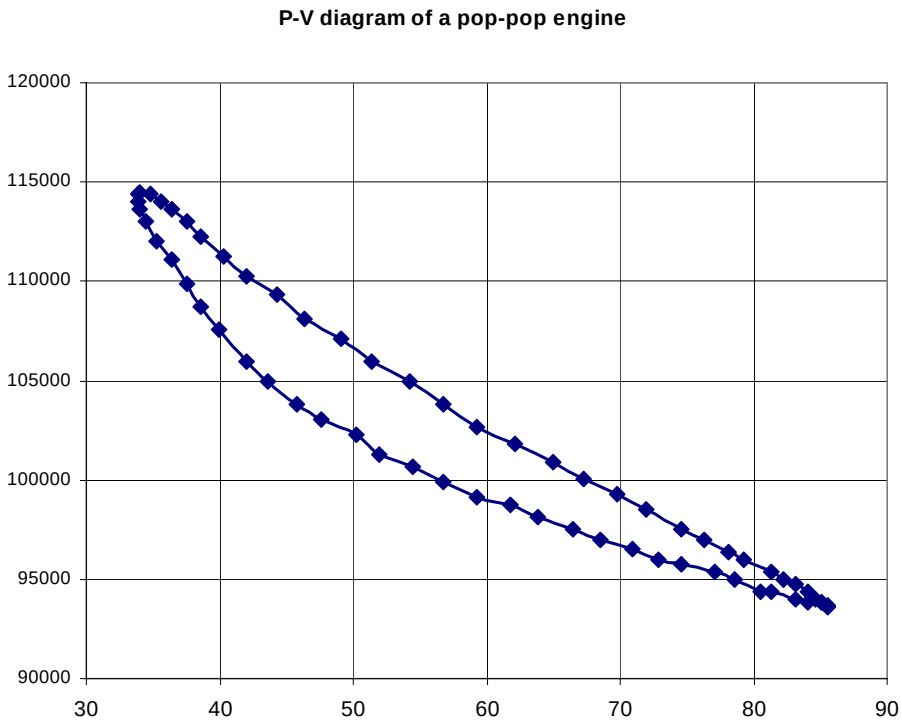
Efficiency of a pop-pop engine : another way to know it

Reminder: By measuring the thrust and the frequency of pop-pop engines, assuming the movement of the water column was sinusoidal, we calculated the power delivered by these engines; and then, by comparison with the heating power we calculated the efficiency. These experiments and calculations are described (among others) in the documents: “Propulsion of a boat by a pop-pop engine” at paragraph 8.3.3 and “Efficiency of a pop-pop engine”.

Recently we succeeded to record the real cycle of a pop-pop engine. (See “cycle of a pop-pop engine”.) The result allows a new approach. Indeed, on the Watt diagram (gas pressure versus volume) the area of the cycle is equal to the work delivered by the engine during this cycle, and dividing this work by the period of the cycle we get the power. To illustrate this method, let’s look at a cycle.



Les pressions sont exprimées en Pascals et les volumes en cm^3

Pressures are expressed in Pascals and volumes in cubic centimeters. The area of the cycle measured with a planimeter or with patience by counting small squares is here 0.165Nm. The period when recording this cycle was 0.67 second. The power is 0.165/0.67 = 0.246W.

When the engine delivered this mechanical power the heating power was approximately 200W. The ratio is the efficiency: 0.246/200 = 0.123%.

Though this efficiency is pathetic, it is slightly better than all the efficiencies measured up to now. This can be justified by the fact we used a stationary engine designed for the test bench and heated with electricity. And this allowed insulating the hot section.