

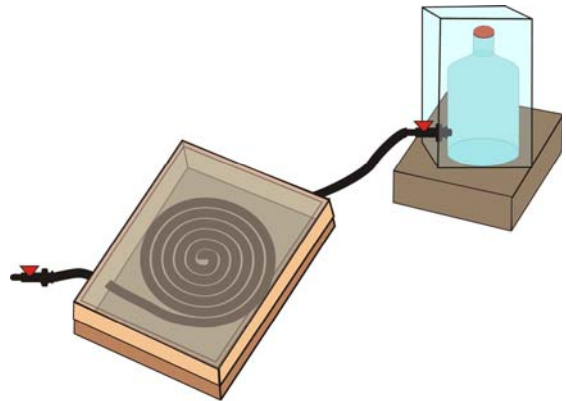
Constructing a spiral solar water heater with a collector and a bottle tank

Solar water heaters may not always use the "*thermosiphon effect*" as a functioning principle. The solar water heater constructed out of a long black tube, curved around in a spiral arrangement, actually heats up water inside the tube without circulating it inside a tank. All that is needed is a constant supply of water. Therefore, a connection to the water pipe network and/or a tank is needed to fill the pipe up at all times. Usually, the amount of hot water stored in a big spiral tube arrangement is enough for a hot bath. That is because several meters of tube can be curved in a spiral arrangement and the water heated inside the tube is usually enough. The principle is simple: the more spirals in the tube, the more heated water can be used. Otherwise we have to wait for a while for solar energy to heat up the "new water" in the tube ...



Materials

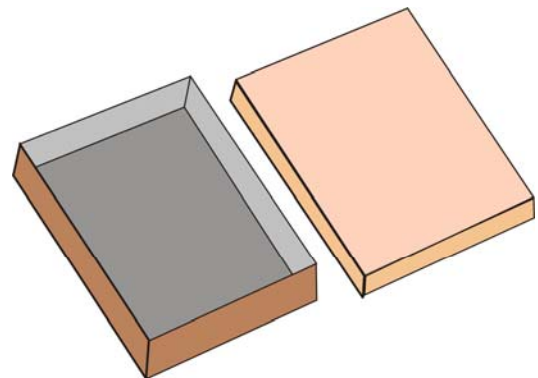
- ✓ a shallow parallelepiped box with a lid, roughly 50x40x10 cm or bigger
- ✓ approximately 10 m of soft plastic tube 14-16mm inner diameter, either cheap transparent tube to be painted black or original black tube used as watering pipes in the fields
- ✓ 2 plastic pipettes with an end tube matching a 14-16 mm pipe, the ones used in order to drill a whole and connect a piece of thinner tube with a bigger main tube for watering purposes in the fields
- ✓ black tempera or black non-toxic paint & some aluminum foil
- ✓ a 2-liter empty plastic soda bottle with its top
- ✓ a piece of Plexiglas or plain glass
- ✓ a few pieces of corrugated paper or scrap cardboard
- ✓ some pieces of wire and some silicone
- ✓ a piece of dense polystyrene and some tooth sticks
- ✓ scissors, cutter, ruler, pen or pencil



Let's put it together

- 1 Find a shallow parallelepiped box with a top lid, roughly 50x40x10 cm or bigger. If the top lid is not available it has to be constructed. Turn the box upside down and draw with a pencil the frame of the box opening on the piece of cardboard to become the top lid. Add an extra 5-10 cm all around the sides of the frame and then cut, fold and glue accordingly.

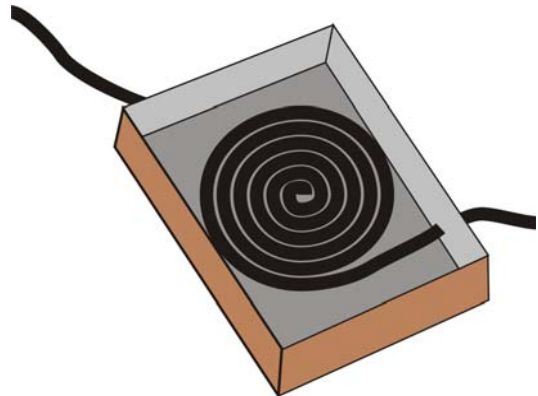
Be sure it is a strong box, in order to handle the plastic tube inside it. Otherwise, enhance the sides and the bottom of the box by gluing extra pieces of corrugated paper and/or scrap pieces of cardboard box.



2 The soft black plastic tube needs to be arranged in a spiral form, that is you start somewhere in the middle and then you keep on curving the tube to create the spiral. Group work is needed for this task since the tube has to be held at many different places simultaneously, as the spiral grows bigger, before it is tied and attached to a base.



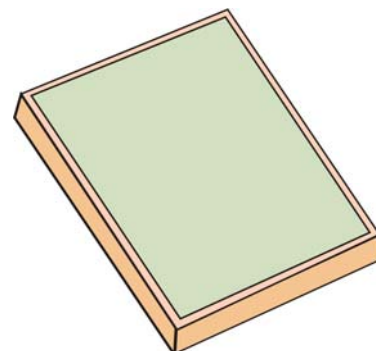
3 Paint the inside of the collector box with black tempera or non-toxic plastic paint, the bottom and the sides of the box. Alternatively, you may paint the bottom black and glue aluminium foil at the sides for more reflections inside the box.



Make a hole at the centre of the bottom side of the box and insert the plastic tube through it, keeping at least one meter out of the box from that end of the tube. Start curving the tube in a spiral arrangement until it reaches the sides of the box. Exit the tube from the lower right side of the box (*see drawing aside*).

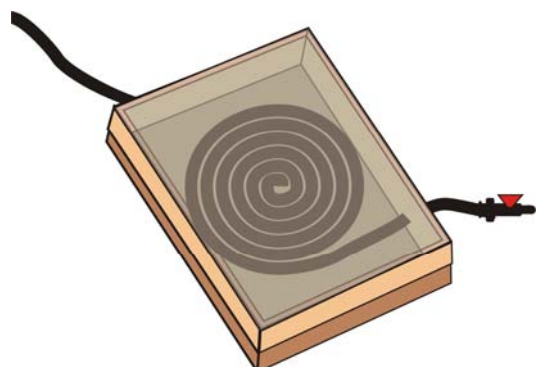
It is better to tie the tube at the bottom of the collector box, in order to keep it always at the right place. For this purpose, seek the aid of an adult to open or drill some holes around the tube and use pieces of wire to tie it firmly. Later, you may need to seal the holes with silicone and/or glue in order to avoid heat losses from the collector box.

4 Draw a frame on top of the box lid spacing roughly 2-3 cm from its edges. Use a cutter and perhaps adult help to take out that frame.



Glue with silicone a piece of Plexiglas and/or plain glass inside the lid, covering the opening created from the extracted frame. Ask the help of an adult for this process and always use with silicon in an open area, preferably outside.

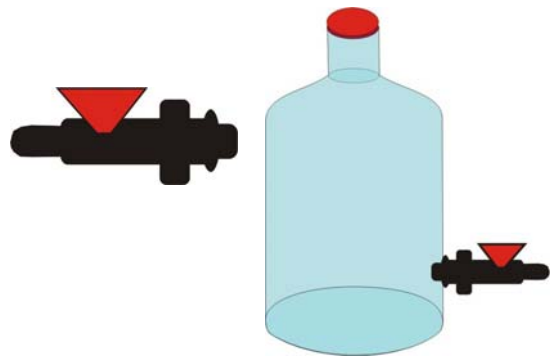
5 Put the lid on top of the box with the spiral tube arrangement.



The collector is now ready to be connected to a sort of tank to complete the construction of the solar water heater.

- 6** A 2-liter empty soda bottle or any other similar plastic container can be used as a tank for the solar water heater.

It is important to find a way to connect the tube coming out of the centre, at the back of the collector box with the tank, avoiding water leaking. One way to do this is to use appropriate pipettes used to branch bigger plastic pipes for watering gardens and fields (*see left drawing*). The tube has to match the one end of the pipette.

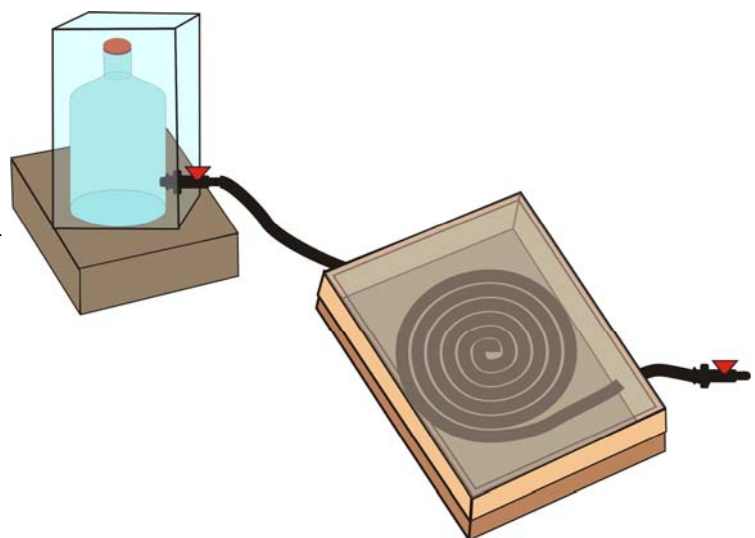


Use one pipette approximately 5 cm from the bottom of the bottle (*see right drawing*). Use another one at the end of the spiral tube arrangement to control the water flow and use it as a tap to be turned on and off accordingly.

Additionally, you may glue the pipette with silicon at the side of the bottle, to avoid possible water leaking. The water tank is now ready!

- 8** Connect the tube sticking out of the bottom of the collector box with the pipette of the bottle-tank. Fill the tank with water and keep filling it as it empties. Turn on the bottle pipette as well as the pipette located at the end of the tube, sticking out of the collector. Wait until the tube is filled with water, actually until it comes out of the other end and then turn off the tube pipette at the end (*on the right of the drawing*).

You may insulate the bottle-tank by cutting and assembling a box, using dense polystyrene frames (Styrofoam), tooth picks and/or self sticking Velcro tape (*see drawing aside*).



In this solar water heater the water heats up being steady in the spiral tube arrangement inside the collector and it comes out hot at the end of the tube after a while. If the hot water is used then the tube has to be filled again with fresh, "cold" water and then it starts heating up again.

Always add water in the bottle-tank to maintain constant flow while presenting this solar water heater at a science fair and/or contest.

Photos from the construction of a spiral solar water heater with a group of children, to be presented at a science fair ...



Photo 1: Inserting the black plastic tube inside the cardboard box leaving a meter or so for later connection with the bottle tank ...



Photo 2: Arranging the tube in a spiral mode using as many hands as possible ...



Photo 3: The spiral tube is now in place inside the cardboard box and needs to be tied ...

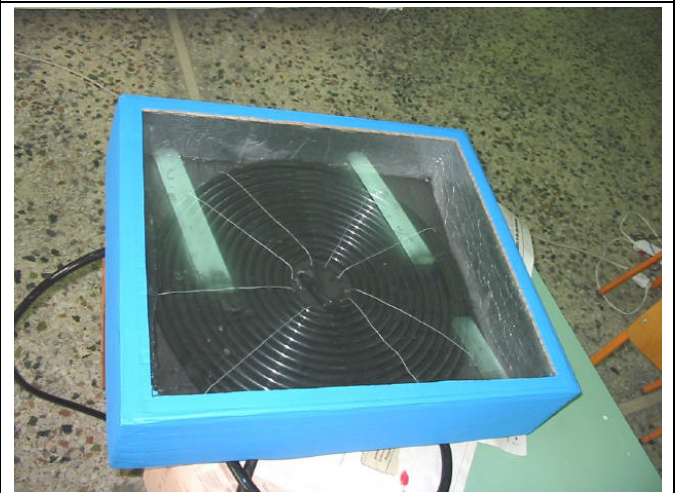


Photo 4: The collector with its top lid and the spiral tube tied with pieces of wire ...

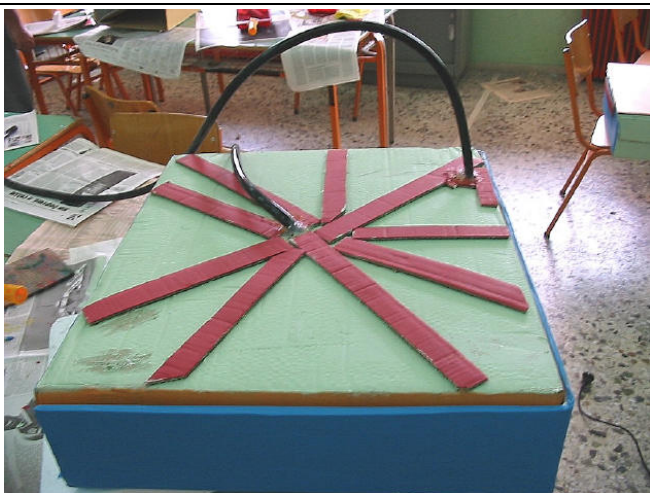


Photo 5: The collector upside down. Notice the tube coming out of the centre and the right side ...



Photo 6: The spiral water heater in action at a science fair with visitors in the school yard ...