How to build a Thermo-electric generator

This thermoelectric generator was designed to charge a mobile phone (like my last version). Because I do not want the peltiers to over heat and melt like they have before, I was weary of having the flame too close to the peltiers. The thermoelectric generator failed to produce enough power to charge a mobile phone, it does produce enough to power a small radio or some bright LED lights. This version is much more reliable than my last one due to the better heat sink it doesn't run anywhere near as hot so the life of the peltiers should be quite long.

It has a 2.5mm output jack for ease of use plugging in different things a large carrying handle and the candle height is fully adjustable to compensate for varying flame heights. If you would like to build on of these you should be able to follow the guide pictures below.
Parts used:

- A thermoelectric peltier chip, the bigger the better. I used a 100W version.
- A large heat sink, I used a dell one with heat pipes. The success depends on this heatsink, get the best you can!
- An emergency phone charger (we are going to steal the joule thief out of it)
- A Small amount of Rock wool insulation, small amounts available from garden centers.
- A small tin can with a lip around the top. (Heinz beans will do)
- A coke can.
- Thermal heat compound
- Some heavy duty foil, about 30x30cm
- A foot of thick copper or steel wire, for the handle.
- 2 25mm long M6 Bolts
- 4 40mm long M5 Bolts
- 1 50mm long M5 Bolt.

The bolt sizes are approximate, almost any will do.

This is the emergency phone charger, I will use it to charge things off the peltier. I bought this from once of those "almost a pound type value stores, they don't seem to be able to afford a name sign for outside, so it doesn't have a name. I got ripped off for £3.99 for this, they are available from £1.70 on ebay! We only need the circuit board with the joule thief in it. There is the possibility of using this as a battery holder, you could put a nicad in it and have the peltier charge this up for more juice for charging things like phones etc.
Mmmm, copper!
Copper heat sink base after cleaning. You can see that I drilled and tapped two holes for the peltier holder. They are M6 x 1.0, I used larger bolts here because they act as catches to locate the peltier in the tin can. Make sure that the bolt heads fit inside of the the tin can!

UPDATED STEP

I recently changed the plate that covers the peltier to a solid aluminium one (1.2mm alu sheet), it's made the same size as the inside of the tin can with two holes drilled to match the inside of the tin can.
Aluminium plate cut to size

One of the holes drilled
Thermal compound applied, the heat sink is now ready for the peltier. In this photo there is too much thermal compound - don't put this much on as it reduces the efficiency of the heat transfer, you want just enough to fill the microscopic ridges in the metal.

Fit the peltier to the heat sink, slide it around to spread the thermal compound about.
I used Rockwool insulation between the candle tin and the heat sink to try and keep hot and cold parts separate. I bought this rock wool from a garden centre, you can but it in small 3" by 3" block for insulating plants. I just folded the foil over the edges, on the other side I cut out a 40mm*40mm square to fit over the peltier.

This is what the insulator should look like. You need to make the two holes for the bolts, I just used a BIC pen.
Next cut a square of aluminium can the same size as the peltier chip and sand the paint off with some fine sandpaper. Apply thermal compound and fit it over the peltier chip. It will be compressed by the steel can so don't worry if it doesn't quite fit!
The candle rests on a aluminium can the height of which can be adjusted to suit the flame. The can sits inside of a small Heinz baked beans tin. The Heinz tin has a lip around the top which the peltier rest on. I used a ruler to get the size right, I made it so that the biggest flamed candle would be around 6mm away from the ruler. There is plenty of room then for adjustment from the candle height adjustment screw.
The Aluminium can is filled with Rock Wool underneath to keep the heat. You'll need to poke a space in the middle for the adjustment bolt.

Because the Aluminium can is smaller in diameter than the steel can I had to use a cardboard buffer to prevent the can from tipping to an angle. The cardboard is sandwiched between two cans away from the flame and insulated by Rock Wool so there is almost no chance of it catching fire. If it ever does, I will have to use something different!
Underneath I drilled four holes for the feet and the candle height adjustment. You might need to cut the adjustment bolt down to the right length. Use a hack saw for this.

Here you can see I fixed the candle height adjustment thread with some glue. The can rests on the top of this bolt.
Here it is from the side, the slot is where you can put the candle. You'll need to cut the candle door slot this is around 50mm by 30mm high. Make sure you sand the edges to prevent any injury. I have also drilled little ventilation holes all around the top of the can. They are about 3mm.

Here you can see the candle holder, the height of this can be adjusted. Test it too make sure that it works smoothly.
Here is the 2.5 mm output jack for power. Inside that little plastic cylinder is a joule thief to step up the power output. I simply glued this to the bottom of the can. You'll need to solder the peltier wires onto the joule thief - make sure you get the polarity right, test it both ways to see which way works.

**Testing and use**

The TEG should be finished now and you're ready to test it.

First of all - not all tea lights are created equal. Some burn incredibly bright, some burn with a flame so small you need a microscope to see it.... We need a candle with a good flame. Some candles come with really long wicks, trim them to around 8mm long as a long wick makes a sooty flame.

Lower the candle height adjustment bolt to its lowest setting. Place the candle on the coke can and let it heat up. Have a look where the flame is, it should be around 4mm below the peltier, if it's too far away then you can raise the candle height, if it's too close then you need to modify the adjustment mechanism so that it accepts the candles without leaving soot everywhere.

With the peltier heated up (only takes around a minute) you can now test the TEG - there should be some power! Try various things like LED's a radio your phone etc. The output of my version was around 0.5W.
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