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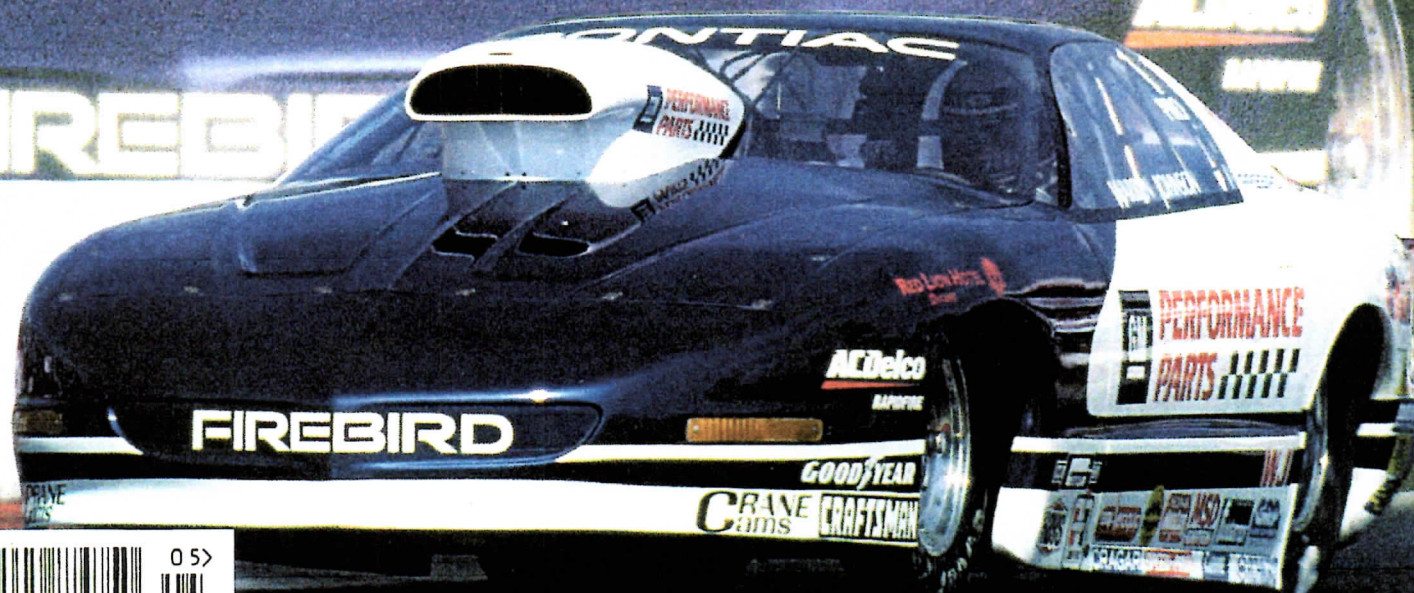
**1996
NHRA
FIREBIRD
DRAG
RACING
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1964 421 Grand Prix

740-hp Pontiac V8

Street Supercharging

1997 Grand Prix Design



**Warren Johnson's 6-second GM
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Centrifugal Force

B&B Racing's Supercharger: Bolt-on Streetable Power for the Pontiac V8

By Don Keefe

Many of you are already aware that the centrifugal supercharger has made a very strong comeback in the last few years, particularly with owners of late-model performance cars. It has proven itself to be a remarkably efficient means of increasing power—simpler than turbocharging, more efficient than positive-displacement supercharging, and easier to package than both.

While Roots blowers have been the traditional favorite of hot rodders and drag racers since the 1940s, and are OEM equipment on cars like the Bonneville SSEi, there are several drawbacks that make them less than ideal as an aftermarket bolt-on. The most notable problems include heat build-up, efficiency, and packaging.

While Roots blowers can indeed make dramatic power increases, the spinning rotors impart a great deal of energy to the air, which requires more power to drive it and also produces a great deal of heat. While heat is generated anytime air is compressed, a Roots blower's relative inefficiency worsens the situation, which reduces air density. This translates into less power and less resistance to detonation, which limits the amount of boost that can be used. Since with carburetion the air compression actually takes place in the intake manifold, and the fuel is mixed upstream of the blower, it becomes very difficult and impractical to intercool a carbureted Roots application.

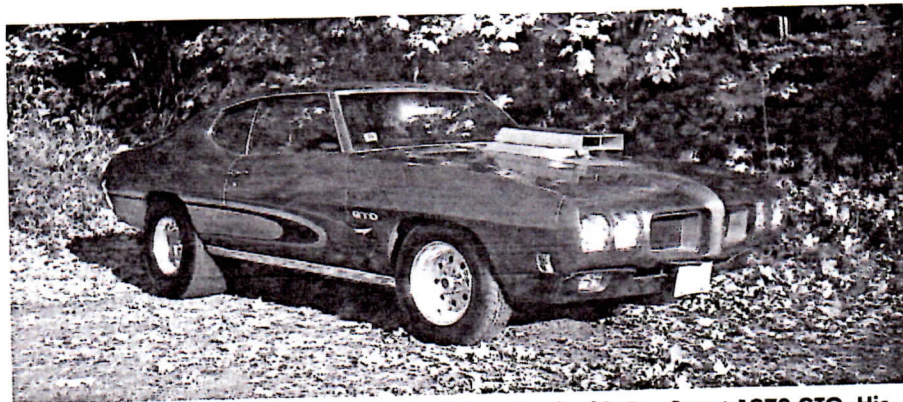
Centrifugal superchargers make boost in a very different manner than a Roots blower does. The low-pressure condition created by the spinning impeller blades draws air into the supercharger, where it is accelerated radially along the blower's blades by centrifugal force.

From there, the air is flung through a diffuser. Pressure is generated by the action of the diffuser, which slows down the velocity of the air to a usable level. Once past the diffuser, the reduced-velocity air enters the outer section of the housing, known as the collector or "volute."

When the slower air already in the volute has higher-velocity air from the other side of the diffuser coming from behind it, the air begins to pile up into the induction system, and pressure is developed by the inertia of the air molecules.

The advantages to this method of pressurizing air make it a more viable candidate for a street/strip application. Since the impeller only accelerates the air and doesn't actually compress it, very little energy is actually imparted to it. Therefore, less heat is generated in the compression process, and less crankshaft power is required to turn the supercharger itself. The actual compression energy comes from the air's own inertia, so it is efficient and free of the beating and turbulence that take place in a Roots blower. And because the supercharger is upstream of the induction system, it compresses only dry air, making it relatively easy to add an intercooler if this is deemed necessary.

The only real advantage that a Roots blower has over a centrifugal (and it may not always be an advantage) is that it makes a consistent amount of boost throughout the entire rpm range. Since they are positive-displacement superchargers, Roots units move the same amount of air per revolution, minus any rotor leakage. That means that if one is geared to put out 10 lbs of



Photography by Frank Pogoda and Carmen Bruno

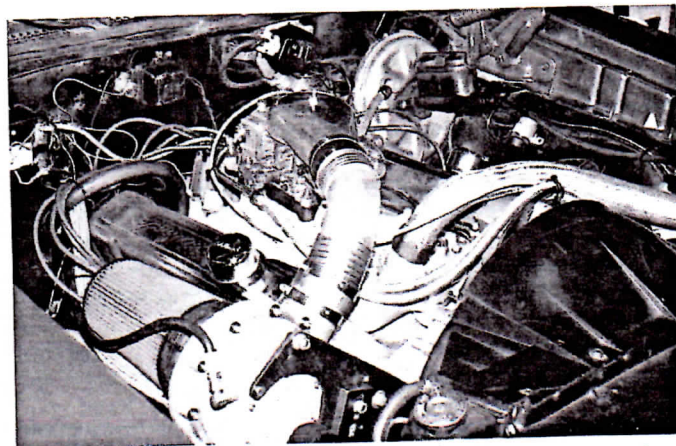
Carmen Bruno wanted a mild but powerful engine for his Pro Street 1970 GTO. His choice to add a centrifugal supercharger eliminated the need for wild camming, heavy porting, and multiple carbs—which make power but compromise streetability.

boost, it will put out 10 lbs of boost throughout the rpm range, although air density at a given pressure will diminish somewhat at higher speeds. This will cause a substantial increase in low-speed torque. While this may seem great at first, having such tremendous power down low can make it quite difficult to control a car on the street. If you are already having traction problems with your normally aspirated Pontiac, you're really going to have your hands full after you bolt on a Roots blower.

The centrifugal blower is much more speed-sensitive than a Roots is, needing high impeller speeds to effectively make boost pressure. The boost pressure increases approximately as the square of blower speed. What this means is that if you double the speed of the blower, the boost pressure will quadruple. If blower speed is tripled, then boost pressure will increase nine times, and so on.

Because a centrifugal's boost comes on more gradually than a Roots blower's, the chassis will get a chance to put the power down to the ground—a definite benefit if you do not plan to tub your car. If your engine and blower combination is designed to withstand 10 lbs of boost at 6,000 rpm, it will only be putting out about 2.5 lbs at 3,000 rpm. This will make the engine easier to control on the street, yet power will still come on very strongly when you want it to. Furthermore, it won't be a major parasite when it's not making boost and will not significantly impact gas mileage until you're actually making boost.

Keep in mind however, that the rapid increase in boost over a



The ATI blower in Bruno's GTO pumps 15 lbs of boost into the 455, which makes 600+ hp yet is docile enough for street use.

relatively narrow rpm band can quickly get the better of a driver or chassis unprepared to handle the quickly escalating surge of power. Supercharging, like anything else that substantially increases performance, requires accompanying chassis, driveline, and safety equipment upgrades to enable a vehicle to effectively use the newfound power. Simply bolting a 500+ hp engine into an otherwise stock car is asking for trouble.

While several supercharger manufacturers have come to market with kits for electronically fuel-injected engines, little attention has been devoted to carbureted applications, and no one has paid any attention at all to the traditional Pontiac V8—until now.

About two years ago, Accessible Technologies Inc. began marketing a rapidly expanding line of supercharger kits for a variety of fuel-injected and carbureted applications. All use the ATI P600 supercharger, an entirely new centrifugal design that incorporates a gear-drive mechanism and is designed to achieve boost pressures from 3 to 15 psi in a blow-through street/strip installation. The unit can generate well over 25 psi if necessary, and a special high-output version called the P1200 is capable, according to the manufacturer, of supplying enough air to generate 1,200 hp in a race-only application.

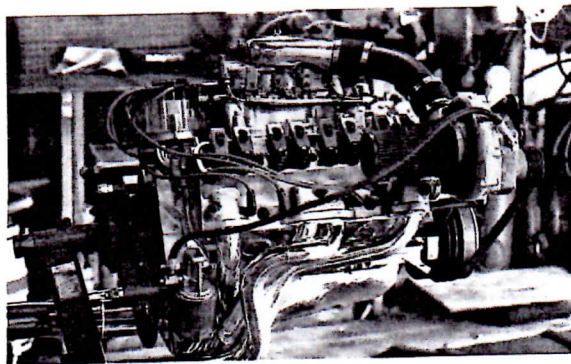
The P600 unit weighs in at just 14 lbs and uses a 6.5-inch heat-treated cast aluminum impeller with a radial design. The cast impeller is rated for a maximum of 45,000 rpm, and an optional billet impeller ups the redline to 60,000 rpm. This upgrade would be beneficial in a high-boost application, but would probably not be necessary in a normal street/strip installation. For example, factory-supplied specifications indicate that an impeller speed of 36,500 rpm, 9,500 rpm less than redline, will provide up to 13 lbs of boost in a 5-liter engine, 12 psi in a 5.7 liter engine, and 10 psi in a 7.5-liter engine.

The B&B/ATI Kit

B&B Racing of Kenil, N.J., has just put the finishing touches on an installation kit that mounts an ATI blower on the traditional Pontiac V8, and as we shall see, it is a combination that shows loads of promise.

Carmen Bruno of B&B Racing is a Pontiac man through and through who has been interested in centrifugal blowers for a number of years. When the ATI blower was introduced, Bruno saw an opportunity to take the power levels of a streetable Pontiac engine far beyond normal expectations.

The B&B system is designed specifically for Pontiacs and is not a cobbled-up Chevy kit. It consists of a CAD (Computer Aided Design) two-piece bracket set, an 8-



This blown and Edelbrock-headed 455 will soon reside in John Cammarata's 1979 Trans Am. The ATI Procharger is designed to fit neatly under nearly any hood. This motor rocked the dyno to the tune of 612 hp and 650 lb-ft of torque—and that's just a start!

rib crank pulley and spacer, an 8-rib driven pulley, an idler pulley assembly, a carburetor pressure bonnet and attachments, oil lines, and an 8-rib drive belt. Optional equipment includes a billet impeller, a special fuel pressure regulator for the pressurized carburetor, and non-collapsible carb floats for Holley applications.

The kit mounts the supercharger in the normal air conditioner compressor location and allows the home builder to supercharge his or her Pontiac with normal hand tools and a minimum of hassles.

In order to give the reader an idea of what results can be obtained from an ATI supercharged Pontiac V8, we will outline not one but two such engines here. The first is a mild 455, which is installed in Bruno's own Pro Street 1970 GTO, as well as an Edelbrock-headed 455 for John Cammarata's 1979 Trans Am.

The 455 in Carmen's GTO illustrates just what kind of power can be extracted from a relatively stock engine when a centrifugal supercharger is added. While some improvements have necessarily been made in the interest of bottom-end strength, not much else has been done aside from the supercharger.

A 4-bolt 455 block was bored .030-inch over and fitted with TRW forged pistons with pressed pins. They are mated to a set of heat-treated 1958-62 forged rods and a stock crank. A set of 1972 7M5 D-port heads were pocket-ported but otherwise left stock.

Valve actuation is provided by a Competition Cams single-profile solid-lifter camshaft with 244° of duration (measured at .050-inch lift) and .366-inch tappet lift. It operates 1.5:1 rockers on the intake side and 1.6:1 on the exhaust side. This provides lift of .550 inch for the intake valve and .586 inch for the exhaust.

The ATI supercharger blows 15 lbs of boost into

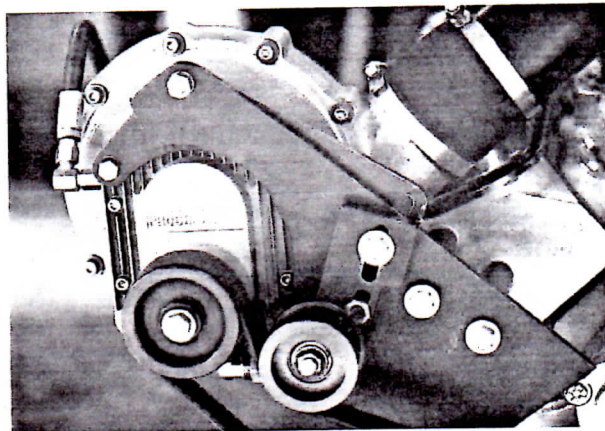
an 850 Holley carb mounted on a Holley Street Dominator intake. The Street Dominator is a good choice for a supercharged application, as its single-plane design allows for even fuel distribution under boost, yet the passages are not so large that they impair mixture velocities under normal operation. The engine's exhaust chores are handled by a set of ceramic-coated Hooker Competition 1 7/8-inch primary headers and a big-tube dual exhaust system.

This engine has not been dynoed, but Carmen's considerable testing with an on-board accelerometer has found that the car is putting about 560 hp to the ground—the rest goes up in smoke, even with sticky 14x32-inch Mickey Thompson street-and-strip tires. It is safe to assume that this 455 is putting out in the neighborhood of 600-625 hp, and in a reasonably streetable state of tune. Bruno plans additional testing and refinement to bring that power level up even more without sacrificing streetability.

John Cammarata, of West Orange, N.J., also wanted a high-horsepower Pontiac engine for his 1979 Trans Am, and he too went the ATI centrifugal route. His 455 has been treated to more modifications than Carmen's has, but it is also a fairly streetable engine. The beauty of John's combination is that he has a very strong foundation and can easily dial in more performance later on if he desires.

Since Carmen is an authorized Jim Butler Performance distributor, recommending an engine builder for John was a snap. Butler Performance built a killer 455 that is more than able to withstand the high boost pressures and power output that John wanted.

The 455 4-bolt block was treated to a .030-inch overbore and was fitted with steel mains, secured with studs. JBP/Ross pistons with Total Seal rings are mated to JBP/Eagle steel connecting rods, which



Compared to a Roots 6-71, the ATI Procharger is very compact and, best of all, requires no hood cutting. Note the beefy B&B Racing mounting brackets and the very sanitary installation.

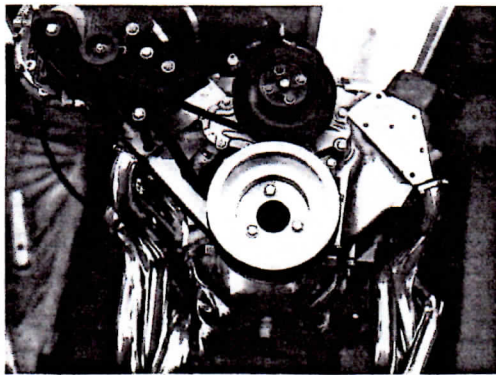
swing on a chromed crankshaft with a 4.25-inch stroke. Total displacement checks out at 467 cubic inches, and compression is a scant 8:1.

Cammarata knew that more power per pound of boost could be had with better breathing. Supercharged engines like better airflow, just like a normally aspirated one. When a port reaches the limit of its flow capacity in a supercharged engine, a higher boost value will exist in the intake manifold than is actually reaching the cylinder, and adding more boost will not make more power. In fact, it will probably make less power, because greater pressure means more heat and less air density.

For this reason, John decided that 87cc Edelbrock heads would be an excellent choice, especially because he wanted to keep the cam fairly mild for street use and needed to make the best use of low-lift flow. Butler kept the heads fairly stock, save for enlarging the exhaust valves to 1.77 inch and adding Ferrea steel valves.

The valves themselves are actuated by an Ultradyne hydraulic dual-pattern grind with 288/296° of advertised duration and .323/.338-inch tappet lift. It is combined with 1.5:1 rocker arms on the intake side and 1.6:1 on the exhaust, providing .485/.540-inch lift.

The ATI P600 blower puffs into a 750 Holley carb mounted on an Edelbrock Performer intake, while exhaust chores are handled by a set of Hooker Competi-



This low-angle shot shows the B&B Racing pulley/adaptor that bolts to a stock after-market harmonic balancer and properly aligns the drive belt to the driven pulley.

tion headers. All in all, the engine is fairly mild, but it packs a very powerful punch.

The engine was dyno tested with and without the supercharger, and in both cases, it did its owner proud. In naturally aspirated form the engine put out 454 hp at 5,500 rpm, with 550 lb-ft of torque at 3,000. This is even more impressive when you consider the low 8:1 compression and the mild cam.

Things got more interesting when the supercharger was bolted to the engine, even though the engine was not properly dialed in for optimal numbers, and the editorial deadline for this issue closed before a second day of dyno testing could be performed. The main problem was a too-small carburetor that was jetted way too rich. Still, at 10 lbs of boost it recorded a best of 612 hp at 5,250 rpm, with 652

lb-ft of torque at 4,000. This kind of power should get the 3,900-pound Trans Am well into the 10s, or a 5,000-pound Grand Safari station wagon deep into the 12s, if that's your bag.

While this engine still needs a little bit of sorting out, it is, like Carmen's semi-stock 455, putting out some very impressive numbers. John's future plans include more tuning, an Edelbrock Victor intake, a larger Holley, and an additional 5 lbs of boost, plus perhaps an intercooler to allow even more boost. We will keep you posted on further developments and quarter-mile times for both cars in the future.

It appears as though the marriage of the centrifugal supercharger and the tried-and-true Pontiac V8 can indeed be a happy one. It appears that new levels of performance are now attainable for street and racing applications with a minimum of hassles. The story of the Pontiac V8 is far from over!

Sources:

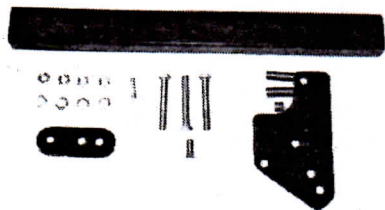
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