TURBO-CHEVELLE

30–40% more power — with smoothness!

How do you boost the acceleration of a standard family passenger car by 30-40% without sacrificing anything in smoothness, flexibility, low speed torque, starting ability, noise or fuel economy? Thousands have tried and failed, but Hugh MacInnes, manager of turbocharger development at Thompson-Ramo-Wooldridge in Cleveland, has done a good job of solving this, probably one of the toughest technical problems in the whole hot rodding sport.

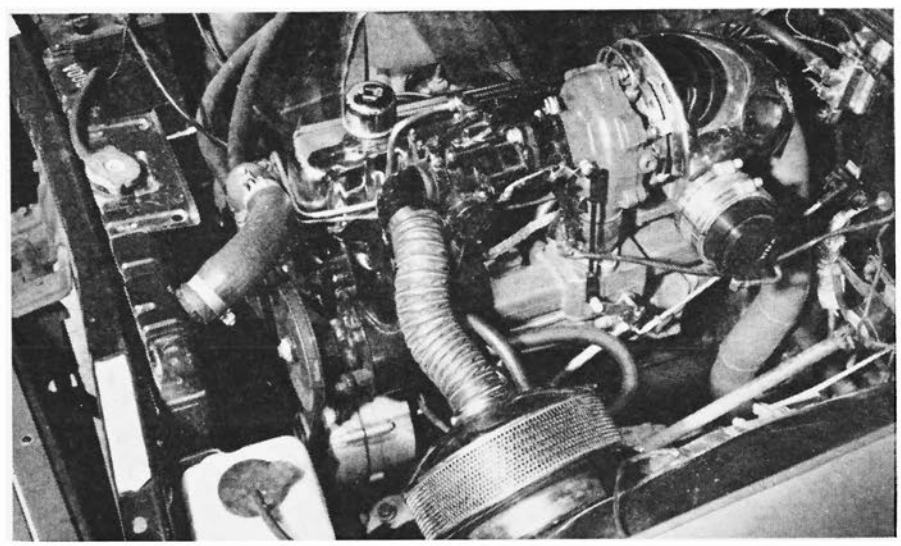
How did MacInnes do it? Not with the usual high performance cams, multiple carburetors, high compression ratios and big-bore pistons. MacInnes' secret was simple: An exhaust driven turbo-supercharger.

The turbo mounts unobtrusively in the engine compartment, uses previously wasted exhaust gases to pump 8 psi manifold boost pressure at maximum rpm, which is good for a 30-40% increase in peak bhp, and nearly that much more peak torque. And yet, under normal driving conditions, you don't know the thing is there. It "floats" on the waste exhaust gases and more or less stands by until pressure is needed. At a given car speed and throttle opening the fuel consumption is not increased with the turbo. In fact, the lb./bhp-hour figure is better, because energy is being recovered from the waste exhaust.

MacInnes started with just about the most unlikely raw material possible for a project of this kind—a 1964 Chevelle 6-cyl. station wagon with manual transmission. This certainly is a typical family utility car and one that would show up any moderate improvement in performance. The commercial turbo-supercharger unit used was a Thompson design, of the size used in twin turbo installations on gasoline marine engines of more than 400-cu. in. displacement. Hugh figured this would be about right for an 8 psi boost on the 230-cu. in. Six.

Exhaust ducting often is the toughest problem with "home" turbo installations, because the ducts must be twisted around circuitously on their way to the turbo unit. Things are much simpler for an in-line Six engine than for a V-8: Both the intake and exhaust manifolds are bunched right together. Hugh replaced the stock 230 manifolds with a set from a sister engine of this family, the 292-cu. in. Chevrolet truck Six. These jut out farther from the head and provide more room for mounting the turbo unit. It was then a matter of cutting a hole in the top of the exhaust manifold, near the back, and welding on a short section of pipe with a flange on top to accept the turbine inlet flange.

The turbine was positioned in such a way that the compressor outlet was pointing directly down at the stock carburetor mounting flange on the inlet manifold (with carburetor removed). This was connected to the inlet manifold by a flange adaptor.



TURBO-SUPERCHARGER was fitted to this Chevelle Six with truck manifold, side-draft carburetor, special adapters and air cleaner relocation.

Of course this left it without a carburetor. It wouldn't have been practical to try to leave the stock carburetor in place and blow the compressed air through it. Sealing and jetting problems are very difficult with such arrangements and there wasn't enough hood clearance for an inlet elbow above the carburetor. The logical answer was to use one of the Carter Model YH single-throat side-draft carburetors that are used on the turbo-charged Corvair engine. It bolts directly to the compressor inlet flange. Hugh bored out the Carter YH venturi to 1.5 in. to nearly match the 1.56-in. venturi on the stock single-throat Rochester.

This tighter venturi area has another advantage on an engine of this kind, MacInnes says. At high engine rpm and full throttle, the air flow through the venturi increases to near the critical sonic velocity point. At this point it won't pull any more air through the throat and the fuel/air mixture tends to enrich if the engine turns any tighter. This richer mixture then becomes a safety factor, as the evaporation of the extra fuel cools pistons and valves.

Spark advance was a bit of a problem. The compressor boost comes on strong at 2500 rpm and the high spark advance in the mid range with the extra pressure tends to cause detonation. At first MacInnes swapped spark advance parts from a Corvair turbo distributor, which has an initial advance of 24° BTC, with additional advance coming in above 3800 rpm. But this much initial advance resulted in hard starting, particularly when the engine was hot. So MacInnes backed off the initial lead to 20°, then used lighter centrifugal weight springs to start the additional advance at 2000 rpm instead of 3800.

Turbine shaft lubrication was provided by tapping from the engine oil gallery at the point where the low-pressure switch is connected. The oil return drain pipe was tapped into the side of the oil pan. The turbine exhaust outlet duct was fabricated from 2.5-in. dia. pipe and extends under the car where it divides into a standard dual system. The positive crankcase ventilation valve system was removed. The air cleaner was mounted remotely and was connected through flexible tubing.

MacInnes now has a peppy Chevelle Six wagon that has lost none of its smoothness and flexibility for everyday driving. The turbo requires no maintenance or special tuning, uses no extra gas. Acceleration? Hugh says his tests with an accelerometer suggest at least a 30–40% increase in power and acceleration. The car performs about like a fairly strong 283 V-8, but with better than 20 mpg on the highway.

—Roger Huntington