CHEVY "396" DYNO TEST RESULTS

RODDING & RE-STYLING

JUNE
50¢

ENGINE SWAP:421 PONTIAC POWERED 'VETTE

INSIDE FACTS ON STROKER KITS

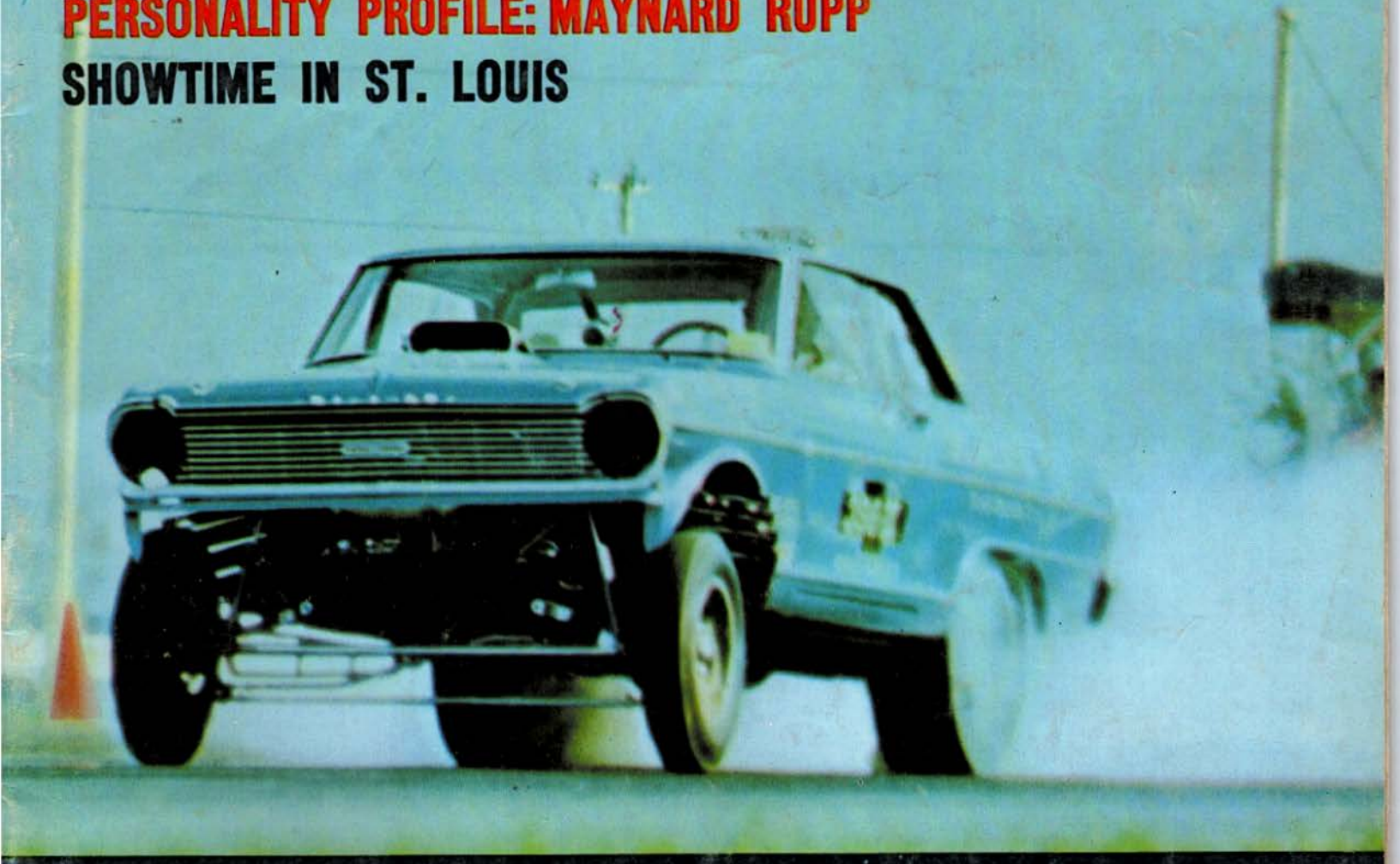
IN COLOR RECORD HOLDING A-B-C BLOWN GASSERS

ENGINEER'S REPORT ON STREAMLINING

NASCAR OPENER: RIVERSIDE 500

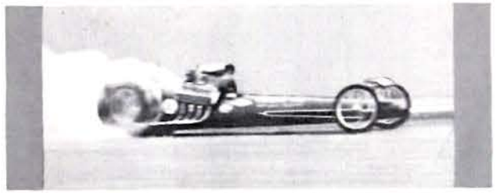
PERSONALITY PROFILE: MAYNARD RUPP

SHOWTIME IN ST. LOUIS



ROAD TEST: CHEVY POWERED ISO GT

ISKY GALLERY OF CHAMPIONS



TOM "TV" IVO

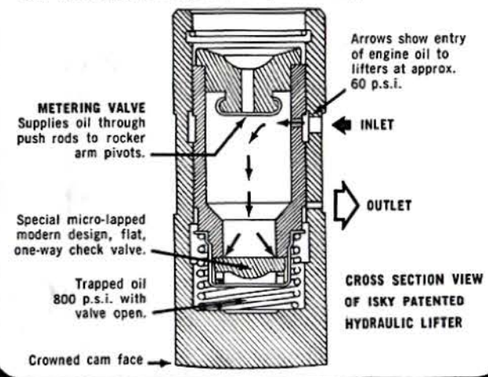
One of the most popular competitors in the sport of drag racing, Tommy recently campaigned coast-to-coast, winning more match races than any other fueler. He defeated Connie Kalitta's D.O.H.C. 427" Ford **ten times in a row** while on this recent tour. Ivo's long list of honors include: 1964 International Championship, defeating Don Garlits in England; runner-up at 1965 NHRA Nationals at Indy over the top fuelers; and has turned top speeds as high as **216 mph!** "TV" Tom is always a strong running top contender, highly respected for his good sportsmanship. For the outstanding, dependable performance of his AA/FD, Ivo runs an **Isky 550 Super Le Gerra cam** in his 392" Chrysler hemi engine.

THE ISKY CAR-OF-THE-MONTH

This month's winner is Bill Wedlake of Sunnyvale, Calif. He wrote us: "My 1964 Chevy S.S. Impala is powered by a 409 mill to which I've added a ¼" stroker kit for a total of 438 cu. in. I'm running your 505-C Magnum Roller Cam and coordinated kit, and I must say that this cam is really too much. I am really impressed at the breathing and rev characteristics of this cam, not to say the least of the boot in the tail it bangs out at 3400 RPM. The thumb rule is that if you go up in cubes your rev limit will go down, but I can actually pull another 1000 RPM now than when the engine was stock! For my money this cam is the GREATEST. Preliminary times at the strip look very promising. Incidentally, I drive this monster around the streets every day and I haven't had a bit of trouble with it."

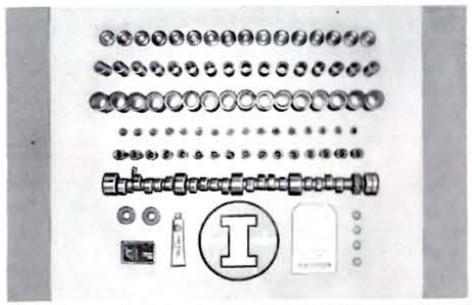
ANOTHER FREE OFFER FROM ISKY!

For all speed shops, racers and hot rodders . . . a large size, 14" X 17", colorful wall chart that tells the story of hydraulic lifters. Large cut-away, cross-section drawings, with explanatory text (example shown below) clearly show how Isky's patented anti-pump-up tappets work in comparison to standard hydraulic tappets. The Isky anti-pump-up feature with bleed port design is acclaimed by automotive engineers as an important contribution to quiet high speed engine operation. **Wall chart, plus set of Isky decals sent FREE upon request. Include 10c to cover postage and handling. Limit: one per customer, please.**



CROSS SECTION VIEW OF ISKY PATENTED HYDRAULIC LIFTER

NEW! FOR CHEVY 396 ENGINES



Iskenderian was the first racing cam manufacturer to obtain a factory 396 Chevrolet engine for the purpose of evaluation on the dynamometer to develop new racing cams and coordinated valve gear. A new Isky all-out competition, flat-tappet grind was designed for this engine, for drags and marine (hot boat) use. Using a factory rated 425 hp 396 Chevy engine, equipped with an Edelbrock X-C96 dual-quad ram log manifold and an Isky 550-62 cam and kit, a gain of 71 hp at 6500 RPM over stock . . . plus a greater operating range . . . was obtained. Further tests are still being conducted, including a supercharged 396 and a stroked 396 unblown engine. Send 10c for full report on our dyno tests of the Chevy 396 engine.

550-62 cam only for Chev 396 engines..... $175.00 list
Cam and coordinated valve gear assembly kit..... 265.80 list

Isky's Top Tuner's Tips

TTT No. 12 . . . WHAT IS BEYOND PEAK HORSEPOWER? The difference between peak horsepower and beyond peak horsepower may be illustrated by this example: say we have two engines, both peak at 500 hp at 5,000 rpm. Engine "A", when revved beyond its peak to 5,500 rpm, flattens out due to valve float and has no further rpm operating range. Engine "B", however, being more flexible (due to a more carefully engineered cam profile and free of valve train vibration) will rev to 7,000 rpm before encountering valve float. Admittedly, this engine's horsepower will probably drop to 450 at 6,000 rpm, and even further to approximately 400 hp at 7,000. Nevertheless, engine "B" still has additional racing potential because of its extra operating range. This is a bonus factor known as "after-power" (power beyond peak horsepower). Also, engine "B" can be held in low gear and revved higher before shifting up to the next ratio, thus out-distancing his adversary. Obviously, engine "B" produces more area under the hp curve. This after-power factor is greatly dependent on the racing camshaft employed. A most important reason why you should depend on a reputable cam manufacturer.

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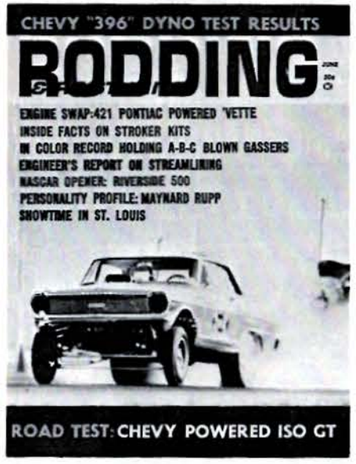

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EDITORIAL

YOUR overwhelming acceptance of our magazine has made us the fastest growing magazine on the market. Thanks.

This issue we have a road test on an ISO GT. It is a little different. If you don't like it, write and tell us.

Our color center fold features three of the top blown gassers in the Nation. As good as these cars are they could be better if they had more realistic rules to race under. A good factory Dodge 'funny' car will put most of them on the trailer. Super Stockers have soared to popularity because of the wild, no holds bared machines that are billed as stockers. Why not open up the rules and kill the fiction that gassers are street machines and let these guys really show what they can do?

In the last issue we had a guest editorial by Ed Sarkisian. He favors stockers being stock. My personal opinion is that no one should be able to go and buy a winner off the showroom floor. It makes little sense to me to make people race a car in the same condition as they purchased it from the dealer. A situation like this over favors certain performance minded car makers. I think that the AHRA formula system with more liberal rules is the way to go.

Rodders are car enthusiasts. Why surpress their desire to work on and improve their cars? What is so sacred about running a stocker? If a person wants to change his cam, rear end, mill his heads and replace his stock ignition why shouldn't he? Inventiveness is the cornerstone of drag racing and should be encouraged, not made to conform to some zealots concept of "stock". If more freedom to modify

cars is not allowed in the stock classes then we are turning the sport over to the boys with cubic money. For example . . if you own a '65 GTO, why shouldn't you be able to improve your car with the new air scoop kit? Should you have to go and buy a new '66 just so that the kit is stock? Let's get on the ball and start allowing people with old (over one year old) cars a fair chance to compete with the people who can afford to buy a new car every time something a little better comes along. Let's get the racers back to the speed shops and out of the showrooms!

Most racers are tired of being lawyers first and racers second. Rules that can't be enforced are stupid. Rules without popular support are a joke. If working on my car and applying my ideas to make it faster, safer and more fun to drive makes me a "cheater" and my car "illegal" then I am an "outlaw" and dammed proud of it.

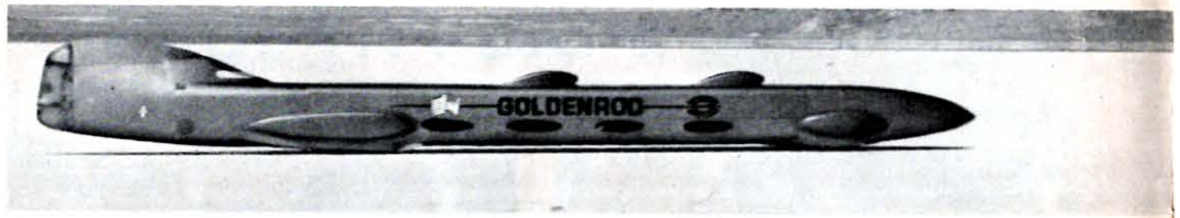
Phil Engeldrum, Editor

BOSCH RADIO CONTEST WINNER

D. E. Dennis
120 Prince George Hall
University of Maryland
College Park, Md.

D. E. Dennis sent in a great idea for promotion of Robert Bosch spark plugs and has been judged the winner of our contest. Many reader's sent in good ideas but on the basis of original ideas Dennis came out on top. The five next best suggestions netted the writer's a subscription to Rodding Restyling, Super Stockers in Action and Customs Illustrated.

Streamlining . . . Fact vs. Fiction



Top notch engineer explodes the myth about streamlining

W. H. Korff
Lockheed-California Div., Lockheed Aircraft Corp.

THE SOPHISTICATED SCIENCE of automobile body design has an important new element--aerodynamics--to utilize. Actually this element of body design has been known and studied for a long time but only in recent years has it become important. This new importance is due to a change in our roadways and driving habits. The body engineer's role in this matter should not be passive. As architect of his design, he must seek out this new tool, learn how to use it, and skillfully blend its capabilities into an overall pleasing end product. Fortunately the lines of well streamlined shapes are pleasing to the eye so, in effect, aerodynamics are compatable with the all important appearance aspect of his job. In fact the trend toward aerodynamic streamlining is well established and the body engineer has already accomplished a great deal in this respect. Prior to World War II the drag coefficient of most cars was around $C_d = 0.70$. Now it is approximately $C_d = 0.50$ for many cars. This is due largely to a sloping hood, blending of hood and front fenders, and to improvements in windshield slope and the wrap around feature.

It appears that the drag coefficient can be further lowered to about $C_d = 0.21$--less than half present day values--by further streamlining. This will have a significant effect on the powerplant and other components of the chassis as well as on body design. This is indeed "the greatest variable left in automotive design."

Let's now look at our driving habits and roadways.

Many years ago we learned that our cars are subjected to a great deal of stop and go short distance driving. Then post-war planners and road builders gave us nonstop high-speed driving on new expressways and freeways across the nation. We still spend considerable time in short distance stop and go driving but the mileage is rolling up at high speeds on the thru-roads. We now have a "lot more go--with fewer stops." A high percentage of our mileage is definitely now in the operating regime that can benefit greatly by aerodynamic streamlining.

Before we get into the many aspects of this subject, we might properly ask: Just what can we achieve by further streamlining an automobile? In addition to the natural beauty of a low drag streamlined shape, the practical achievements on the expressways and highways are:

1. A greater degree of quietness from wind buffeting by smoothed out air paths.

2. Elimination of lift which adversely affects stability and braking control.

3. Improvement in fuel economy, sufficient in many cases to reduce fuel bills by 35% with no reduction in performance.

4. Remarkable improvement in acceleration in the passing ranges without additional engine power. (8.1% improvement at 60 mph and 20% improvement at 80 mph in the example shown.)

5. Higher maximum speed (25-35%) to permit the vehicle to operate with less effort at cruising speed.

6. A lower cost vehicle for equivalent performance because a smaller, less powerful engine and power train may be used along with resulting lighter chassis components. Initial cost of the car may be lowered by 10% or more in most cases.

This paper is in two sections. The first section deals with

the Elements of Wind Resistance and Basic Principles of Aerodynamics as applied to an automobile.

The second section applies aerodynamic data to automobile design. Tabulated data and formulas are included. As an example, a streamlined compact car with two hp choices is compared to a modern compact car. Front, side, and plan views of proposed streamlined cars are included. Busses and a tractor-trailer unit are briefly discussed. To round out the general information on wind resistance of road vehicles, some data is included on motorcycles, Karts, Formula Racers, and open sports cars.

The conclusion points out trends and suggests a mutual indoctrination and training program between the Aerodynamics Dept. and the Body Engineering Dept. Before moving to the first section, let's briefly discuss:

Reduced Wind Noise At High Speed - We have two interesting examples to illustrate how far we can go in reducing wind noise without insulation.

1. Fully enclosed highly efficient Sailplanes soar in an effortless manner at greater than freeway speeds and the pilot has no difficulty in hearing conversation on the ground hundreds of feet below.

2. The drivers of record breaking streamliners at the Bonneville Salt Flats are frequently amazed at the remarkable quietness of their cars after they shut-off and coast for miles in excess of 200 mph.

There is not the slightest doubt that the wind noise of an automobile can be further reduced--nearly eliminated--by smoothing the flow of air around parts of the body that now tear the air to create turbulance and noise.

The other five achievements will be discussed in the second section with examples.

ELEMENTS OF WIND RESISTANCE AND BASIC PRINCIPLES OF AERODYNAMICS

A few basic principles of aerodynamics are necessary for a working knowledge of the subject. The following information, while in simplified form, will serve as an aid to better understanding of wind tunnel data, and provide some "feel" for aerodynamics as applied to an automobile.

Speed - The affect of speed is fundamental to any problem of aerodynamics. The tremendous increase in wind resistance with small increases in speed is seldom understood or appreciated. We know that, when speed is doubled, wind resistance is four times as great. Wind resistance increases by the square. Fig. 1 illustrates this.

Size - The size of the body has a direct effect. In this case we are not thinking of length or volume--only width and heighth, or cross-sectional area. If the cross-sectional area for one body is 10 sq ft, it will have half as much wind resistance as another body 20 sq ft in size and of the same shape and smoothness.

Shape - The shape of a body is most critical. To demonstrate, try this in your bath tub or swim pool. Tie a string to a square block of wood and drag it down under. Watch the turbulent flow of water around it. Then do the same with a fish-like shape and notice how much easier it is pulled and how little disturbance is created. The paths of water (air also) bend gently at the nose of the fish and flow smoothly and equally to the tail and rejoin with the least resistance or disturbance. But not so with the square block--the water is disturbed violently--it simply cannot flow around the sharp corners. Air becomes turbulent like water, thus causing the tremendous increase in wind resistance.

Another way to understand the great difference streamlining a shape makes, let's start with a square rod whose frontal area is 1 in. by 100 ft. At 100 mph the air drag comes to 433 lb. This is shown at the top of Fig. 2. Progressing downward we next try a round rod of the same frontal area, then an elliptical, and the last two are streamlined shapes, and we find that in the last case the air drag is a mere 18 lb - just 1/24th as much as the square cross-section shape! This quickly illustrates the importance of streamlining.

Wind tunnel drag data uses a nondimensional and internationally recognized aerodynamic coefficient--C_d. This coefficient of drag (C_d) of a shape gives us a number that we can use to compare with the numbers of other shapes

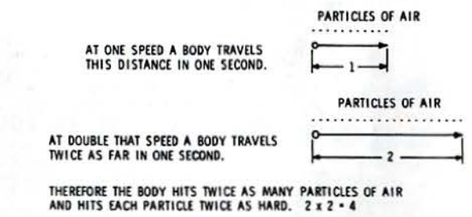


Fig. 1 - Effect of speed

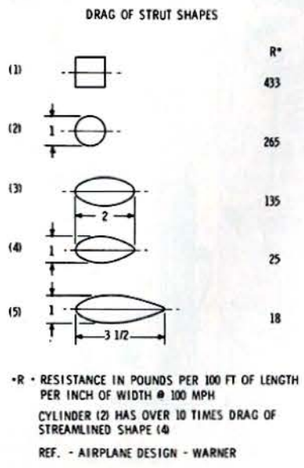


Fig. 2 - Drag of strut shapes

when tested under similar conditions. In the early days of testing, airspeeds were low and models were small. As speeds increased and larger but otherwise identical models were tested, results were similar but C_d differed. This led to recording the "Reynolds Number," a value based on size and speed. For example, a flat plate of 1 sq ft area will, at low airspeeds, have a C_d of 1.00. At high speeds it will increase to 1.28. The latter value $C_d = 1.28$ is most commonly used. Sometimes the drag of a shape is compared to the drag of a flat plate by quoting "equivalent flat plate area."

Fig. 3 illustrates two extremes in shapes. At the top is shown flat plate and below a streamlined shape (like the fish) of the same cross-sectional area. We can compare these directly by reading the C_d values. The streamlined shape with $C_d = 0.04$ has but 1/32nd as much drag as the flat plate with its $C_d = 1.28$.

Even though a shape may have smooth, curved contours, the drag may be high if the contours curve too rapidly, causing flow separation from a smooth surface. The so called "fast back" tops of some American sedans and many European G. T. coupes illustrate this point. The airflow separates because it cannot bend downward as fast at the body surface -- thus causing turbulence and high wind resistance. The contour must curve gently, even if it ends abruptly at the rear, if wind resistance is to be kept low.

Skin Friction and Surface Condition - Skin friction is caused by the air somewhat sticking to the surface as it flows rearward. This slows it down next to the surface, like water at the banks of a stream. This portion of air is called the boundary layer. The boundary layer acts like little rollers and builds up thicker and more turbulent as it moves rearward. A smooth continuous surface keeps skin friction low. A polished surface is better. While this helps, this element of wind resistance is of itself considered a minor factor on an automobile, except for highest speeds with streamliners. Low skin friction can, however, be quite important in critical areas to delay flow separation.

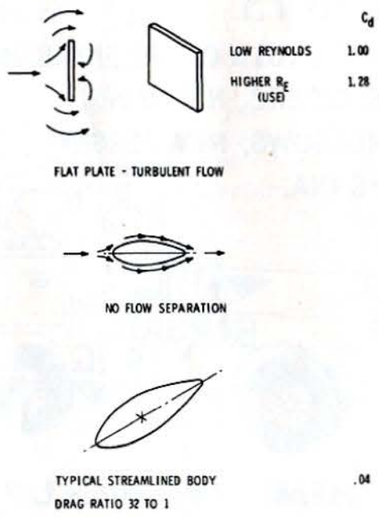


Fig. 3 - Air drag extremes in shapes

It is quite difficult to keep the surface completely smooth due to windshield frames and recessed windows, gaps, drip moldings, mismatch between parts, and sharp corners. This causes a rapid build up of the boundary layer and frequently will cause airflow separation and more turbulence. This is of a higher order of importance than skin friction and should be given careful consideration. Windows should be flush with the surface and rip moldings eliminated. The windshield should be well rounded into the side windows to avoid airflow separation caused by sharp corners. The top should curve down tangent to the windshield surface for the same reason. If airflow separation occurs at any point, it will spread for some distance rearward before returning to contour. If the contour curves away too rapidly, airflow will continue separated and never return, thus causing high drag.

Exposed - Poorly Defined Surface - The rugged, exposed underside of an automobile somewhat follows the frame but can hardly be called a surface as such. The frame and its cross-members, outboard brackets, springs, bouncing axles, suspension arms, steering rods, levers, and other exposed parts are real wind catchers and tear the airflow so badly that this under side of a car is a major source of wind resistance. A smooth, full length belly pan offers an immediate and worth-while major aerodynamic improvement. This element of wind resistance is frequently discussed as interference drag. We put it here because it is corrected by covering with a smooth surface -- the belly pan.

Protuberance on Surface - Unfortunately, an automobile has many protuberances from its surface and these add up to a great deal of wind resistance. The wheels extend below the body, and the front ones are steerable -- thus requiring additional clearance on the underneath and to the sides of the body. Other items are bumpers, outside mirrors, door handles, fenders, headlights, and even the wide windshield protrudes from the basic body shape. These items usually add to the frontal area and certainly disturb the smooth flow paths of the air. As far as possible, these items should be blended into the smooth contours, eliminated, or made as small as practical.

Interference Drag - As the air flows around, or over, an object it must speed up to cover the greater distance of the curved surface in the same time adjacent air flows along a straight path. Any object in the path of the curved airflow will then have more wind resistance because of the relatively faster airflow. A well streamlined rear vision mirror located on the fender near the side of the windshield,

continued on page 59

big inches cost money, but how they run!

STROKE to *STREAK*

There is no doubt that stroker kits have come on like gangbusters in the past two years. For a long time, stroking was one of the more exotic engine operations that was talked about and rarely understood by the average hot rodder or super stock fan.

All engines are rated on a basis of factors that determine the cubic inch cubic inch displacement. The two displacement of an engine, are the cylinder bore and the stroke. Stroke is the distance that the piston travels up and down in the cylinder bore. If the piston travels down further, naturally it will be able to draw in more of the fuel air mixture and develop more power.

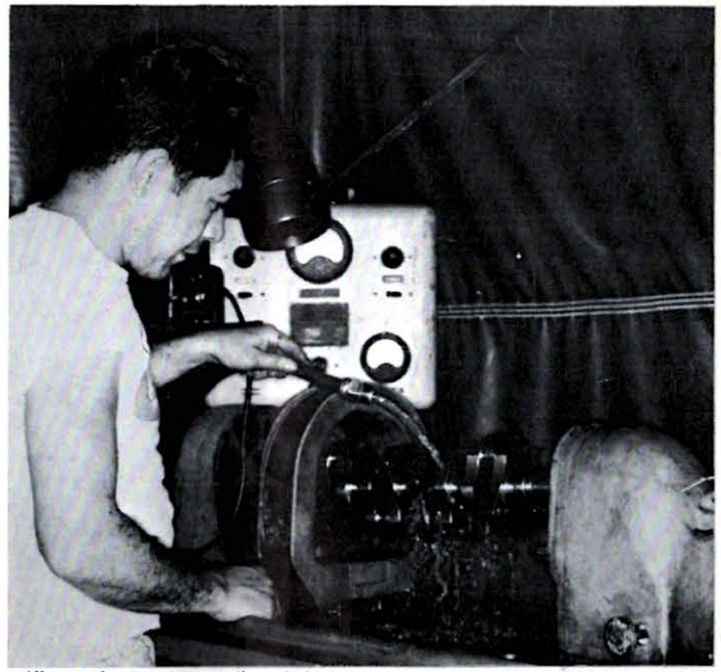
Almost all racing classes are based on cubic inch displacement classifications and it's been said that there is no substitute for cubic inches. Let's put it this way, there is a substitute for cubic inches. Unfortunately, it's cubic money. Big engines tend to run better than small engines. The bigger the engine the more there is to work with. This fact has been proven time and time again and it can be illustrated quite easily by looking at the current cubic inch displacements of popular American engines.

A few years ago, in 1955, the Chevrolet V-8 was 265 cubic inches and now Chevrolet has a V-8 available which displaces 427 cubic inches. At one time, the Oldsmobile with 324 cubic inches was considered a Goliath of engines. Now small Chevrolets have 327 cubic inches and some of the new Lincolns have over 460 cubic inches. Chrysler Corp. is not far behind, they have engines with 440 cubic inches! These big engines generally can work slower and still produce the same output, as a small engine which is working hard. You can just figure out what happens when you get the big engine to work hard. Stand back, man, you've got a tiger on your hands.

Few people realize the work that goes into making a stroker crank. Often it is possible to increase the displacement of your engine by buying later factory crank shafts, rods and pistons. For example, the 265 inch Chevy got an 1/8 inch bore and became a 283 Chevy, then it was bored a little more and stroked a little bit and became a 327 inch Chevy. A lot of guys felt they could take this 327 inch crank and just drop it into their 283 block and with a slight 1/8 inch bore job on the 283 block, that they would have a 327. Well, they were faked out. While the crank will fit the block it requires extensive work on the counter weights for it to clear the block. Generally, it's cheaper to buy an engineered stroker kit assembly. One of the leading suppliers of stroker kit assemblies, is the world renown Crankshaft Company in Los Angeles. Crankshaft Company has a long and enviable history of grinding the cranks on every Indianapolis winner since 1946. Their machining is at space age tolerances but it still fits a hot rodder's budget.

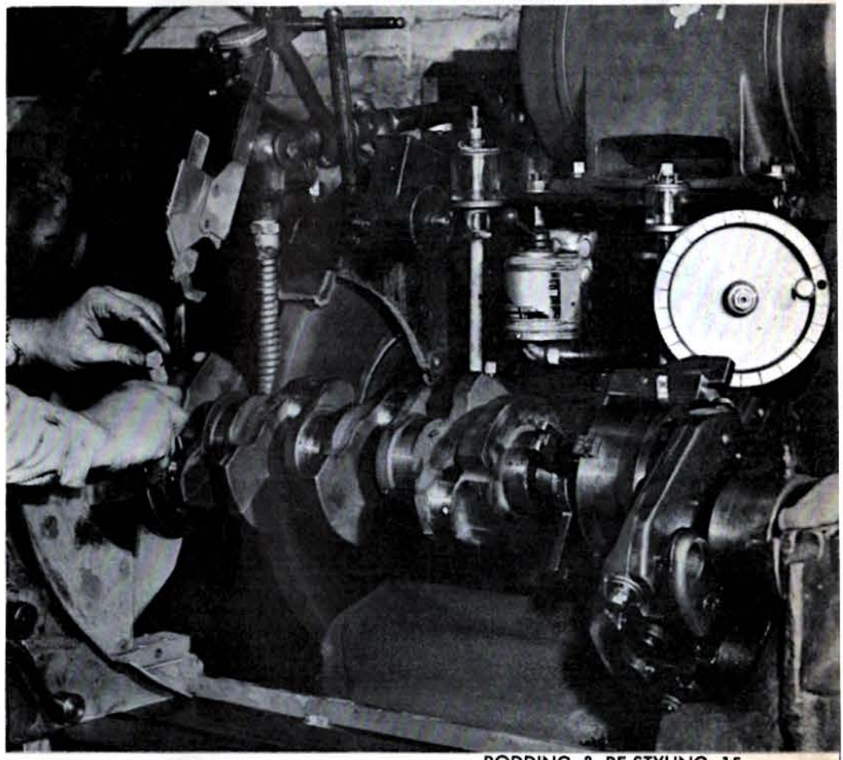
Some of the operations that go into making a stroker kit are extremely delicate, and extremely exacting. It is not something that is that any klutz who can weld should attempt. It requires a good deal of skill and when you're sinking that much money and time into an engine, it doesn't pay to to fool around with any second rate Mickey Mouse equipment.

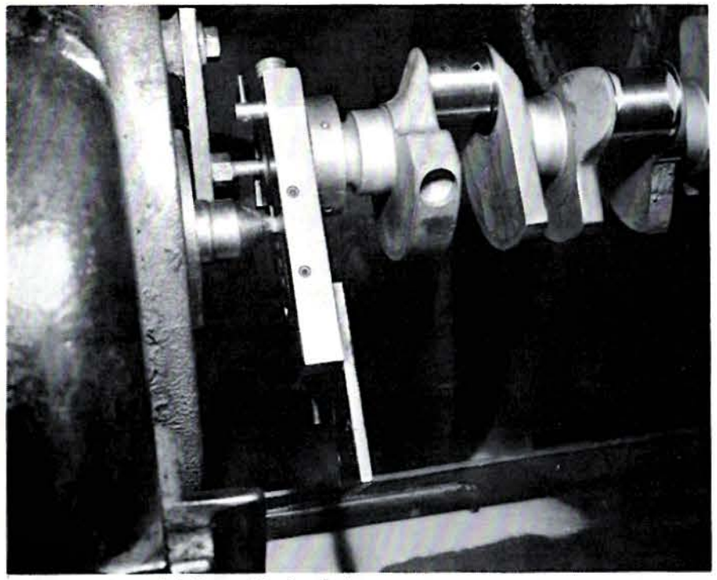
Let's take a tour through Crankshaft Company and see how they rework a typical stroker crank. Crank shaft cores are either sent in by a customer who desires to have his crank shaft stroked or they are purchased from a wrecking yard, or in some instances they are bought new. When the crank arrives, it is cleaned and checked. The first way it is checked is with a magnetic inspection, by means of magnaflux and zyglo. This makes it possible to determine if the crank shaft has any invisible flaws that will make it unsuitable for racing use. If the crank shaft passes the magnetic and zyglo inspections, it is then put on a grinder, and the centers on each end of the crank are cut to make cure the crank



All cranks are magnafluxed before any other operations are started.

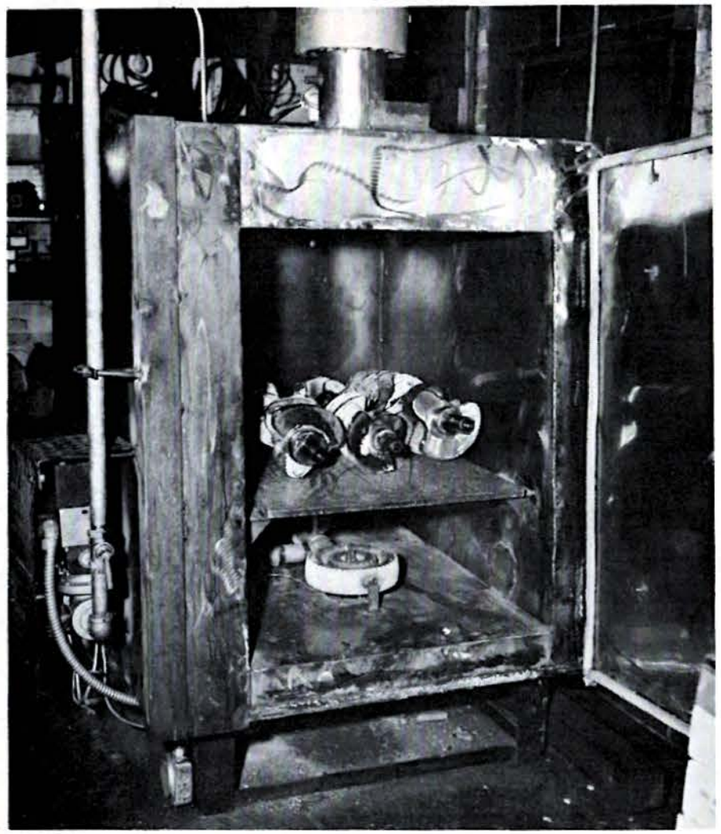
Crank is placed on grinder and checked for accurate dimensions.





Close up of special throw blocks that are used to index the cranks.

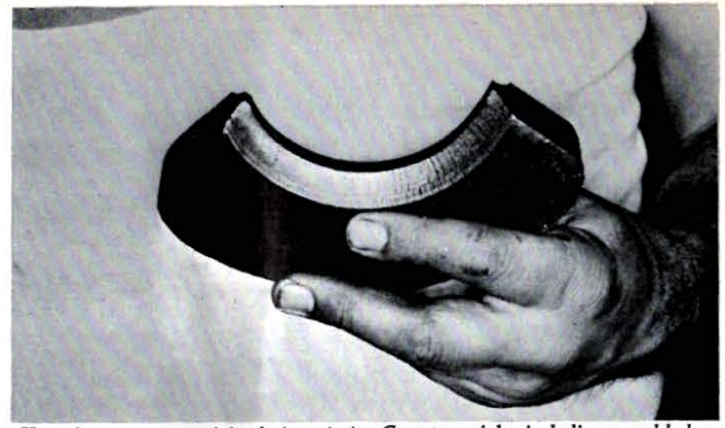
Huge oven is used to heat treat the cranks before and after they have been stroked.



shaft runs true. This is critical because more often than not, the stock factory crank shafts are not ground exactly 90 degrees apart on the throws as they must be in a V-8 engine. There will be some variation on stock cranks and quite frequently the crank itself will not be straight. This is because of the mass production tolerances which the car manufacturers must use. If each crank were to be checked to such exacting standards, it would probably increase the cost of the car another $300.

After the ends of the cranks are cut to run true, counter balancing of the center main is usually done. This counter balancing reduces the flexing of the crank shaft and increases main bearing journal and bearing life. Counter balancing in effect, puts a flywheel in the middle of the crank shaft and prevents the crank from whipping at high r.p.m. No matter how short the crank shaft is, at extreme high r.p.m. operation, it will tend to whip, and this center counter weighing does away with this tendency. Not all cranks are ordered with the counter weights but most all of the winning ones are. Counter balance is put on by Heliarc welding. The welded area is machined smooth and all tool marks are ground off and polished. It is extremely important that any tool marks or grinding marks be removed from the crank shaft. If they are not, they can lead to stress buildup in these areas and eventual cracking of the assembly. Now that the crank has been counter weighed it is ready for the actual welded stroker assembly. The oil holes that go through the bearing journals are carefully marked and filled with carbon. The crank is then coated with a special secret Crankshaft Co. compound to protect it against weld spatter. Whenever a bearing area is being welded up to increase the stroke, there is always a chance of spatter from the electric weld landing on the other counter weights. This again may have the same detrimental effect as tool marks or chips and will cause cracks to form. The crank is put in a giant oven, and heated to over 400 degrees Farenheit. This heats the crank completely and allows the weld to be worked on with little problems. If the crank were ever welded cold, there would be a distortion of the crank shaft by the heat of the welding arc. A 400 degree heat tends to normalize this and prevents the crank from being distorted. The throws are built up with an arc welder. A special welding rod that is compatible to the crank shaft is used to build up the welds. After the welding operation is finished, the crank is then put back in the oven and heat treated to over 400 degrees Farenheit to normalize the crank and to remove any stress that may have been put in the crank by the welding. After the oven treatment, the crank is taken out and straightened. Very frequently, the crank, in spite of the heat treating, will not be 100% straight. Straightness in a crank is absolutely critical and the crank must be straightened. If the crank can not be straightened, it is immediately discarded. Now comes the critical part of the operation, the throws must be accurately ground with high precision grinding wheels. These wheels must be clean and in good balance and accurately dressed in order to get a good finished bearing surface. Before the crank can be ground correctly, it must be indexed. This means that the key way, where the pulley is put on in front of the crank shaft, is used as a reference point and is checked on a special surface plate with special throw blocks and index fixtures. This insures that the stroke is held accurate within .001 of an inch. The throws are ground within a ¼ degree of 90 degrees apart. If this were not done, some cylinders would have a longer stroke than others and the engine would be unbalanced. Only after these absolutely critical operations can the crank be used for successful racing.

After the first coat of slag has been ground off the throws, the oil holes become visible, remember that they were filled with carbon to protect them when the crank was welded. The crank is inspected carefully and any low spots, which are apparent after the first rough grind, are then rewelded with compatible material to insure a complete round bearing surface. If the crank is hard chromed, (about 80% of the better stroker kits are, because hard chrome gives a very good bearing surface, and it's well worth while for longevity,) the throws are ground .015 under standard and the mains .008 undersize. The hard chroming will build up the difference between the desired final bearing surface and the current dimension. After it's completely hard chromed on the bearing surface, the crank is heat treated, then

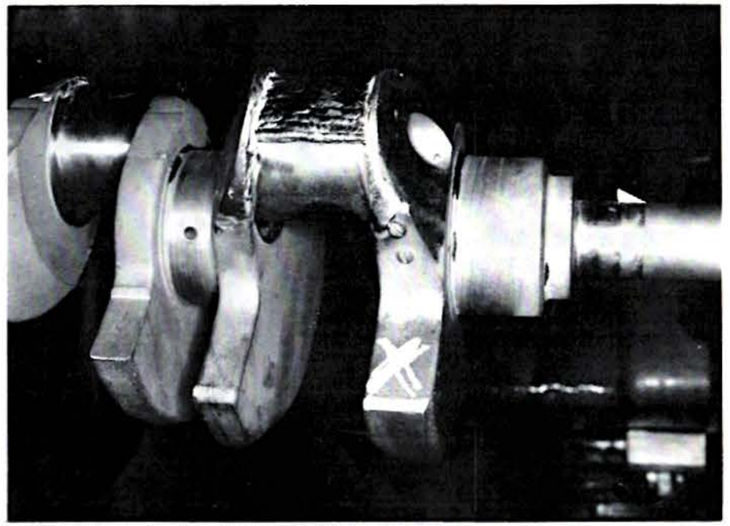


Here is a counterweight before it is installed.

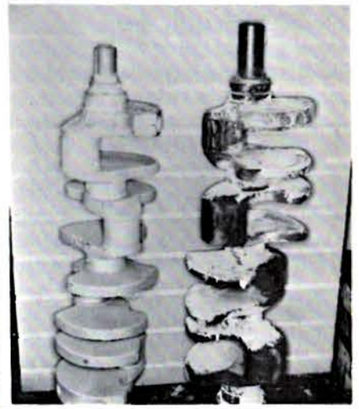
Counterweight is heli-arc welded on each side of the center main to eliminate crank flexing and extend rpm range of assembly.

the hard chrome is ground down to the standard crank shaft diameter. There is yet another step before it is removed from the fixture. The crank shaft flywheel flange must be faced so that it is square with the center line of the mains. This is critcial for good clutch operation and/or to insure adequate life from an automatic transmission. If the flywheel flange on the crank shaft is not in line, the deflection will put undue stress and strain on the transmission components. Not only will an out of round flange put undue stress and strain on the transmission components, but by being out of line, will put an additional load on the crank shaft itself and could lead to breakage. After the crank grinding operation is fully finished the oil holes are chamfered to make easy exit and entrance for the oil and to make sure there is no slag. The holes are checked to be sure they are round and of the proper size. The crank is then polished to the correct journal size with the proper surface finish. The crank then is given a final inspection and boxed for shipment.

All of the forged crank shafts are guaranteed indefinitely against the welds ever peeling off the throw area. In the older days of hot rodding, crank shafts had to be built up with a metal spraying technique. Metal would be actually sprayed onto the crank journals. There were many problems with this method. While it makes up for worn surfaces and gives a stroker effect, more often than not, the metal spray was not compatible with the original crank shaft material and it would split or peel. This has been completely eliminated on welded strokers by the use of special alloy welding rods. All of the forged cranks, with the exception of Chrysler products, are guaranteed for 120 days against breakage. All cranks are guaranteed against peeling. Cast iron cranks, because of their lack of strength, are not guaranteed against breakage. Crankshaft Co. has come up with a major breakthrough called an ultra-duty-radii. This ultra-duty-radii consists of a gentle curve from the bearing surface to the crank shaft counter weights. The smooth, curved parting area rather than a 90 degree parting line, prevents the crank from cracking in this critical area. By giving this area a small curve, it breaks up any stress patterns that may be form-



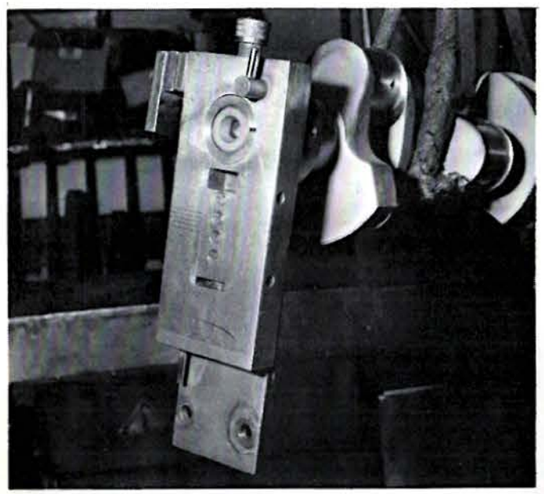
Bearing journals after initial welding operation.

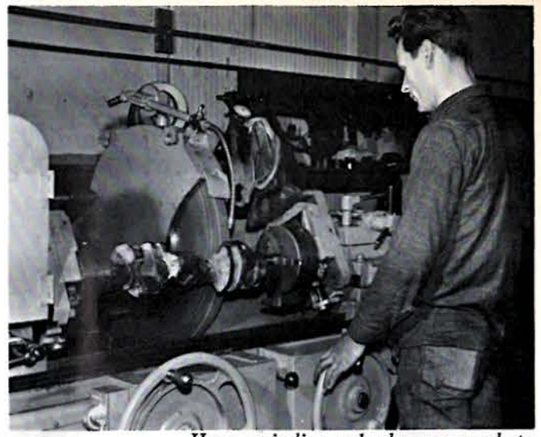


Crank on left has been cleaned and vapor blasted. Crank on the right is shown after rough welding operations have been completed.

Crank is checked for straightness and slag is ground off.

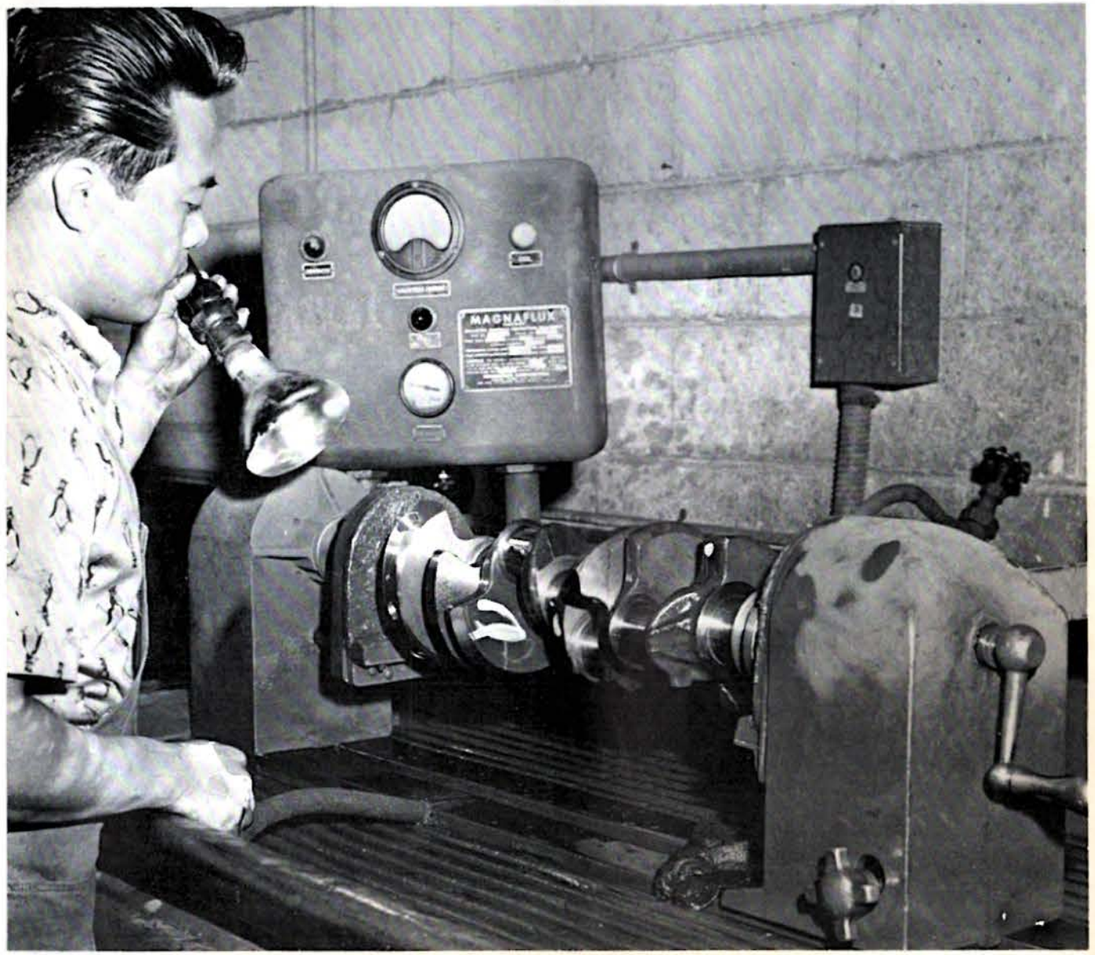
Cranks are positioned on special throw blocks to insure that the throws are ground 90 degrees apart.

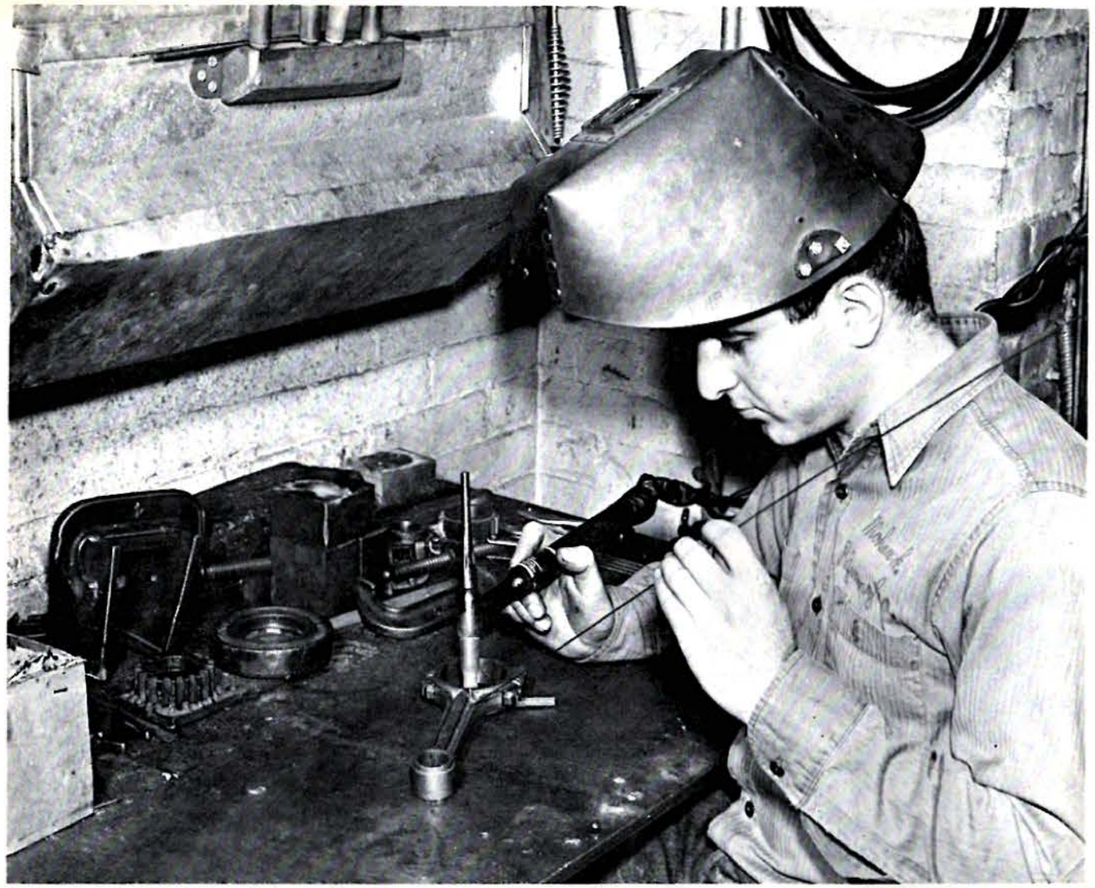




Huge grinding wheels are used to grind down the welded journals.

Crank is magnafluxed after grinding. Magnaflux shows up any hidden flaws that are not visable.

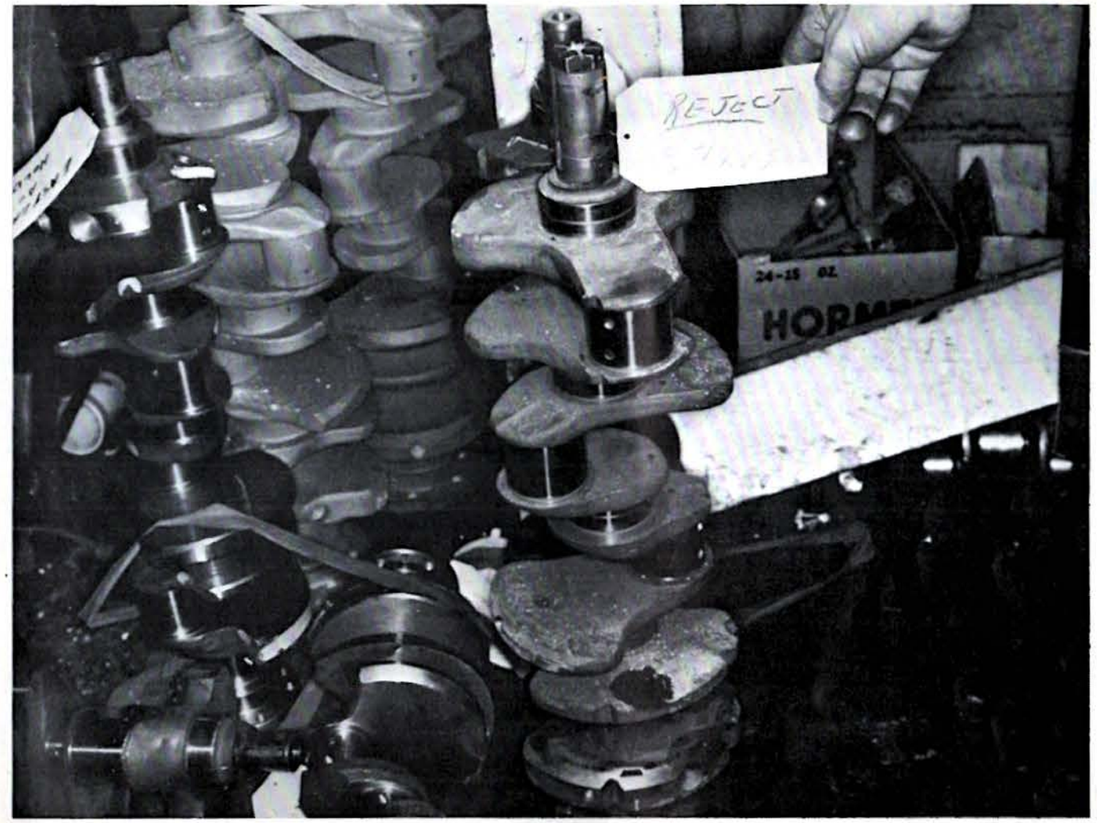




Rods are reinforced by heli-arc welding a rib in the middle and then heat treating the entire rod.

Here is the custom chrome-vanadium rod that costs over $400 for 8.

Here is a ribbed rod after it is finished.



ing there, and tremendously increases the life of the crank.

A stroker kit just doesn't end with the crank shaft, it must have a compatible set of pistons, connecting rods, bearings, piston pins, and piston rings. Crankshaft Co. can supply reworked rods.

When it comes to beefing stock rods they prefer using a chrome moly rib in the rod, and then heat treating it and straightening it. They feel that this gives the best durability with stock rods. Naturally, aluminum rods have come on rather strong in the last few years, and maybe you prefer to use aluminum rods. Aluminum rods are completely compatible with any of these cranks. The Crankshaft Co. has for Chevrolets, a special set of chrome vanadium steel rods, which are virtually indestructible. The only problem with the chromé vanadium rods is that the price is also indestructible. The list price is $418 a set. Not too many people are running these chrome vanadium steel rods, except for the top notch running Chevys. Unfortunately, one gets what one pays for and these chrome vanadium steel rods probably are the ultimate rod for an all out Chevy engine. The aluminum rods will work almost as well but not for quite as long. If you run the engine long enough it's cheaper to go for the chrome vanadium rods. On most other engines though, it is not necessary to go to an exotic rod and because of the tremendous interest in late model super stock and FX racing, the factories have made available heavy duty rods which are far superior to the rods that were used just a few years ago. Chrysler Corp. has a special heavy duty rod that can be adapted to most other cars without too much trouble. Ford also has a special heavy duty rod and the late Chevrolet 427 and 396 engines have an extremely strong and rigid rod.

Probably the thing that makes the stroker kit from Crankshaft Co. better than most, is the tremendous amount of inspection and quality control. As you can see by one of the photos, they have a pile of crank shafts that are rejected. When I went through their shop it was very heartening to me to see a pile of cranks in the reject pile. I had gone to some other shops and I never saw any rejected cranks. Quality control is extremely critical in the crank shaft area. When you're turning 7000 rpm or 8000 rpm that crank is really cranking and if it lets go, it can wipe out your whole engine. It's not like a distributor cap rotor or a valve spring retainer or a push rod breaking.

As each particular racing engine has its own special application, there is nothing that can be recommended for all uses. If you have a particular problem, your best bet is to consult with your local speed shop and if he is a knowledgable person he can probably steer you past the pitfalls that inexperienced people might make. If you can't get good expert advice locally, your best bet is to write to Henry Betchloff at Crankshaft Co., 1422 So. Main Street, Los Angeles 15, California. Don't forget to tell him that we sent you.

ENGINE SWAP:

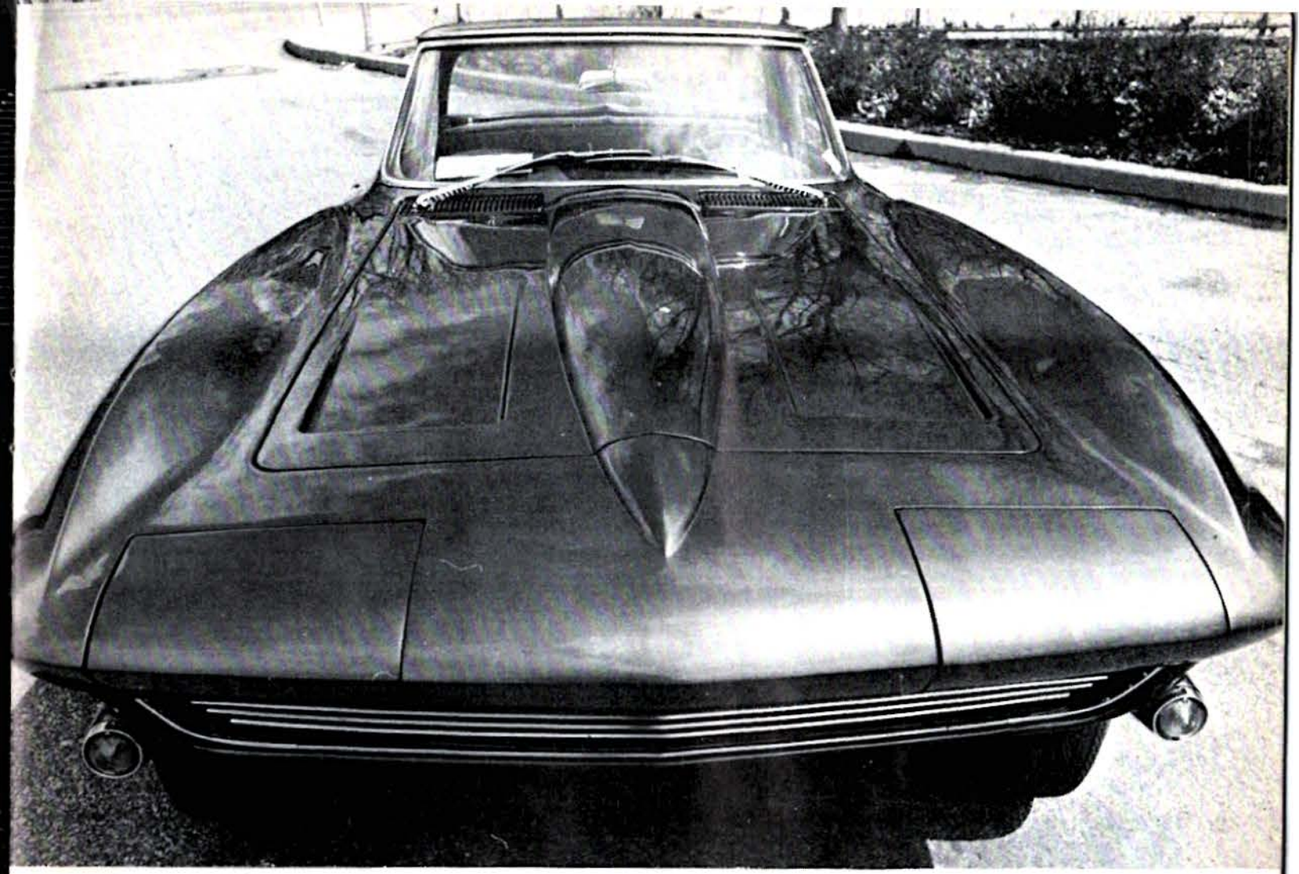
421 Pontiac powered Vette

replace that tired small Chevy with tiger power!

MOST people have been fairly well satisfied with the performance of most Corvettes. They were originally available with 283, 327, 396 and now 427 engine. All these engines have had performance which was adequate to keep them up with the stock cars of the same years. However, hot rodders are never satisfied and as such they want something bigger and better at all times. This month's feature car is a Corvette Sting Ray powered by a 421 cubic inch Pontiac engine. To say that this combination runs is putting it mildly.

Two all time Pontiac fans, Harry Wesh and Werner Kniesel decided that Pontiac was the way to go. After having run a variety of '58, '59 and '60 Pontiacs as well as some '62 Pontiac 421 Super Stockers, it was only natural that their faith in Pontiac engines would lead them towards this very potent swap.

Werner's experience with Pontiacs goes back to a '58 Pontiac he ran in automatic E stock class. He turned a low of 14.2 seconds and a high of 102 miles per hour. When you consider that this car was a legal stocker, and still managed to pick up sixty trophies, and that during the three years in which he owned the car he never lost, you know why Werner has a lot of faith in the big Pontiacs!

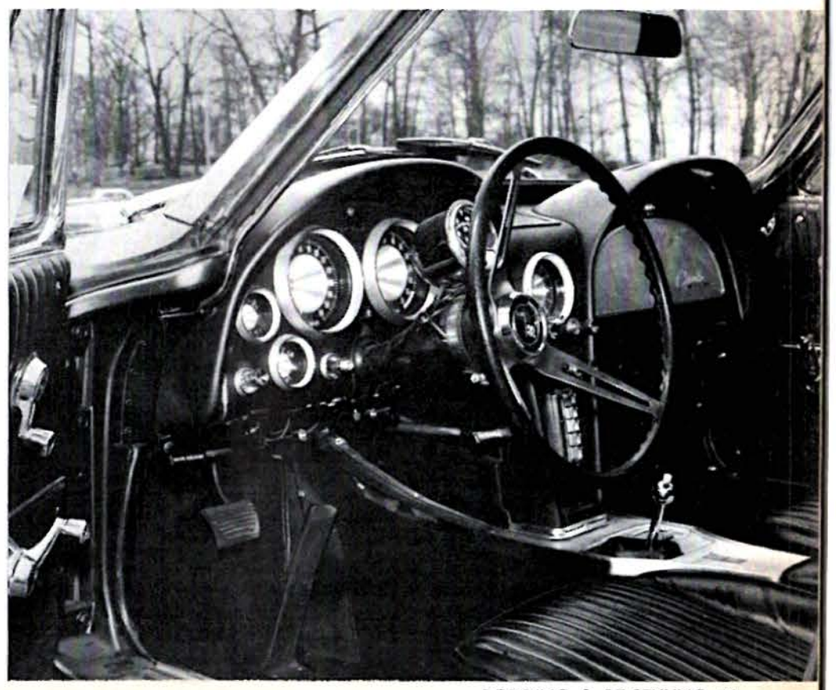


Harry is another old time Pontiac fan and he's run everything from Super Stock 421's to super charged G T O's.

When it started out, Harry was the owner and Werner was helping him work on it. When the car was finished, Harry sold it to Werner.

Fabricating the special motor mounts and exhaust system required by the swap was done by Benny of Benny's Speed Shop, Forest Hills, Queens. Benny's expert welding greatly simplified the installation.

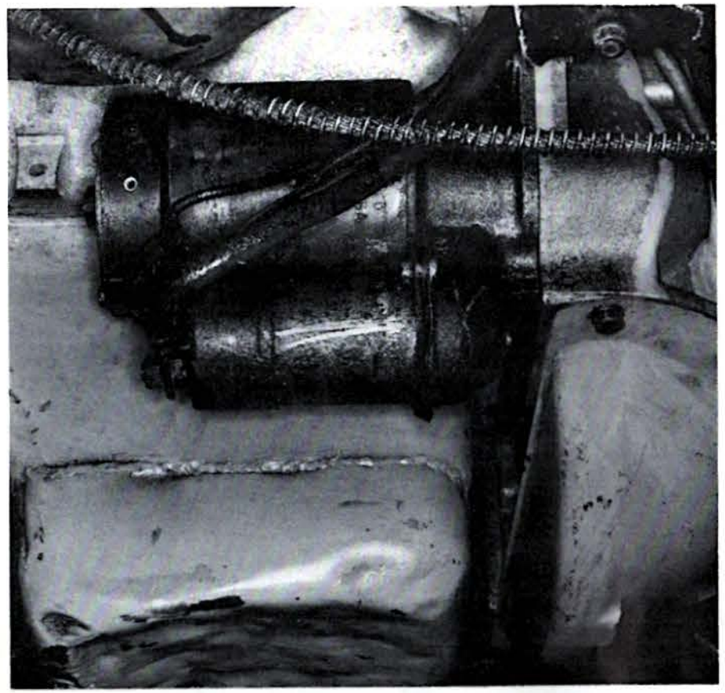
The car is run in the B Modified Sports Class and it turned 118 miles per hour in the quarter with an ET of 12.6 seconds. The car weighs in at 3,130 lbs. Looking quickly at the car from the outside it is impossible to tell that a big giant Pontiac lurks under the hood, and it's been a consistent money maker on the street. Quite a few 327 and 396 Corvette owners have felt the sting of this 421 powered ray.



Front motor mount was welded to Corvette frame.

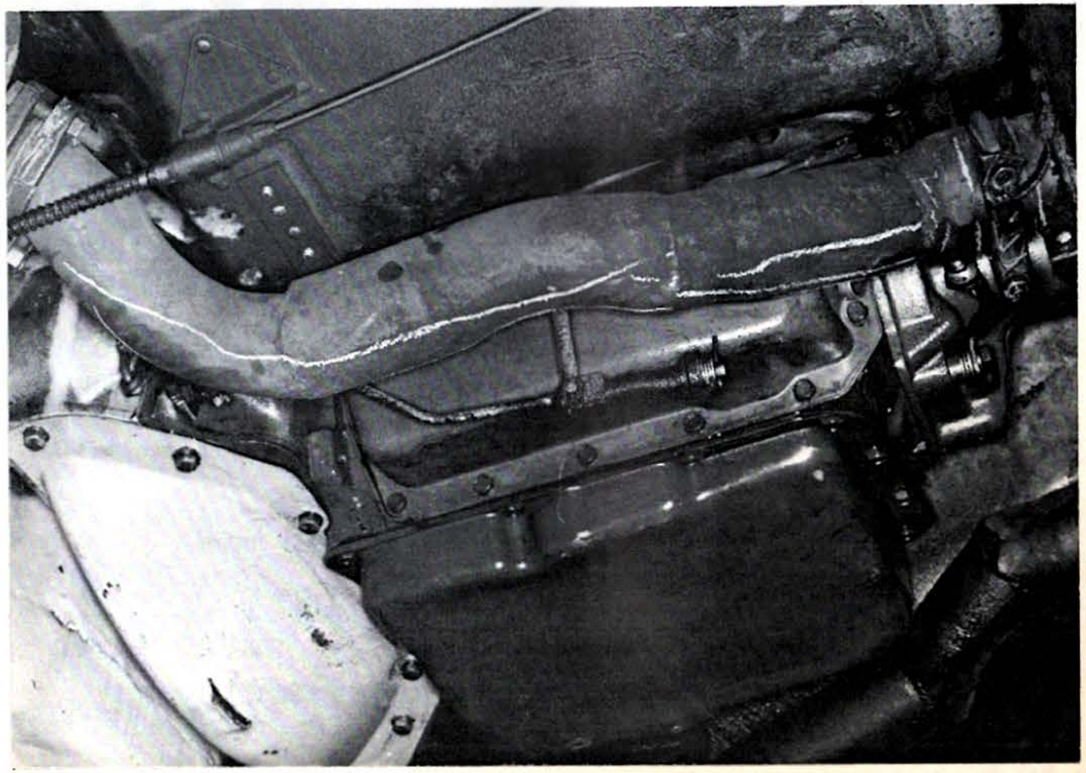
The engine is a '62 Pontiac super duty block, which displcaes 421 cubic inches. This is one of the original Nascar racing versions and found its way into the 'Vette from one of Harry's stock cars. It has 2.02 intake valves and the exhaust valves are 1.96 inches. A variety of cams have been tried and the ones that have worked out the best have been a #12 McKellar and an Isky 505 Magnum roller. The pistons are stock forged aluminum Pontiac units, while the rods are Mickey Thomson forged aluminum. The '62 super duty Pontiac heads have been giving a super valve job and the heads have been milled to give a 12 to 1 compression ratio. All of the combustion chambers have been carefully matched. The intake system consists of two Carter AFB Nascar type four barrel carburators on a Pontiac aluminum high riser intake manifold. Ignition is handled by a Mallory Mini-Mag magneto. This magneto fits right in with plenty of clearance in the cowl area and gives adequate performance at all engine speeds. The exhaust system consists of two inch tuned headers, again built by the welding expert Benny. It features a three inch collector with removable caps. They are routed back to stock mufflers. The car is quiet enough to be driven on the street with no indication that it has a 421 Pontiac under the hood. To transmit this power to the rear end, a very reliable Power-Shift hydro, made by Vitar Engineering Co. was chosen. The hydro is a full competition unit designed for blown engines. It has given flawless service in the past year and a half.

Huge 2½ inch exhaust pipes run from the collectors to the mufflers.



Heavy duty 421 Pontiac starter fits on the B-M adapter.

Throttle pressure linkage is easily adjusted on the hydro. Note how exhaust pipe was bent to clear the linkage.



The '55 Olds hydro which has been completely reworked by Vitar is connected to the engine by means of B-M adapting unit.

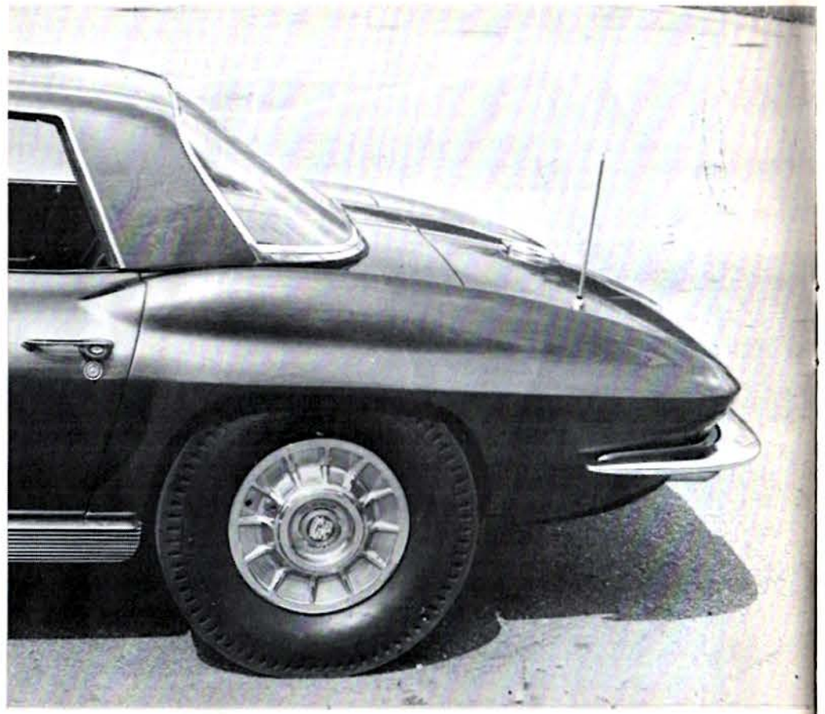
Both Harry and Werner agreed that the commercially available hydramatic shift linkage was pure garbage. They chose a shift linkage from a Starfire Oldsmobile with a center console. This has worked out the best and has given them no trouble at all.

The front engine mount, which has been welded to a special mounting pad on the Corvette cross member was from a '58 Pontiac. Two side mounts have also been used.

To keep the car on an even keel '59 Chevrolet Station Wagon rear springs were used in the front end of the Corvette. They fit right in and balance out the additional weight of the Pontiac engine. Up front Cure-Ride shock absorbers feature 90-10 valving. They are the uplock models so widely used by drag racers. At the rear end are Columbus shock absorbers. Rear end ratio varies between 4.56 and 5.14. A Positraction differential assembly is used to assure adequate bite.

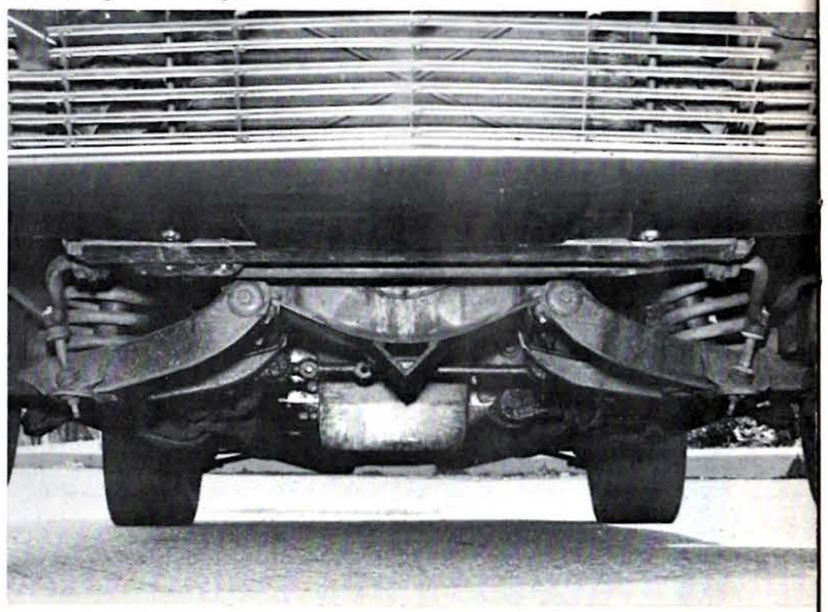
Another area where clearance was a bit tricky was with the oil pan. Benny reworked the oil pan to hold nine quarts of oil and also reworked the swinging oil pickup to insure that the engine would have an adequate supply of oil at all times. He dimpled in the front section of the pan to clear the steering linkage. The engine was completely balanced by Jack Merkel Automotive in Queens. The moderate exterior customizing consisted of removing the front bumper and modifing the grill, and painting the car a deep metallic blue. The paint was done by Metropolitan Auto Body Shop, Ridgewood, Queens.

No matter how you look at it, this is one Corvette that doesn't show what it has, but goes better than it shows. In other words, it is both a clean conservative looking custom, but yet underneath the hood lurks 421 tigers ready to gobble up any stock Corvette around!



7.60-15 Racemaster slicks sit on the rear, they have been groved for street use.

This low angle shot shows the front end. Heavy springs from a Chevy wagon are used up front to balance out the big Pontiac engine.



Corvette power combined with Italian craftsmanship results in a Ferrari stomper.

ROAD TEST CHEVY POWERED ISO GT

A real GT machine from Italy

THERE is probably no doubt that the original hot rodders were the Romans. They were the first ones to run their chariots for a jug of wine through the Colosseum quite a few years ago. Italy has long been fabled as a land of wild cars and exotic automotive engines.

This month's road test presents an unusual combination of an Italian body and a big American Corvette engine. The Iso G T is a true G T car and it doesn't need to use the initials G T as a sales gimmick, as many American cars. This interesting hybrid goes for about $8,500, which is a little bit steep. But when you consider that you're getting an all out four seater, Corvette powered car that can cruise at 130 miles an hour, has a deDion rear end, and inboard disc brakes, you begin to feel that you're getting your liras worth.

The car is not too big. It has a wheel base of 106 inches and the overall length is 187 inches. The height of the car is 36 inches and it is 68.7 inches wide. It scales in at a comparatively hefty 3400 hundred lbs. on the curb. This is a little bit heavier than the Corvette Sting Ray. The dashboard is fully instrumentated and has gauges for about every conceivable thing you can think of including oil temperature. They are nice round, legible gauges which give you an instant appraisal of engine conditions. There are no idiot lights used in this car at all. The front seats are extremely comfortable and they are made of genuine black leather. Leather has a big advantage over

vinyl in that it allows a certain amount of air to pass through and it doesn't become sticky and sweaty.

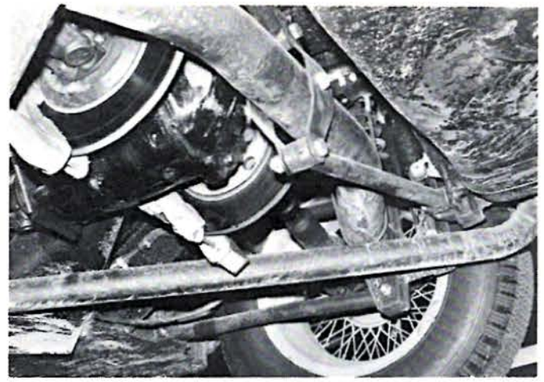
The overall quality level of the car is quite high. It's a hand built limited production item and you can expect that everything fits perfectly, it does! Front seat room is compartively comfortable. The car has excellent visibility all around. It doesn't have a fast back, as such, it has a sloping semi-notch back window which gives excellent visibility and it has narrow front windshield pillars. The styling is best described as smooth and round, like Italian movie stars. The front end does not have quad headlights, instead it uses two regular sealed beams. It has an adequate bumper and bumper guard, very nice grill, and a functional hood scoop which really works. The side has almost no chrome at all and the lines blend back to a smooth rounded back which is protected by bumpers for use in American parking by ear situations. The rear seats are big enough for two adults to be taken a short distance, roughly the same as sitting in a four seater Thunderbird. The car is really designed as a G T or a two passenger high speed touring car. The front seats recline similar to the seats used on the current Ramblers. Seating position and steering position are quite comfortable. There is one problem with driving the car, the steering rate is comparatively slow, it requires about five and a half turns lock to lock. The overall steering rate is 20.5 to 1. It's quite a bit slow. There is an optional 15.8 to 1, which is available. I think the 15.8 to 1 option is definetly worth while in this car. One other item of discomfort is the pedal position. It seems that many Italian cars have the pedals so close together that you need pointed Italian shoes in order to work them. Having a size 11½ E foot made it a bit difficult for me to manipulate the pedals. In fact, sometimes when I was pushing down the clutch for a speed shift it was overlapping a bit onto the power disc brake pedal. It made for tricky shifts to say the least.

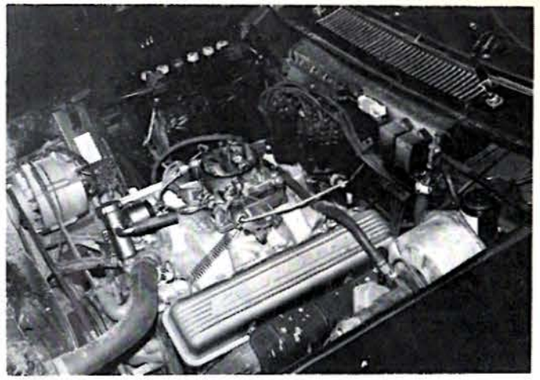
The engine in this test car was the well proven 327 cubic inch, Corvette 300 h. p. model with one large four barrel carburetor. Everybody knows that this is about as reliable a high performance engine as is available anywhere in the world. There is an optional version which gives 350 h.p., the same as is available in other Corvettes. The larger 427 and 396 cubic inch engines are not available in this car because of limited engine room and that the additional weight on the front end would make it handle like a pig.

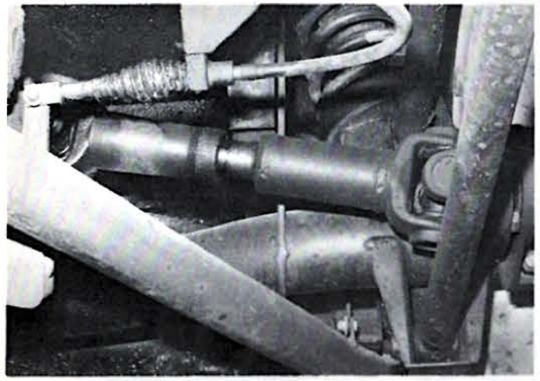
The car will not charge like a 427 Vette or street hemi. However, it is quite quick, we recorded times of under three seconds for 0 to 30, between 6.7 and 7 seconds for 0 to 60, and from 40 to 70 took between 3½ and 4 seconds. All of these times were recorded in first gear! The transmission is the Chevrolet close ratio box which uses the 2.20 first gear ratio. This is coupled to a deDion rear end, with a 3.07 ratio. The car is geared for top end and it doesn't seem that the 300 h.p. engine will ever be able to pull top r.p.m. in high gear. I think that a ratio of around 3.55 would probably be more suitable for acceleration and would give an actual higher top speed.

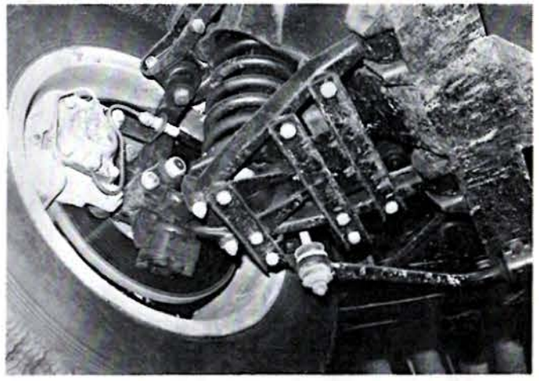
Coming off the line was a bit of a problem in that Pirelli tires were not the equivalent of a pair of Race Master slicks. The car could burn rubber quite easily even though it didn't have much overall gear multiplication in first. Once the tires bit, it sort of was a big woosh type movement and the car would accelerate extremely smooth and very, very quietly, almost like a high speed elevator. Shifts were very quick and positive and the clutch released smoothly and gave no trouble at all. The engine would turn over 6000 rpm with the hydraulic lifters with no sweat at all. Probably the most intriguing factor about the car is its absolutely fantastic braking ability. It has disc brakes on the front end and it has disc brakes at the rear. The rear brakes are mounted inboard very close to the differential housing. The braking has to be experienced to be believed. It's almost as if a giant hand reached down and stopped the car. It doesn't sway or skid or lean, it just stops the car like mad. It's really wild. The brakes are probably better than the four wheel disc brakes on the Corvette.

While the car won't go as fast as a 427 Sting Ray or even corner as well, it does have advantages in that it is a four seater and the body style is quite beautiful. The body is built by Bertone and the car is assembled by an Italian industrialist by the name of Renzo Rivolta. An interesting touch is the horseshoe emblem on the front hood. When we inquired as to why Rivolta chose this horseshoe emblem, whereas Ferrari has a prancing horse, we were told that the horseshoe indicates luck and also it's the part that's used to kick the other horse in the rump. This Iso will probably run with any Ferrari, that sells in the $8500 price class, if there is such a Ferrari. It's an all around, top notch, G T car in the true sense of the word. The rear end is quite note worthy. It's a 3.07 ratio with a Salisbury limited slip differential with inboard disc brakes. We haven't seen the equivalent on any car which goes for under 12 grand. The deDion rear-end design features independently sprung rear, with sliding spline axle shafts. The rear end









DeDion rear end features inboard didc brakes. Car has the best brakes of any car I have driven!

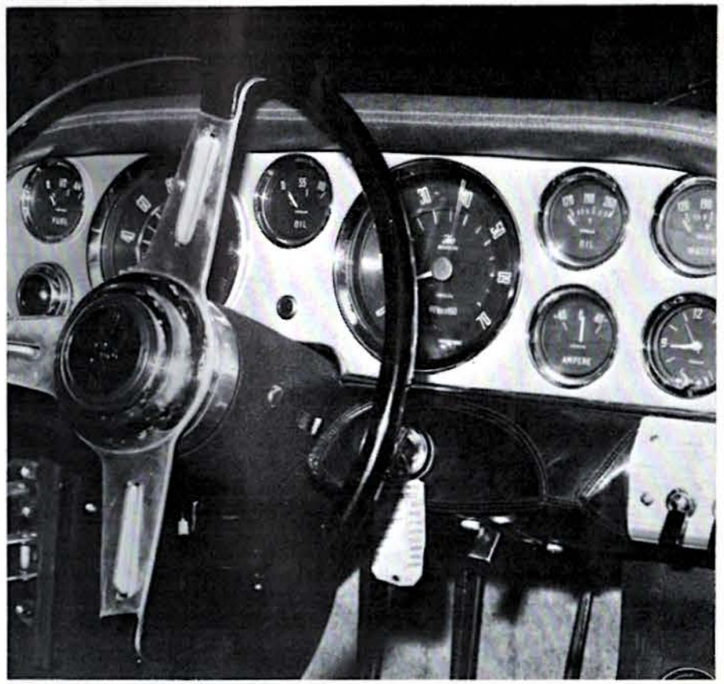
Reliable 300 hp Vette motor is standard. The 350 version is available on an optional basis. Engines are 100% stock Chevy.

Axles are tubular with sliding splines. Coil spring suspension is used on the rear end. Note the huge sway bars.

Mufflers are mounted near rear bumper for better weight distribution.

Independant front end has Girling disc brakes, knock off wheels.

Your chances of finding idiot lights here are about as good as finding flat chested Italian movie queens in Hollywood.



is located by longitudinal and transverse rods.

The car is much smoother riding than any Corvette has ever been and probably ever will be. All around it's an excellent compromise vehicle if you have $8,500. The chief reason this test was incorporated in the magazine was to show you how far the Chevrolet engine has reached. The Chevy engine is regarded as a masterpiece in design, both in America and in Europe. In the land of Ferrari and Lancia and Gina Lollabrigida and some other exotic machinery, it's interesting to note that the Corvette engine is first choice in a first choice car.

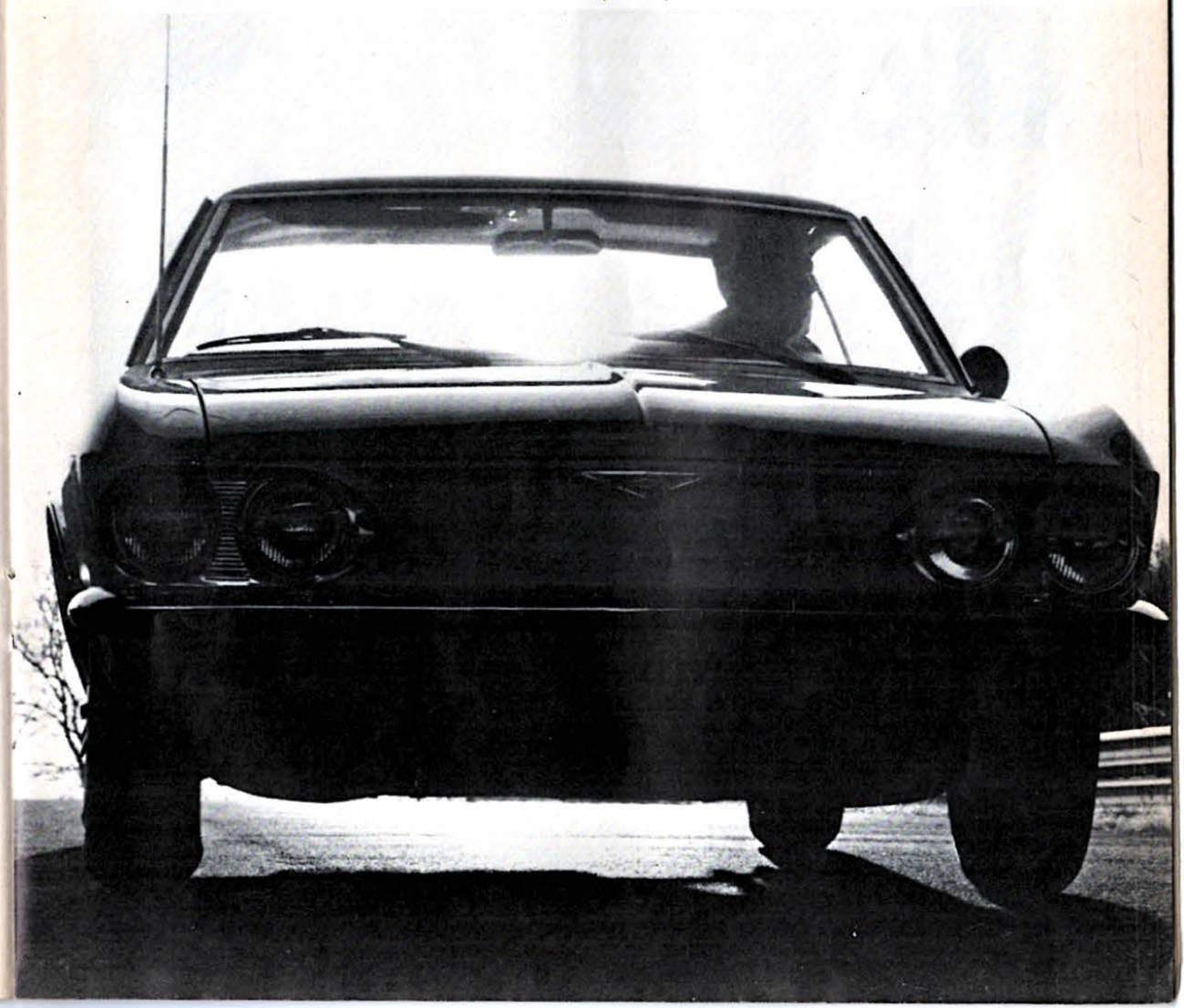
The car is imported by Malcolm Konner Chevrolet of Paramus, New Jersey. Malcolm Konner has been in the automobile business since about the time of Henry Ford and he stands fully behind the car and he stocks a complete line of body parts for it. Naturally, the engine and transmission can be serviced at any Chevrolet dealership. The rear end seems to be of the indestructible variety and quite likely won't require much servicing

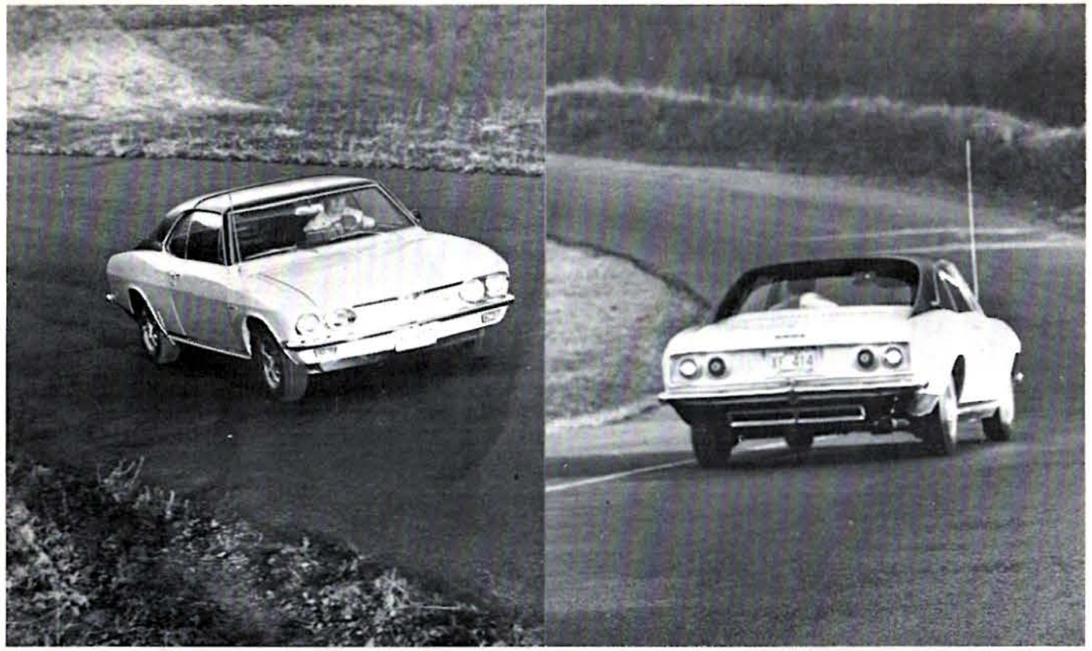
For any of you Corvette fans who maybe have a few little kiddies who don't quite fit in the back of your luggage compartment in your Sting Ray Coupe, the Iso G T may be the way to go.

ROAD REPORT:

Corvair Corsa ala John Fitch & Co.

The Corvair finally arrives!





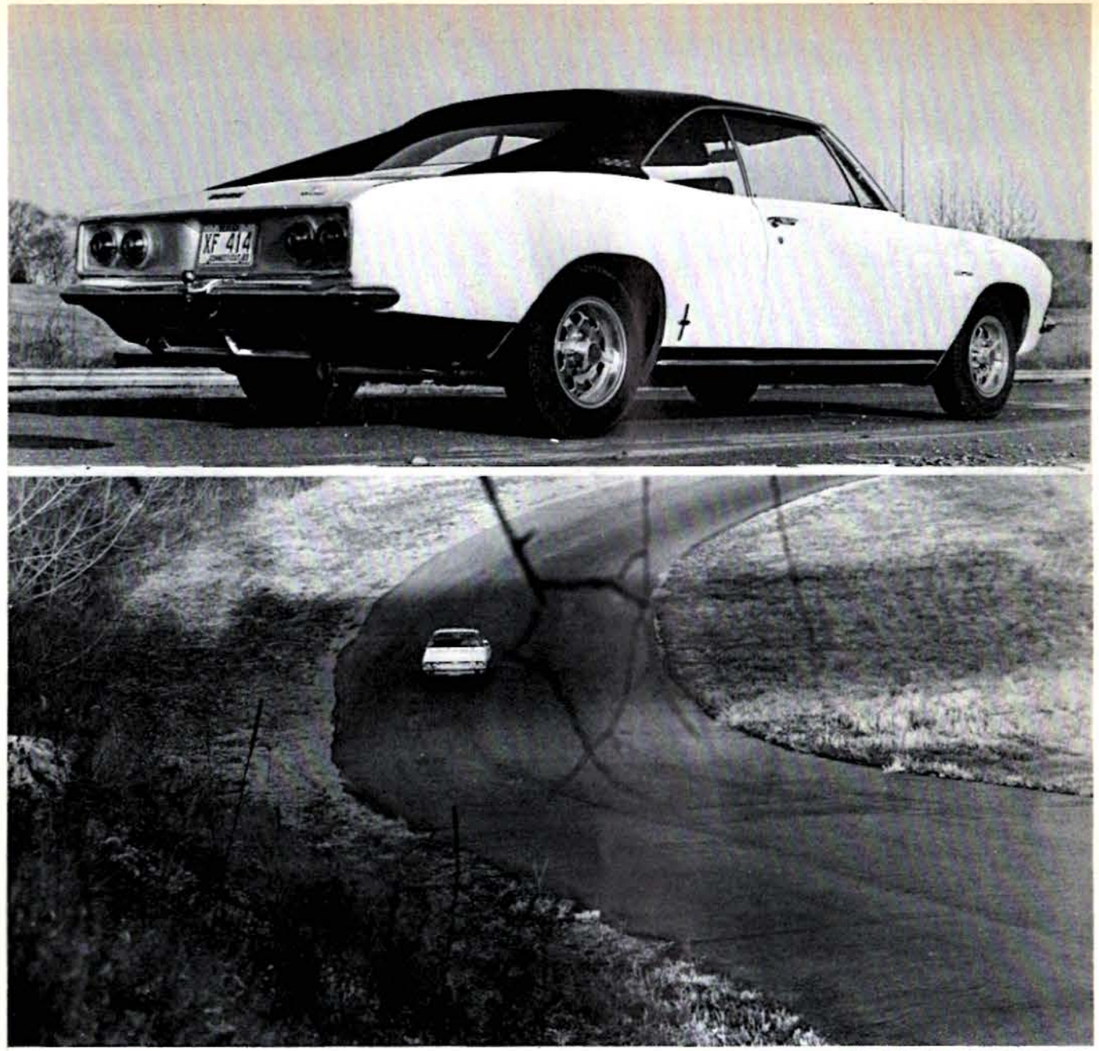
THE small town in northwestern Connecticut which goes by the name of Falls Village, is a rather unlikely place to find a modified Corvair. Actually Falls Village is a few miles from the famous Lime Rock road racing course. It's the home of John Fitch and Co., who have been making the Corvair into a civilized car.

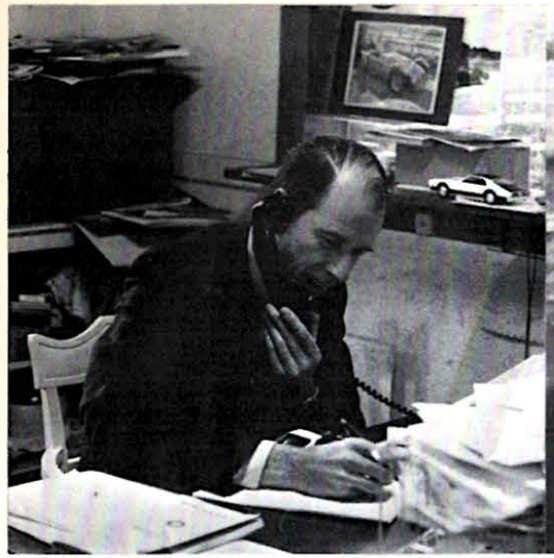
For many years the Corvair has been an enthusiast's play thing. Fitch, who is a driver of international renown competed in races the like of LeMans, personalized the Corvair to his own particular likes. He has come up with an over all package that is really fantastic when you consider the price of the whole deal is under three grand. The end result is not a tire frying, straight line beast, but a car that embodies quite a few G T characteristics.

He starts with the basic 140 h. p. Corsa two door coupe and turns it into a Corvair Sprint. Fitch changes the air cleaners, and modifies the carburetion a little bit by putting in bigger jets. He reworks the distributor to give it a little more advance and puts on a set of straight through mufflers which have the sweetest sound since '54 Fords used to run steel packs on the street. Besides doing work on the engine, he also modifies the suspension to handle the additional power. He calls it a G T suspension and has adjustable shock absorbers for front and rear. Progressive rate auxiliary rubber springs are used inside the stock coil springs. To make the car steer faster, he uses special shorter steering arms that have been magnafluxed and heat treated. They cut the ratio to 15 to 1 from 13 to 1. They give approximately 3 turns lock to lock. Borrowing from the new Sting Ray, they installs a special steering damper. The damper is the stock Delco unit which is used on the Sting Ray. This prevents the car from shaking at high speeds and from getting any wheel fight. It maks a very, very smoothly responsive steering car.

The other goodies he has are: wood rim steering wheel, which at first didn't turn me on too much, but after driving with it I have to agree that wood is probably the ideal material for a steering wheel. It is somewhat resilient to the touch, hands don't sweat and it gives a perfect grip. It's a nice thick wheel, and not one of the little Casper Milktoast wheels that come on most of the American cars as stock equipment. I think a real fake bit is the "simulated" wooden wheels which appear on quite a few production American cars. The plastic wheels that are grained to look like wood have none of the advantages of the wood and it's just a different type of plastic from the ones originally used and yet it's an additional extra cost option. I can't figure it out, maybe you can. Anyway, John Fitch didn't try to figure it out and he had a special real wood steering wheel which really works, and is really great, and you really can't believe it until you try it and it's the only way to go. Enough said about the wheel.

Fitch has one enduring claim to fame, in that his so called vent top, fast back has been copied by G M divisions and is now used on cars like the GTO, some Buick Specials, and Oldsmobile 442. Personally, this vent top roof is something I could do without. It's a vinyl roof but it flows back and from the side it appears to be a fast back, but when you're sitting in the car you don't have the visibility problems of a fast back. This is really a cosmetic effect which you may or may not like, I don't like





Mild mannered John Fitch, sports car champ, designed the goodies that turn a Corvair into a Sprint.

Ron Mead, Fitchs sales manager, points out some of the "good stuff" under the "bonnet."

RETAIL KIT PRICES for the CORVAIR-SPRINT

Stage 1 (4 carb) Engine	$21.00
G. T. Suspension	47.00
Fast Ratio Steering	39.95
Steering Damper	24.50
(Total Steering Package)	52.50
Wood Rimmed Steering Wheel	59.00
Long-Range Driving Light	8.95
Luggage-Area Carpeting	19.95
Sprint 904 Ventop	102.00
Sprint Shift Knob	3.75
Sprint Nameplate	1.00
(No cost with orders of $50.00)	

Recommended Options

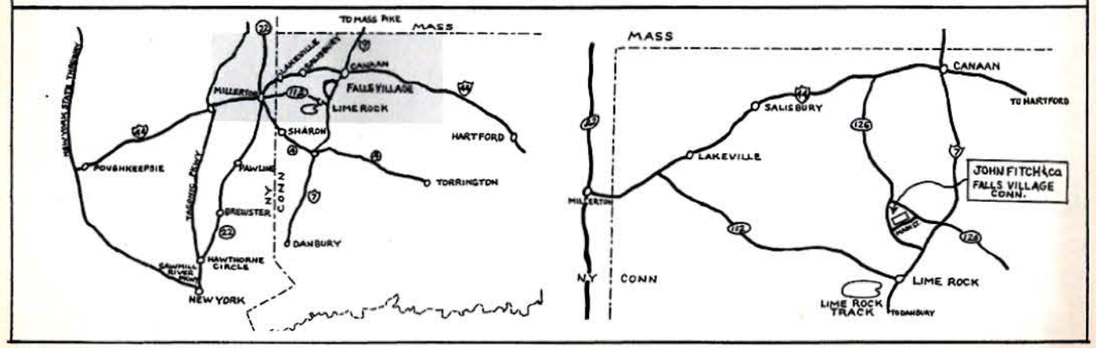
Tall-Driver Seat Bracket	$5.00
Leather Steering Rim Cover	8.50
Judson Electric Magneto	49.50
Michelin X Tires incl. tube ea.	40.17
Metallic Brake Linings	39.50
Tachometer	44.95
Dual Mufflers 95 & 110 HP only	44.95

Other Options

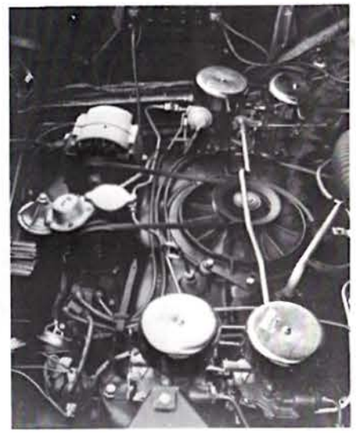
Head Rest	$15.95
Ammeter & Oil Gauges	28.00
Sound Insulation	4.50
Cast Aluminum Wheels (4)	198.00
Pirelli Sempione Tires (ea.)	24.65
Competition Suspension	70.00
above with Koni Shocks	118.00
Racing Suspension	164.00
Stage 1 (2 carb) Engine	53.50
Sprint 4 Carb 155 HP Engine	92.50
Heel & Toe Bracket	3.95
Replacement Shocks (ea.)	12.00
Headlight Flasher	3.95
Vinyl Stripe Kit (3" width)	4.00

Please specify year and body style when ordering.

Sprint equipment is available for all Corvairs, including the '66 models.



Beautiful wood steering wheel gives a mansized grip and makes driving more fun. Hands don't sweat with a wood wheel.



Fitch's Corvair had the stock 4 carb mill with some of his goodies: low restriction mufflers, special air cleaners, bigger carb jets, and reworked ignition system.

it. I don't like it on the GTO nor do I like it on the 442 nor on any of the other cars that have it. If it's going to be a fast back, let it be a fast back. If it's not going to be a fast back, why fool with stylistic gimmicks that have no function? This is probably the only thing about the car I didn't like.

I have not been a fan of the Corvair and I've always considered it a rather slow, evil handling little car but the new independent rear end suspension Corsa is fun to drive.

Mr. Fitch was nice enough to lend us his own personal Sprint which we took to the Lime Rock course. After trying to get it to break loose on turns or to skid out or in general lose control of the car, I found it almost impossible to fault. It was probably the most responsive car on this road course that I've ever driven. It reminded me of a top notch road racing motorcycle. The Corvair went hanging on the curves, it wouldn't roll, it wouldn't lean . . It was just an all around fantastic car.

While driving through the hilly Connecticut countryside, the additional power from the Sprint made itself known. It's a quick little car. We were getting times of 0-60 in about 9.7 - 9.8 seconds. It was turning the quarter mile in 16.7-16.8 with a little over 80 miles per hour. This is comparatively good performance for an engine that only displaces 168 cubic inches.

Shifting in the Corvair always involved a long throw, almost like rowing a boat. Fitch has come up with a goodie to rectify that. He calls it a quick shift conversion kit. It cuts the linkage throw in half, and gives a very tight feeling to the shift linkage. It's very effective and amazingly it's about a ten minute installation job. Why all the Corvairs don't have this as stock is something I still can't understand.

The Fitch Sprint runs faster, corners better, stops more efficiently and is much more pleasant to drive than any Corvair available from General Motors. Corvair has been the subject of a tremendous improvement campaign in the last two years.

Without having the all out performance potential of the Mustang or the Dodge Dart, this Corvair has a nicer feel to it and nicer road manners than any of them. Where else can you get something like this for under three grand? There is probably no value comparable to it anywhere in the world!

One of the things that is so important on the road in helping the handling ability of the Corvair Sprint package, are the Pirelli tires. These radial ply tires have quite a bit of stiffness and coupled with independent coil spring suspension on all four wheels, plus the special springs that Fitch installs, the car is just fantastic. It doesn't lean, it doesn't slide, it doesn't skid, it just hangs on. It goes through turns and curves with such little effort that you can hardly believe the speeds that you're going through at. It's a deceptive car and you'll go through a bend at 60 mph and you will feel like you're doing 40 mph because of the tremendous stability.

The Sprint package is a worthwhile addition to the Corvair line and it might be time for you to reappraise the Corvair. To people who are interested in a nice performance car it offers a lot of driving fun. The top speed of the little "storming cockroach" was about 115 miles an hour which is adequate to make you lose your license in any state other than Nevada.

If you have any further questions concerning the Sprint or the different parts, we suggest that you write directly to: John Fitch and Co., at Falls Village, Connecticut. We are quite sure he will be more than happy to answer any of your questions and work with you on any intended modifications to your Corvair.

SPRINT by Fitch

AG/S competition TERROR is the big black '41 Willys coupe owned by Fred Stone and Lenord Woods. Doug "Cookie" Cook has pushed this beast to 154 mph with an et of 9.30. The car runs engines that vary from 420 to 468 cubic inches of blown Chrysler hemi-power. For NHRA competition the car weighs 6 lbs. per cubic inch. Cook drove this car to the class win at the 1965 NHRA Nationals.

BG/S has been the scene of many new developments. One of the most exciting has been the use of a Garret AiResearch turbocharger on the 327 cubic inch Chevy, owned by the Mallicoat brothers, which holds the NHRA mph record with a sizzling 136.93 mph. This pioneer use of a turbocharger may well be a guideline to the future in supercharged gasser competition. This record wrecker weighs in at 2943

CG/S four door sedans are quite rare but this Willys sedan is top dog of the wild and woolly class. Vinny Tarantola used this 283 cubic inch, GMC blown Chevy to prove new ideas in hydros. This Power Shift hydro special has held the NHRA et record for 2½ years and in 1965 won its class at the NHRA Nationals. The car weighs 3410 lbs. The best times for this hauler are 125.69 mph with an et of 11.22.

RECORD HOLDING BLOWN GASSERS

NASCAR OPENER: RIVERSIDE 500

Fords win in spite of hummin' hemis.

By Hal Schweninger

Photos by CHAN BUSH

RIVERSIDE—The hometown boy made good again . . . Dan Gurney won another Riverside 500 stock car race.

Gurney, who has never won a sportscar event here, took his fourth consecutive NASCAR Grand National Race in a quiet, capable fashion. He drove a 1966 Ford, prepared by the Woods brothers of Stuart, Virginia.

David Pearson broke Gurney's record to win the pole position with a speed of 106 mph, and thus provided a real challenge.

Pearson took the lead on the first lap, lost it 10 laps later when they restarted on the backstretch.

From then on, it was really Gurney's race. He was headed briefly again by Pearson and veteran Curtis Turner who drove another Wood brothers Ford.

The leaders took off in a hurry and by the third lap were beginning to lap the slower cars. It was South against the West, and the southern cars were the fast ones. Gurney was the lone westerner to get a ride in a southern-built car.

Dan also benefited from the fastest pit crew in the business. When Ford wanted to win Indianapolis, they imported the Woods crew to pit for Jimmy Clark; and, when they wanted to win Riverside again, it was the Woods Brothers who did the job.

Gurney had pit stops of 17 and 18 seconds for fuel and 25 seconds for tires, fuel, and oil. Although Pearson could run faster on the track, Dan picked up 10 to 15 seconds per pit stop. This was more than the margin of his victory.

The retired Junior Johnson had two yellow Fords at Riverside, and they were the lowest sitting machines on the track. Bobby Isaac, who admits he cannot drive road courses had one and A. J. Foyt had the other.

On qualifying day, Foyt told his pit crew that if they would be ready to do bodywork he would take the headlines

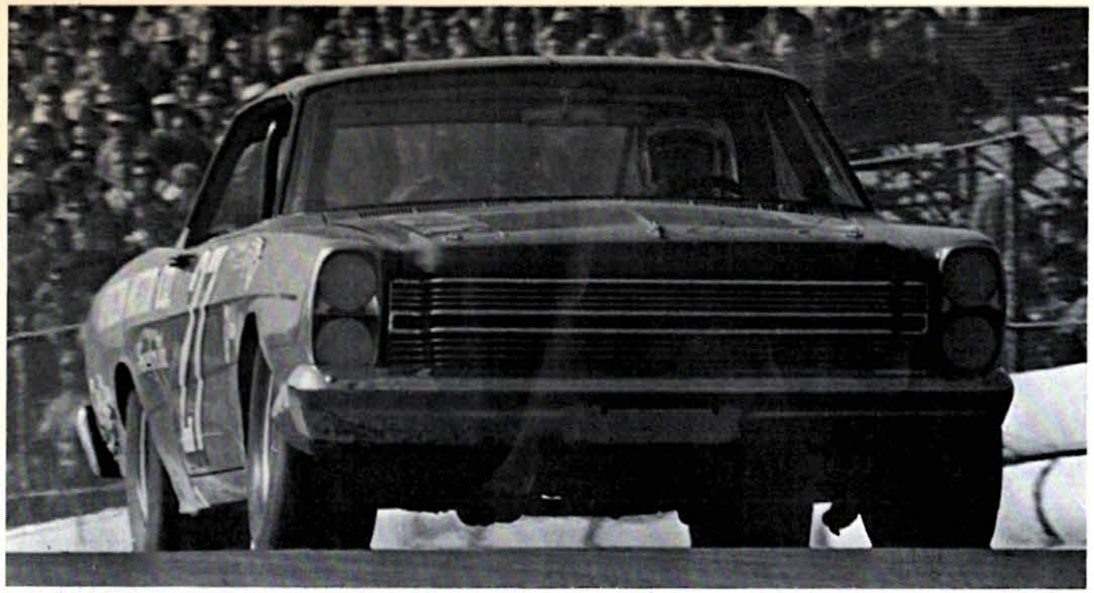
GURNEY (who else?) wins again

from Pearson and Gurney. Foyt tried to take the first turn at full speed, and wrecked on the first lap!

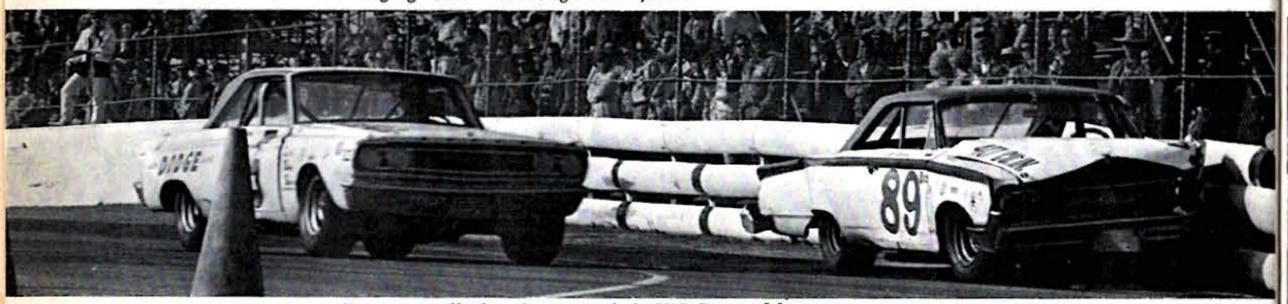
On race day Foyt said, he planned to move up, but by lap 27, he had developed a cold and quit. Darrell Dieringer, who had had no practice in the car or on the track, took over and moved the car better until the transmission failed. It would seem that the Foyt of 1966 is different from Foyt, the champion.

The front runners included all three (3) of the Woods cars: Gurney, Turner and Marvin Panch. Panch showed early speed and drove harder than he has in years, but blew a tire on turn 2.

Cale Yarborough, who has settled down to serious driving, was the fastest car on the backstretch with a trap speed of over 146 mph. Cale is not used to road courses and his line through the turns varied with each lap. But his speed, until his transmission failed, proved that Ford's work on the intake and heads was to be reckoned with.



Charging Cale Yarbrough had fastest car in race.



Pearson pulls by the crumpled Cliff Garner Mercury.

Mario Andretti manhandles his way through the esses.

USAC's Rookie of the Year passes Jack McCoy in Turn 8.

Don White drove consistently and smoothly but had slow pit stops.

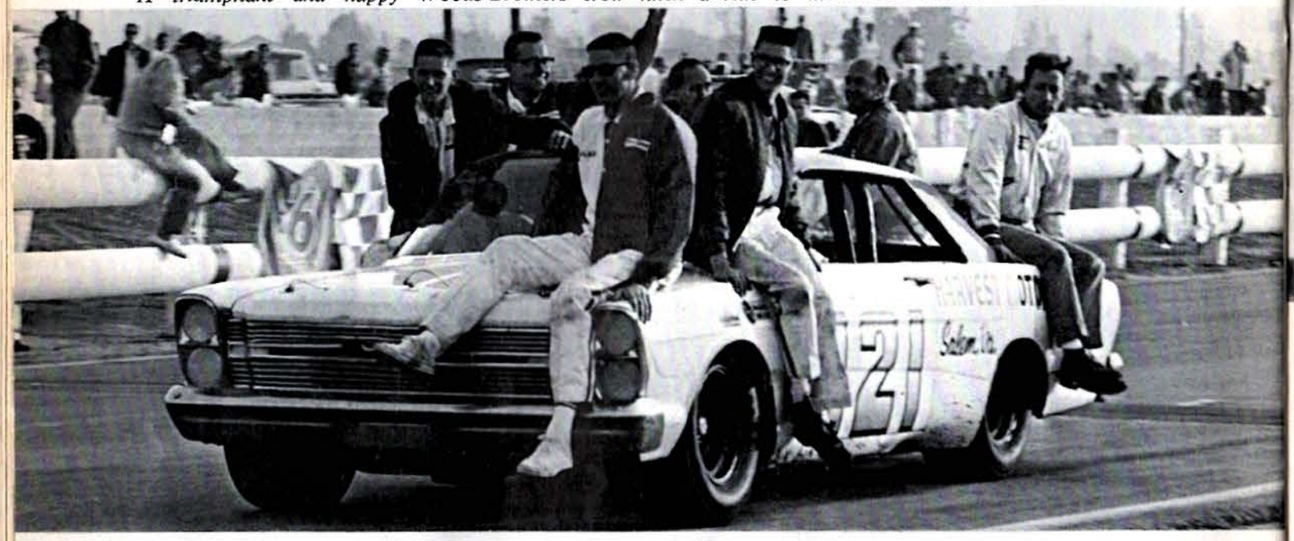
Gurney swings smoothly through Turn 6.

Wood Brothers swarm over Gurney's car in a "long" 18 second stop.

Cotton Owens crew swarms out to pit David Pearson. Man in black coat at left is Ronney Householder, Chrysler racing chief.

Gurney waves as he takes the checked flag.

A triumphant and happy Woods Brothers crew hitch a ride to the winners circle.



If the 427 Fords could pull the 426 Hemis on the backstretch at Riverside, what would happen on the superspeedways of the South where Dodge and Plymouth have to run the 405 cu. in. Hemi? Would the streamlining of the Charger be enough to offset this advantage?

Richard Petty, former NASCAR champion, wasn't handling well, and he didn't have the speed to stay with the leaders. On the 106th lap, he retired with a blown engine.

By now, the battle was between Curtis Turner and David Pearson . . . to determine who would be second behind Gurney. They ran side-by-side, switched back-and-forth, and double-passed slower cars in the esses. It was wildsville. Then, the "wind-driving" Turner was off course and had a long pit stop to repair the sheet metal damage.

Then, Pearson had a long pit stop for gas, oil, and tires. Turner and Pearson went back on even terms and on lap 143, Turner was running second.

The Woods Brothers cars were running 1-2, and the Holman Moody crowd was even more unhappy than the Chrysler clan. Then, Pearson took Turner.

On lap 152, Turner slid off the track again. From then on, it was a parade. Unless Gurney broke, it would be an unprecedented 4 for 4 and they were already talking about renaming the race the "Gurney 500".

At the 150th lap only Gurney and Pearson were in the same lap. Turner and the steady but unspectacular Dick Hutherson (Ford) were a lap back. Paul Goldsmith and Jim Hurtabise (Plymouths) were another lap back, and Billy Foster ('64 Dodge) was three laps off the pace.

Behind Foster, who struggled masterfully with a poor-handling car, was Mario Andretti in a car that was 11 mph. slower than the leaders. Many drivers would have parked it. But, Mario just would not quit. He proved that he was a real race driver and stayed with it until Don White (Dodge) blew his engine and spun out in front of him. Both cars were wrecked.

Would anything happen to the smooth running Gurney? That was the only possibility that could change the standings. Gurney pitted and was out in 20 seconds, and Pearson pitted for 34 seconds. The gap was wider. Pearson could gain on the track, but lost on every pit stop.

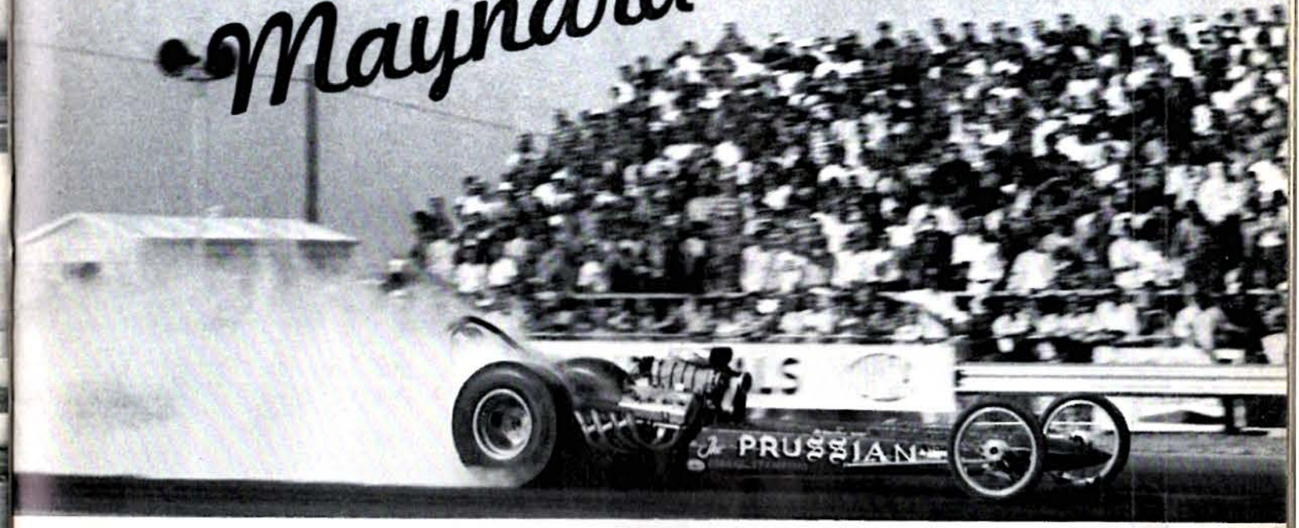
The leaders set speed records throughout the race. When Gurney took the flag, he set a record of 97.946 miles an hour, some 6 miles faster than last year.

Is Gurney Unbeatable at Riverside? Perhaps not, but the combination of Gurney and the Woods Brothers, makes everyone else a long-shot.

And at Riverside, only the favorites win.

PERSONALITY PROFILE:

Maynard Rupp,



driver of the Prussian dragster

Where do you go from the top? What worlds are left to conquer after a fuel dragster-pilot has bested a field of the nation's toughest competition twice in a single season?

Maynard Rupp, co-owner and driver of "The Prussian", a Chrysler-powered double-A fuel dragster, has done just that. Rupp scored the Top Fuel victory at the NHRA "Springnationals" at Bristol, Tenn., in June, and backed it up by winning the Top Fuel Eliminator spot at NHRA's "World Championship Point Finals" at Tulsa, Okla., in October.

As a rule, a professional drag racer who scores two such big wins in a single season would be expected to stay at the wheel of the same car and exploit the winning combination with appearances during the months that follow. Maynard, however, feels there is a new trend in drag racing. He has chosen to retire The Prussian and travel a new route to success in the quarter-mile sport.

"You can't be successful in fuel dragster competition unless you win meets," says the Champion, "and that means facing the most brutal competition in the sport, week after week—and winning. It doesn't take long to discover there are more losers than winners in this game."

If winning money meets and match races is not the way to go in drag racing, what is? "Exhibition dragsters," says Rupp. "Professional drag racing is not unlike any other business," he continues, "Racing programs are dictated by what strip promoters are willing to pay for, and they'll pay best for what spectators want to see most. This year, that has been exhibition cars. The 'show' in drag racing has become just as important as the 'race'. I don't know just when the change started, but there's no doubt in anybody's mind now, that fans want lots of smoke, noise and wheelstands. A few good exhibition cars have done very well for themselves this season, most notably the 'Hemi Under Glass' Plymouth Barracuda. With relatively few cars vying for the exhibition spotlight, they haven't had to be super-fast to get the job done. I think there is room in the business for a really fast stock-bodied exhibition dragster, and I am building it. I think I'm going to like the brand of "racing" in which you are a winner before you ever take your car off the trailer."

Rupp's new car, is a rear-engined fiber glass Chevelle, mounted on a slightly-longer-than-stock tubular frame. It will be powered by the "old reliable" 354 cubic-inch, supercharged, fuel-burning Chrysler engines that have powered Rupp's championship rails. "I don't feel that any of the exhibition cars have engines that are capable of turning 200-mph runs in a rail," said Maynard. "We have been pulling about 1,400 horsepower out of our Chryslers and I think this will give us an advantage on the others.

"Ideally, I would like to be able to take the engine out of the exhibition car, drop it in a dragster classis, and go racing on an equal basis with the best fuel dragsters in the country. In fact, I intend to order a new car and use the Chrysler engines interchangeably to compete in a few of the coming

season's big money meets.

"The exhibition car is being sponsored by Gratiot Auto Supply in Detroit, and we're trying to keep it as stock appearing as possible. It will be stock height with a stock paint job and working headlights and doors. We are using Cragar street mags all around. Hopefully, it will look more like a real, drive - to - the-supermarket-type car than any of the other exhibition machines. Then, if we manage to uncork a few 180-mph runs, with elapsed times just over eight seconds, I think we will have a real show stopper.

"As soon as we get the car done, we're going to swing down South for some trial runs, and we hope to return to the Detroit 'Autorama' show in late January, with the World's Fastest Stock Bodied Dragster."

Unlike many professional rail handlers, Rupp did not enter the sport through the lower stock classes. His first mount, at the age of 18, was an injected Chevy C/D. Maynard spent the next three years doing some driving while a full-time student at the University of Detroit.

Rupp caught drag racing fever, however, and in 1960 he started his own business, building bicycle wheels for dragsters. This job brought him in contact with many people in drag racing and it wasn't long before he got a ride in Larry Posluszany's Chrysler-powered AA/GD, "The Grunt."

The Grunt carried Maynard to a DRAG NEWS "1320" A/GD record (8.49-182.18 mph) in 1963, and top speed of the meet at the "U.S. Fuel and Gas Championships" at Bakersfield, Calif., early in 1964.

From a top-notch gas dragster, it was an inevitable jump into the fuel ranks for the young driving ace. His first fuel ride was in the summer of 1964. It took the young Champion less than a year to rise to the top of the heap in drag racing's big leagues.

Asked the secret of his rapid success in one of the world's most competitive sports, Maynard replied, "There are two essential elements in the winning formula, a car capable of going a quarter of a mile quickest, and a driver capable of getting it there. But it's not that simple. There are a million ways of losing."

"The greater part of my success must be attributed to those honkin' little Chrysler engines. Although most fueler men prefer the bigger 392-cubic inch hemi that was standard equipment in the 1957-58 New Yorkers, I stick with the 354-cubic inch version,

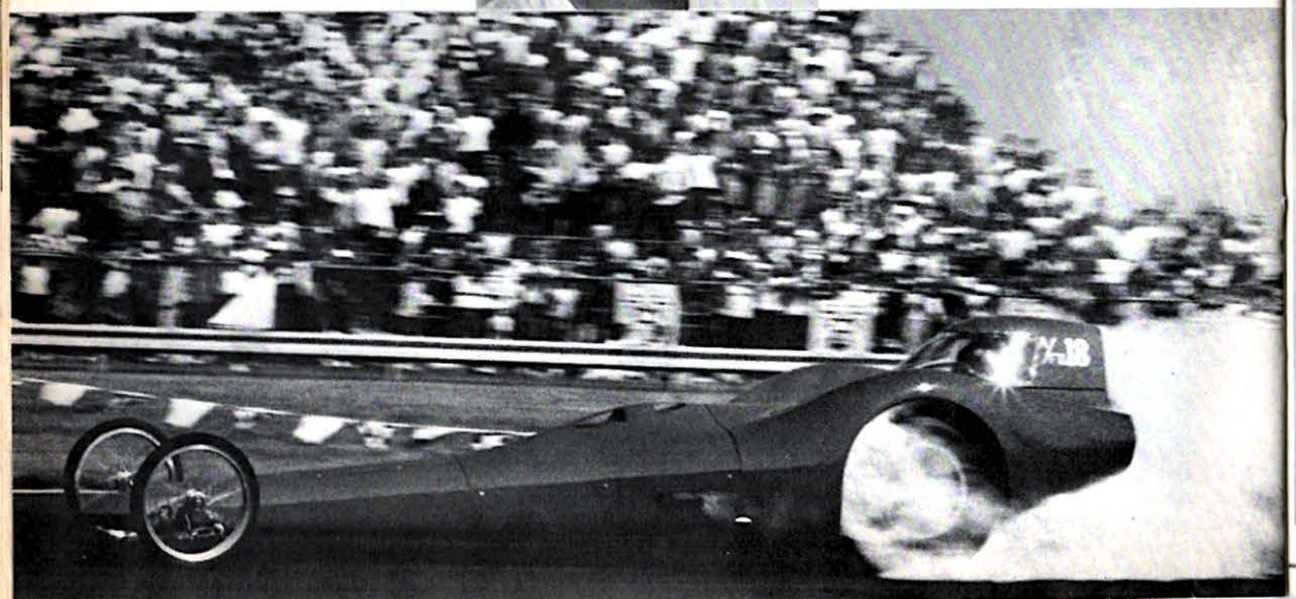
originally built in 1956. The people at Schneider racing cams really work magic with this machine, and I have felt no need to go to the bigger engine.

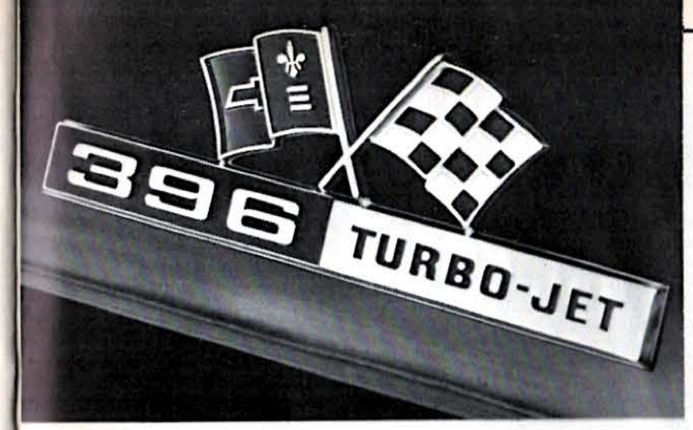
"This 140 horsepower is tied to a Logghe chassis that I built myself, so I know my entire car inside-out. I think this is very important, and it is the knowledge that can only come with experience.

"The other half of the winning combination is, of course, the driver's job. I had been driving a rail for seven years before I realized the most important factor in driving a race or a meet was in the driver's head. It's not half so important for you to 'psych-out' your opponent as it is that you have *yourself* psyched-out when you roll to the starting line.

"You must go to the line knowing you are going to win. If there is any doubt in your mind, you are apt to get a case of nerves that will cause you to slip-up. A mistake doesn't have to be a big one to cost you the race. At 200 mph, a tenth of a second is equal to 30 feet!"

No one knows for sure where the future of the drag racing sport will lead. Very few people foresaw the phenomenal rise of exhibition dragsters. Very few people, indeed, have been as successful as Maynard Rupp at the wheel of a AA/Fuel dragster. One thing is almost certain, however: Wherever the sport is going in the future, a young man named Rupp can be expected to be there first with the most.

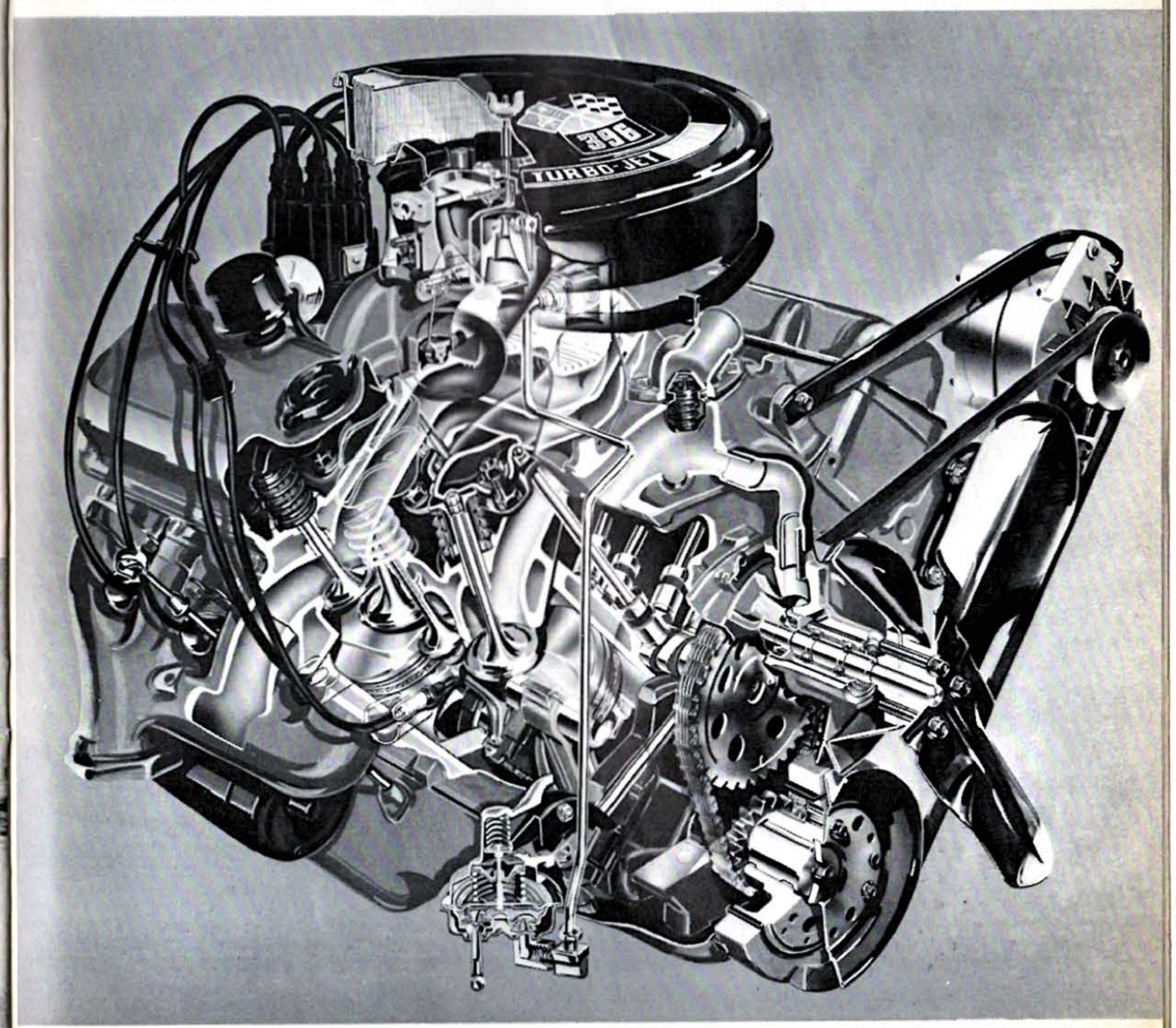




Special report . . . .

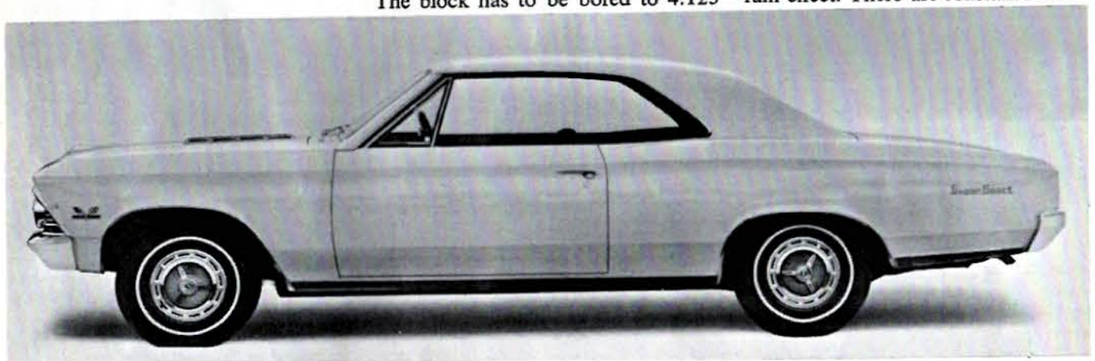
Isky dyno test of the

Chevy 396



THE 396 Chevrolet engine offers a fantastic amount of performance potential that has yet been untapped. Last year the biggest engine available in Chevrolet or in Corvette was 396 cubic inches and it had a horsepower rating of 425. This year a 427 cubic inch engine is available in Corvettes and full size Chevrolets; and the horsepower is still rated at 425. These engines can put out an easy 550 horsepower from 427 cubic inch displacement.

If you look carefully at the Isky dyno test you can see that cam shafts still make a big difference. Some other factors you may want to keep in mind regarding a build up to 396 Chevrolet is that General Motors makes pistons which will give a 427 cubic inch displacement. The part number of the pistons is 3879928. The block has to be bored to 4.125 inches for the pistons to fit in. For piston rings you can either use Chevrolet number 3879912 or Perfect Circle, set number 40698.



Good engine assembly techniques apply to this engine as well as any others. The critical factor on this new Chevrolet engine seems to be the valve area. It should have an exact 45 degree angle seat; and the intake valve seats should be .040 to .045 inches. The exhaust seats should be .055 to .065 inches. Naturally the measurements should be made at the edge of the valve. It's important not to sink the valves too deeply into the cylinder head. This will greatly mess up air flow, and cost quite a bit of power. The cylinder heads should be checked carefully, and each combustion chamber should have 108 cubic centimeters. This combined with the deck height of .012 will give a compression ratio of about 12½ to 1, which is more than adequate for pump gasoline. Spark plugs seem to be critical and some of the most widely used models are Autolite AG 12's gapped at .018 to .020.

This engine can greatly benefit from a good set of headers. A variety of headers is available for it from the California Speed Merchants. Chevrolet only has one four barrel manifold available. The best bet is to stay with it, and to use one large Holley carburator, model number 3298. There are larger Holley carburators available, and it may be worthwhile experimenting. The special Chevrolet air cleaner number 6422373 seems to give a pretty good power boost when the engine is installed in the car. This air cleaner will pull the air in from the cowl plenum chamber at high vehicle speeds giving a slight ram effect. There are constant rumors that General Motors will be bringing out additional speed equipment for this engine during the year. Frankly I wouldn't hold my breath until they do.

Your best bet is to work from existing specifications, and make small modifications a little at a time and see what works. If you run into any particular problem on this engine write directly to Isky for information which they may have turned up in their dyno room. If you really want to go all out with the 396 or 427 inch block it's possible to get a Stroker kit from Crankshaft Company which will give you 497 cubic inches. With this 497 cubic inch deal and a set of injectors the sky is the limit in regards to horsepower. It should be able to put out as much as a Ford OHC or the Dodge and Plymouth hemi heads.

ISKENDERIAN RACING CAMS

"CHEVROLET - 396"

ENGINE: 396" cu. in. factory rated425 hp.
CARBURETION: 1 Carter AFB 4 bbl. (#3269 S) Daytona Series E with 1-11/16" Venturi, Prim. jets. .101, Sec. jets .098, and metering rods #16-24.
IGNITION: Roto Faze
ADVANCE: 40° locked out (no automatic advance)
SPARK PLUGS: Champion (gap .025) N-64-Y
FUEL: Flying A premium
OIL Mc Millan MS - SAE 50W
BAROMETRIC PRESSURE: 30.00 in. (this factor varies with each test which will be noted)

NOTE: All tests were made with cams advanced 5 crankshaft degrees (from split over-lap position)

RPM=	3500	4000	4500	5000	5500	6000	6500	7000
Test #								HORSEPOWER
1	259	296	324	350	380	402	397	
2	259	293	324	352	381	406	403	
3	260	278	337	392	420	452	439	
4		268	329	370	435	458	468	460
5			333	390	441	490	506	488

TEST 1

Stock factory cam 425 H.P Room temperature 95° F. Barometric pressure 30.00"; stock ignition, single springs

TEST 2

Roto Faze Ignition, Room temperature 95° F. Barometric pressure 30.00"; single springs

TEST 3

Edelbrock X-C96 Ram Manifold, 2AFB 4 bbl, series 3362-S, metering rods #16-169, Primary jets #120-166, Secondary jets #120-177, room temperature 84° F.; Barometric pressure 29.80"; single springs.

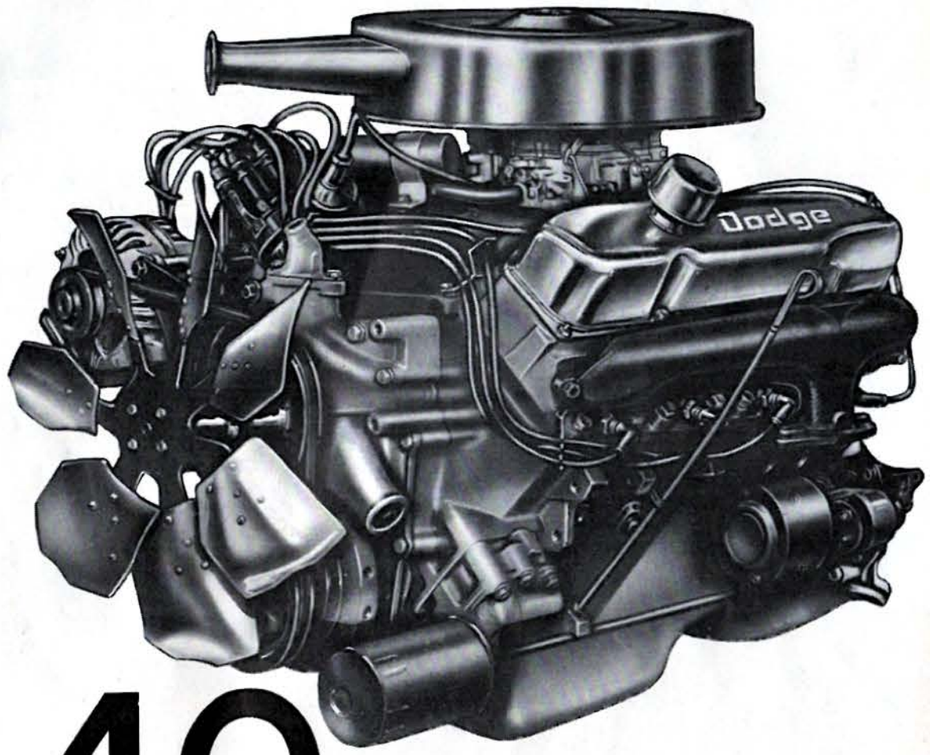
TEST 4

Latest factory Hi-Performance cam; Intake .020, Exhaust .024; Room temperature 80° F., Barometric pressure 30.00"; dual springs

TEST 5

Isky 550-62 cam, Valve lash: Intake .030, Exhaust .030; Air temperature 78° F., Barometric pressure 30.02"; dual springs; N-64-Y Champion spark plugs

What's better than 426 cubes?



440 cubes

A 440-cubic inch V-8 engine, the largest passenger car engine ever offered by Chrysler Corporation, is standard on 1966 Imperials and Chrysler New Yorkers. The 440 makes a valid contribution to an improved horsepower-to-weight ratio; it gives these big cars better acceleration and road agility to cope with the ever-increasing density of expressway and city traffic.

The 440-cubic inch V-8 also is an optional engine for Dodge Polara and Monaco. A high-performance version with a low back pressure exhaust system is available at extra cost for the Plymouth Fury, and the Chrysler Newport, 300, New Yorker, and the Town and Country Station Wagons.

Both the standard and the high-performance 440s have a bore and stroke 4.32″ x 3.75″; single, four-barrel carburetor; and 10.1:1 compression ratio. The engines are identical, except for the air cleaners and exhaust systems. The standard 440 with a rated horsepower of 350 @ 4400 rpm and torque of 480 @ 2800 has a single exhaust system with resonator. The high-performance 440, which makes more power available to the rear wheels, is rated at a higher horsepower and at a higher rpm—365 @ 4600. Torque is 480 lb. ft. @ 3200. A twin snorkel air cleaner and dual exhaust system are standard equipment.

The 440 in either standard or high-performance form is considered an evolutionary engine, that is, great care has been taken in its design—which stems from the 413- and 426-cubic inch engine family—to make use of the latest manufacturing techniques but retain as many of the tried and proved engine components of the 413 and 426 as possible. The cylinder block, for example, is cast with the use of new furan resin and cores for greater accuracy, yet has the same bore centers as the previous two engines. This simplifies machine requirements during manufacture. Some other areas of similarity are the cooling, lubrication, and starting systems.

Design Background

When designing an evolutionary engine, one of the best ways to get greater performance is to raise displacement by increasing bore. This approach confines the majority of changes to the engine block and allows for maximum use of machining operations that already have been established. This was the design route selected for the 440 V-8. In making this choice, however, it was important to consider two aspects of the block casting which would make the entire design objective possible: (1) the cores used for casting should be very accurate, especially in the immediate area of the cylinder bores; (2) because of slimmed-down water jacket passages between cylinder bores, core shift during casting should be held to a minimum. By adopting the latest furan core foundry techniques and providing excellent core interlocks, the 440 engine block casting have proved to be as precise as planned.

What are Furan Cores?

Furan cores are a special type whose accurate dimensions provide greater precision in block casting. Made of mixtures of sand, furan resin, and acid solution, the cores take the name "furan" from a chemical compound of the same name, one of whose derivatives—furfuryl alcohol—makes up part of the furan resin.

To make a furan core, dry sand first is mixed with an acid solution, then with the furan resin. This damp, coated sand then is blown into a heated core box. The heat from the box sets off a chemical reaction in the sand mixture through which the outside shell of the core is cured to shape in a matter of seconds. The core then is removed from the box and placed in an oven where it is baked long enough to cure the thicker portions.

The accuracy of a furan core is derived in great part from its cure in the core box. Contained by the solid, rigid mass of the box, it cures to the exact dimensions of the core mold without warping. Oil sand cores which must be taken out of the core boxes and cured completely in the baking ovens do not have this dimensional stability.

ENGINE SPECIFICATIONS

Engine	
Type (Cylinder Arrangement)	90° V
Number of Cylinders	8
Bore	4.32″
Stroke	3.75″
Piston Displacement	440 cubic inches
Compression Ratio	10.1 to 1
Compression Pressure @ 120 rpm	130 - 165 psi
Valve Timing	
Intake Opens (BTC)	18°
Intake Closes (ABC)	58°
Exhaust Opens (BBC)	66°
Exhaust Closes (ATC)	14°
Valve Overlap	32°
Intake Valve Duration	256°
Exhaust Valve Duration	260°
Valves—(Intake)	
Head Diameter	2.075″ - 2.085″
Over-all Length	4.781″ - 4.796″
Stem Diameter (Standard)	.372″ - .373″
Stem to Guide Clearance	.001″ - .003″
Face Angle	45° - 45.5°
Lift (Zero Clearance)	.425″
Valves—(Exhaust)	
Head Diameter	1.595″ - 1.605″
Over-all Length	4.781″ - 4.796″
Stem Diameter (Standard)	.371″ - .372″
Stem to Guide Clearance	.002″ - .004″
Face Angle	45° - 45.5°
Lift (Zero Clearance)	.437″
Valve Springs	
Number	16
Free length	2.58″
Load when compressed to (Valve Closed)	125 lb @ 1.86″
Load when compressed to (Valve Open)	200 lb @ 1.47″

Carburetor

Vehicle Model Application	With Torque Flite Transmission	With Manual Transmission
Make	Carter	Carter
Model	AFB-4131S	AFB-4130S
Number and Type	1, 4-bbl	1, 4-bbl
Barrel Size: Primary	1.44″	1.44″
Secondary	1.56″	1.56″

The Block is Cast

The story of a precision-cast, 440-cubic inch engine block does not stop with the manufacture of accurate furan cores. Provisions must be made to control and diminish the shift of the cores to different positions under the stress of pouring hot, molten iron into the mold.

The 440 cores are designed to lock securely into place so that core shift is held to a minimum. The tappet chamber core, for example, has a tongue-and-groove connection to the barrel slab cores that form the core openings. The latter, in turn, are locked in place to the water jacket cores, and so on. The end result of this complicated interlocking of the cores is a block casting that is dimensionally accurate and requires little machining.

The Lower Half of the Engine—New Mechanical Components

Inasmuch as the 440 V-8 is a larger bore engine than either of its two predecessors, it is axiomatic that larger pistons are used. The new 440 pistons are the slipper-type fitted with struts to control thermal expansion of the piston skirt. They are cast of alum-

inum alloy and have a tin-plated finish.

Each piston also has a hole drilled through the top and bottom of the boss which surrounds the piston pin. The holes allow oil that drains down down off the inside of the piston head to lubricate the pin.

Drop-forged steel connecting rods, 6.77-inches long, are the same as those used in the 413 V-8, except for the rod bearings. These new bearings consist of a porous copper layer sintered on a steel back and impregnated with lead. The copper material has good load carrying ability and fatigue characteristics, while the softer lead mixture acts as a trap for dirt which becomes imbedded in it.

The 440 crankshaft forging appears similar to the 413-cubic inch engine crankshaft forging, but has larger, heavier counterbalance weights to compensate for the heavier pistons. The 440 crankshaft, therefore, is not interchangeable with that of the 413.

The Upper Half of the Engine—Refinements

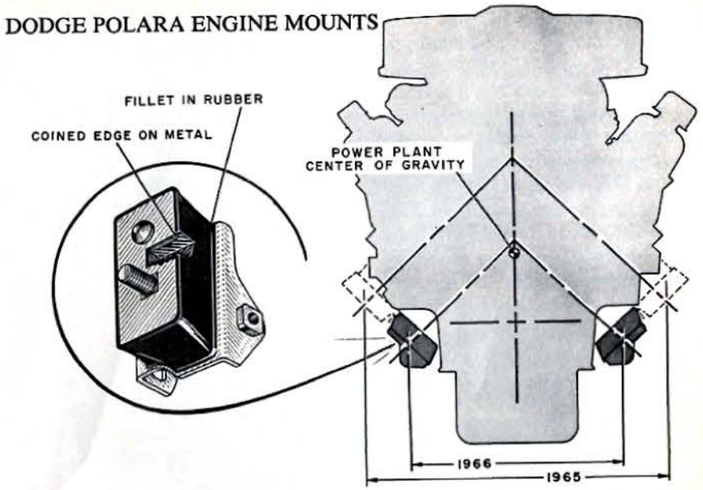
Modifications that take place in the upper half of the 440 engine are consistent with the bigger bore-size design step. The cylinder heads consequently are interchangeable with those of the 413-cubic inch V-8. They are a chrome-alloy cast iron, with short exhaust ports and wedge-shaped combustion chambers.

A new .022-inch thick embossed steel gasket allows for the larger 440 cylinder bore sizes. The valve train also is the same—overhead valves arranged in line — except that higher load valve springs are used for smooth high-speed engine performance.

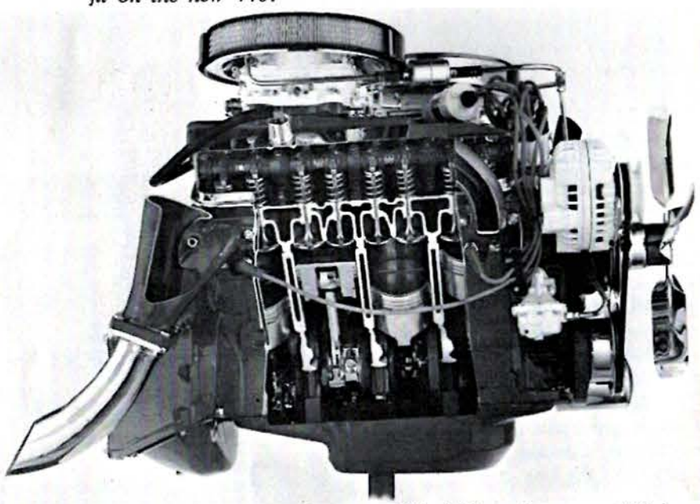
Fuel is fed through a single, four-barrel carburetor with a primary throttle bore size of 1.44 inches and secondary bore size of 1.56 inches. Air is supplied to standard 440 engines through a large diameter, single snorkel air cleaner. The high-performance 440, however, is equipped with a double snorkel air cleaner (two air intake horns); this provides the low restriction of an unsilenced air cleaner minus the latter's higher sound volume. This is the first occasion that a Chrysler Corporation car has made use of a double snorkel air cleaner.

The engine ignition system incorporates a Chrysler-built single breaker distributor, standard coil, and J-13Y Champion or P-3-5P MoPar spark plugs. These are new spark plugs. They run inherently cooler than the type used in the 413 engine. They were chosen to fit the needs of the 440 V-8.

1966 DODGE POLARA ENGINE MOUNTS



Here is a cut-a-way view of the 426 wedge head Ramcharger engine. Many of the parts from this engine will fit on the new 440.



The Exhaust System

Two types of exhaust systems are scheduled for the 440-cubic inch V-8. The standard 440 uses a single exhaust system with large, reverse flow muffler, and the tail pipe is fitted with a resonator that serves as a second muffler. The resonator combines good exhaust flow with added silencing. The single exhaust has 2-inch branch pipes feeding a main exhaust pipe of 2-1/2 inches. Tail pipe diameter is 2-1/4 inches.

The high-performance 440 is outfitted with a dual exhaust system for maximum exhaust efficiency. Each of the two main pipes is 2-1/4 inches in diameter, leading to 2-inch tail pipes (without resonators). The two large mufflers are the reverse flow-type. The left-hand muffler is made of aluminized steel which gives it ample protection against corrosion. The right-hand muffler uses stainless steel for its critical parts as an added anticorrosion precaution, because this muffler runs cooler than the left (the right exhaust manifold incorporates the heat control valve). As a result, unburned condensates tend to collect and need a longer drying-out period.

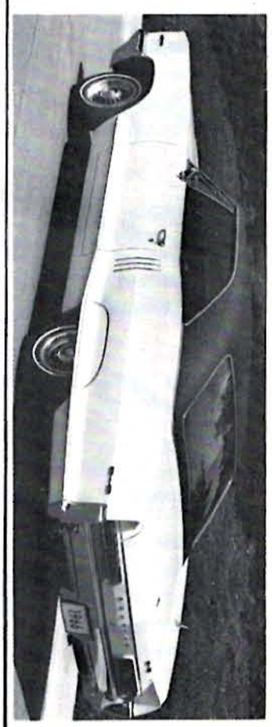
PONTIAC POWER TRAINS

Engine	Transmission	Standard Axle Ratio	Optional Economy Axle	Optional Performance Axle	Special Order Axles*
1 OHC-L6—230 cu. in. 1-BBL—165 hp	3-speed	3.08 (a) 3.23 (b) 3.36 (c)			3.23 (b) 3.36 (b) 3.55(a,c)
	4-speed (d)				
	Automatic	2.56(a,b) 2.78 (a,c) 3.08	2.56	2.93 (b) 3.08	3.36 (a)
2 OHC-L6—230 cu. in. 4-BBL—207 hp (b)	3-speed	3.55 (a) 3.23			3.90 (a)
	4-speed	3.55 (a) 3.23			3.90 (a)
	Automatic	3.23		3.55	3.90 (a)
3 V-8—326 cu. in. 2-BBL—250 hp	3-speed	3.23	3.08		3.36
	4-speed	3.23	3.08		3.36
	Automatic	2.56 (a) 2.93		2.93	3.36 (a)
4 V-8—326 HO 4-BBL—285 hp	3-speed	3.36 (a) 3.23			3.08 3.55 3.90 (a)
	4-speed	3.36 (a) 3.23			3.08 3.55 3.90 (a)
	Automatic	3.23			3.08 3.36 3.55 (a)
5 GTO V-8—389 cu. in. 335 hp—4-BBL	3-speed	3.55 (a) 3.23			3.08 3.23 3.36 3.90 (a) 4.33
	4-speed	3.55(a) 3.23			3.08 3.23 3.36 3.90 (a)
	4-speed w/close ratio				3.90 4.33 (a)
	Automatic	3.23 (a) 3.08			3.08 3.36 3.55 3.90 (a) 4.33
6 GTO V-8—389 cu. in. 360 hp—3 2-BBL	3-speed	3.55 (a) 3.23			3.08 3.23 3.36 3.90 (a) 4.33
	4-speed	3.55 (a) 3.23			3.08 3.23 3.36 3.90 (a)
	4-speed w/close ratio				3.90 4.33 (a)
	Automatic	3.55 (a) 3.08			3.08 3.23 3.36 3.90 (a) 4.33
7 2+2 V-8—421 cu. in. 338 hp—4-BBL	3-speed	3.42			3.55 3.73 (a)
	4-speed	3.42			3.55 3.73 (a)
	4-speed w/close ratio				4.11 (a)
	Turbo Hydra-Matic	3.23 (a) 3.08			3.42 3.55 (a) 3.73

Engine	Transmission	Standard Axle Ratio	Optional Economy Axle	Optional Performance Axle	Special Order Axles*
8 256 hp V-8—Standard 389 cu. in.—2-BBL	3-speed	3.23	3.08		3.42 3.55 (a) 3.73
	4-speed (d)				
	Turbo Hydra-Matic (d)				
9 290 hp V-8—389 cu. in. 2-BBL	3-speed (d)				
	4-speed	3.42			3.55 3.73
	Turbo Hydra-Matic	2.41 (e)		2.93	3.08
		2.56 (f)	2.41	2.93	3.23 3.42 3.55 3.73 (a)
10 325 hp V-8—389 cu. in. 4-BBL	3-speed (d)				
	4-speed (d)				
	Turbo Hydra-Matic	2.56 (g)	2.41	2.93	3.08
		2.73 (h)	2.56	3.08	3.23 3.42 3.55 3.73 (a)
11 333 hp V-8—389 cu. in. 4-BBL	3-speed	3.23	3.08	3.42 (j)	3.42 3.55 (a) 3.73
	4-speed	3.42			3.55 3.73 (a)
	Turbo Hydra-Matic (d)				
12 256 hp V-8—389 cu. in. 2-BBL	3-speed (d)				
	4-speed (d)				
	Turbo Hydra-Matic	2.41 (k,l)			
		2.56 (m)			
13 338 hp V-8—421 cu. in. 4-BBL	3-speed	3.23			3.42 3.55 (a) 3.73
	4-speed	3.42			3.55 (a) 3.73
	w/close ratio				4.11 (a)
	Turbo Hydra-Matic	3.08 (a) 2.93	2.56	3.23 (a)	3.42 3.55 (a) 3.73
14 356 hp V-8—421 cu. in. 3 2-BBL	3-speed	3.23 (k) 3.42 (a,n)			3.42 3.55 3.73 (a)
	4-speed	3.42			3.55 (a) 3.73
	w/close ratio				4.11 (a)
	Turbo Hydra-Matic	3.08 (a,k) 3.23 (a,n) 2.93 (k) 3.08 (n)	2.73		3.23 3.42 3.55 (a) 3.73
15 376 hp V-8—421 HO 3 2-BBL (b)	3-speed	3.42 (a) 3.23			3.55 3.73 (a) 4.11
	4-speed	3.42 (a) 3.23			3.55 3.73 (a)
	w/close ratio				4.11 (a)
	Turbo Hydra-Matic	3.23 (a) 3.08			3.42 3.55 (a) 3.73

3.90:1, 4.11:1 and 4.33:1 rear axle ratios can be dealer installed.

(a) Not available with air conditioning
(b) Except station wagons
(c) Station wagons only
(d) Not available with this engine
(e) For Catalina 2-door and 4-door sedans and 4-door hardtop models only
(f) Except Catalina 2-door and 4-door sedans and 4-door hardtop models
(g) For Bonneville hardtop coupe and 4-door hardtop models only
(h) Except Bonneville hardtop coupe and 4-door hardtop models
(j) Grand Prix only
(k) Except 2+2 models
(l) Except Grand Prix and Bonneville station wagon and convertible models
(m) Grand Prix and Bonneville station wagon and convertible models only
(n) 2+2 models only



TRANSMISSION GEAR RATIOS—TEMPEST, TEMPEST CUSTOM, LE MANS AND GTO

Transmission	Gear Ratios for Manual Transmissions: Std. 3-speed	Std. 3-speed	Opt. H-D 3-speed	Opt. 4-speed[1]	Opt. 4-speed	Special order 4-speed close ratio	Automatic Transmission Ratios
Engine	OHC L-6 only	All V-8's w/column shift	V-8 w/Floor Shift	OHC L-6 w/4-BBL carb. only	All V-8's	GTO only	Low 1.76:1
1st	2.85:1	2.54:1	2.42:1	3.11:1	2.52:1	2.20:1	Drive 1.00:1
2nd	1.68:1	1.50:1	1.61:1	2.20:1	1.88:1	1.64:1	Reverse 1.76:1
3rd	1.00:1	1.00:1	1.00:1	1.47:1	1.46:1	1.28:1	**Total Torque Multiplication at Start**
4th	—	—	—	1.00:1	1.00:1	1.00:1	OHC L-6 4.93:1
Reverse	2.95:1	2.63:1	2.33:1	3.11:1	2.59:1	2.27:1	V-8 4.23:1

[1]See your dealer for availability

TRANSMISSION GEAR RATIOS—CATALINA, 2+2, STAR CHIEF EXECUTIVE, BONNEVILLE AND GRAND PRIX

Transmission (all engines)	Gear Ratios for Manual Transmissions: Standard 3-speed Manual	Optional 4-speed Manual	Special order 4-speed Manual close ratio	Gear Ratios for Turbo Hydra-Matic
1st	2.42:1	2.52:1	2.20:1	1st (Low) 2.48:1
2nd	1.61:1	1.88:1	1.64:1	2nd (Super) 1.48:1
3rd	1.00:1	1.46:1	1.28:1	3rd (Drive) 1.00:1
4th	—	1.00:1	1.00:1	Reverse 2.08:1
Reverse	2.33:1	2.59:1	2.27:1	**Total Torque Multiplication at Start**
				5.22:1

3-Speed Manual Transmissions

Fully synchronized 3-speed column shift transmission standard on: Tempest, Tempest Custom, Le Mans, GTO, Catalina, Star Chief Executive and Bonneville.

Fully synchronized 3-speed floor-mounted shift standard on 2+2, and Grand Prix with bucket seats.

Floor shifts available on all models at extra cost.

All 3-speed floor shifts are equipped with Hurst linkage.

Consoles available only on models with bucket seats.

4-Speed Manual Transmissions

Optional fully synchronized 4-speed floor shift available on all Tempest, Tempest Custom, Le Mans (except regular fuel OHC-6 engine), GTO, Catalina, 2+2, Star Chief Executive and Bonneville models.

Grand Prix—Optional fully synchronized 4-speed available, console shift only.

Consoles available only on models with bucket seats.

A Special Order close-ratio 4-speed is available on the GTO only when equipped with a 3.90:1 or 4.33:1 rear axle ratio and on all Pontiacs with 421 cu. in. engines when equipped with a 4.11.

All 4-speed floor shifts are equipped with Hurst linkage.

Automatic Transmissions

Optional Automatic Transmission with column shift available on all models. Console floor shift standard on Grand Prix only; available at extra cost on all other bucket seat models.

Tempest, Tempest Custom and Le Mans

165 hp

1. New, standard Overhead Cam L-6. Single barrel carburetor. Displacement—230 cu. in. Torque—216 lb.-ft. Compression—9.0:1. Regular fuel.

207 hp

2. New, optional high compression Overhead Cam L-6. 4 barrel carburetor. Displacement—230 cu. in. Torque—228 lb.-ft. Compression—10.5:1. Chromed low-restriction air cleaner. Premium fuel.

250 hp

3. Optional V-8. Displacement—326 cu. in. 2 barrel carburetor. Torque—333 lb.-ft. Compression ratio—9.2:1. Regular fuel.

285 hp

4. Optional 326 HO (High-Output) V-8. Displacement—326 cu. in. 4 barrel carburetor. Torque—359 lb.-ft. Compression ratio—10.5:1. Premium fuel.

GTO

335 hp

5. Standard GTO V-8 engine. Displacement—389 cu. in. 4 barrel carburetor. Compression ratio—10.75:1. Torque—431 lb.-ft. Low back-pressure dual exhaust system. Declutching fan. Chromed air cleaner, rocker cover and oil filler cap. Premium fuel.

360 hp

6. Optional, higher-performance V-8. Displacement—389 cu. in. 3 2-barrel carburetion. Compression ratio—10.75:1. Torque—424 lb.-ft. Low back-pressure dual exhaust system. High-output camshaft and valve train. Chromed low-restriction air cleaners, rocker covers, oil filler cap. Declutching fan. Premium fuel.

2+2 →

338 hp

7. Standard 2+2 V-8. Displacement—421 cu. in. 4 barrel carburetor. Torque—459 lb.-ft. Compression ratio—10.5:1. Low back-pressure dual exhaust system. Chromed low-restriction air cleaner, rocker covers, oil filler cap. Premium fuel.

Pontiac Standard

256 hp

8. Standard, V-8 for Catalina and Star Chief Executive with manual transmission. Displacement—389 cu. in. 2 barrel carburetor. Torque—388 lb.-ft. Compression ratio—8.6:1. Regular fuel.

290 hp

9. Standard, V-8 for Catalina and Star Chief Executive with Turbo Hydra-Matic. Displacement—389 cu. in. 2 barrel carburetor. Torque—418 lb.-ft. Compression ratio—10.5:1. Optional at no extra cost with 4-speed manual transmission. Premium fuel.

325 hp

10. Standard, V-8 for Bonneville and Grand Prix with Turbo Hydra-Matic. (Optional at extra cost on Catalina or Star Chief Executive.) Displacement—389 cu. in. 4 barrel carburetor. Compression ratio—10.5:1. Torque—429 lb.-ft. Dual exhausts standard on GP only. Premium fuel.

333 hp

11. Standard V-8 for Bonneville and Grand Prix with manual transmission. (Optional at extra cost on Catalina or Star Chief Executive.) Displacement—389 cu. in. 4 barrel carburetor. Compression ratio—10.5:1. Torque—429 lb.-ft. Dual exhausts standard on GP only. Premium fuel.

Pontiac Optional

256 hp

12. Optional Regular Fuel V-8 available with Turbo Hydra-Matic only. Available on all models except 2+2 at no extra cost. Displacement—389 cu. in. 2 barrel carburetor. Compression ratio—8.6:1. Torque—388 lb.-ft. Regular fuel.

338 hp

13. Optional high-performance 421 V-8. Displacement—421 cu. in. 4 barrel carburetor. Torque—459 lb.-ft. Compression ratio—10.5:1. Available on all models at extra cost. Premium fuel.

356 hp

14. Optional Tri-Power 421 V-8. Displacement—421 cu. in. 3 2-barrel carburetors. Torque—459 lb.-ft. Compression ratio—10.75:1. Chromed rocker covers and oil filler cap. Available on all models at extra cost. Premium fuel.

376 hp

15. The famous optional 421 HO (High Output) Tri-Power V-8. Displacement—421 cu. in. 3 2-barrel carburetors. Torque—461 lb.-ft. Compression ratio—10.75:1. High-output camshaft, valve train and special exhaust manifolds. Low-restriction chromed air cleaners plus chromed rocker covers and oil filler cap. Low back-pressure dual exhausts. Declutching fan. Available on all models except Station Wagons. Premium fuel.

Meet me in St. Louie, at the car show.

photos by Bob Hegge.

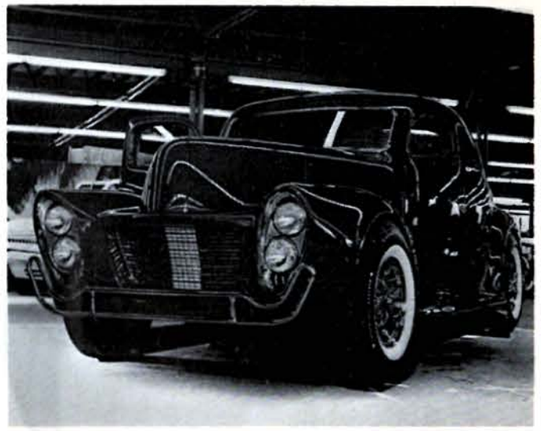
ST. LOUIS is in the center of the United States and some of the finest cars in the country appeared at the 6th annual Autorama. Most of the finest Midwestern examples of the Rodding and Restyling arts were well represented. This show was a true cross-section of America's best rods and customs. Many show bikes made the scene and they seem to be getting more popular. Ace photog, Bob Hegge, captured the finest of the show for our critical inspection.

Torquers and Coachmen combine with Promotions, Inc., to throw the finest show in the Midwest.

This fiberglass body Aztec, from the West Coast, mounts on a VW chassis and makes up into a very attractive roadcar.

Jack Webb, St. Louis, Mo. took Second Place in Altered Street Roadster Class. Body is '28 Graham Paige, mill is 303 Olds.

Boots Frithiof, Austin Texas ran away with show honors with this wild looking Chevy pickup powered with a full race Chevy mill. Car took Best Custom in Show, Best Engine Compartment, Best Pearl Paint, Long Distance Trophy, First in Full Custom Pickup.

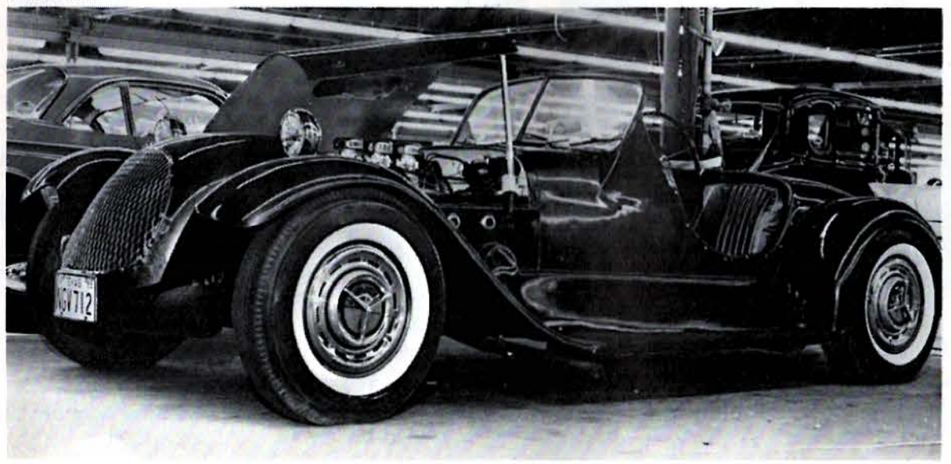


First showing of this '40 Ford rebuilt by owner George Schwable, took First Place in Radical Custom, Most Popular Car in Show.

Ron Johnson, Greenfield, Indiana, First Place in Altered Pre-war Pick up Class. Truck is '36 Chevy, with mag wheels, 'Vette mill.

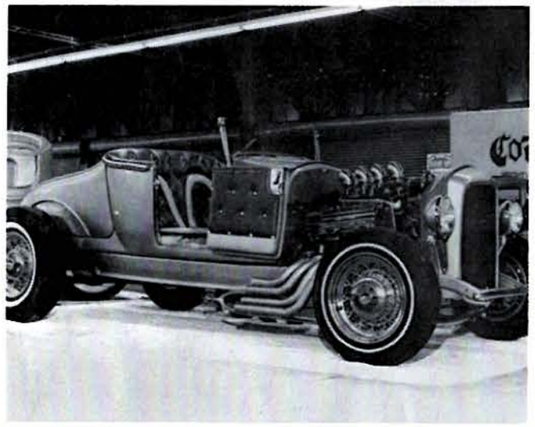
Don Sanders of Houston, Texas took First Place in Hand Built Class with his Chevy powered aluminum bodied road car.

Jeff Boock, St. Louis, Mo., took Second Place in Conservative Custom Compact Hardtop Class with his 1962 Corvair featuring '65 Corsa 140hp engine.



Bob Hawk, St. Louis, entered his warm Mustang GT-350 featuring a 306hp mill.

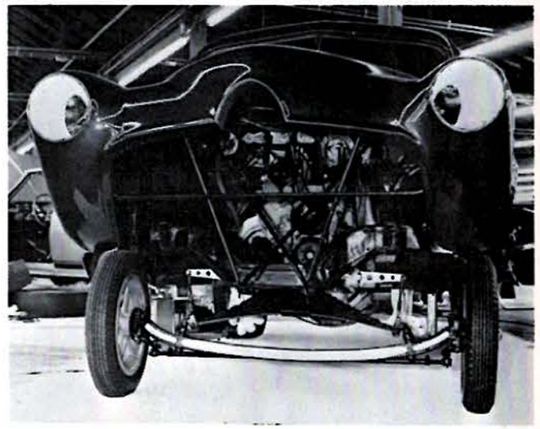
Bob Iden with his popular rebuilt Model A took Best Rod in Show, Best Rod Interior and Best Rod Engine, and First In Class.



First Place in Altered Street Coupe Sedan Class was taken by Rich Steyh, St. Louis with his 1927 T.

Charles Crowe, St. Louis, Mo. took First Place in Competition Coupe and Sedan Class with his Red Plymouth powered by a 292" Chevy truck mill. Also voted Best Engineered Car in Show.

Art Kelly came up from Valley Station, Ky. and took Second Place in Hand Built Class with his 272" Ford powered rebuilt English Hillman.



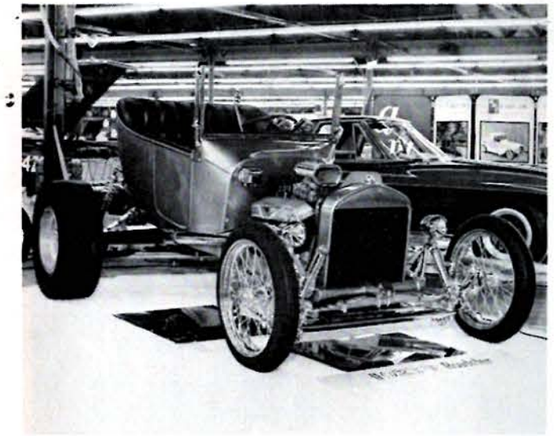
First Place in Altered Competition Coupe Sedan Class was won by owner-builder Paul Thursman with his '57 Buick powered Henry "J".

This '29 Ford roadster owned by Brad Johnson, St. Louis, Mo. took First Place in Altered Street Roadster Class.

From Chicago, Ill. came this midget owned by Joe Masteroleo to take First Place in the Half Midget Class. Big mill is 3hp Continental!

Neat looking rebuilding job on '56 Bird was done by Tom McMahon Ford of St. Louis. Engine is 312" Ford. A reported $12,000 went into the project. Chrome undercarriage is featured. Car took First Place in Custom Sports Class.

This 1959 Berkley is owned by St. Louisian Don Bouckhaut, runs with a 3 cylinder two-cycle 492cc mill.

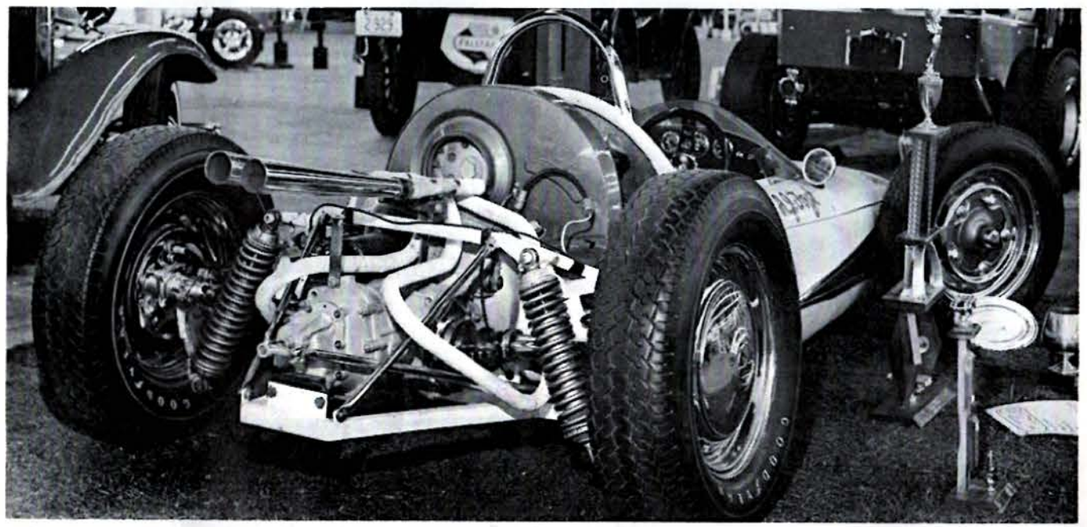


This 1923 T Roadster was built by Tom Tokas of Lemay, Mo. he took First Place in Altered T Roadster Class.

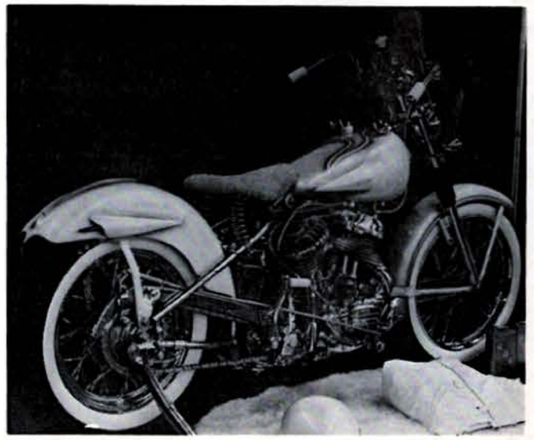
Jesse Hays Dallas, Texas took First Place in Radical Convertible Class.

First Place in Competition Bike Class was won by this '51 Triumph with a '60 Triumph mill. Owner, Cris Zaganelli, is from Collinsville, Ill.

Ron Ulrich from St. Louis, Mo. built this '34 Ford powered with a '55 Chevy mill.



This popular Formula Vee race car is powered with a hot VW engine and is built and owned by Peterson-Mansfield of Flat River, Missouri. A. J. Foyt is named, on the car, as driver!



MARY HORNE of Memphis, Tenn. came up with HER '41 Harley and ran off with First Place in Show Bike Class and Most Outstanding Bike in Show.

will be in the curved path of the faster moving air around the side of the windshield corner. This is called interference drag and might easily cause the mirror to have double the normal amount of wind resistance. Mutual interference occurs as in the case of high rear fender humps and a headrest between them as on some sport racers. The channels of air on each side of the headrest are restricted sideways by the fender humps. This narrowing down of the channels forces the air to speed up and therefore the headrest and both fenders are operating in a faster moving wind stream. Thus, each adds to the drag of the other. Exposed uncovered wheels and suspensions have greatly increased wind resistance because of the interference caused by the small body between them. Further interference drag occurs at the tops of the tires. These portions of the wheels are moving forward twice as fast as the hubs and body so have four times as much drag as if the wheels were not rotating. Wire wheels have more drag than discs. A smooth, slightly crowned disc out to the tire sidewall, on each side of the wheel, provides a big improvement. Covering the wheels and suspension with an envelope type body is better; smoothly streamlining the envelope is best by far.

There are many items subject to interference drag -- in fact, anything exposed to the wind stream and located near another part or surface. Interference drag is one of the worst offenders and deserves detailed analysis.

Wind Resistance Due to Lift (Induced Drag) - A wing like body lifts and this action forces the air downward as shown by a thread attached at the rear. This downward forcing of the air causes additional turbulance or resistance in the surrounding air, hence the name "induced drag." Power is consumed by this action (Fig. 4).

Air forced upward by a windshield and then curved back downward at the rear by the top and rear deck, lifts in the same manner as the wing and creates the same kind of "induced drag." Fenders and similar airfoil like shapes create lift and the accompanying induced drag as shown in the lower portion of Fig. 4.

Induced drag on this type of automobile may easily "lift" as much as the pressure drag only of a pure streamline shape of the same size. Conventional American sedans generally "lift" about 300 lb at 100 mph. It is divided somewhat equally between front and rear axles. The same car will have about 300 lb air drag also at 100 mph. A lift of 300 lb accounts for a serious loss of weight on a "light" car and will adversely affect stability, controllability, and braking at high speeds. It is obvious that proper aerodynamic design

Fig. 4 - Lift and induced drag

is a must for these reasons alone for light cars at good speeds and for all cars at high speeds.

Drag Due to "Bob-Tailing" A Streamlined Shape - Aeronautical engineers have known for many years that the pointed tail of certain streamlined shapes could be cut off with but minor effects on drag. A good example is World War II bombers on which the tip of the fuselage tail was "bobbed" or cut off to provide room for the tail gunner. Tests have shown that a surprising amount of the rear portion can be removed with relatively small increases in drag. This is important to the problem of the streamlined automobile in keeping the length reasonable for parking.

Bob-tailing also affects a lifting shape (induced drag) if the "bobbing" occurs shortly after the start of the downward curve of the upper surface or top. Since the cut-off increases the base, or pressure drag, slightly and reduces the induced drag, an optimum cut-off point can be determined for an automobile at which the two effects essentially cancel each other. Then the automobile with this blunt or cut-off aft portion will have no more drag than a full length streamlined body that curves down to the belly pan. Dr. W. I. E. Kamm of Germany was probably the first to apply this knowledge to the design of a streamlined sedan automobile. The development was carried through the test stages and several successful efficient streamlined automobiles were built although, for other reasons, they did not become available in production quantities. (6)*

Ground Effect - If our automobiles operated at some considerable distance above the roadway, the shape might logically be a bit different. The underside could curve upward at the rear (also at the front) to match the curve of the upper contours, again like the fish or submarine. Then we would avoid "induced drag" and could utilize the lowest drag shape. Since the automobile must operate just a few inches above the ground, we must consider "ground effect." At automobile speeds, we really don't compress the air underneath as some people think -- but we do move it, or deflect it. This then affects the airflow along the sides and over the top. If the underside curves upward at the rear very quickly, the air below cannot fill in the larger space adequately and so air will be sucked under from the sides. Air from above will then be pulled over to the sides also. The overall effect is "induced drag" again.

Our object is to not disturb the air underneath the automobile any more than absolutely necessary. At first it would seem that a perfectly flat and level belly pan would be ideal. But it doesn't quite work out that way. Remember skin friction and the buildup of the boundary layer of air. This should be determined and allowance made for it.

Internal Wind Resistance - The radiator, carburetor air intake, brake cooling, and cockpit ventilation consume considerable air and in each case this air should be carefully ducted. After the air enters the body shell it is subject to

*Numbers in parentheses designate References at end of paper.

skin friction, turbulence, and interference drag just as though it were flowing on the outside of the body shell. Calc must also be taken as to where this air is exhausted. External suction or pressure can seriously affect the flow. If exhausted into a pressure area it is possible to stop the flow or even reverse the direction -- thus nullifying the purpose.

Entering air ducts should not expand or enlarge too rapidly to avoid flow separation along the walls. The surfaces should curve smoothly. Fig. 5 illustrates about the maximum expansion and length to width (or height) ratio to avoid flow separation.

As the air enters at relative car speed it slows down by the ratio of opening size used by the air to radiator size. This slowing down is accompanied by an equivalent increase in air pressure. The air pressure increase is most useful in getting the cooling air through the radiator. However, the effect can be largely lost if the duct is not tightly sealed at all joints and to the radiator. The air pressure would simply escape through the leaks.

If the air is conducted away from the radiator to the outside surface as carefully we then have a low drag duct. If no duct is used on the back side of the radiator, the air will buffet around the engine, frame, and controls, and will cause a loss in cooling efficiency as well as about four times as much internal wind resistance as a good low drag duct.

High Speed Directional Stability - Many sports cars suffer from lack of directional stability at high speed. The tendency to place more weight on the rear wheels to avoid wheel spin aggravates the problem further. The problem can be aerodynamic, a matter of weight distribution, suspension, lack of frame torsional rigidity, steering, tires, or a combination of several of these items. We will deal with the aerodynamic problem only. The body should be designed so that air forces tend to head the car into the wind like a weathervane. These air forces act about the center of gravity of the car. If the c.g. is to the rear of the midpoint of the wheelbase it is not unusual to have more of the body length and side area ahead of the c.g. than to the rear. Extended radiator ducts and stubby tails occur frequently. This puts the center of air pressure ahead of the c.g. and the car is directionally unstable at high speed, difficult to manage, and a menace to other cars and its driver. Usually larger rear tires and higher rear tire pressures which help cornering, will help this situation too. Additional fin area to the rear is the aerodynamic need in this case. It is better however to design the body so that more fin area is not needed. This requires some increase in body length behind the rear wheels.

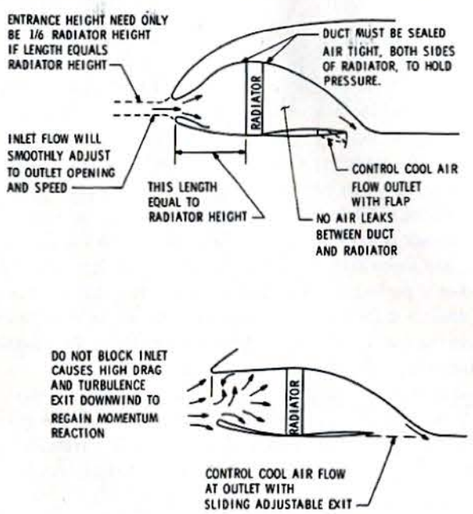


Fig. 5 - Duct design

In the case of the streamlined automobile this is compatible with the need for sufficient length aft to taper to a smaller cross-sectional area for minimum drag. The center of pressure is not at the point where the side area balances, it is ahead of that point, closer to 25% from the front. One-third back from the front is approximate for a racer with headrest and small windscreen. That point should be at the c.g. or behind it for high speed directional stability. The exact center of pressure cannot be determined except by wind tunnel test. This should be done particularly in the case of well streamlined shapes because the center of pressure is more forward than with less streamlined shapes.

Power Losses Due to Carburetor Inlet, Air High Temperature and Low Pressure - Existing cars, almost without exception, permit the carburetor to suck in hot turbulent air from around the engine. The fuel-air ratio is determined by weight: weight of fuel and weight of air. Hot air is lighter so at higher inlet air temperatures the mixture is air-starved and power drops off. How much? One per cent with every 10 F rise in temperature. It is entirely possible that under hood temperatures reach 180 F on a hot day, and may-be more in certain racing aircooled cars, with the carburetor quite near the hot cylinder and with only a slight movement of air. This is 120 F warmer than standard outside air at 60 F. This temperature rise therefore causes a loss of power amounting to 12%. It obviously pays to direct cool air to the carburetor air inlet.

Altitude causes a power loss of 3-1/2% for each 1000 ft. Many communities are at about 1000 ft, so you can expect a loss of 3-1/2% quite normally.

Ram air helps although not too much. If we are going to direct the carburetor inlet air, naturally let's obtain ram air. At 75-100 mph the ram effect is slight -- only accounts for a horsepower gain of about 1%. It can help to overcome losses due to air turbulence, through its slight pressurizing effect, thus avoiding another source of air starvation at high speeds. Negative air pressure and air turbulence could account for a loss of 2 or 3%.

Adding up these losses, we find typically we may lose 12% to temperature rise, 3-1/2% to altitude, and 2-1/2% to negative pressure turbulent air -- a total of 18%!

(continued next issue)

BOOKS TO READ

The most complete collection ever gathered of the colorful language of the automobile and racing enthusiast is presented in John Lawlor's new book, **HOW TO TALK CAR.**

With more than 100 photographs to illustrate definitions, the 128-page book lists more than 1,000 colorful terms in its glossary of car slang.

The full-color hard cover of **HOW TO TALK CAR** is an unusual creation of design art, and lends a distinctive touch to the book.

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The down-to-earth, practical definitions of the slang words make **HOW TO TALK CAR** an instructive and enjoyable book for anyone to read.

A few popular examples of the definitions in **HOW TO TALK CAR** include:

Bottom out: In oval track racing when a car settles down tightly on its springs as it travels through a banked turn, it is said to bottom out. If the car is going fast enough and the bank is high enough, centrifugal force tends to pull the vehicle toward the track surface, causing the chassis to bottom.

Meat: Structural metal, especially within an engine block. When overboring, it's important not to cut too deeply into the meat.

Put it to the wood: To floor the throttle for maximum acceleration.

Scratch: To perform well on a motorcycle. A rider who is steadily improving his position during a race is scratching, for example.

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(Signed) Patrick T. O Rourke ,Business Mgr.

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To make the most of this fantastic accuracy, the tach is a big 3 13/16 inches in diameter. This large face allows easy reading during critical races. The tach has a 100 degree movement. The 100 degree movement has been proven to be the easiest to read. What good is a tach if you have to take time out to read it? Instant accuracy and instant readability are the two plus features of Faria tachs. The needle moves smoothly through all rpm ranges and responds instantly, as only a solid state tach can, to variations in engine rpm. You never have to worry about tach lag. This is the best insurance your engine can have.

Shock and vibration cannot faze this solid state tach. The tach has only one moving part, the needle, and this is electronically damped to insure free and easy response to engine speed changes.

This tach is the only tach on the market which undergoes rigorous testing for shock and vibration. The tach is guaranteed to withstand a shock of 50 G's. Some special space age Faria tachs have been tested to 110 G's. Unless you are going to outer space the 50 G model will do just fine.

The tach has been designed to withstand a vibration magnitude of .030 excursion at 30 cycles per second. No car on earth is capable of shaking this instrument's accuracy.

Vibration is a problem in marine applications. Let it be known that the Faria tach is standard equipment with the overwhelming majority of marine engine makers because of its durability, accuracy and reliability.

This special low price is possible because of a new design circuit breakthrough that has been patented by Faria. US Patent #3005155 protects the unique design of this instrument.

Prototypes of this new solid state tach have been tested by two of the top wheelie machines in the nation. Wild Bill Flynn, driver of the funny Dodge, uses and endorses the solid state Faria tach. G. Schumpert, driver of the Thunderwagon is another enthusiastic user of the Faria solid-state tach.

This Faria solid-state tach has no sending unit, no batteries and no fragile vacuum tubes. It connects with only two wires. This insures changability from car to car. A chrome mounting cup is included as is a built in light for the dial. There is no finer instrument value on the market. We do not hesitate to guarantee that the Faria tach will outperform any tach that sells for under 85.00 or your money back.

Various face models are available: 0-4000, 0-5000, 0-6000, 0-8000 and 0-12000. The most popular is the 0-8000. This is the one chosen by Flynn, Schumpert and other top Super Stocker and FX drivers.

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