Contrast and comparison between the Papp engine and the PAGD™/XS NRG™ Technologies

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(The following is an edited extract of a report the authors were asked to make for evaluation of a technology which copied Papp's but gave him no credit whatsoever.)

A comparison between the Papp engine [1] and the PAGD/XS NRG system [2-5] can be a very instructive exercise not just in the comparative analysis of new power-generation technologies, but also in the evaluation of electric plasma-based devices that deploy anomalous cathode reaction forces [6-7].

Both the XS NRG energy converter and the Papp engine employ emission plasmas and inert gases to harness, in the former, the energy of the discharge and, in the latter, the motive power. Both systems operate with hermetically closed vessels - the compression chambers of the reciprocating cylinders in the Papp engine, and the PAGD pulse generators in the XS NRG energy converter. However, whereas the Papp engine must employ a very high pressure for the mixture of inert gases (lines 60-65 of page 8, ref. [1]), in the PAGD system the inert gas is merely residual, as it plays its role in the initiation of the discharge and in the electrodynamic force transfer [8].

Both systems employ a sudden (and catastrophic) electric discharge. Papp followed the model of the internal combustion (IC) engine, with the high-pressure spark igniting the inert gas fuel. In the PAGD, the 'spark' consists of a diachronic cluster of auto-electronic emission sites that fail to sustain a vacuum-arc. The electric discharge is not accessory, as it is in the Papp technology; rather, it is constitutive of the technology by its physical characteristics, including the autogenous pulsation. It is, in fact, the method whereby the 'vacuum-state' is tapped. The PAGD discharge is a low field auto-electronic emission that directly generates the electron plasma from a cathode that can be treated as fuel [9]. This has a deep parallel with the Papp engine, where the explosion is, in our view, driven by the formation of an electron plasma emitted from the inert gas mixture - which must thus be treated as the fuel proper (see below). The basis for the presence of anomalous cathode reaction forces in the Papp combustion, stems, in our view, entirely from the (quasi-solid) conditions that permit autoelectronic emission from inert gases.

Magnetic excitation of the combustion plasma is required in the Papp engine, in order to optimize the compression structure of the fuel gas mixture at ignition. Magnetic induction is not necessary in the autogenous PAGD regime - though it can be employed to modulate firing rates. Electrostatic means can equally be used for the same task, but if the XS NRG system is properly tuned, neither is necessary for fixed rate operation.

Like the IC engine, the Papp engine requires high-voltage ignition coils to ionize and ignite inert gases at atmospheric or supra-atmospheric pressures. Papp himself described how the discharge at these voltages produces X-rays, and how, "at the focal point of particle collision" inside a cylinder, alpha, beta and gamma radiation will originate from the thermonuclear fusion process involving the helium core.

In some versions of the Papp engine that have been witnessed by the authors, high-power hardened X-ray production could be readily observed in transparent cylinders. This reminded us - but in a massive way - of the...
X-ray production that we observed in high-vacuum tubes when we were learning how to isolate the PAGD regime and sustain it at lower breakdown voltages in the absence of X-ray production. Indeed, this is one of the main differences between the PAGD/XS NRG system and the Papp engine: that the PAGD micro-explosions occur at low voltage and generate no significant ionizing radiation.

In the Papp engine there are also significant so-called radio frequencies associated with the high frequency oscillator circuits, the ignition coils, the ionization step, and the plasma ignition proper, that must be shielded against. This, in our view, does not present a health hazard - and a similar, though broadband, RF signature can be obtained from an operating PAGD reactor.

The transfer of the explosive force to assist the recompression of the gas and the transfer of output electric energy to re-ignite the mixture (lines 53-53, p.10 of ref. [1]) are critical steps in the Papp engine protocol, and are carried out, respectively, by the reciprocating cylinders and the inductive couplings and internal wiring of the firing circuitry. Papp employed one or two very large amperage 24V batteries (line 14, p.7, ref. [1]) as the electrical drive to power the engine's 40kV ignition coils (lines 41-43, p.7 ref. [1]). Much debate has occurred on the sidelines as to whether or not he battery was needed for the continued operation of the system. To us, it is apparent that it was required and that Papp never demonstrated either that his engine could do away with it, or that it was capable of being recharged through operation of the system (Feynman argued otherwise, that Papp claimed a perpetual motion machine; he wrote this to justify his actions, following a lawsuit filed by Papp and lost by Feynman and Caltech, and caused by Feynman's failure - during a demonstration of the engine - to hand over the power line switch to Papp, which resulted in a major engine explosion, serious injuries to two participants and the death of a third) In fact, the Papp engine requires a continuous input of power to make up for the loss in each subsequent ignition. Furthermore, Papp emphasizes that the 24 volts present across the main electrodes "is always present during operation" (line 54, page 10, ref [1]). What Papp indicates (lines 67-68, p.11) is that, once initial ignition has taken place in both cylinders, subsequent ignition will no longer need the starter motor; but the need remains for (1) the modulating oscillators (Papp utilizes a high-frequency source for supplying varying voltage to the electrodes, and a pulse timer and distributor that provides three or more pulses from the ignition coil to each of the cylinders at any one time), (2) the high voltage source, and (3) the low voltage/high-current source - even if the latter is only applied sporadically (the capacitor banks hold substantial portions of the power input over time).

The XS NRG converter also employs a drive pack (of much greater voltage and lower current) as source for the triggering of plasma pulses, but the system output greatly exceeds the spent electric input, permitting demonstration of the recharging of the drive pack via interchange with the battery system (the charge pack) placed to capture the system output [10].

The reaction vessel is, in both systems, the source of radiant heat. Papp reported that the key function of his engine was the 'minute fusion reaction' (line 55, page 11, ref [1]) in the highly ionized helium layer, at the very core of the plasma formed, and reported a temperature of approximately 100,000,000°F. Papp emphasizes that the plasma must not last longer than 10-6 seconds, otherwise the intense heat will damage the cylinder walls. Papp also mentions that the cylinders will heat up with time of operation. We very much doubt that the Papp engine reaches the quoted temperatures, even at its core. Be that as it may, because of the high pressure gas, heat transmission to the engine walls constitutes a real engineering problem of plasma confinement with definite timing constraints. In the PAGD electron plasma, temperatures of >48,000 °C are also reached (modal photon radiation at 300 nm) [8], but the high-vacuum and high-volume vessel prevents substantial heat transfer to the vacuum envelope. Yet, there is sufficient residual heat to also be tapped directly and advantageously in the process of electrode cooling.

The Papp art teaches that both the anode and the cathode must be constructed so as to contain specific radionuclides (thorium 232, rubidium-37, phosphorus-15, or strontium-38 and sulfur-16). The technology thus utilizes radioactive compounds. No such need arises in the PAGD technology, though we have had plenty of unsolicited advice on how to duplicate the Moray valve method, which employed certain radioactive compounds to sustain low-level ionization of the gas substrate. With proper tuning of the physical parameters of the discharge, no such coarse methods are needed by a clean XS NRG system. The critical parameter lies in taking advantage of the constitutive benefits of the Paschen Law, when the latter is aethermetrically understood.
Replacement of the rare gas canisters in the Papp engine is the equivalent of tube replacement or refurbishing in the PAGD/XS NRG system. Each has its ash, radioactive in the former and nonradioactive in the latter. Papp indicates that each cylinder will have to be replaced every 1,000 hours or so, with the helium gas being consumed in the process. Another element to consider is that, while the gases utilized are cheap and readily available, the engine requires very precise gas mixtures and ultra-high purified gas components. The process of mixing, filtering, photon injection, frequency separation, etc, necessary to prepare the gas mixture is both costly and elaborate, and entails a substantial power expenditure. It involves all manners of steps, and is described in great detail by Papp on pages 15-22 of his patent.

R&D problems of a similar nature arise in the case of the XS NRG technology - problems having to do with the mirroring of the tube and with the changing work- function. Rare gas is not necessary, and properly evacuated tubes can easily last more than ten years with respect to the residual inert gas content. Innovative solutions were pursued for the more serious problems of mirroring, ion-pump effect and the emissivity of the metal fuel, and some have borne unexpected results out of simple engineering solutions.

Essentially Papp described his invention as being analogous to a hydrogen fusion reactor, except that: (1) it used inert gases, not hydrogen; (2) instead of a high input power required to contain the plasma by strong applied magnetic fields, it used a form of inertial containment of the core helium (layering of the other gases with increasing atomic weight); (3) whereas with hydrogen reactors, the input power is high and the excitation power low, with the Papp engine, the input power is low but the excitation power is high. Papp did not make any claims whatsoever of producing or obtaining energy in excess of breakeven, he did not show any data for such, and simply stated that his engine had overall lower energy requirements than combustion engines and was, accordingly, more efficient. It would be indeed very difficult to estimate all the power inputs to the Papp engine from the patent specifications, given the plurality of sources utilized.

In contrast to the complex requirements of the Papp technology, our technology stands to provide a high-volume power source as a compact system having no moving parts and generating no noise, where efficient motor couplings are made external to the reactor system [5]. It offers a light-weight implementation and has the benefit that the key power unit is a replacement item with a long lifetime and low associated fabrication costs (nothing like the laborious and expensive Papp cylinder cartridges), thus also making it easier to recover R&D investment. Reactor components are constructed of readily available, recyclable material and produce no radioactive or other noxious residues.

REFERENCES


