Steam Iron - Step 2: How does it work?

The idea here is to see the different...

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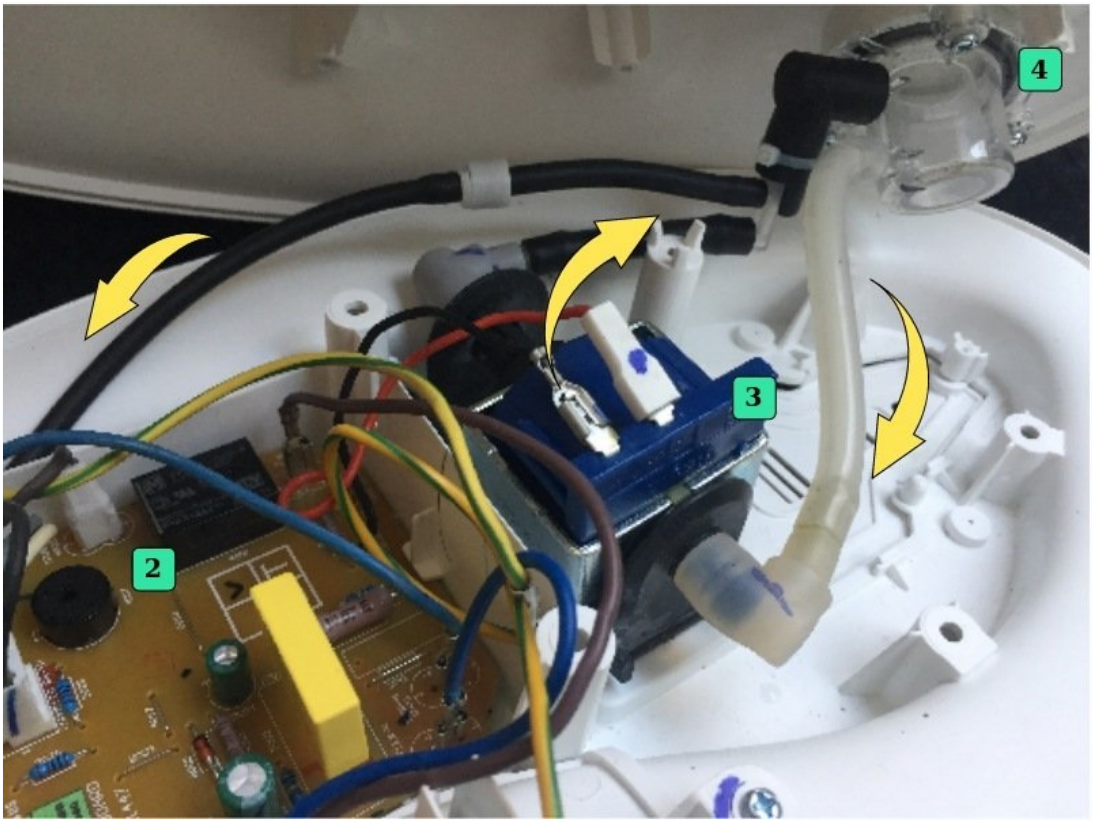
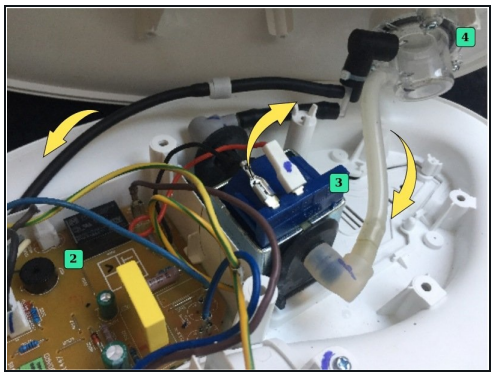


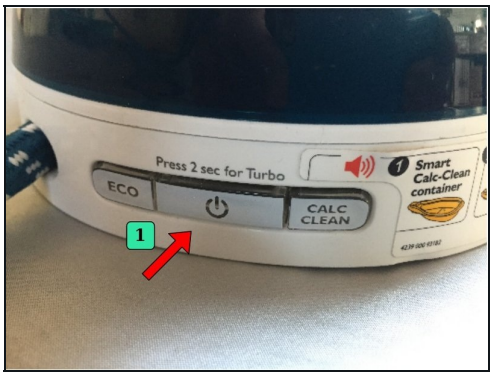
INTRODUCTION

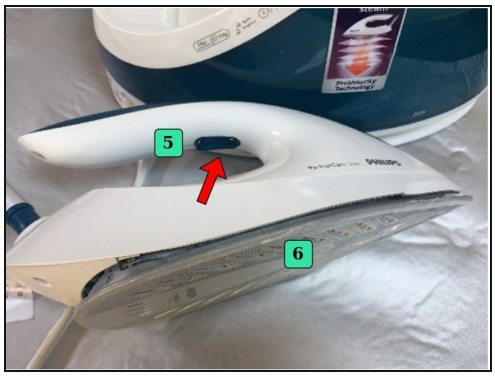
The idea here is to see the different components that make up the device, to understand what they are intended for, how they work independently and also how they interact with each other.

The animation below shows the operation of the pump that will be studied in step 2.

Step 1 — General operating principle





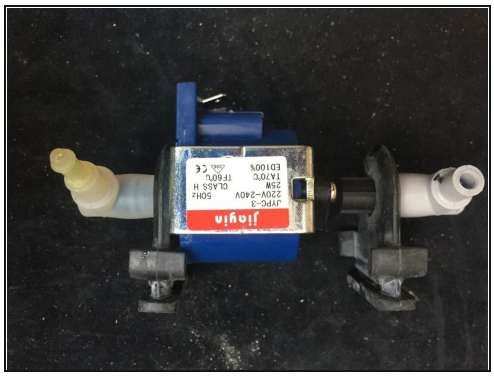


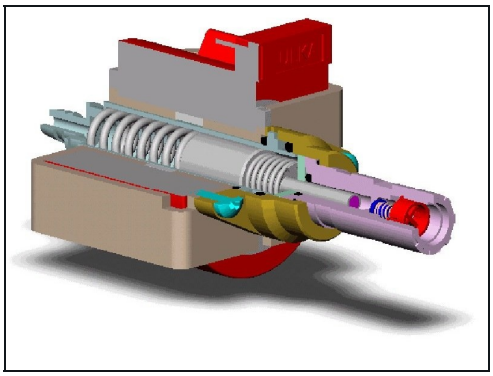
- When the Start button is pressed (item 1), a circuit is closed which powers, via a relay (item 2), the heating resistor placed in the soleplate of the iron (item 6). When the temperature is reached, a beep is heard (after about 2 minutes)

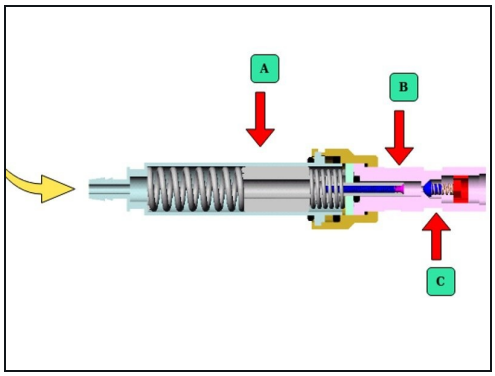
- After the beep, steam can be produced by pressing the button in the iron's handle (figure 5) Thus, a circuit is closed which turns on a pump placed in the frame beneath the water tank (figure 3) This pump, placed between the tank (figure 4) and the iron will make the water flow from one to the other

- The water, being carried into the iron's soleplate through soft tubing, will turn to steam when coming into contact with the heating resistor. Indeed, because of the heat (around 130°C-160°C), the water turns to steam and escapes through the holes in the sole. By releasing the button, the pump stops and so does the steam.

Step 2 — Water pump operation



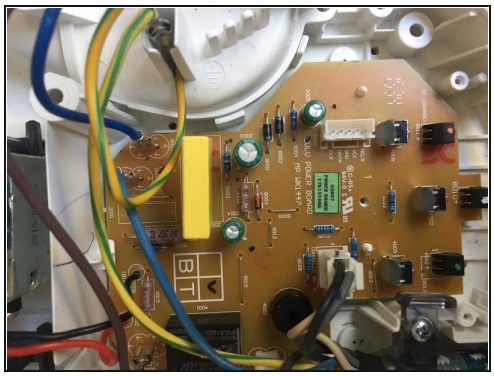


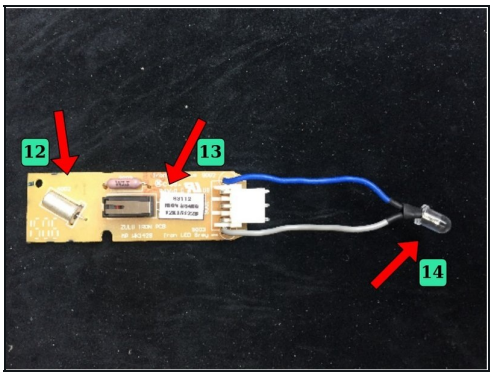


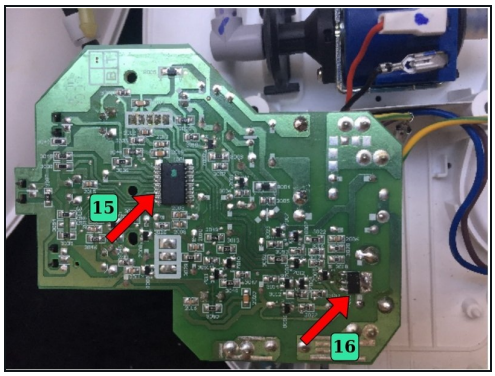
- The device is made of several smaller bodies that we will look at seperately. We shall start with the **water pump**.
- This kind of pump, called a suction pump, is frequently found in devices requiring the pressurizing of liquids, usually water. They can be found in expresso coffee machines (pressurized hot water for percolation), and certain steam irons.
- The axial movement of a metallic piston (**Fig. A**), perforated at both ends so as to create the movement of the water, creates the pressure in the system. The back and forth is driven by a magnetic field created by a reel. You can see these parts by following the link at the end of this step.
- The reel contains a diode in series with the coiling, which allows power from a single-phase, full-wave rectified voltage. Put simply, the piston follows the electrical current (50hz) and oscillates with 25 backs and 25 forths per second.
- This very pronounced vibration is the source of the very recognizable sound of a functioning pump.
- Water arrives on one side of the pump (yellow arrow on the schematic) goes through the actuator (**Fig. A**), and arrives in the pale pink chamber. This chamber is alternatively closed of by two valves, pink (**Fig. B**) and blue (**Fig. C**) The pink one lets the water into the chamber when the piston is released, and the blue one is closed.
- When the piston is driven, the pink valve closes, the chamber is pressurized, forcing the blue valve open and letting the water through. This cycle is renewed 25 times per second.

ⓘ Animation showing the pump in operation.

Step 3 — Electronic Circuit Operation







- The device is equipped with a printed circuit board located in the base of the tank. The operation of the device is entrusted to a **microcontroller (Fig. 15)**. This manages the inputs-outputs of the device connected to the various elements, probe, sensor, pump and control panel in order to ensure proper heating of the iron.

- **Iron soleplate temperature management**. It is carried out by means of a probe placed in contact with the soleplate. This iron does not have a manual thermostat to adjust the temperature of the iron. The temp is fixed and is controlled by the probe (see next step in **Fig. 8**) The temp measured on the soleplate of the iron is 160°C.

- **Pump flow management using a BT168 GW thyristor (Fig. 16)** This allows the volume of steam to be reduced in ECO mode or increased in TURBO mode.

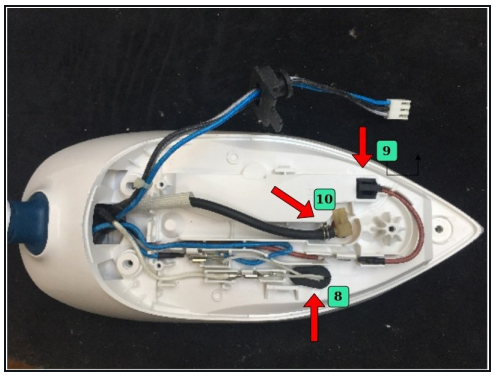
- **Iron inclination management.** This iron has a tilt or motion sensor **(Fig. 12)** This takes the form of a capsule containing a metal ball. When the iron is horizontal, the ball closes the circuit: allowing the resistor to heat up. When the iron is tilted (on its base, for example), the circuit is open, and the resistor is no longer powered.

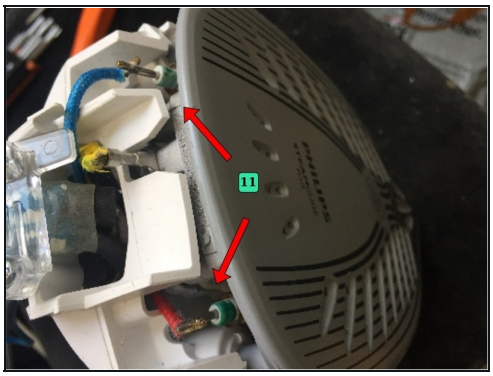
- **Descaling management** By pressing the descale button, the pump operates for 2 minutes without interruption with the maximum flow rate. The iron will signal whenever descaling is needed. The micro-controller is programmed to manage this alert and will stop the pump if the operation is not started.

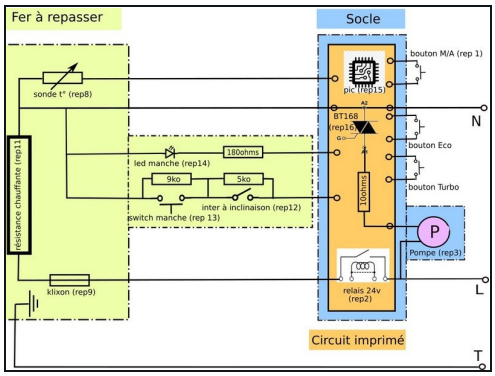
- **Light and sound signal management.** 3 LEDs are placed on the printed circuit opposite each button of the control panel as well as a buzzer. The signals emitted by these components are described in step 3 of the "different functions" tutorial. Another led **(Fig. 14)** is connected to a small PCB board placed in the handle of the iron.

- This small PCB board also supports the steam switch **(Fig. 13)** which is activated by the steam button **(Fig. 5)** and the tilt sensor **(Fig. 12)**.

Step 4 — Electric circuit operation





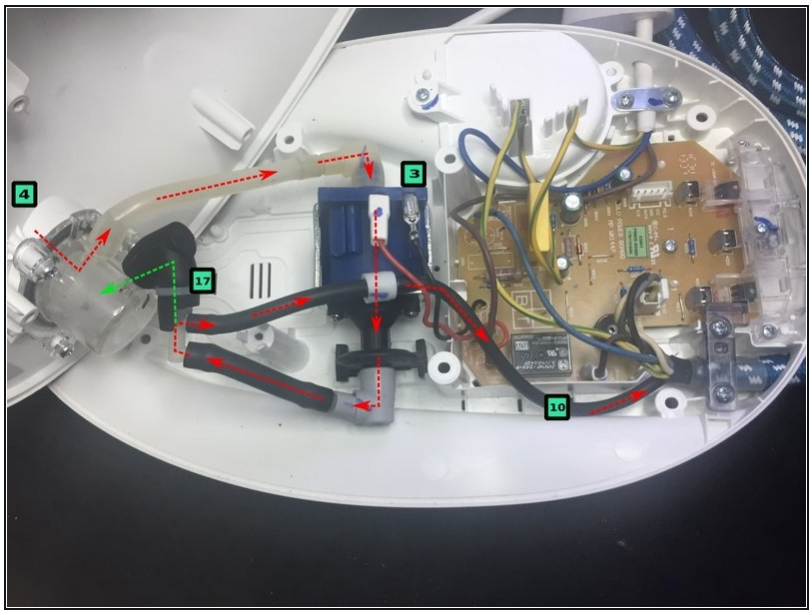


- The electrical circuit is made up of a power cord with 3 conductors Phase (brown), Neutral (blue), Ground (green/yellow). These three wires are connected to the electronic board. The ground wire is extended towards the iron through a protective sheath.

- In this sheath are also the wires that will supply the heating resistor **(Fig. 11)** via the Klixon protection **(Fig. 9)** and the temperature sensor **(Fig. 8)** as well as the control wires (M/A button, led. ..) which is in the handle of the iron. There is also the pipe in which the water circulates **(Fig 10).**

- The attached diagram shows the main elements and their connections.

Step 5 — Hydraulic circuit operation



- The water circuit is as follows (red): the water is stored in the reservoir **(Fig. 4)** When the user requests steam by pressing the button placed in the handle of the iron **(Fig. 5)**, the pump **(Fig 3)** is started. The water is then sucked up and sent through the tube **(Fig. 10)** to the sole of the iron **(Fig. 6).**
- A safety bypass is located at the outlet of the pump **(Fig. 17)** If the water cannot be evacuated (clogged pipe) it returns to the tank (green).

Now that we know the functionalities of our device and we know the sub-assemblies and the operation, we can move on to the repair phase with the following tutorial: "Steam iron, Step 3: common breakdowns" (Please note that this page is currently untranslated.)