

As the Indianapolis 500 continues each year, the entries become more interesting and unusual with fresh engineering approaches taken to the historic race. On every May 1, the new and old get together and compete against each other for the coveted 33 spots in the "great race"

indy: the new breed

BY HOWARD PENNINGTON

THERE ARE TWO great battles fought at the Indianapolis Motor Speedway each year. The battle of the drivers takes place on Memorial Day before hundreds of thousands of shouting spectators. The battle of the designers, engineers and mechanics goes on all year long, waged partly behind the high, guarded fences of Gasoline Alley, and partly on the track during practice and qualification days. Both are important.

The battle of the drivers attracted greater interest than ever this year. And no wonder. The race started with Mario Andretti in his second year at Indy sitting on the Pole with last year's winner, Jim Clark, right beside him. Parnelli Jones, 1963 winner, was right behind Andretti, while two-time winners Roger Ward and A. J. Foyt started way back in the pack.

The pack hardly got started when the race came to a sudden end for 11 of the cars — right on the first lap! Accelerating at the start, Billy Foster's car hits Gordon Johncock's mount. Cars and wheels go every which way! The first two rows are ahead of the trouble, and get through unscratched except for Johncock. The race is stopped, restarted an hour and 24 minutes later, under the yellow flag. Among the 11 cars wiped out are A. J. Foyt and Dan Gurney's. Amazingly, no driver is injured. They restart in single file, under the caution light. Seventeen cars start on the track, and five from the pits, where repairs

can be made once the race starts. Johncock, involved in the first crash, is able to get back in.

The green comes on at lap #5. Andretti holds the lead, with Clark in pursuit. Johnny Boyd spins into the wall, out, but unhurt. Hurtubise is black-flagged in for leaking oil. At about 20 laps, Clark passes Andretti. Almost at once Andretti's car begins to pour out smoke. A swallowed valve! On the 25th lap, Andretti pits. On lap 35, he retires for good.

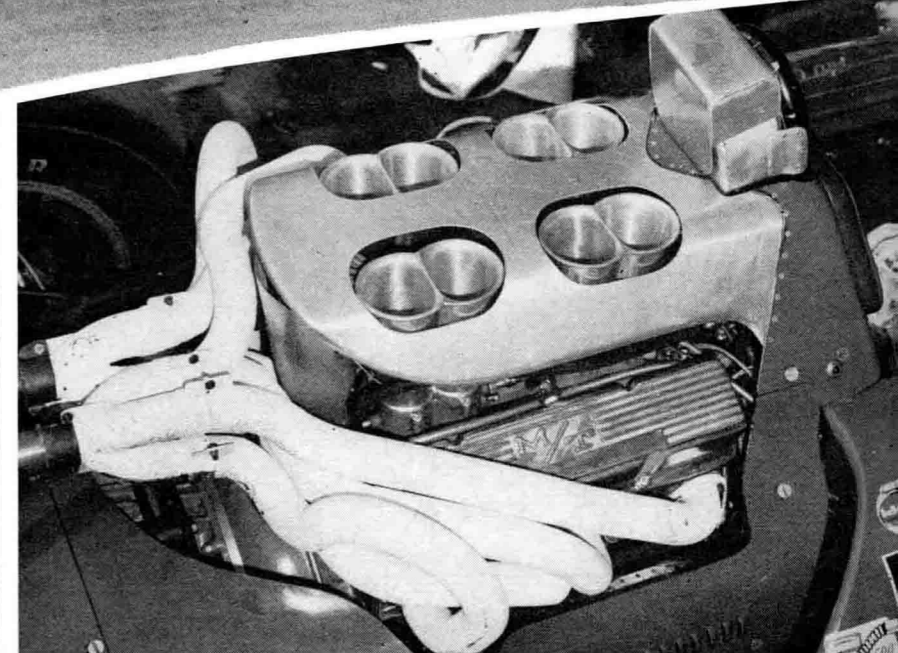
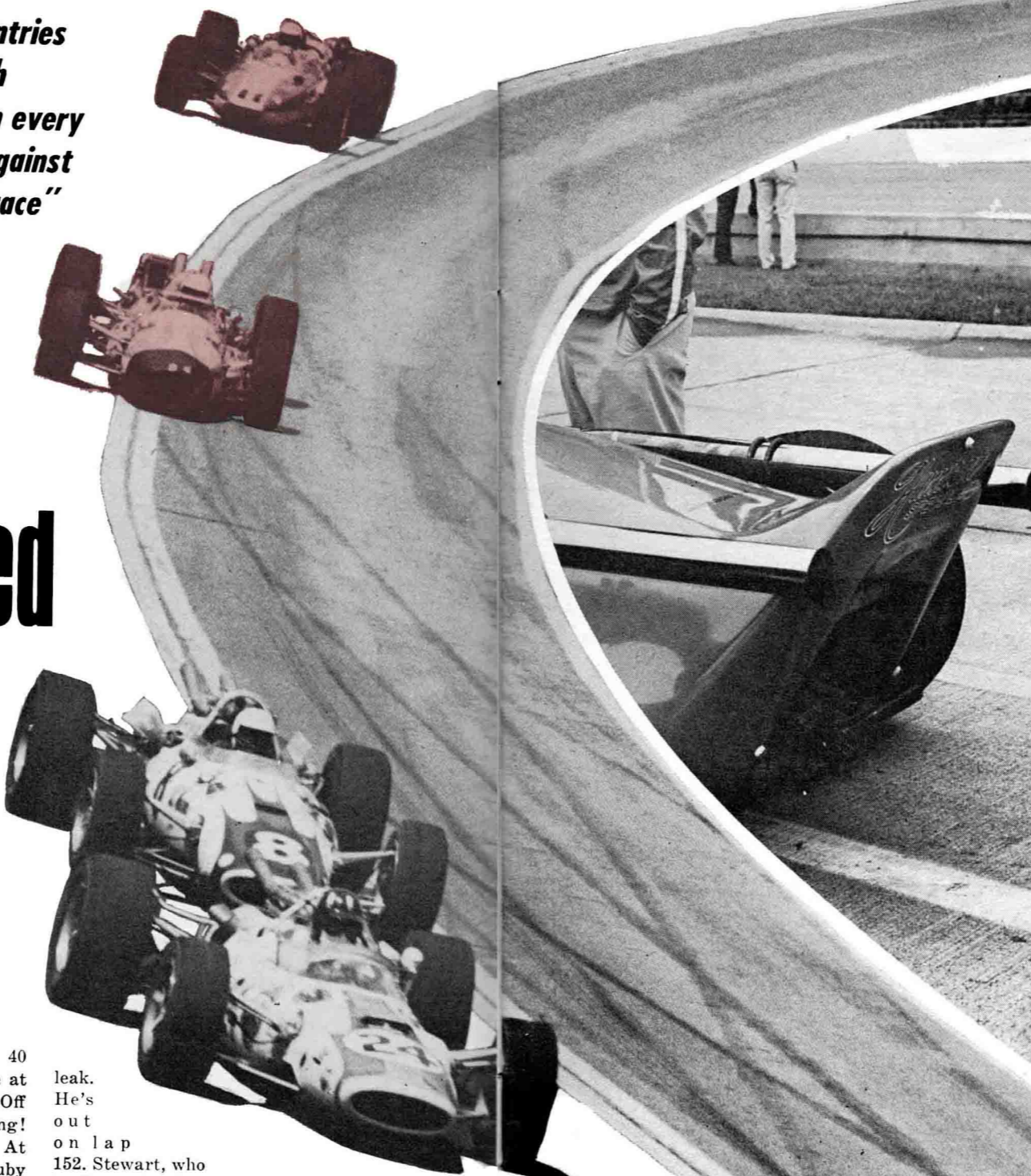
Clark leads, with Lloyd Ruby and Parnelli Jones in pursuit. At 40 laps, it is Clark, Ruby, Jones. Same at 50 laps. Then Clark loses it! Spins! Off the track and back on! Still leading! Clark pits, and Ruby grabs the lead. At 70 laps, averaging 140.950 mph, Ruby leads, with Clark second and Jim McElreath now in third. Ruby pits, loses the lead to Clark. Ward pits and gets out, his car done for.

Again Clark loses it! He spins 3 times! And keeps going! At 100 laps, Ruby has the lead. Only 13 cars are running. At 110 laps, it's Ruby, Clark, and Jackie Stewart. Jones is out with wheel bearing trouble.

At 120 laps, Ruby, Clark, Stewart. Then Stewart passes Clark for second. At lap 140, it's Ruby, Clark, Al Unser in third and Stewart fourth. And on the 149th lap, Ruby is black-flagged! Oil

leak. He's out on lap 152. Stewart, who had regained second, takes the lead from Ruby on lap 150. Clark is second, Unser third. Graham Hill, Stewart's teammate on the Mecum Racing Team, is now fourth. Lap 164. Yellow flag! Al Unser hits the wall. He's out, but OK. At 170 laps, it's Stewart, Clark and Graham Hill, three Grand Prix drivers dominating the Indy race. By lap 180, Hill has passed Clark and moved to second. At lap 190, it's Stewart, Hill and Clark, with Stewart a lap ahead. With only 20 miles to go, on lap 192, Stewart's engine gives out. Only 8 cars are now running as teammate Graham Hill, former

Coming around the first sweeping turn at the Indianapolis Motor Speedway, eventual winner Graham Hill leads in his Lola-Ford, the American Red Ball Special followed closely by Roger McCluskey in the G. C. Murphy Special who also runs a Ford. Hill demonstrated cool driving and steady concentration throughout race. Had few problems with either car or competition, just waited as others around him got into trouble and slipped by when the time was right. Because of several accidents, Hill's average speed was held down considerably.



Many Chevrolet powered entries were in evidence at the '66 race, taking advantage of new ruling which allowed U.S.A. produced engines at 305 inches. This one sported Enderle injectors, M/T innards.

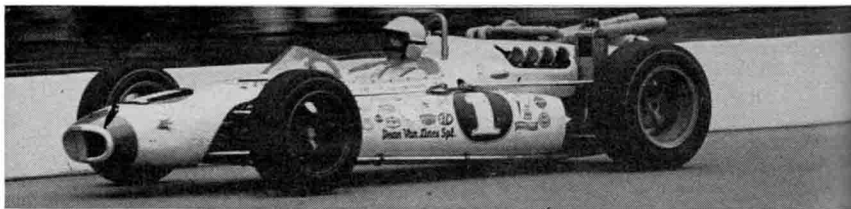
Left — Rear mounted "spoiler" fins were another feature on many '66 entrants such as that of Frank Harrison, driven by Bob Mathouser. Idea is to increase wind resistance which in turn improves handling.

Graham Hill, '66 winner was in a calm and cool state throughout most of the race. Hill qualified well, managed to keep out of trouble and other competitors way and caught the big checkered flag first.

Below — Responsible for much of the research and design work on blown Offy was Dick Jones of the Champion Spark Plug Co. 168 cubic incher puts out better than 525 ponies using straight alky for fuel.



Mario Andretti (right) captured the coveted pole position, only to go out of the race early with mechanical problems.



World Driver's Champion in GP racing, takes the lead. After all, that's gone before, anything could still happen. But it doesn't. And Graham Hill, a rookie at the Speedway, takes the checker in a fantastic race that saw favorites fall by the wayside, and old Indy pros sidelined by mechanical trouble and accidents. Tough as it was on machinery, the race is easy on men. No driver is hurt. Because of all the yellow lights, Hill's winning speed, 144.317 mph, is far from a record. Clark finished second, McElreath third, Johncock fourth, in the battle of the drivers.

You can always tell how much interest there is in the drivers' battle by looking at the crowd jamming the stands and the infield. It's harder to measure just how much interest there is in the long battle between the men behind the machinery, but it can be done. Just ask a man who's been a careful observer of the Speedway for many years. We asked Dick McGeorge, director of public relations for Champion Spark Plug Company. McGeorge started at Indy back in 1937.

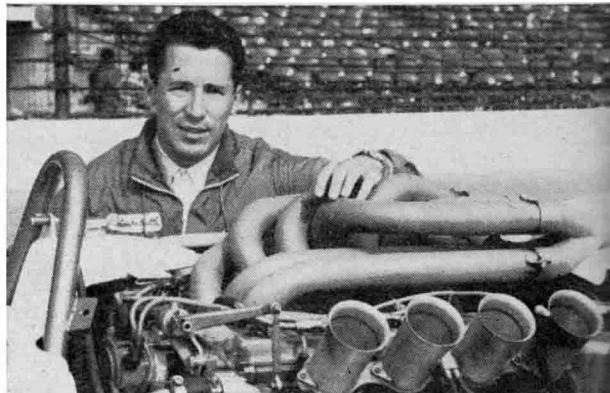
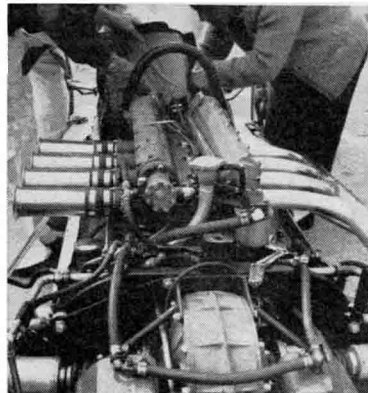
"Interest is greater than ever," McGeorge said during time trials, "because this is the biggest year yet for technical change at the Speedway. When I first came here, Bill Cummings got the pole position with a speed of 123.445 mph. Andretti was 42 mph faster! Those higher speeds are due to technical improvements."

The best time to examine and compare the technical improvements and innovations on the different cars that are entered at Indy, regardless of whether or not they actually qualify for the race, is during the first weekend of time trials when front row starting positions are determined. So now let's move backward in time to that weekend when the battle of the designers was reaching its first big showdown.

To find out what an Indy expert thought were the most important technical developments, we asked Fred Agabashian. He raced at Indy for twelve years, sitting on the Pole in 1952, and is now in his eighth year as a radio and television commentator on Speedway subjects. He listed a number one improvement for this year; better aerodynamics for the cars. Next he placed scientifically refined suspension.

"Tires are important, too," he added, "and there is engine progress."

Another Indy veteran, 1950 winner Johnny Parsons, gave tire improve-

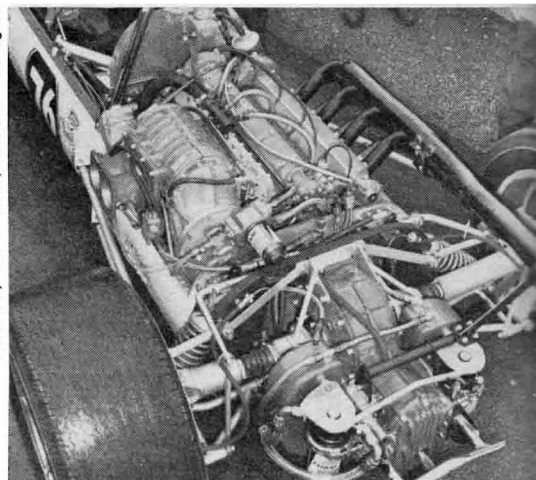


Above — The tried and true warhorse of the "Great Race" was on hand in smaller numbers than any other year. Injected 255 Offy proved for the second straight year that it was not up to beating the fast Fords. Only 3 of these made race program.

Above right — The man and engine that set qualifying on its ear. Mario Andretti in the Ford powered Dean Van Lines entry set a mark of 166.328 mph for 4 laps which was good enough to win the coveted pole position. Clint Brawner tuned car.

Right — Closeup of 168 cubic inch blown Offy, the latest of the "old warhorse." Blower is mounted to left of engine and features Hilborn injector. Setup for engine made especially by MD Blowers. Case is aluminum, drive is special enclosed unit.

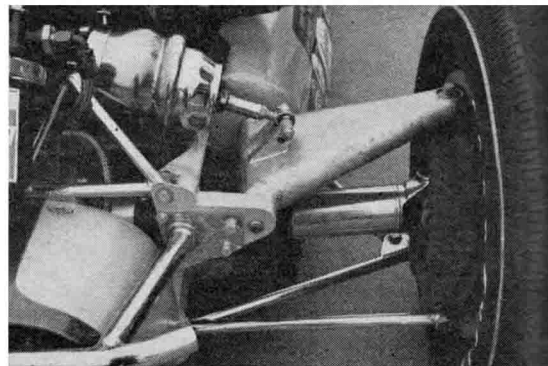
Photos by Bob D'Olivo, Howard Pennington



Above—The famous MG "Liquid Suspension" system was incorporated into several creations. By twisting a few nuts, setup of car can be easily changed to fit any type of track conditions. Note lightness theme.

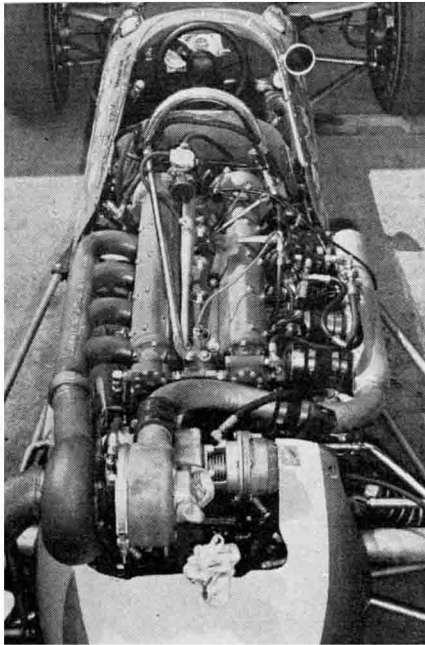
Above right — Undoubtedly the car with the worst luck at the speedway, The Novi. A qualifying crackup dashed the hopes of the powerful blown V-8 which is used in conjunction with a tricky 4 wheel drive.

Right — Another variation of the "Liquid Suspension" design featured heavy A-arms rather than lightweight assembly. In case you're wondering about exactly what the liquid is, it's water & alcohol.

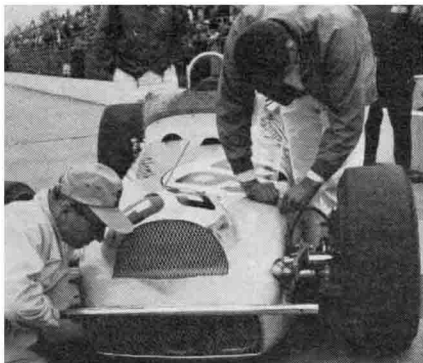


ments greatest credit for the vastly increased speeds, also mentioning rear mounting of engines.

Both of Agabashian's first two points, aerodynamics and suspensions, are part of chassis design, so let's study the chassis situation first. It was significant that only a couple of examples of the old front-engined roadsters were around. Car #39 was one of the A. J. Watson chassis that completely dominated the Speedway about four years back. But it was a long way from being



Turbo-charged Offies were also in attendance this year. Using exhaust gasses to run the blower. Engine showed great potential with three car's qualifying to run.



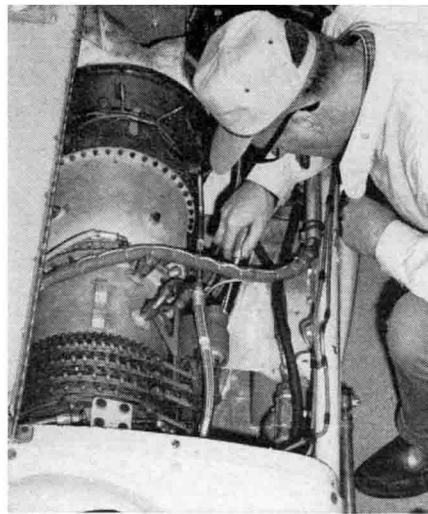
One of the wildest machines on hand for the qualifying session was the Jack Adams Aircraft Spl. which featured along with having an "outdated" roadster chassis, a husky turbine engine which carried the car to better than 260 mph down straights.

Above right — Pop open the hood and we don't find an Offy, we find a husky General Electric LM-100 turbine engine which can scream to better than 18,000 rpm. Car was driven during the last few practice days by vet Bill Cheeseborough.

Right — When running, this is a real hot spot. Turbine exhaust had to be largest on the track but it wasn't the noisest. Spectators reported car sounded something like new turbo-prop jet plane when running. Main problem was lack of brakes.

an "old time" Indy car, as its front engine was a new turbo-charged Offy. Watson cars were harder to find this year, and European chassis were moving in strong. Andretti won the pole position in a Brabham-designed car with the British Lotus of Jim Clark and George Snider next to him for an all-important front row. Two-time winner Roger Ward, first to qualify, rode in a British Lola.

There were plenty of beautiful American machines on hand, however. The Eagles, built by Dan Gurney's All American Racers. The popular Gerhardt cars. The Shrikes of Parnelli Jones and teammate Dick Atkins, which Fred Agabashian called outstanding examples of improved aerodynamic design. There were cars designed by Rolla Vollstedt, and the Harrison team. None looked better than the beautiful Genies. Equipped with the unusual MG liquid suspension systems, they were diamonds of design. Dwarfing them all, like an elephant among antelope, was the brutally big Novi. Except for the Novi and a couple of others, the cars are all extremely low, no higher than a man's knee. They look like torpedoes on wheels. Or, to be more specific, like European Gran Prix cars. Most have Lotus-type construction, with the car's skin forming the actual body, rather than just



serving as a covering for a tube frame.

The old solid suspension has all but vanished. Most have independent suspension all around, generally with in-board shocks in front and cross-mounted shocks and springs working with the rear trans'axles. Probably the most interesting suspension systems, although not brand new, are the Joe Huffaker developed "MG Liquid Suspension Systems" patterned after those used on British-made MG autos. A mixture of water and alcohol, contained in a flexible rubber diaphragm encased in two metal hemispheres soaks up bumps at both front and rear.

Important as the new chassis designs are the tires. Most Indy experts give tires more credit than chassis for the vastly increased speeds.

"When I won in 1950," said Johnny Parsons, "tires were about 5½" wide. Now they are as wide as 12"."

Why didn't they make tires wider in those days? It seems available rubber compounds just wouldn't stay together if made any wider than they were being made. According to Firestone experts, other recent tire improvements include lower section height (giving cars greater stability around the track), a more adhesive tread compound, and body construction that allows tires to run cooler even at higher speeds. And just since last year, tires have gained a bigger "footprint" that puts about 10% more rubber on the track. Speed through a corner is, of course, limited by the tire's ability to hold the car from shooting sideways and keep it moving ahead. (Part of a top driver's skill comes in getting right up to this point without going over it into trouble.)

As important as chassis, suspension and tires are, the thing that most interests serious observers at the Speedway this year is engines. I asked the question, "Of all new technical developments this year, which single one is most interesting to you?" The answer almost always named an engine. Seventeen year old John Laidlaw of Indianapolis races karts at 90 mph and has a driving determination to be racing at the Speedway in a few years. He picked the four-wheel drive car that's powered by twin Porsche engines. Speed merchant Mickey Thompson, named Indy's "Mechanic of the Year" in 1962, selected the newly-developed turbo-charged Offenhauser engine. "I think turbocharging is the way to go," Mickey said.

Certainly there was enough variety engines to interest anyone this year. Thirty-three cars were carrying the power that won it big in 1965, V-8 double overhead cam Fords. Fifteen regular Offy four-bangers were entered, and thirteen entry forms listed super-charged Offys, a new development for 1966. By the first weekend of time trials,

(continued on page 72)

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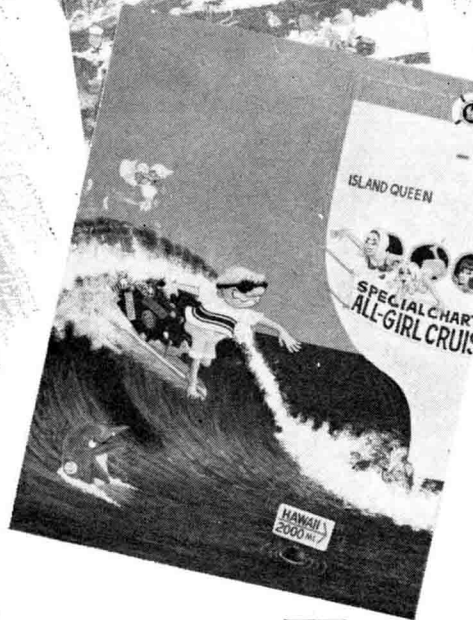
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at least three turbocharged Offys were running. This form of power is even newer than the supercharged Offy. Chevy fans were cheered by the news that five Chevrolet stock block engines were listed, and they were in some beautiful machinery. One Novi, noisy as a fuel dragster, was in contention for a starting spot. The oldest car on the track carried the newest (for the Speedway) power of them all—a GE aircraft turbine engine. Two sixteen-cylinder BRM mills never showed from England, and the car listed to carry a supercharged Rambler engine sat alone and engineless in a corner of Gasoline Alley.

I asked veteran racing engineer Bob Strahlmann what changes, if any, had been made in the conventional Offy mills and the V-8 Fords since last year.

“Camshafts and valve springs are the main changes in the Offy.” Strahlmann said. “They’re looking for higher power, and a wider range of useful power to compete with the Fords. Offys used to run at 6800 to 7000 rpm. Now they’re turning at 7200 to 7400. And they’re running anywhere from 10% to 15% or 20% nitro.

“There have been a lot of changes in the Fords. Camshafts, injectors, rods, rod bolts, and pistons. Those are some of the changes,” he said. “In their search for more power, they’re going to nitro in some of the Fords. The first year they all ran gasoline. Second year some went to alcohol. Now they’re using more nitro than the Offys, going as high as 25% or 30% in some cases.”

I got the word on the blown Offys right from Dick Jones, head of Champion’s Long Beach dyno facilities. “The cubes were reduced from 252 to 168,” Jones said, “by reducing the bore from 4⁹/₃₂” to 4¹/₈”. Stroke went from 4³/₈” to 3¹/₈”. Compression ratio was lowered from 14¹/₂:1 to 9:1. No nitro is used, just straight methanol. A different cam is used, and I designed a special manifold for the blown engine. Instead of a belt, a gear drive runs the blower. The block is aluminum instead of cast iron. Those are some of the major changes.” Jones concluded.

Roger Ward, two-time Indy winner, was driving a blown Lola Offy for the Mecom Team. I asked his opinion of the engine. “We haven’t begun to scratch the surface of its tremendous potential,” Ward said. “It responds well. If it has one particular advantage, it would be the engine’s power out of the corners for the first 200 or 300 yards.” Not long after this interview, Ward became the first to qualify for the 1966 “500” at 159.468 mph.

The turbocharged version of the Offy was causing quite a stir, and again I got the word from the engine’s devel-

oper. He's Herb Porter, a top mechanic at the Speedway for many years.

"The basic difference between a supercharged engine and a turbocharged engine," Porter said, "is, of course, that on a supercharged engine its blower is driven mechanically by belts or gears. A turbocharger uses those gases to turn the blower, by means of a turbine. So instead of soaking up some power to drive the blower, you take power that's being wasted and put it to work. The hotter the engine gets, the faster the blower turns. We regulate its speed with a bypass valve."

Jim Hurtubise, first man to ever hit the 150 mph mark at Indy, had switched to a turbocharged Offy and I asked him what he thought of it.

"I haven't tried it enough to tell," was all he would say. Next day he qualified the car at 159.208 mph.

Without a doubt, the two cars with the most unusual power were one newly built car and one real Indy old-timer that finished second way back in 1958. The new car had twin Porsche 6-cylinder engines, one in front and one in the rear. The old timer was powered by a turbine engine, now.

John Hulbert, chief of gas turbines for Bell Aerosystems, was with the turbine car and gave this rundown. The engine is a GE Model LM 100 originally designed for Navy helicopters. When outside air temperature is 100 degrees, the engine is rated at 900 hp. It's a "turbo-shaft" setup, which means the turbine turns the wheels, rather than working like a jet. There is no clutch, no gearbox. When the engine turns, the car goes. The driver has to stand on the brakes when they start it up.

Indy veteran, Bill Cheesbourg, had driven both the turbine car and the twin Porsche in practice and I asked his opinion of the two cars.

"Right now, the Porsche doesn't have enough power, and the turbine has too much. They just haven't had enough development time on the Porsche engines, and no chance to dyno them," Cheesbourg said. "The acceleration on the turbine car is enough to blow your helmet off. Braking is a problem right now, because you can't downshift. If they could put the turbine into a good four-wheel drive car, it would really have a future here."

Neither the twin-Porsche nor the turbine car made the starting lineup. Nor did the Chevies and the Novi. It was Ford against Offenhauser, with 24 Fords, 3 regular Offies, 3 super-charged and 3 turbo-charged versions making up the 33 car-field. First four cars over the finish line were Fords. Hill's mount was an English-built, Ford-powered Lola. Cheers from Dearborn, Ford's headquarters. And from the Offy camp? Cries of, "Wait 'til next year!"

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