Experimental test of a mini-Rossi device at the Leonardocorp, Bologna 29 March 2011.
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Travel report by Hanno Essén and Sven Kullander, 3 April 2011.

We gathered in the Leonardo Corporation building where the 10 kW apparatus for anomalous energy production by nickel and hydrogen was demonstrated during a press conference on 14th of January. References [1] to [4] for the original papers describing the innovation are listed at the end. In the same building, two CHP facilities were located, based on biodiesel from waste which Andrea Rossi, prior to his present Ni-H activity, had developed.

The present test was done on a smaller device [5] than the 10 kW device that has been used earlier during the January press conference. One of the reasons for going to smaller dimensions is safety according to Rossi.

The conclusions from the papers [1] to [4] are that nickel and hydrogen provide the fuel for nuclear processes inside a small container in a radiation shielded setup and that in the room outside, no radiation different from the ambient one is found.

Figures 1 and 2 below depict the insulated device used for the experiment together with three spare devices. As can be seen on the bare devices there is a horizontal section with a central container. The tube was made of copper and according to Rossi, the reaction chamber is hidden inside in the central part and made of stainless steel. Note that on the main heating resistor which is positioned around the copper tube and made of stainless steel (Figure 3) you can read the dimensions and nominal power (50mm diameter and 300W). The vertical chimney is for the steam-water exhaust. The cooling inlet water of about 18 °C comes from a reservoir via a pump (yellow). The transparent blue rubber hose going from the reservoir to the device is visible above the yellow pump, on the left of the photo in figure 1. To the right at the chimney, a black hose of heavy rubber, for high temperatures, carries the hot water/steam to the sink on the wall of the adjacent room. At the end of the horizontal section there is an auxiliary electric heater to initialize the burning and also to act as a safety if the heat evolution should get out of control.

The central container seen in figure 3 has an estimated volume of 50 cm^3 and it contains 50 grams of nickel. The container has on its top, a pipe for the filling of hydrogen gas. During the running we used the rightmost one of the devices, figure 4, which is surrounded by a 2 cm thick lead shield, as stated by Rossi, and wrapped with insulation, figure 5. We had free access to the heater electric supply, to the inlet water hose, to the outlet steam valve and water hose and to the hydrogen gas feed pipe. The total weight of the device was estimated to be around 4 kg.

Calibrations. The flow of the inlet water was calibrated in the following way. The time for filling up 0.5 liters of water in a carafe was measured to be 278 seconds. Visual checks showed that the water flow was free from bubbles. Scaled to flow per hour resulted in a flow of 6.47 kg/hour (Density 1 kg/liter assumed). The water temperature was 18 °C. The specific heat of water, 4.18 joule/gram/ °C which is equal to 1.16 Wh/kg/ °C is used to calculate the energy needed to bring 1 kg of water from 18 to 100 °C. The result is 1.16×(100-18)=95 Wh/kg. The heat of vaporization is 630 Wh/kg. Assuming that all water will be vaporized, the energy required to bring 1 kg water of 18 °C to vapor is 95+630=725 Wh/kg. To heat up the adjusted water flow of 6.47 kg/hour from 18 °C to vapor will require 725×6.47=4.69

kWh/hour. The power required for heating and vaporization is thus 4.69 kW. It should be noted that no error analysis has been done but according to Giuseppe Levi, a 5% error in the measurement of the water flow is a conservative estimate. Even with this error, the conclusions will not change due to the magnitude of the observed effects.

Startup. Prior to startup, the hydrogen bottle with a nominal pressure of 160 bars was connected for a short moment to the device to pressurize the fuel container to about 25 bars. The air of atmospheric pressure was remaining in the container as a small impurity. The amount of hydrogen with the assumed container volume of 50 cm^3 is 0.11 grams of hydrogen. The electric heater was switched on at 10:25, and the meter reading was 1.5 amperes corresponding to 330 watts for the heating including the power for the instrumentation, about 30 watts. The electric heater thus provides a power of 300 watts to the nickel-hydrogen mixture. This corresponds also to the nominal power of the resistor.

Initial running to reach vaporization. The temperatures of the inlet water and the outlet water were monitored and recorded every 2 seconds. The heater was connected at 10:25 and the boiling point was reached at 10:42. The detailed temperature-time relation is shown in figure 6. The inlet water temperature was 17.3 °C and increased slightly to 17.6 °C during this initial running. The outlet water temperature increased from 20 °C at 10:27 to 60 °C at 10:36. This means a temperature increase by 40 °C in 9 minutes which is essentially due to the electric heater. It is worth noting that at this point in time and temperature, 10:36 and 60°C, the 300 W from the heater is barely sufficient to raise the temperature of the flowing water from the inlet temperature of 17.6 °C to the 60 °C recorded at this time. If no additional heat had been generated internally, the temperature would not exceed the 60 °C recorded at 10:36. Instead the temperature increases faster after 10:36, as can be seen as a kink occurring at 60 °C in the temperature-time relation. (Figure 6). A temperature of 97.5 °C is reached at 10:40. The time taken to bring the water from 60 to 97.5 °C is 4 minutes. The 100 °C temperature is reached at 10:42 and at about 10:45 all the water is completely vaporized found by visual checks of the outlet tube and the valve letting out steam from the chimney. This means that from this point in time, 10:45, 4.69 kW power is delivered to the heating and vaporization, and 4.69 – 0.30 = 4.39 kW would have to come from the energy produced in the internal nickel-hydrogen container.

Operation. The experiment was continually running from 10:45 to 16:30 when it was stopped by switching off the heater and increasing the cooling water flow to a maximum of 30 liters per hour. On two occasions during the steam production phase, David Bianchini tested the radiation level which did not differ from the normal level in the room. The temperature at the outlet was controlled continually to be above 100°C. According to the electronic log-book it remained always between 100.1 and 100.2 °C during the operation from 10:45 to 16:30 as can be seen in figure 7. Between 11:00 and 12:00 o'clock, control measurements were done on how much water that had not evaporated. The system to measure the non-evaporated water was a certified Testo System, Testo 650, with a probe guaranteed to resist up to 550°C. The measurements showed that at 11:15 1.4% of the water was non-vaporized, at 11:30 1.3% and at 11:45 1.2% of the water was non-vaporized. The energy produced inside the device is calculated to be (1.000-0.013)×(16:30-10:45)×4.39 =25 kWh.

Discussion. Since we do not have access to the internal design of the central fuel container and no information on the external lead shielding and the cooling water system we can only make very general comments. The central container is about 50 cm^3 in size and it contains 0.11 gram hydrogen and 50 grams nickel. The enthalpy from the chemical formation of nickel and hydrogen to nickel hydride is 4850 joule/mol [6]. If it had been a chemical process, a maximum of 0.15 watt-hour of energy could have been produced from nickel and 0.11 gram hydrogen, the whole hydrogen content of the container. On the other hand, 0.11 gram hydrogen and 6 grams of nickel (assuming that we use one proton for each nickel atom) are about sufficient to produce 24 MWh through nuclear processes assuming that 8 MeV per reaction can be liberated as free energy. For comparison, 3 liters of oil or 0.6 kg of hydrogen would give 25 kWh through chemical burning. Any chemical process for producing 25 kWh from any fuel in a 50 cm^3 container can be ruled out. The only alternative explanation is that there is some kind of a nuclear process that gives rise to the measured energy production.

Acknowledgements.
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References.

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Figures.

Figure 1 showing Andrea Rossi (left) and Giuseppe Levi (right). Shown are the water pump in yellow, three bare Rossi devices (ECATS) and one heat- insulated Rossi device (ECAT) which was used for the experiment. In the middle of the horizontal section is seen the container ca 50 cm^3 in volume with the hydrogen gas- fill pipe on its top. The electric heater is connected at the end of the horizontal section. The chimney is used for the steam accumulation. (Photo: Sven Kullander).

Figure 2 showing in principle the same ECATs as in figure 1 but in another perspective. (Photo: Giuseppe Levi).

Figure 3 shows the central fuel container between the 35 and 40 cm marks on the ruler. It is about 50 cm^3 in volume. (Photo: Giuseppe Levi).

Figure 4 showing the chimney with the black outlet tubing, the thermocouple holder and on the top, the steam exhaust valve. (Photo: Giuseppe Levi).

Figure 5 with Andrea Rossi preparing the insulation of the chimney together with Sven Kullander (left) and Hanno Essén (right). (Photo: Giuseppe Levi).

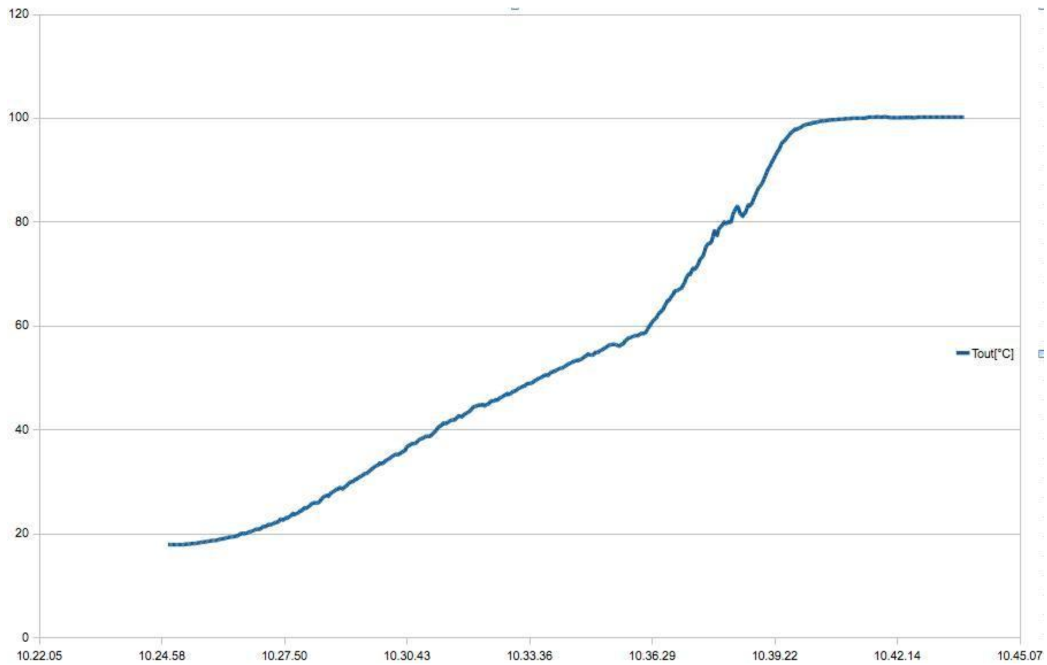

Figure 6. The evolution of temperature in Celsius degrees versus the time in hour.minute.second. (Photo: Giuseppe Levi).

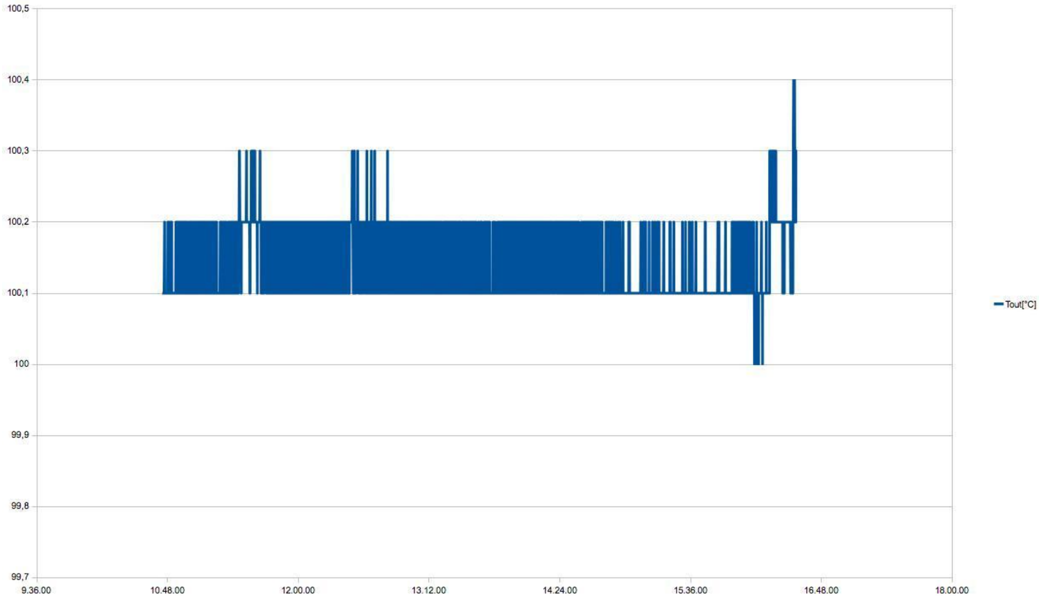

Figure 7. The monitoring of the exhaust temperature during the experiment. (From Giuseppe Levi).

Figure 8 showing from left to right, Hanno Essén, Andrea Rossi, Carlo Leonardi and Sergio Focardi.
(Photo: Sven Kullander).

Figure 9 showing from left to right, Hanno Essén, Sven Kullander, Giuseppe Levi, David Bianchini and Andrea Rossi. (Photo: Sven Kullander).

Figure 10. David Bianchini, Andrea Rossi holding the mini ECAT and Giuseppe Levi. (Photo: Sven Kullander).