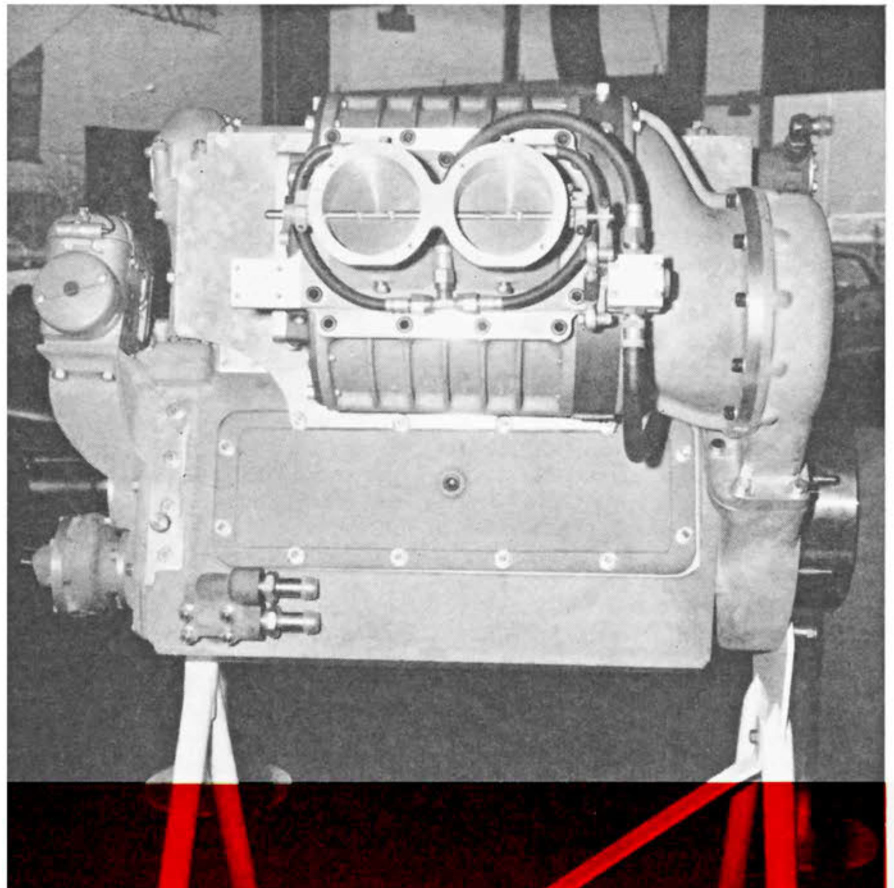
BY JIM WRIGHT

PHOTOS: JIM WRIGHT, CHAN BUSH

SUPER-OFFY



They'll Huff and They'll Puff to Blow Those Fords Down!

IN THE HECTIC aftermath of last year's Indianapolis 500 there were those who said the venerable old Offenhauser was all washed up as a competitive powerplant. At the time it appeared as if they just might be right.

The basic design of the engine had been on top for 35 years; either in its original Miller-built form or later as the Offenhauser, and still later as the Meyer-Drake. It had been beaten before; in 1939 and 1940 by Wilbur Shaw's Maserati and again in 1946 by the Sparks-Thorne 6-cyl. engine. (Interesting sidelight: The Maserati and the Sparks both were supercharged.) But last year it wasn't just beaten; it was completely overwhelmed. More than half the starting field was Ford-powered and seven of the first 10 finishers, including those in the 1-2-3 spots, had Ford engines.

It looked bleak; so bleak, in fact, that Louis Meyer dissolved his 19-year partnership with Dale Drake to move to Indianapolis where he set up shop as the sales and service man for the dohc Ford racing engine.

But in view of recent developments it would appear that early reports of the Offenhauser's death—like Mark Twain's—were "greatly exaggerated." There's a new version of the old girl in the works. She has a new, bulky look which comes from a big Roots-type supercharger hung on her side, and new power and torque curves to match. If she does succeed, she could usher in another new era in Indianapolis engines—or rather, revive an old one.

Viewing the 1966 race is almost a look at a page out of the past. It could very well be 1924 all over again. This was the year Duesenberg adapted the supercharger to its 122-cu. in. straight-Eight and caught everyone else napping. Three machines of Duesenberg's 4-car entry were so equipped and when Joe Boyer put the winning Duesenberg across the line in record time, with a minimum of trouble, it touched off a major revolution. The following year every car in the lineup was supercharged. The same was true for each following year until a 1930 rules change banned blowers on anything other than 2-cycle engines.

In 1937, the rules were changed again and superchargers were once more allowed, but the best they could do that year was Ted Horn's third place in a Miller Eight. The following year saw a rule change which limited supercharged engines to 183 cu. in. and unsupercharged engines to 274 cu. in. Again it was Ted Horn who made the best showing; fourth place.

Then, in 1939 and '40, Shaw came through in the Maserati. This marked the first time that anyone had had any luck with a Roots-type supercharger. In the past, very few had even tried this type of blower. Most favored the centrifugal unit with its higher boost pressures. Shaw almost repeated in 1941, but a crash on the 152nd lap put him out of contention. At the finish it was a non-supercharged car which crossed the line first.

After Robson's 1946 win in the centrifugally-blown Sparks-Thorne car, the use of superchargers quickly tapered off. Except for the Novis, which seem always to be in there trying, supercharged entries became fewer and fewer.

In 1950, Meyer-Drake Engineering tried to revive the design with the introduction of a new, 176-cu. in., centrifugally blown engine. But it never caught on. There now was added emphasis on pit stops and light cars, and it was no secret that the centrifugal blower's large appetite for fuel meant a blower-equipped car was running under the handicap of carrying more fuel to start and would be required to stop more often to replenish. Other than the Novis, there hasn't been a supercharged car in the show since 1959, when Len Sutton drove the Walcott Special. It finished 32nd.

Now, perhaps, the supercharger has come full circle. This newest blown Offenhauser, designed and built by Drake Engineering, appears to have eliminated most of the faults that plagued earlier attempts.

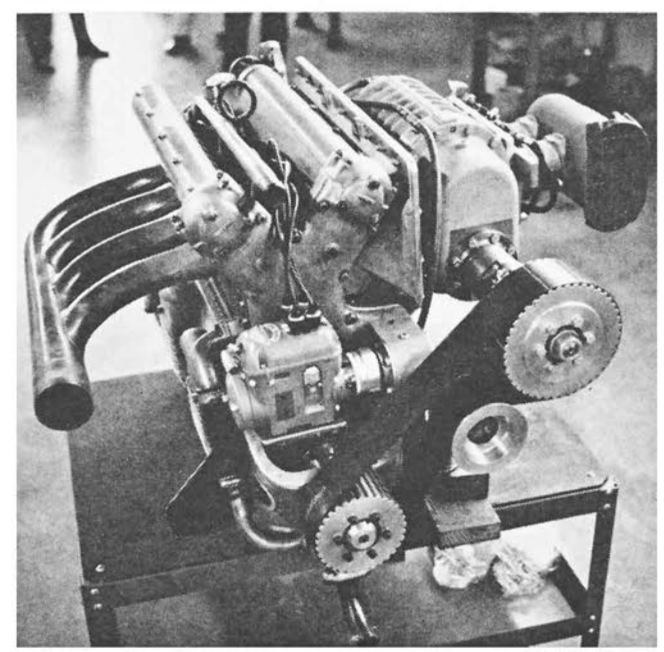
First, it will use a Roots-type positive displacement blower instead of the more familiar (to Indianapolis) centrifugal blower. While it is true that a centrifugal supercharger can produce 3-4 times as much boost pressure as a Roots, (and therefore more horsepower), the Roots offers enough advantages to overcome this.

BECAUSE THE output of a centrifugal blower increases as the square of impeller tip speed, it must be turned at 5.5-6 times engine crankshaft speed to be really effective. On a graph the boost curve goes up like a stepladder and falls off about the same way. The horsepower curve follows about the same path. This results in a narrow usable range. The high boost pressure produces high peak horsepower, but at a terrible cost. The Novis are a good example. They have a 150-200-bhp edge on both the Offenhauser and Ford engines, but it doesn't do them any good because they can't get it to the ground effectively. So they're carrying and burning all that extra fuel to pay for power they can't use. The high boost pressures also result in highly stressed engines with lower reliability factors.

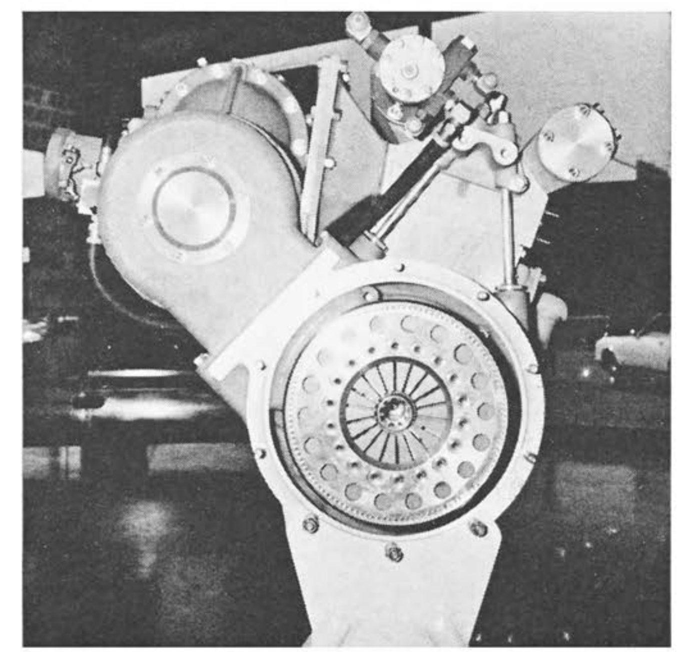
On the other hand, a positive displacement blower will put out the same amount of air with every revolution. At least it will up to a point where its speed becomes great enough to reduce its volumetric efficiency, or where manifold pressure reaches a point where it blows back past the sealing edges of the rotors. There are several reasons why the new engine shouldn't be bothered by either of these problems. First, its speed won't be that great. It's geared to run at 75% of crankshaft speed, which even at the engine's maximum rpm of 8500 means the blower is turning only 6375 rpm—only 175 rpm over the manufacturer's 6200 rpm recommended limit. At this ratio, it produces a boost pressure of 15-17 psi, which is also well within its capabilities. By keeping the pressure fairly low, the engine won't be as highly stressed, power will be adequate and fuel consumption will be competitive within the Speedway's two-pit-stop ruling.

The supercharger itself is manufactured by Blowers Inc., of Racine, Wis. It is similar to a GMC 4-71, the main difference being that instead of using two 3-lobe, helical rotors, the rotors are straight. To insure adequate rotor sealing Drake has the blowers modified to his specifications. A thin formica strip is inserted along the sealing edge of each rotor lobe. The strips run with zero clearance to the case. The end plates have Buna N rubber grids bonded to them to provide increased rotor-end-to-end plate sealing. The blower is gear driven off the rear of the engine and gear ratios can be changed to either increase or decrease blower speed.

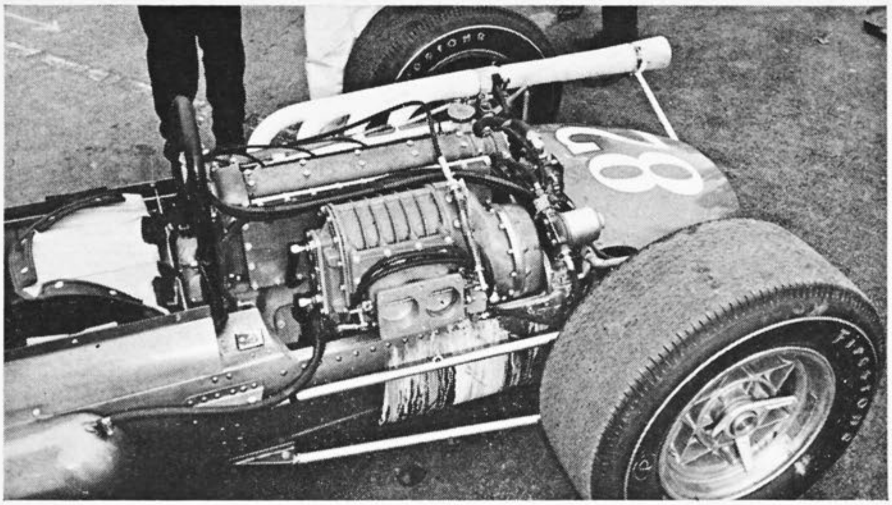
The engine's external appearance is very similar to the normally aspirated, 251-cu. in. engine, the big difference being in block height, which has been lowered considerably to accommodate the shorter stroke of the blown engine. Internal dimensions are quite a bit different. Bore and stroke of the new ▶



TO PROVE his point—blown Offenhausers can compete with Fords—Dick Jones built an experimental model.



DALE DRAKE engineered this gear-driven Roots blower for his new 168-cu. in. Indianapolis racing engine.



PREPARED FOR the Phoenix 200-mile Championship race, Drake's supercharged Offenhauser developed problems and failed to make the starting lineup.

SUPER-OFFY

The lower end features an aluminum crankcase. The main bearing plates also are aluminum. The plates are split to accept 2-piece bearing shells. The bottom half of the insert takes most of the load, so it is made of steel-backed copper lead. The upper half is tin-based babbitt and provides a certain amount of embedability. The crankshaft is machined from a solid billet of SAE 4340 steel. Bronze plates are bolted to the counterweights to balance it.

engine are 4.125 in. and 3.125 in., which give it a displacement of 168 cu. in. This is the limit for supercharged engines under the current rules. The new short stroke corrects what always has been a major drawback in Offenhauser engine design. This is an unfavorable bore/stroke ratio which limited rpm. At 8500 rpm the piston speed on the new engine is only 4400 ft. per min., which is well within the limits of current design practice. By comparison, the 251 produced a piston speed of 5100 fpm at only 7000 rpm. Forged aluminum pistons, domed to create a compression ratio of 8:1, are used.

The head and block, cast in one piece, are aluminum. Dry sleeves are used. These are cast iron and are an interference fit in the cylinder bores. O-rings are used at the bottoms of the sleeves as a precautionary seal and the sleeves are held in place by flanges at their bottom ends which mate with the bolt-on crankcase.

The familiar pent-roof combustion chamber with its four valves per cylinder is retained. Intake sizes are 1.562 in. and exhausts are 1.375 in. The exhaust valves are sodium cooled and made of SAE 2112 steel, while the intakes are of SAE 4130 grade steel. Dual valve springs with flat wire dampers are used. Spring pressures are 140 lb. on the seat and 375 lb. open.

SHORT, STIFF connecting rods are machined from SAE 4340 forgings. They have the same large and small end dimensions as the longer 251 rods and also the same size tubular section, so should be quite a bit stronger. Overall length is 5.670 in., compared with 7 in. for the old rod. Diameter is 1.094 in. with a 0.156 in. wall. Steel-backed copper-lead inserts are used.

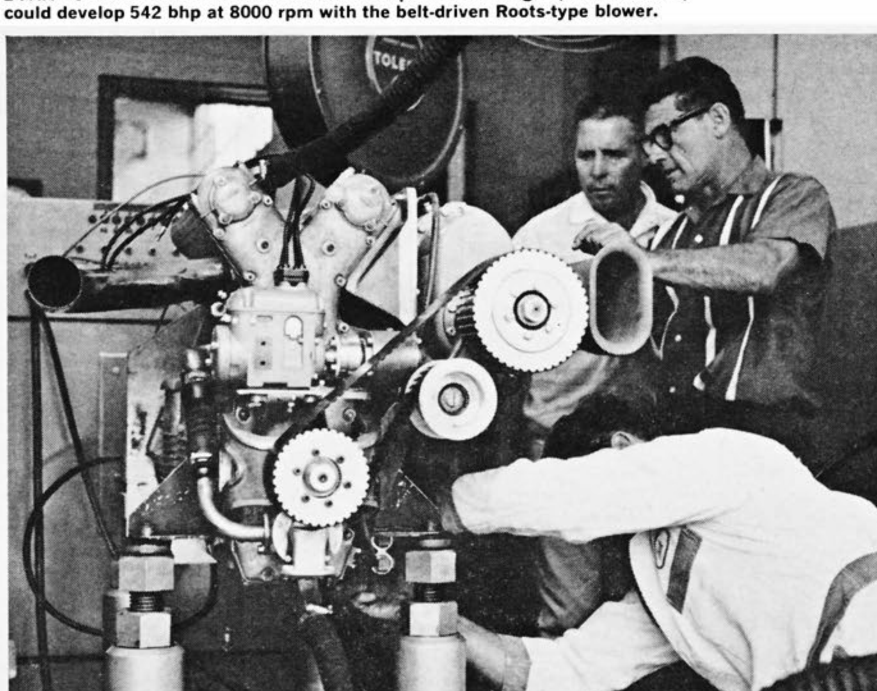
Both main and rod bearing sizes and areas are the same as on the big engine, as are the 1.062-in. diameter piston pins.

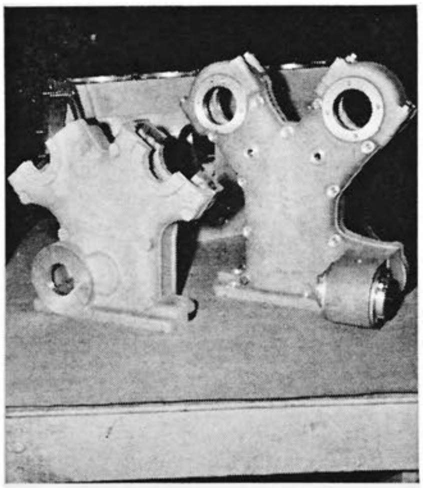
At this writing the engine still hasn't been on a dynamometer for testing, so it is impossible to say exactly how much power it will really develop or what its exact operating characteristics will be. However, a very similar engine has been built and has been thoroughly tested. The resulting figures should closely approximate those of the Drake supercharged engine.

This engine was engineered and built by Dick Jones, head of Champion Spark Plug Company's Racing Division. Jones also oversees the operations of Champion's well-equipped dy-

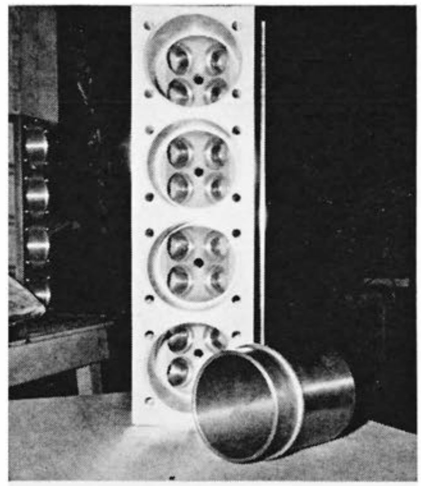
DRAKE says supercharging will breathe new life into racing.

DYNAMOMETER TESTS showed the Jones experimental engine, at 170 cu. in., could develop 542 bhp at 8000 rpm with the belt-driven Roots-type blower.

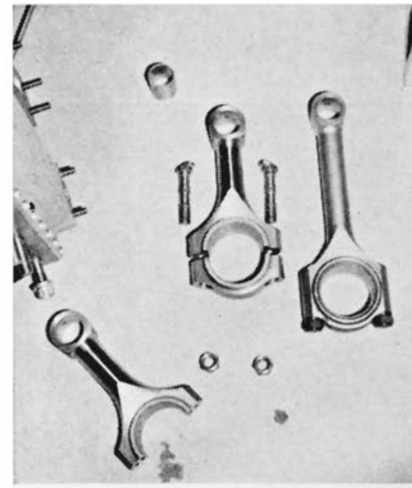




BLOWN engine's cam drive cover is shorter than its 251 counterpart.

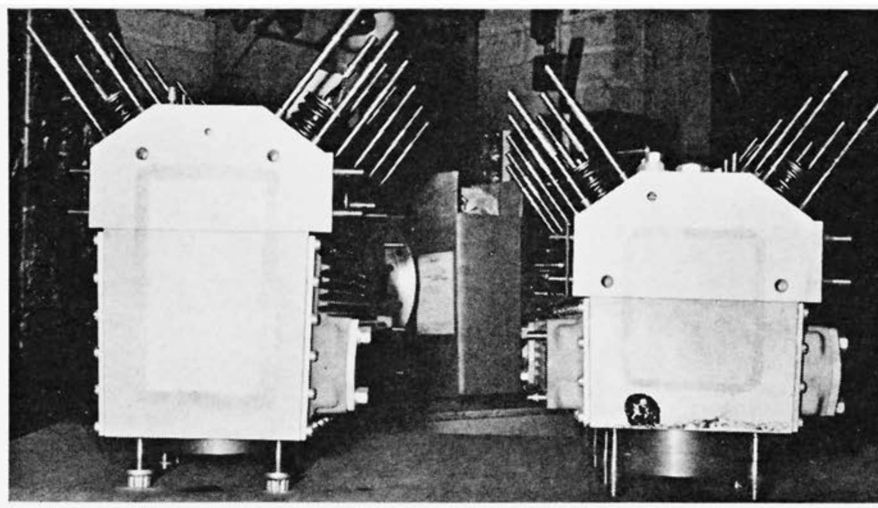


PENT-ROOF combustion chamber and 4-valve layout remain.



SHORTER RODS retain large and small end dimensions of the 251.

namometer test facility in Long Beach, Calif., where a large amount of racing research and development always is in progress. Jones has long been an exponent of supercharging—especially as it applies to Indianapolis. He believes that if properly done, it's the only way to go. And he has been saying just that for the past 10 years. Until the past year he has had a hard time finding really interested listeners. For the most part, Indianapolis mechanics resist trying something different. To say they are merely conservative would be a large understatement.



COMPARISON OF 251- and 168-cu. in. block castings shows low head height for the blown engine. Shorter stroke length should boost performance.

TO PROVE his point, Jones came up with what he thought was the right way to go. Basis for his experiment was an old 220 Offenhauser sprint engine that car owner, builder and parts collector Vince Conze lent him. The 3.625-in. stroke of this particular engine was about right, but to get the proper displacement it had to be sleeved down to 3.875 in. This combination worked out to 170 cu. in., which is close enough to the 168-cu. in. limit for comparision purposes.

Jones has run this engine with both GMC 4-71 and Blowers Inc. superchargers and says there's no difference in performance.

The blower was mounted to the engine on an open-type plenum chamber. A Hilborn injector was modified to fit the blower. Port injection isn't used and all the fuel is put through the blower. The Drake engine uses a like injection system and plenum chamber manifold.

Jones used gear-belt drive for the blower because it was simpler and cheaper, and also quicker than laying out a gear train and building it up. This setup also made it easier to change blower drive ratios quickly. The engine was built for experimentation only and there never were any plans to actually mount it in a car.

The engine was completed early in 1965 and underwent one dynamometer run before Jones had to leave for his annual month-of-May stint back at the Speedway. But even the preliminary figures he took back with him were good enough to raise a few eyebrows—including Dale Drake's.

On his return to Long Beach the development work continued as he tried different combinations of boost, compression ratios and cam profiles, all the while checking out the results on the dynamometer.

In the meantime, Dale Drake, who had long been toying with the idea of a new supercharged Offenhauser, decided the results Jones was getting were reason enough to get his project into high gear. After the Indianapolis debacle, he put long-time Miller-Offenhauser-Meyer-Drake engine designer Leo Goossen to work on the new design. Jones and his experimental engine were the catalyst that touched it off.

In its present state of development the Jones engine produces a solid 542 bhp at 8000 rpm. At 8500 rpm the output only drops to 540 bhp and at 9000 rpm the engine still develops over 500. On the low end, the curve breaks through 400 bhp at 5000 rpm. This gives the engine a usable range of 3500 rpm. Boost pressures are between 15 and 17 psi, and at 9000 rpm the pressure just starts to fall off slightly. Torque, while not quite up to the rating of the longer-stroked 251 Offenhauser, is still healthy, with a peak reading of 380 lb.-ft. at 6500 rpm. The curve is broad and flat, with over 300 lb.-ft. available at the 4500-8500 rpm range.

By comparison, Drake's production engine should, if anything, produce slightly more power at a bit higher rpm due to its slightly better bore/stroke ratio, though torque might be slightly less because of the shorter stroke. Whatever the results, they should be widely known by the time this article reaches print because the engine was due on the dynamometer before then, and also was scheduled to debut in a race car in the 200-mile Championship race at Phoenix late in November.

We're betting that it does the job. ■