SUPERCHARGERS FOR IHRA RACING

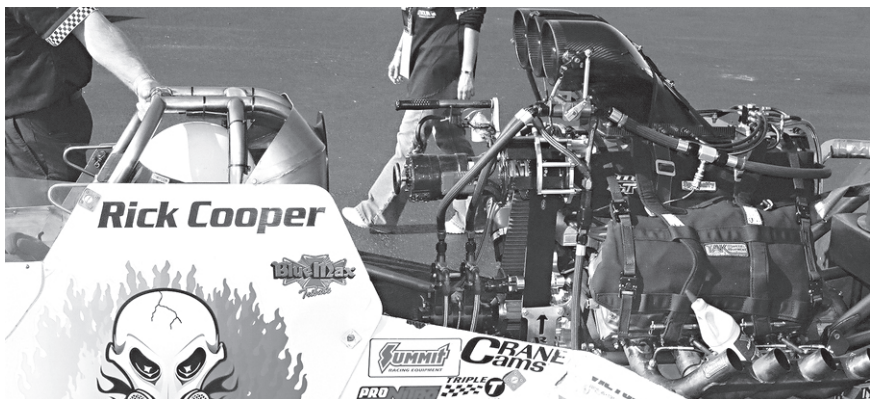
by Robert Szabo

Superchargers are the method of power enhancement for Top Fuel, many in Pro Mod, Top Alcohol and many racecars in Top Sportsman, Top Dragster, and various other bracket classes. Several of the bracket cars run the quarter mile ET in the six's with ease from the use of a supercharger. The GMC Roots blower forms the design basis for most of the superchargers used throughout IHRA racing.

Originally used for diesel truck engines, the Roots blower came in various sizes. The most common was the 6-71. It was on a six-cylinder diesel with 71 ci per cylinder. Early versions were for two cycle diesels. The blower operated at atmospheric pressure. That is, the air inlet took in air from the atmosphere and passed it into the intake of the diesel engine. Operating speeds were a couple thousand RPM.

In the early 50's, multiple carburetors were dominant in higher horsepower drag race classes. Racers were starting to use the Chrysler Hemi V-8 as well as the GM and Ford V-8's. Power levels were in the 400 to 500 horsepower level. In the mid 50"s, mechanical fuel injection was developed to provide further power increase. Power increased a bit from fuel injection on gasoline. However, racers were also gaining experience with methanol and potent nitromethane. Power levels on injected nitro approached 700.

Then in the late 50's, the GMC blower was put on top of the V-8. Blower speeds varied from underdrive (blower speed less than engine speed) to a bit over 20% overdrive (over engine speed). Whether the blower was added to a gasoline, methanol, or nitromethane engine, a lot more power was made. Nitro engine power was approaching 1,000.



Rick Cooper Top Fuel dragster showing blower running about 50% overdrive, on top of 7,000+ HP engine

One way of looking at where all of that power came from is to look at the displacement of the blower. The 6-71 displaces a little over 400 ci per revolution (6 x 71 ci). At a one to one speed on a 392 Chrysler Hemi or 394 Olds V-8, that setup made about 2 atmospheres of boost. Those engines pump half of their displacement every revolution. They are four cycle engines. The 6-71 displaces the entire 400+ ci every revolution. A 6-71 on a 400 ci V-8 was effectively equivalent to an 800 ci engine without a blower.

What was further not realized was the blower pumped that amount of air every revolution at both low and high speeds. The engine torque curves were flat. Roots blown engines made tons of torque literally from idle on up.

That same overall design is used in superchargers of today. Two meshing rotors are inside the blower housing. They mesh when they turn. As they turn, they unmesh on the top of the supercharger. A cavity is formed and atmospheric pressure fills that cavity with air. Rotors have several lobes for several cavities of air. Traditional fuel systems introduce fuel into that opening also. In IHRA's Top Fuel, some of the racecars of Pro Modified and Top Alcohol Funny Car, the fuel system is mechanical fuel injection. In bracket classes, both fuel injection and carburetors are used.

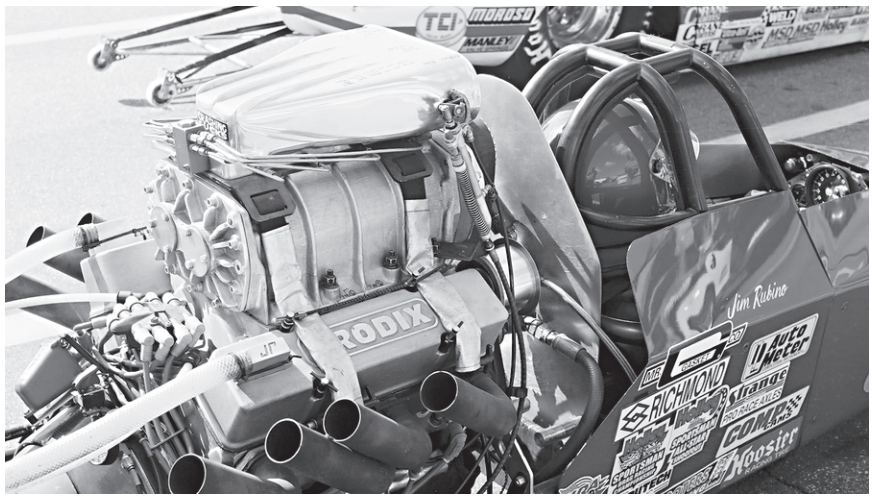
As the rotors are turned, they mesh on the bottom. The contents of the blower meet with the contents of the manifold. A tornado is literally made inside the manifold. The air in the blower is displaced into the manifold. Since each revolution of the blower usually displaces more air than the engine, the pressure in the manifold is raised. That boosted air then flows to the cylinders through ports and valves.

Modern Roots superchargers are often bigger than the original 6-71. Common sizes are 6-71, 8-71, 10-71, 12-71, and 14-71. The original 6 x 71 relation is not valid for the larger blowers. Each blower size increase is one inch longer than the original 15 inch long 6-71. Some Match Racecars use 16-71 blower sizes. The 14-71 is the choice in the Top classes that were previously referenced. It displaces over 500 ci per revolution. Manifold boost values can go over three atmospheres. Power levels can go over 2,500 in Pro Modified and Top Alcohol. In Top Fuel with nitro-methane, power levels are over 7,000 although not for very long.

Much of the blower design for more power is now in the inlet and the outlet. More common composite fuel injection hat assemblies are seen throughout the sport that direct the inlet air into the blower cavity on the top. Blower case and rotors are now stronger materials than the original 6-71. Rotor seals are now standard. They rub against the case and between the rotors for better sealing. Special blower end plates often have porting to assist in the air-flow through the blower. Rotor twist is a design standard even in the original 6-71. Now, some classes use the previous rotor twist angle. Some use a higher twist angle. Those are called high helix. A few of the street blower kits use no twist in the rotors.

One of the biggest design issues with blowers now is the bottom outlet opening. In Top Alcohol and Pro Mod, a small pie shaped opening is the standard. It is used to close off the output of the blower for much of the rotor rotation. The twist in the rotors results in rotor meshing in the rear of the blower first. Air is displaced from this meshing. Compression occurs in the remaining rotor cavity. When the rotors continue to turn, meshing continues and compression continues. The compressed contents are eventually exposed to the manifold through that small opening in the bottom front and released.

In Top Fuel, blower openings vary for different tuners. Some are big. Some are small. In this application, blower heating from that tornado effect is a tuning aid to many. Blower placement is moved rearward in some setups. This results in air output from the forward part of the blower and entry into the manifold in the center. Port fuel injectors are better balanced from one cylinder to the other with this change.



Jim Rubino's blown injected rear engine Top Dragster #124; note throttle mechanism used control starting line rmp; without this setup, the low speed torque of the Roots blown engine would spin the tire on the starting line.

Roots blowers are occasionally used on the street. Power is spectacular. Unfortunately, blower efficiency is not good in many high-powered street engines, especially with traditional blower designs with large bottom openings. Fuel mileage in a high output blown gas street machine can be in the 2 to 4 MPG range. A hand full of street machines use methanol with blowers. Fuel mileage is worse.

In both cases, though, anyone who has a ride in a Roots blown street machine has noticed the instantaneous power from low speed up. Several commented about "Black-tracking" (spinning the tires) in high gear. Note the large rear aerodynamics on IHRA Roots blown racecars to hold them down in high gear. Yet some still "black-track" all the way to the finish line from the power of that blower.•

Bob Szabo is a racecar book author and drag racecar driver / owner. His current book "Fuel Injection Racing Secrets" is all about mechanical fuel injection used throughout IHRA drag racing. Roots blowers discussed in this article are covered as well. Bob is currently working on a new publication about racing with METHANOL. While high fuel consumption is discussed in this current article, Bob's new book will reveal technology with alcohol fuels that can produce efficiencies comparable to diesel. And in some engine designs, power levels comparable to nitro. Bob is a lifetime student of technology who encourages all IHRA racers to study and develop new technologies as well. IHRA's racing environment is ideal for technological advancements that can provide both extraordinary fun as well as valuable contributions to society and spectacular racing entertainment. For book ordering information, check the DRM Yellow Pages for his Fuel Injection Racing Secrets listing under S's (for Szabo) or look on the Internet at http://www.racecarbook.com or call (707) 446 2917.