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column

A carbon-free fuel?

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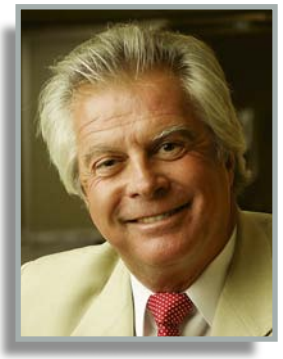

Some time ago, I mentioned the brilliance of Eddie Sturman, the father of the camshaft-free engine. On a recent visit to the Woodland Park, Colo.-based Sturman Industries, I was privileged to view the first beginnings of his crank-free internal combustion engine.

Sturman is a hydraulics inventor and creator of the Sturman Digital Valve, which has him both in the Aerospace Hall of Fame and the man who makes the Navistar International HEUI fuel system possible. His injectors are in the straight six-cylinder engines that have earned all those emissions credits for Navistar over the last few years.

Sturman's latest concept is, of course, hydraulics-based. It uses a free floating piston that has a hydraulic connecting rod that positions the piston in the bores – in the case of the prototype being assembled, a custom-made piston in a single International cylinder liner.

Other hydraulic cylinders under the piston, together with the positioning cylinder, convey the force generated in combustion to hydraulic pressure. This, instead of rotary motion of a crankshaft, becomes the energy output from the power unit.

Conventional poppet valves, also controlled hydraulically, manage the flow of air through the combustion chamber. So at a stroke, Sturman has control of air, fuel and piston position completely independently. He can change compression ratio, displacement, injection timing, valve opening and closing, completely independently of piston position. This engine can even idle cylinders with pistons not moving, saving the pumping losses associated with more conventional cylinder cut-out configurations. Or, alternatively, make some cylinders air pumps to supercharge the engine. The possibilities are endless.

But the most important may be the fact that the engine can run on almost any fuel. "How about a completely carbon-free fuel?" asked company president Carol Sturman over lunch.

I was a little taken aback.

I had not thought of the mechanism before, but what burns in an internal combustion engine is the hydrogen that is associated with the carbon in a conventional fossil fuel. You can squirt hydrogen into an engine and it'll run quite well with only water as the combustion product – as in a fuel cell, for instance – but hydrogen is a difficult fuel to manage. But combine that hydrogen with nitrogen in ammonia, and the NH3 molecule becomes a perfect carrier for the hydrogen.

Ammonia is the second largest manufactured chemical in use today.

An ammonia fuel?

Why not? In WWII, buses in Belgium were run on ammonia. Various demonstration projects have shown it is a viable fuel, though engines have to be converted to run on it as it is fairly difficult to light off. But Sturman's concept engine, with its infinitely controllable combustion, is a perfect candidate.

Think about an ammonia-fuel economy. Ammonia is already the second largest manufactured chemical in use today. Farming pours billions of tons of ammonia onto crops every year. It is made today from natural gas, but it can be produced electrolytically from water and air.

We wouldn't have to drill for it in sensitive environments or suffer the consequences of spills. We wouldn't have to obtain fuel supplies from politically unstable areas of the world where currently we spend billions of dollars a day supporting America's declared enemies.

Then we got on to the dangers of electromagnetic fields and high-voltage transmission lines. Not that I am necessarily a subscriber to that notion. But if you can use the current ammonia distribution infrastructure and generate electricity locally using ammonia-burning internal combustion engines, you have addressed the whole electrical distribution and power-grid issue.

Spend an afternoon with the Sturmans and you come away shaking your head. It's a humbling experience.

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