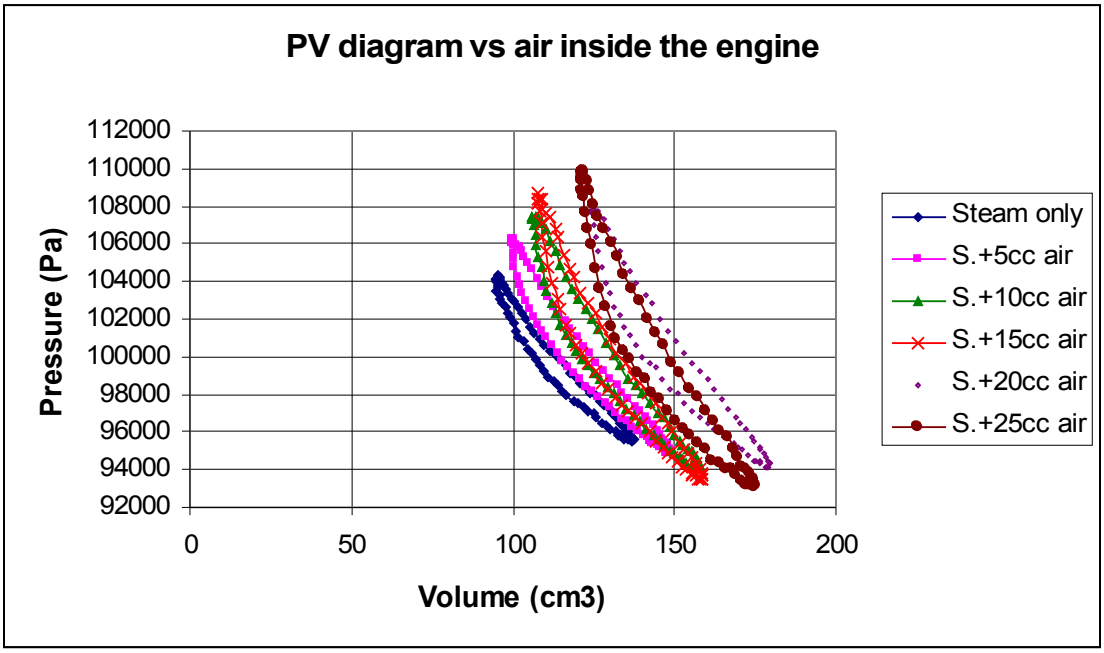
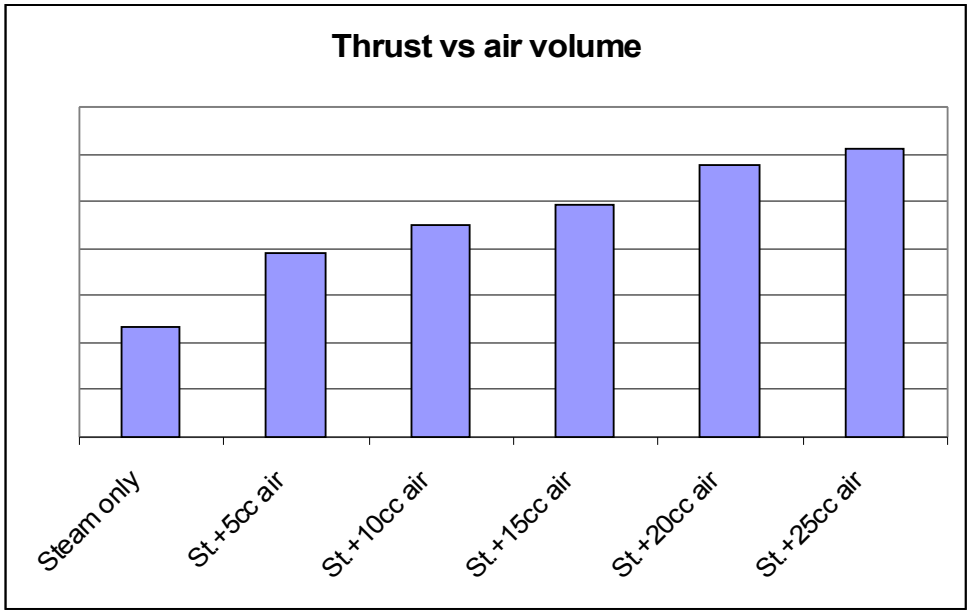
Performances according to gas volume inside a pop-pop engine

I reused the engine and the test bench used end of 2009 to record the engine cycle, but here to save time I introduced voluntarily well known quantities of air inside the engine. The air quantities noted on the following diagram were measured at 20°C.



Note: In order not to hide something I used a dotted line for the cycle with 20cc of air, but this one is not as expected because it was recorded after a burn-out.

This diagram confirms that the presence of gas (other than steam) improves the cycle for stroke volume as well as for pressure. However, more than the stroke volume and the differential pressure, it is the thrust which matters. And there, thrust increase versus gas quantity is clear, including the particular case with 20cc of air because the stroke volume increase is compensated by a loss of frequency.



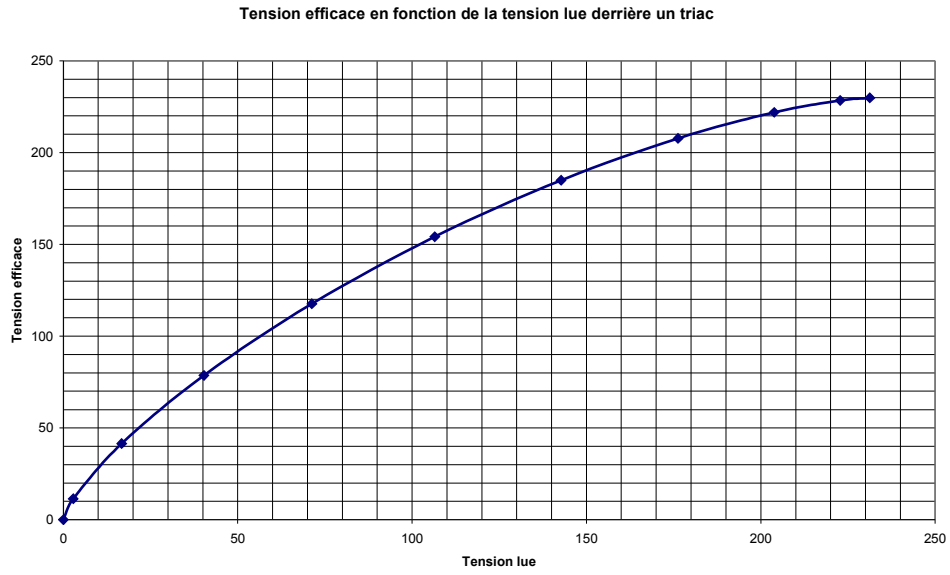
Note: for this engine 25cc of air is the upper limit. Above it, the engine stops.

What did we use to do this monitoring ?

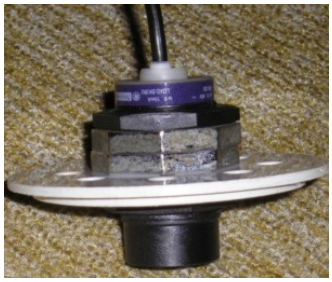
To heat and control the power: an old iron driven by a dimmer using triacs.

View of the engine isolated and provided with measuring instruments. The yellow wire is the one of a thermocouple measuring the copper pipe temperature. The grey one going out of the rock wool is the one of a thermocouple measuring the temperature of the boiler copper. The 3 black polystyrene sleeves cover PTC type temperature probes. This is a partial view of the engine. Totally there are 7 PTC probes equally spread along the pipe. The analysis of the temperature records will be done on another document.
As it can be seen, the hot section is well isolated and the rest of the pipe is isolated at 30%.

One drawback of the control by triacs and voltage measurement using cheap indicators is that the read voltage differs from the effective voltage. Therefore, I calculated and drew the corresponding curve and it was displayed by the side of the monitoring and control panel.

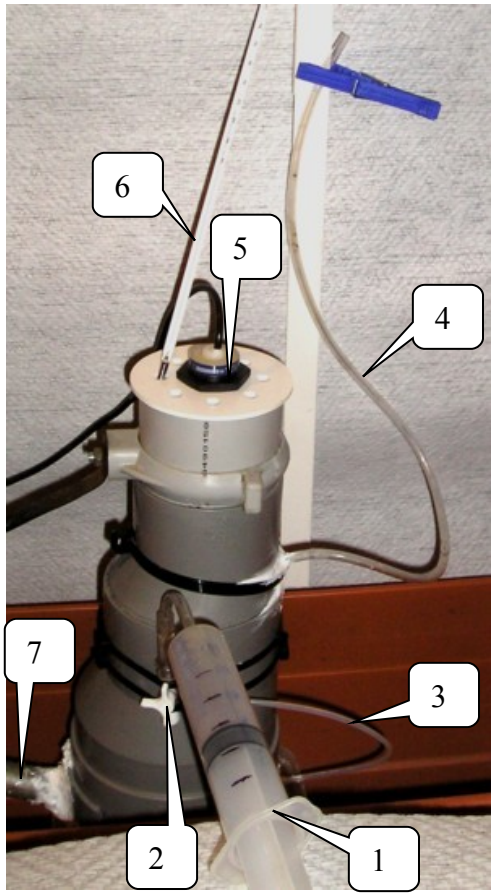


On the above photo the little grey tube which is visible at the top of the engine connects it to a cooler (small brass pipe with cooling winglets) itself connected to an absolute pressure transducer. The signal from this transmitter is amplified and sent to a data logger, itself connected to a personal computer.



The gas volume is indirectly determined by means of a proximity sensor (here on the left) which measures the position of a float located inside the measuring pot to which the pop-pop engine is connected.

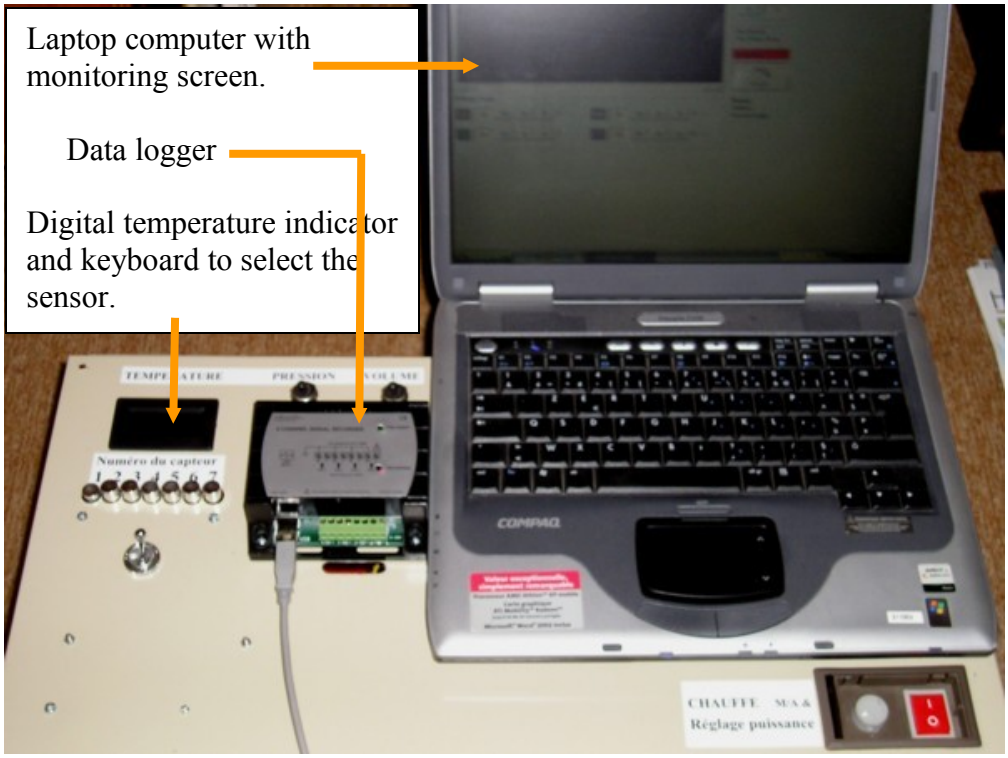
The proximity sensor is connected to the data logger.



View of the measuring pot (here on the left).
Caption:

1- At the foreground a syringe used to inject air in the engine.
2- Isolating cock (closed when no air injection)
3- Capillary tube to connect the syringe to the top of the engine inside.
4- Little tube used to drain some water when the mean level in the pot increases. When not used its outlet is maintained up by mean of a cloth pin.
5- Proximity sensor.
6- Thermometer used from time to time to measure the water temperature in the pot.
7- Engine pipe and its penetration through the pot wall.

Jar used to measure by weighting the water amount drained from the pot.



And to measure the surrounding temperature of the room, the last instrument is the « love thermometer ». When one loves so much the pop-pop engines, measuring instruments are needed.