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TWIN TURBO CAMARO TEST!

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TURBOTERRORS!

CAMARO Z28
Owner John Criss pulled out all the stops when preparing his '83 Z28. Gale Banks' twin-turbocharger system on the 350-cubic-inch V8 produces an honest 500 horsepower! With only seven to eight pounds of boost dialed in, there is an abundance of smooth, instant power.

MAZDA RX-7
Mark Yeager's turbocharged Mazda shows a lot of IMSA influence. The Cartech turbo system works beautifully and is enhanced by the well-tuned suspension tucked underneath to handle the power. Quickor spring and sway bar set, Bilsteins and Comp T/A's on BBS wheels are the featured performers.

PORSCHE
Don Walker is an absolute horsepower nut. His latest Porsche rocketship is this Kevelar-glassed, Stage 1 (410 hp) turbo Kremmer GR5-SR. Don initiates unsuspecting first-timers by demonstrating how quickly he can make a Texas road disappear.

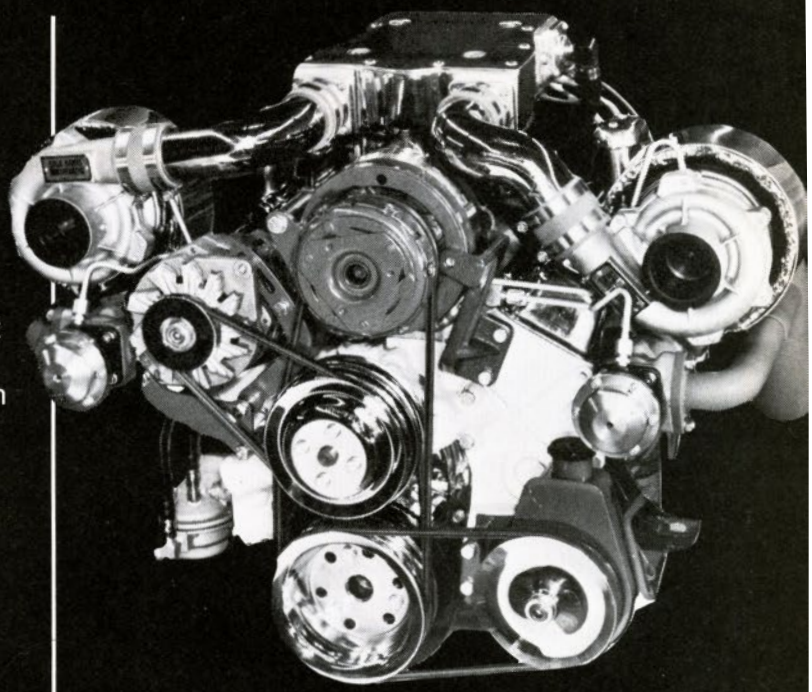
You Can Huff And Puff And Blow Your Competition Away!

The search for improved automobile engine power has been going on as long as enthusiasts have been tinkering with cars. There are a number of ways to increase an engine's power output, but regardless of the method used, the end result must always be the same: to release more work-producing heat in the combustion chambers. The basic approaches to that end are to burn more fuel in the combustion chambers and/or to use a different fuel that produces more heat. Since most vehicles still use gasoline as a primary fuel, most engine development is devoted to the improved combustion of that fuel.

Of all the performance modifications developed in the last century, only one—turbocharging—can be said to have significantly improved the thermal efficiency of the internal combustion engine while simultaneously producing more heat in the combustion chambers.

Turbocharging is one of the simplest but most misunderstood subjects in the auto performance world. There are dozens of exaggerated stories about engine damage and lack of throttle response, told by self-appointed experts who have never even ridden in a high-performance turbocharged car, let alone worked on or owned one. Critics also tend to lump all turbocharged cars together. Although offering considerable performance improvements over similar non-turbocharged vehicles, most past production turbo powerplants have been extremely conservative packages combining emissions, mileage, smoothness and durability. They bear little resemblance to the latest generation of turbo packages or most aftermarket turbo kits. The days of turbo-stones are behind us.

For the Eighties, turbocharging is the real future of performance on the racetrack and on the street. It offers more horsepower per dollar than extensive internal engine modifications or component substitution. It is essentially a bolt-on installation and it imposes no loss of driveability or gas mileage, as would generally be associated with non-turbocharged engines modified to produce equivalent power. Turbocharging is also relatively easy on engine parts, producing power without demanding extremely high engine speeds. Because turbocharger operation is directly related to the heat energy generated by the exhaust, the turbo is simply along for the ride at idle or under light loads, without altering normal engine



operation in any way (except possibly to improve fuel atomization as the mixture passes through the coasting compressor blades). As engine load increases, exhaust heat increases and so does compressor output, raising boost pressure. In other words, a turbocharger only works when you need it—automatically. Properly matched to the engine, a turbocharger is more efficient than a supercharger, and since it draws no power from the crankshaft, the potential power increases are limited only by the turbo match and the detonation properties of the fuel. For street use, power gains of 50 to 100 percent are common, but highly refined systems with intercooling and water injection can more than triple power output.

In the following special section, we'll take a closer look at turbocharging for high-performance sports cars. We'll begin by looking at some very successful aftermarket applications: a Gale Banks Engineering twin-turbocharged Camaro Z28, a Mazda RX-7, Porsche Kremer GR5-SR, Ferrari 512 Boxer and even a blown DeLorean. The owners of all of these cars didn't just stop with the turbo installations. Everything else about them is super trick. Following that, Len Frank takes a look at the basics of why turbocharging works so well on the internal combustion engine.

But this is only the beginning. Next issue, in part two of "Turbo Terrors," we'll look at more installations, give you some tips and sources for retrofitting your own turbo kit, and we'll round up the latest news on all the 1984 factory turbo offerings. Enjoy.

—C.J. Baker and Craig Caldwell

PHOTOGRAPHY: BOB MCCLURG AND PAUL MARTINEZ

TURBOTERRORS!
AN AMERICAN EXOTIC

Track-Testing Gale Banks Engineering's Twin-Turbo Z28

By Peter W. Frey

With a slight depression of the right foot, the engine howls up to 6000 rpm. Sidestep the clutch and smoke and tortured screams whirl from the rear wheels. Hot rubber and asphalt finally get a grip on each other and the sleek white missile launches itself so hard that the cigarette lighter pops out of the dashboard like a miniature Polaris and slams into the rear seat.

Sometimes an incident like this can bring a larger story into focus. The place is the eighth-mile dragstrip at Carroll Shelby's R&D skunkworks in Santa Fe Springs, California. The sleek white missile is a highly modified 1982 Camaro Z28 belonging to a trusting, steel-nerved real estate wheeler-dealer named John Criss. The driver is turbocharger czar Gale Banks, a name often found on the pages of HOT ROD and *Car Craft* (or various powerboat magazines since marine tubocharging was where he built the first level of his enviable reputation and business). The power is supplied by a twin-turbocharged 350-cubic-inch V8 that places 500 horsepower at the beck and call of the fortunate thrill seeker strapped into the driver's seat.

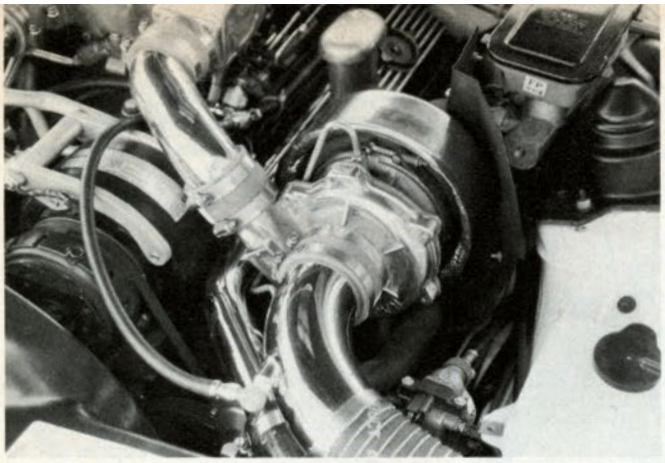
"I owned a Ferrari, a Lotus and a pair of Porsche 930 Turbos on the way to this car," says Criss, "and they worked their way through a larger hunk of my wallet than I could tolerate. I bought this Z28 because I liked the looks and was enchanted by the idea of a car I could drive for more than a month without once having it in the shop. But the engine didn't have enough power to satisfy my macho appetite, so I called Gale Banks about a turbocharger system. One thing led to another, with the overall performance of the car improving in quantum leaps, until I now have a totally reliable supercar that's so tractable my mother could drive it, yet is faster than a Porsche Turbo and handles better than a Ferrari."

Criss's once-docile domestic has evolved from one man's search for a reliable high-performance car into the prototype of a vehicle that Gale Banks Engineering is seriously considering producing as a series, in whatever volume the market will absorb. "I don't honestly expect to sell a lot of them," says Banks, "but there are certainly other men like John Criss out there, men who have evolved beyond the status/ego gratification aspects of a car, and would be interested in a machine that out-performs the most expensive, exotic cars in the world, but without the associated reliability and maintenance problems."

There are few visible clues to suggest the capabilities of this particular machine. It hunkers down closer to the road than an ordinary Z28, and certainly the steamroller-sized P225/50-VR16 Goodyear Eagle radials (normally found on 1984 Corvettes) mounted on 16 x 9-inch Center Line 928 Style X wheels (prototype units milled out of solid aluminum) are an indicator that there is something special about this vanilla Z28. But it's not until you notice the small black decals on the front quarter panels, the decals that read "Banks Twin Turbo," that you begin to suspect just how capable this machine might be.

Under the hood is a Gale Banks 350-cubic-inch Chevrolet V8 fitted with a Banks twin-turbocharger system that, with a pair of Rotomaster turbos pumping seven-eight pounds of boost through the Holley four-barrel carburetor, produces 500 horsepower. In keep-

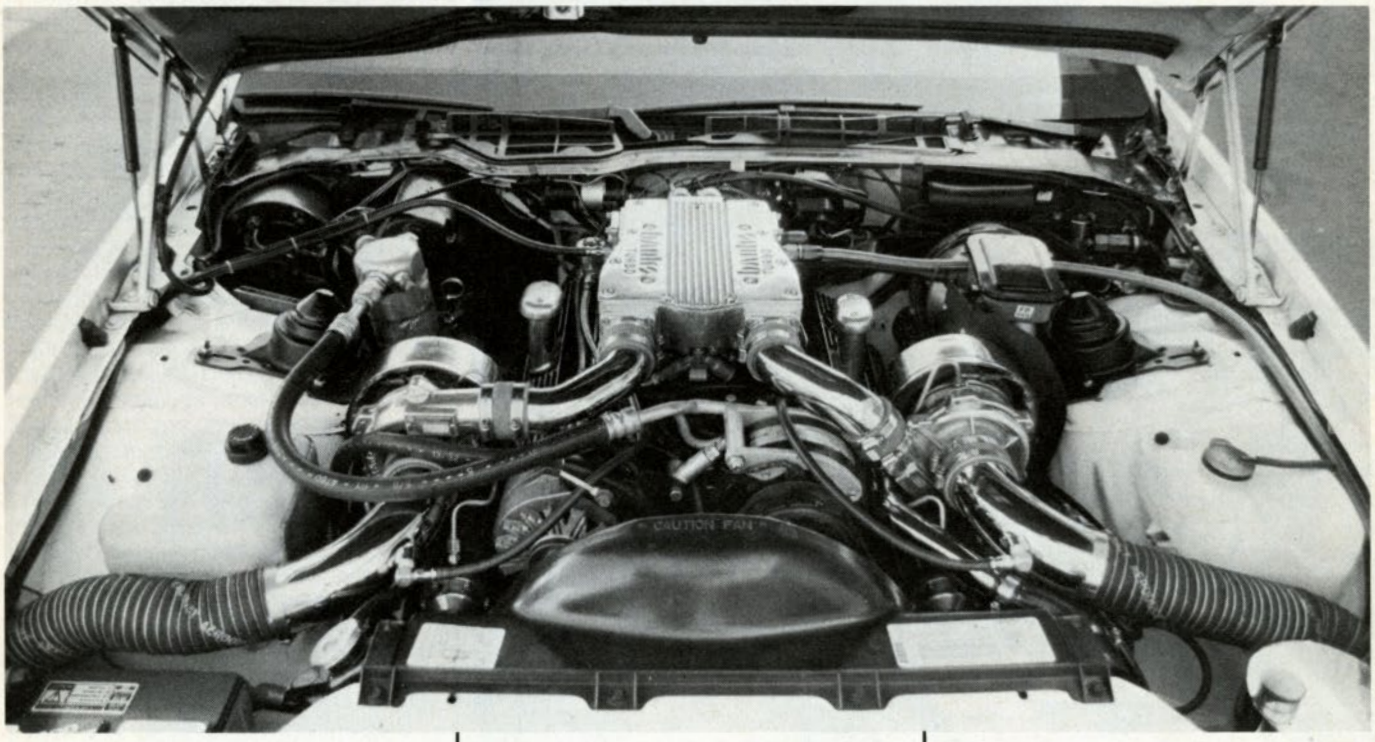
PHOTOGRAPHY: PAUL MARTINEZ



Left—A closer look at one of Banks' turbocharger installations. Note the heat shield for the brake fluid reservoir and the specially fabricated bracket for the air conditioning compressor.

Far Left—We did some fiddling with tire pressures and suspension adjustments to fine-tune for the skidpad session at Shelby's, but when we got everything hooked up, the car cornered as if it were running on rails.

Below—Banks' work is always a delight to both the seat of the pants and the eye. A self-designed and repeatedly demonstrated aspect of his engineering ethic is to make it look as good as it works.



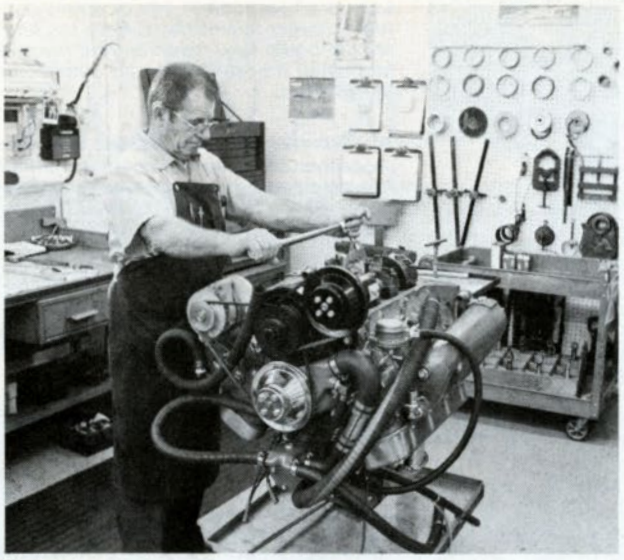
ing with Banks' reputation for aesthetics and attention to detail, all the underhood hardware is either chromed or polished, and neatly packaged to fit under the stock hood making maintenance relatively easy, and allowing room for such amenities as power steering, cruise control and a/c.

The engine is based on a Chevrolet four-bolt main, heavy-duty 350-cubic-inch marine block, and has a forged steel crankshaft, forged aluminum pistons (a Banks exclusive design with his "reverse deflector" dome design to suppress detonation, longer skirts to prevent piston rock in the cylinder bores, and stronger wrist-pin bosses), LT-1 connecting rods, hydraulic Turbo-Torque camshaft, high-velocity cylinder heads, six-quart oil pan with windage tray and baffles, modified oil pump, special intake manifold, special valve springs and retainers, Corvette aluminum valve covers, an eight-inch high-performance harmonic balancer, and a high-energy electronic ignition system. Many of the parts, such as the pistons, camshafts, variable duration lifters and oil pan are designed and manufactured by Gale Banks Engineering, which, as Banks puts it, "eliminates a lot of the quality control problems that plague the high-performance business."

Also fitted is a four-barrel carburetor manufactured by Holley to Banks' specifications, and equipped with a Banks-installed, boost-activated four-point fuel injection system mounted in the carburetor body. This auxiliary fuel delivery system allows tractable carburetor calibration for normal around-town driving as well as providing sufficient fuel for high-boost situations. Another important part of the turbo system is a specially designed valve in the air plenum on top of the engine that helps eliminate turbo lag by opening a dump port whenever the throttle is closed (such as in up or down shifts) while the engine is under boost. This allows the turbochargers to continue pumping and as soon as the throttle is reopened, the valve closes and the boost pressure returns almost immediately since the turbochargers are still spinning at full speed.

This system also includes an optional boost control knob located in the engine compartment (just above the battery) that allows the boost to be dialed up in excess of 15 pounds (900 hp). However, as Banks says, "You'd have to use the highest octane gas available, and plan on not having the engine live too long. We don't normally put this control on customer's cars, but since we know that John Criss isn't a horsepower-crazed madman, we went ahead." Also part of the system is an automatic, dual-feed water injection system and a closed-loop detonation suppressing system that allows the engine to run safely on 91 octane pump gasoline, which is eight-10 octane points lower than it would otherwise require.

Increasing the engine's power output to this level required a number of modifications to the various sub-systems if reliability in daily operation was to be maintained. This included such items as special high-volume ram air filters, a high-flow fuel system with twin tank pickups and a pair of booster pumps, a dual-disc clutch with the appropriate flywheel, a high-flow, low-restriction exhaust system and muffler, heavy-duty torque-limiter motor and transmission mounts, heavy-duty cooling system and high-volume water pump, heavy-duty driveshaft and rearend, and special



Right—All Banks' engines are assembled in a 'clean room' and are dyno-tuned and run-in before delivery to a customer. Many of Banks' own specially designed parts are used to ensure maximum reliability.

Below—Gale Banks himself, occupying center stage, surrounded by the various projects he currently has under way. The motor at his immediate right is a mockup of the one intended for the 300mph Trans Am Bonneville car.

suspension components. As Criss says, "It looks like a Chevy on the outside, but there is no area of the car's functional hardware that hasn't been modified, massaged, or replaced."

We rolled up to Banks' rambling, 20,000-square-foot facility (Dept. SCG, 843 Commercial Ave., San Gabriel, CA 91766, telephone: 213/285-3107) just in time to see Banks, Criss and the Z28 go roaring down the road in the opposite direction. They were testing the close-ratio Doug Nash five-speed transmission that the crew had just finished installing in place of the durable but excessively wide-ratio T-10 four-speed. When they returned, Banks explained that the Nash five-speed was much better suited to the twin-turbo motor.

After shooting the in-shop photos, we fired up the Camaro and set off for Shelby's place, about 20 minutes away over a route that included a section of freeway driving that proved both entertaining and illuminating.

The curving, decreasing radius on-ramp, taken in third gear at about 4500 rpm, gave us our first in-motion example of just how good this car really was; no body roll, handling neutral up to the point of power-induced oversteer, the engine flexible and willing. The velocities and lateral g loadings involved would have laid any Ferrari this side of an F1 off into the weeds.

Out on the freeway itself, a hard burst of throttle shoved us back into the seats and sent the tachometer needle diving for the redline. Even when we hit denser traffic, sliding in and out of momentary openings in the flow demonstrated just how docile yet available the rated 500 horsepower is; no hesitation, just an instantaneous, smooth, seemingly endless rush of power.

On Shelby's 200-foot diameter skidpad we unlimbered the stopwatches, searching for the .98 lateral g figure Banks recorded in testing a Trans Am equipped with similar tires and suspension components. The first couple of circuits showed an understeer condition. After a few adjustments of the Guldstrand suspension, which was set up for slalom rather than skidpad testing, a .975 lateral g figure was attained.

Moving from the skidpad to the dragstrip, we generated the anecdote with which this story began. In independent instrumented testing, Banks has recorded 0-60mph times of 4.2 seconds and quarter-mile numbers of 11.68 seconds at 123.72 mph. He also conservatively figures the top speed (calculated with the aid of numbers from the General Motors wind tunnel) at 202 mph. Performance figures with the 600hp version of the twin-turbo engine (in another car with different tires) are documented at 0-60 mph in 3.8 seconds, quarter-mile time of 10.87 seconds at 132.63 mph, and a calculated top speed of 216 mph. Banks also produces a 700hp twin-turbo V8, which has never been involved in instrumented testing, but has a calculated top speed of 228 mph. These engines, by the way, as well as the turbocharger kits, are available separately for those of you so inclined. Engine prices begin at around $8000.

Standing on the sidelines with John Criss while Banks was out making passes in the car, we learned that the fuel economy is about 12 mpg around town ("And I like to get *on* it . . . frequently!"), and about 17 mpg on the highway. The one-gallon stainless water injection system tank has to be filled at about every third visit to the gas station, but in the nine months the car has been on the streets, the only time it has spent in the shop is when Banks wanted to install some new piece of trick hardware.

Criss' overall feelings about the car? "It would cost in excess of $30,000 to duplicate, which makes it one hell of an expensive Camaro, but considering the level of performance it offers, and the fact that it costs maybe 25 percent as much to insure and operate as an exotic, I think that's a bargain."

One final note: Back at the shop, Banks mentioned a couple of projects he has in the works, including a 1500hp, 300mph Pontiac Trans Am Bonneville car sponsored by Budweiser and a streetable, 1200hp, 250mph version of the Bonneville car being built for a construction tycoon in South Africa. And he's been working with Chevrolet on a twin-turbo version of the 1984 Corvette. We can't wait to try that one. ■