Under the Hood, May, 2018

I have been writing this automotive happening column for four years. Originally, it was part of my newsletter President's column and then I continued with a new column name after my term as president was concluded. Today, I want to re-visit a couple of topics that we have previously discussed.

For some time, I have been waiting for the arrival of electric motor powered auto air compressors to replace the belt driven supercharger or exhaust driven turbocharger. We are seeing much more of the exhaust driven turbocharger as many marques now feature a 2.0 liter turbo four as their primary engine. Both the supercharger and turbocharger have benefits and the end result of each is different. There seems to be a common misconception that since a turbocharger uses exhaust flow to spin the turbine wheel that it is "free" energy, while the belt driven supercharger is taking engine energy that could be going directly to the wheels. That exhaust flow is actually spinning a turbine wheel that in turns spins a compressor wheel that is hard at work trying to compress the incoming combustion air. The First Law of Thermodynamics basically says that machines that produce work with no energy input are impossible. Many of you installed dual exhaust to reduce backpressure in the exhaust system to free up horsepower. Then we graduated to headers to help reduce backpressure even more. Exhaust systems help with this backpressure reduction. The dual mode exhaust in the Corvette C6-C7 models is even claimed to have increased engine horsepower by 5-6 hp, when the exhaust is in the more open mode. The dual mode exhaust didn't really increase the engine horsepower; it simply reduced the amount of horsepower that was pushing the exhaust out the exhaust pipes, to allow more horsepower to be available to power the vehicle. Add headers to our Corvette and delete the catalytic convertors and mufflers and you would have a significant horsepower increase. Why? Because all of these exhaust components add backpressure which reduces available horsepower. Putting a turbocharger in the exhaust stream just adds more exhaust backpressure. In a four-cycle engine the upward motion of the piston in the exhaust cycle pushes the exhaust out the valve and out the exhaust system. That upward motion of the piston against the backpressure of the system is enabled by using some of the energy developed by the adjacent cylinder in the downward combustion cycle. Only one of the 4 piston movements actually generates power, as the other three piston movements support the combustion cycle. In our vehicle engine (and in single cylinder engines) these opposing actions are smoothed by spinning a flywheel which provides a source of stored energy. When we added the turbocharger in the system we now have that upward piston movement trying to push that exhaust air to spin the turbine wheel which then turns the compressor wheel all while working to compress the incoming air. It is clear that there is no free energy in the system. So why have I been talking about an electric compressor? It is only when you want maximum acceleration or maximum velocity that we really use all the available horsepower. Those moments are exactly when the belt driven supercharger or exhaust driven turbocharger are both helping, but also hurting us by taking some of that engine energy. The electric compressor would still use energy but it would be taking that energy from the battery, which is simply an energy storage device. For that quick burst of acceleration, the battery would be being depleted while it powered the electric motor. That battery use is like the large battery drain used to turn over the engine during starting. Then the battery can be re-charged during normal operation. Now, we can assume that electric compressors are not practical for heavy duty diesel trucks or train locomotives where the engines are almost always under boost, or even in car racing. However, in a street driven auto the engine is seldom under full boost for long periods and the electric compressor could free up some of the parasitic losses that we endure with the other forms of super/turbo charging. Regardless of the form of compressing the intake air, this process takes a lot of energy to effectively provide much boost. I would anticipate that an all-electric supercharger could require a larger battery to store sufficient energy even for that ¼ mile sprint. I have read several claims about after market electric compressors that claim to be effective. Most of those claims need to be read with caution, as the electric motors simply don’t have enough power to effectively compress much air.   One fun recollection: A couple of years ago I read and reported about two goof balls that mounted a couple of gasoline leaf blowers to the intake system of their import car. The end result? While the leaf blowers generate a fair amount of wind force to blow leaves, they didn’t have enough power to significantly compress the intake air, so there was no measurable gain in vehicle performance. Regardless, we are starting to hear more about vehicle electric superchargers.   We are already seeing the first examples where we have an electric motor mounted in the turbocharger system to spin the compressor wheel until the exhaust flow can spin up the turbine wheel, all trying to reduce turbo lag.

With the advent of direct injection, water injection and other technologies, we have seen engine compression ratios rapidly increasing. An increase in compression ratio will (assuming we have adequate fuel octane) result in increased efficiency and horsepower. Most (non-boosted) car engines are now in the 11:1 or 12:1 compression ratio range. Mazda has been trying to perfect a gasoline engine that would run at 18:1 with moderate success. Now Mazda is working on a newer technology that would still use a spark plug ignition, but allow for higher compression ratios and also revised air:fuel ratios. Under light engine loads Mazda claims that this engine can run at an air:fuel ratio of 30:1, almost half of normal fuel than a typical gasoline engine at a 15:1 ratio. Under higher engine loads, the air:fuel ratio would be revised to the more typical ratio. Mazda claims that this new engine could generate a 20-30% increase in fuel efficiency. Will this be another claim that sees production, or will it be another engine breakthrough that silently disappears? Stay tuned.

Recently we had house guests from Canada. Alex and I headed over to Park Place Motors in Bellevue to get out of the house. The new facility has three main buildings and still quite a few nice cars parked outside. I would guess there were 150 collector cars available and even one very nice 1927 speedboat. One of the sales people told us that Park Place is the largest buyer and seller at the Barrett Jackson auctions. Shortly afterwards I was reading an article in a local business newsletter that explained that Park Place was planning to take 90 cars (and the speedboat) to the January Barrett Jackson auction. Included were 11 rare Chevrolet muscle cars from the local collection of David Fluke. I did a quick search of Fluke’s collection and found a gorgeous 67 427/435 Vette and a very rare 65 Z16 Malibu with the 396/375 engine. Both were listed as no-reserve cars.   When you are watching Velocity channel with the B-J reruns, pay special attention for Fluke’s cars. If you find a rainy weekend and are bored, take a drive over to Park Place and drool over the selection.