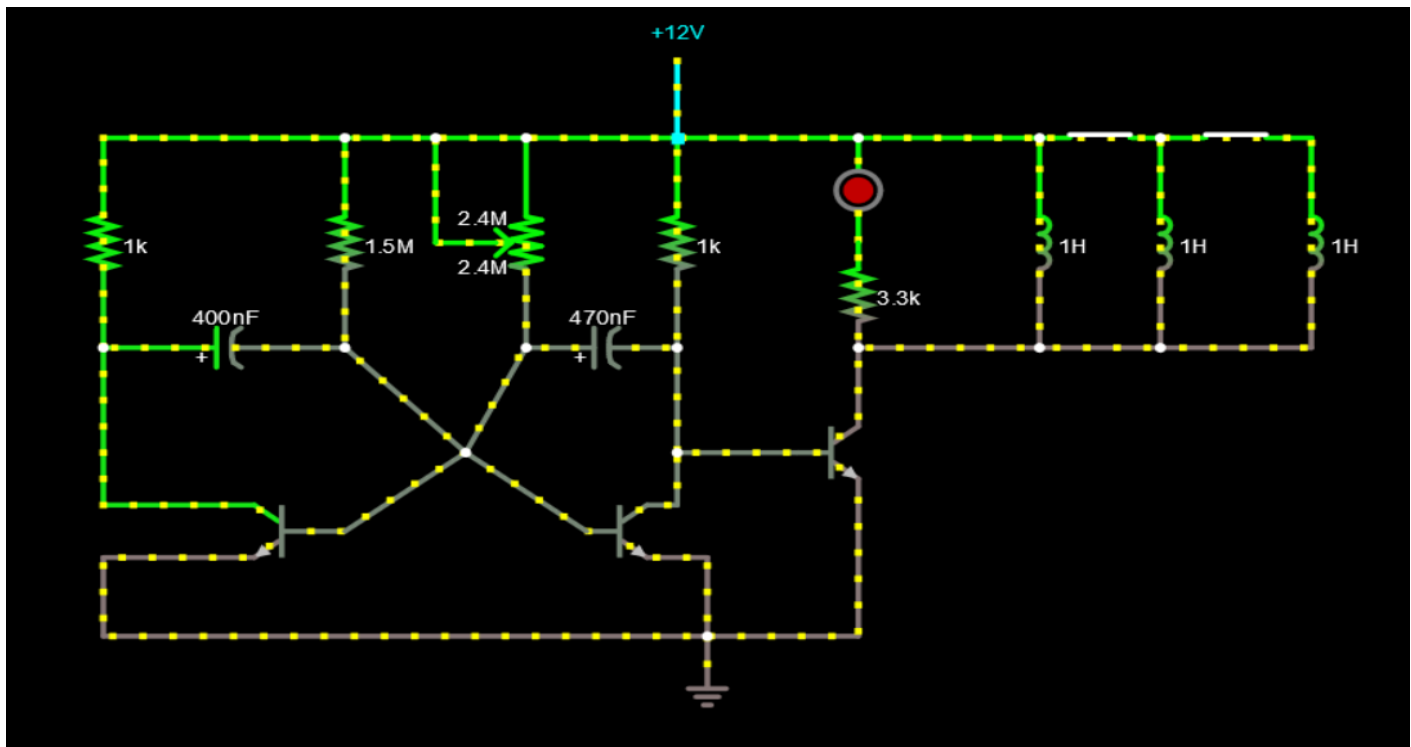


Figure: Battery based Heater drawing from Falstad simulator

Equipments:

1. Falstad simulator
2. NPN Transistor
3. DC voltage source 1 terminal (12V)
4. Load Resistor
5. Wires
6. Inductors
7. LED
8. Polarized Capacitor
9. Ground
10. Potentiometer

Procedure:

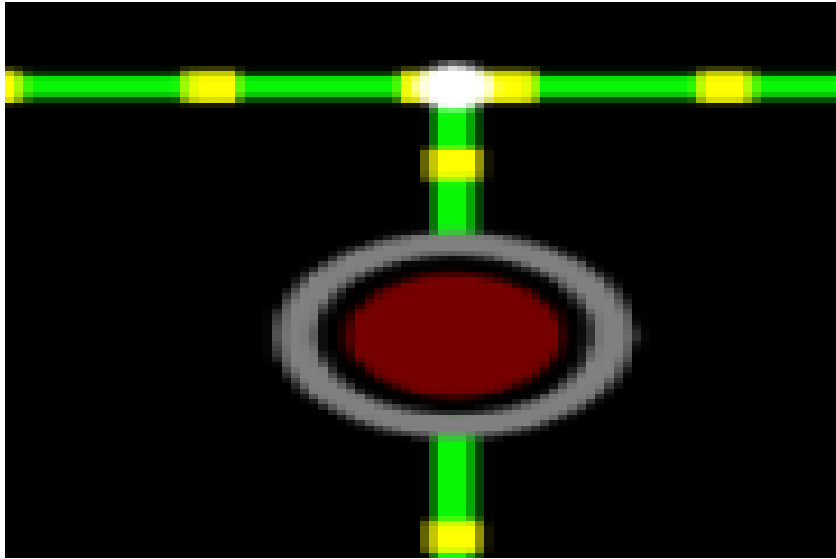
1. For DC supply we added 12 volt with resistor R2 and R3 and a LED D1. We also added a resistor R5 with the other part of LED D1.
2. We used 2 capacitors C1 and C2 then we connected the capacitor C1 with the resistor R1 and R2 and connected the capacitor C2 with the resistor R3 and a potentiometer R2. 3. We used three NPN transistors T1,T2 and T3. We connected the collector part of T1 with capacitor C1 and resistor R4 .
4. We connected the base part of transistor T1 and T2 and also connected resistor R1 and capacitor C1 and potentiometer R2 and capacitor C2.
5. Now we connected collector part of transistor T2 with the base part of transistor T3 and this node we connected the node of capacitor C2 and resistor R3.
6. Now we connected all the emitter parts of transistors T1,T2 and T3 and added ground with them. Then we connected the collector part of T3 with the resistor R5.
7. Finally we added three inductors L1,L2 and L3 with Led D1 with parallel connection.
8. In L2 and L3 we connected two switches S1 and S2.

Circuit Analysis:

As per the circuit diagram, the transistors are being used as a switch.

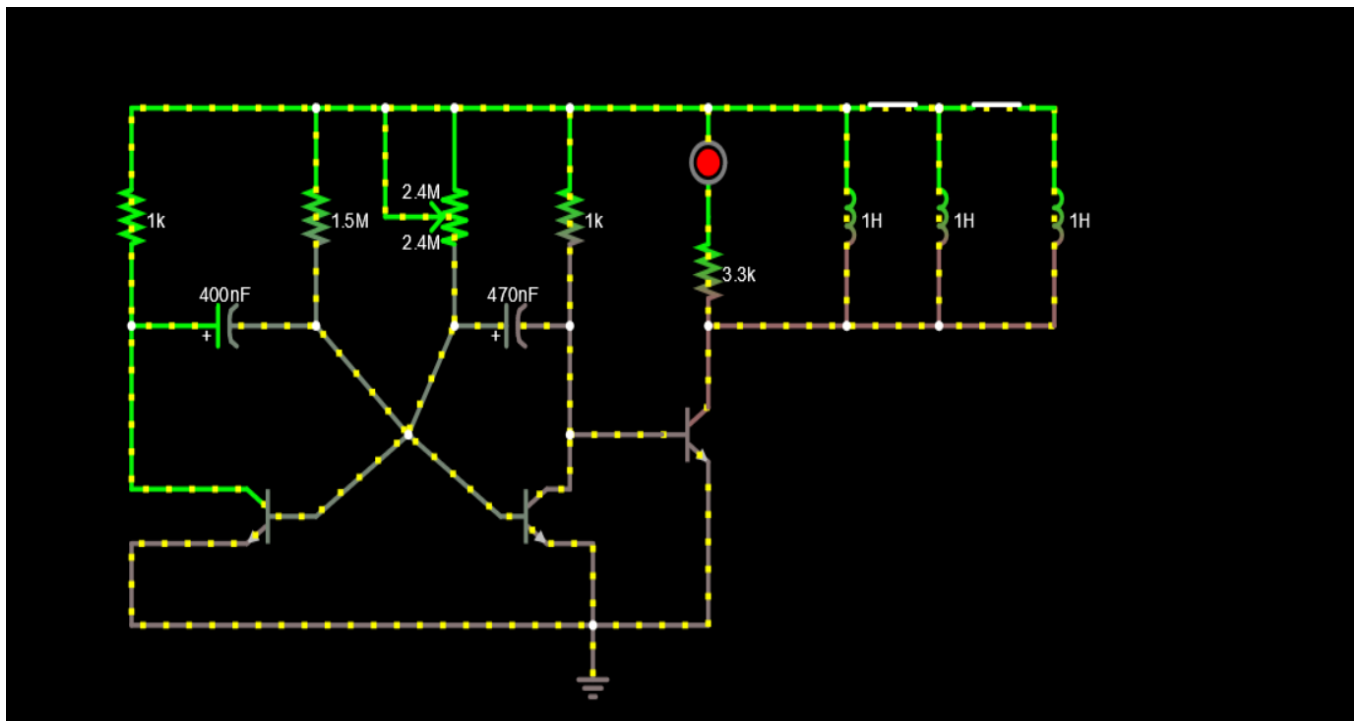
When the 12V power supply is turned on, capacitor C1 gets charged and turns the NPN transistor T2 on, C2 also gets charged and turns on T1. But the switching on of T1 depends on the resistance of the potentiometer, based on the resistance a specific amount of current will be provided to turn T1 on. C1 provides base current to T2 and then there is an output current in the base of T3 and T3 turns on. When T3 turns on there is an output current at D1, L1, L2 and L3.

This current turns the LED on

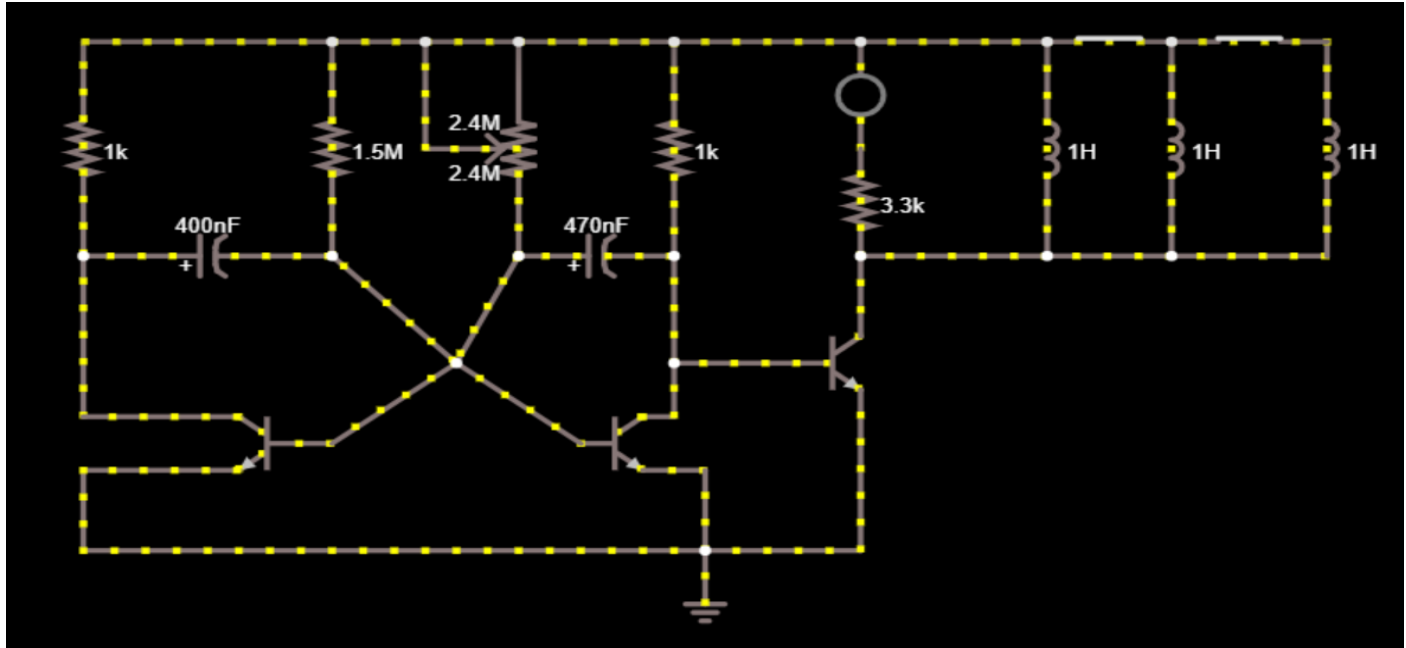


and it shows that the circuit is now ready for heating. L1, L2 and L3 are inductors which can also be used as heating coils. These heating coils will heat up and it will be used as the battery operated heater.

Even after turning off the voltage source for some time, current will flow through the circuit and inductor will still work as heater



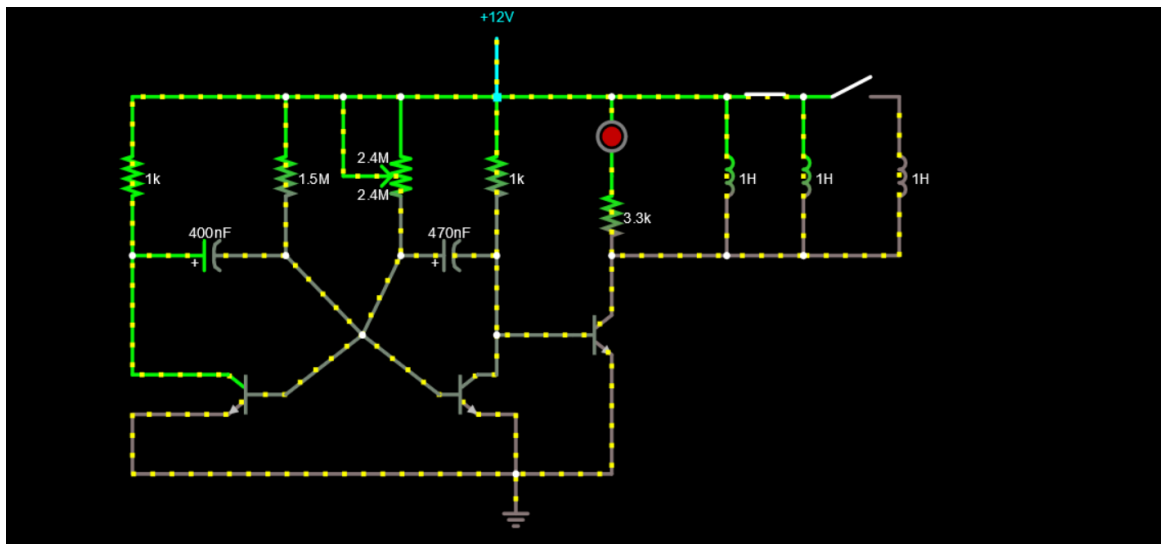
Then after some time the current will stop flowing and light will be off and the heater will be off.



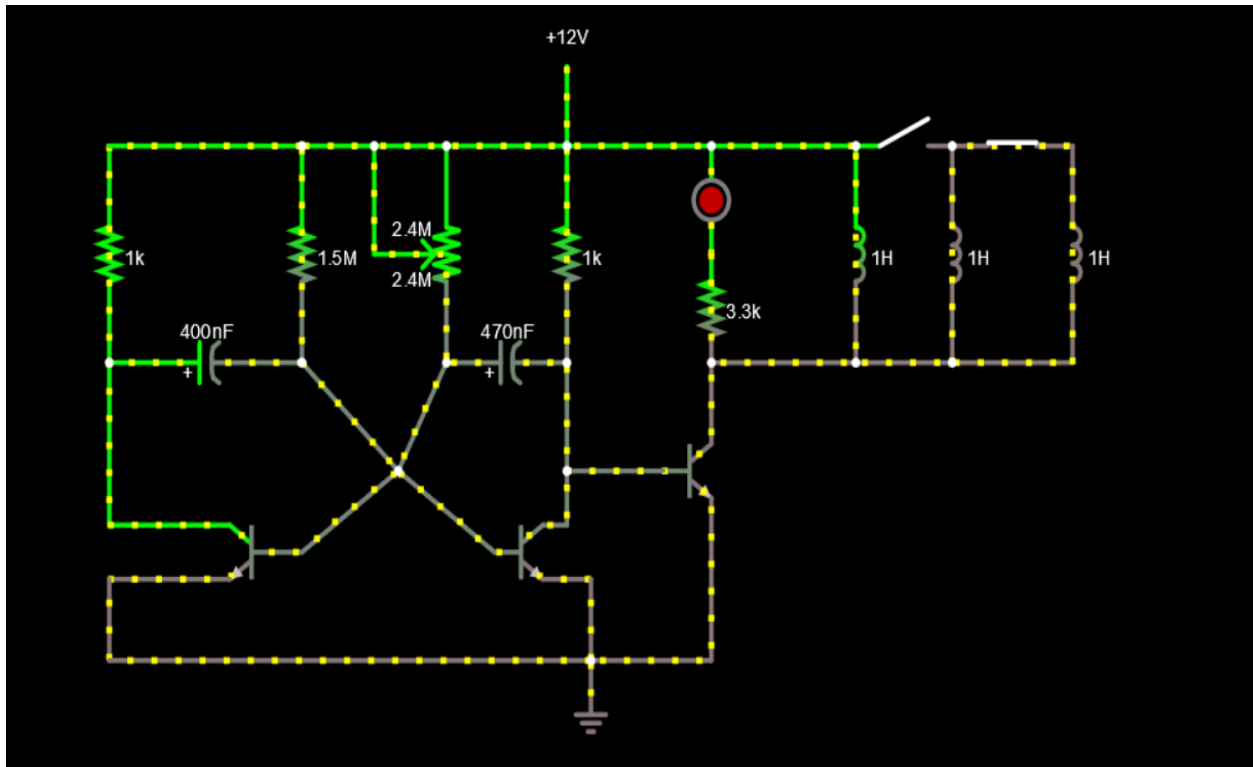
And D1 LED light is here to assure us that coils are heated up. So, LED works here as visual output.

Discussion:

- The circuit can be assembled on a general purpose PCB.
- We used the T3 transistor as a heat sink for cooling our battery heater device.
- The elements L1 to L3 can be heating coils.
- The switches S1 and S2 work as a limiter of heating coil (inductor). If we switch off S2 then only L1 and L2 will heat up and L3 will not heat up.



If we want to heat up the heater a little then we can switch off S1 then only L1 will heat up and L2, L3 will not heat up.



- The circuit powered from a 12V battery.
- The LED D1 gives a visual indication of the duty cycle of the circuit.

In a heater, the battery or in this case 12V supply is the input. Once the battery is turned on it turns on the power transistors and drives the power to heat the inductors L1, L2 and L3. As inductors are coils they will heat up due to the current and thus can be used as a heater. So the output is L1, L2 and L3. The LED will turn on if the coils are heated, so the LED is to be a visual output.