HOT RODDING THE BUICK

By Bob Russo

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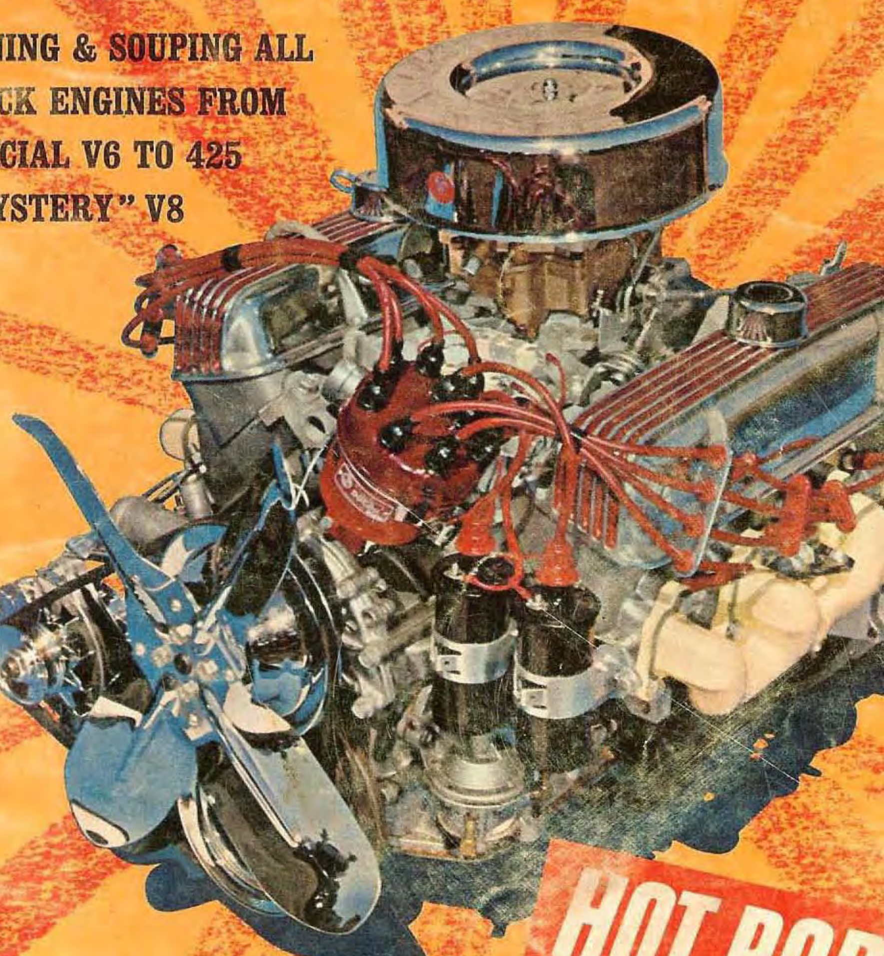
TUNING & SOUPING ALL BUICK ENGINES FROM SPECIAL V6 TO 425 "MYSTERY" V8



HOT ROD MAGAZINE TECHNICAL LIBRARY

PERFORMANCE SECRETS OF REVENTLOW'S SCARAB, THOMPSON'S INDY SPECIAL, BALCHOWSKY'S OLD YALLER, IVO'S 4-ENGINED DRAGSTER

INTRODUCTION

Buick engines are neither the biggest nor the hottest being made today. They're merely successful!

Buick hasn't sought a high-powered image in recent years. In fact, no other car this side of the strict luxury field has played it so cool. While Chevrolet, Ford, Plymouth, Pontiac, Mercury and Dodge have bid for the attention of the performance enthusiast, Buick has been satisfied with its traditional appeal as a "nice" car, not a spectacular one.

Yet a Buick came within an ace of the NHRA Stock Car Championship just two years ago. Lennie Kennedy of Pomona, California, campaigned his '61 Invicta as a D/Stock Automatic and piled up more points than all but one other contender for the title. Out of the thousands racing stocks at NHRA strips, Kennedy finished second in the nation, right behind Bruce Morgan and his '57 Chevy.

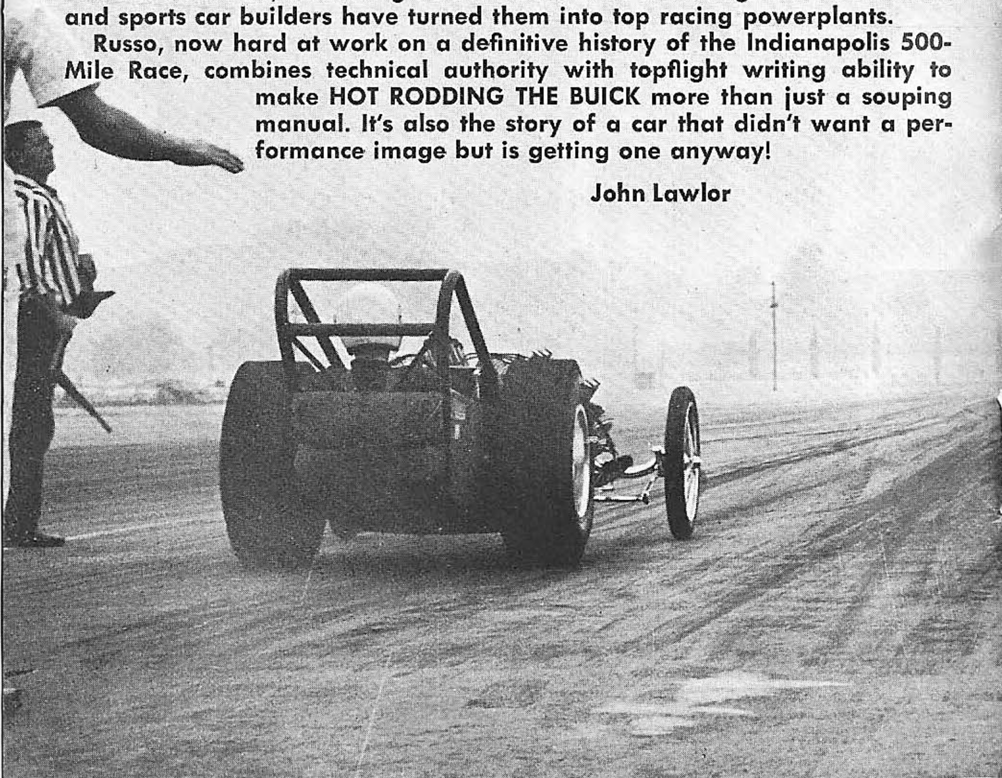
And, in the hands of such varied racing personalities as Tommy Ivo, Max Balchowsky, Lance Reventlow and Mickey Thompson, Buick-powered cars have made their marks on drag strips, sports car circuits and even on the hallowed bricks of Indianapolis.

Obviously, there's something to Buick engines that a good many hot rodders have been overlooking.

Bob Russo tells about it in HOT RODDING THE BUICK. Following the pattern he established in his earlier Spotlite Book, HOT RODDING THE FORD V8, Russo examines all of Buick's current engines, from 198-cubic-inch V6 to 425-cubic-inch V8, describing them in detail and revealing how hot rodders and sports car builders have turned them into top racing powerplants.

Russo, now hard at work on a definitive history of the Indianapolis 500-Mile Race, combines technical authority with topflight writing ability to make HOT RODDING THE BUICK more than just a souping manual. It's also the story of a car that didn't want a performance image but is getting one anyway!

John Lawlor



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Modified Buick Special V8, photo by Eric Rickman

HOT RODDING THE BUICK by Bob Russo, Spotlite Book #537, U.S.

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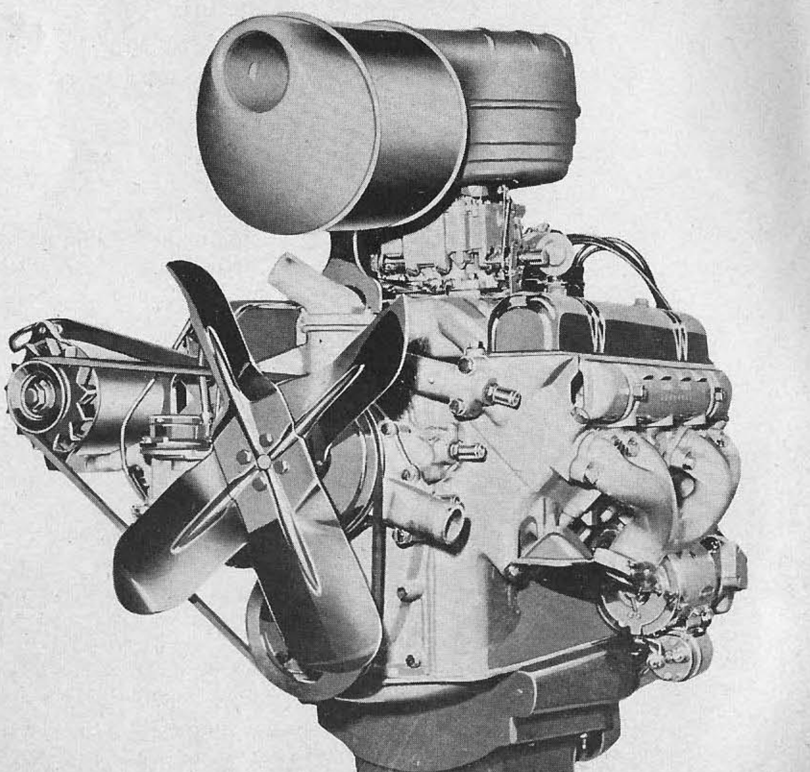
BUICK ENGINES TODAY

FOR MORE than a half century now, the name Buick has been important to consumers seeking quality. Built on a rugged foundation of durability and reliability, Buick cars have been a bulwark to the industry over the years, featuring consistently high engineering standards and enjoying wide acceptance from the motoring public.

Those two qualities—reliability and durability—have been foremost in Buick production from the very beginning. They are two excellent reasons why Buick has remained high in popularity all these years while others have run up and down the scale or dropped from the picture altogether.

Of course, Buick has not enjoyed the performance image created by Ford, Chevrolet, Pontiac, Dodge, Plymouth and some of the other manufacturers in the past and present, simply because such an image hasn't been sought on a full-scale basis. The guiding hands behind Buick production seem content to follow the established pattern for quality and reliability rather than pursue the high-performance route taken by other manufacturers.

Still, when the occasion has called for performance in competitive events, Buicks have been more than equal to it. They did well, for example, in the Mexican Road Race; have been successful in NASCAR Grand National racing and, perhaps even more significant, it was the Buick engine that finally broke into the starting field at Indianapolis, where stock-block engines had virtually been overrun and shut out for years by the dominating Offenhauser and other all-out racing mills.



Smooth, silent behavior of stock Buick V8 is ideal for plush models like '63 Riviera.

First Buick V8 (left) appeared in '53. Displacement was 322 cu. in., rating 164 hp.

Buick engines are being used successfully today at the drag strip, in sports car racing and for engine swaps by more and more enthusiasts who have realized the high-performance potentiality and durability these powerplants offer. In their stock form, coupled with the 26 models offered by Buick in 1963, they are both light and lively.

The current crop of Buick engines consists of three basic mills, ranging from the spectacular V6 to the small but mighty aluminum V8 and the bigger 401 cubic-inch cast iron V8. All three, combined with good styling and other engineering features helped increase Buick production to 400,150 in 1962, the biggest year since 1956. An increase to 425,000 was anticipated for 1963, running the overall production figure to more than 11 million since the Buick was first built 60 years ago.

The Special V8 was introduced at the beginning of the 1961 model year as the basic engine for the Buick Special and promptly won national acclaim for its light weight and lively performance. It has a displacement of 215 cubic inches and weighs slightly more than 300 pounds, including carburetor, generator and starter, which makes it an excellent choice for swapping or hop-up. In its basic form, the aluminum V8 is capable of 155 hp at 4600 rpm.

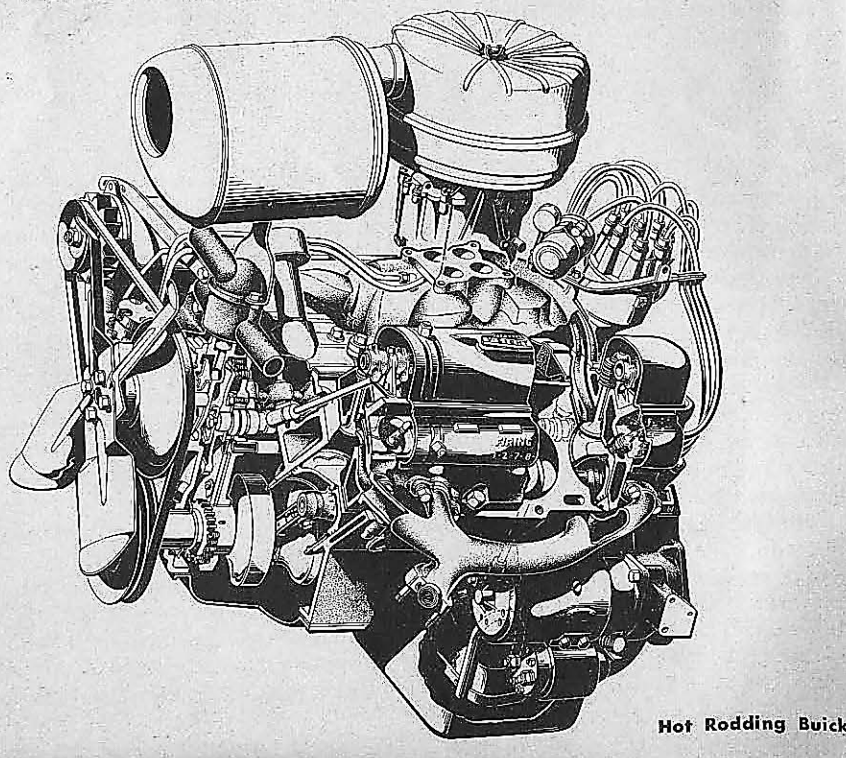
Extensive planning and engineering went into the development of the Special V8. While aluminum was not exactly new to the industry, tooling and casting methods used here were the results of the latest techniques developed by GM engineers, to eliminate high costs and casting problems generally associated with aluminum.

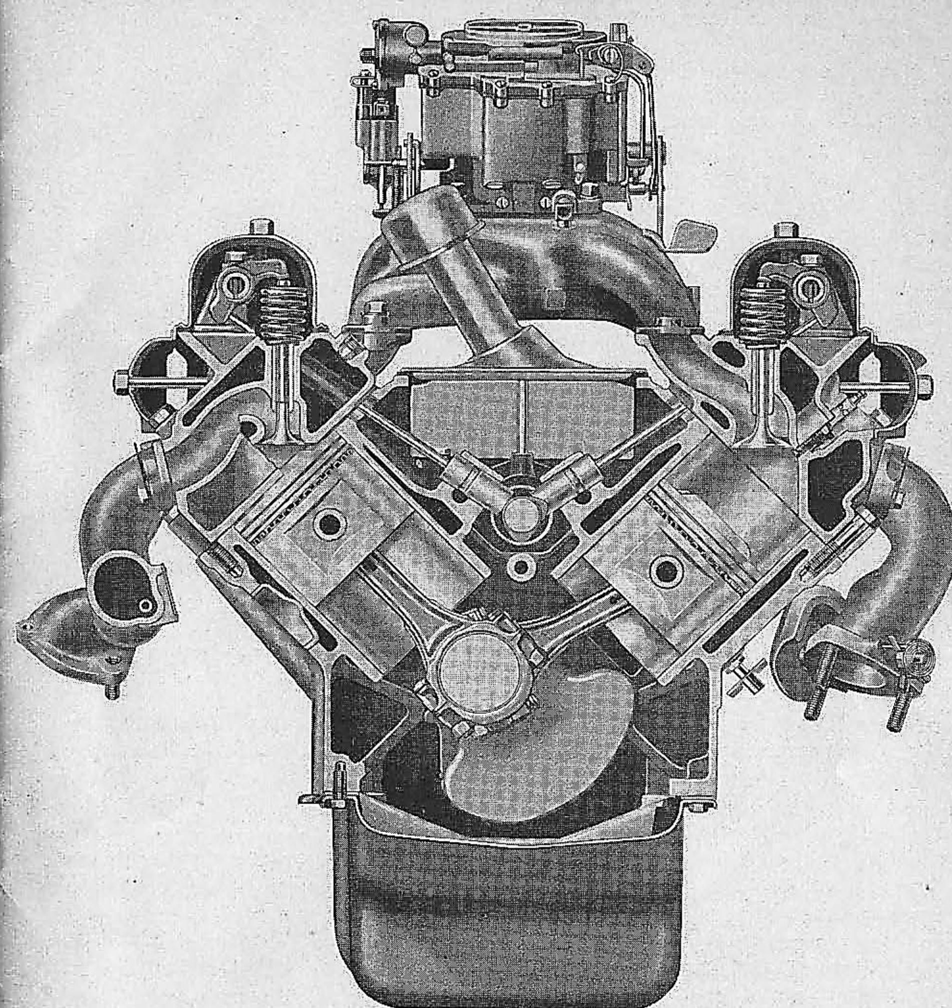
Instead of using all steel dies for example, a permanent mold type system was employed using external steel molds but with internal passages made of sand cores. Molten aluminum is fed by gravity rather than by pressure so that no after bonding of the block and head sections is necessary. This system is a good deal cheaper than full die-casting and just as effective.

Specification-wise, the basic Special V8 has a bore and stroke of 3.50 x 2.80 inches, which gives the total 215 cubic inch displacement. Maximum torque is rated at 220 lb/ft at 2400 rpm, and a single two-barrel carburetor is used. Compression ratio is 9-to-1.

An interesting comparison can be drawn between the Special V8, the 221-cubic-inch Ford Fairlane V8 and the 283 Chevy V8, showing the weight advantages of aluminum. The Buick is 200 pounds lighter than the Chevy and nearly 120 pounds lighter than the Fairlane, both of which are cast iron, of course. With all its accessories (starter, generator and carburetor) the Special weighs in at only 330 pounds (minus the flywheel and clutch assembly), and this can be appreciated further when you consider the fact that the bare block alone weighs but 57 pounds as compared to 144 pounds for

Basic design of '53 engine, especially layout of valves, continues in latest Buicks.



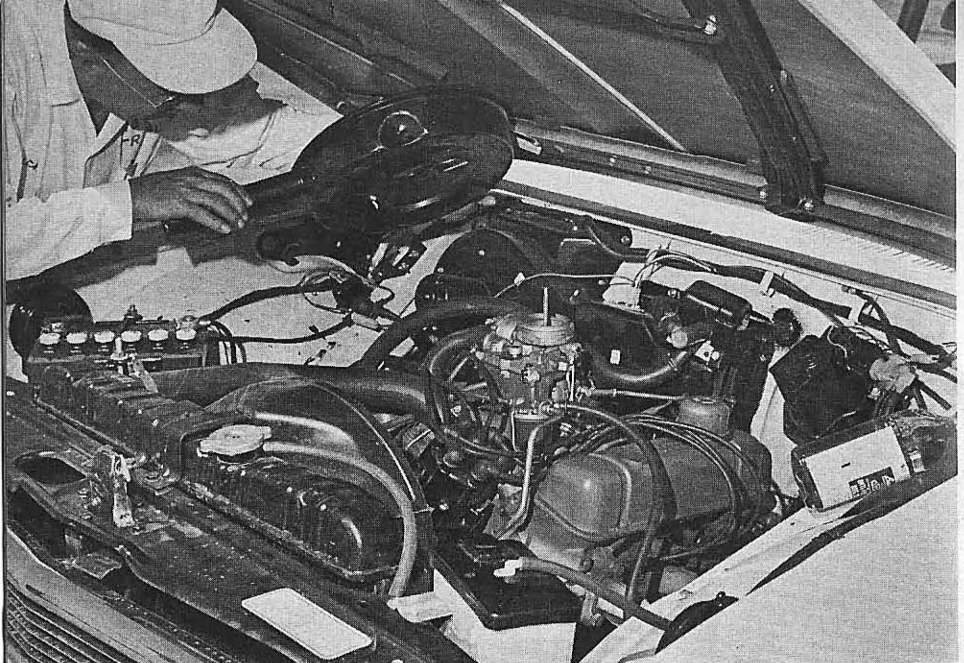


By '54, Buick V8's ranged from 143-hp Special to lively 200-hp Century, Roadmaster.

the Chevy!

Ford engineers have done an excellent job on the Fairlane by utilizing new casting techniques to reduce weight of the cast iron block. They succeeded in coming up with a slightly smaller (in overall size) engine than the Buick, but there is still that matter of weight . . . more than a hundred pounds worth. The Buick still has the honor of being the lightest. As a matter of fact, the aluminum V8 weighs five pounds less than the Chevy II four-banger and is equal in weight to the Corvair flat six!

Further comparison shows that the basic Special V8 produces more horsepower with less weight and less displacement than the 221-cubic-inch Fairlane V8, and has only five less horsepower than the 260 Fairlane V8. Little wonder then why more and more



For '63, 401-cu.-in. engine is used in Wildcat (above) and in Riviera (opposite page).

enthusiasts are going the Buick route. Just with basic modification work, it can be a real hauler.

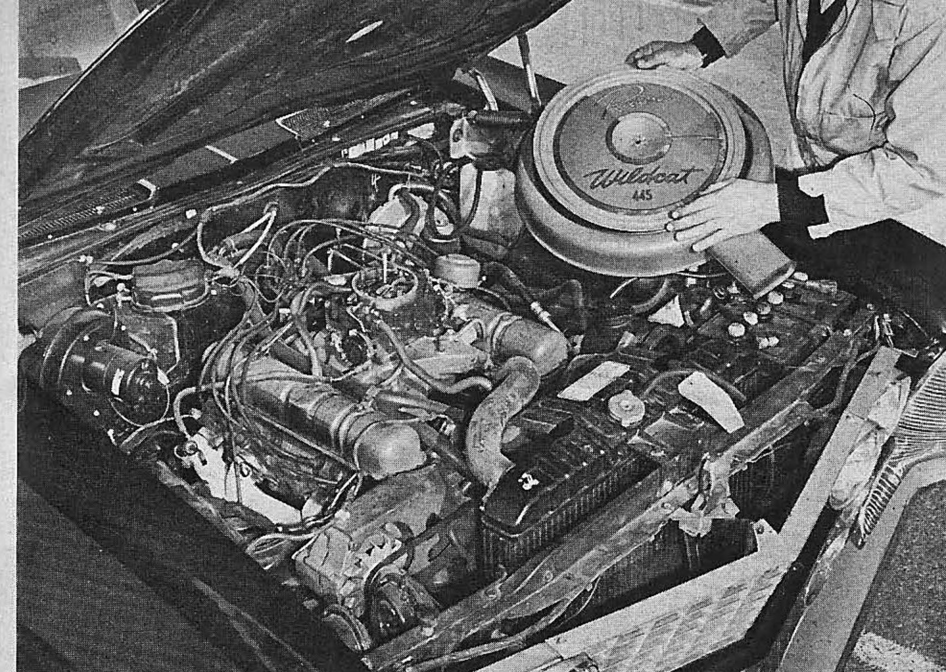
Probably the best testimonial of the engine's durability was given during the 1962 500-mile race at Indianapolis where a highly modified version of the stock powerplant was used in a rear-engine creation fielded by speed king Mickey Thompson. The car was driven by veteran Dan Gurney who out-qualified the majority of Offenhauser-powered cars in the race and was running well up in the pack when an oil seal came out of the rear end late in the race. The engine ran perfectly.

Halfway through the 1961 model year, Buick introduced a stepped-up version of the basic Special engine, a 185 hp bear (increased to 200 hp for '63) known as the Skylark. This increase in horsepower was achieved through four-barrel carburetion and a hotter cam, without changing bore, stroke or displacement. Compression ratio was raised, of course, from 9-to-1 to 11-to-1. This engine is standard on all Skylark models and is available as an optional engine for all other Buick Specials.

Worth noting here is the fact that the Skylark engine produces 40 more horses than the Fairlane 260 and five more horsepower than the big 283-cubic-inch Chevy, all on less weight and less —considerably less—displacement.

The Special V8 was replaced as the standard engine on the Buick Special in 1962, when Buick pulled the rug out from the rest of the industry by introducing its spectacular V6. Now standard equipment on the Special, the V6 has been heralded as the greatest engineering advance in modern automotive history. It is the only V6 passenger car engine produced in this country.

Introduction of the V6 in 1962 wasn't exactly a surprise. It had been known for more than a year previous that



Big 401 produces 325 hp at 4400 rpm and hefty 445 lb/ft of torque at 2800 rpm.

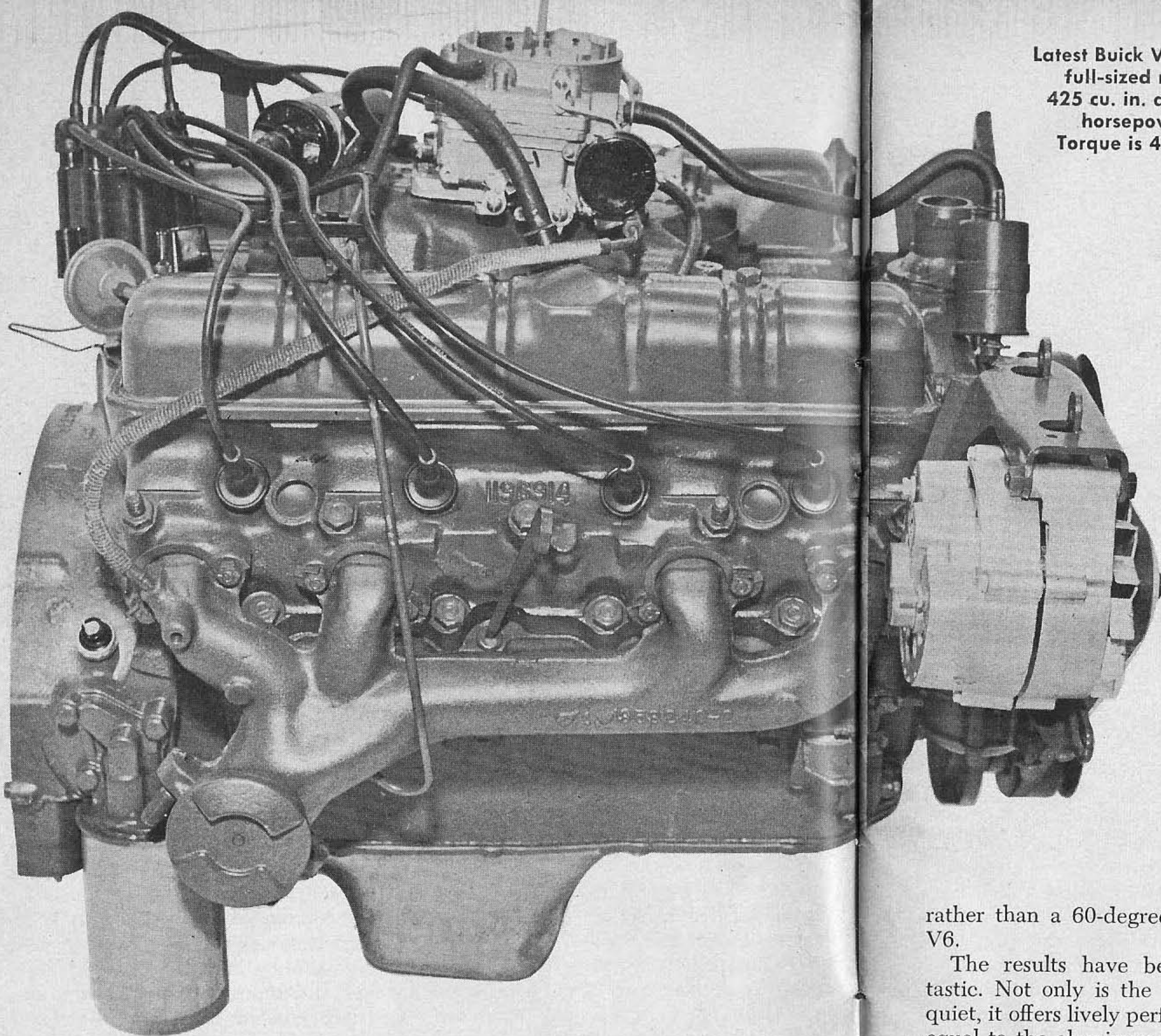
engineers were working on such a powerplant, but few persons expected to see it in actual production so soon. In any case, there is no doubt that this revolutionary new powerplant has been one of the most successful engineering developments to hit the industry in a good many years.

There are several reasons why GM brass decided upon a V6 rather than a standard in-line, ohv six. According to Buick's chief engineer, Lowell Kintigh, the decision was based upon common logic. Since Buick had produced only eight-cylinder engines for more than 30 years, there was a new market to be gained with the introduction of a six.

In the interest of production economics, a V6 design proved to be the best answer since it solved a number of problems. Competing six-cylinder engines were, for example, two cylinders longer than the Special's aluminum V8 powerplant so there was a problem of fit in the existing engine compartment. Weight distribution also had to be considered as well as mounting points and interchangeability with the V8 transmission and other components already in production. Last but not least, V6 design was easily incorporated into assembly and tooling already set up for the V8.

The V6 solved those problems. It fit the existing engine compartment with plenty of room to spare; offered ideal weight distribution for the existing suspension system and, from a sales standpoint, offered the Buick dealer an exclusively new feature that really increased sales.

Basically, the V6 strongly resembles the aluminum V8, and most of the vital components are identical. It has a bore and stroke of 3.625 x 3.20 inches, with a total displacement of 198-cubic-inches. Horsepower is rated at 135 at 4600 rpm with a maximum torque output of 205 lb/ft at 2400 rpm. Com-



Latest Buick V8, optional in all full-sized models, displaces 425 cu. in. and produces 340 horsepower at 4400 rpm. Torque is 465 lb/ft at 2800.

pression ratio is 8.8-to-1.

GM engineers did an outstanding job of overcoming balance problems which have been prominent with a V6 engine. Actually, they were problems of primary and secondary unbalance. The primary was handled in the same manner as for a 90-degree V8, by locating counterweights on the crankshaft. The secondary unbalance, which is caused by parallel forces acting in opposite horizontal direction, was eliminated in the design of new motor mounts. Experience established that this was much easier to isolate in a 90-degree engine

rather than a 60-degree or 120-degree V6.

The results have been pretty fantastic. Not only is the V6 smooth and quiet, it offers lively performance almost equal to the aluminum V8 and is quite economical. There is very little difference in fact, in low-end performance of the two engines. The difference can be noticed at the top end, where the V8 has the edge.

The V8 is not quite as economical as the V6 but here again, the two are quite close. The Special V8 is a two-time class winner in the Mobilgas Economy Run, producing as much as 25 mpg.

Overall, the V6 and its 90-degree configuration is considered efficient. In addition to smooth, lively performance, it is lighter and more compact than an in-line six and, thanks to all the research, designing and engineering that went into development of the aluminum V8, is being produced at low cost. Nearly all of the basic engineering was done with the development of the V8, and Buick was able to pass on the savings to the consumer.

Buick's basic big V8 is the 401-cubic-inch power plant that ranges in horsepower from 265 and 280 to 325. Power teams are available for application to the LeSabre, Invicta, Wildcat, Electra and Riviera, with a choice of two- or four-barrel carburetion and a range in compression ratio from 9-to-1 to 10.25-to-1.

The 401 has a bore and stroke of 4.1875 x 3.64 inches and, until the middle of the 1963 model year, rated as Buick's biggest engine. For 1963½ however, Buick introduced its current 425-cubic-inch version which is capable of 340 horsepower at 4400 rpm, with a torque output of 465 lb/ft at 2800 rpm.

Chief differences here over the 401 is an increase in bore size. The 425 has been punched out to 4.315 inches to account for the increase in displacement, but retains the same 3.64-inch stroke. There is a difference in cams and valve timing, and a four-barrel Carter carburetor is standard while hydraulic lifters and all other components are the same as the 401.

The LeSabre, Buick's smallest big car, employs the 401 with two-barrel carburetor, 10.25-to-1 compression and 280 hp as its standard engine. Two optional versions are available including the 265 hp engine with two-barrel carburetion and 9-to-1 compression, and the 325 hp power plant with a single four-barrel and 10.25-to-1 compression.

The latter, 325 hp engine is also standard on the Invicta, Wildcat, Electra and Riviera. ■

LIGHTWEIGHT V8

DEVELOPMENT of the lightweight aluminum V8 engine was a joint venture by engineers from Buick and Oldsmobile, working under the auspices of their parent, General Motors Corporation. Produced in two separate versions, one for the Buick Special and the other for the Olds F-85, both power plants represent a milestone in automotive design and engineering—a milestone that has paved the way to lighter, more compact engines with greater performance characteristics than the bigger and heavier cast iron V8's found in most other cars.

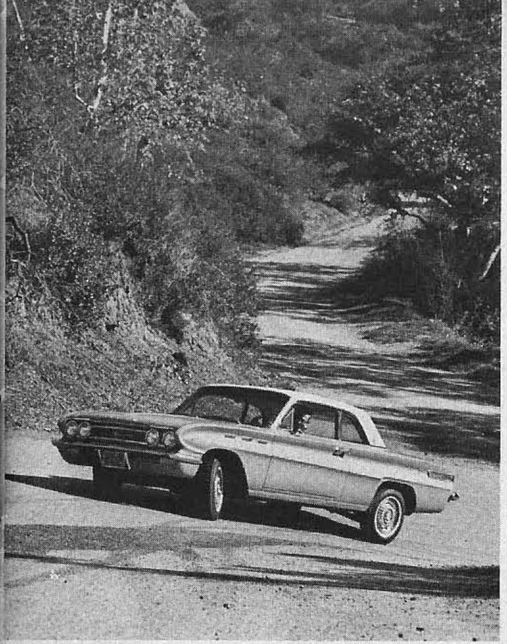
Basically, the Buick and Olds V8's are the same. That is, they are produced by the same casting methods, utilize the same block, crankshaft, rods, oil pumps and other components below the cylinder heads, sport the same 3.50 x 2.80 bore and stroke, the same 215-cubic-inch displacement and allow interchanging of most vital parts. The chief differences are in and above the cylinder heads where there is a decided change in combustion chamber configuration, pistons, valve size, rocker shaft stand mounting and rocker arm lubrication.

These differences are the results of individual engineering preferences by both factories, and while there isn't a great deal of performance differential between the two engines, the Buick does have a slight edge in horsepower. It also is slightly lighter than the F-85.

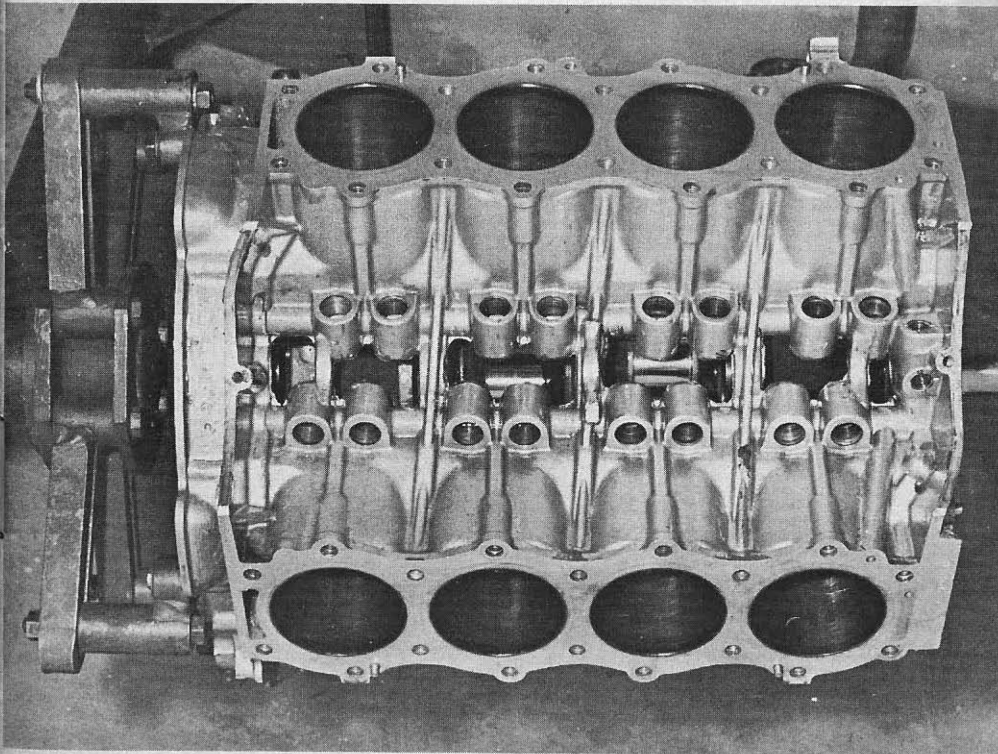
We won't dwell too heavily on the F-85 version in this book, other than to offer comparisons whenever the occasion warrants. Anyway, except for the components already mentioned—pistons, combustion chamber, valves, etc.—our description of the Buick will pretty well cover the F-85, too. Before moving into more detail, however, we should like to point out here that it was the Buick V8 and not the F-85 version that was offered briefly as an optional engine for the Pontiac Tempest a short time after the new powerplant was introduced. This option has since been dropped in favor of Pontiac's own 326-cubic-inch, cast-iron V8.

The all-aluminum V8 was produced after a great deal of engineering study and research into comparatively inexpensive casting methods and design. Needless to say, there were many problems both before and after production began, just as there always is with an entirely new engine built from scratch. Some of these problems were the result of using aluminum instead of cast iron for weight saving, and some were costly. In any case, Buick and GM engineers have managed to solve them and have proved that a lightweight, all-aluminum powerplant could be produced at a reasonable price.

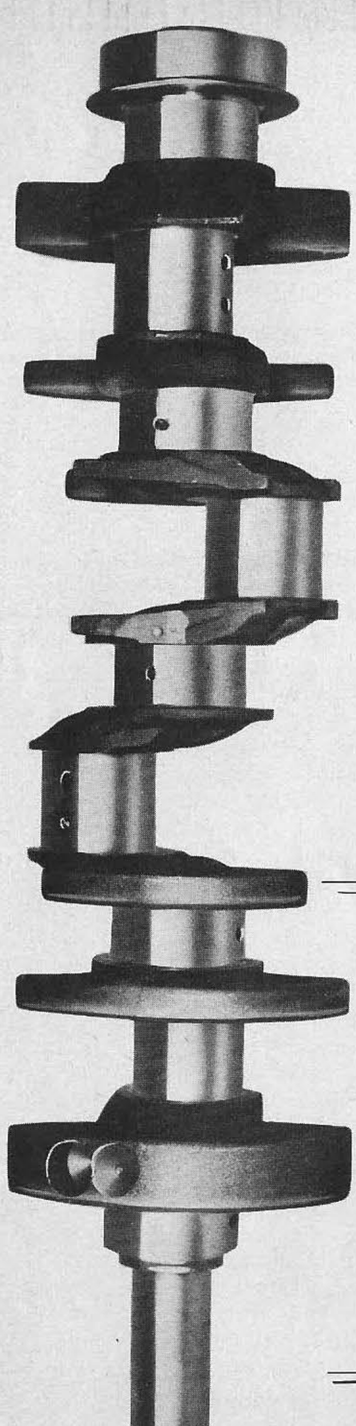
In the opening chapter, we pointed out that a permanent mold casting method is used, and has worked out successfully. A big problem that faced engineers, however, was a method of sleeving the aluminum cylinders. Since



Factory saw performance potential of aluminum V8 at early stage, upped it 30 horsepower for first Skylark in early '61.



Naked block of aluminum engine registers 57 pounds on scales. Basic casting for Olds F-85 engine is almost identical.



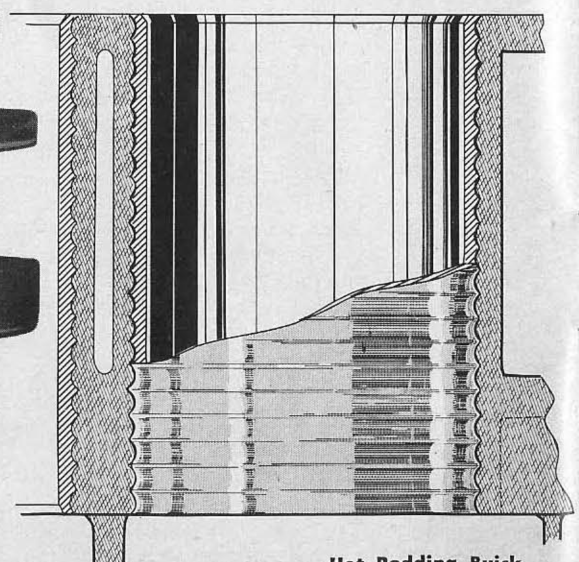
aluminum is softer than cast iron, it became necessary to provide cylinder walls with a surface that would withstand constant scrubbing and wear of the pistons.

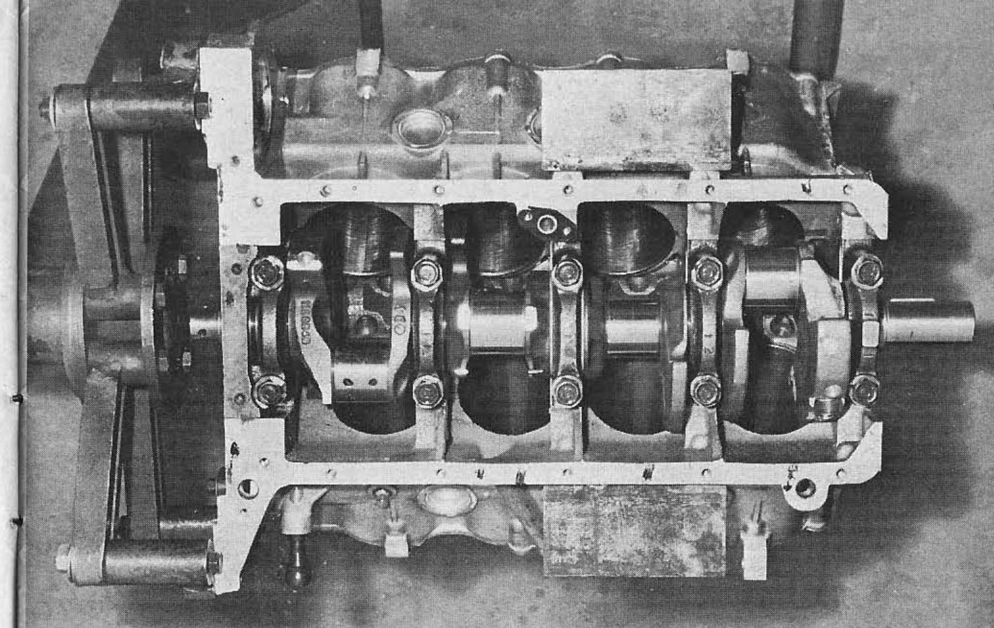
To solve this, cast-iron sleeves were used, but rather than just pressing them into the block, a method was devised whereby the sleeves are actually cast in the molds where molten aluminum is poured around them. To further insure that the sleeves would be locked in, they were made with outside grooves or ridges which grip firmly into place once the aluminum solidifies around them. This way, there is never any danger of the sleeves slipping or turning inside the bore.

The sleeves have a thickness of .060-inch. Bore spacing of the V8 block,

Crankshaft is cast of Pearlitic malleable iron. Casting has proven less expensive, just as efficient as usual forged steel.

Cylinder sleeve is iron, is cast right in aluminum block. Note grooves on outside of sleeve to hold it securely in position.





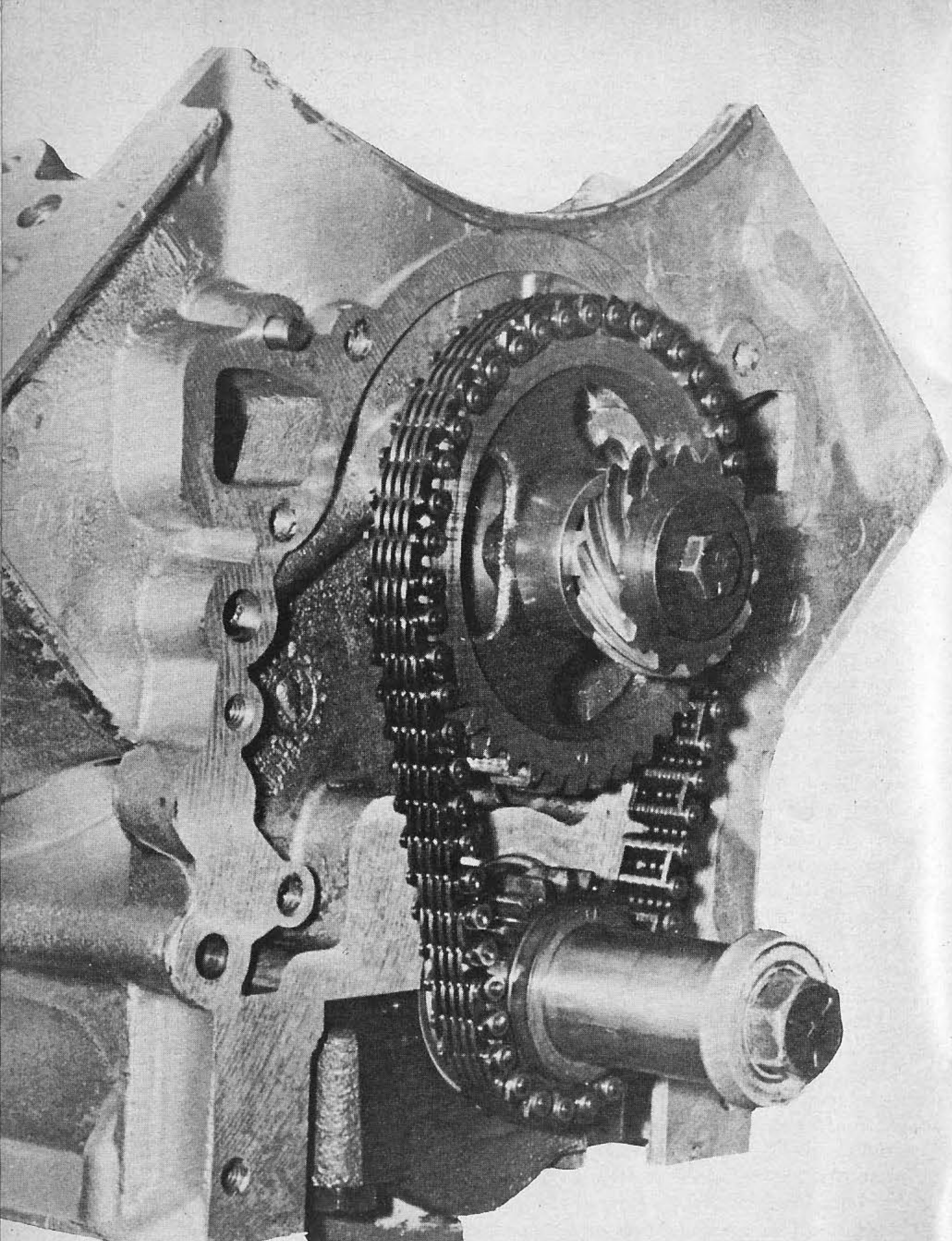
Despite lightweight block, bottom end is rugged enough for strong increase in power.

which is measured from the center of one cylinder to the center of the next in line, is 4.240 inches, leaving plenty of room for a .020-inch overbore if and when it is needed or desired. The block itself is of the "Y" design. That is, the bottom skirt extends down well below the crankshaft center line for added support to the main bearings, a design also used by Ford. Each block is precision machined and electronically checked for tiny flaws or cracks, after final boring.

In designing the aluminum V8, GM engineers eliminated the usual forged steel crankshaft like so many manufacturers are doing nowadays and came up with a crank that is cast of Pearlitic malleable iron. Ford and several other manufacturers also are using a cast crank, which is less expensive to produce and just as efficient as forged steel. Most experts, in fact, predict that forged cranks will soon be obsolete in the industry.

The same crank is used for both the 155 and 200 hp Buick engines and is identical to that used in the F-85. It employs a rubber absorption vibration damper, and end thrust is taken by number three main bearing. Main bearing inserts are removable, steel-backed Durex with a babbitt overlay. Main bearing clearance is .0005- .0021-inch, with crankshaft end play at .004- .008-inch. The same 2.2992-inch journal diameter is used in both engines.

Examination of the front accessory drive components reveals that they have been kept simple, light and efficient, and are easily accessible for adjustment or maintenance. The crankshaft drives the water pump by means of a belt while the oil pump and distributor are cam driven by a diagonal shaft located ahead of the timing chain. Some wear has been noticed in the distributor drive gear during constant high speed performance, and this should be replaced by hardened steel cogs produced by leading speed shops such as Clay Smith Engineering if the engine is to be subjected to major modification and high speed running.



Accessory drive includes diagonal gear ahead of timing chain for distributor and oil pump, belt to operate water pump.

Connecting rods for the aluminum V8 were forged from SAE 1141 steel. They weigh 17.552 ounces and measure 5.660-inches from the center of the big end to the center of the pin end. Bearings are also Durex with a steel-backed babbitt and have a recommended clearance of .0002-.0022 inch. There is a fraction of an ounce difference in the Olds F-85 rods which are slightly heavier, but for all practical purposes, both rods are the same.

Overall, the bottom end of the engine is considerably well beefed and should accommodate a considerable increase in displacement and horsepower without change to the main bearing journal diameter, etc., and we probably will see some increase from the factory with the introduction of the 1964 models. As pointed out previously, the big V8's of 400 cubic inches and more have about reached the end of the line, and the trend now is decidedly toward the smaller, lighter and more compact engine that produces more horses with considerably less weight.

We mentioned earlier that one of the chief differences between the aluminum Olds engine and the Buick Special was in the piston design. Where Olds engineers went to a flat-top slug, the Buick has dish-type pistons and a smaller combustion chamber which accounts for the 9-to-1 compression ratio on the standard engine . . . slightly higher than that of the Oldsmobile, which utilizes a different combustion chamber.

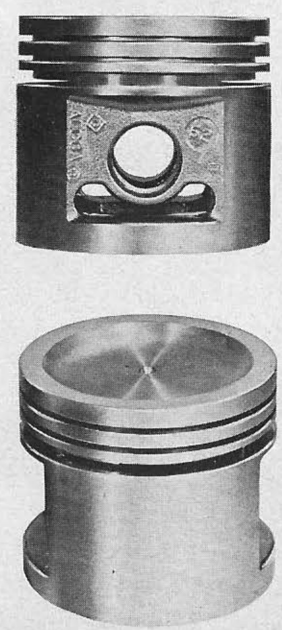
The pistons themselves are cast aluminum alloy, with a divorced skirt, and weigh in at 12.81 ounces on the 155 hp version. Slightly heavier (14.0 ounces) slugs with less dish design, are used with the 200 hp engine which has a compression ratio of 11-to-1. Skirt clearances of .0005-.0011 inch at the top end and .0075-.00135 at the bottom are the same for both mills.

SAE 1118 steel piston pins, 2.870 inches long and .8748 inch in diameter are press fitted to the rod end where they have a recommended clearance of .0007-.0015 inch. Clearance in the piston is .0003-.0005 at 70 degrees. Both compression rings are cast iron, the top one being chrome plated while the number two ring is lubricated. The steel oil ring also is chrome plated.

Another decided difference between the Buick and Olds engines is in the cylinder heads. Patterned a great deal after the big V8's in each individual line, the Buick has a semi-hemispherical combustion chamber which is smaller in volume than the wedge-type configuration used with the F-85 engine. The Buick valves are offset more from the center of the chamber than are those of the Olds, and there is a difference in the location of the spark plug holes. Buick places theirs almost in the exact center of the cylinder while the Olds' are placed in the top of the wedge.

Both cylinder heads use the same pattern for spacing the intake and ex-

Cast aluminum alloy pistons are featured in Special engine. Note how top surface of piston is dished out. F-85 has flat top.



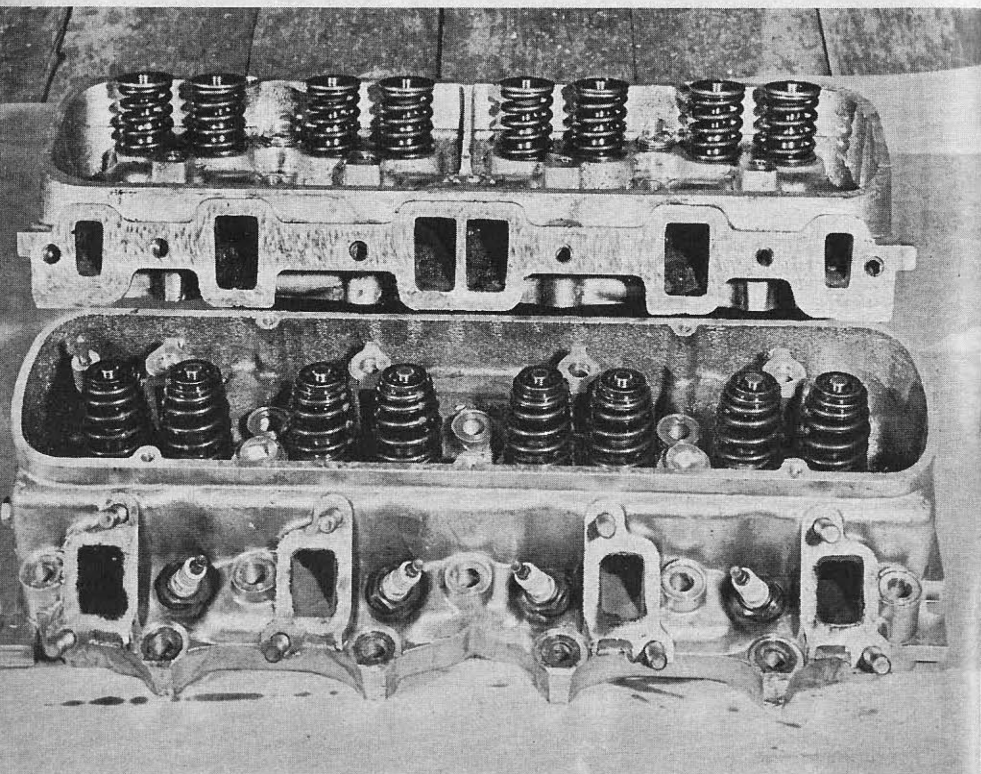
haust ports so that the manifolds are interchangeable. There is a slight difference in the exhaust ports themselves, however, with Buick retaining a smaller, somewhat restricted port beneath the valve and flaring out as it approaches the exhaust manifold.

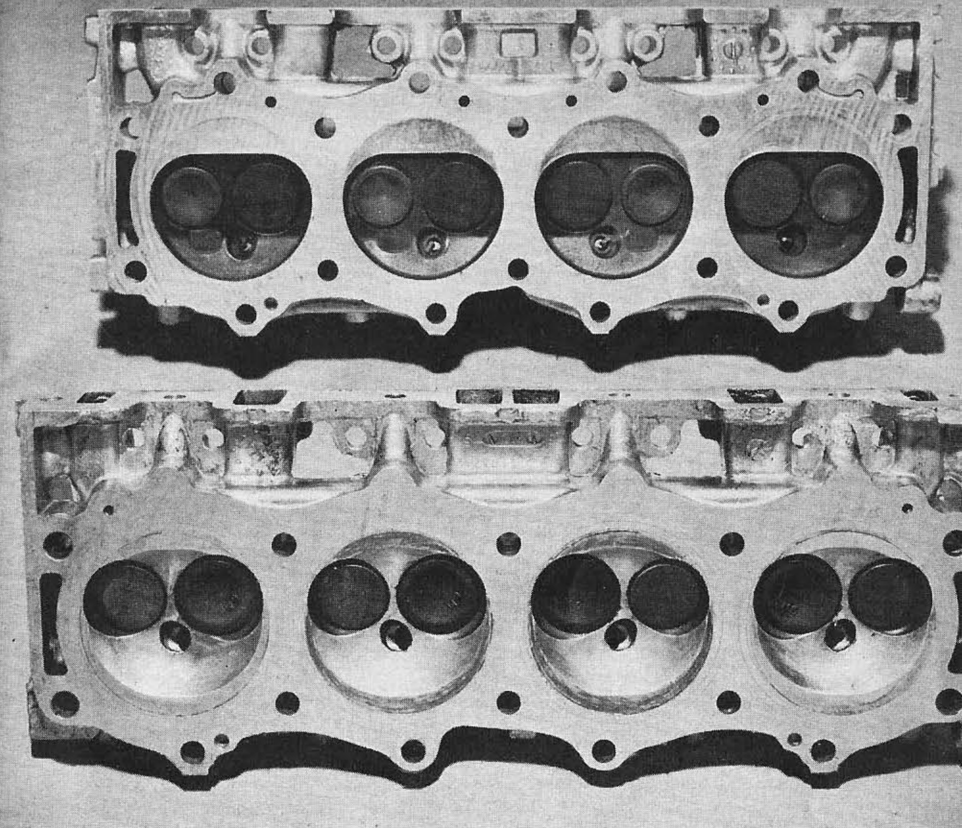
With so many of these components interchangeable, considerable performance increase can be accomplished with a bit of careful planning, such as swapping the dish-type Buick pistons for the Oldsmobile's flat-top design which will raise compression ratio considerably. We'll go into more detail on this and other modification possibilities in another chapter.

The valve train for both engines is similar but with a few exceptions. Both use a cast alloy camshaft, driven by a nylon coated aluminum gear, and are equipped with hydraulic lifters as are all 1963 Buick engines. The basic Buick and Olds engines share the same timing while the 200 hp Skylark mill uses a bit wilder cam. Timing figures according to factory specifications are:

Intake	155 hp Engine	200 hp Skylark
opens BTC	29 degrees	30 degrees
closes ABC	71 degrees	75 degrees
duration	280 degrees	285 degrees
Exhaust		
opens BBC	67 degrees	68 degrees
closes ATC	33 degrees	37 degrees
duration	280 degrees	285 degrees
Overlap	62 degrees	67 degrees
Lift-Intake & Exhaust	.383	.401

Biggest difference between Special and F-85 is in cylinder head. Buick is at bottom.



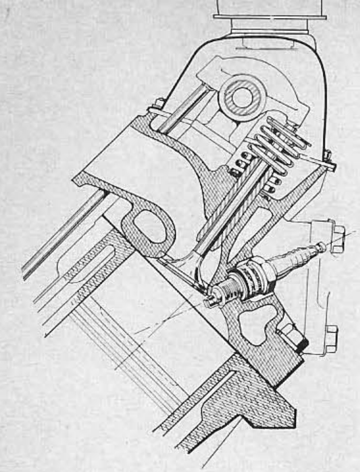


Special, top, has characteristic Buick combustion chambers, F-85 has normal wedge.

The valve train differences we mentioned above are in the valves, pushrods, and rocker shaft stands, as well as the rocker arms themselves. Pushrods for both engines are of the solid type rather than tubular and are made of forged steel. Those used on the Buick, however, are slightly shorter in length than the Oldsmobile's. Buick also uses aluminum rocker arms with pressed-in steel buttons on the valve end and sockets on the pushrod end, and the aluminum rocker-shaft-stand assemblies are bolted directly to the cylinder head. The Olds on the other hand uses steel rockers, and the shaft stands are secured to the block by long cap screws which go completely through the head and into the block where they also help hold down the heads as well as the rocker shafts. Rocker arms have a ratio of 1.6-to-1 for both engines, however.

Lubrication of the Buick rocker arms comes from the main oil galleries which run the length of the block and intersect with the lifter bores. Oil flows through passages drilled to the crank and camshaft bearings and then is carried to the front rocker stand through a slanted passage in the head. The hallow rocker shaft then permits the oil to flow to each rocker arm.

The F-85 has slightly larger valves than the Buick but, unfortunately they are not interchangeable, since stems are larger and longer. Buick valves have a



By off-setting valves slightly, Buick is able to bring spark plug closer to center of chamber. Chamber volume is small.

Rockers also differ. Buick's (far right) are aluminum, with stands that bolt right to head. In F-85, they are made of steel.

head diameter of 1.500 inches for the intakes and 1.3125 inches for the exhausts. Both intake and exhaust are 4.605 inches in length and, like the F-85, their stems are tapered, .3412 plus .0005 inch to .3407 plus .0005 for the intakes and .3407 plus .0005 inch to .3402 plus .0005 inch for the exhausts.

Valve springs for the Buick are straight-wound steel, and do not incorporate the use of an inner spring. Pressures on the intakes have been set at 64 pounds with a length of 1.640 inch closed, and 168 pounds and 1.260 inch open. Exhaust springs are the same, and there is no difference in pressure between the standard Buick V8 and the 200 hp Skylark.

Sintered iron valve seat inserts also are used in the Buick, and these are press-fitted into the head. Valve seats can be moved out slightly on the inserts for porting but there isn't enough material around the ports to permit much more than 1/16 inch.

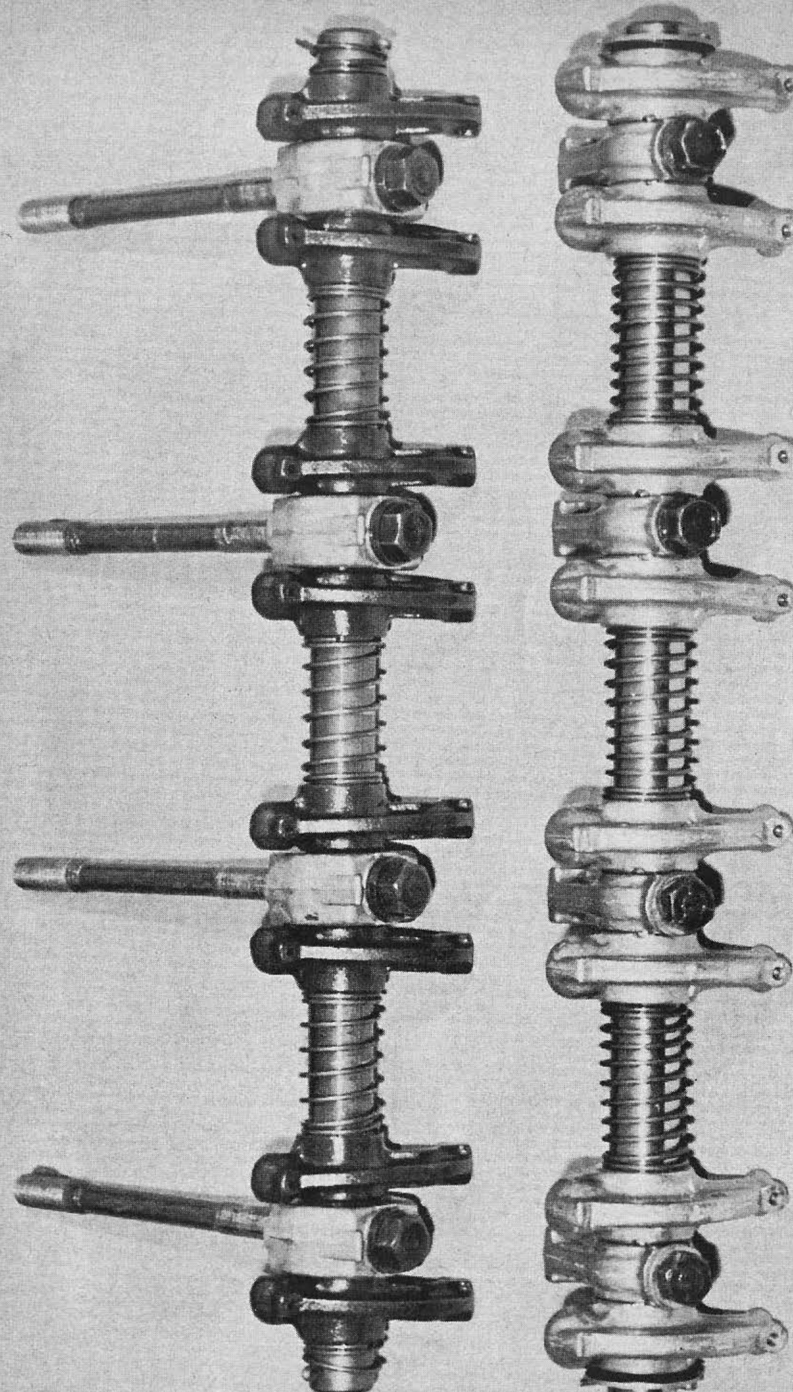
We've already pointed out that the Buick and Olds manifolds are interchangeable, though not identical. Carburetion, however, is the same, with both engines employing Rochesters. The two-barrel is standard, of course, and the four-barrel carb is offered with the DeLuxe Buick Special and is standard on the Skylark. Both models have a barrel size of 1.3125 inches.

A Delco-Remy coil and distributor ignition system is used with the engine while recommended spark plugs are AC 45FFS for the 155 hp engine and 44 FFS for the Skylark. The distributor starts its initial advance at 450 rpm, reaching its maximum of 28 degrees at 3700 rpm. Initial timing is set at 7.5 degrees at 1050 rpm, with the vacuum line disconnected. Timing mark is located on the harmonic balancer at the front of the engine.

The all-aluminum V8 is now in its third model year of production, and sales records indicate that it is becoming more and more popular by the day. Its future, at this point anyway, seems virtually unlimited, especially for the enthusiast who is never content with the status quo.

Undoubtedly, Buick has plans for increasing performance, too, in the coming years, although from past policy we don't expect to see them go after the same performance image sought by Ford, Chrysler Corporation and some of the others. But the potential is all there and we probably will be seeing more of it in 1964.

Meanwhile, the door to individual modification remains wide open to the enthusiast who is eager to capitalize on the basic advantages of good design, dependability and lightweight provided at the factory. ■



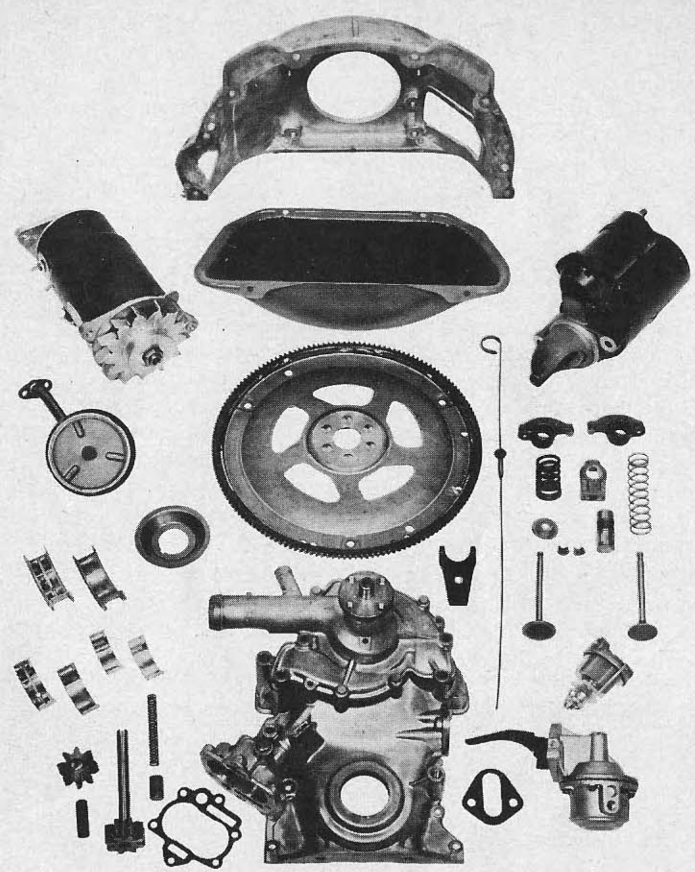
UNIQUE V6

Buick V6 made spectacular entry into ranks of low-priced cars at start of '62 season.

WHEN you experience your first ride in a Buick Special powered by the fantastic little V6 engine, you wonder how so many problems previously associated with this type powerplant could have been solved so quickly and efficiently. Its smooth, lively performance is much more than one would normally expect from a six. But a closer study of the developement and production story tells us why this compact little mill has been so successful from every standpoint.

The possibility of a V6 for regular passenger car production has been kicked around and experimented with for years inside the industry. But the problems—mostly in cost—have always been a stumbling block. So when word leaked out that Buick was planning and experimenting with just such an engine—and an unprecedented 90-degree V6 at that—the skepticism ran hot and heavy.

There was, first of all, the problem of balance and smoothness, both hard-to-achieve necessities that had been overcome in the past but with costs so



Despite shorter, cast-iron block, V6 is able to borrow parts shown from aluminum V8.

high that they canceled any possibility of regular production. Past experience showed that perfect balance and smoothness was possible from a V6 through the use of an auxiliary counterweight shaft rotating opposite to the crankshaft, at twice crank speed. It worked, but it was costly and complicated.

That was one of the major problems that faced engineers when they began exploring the possibility of a V6 for the Buick Special. Still, when they weighed the advantages to be gained with a V6, they soon discovered that they more than compensated for the problems involved, and the search began for new ways of solving those problems. As it turned out, the odds had already been favorably stacked. Initial engineering began about 11 months before the engine was made available to the public, and the final decision to build it came only six months before actual production began. Development of an all-new engine in that short a time was unheard of before the V6.

For the most part, the V6 is a cast-iron version of Buick's aluminum V8 engine with the two rear cylinders eliminated, and this is a big reason why Buick was able to get the V6 into production so quickly. Many of the V8's vital components are interchangeable with the V6. Both engines have the same attaching points, use the same valves, rockers, rocker stands, valve springs, timing chains, flywheel housings, oil and water pumps, generators and starters. The entire aluminum front cover from the V8 in fact, bolts right up to the V6.

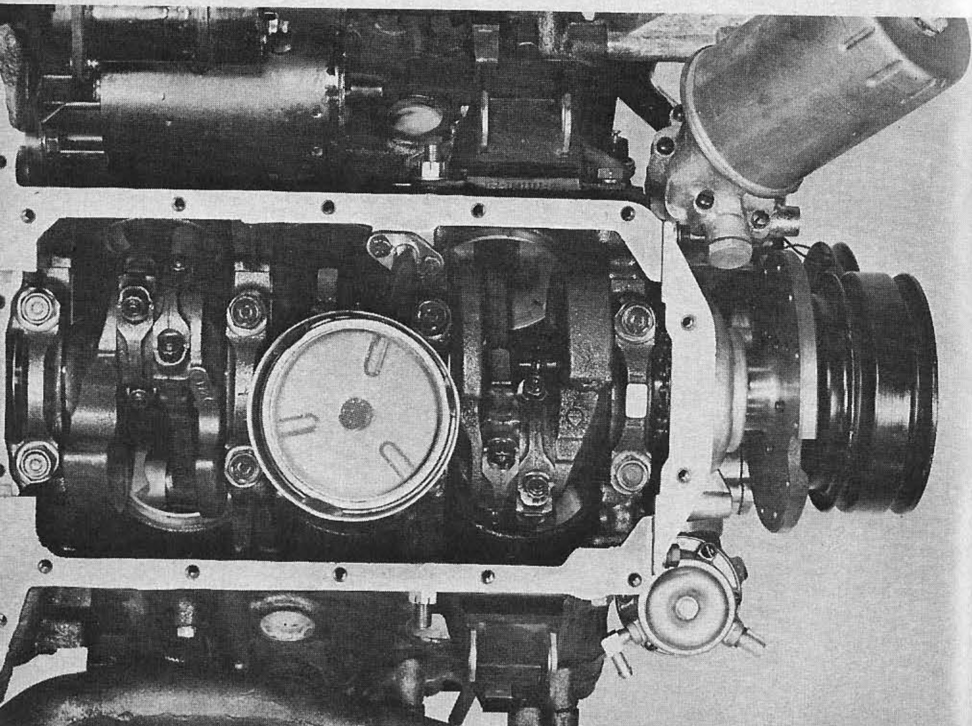
To further facilitate production of the V6, the same manufacturing facilities used for the V8 also machine the V6, with very little retooling required. Hand assemblies are virtually simple since so many components are identical.

The 90-degree V6 block does not incorporate some of the more advanced "thin wall" casting methods recently developed. There wasn't that much time. Core distortion was reduced appreciably, however, by eliminating some of the core pieces used in the block and head assemblies, leaving fewer joints to distort. Still, the block itself weighs only 105 pounds and the fully assembled engine weighs only about 50 pounds more than the aluminum V8.

Like the V8, the V6 has a "Y" block design, where the block skirt extends down below the crankshaft center line for added support to the main bearings. Each block is precision machined and electronically checked after final boring.

Specificationwise, the V6 has a 3.625 x 3.20 bore and stroke for a total displacement of 198 cubic inches. Bore spacing, 4.240 inches from cylinder to

Novel three-throw crankshaft is cast Pearlitic malleable iron, has four main bearings.



cylinder is the same as the V8. Maximum horsepower is achieved at 4600 rpm, as with the V8, and is rated at 135—20 less horses than the standard V8. Torque is 15 lb/ft less (205 lb/ft total), at 2400 rpm.

The Pearlitic malleable cast-iron crankshaft uses the same Durex main bearings as the V8, with the same .0005 – .0021 recommended clearances. Main bearing journal diameter, crankpin journal diameter and crankshaft end play also are identical, although end thrust is taken by number two bearing instead of number three.

Primary unbalance in the V6 was handled in much the same manner as in the V8, by placing counterweights properly on the crank. The secondary unbalance, which is caused by parallel forces acting in opposite horizontal directions, was isolated in the design of soft motor mounts which actually soak up vibration. Sweet and simple, this method eliminated the costly procedure of an auxiliary counter-weight shaft used previously to smooth out the V6.

The three-throw crankshaft itself has four main bearings and is designed to give more freedom in the size and placement of counterweights, which is another reason why the V6 is exceptionally smooth. The throws are 120 degrees apart.

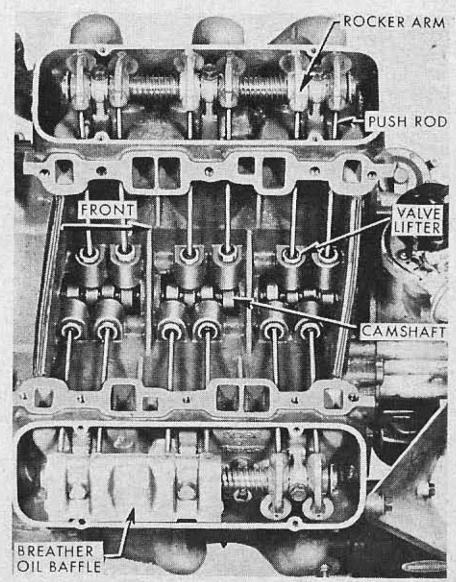
Connecting rods for the V6 are cast of the same Pearlitic malleable iron as the crankshaft which is really a switch from rods of forged steel used in the V8 and by nearly all other manufacturers. They are cheaper to produce than forged steel and appear to be just as durable. Clearance limits and end play are the same as with the V8 but the V6 rods weigh more (19.616 oz.) and are slightly longer, 5.860 inches as compared to 5.660 inches.

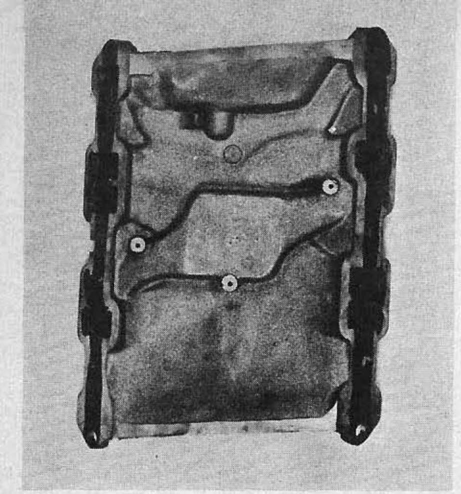
Piston are of the same dish-type, divorced skirt design as the V8 and are a cast aluminum alloy. The V6 slug is bigger, however, due to the difference in bore, and therefore weighs nearly two ounces more than the stock V8 piston. Top skirt clearances are the same although the V6 has slightly less bottom skirt clearance. The only difference in piston pins is their length, .090 inch longer for the V6.

There isn't a great deal of difference in the cylinder heads, either, except that those of the V8 are fully machined and the V6's are not. The combustion chambers are semi-hemispherical as in the V8, and the spark plug holes are located almost dead center in the cylinders. Standard compression ratio, with the dished pistons, is 8.8-to-1.

The V6 has ample intake port area in the heads but is hurting somewhat in the valve department. This is due to the fact that V8 valves, guides, pushrods, rocker arms and other valve components are used which means that the V6 has considerably less nominal valve area per cubic inch. The V6 has six intakes to feed its 198-cubic-inches while the V8 has eight to feed only

Entire valve train, with exception of cam, rocker shafts, is repeated from little V8.





17 more cubic inches.

There is some gratification, however, in the fact that the larger bore has left plenty of room for bigger valves, and this undoubtedly will be one of the first areas considered by enthusiasts with modification in mind. It is quite reasonable to assume, too, that future V6 engines from Buick will incorporate bigger gates. We should point out, however, that even with this valve restriction, the V6 is quite capable of running with the V8 and other competitors, at least on the low end. Its snappy performance is almost unbelievable.

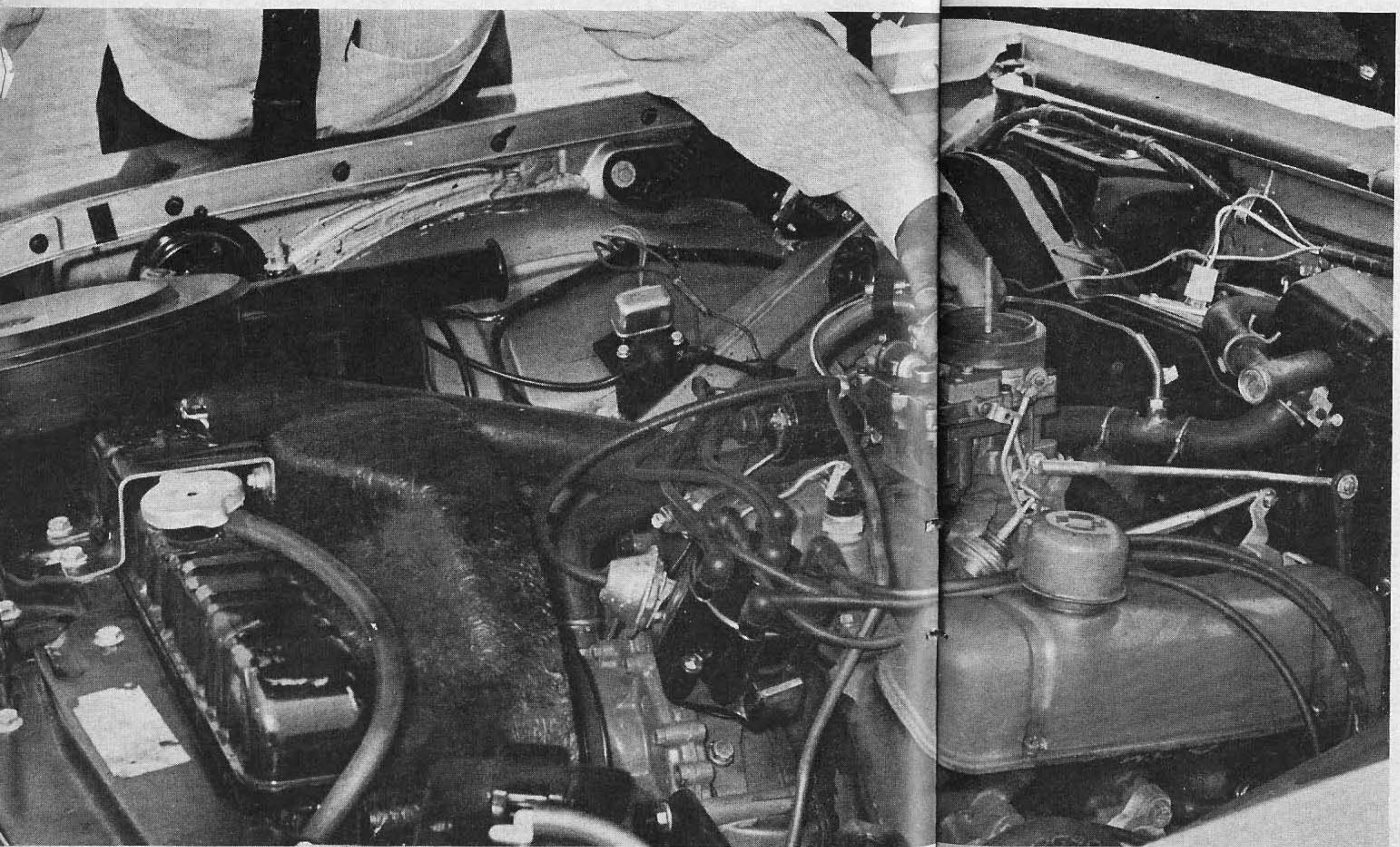
Some compensation for the relatively small valve area has been given by a stronger camshaft with a duration of 280 degrees and a 56 degree overlap. The cam is cast iron and has four bearings. Hydraulic lifters and valve springs from the V8 also are incorporated into the V6.

Manifolding for the V6 complements the overall engine design. The exhausts are clean, free flowing which fit into a single reverse flow muffler. The intake manifold is a simple "log" type that is both light and inexpensive. Simple but effective design here was made possible by the firing order of the V6 (1-6-5-4-3-2) back and forth across the V, which provides evenly spaced intervals of 240 degrees crankshaft rotation from intake suction impulses of the three cylinders on each bank. With a two-barrel Rochester carburetor, each bank draws from one barrel without the need of complex 180-degree passages such as those used with the V8 manifold. This also provides fairly long passages of equal length that give somewhat of a ram effect in the high speed range.

A slightly different ignition system is used on the V6. The Delco-Remy distributor begins its centrifugal advance at 450 rpm like the V8 but reaches its maximum of 26 degrees at 4200 rpm. The same 7.5 degrees of initial advance at 1050 rpm is used for the basic setting, with the vacuum line disconnected.

While the V6 was primarily designed as an economy engine, its potential has made it increasingly popular with enthusiasts everywhere. It lends itself well to most any type installation, especially where engine room is at a premium, and snaps right up to some of the best gearboxes, such as the Warner T-85 heavy-duty three-speed and the T-10 four-speed.

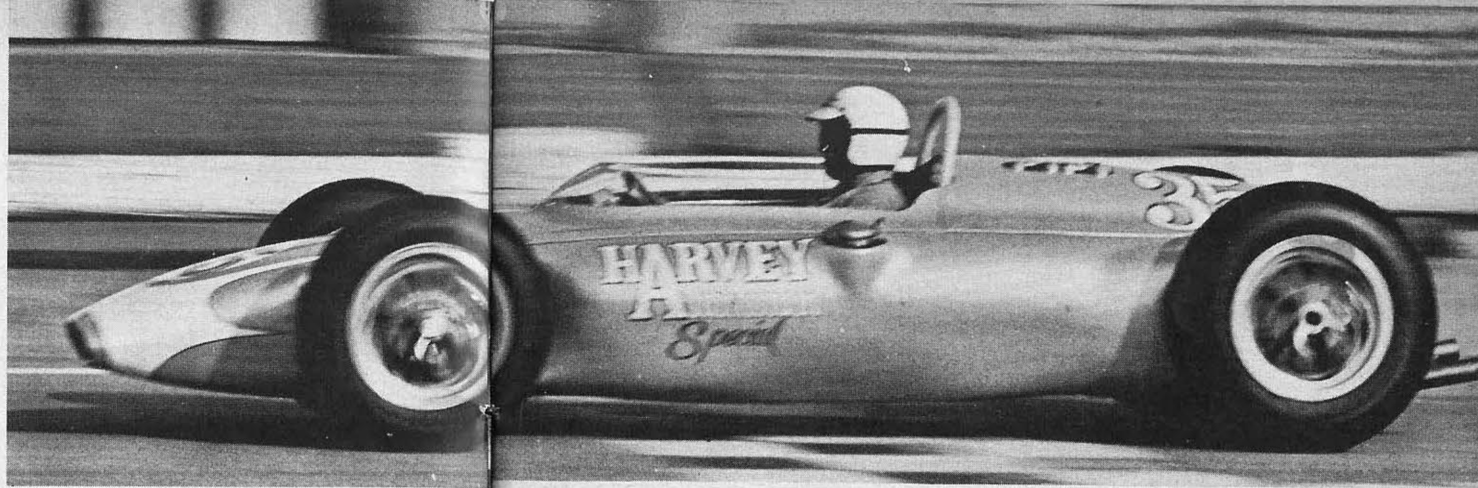
Probably the most eloquent testimony to Buick's success in producing a quiet, smooth running V6 came at the press preview, when automotive editors were busy raising hoods to see if they were driving V8's or V6's. Buick's general sales manager Roland S. Withers reduced this to the expression "This engine doesn't know it's not an eight!" ■



Intake manifold (above, left) is arranged for V6's unique 240-degree firing order.

Developing V6 helped Buick win *Motor Trend's* "Car of the Year" award in '62.

Mickey Thompson used Buick's little V8 in his first Indy cars entered in 1962 "500."



SOUPING THE SPECIAL

IN THE preceding chapters, we have been rather emphatic in describing the Buick aluminum V8 as a popular choice for modification, swapping or racing. Its compact design and lightweight lend themselves well to all these applications.

Since it was first introduced in 1961, the aluminum V8 has been used successfully in a variety of competitive events, including the 500-mile race at Indianapolis as mentioned earlier, for boat drags, in the latest version of the Scarab racing sports car by Lance Reventlow, in midgets, dragsters, gas coupes and sedans and, as one of the latest ventures, as the muscle for Jerry Grant's new Lotus sports car which was scheduled to make its debut in the 1963 Pikes Peak Hill Climb.

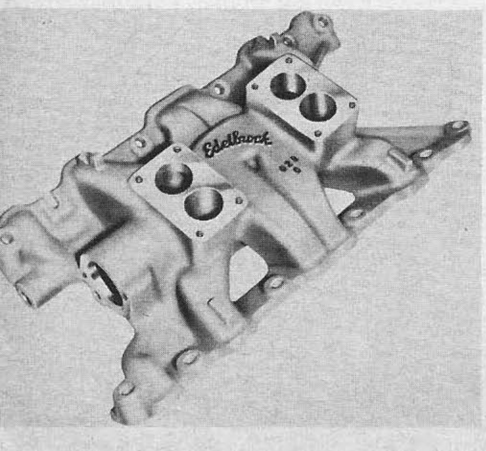
The in-roads to improving the already lively performance of this little bear are many and varied, and can range anywhere from simple and inexpensive minor changes to the full treatment. Let's take a look at some of the possibilities.

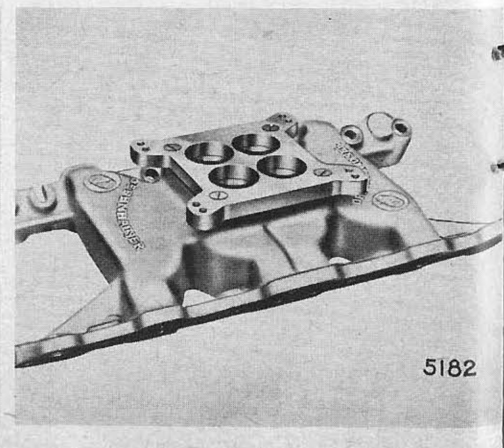
Initially, work of any type on the aluminum V8, whether it be major or as simple as changing spark plugs, must be carried out with more than just the usual care exercised with a cast iron mill. The reason for this is simple: aluminum is softer and more susceptible to warping, especially when hot.

Allowing the engine to cool, at least to the point where the hand can be placed on the engine without fear of getting burned, is highly recommended before tightening down any bolts. This is especially important with spark plugs. Since aluminum is softer, there is more chance of stripping threads, so extreme care should be taken here. You will find that the aluminum also dissipates heat more rapidly than conventional cast iron blocks, so the engine will cool faster. In fact, this rapid dissipation of heat seems to lengthen the time of breaking in an engine. One V8 that we looked at, after 15,000 miles, still had the hash marks on the cylinder walls.

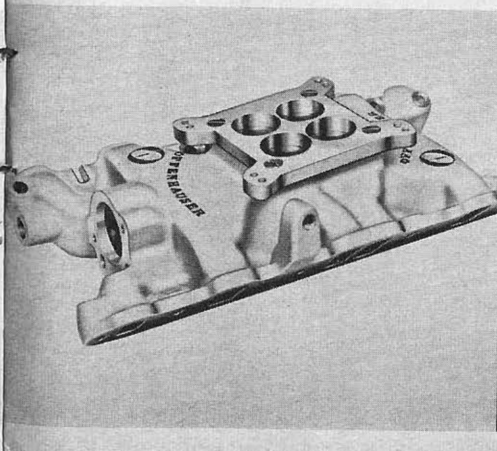
Buick recommends a special lubricant or sealer to coat the threads of all bolts that go into the block or head to prevent seizing and stripping. When this is applied, care should be taken that the bolt and bolt holes are absolutely clean and that excess lubricant does

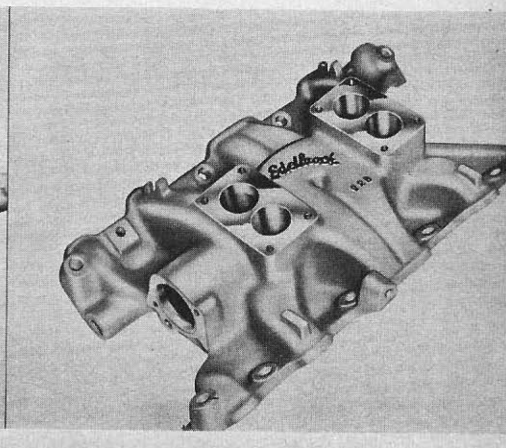
Edelbrock racing manifold (left) for Special V8 costs $92.95; Offenhauser is $86.50.

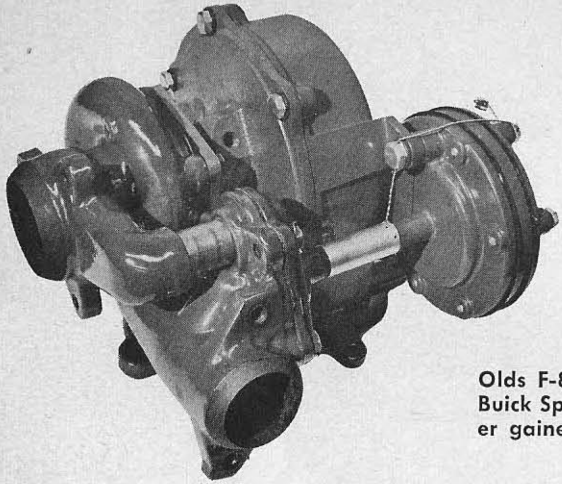




For street use, similar manifolds can be obtained with normal water-heated passages.







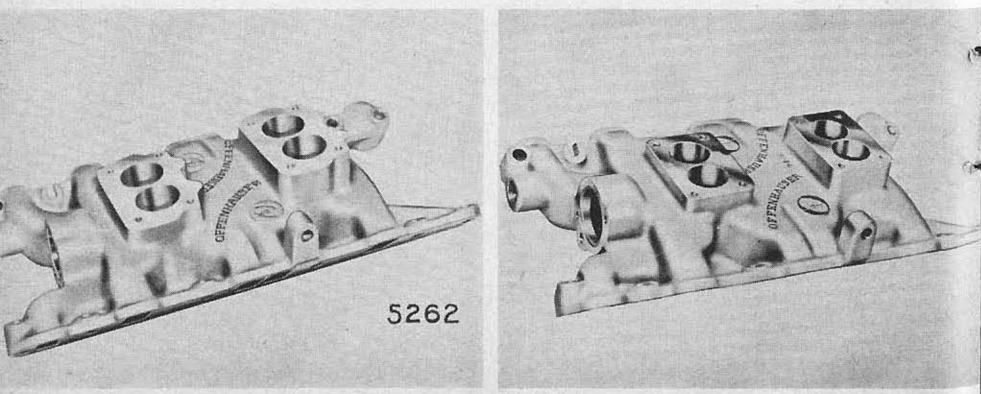
Olds F-85 turbocharger can be fitted to Buick Special engine but amount of power gained is hardly worth trouble, cost.

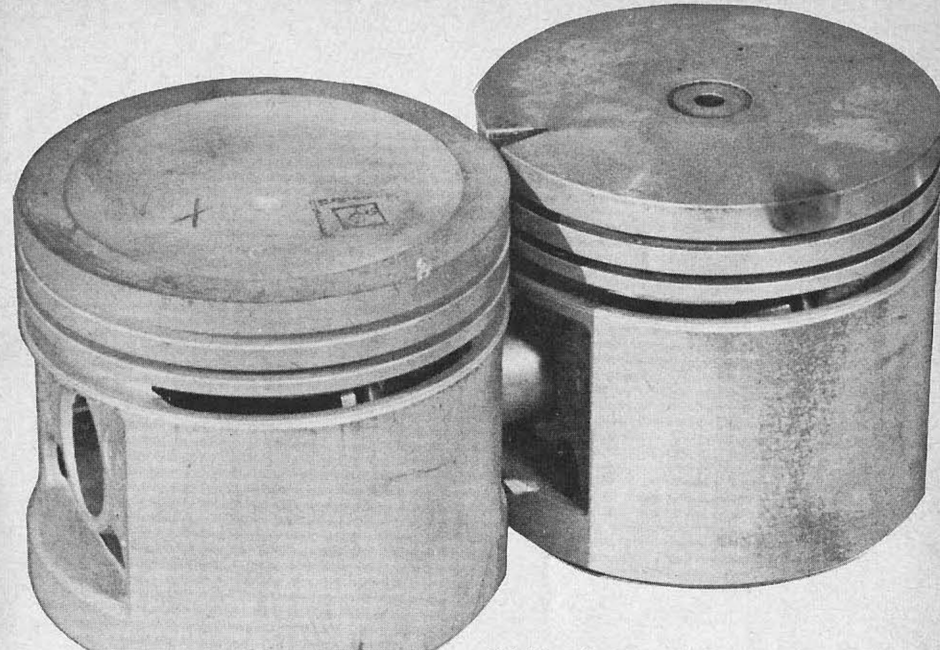
not get on the underside of the bolt where it will cause pressure to build up when the bolt is torqued down. A light coating is sufficient.

A lightweight oil also is recommended for coating spark plug threads (do not dip the plug in oil, just coat the threads) for easier installation and removal and for less chance of stripping. For those planning any number of teardowns or plug changes for competition or what have you, its a good idea to keep a Heli-Coil kit around. The steel inserts are the perfect answer to stripped threads.

One further word of caution: Block and head surfaces of aluminum will scratch or score more easily than cast iron so be sure your work bench is clean and free of any abrasives. Scratch-

Offenhauser makes dual 2-barrel manifolds in heated, non-heated versions for Buick.





Subbing flat-top Olds F-85 piston (right) for dished Buick unit (left) is slick way to boost aluminum V8's compression.

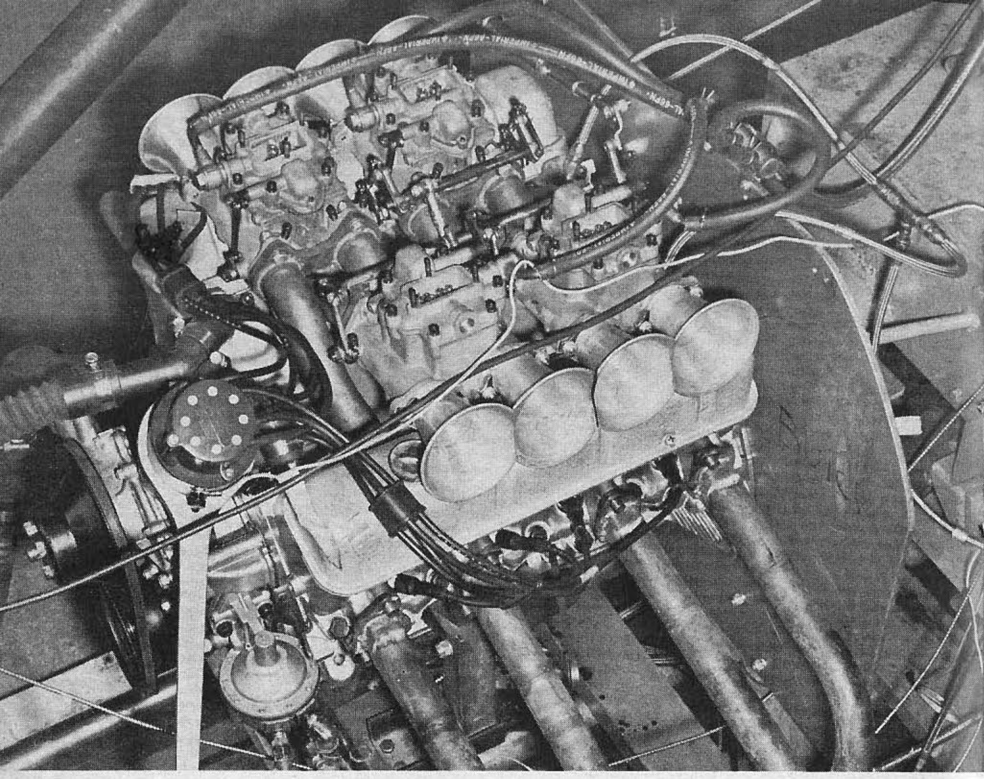
ing or scoring can cause leakage and loss of compression.

Simple modifications can be very effective with the Buick V8, and one of the most logical places to start is with improved breathing. While breathing is fairly good on the stock engine, it is one of the weaker points and there is much to be gained here.

Considerable advantage can be gained with the V8, and especially with the V6, through modification of the exhaust system. A good set of headers such as Hedman or other top name products will pretty well take care of the small restriction which is evident in the exhaust manifold.

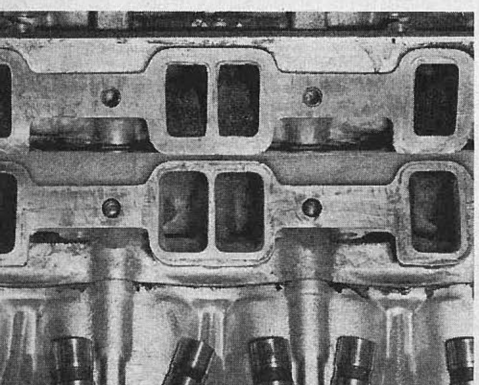
Another method involves a Y-type system whereby a supercharging effect is applied to the exhaust gasses as they leave the exhaust pipe. This can be accomplished with two pipes of 1¾-inch diameter running from the exhaust manifold on each cylinder bank, back to a single two-inch pipe and joined in the area of the flywheel. The single pipe should then be extended a minimum of 30 inches for best effect.

Actually, the Y acts as a venturi, and you actually have a suction applied to each bank. When one bank exhausts, it applies suction to the opposite bank. This particular system works best on the V6, although it is effective on the V8 also, and the improvement it brings can be noticed in acceleration runs of



Buick V8 in Lance Reventlow's last Scarab was enlarged to 239 cu. in. Carburetors are Webers, set on cross-fed manifolding.

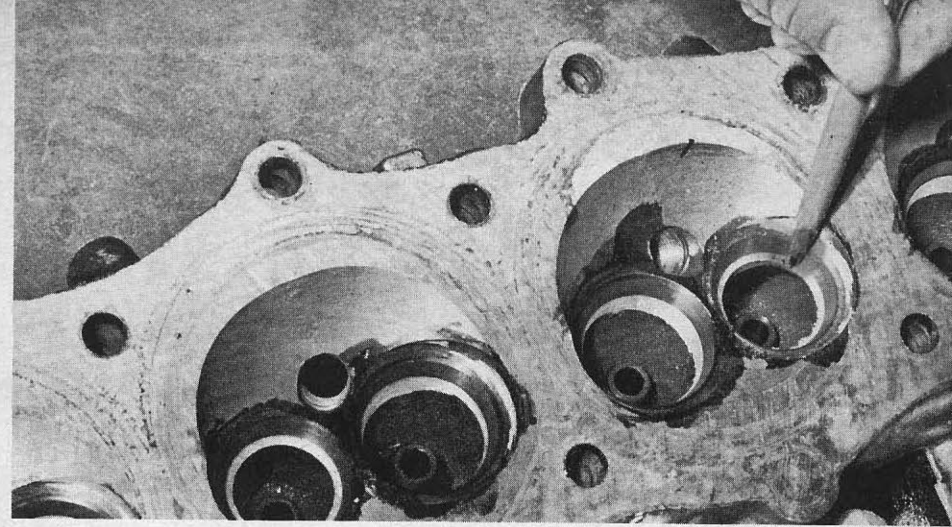
Flow bench was used as guide to breathing improvement in Reventlow motor. Porting of stock Buick (top), Scarab are compared.



a quarter-mile or more.

Carburetion can also bring some marked increases in horsepower without getting too involved. Replacing the standard two-barrel carb on the V6 and standard V8 with a four-barrel from the Skylark is, of course, a logical choice or, if cost is a determining factor, the Buick LeSabre two-barrel will bolt right on either engine and add as much as 17 hp, according to dyno tests.

The beauty of this modification is that it is reasonably cheap and simple, and everything fits, including the linkage. Actually, the two-barrel LeSabre carb has a venturi area approximately half-way between the standard Special two-barrel and the Skylark four-barrel. It will give almost the same effect as the Skylark carb and, with the right



Intake and exhaust pockets were trimmed in Scarab to allow for $1/8$-in. larger valves.

tuning, etc., even offers a bit more lively acceleration at the start.

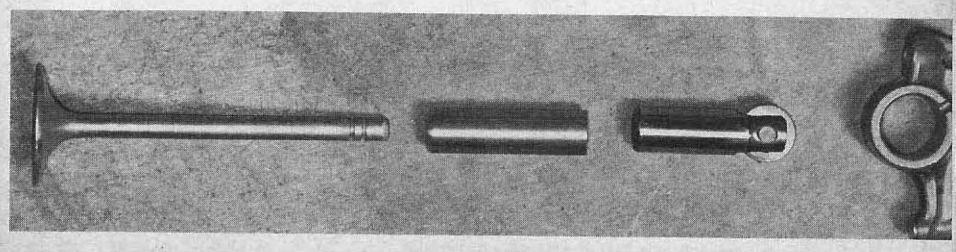
If the LeSabre carburetor is used, however, it is best also to include the LeSabre air cleaner, trimming the intake snorkle tube so that it does not interfere with the fan.

If other than stock Buick carburetors are desired, manifolds are available from some speed equipment manufacturers. Buick speed equipment is not as plentiful as, say Chevrolet or Ford, but since the introduction of the aluminum V8, more and more manufacturers are coming out with accessories and we'll probably be seeing a greater selection in the very near future.

Edelbrock produces a dual two-barrel manifold that will permit the use of stock Buick carbs. It is available with either a three- or four-bolt pattern so that other make carburetors may also be used. It also comes equipped for heating for street use or cold for use in competition. They sell for $92.95 and offer a 10 percent boost in horsepower. In any case, carburetion changes are pretty effective and fairly simple to do on the Buick V8, and they can be complimented by modifications to the valve train which we'll discuss a bit further on.

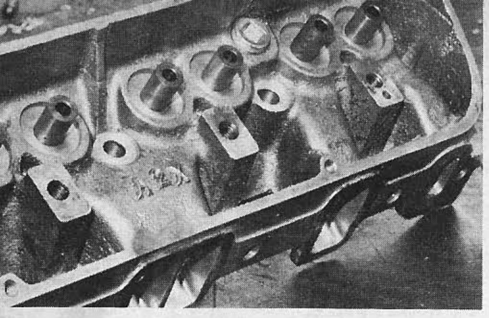
In addition to carburetion, changes in compression ratio on the aluminum V8 can be effectively accomplished rather simply and inexpensively. There is a difference in compression (9-to-1 versus 11-to-1) between the standard Buick V8 and the Skylark, one offering 155 hp while the other is rated at 200

Reworked Pontiac Six valve, roller tappet, stock Buick rocker are used in Scarab-Buick.

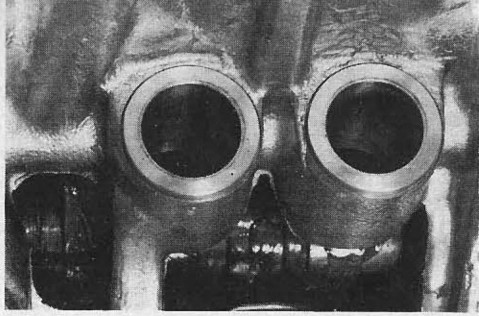


SPECIFICATION CHART FOR BASIC BUICK ENGINES

ENGINE	V6	Special V8	Skylark	401	425
Bore	3.625	3.50	3.50	4.1875	4.3125
Stroke	3.20	2.80	2.80	3.64	3.64
Compression Ratio	8.8:1	9.0:1	11.0:1	10.25:1	10.25:1
Bore Spacing	4.240	Same	Same	4.750	Same
Cylinder Numbering					
Left Bank	1 - 3 - 5	1 - 3 - 5 - 7	1 - 3 - 5 - 7	2 - 4 - 6 - 8	2 - 4 - 6 - 8
Right Bank	2 - 4 - 6	2 - 4 - 6 - 8	2 - 4 - 6 - 8	1 - 3 - 5 - 7	1 - 3 - 5 - 7
Firing Order	1 - 6 - 5 - 4 - 3 - 2	1 - 8 - 4 - 3 - 6 - 5 - 7 - 2	Same	1 - 2 - 7 - 8 - 4 - 5 - 6 - 3	Same
PISTONS					
Type	Cast Aluminum Alloy - Transverse Slot With Divorced Skirt				
Weight	15.6 oz.	13.81 oz.	14.0 oz.	23.68 oz.	25.31 oz.
Number Rings	Three				
Skirt Clearance, Top Land	.0215 - 0304	.0255 - .0355	Same	.029 - .037	.034 - .042
Pin Bore Offset	.040 Hi-Thrust side		Same	None	None
PISTON PINS					
Length	2.960	2.870	Same	3.520	Same
Diameter	.8747 - .8750	Same	Same	.9994 - .9997	Same
Locking Method	Pressed In Rod				
Clearance in Piston	.0003 - .0022	Same	Same	.00005 - .00001	Same
CONNECTING RODS					
Material	Cast Iron	Forged Steel	Forged Steel	Forged Steel	Forged Steel
Weight	19.616 oz.	17.552 oz.	17.552 oz.	24.384 oz.	24.384 oz.
Length, Center-Center	5.860	5.660	5.660	6.220	6.220
Bearing Material	Steel-Backed Durex			Steel-Backed M/400 Aluminum	
Bearing Length	.737			.820	
Clearance	.0002 - .0022			.0002 - .0023	
Endplay	.006 - .014			.005 - .012	
CRANKSHAFT					
Material	Pearlitic Malleable Cast Iron			SAE 1145	
Endplay	.004 - .002				
Main Bearing Journal Diameter	2.2992			2.4985	
Crankpin Diameter	2.000			2.2495	
Bearing Material	Steel-Backed Durex 100A			Steel-Backed M/400 for First Four Durex 100 A - Rear Four	
Clearance	.0005 - .0021			.004 - .008	
CAMSHAFT					
Material	Cast Alloy Iron				
No. Bearings	Four	Five	Five	Five	Five
Type Bearings	Steel-Backed Babbitt				
Type Drive	Chain				
Crankshaft Gear	Sintered Iron				
Camshaft Gear	Nylon Coated Aluminum				
Chain Width	.875			.864	
INTAKE VALVES					
Material	SAE 1041 Steel				
Head Diameter	1.500			1.875	
Face Angle	45 Degrees				
Stem Diameter & Taper	.3412 to .3407 Plus .0005			.3730 - .3720 Plus .0005	
Clearance in Guides	.001 to .003 Top				
Seat Inserts in Head?	Yes, Sintered Steel			None	
EXHAUST VALVES					
Material	High Alloy Steel				
Head Diameter	1.3125			1.500	
Face Angle	45 Degrees				
Stem Diameter & Taper	.3407 to .3402			.3725 to .3715	
Clearance in Guide	.0015 to .0035, Top - .002 to .004, Bottom				
Overall Length	4.605			4.785	
Seat Inserts in Head?	Yes, Sintered Steel			None	
VALVE SPRINGS					
Single or Dual	Single			Dual	
Pressure, Closed	64 pounds @ 1.640 inches			46 pounds @ 1.60 inches	
Pressure, Open	168 pounds @ 1.260 inches			101 pounds @ 1.60 inches	
LUBRICATION SYSTEM					
Type	Pressure				
Normal Oil Pressure	33 pounds @ 2400 rpm			40 pounds @ 2400 rpm	
Filter	Full Flow				
Crankcase Capacity	Four Quarts, Less Filter				
IGNITION SYSTEM					
Type	Delco Remy Single Coil				
Distributor Make	Delco-Remy				
Distributor Number	1115179	1115136	1115161	1115182	
Dist. Auto Advance					
Starts at	450 - 800 rpm			550 - 900 rpm	
Intermediate Points	13 to 17 degrees @ 2100 rpm			0 - 4-degrees @ 900 rpm	
Maximum Degrees	26 @ 4200	28 @ 3700	26 @ 3800	22 @ 3800	
Vacuum Advance Starts	6 to 8 inches			8 to 10 inches	
Intermediate Points	14 degrees @ 14 inches			5.5 degrees @ 12 inches	
Maximum	17.5 degrees @ 16 inches			17.5 degrees @ 18 inches	
Initial Spark Lead	7.5 @ 1050 rpm			12 degrees BTC @ 400 rpm	
Spark Plugs	AC - 44S	AC - 45FFS	AC - 44FFS	AC - 44S	
Plug Gap	.030 - .035				
Point Gap	.013 - .019				



Aluminum-bronze alloy guides were fitted to accommodate Scarab's special valves.



Existing tappet holes were bored to take bronze guides for roller tappet assembly.

hp, and this is due to a difference in pistons. However, the difference is too slight to warrant consideration of changing from one to the other, especially when you look at the Olds F-85 slug which fits the Buick perfectly.

As mentioned, the difference between the two Buick pistons is slight. Both are dish-type, but the Skylark slug has a much shallower dish, hence the higher compression. The F-85 piston on the other hand is of the flat-type. Slipped into the Buick V8 it raises compression to an even 12-to-1, and accurate dyno tests show that they are worth an increase of 17 hp, with everything else stock!

So what happens when you go the piston route and then add carburetion like, say, Edelbrock's dual manifold and stock carbs? Well, the effect of more efficient breathing provided with this setup will jump horsepower even further, especially in speed ranges from 3500 rpm and up. You can look for an increase of 20 hp and possibly a bit more with the right tuning. Adding it up, you come up with an increase of nearly 40 hp, just with pistons and carburetion.

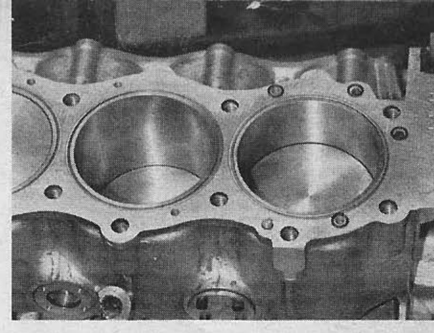
The piston swap, while somewhat involved, is not too expensive and well worth the trouble. Olds F-85 pistons retail for about $8.00 apiece, not bad at all considering the job they do. Of course it's always a good idea to rebalance the crank assembly after installing these pistons since they are about ¾ ounce heavier than the stock Buick slugs.

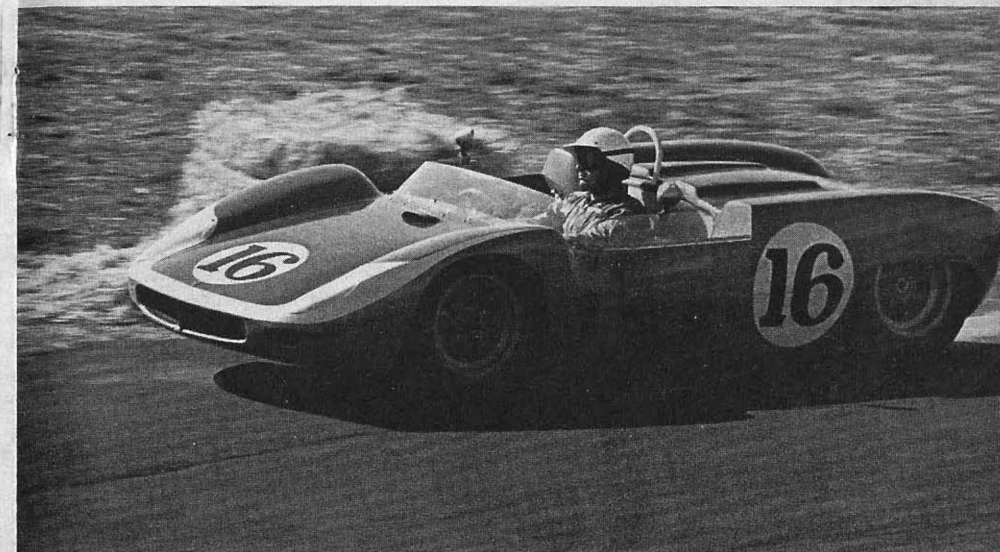
Unfortunately, the Olds pistons are not interchangeable with the Buick V6, because of the difference in bore. However, speed equipment specialists such as Forgedtrue or JE can machine up just about any size or type piston desired.

Changes in camshaft and valve train will, of course, provide effective increases in the V8's horsepower output. However, when you start to get more involved with this type of modification, it is wise to take another look at carburetion and ignition.

Stock ignition on the Buick is pretty efficient up to 5000 rpm. Beyond that, it can still be effective providing it is given some attention to compensate for the increased rpm and performance brought on by a hotter cam, porting and improved carburetion. Set up right, with at least 28 ounces of spring tension on the points, and with proper point alignment, stock ignition can be efficient as high as 6000 rpm. Beyond that, one of the better brands of dual-point, dual-coil ignition such as Spalding, Mallory or, perhaps the Vertex magneto from Joe Hunt should be considered. Resistant secondary wire is

Copper rings in grooves around cylinders insure sealing of combustion pressures.





Rear-engined Scarab has proven Buick aluminum V8's potential for sports car use.

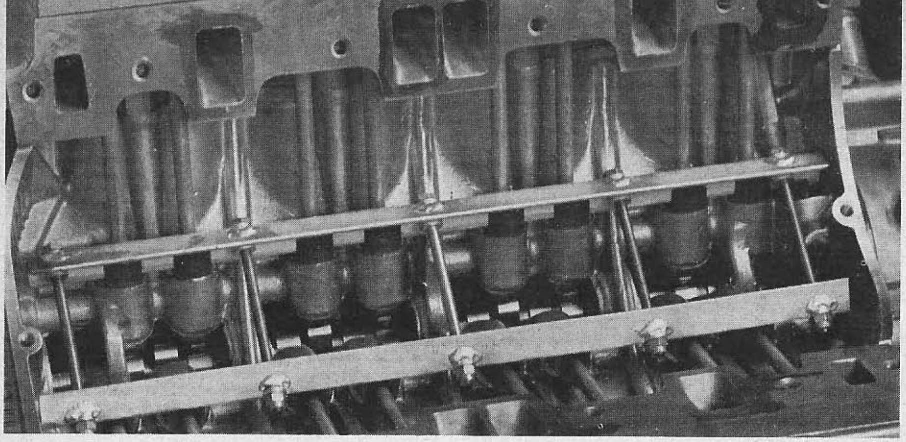
still the recommended thing for high speed performance, with the exception of the coil which should have a standard conductor wire.

There has been one cam change by the factory since the Buick V8 was first produced, and that was put into effect for 1963. The '63 cam has a little higher lift and more duration than the '61 and '62 and is, of course, interchangeable with both models. Consequently, it is possible for the owner of a '61 or '62 to add some muscle to his engine with the '63 cam.

Speed equipment manufacturers are now making special cams and kits for the V8. Iskenderian for example, puts out what is known as the E-2 cam with solid lifters included in the kit. This is a very effective cam and is being used by quite a few Buick owners. Not too long ago, *Hot Rod Magazine* technical editor Ray Brock made some dyno tests with this cam and reported a maximum hp reading of 226 at 6000 rpm. The Isky E-2 was used in conjunction with Olds pistons and dual ignition for the test.

With this type of power increase, precautionary measures should be taken to insure proper oil pressure. Shimming the oil pump relief valve 1/16 inch will raise oil pressure to a satisfactory 60 psi at 6000 rpm.

Wilder cams such as the E-2 can also be complemented by more car-



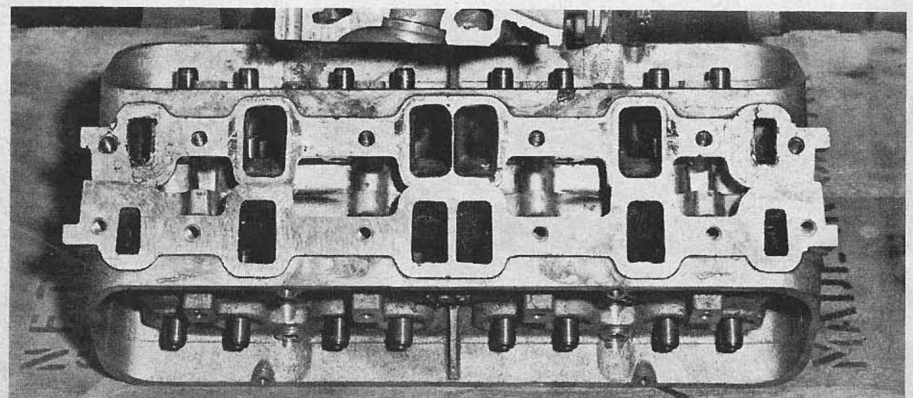
Scarab's roller tappet assemblies are kept securely in place by longitudinal carriage.

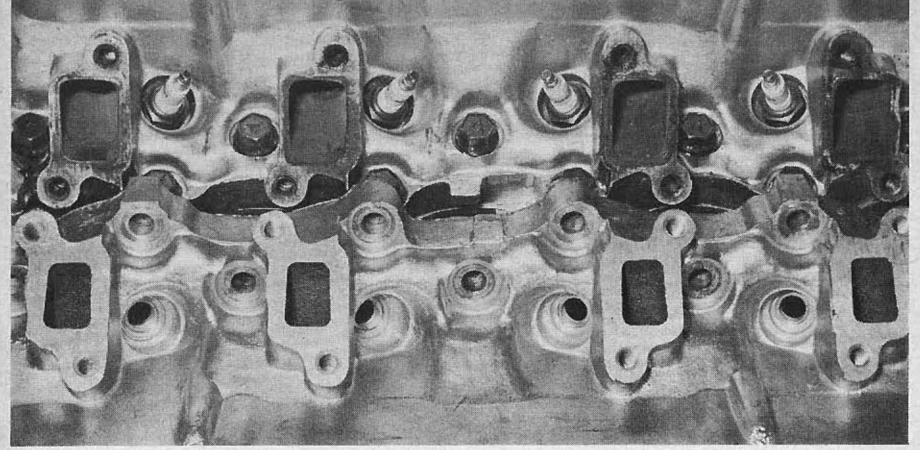
buretion. For example, the Edelbrock dual manifold mentioned earlier will permit the use of Chevy carbs which are bigger than the stock Buick. Jetting them at .062 (according to conditions) seems to work out pretty well, although some experimentation probably will be necessary here to find the right combination. The same goes for spark plugs, since various heat ranges will effect performance considerably.

Very little gain if any can be accomplished by changing from stock hydraulic lifters to solid if the stock cam is retained. The heavy duty hydraulic lifters which have been used in all Buick engines since 1957 seem to work out well, even with the engines turning as high as 6000 rpm. When running them in competition such as the drags, however, it is recommended that 20 weight oil be used to lessen the chances of the lifters pumping up. Solid lifters are recommended, of course, for wilder cams such as the E-2.

Naturally, reworking the heads is important when you get into major modifications. Porting needs to be done carefully, however, since there isn't too much material around the ports, and anything more than 1/16 inch could lead to trouble. If you do go too far into one of the ports, the thin walls make it virtually impossible to mend the damage by heli-arcing and you probably will wind up buying a new head.

Porting of Thompson engine, stock Buick (below). Compare with Scarab on page 30.





Tests by Reventlow engineers showed shape, not size, of ports is most critical factor.

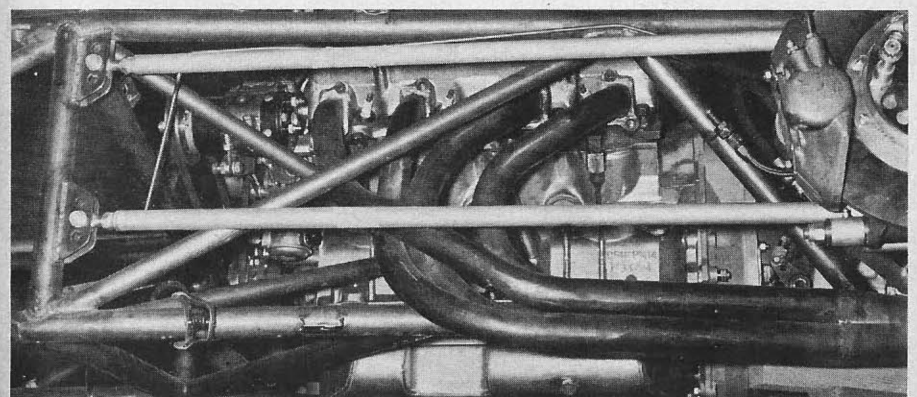
Cleaning up the combustion chamber, however, and eliminating all sharp edges is well worth while. It's the knife edge type of surfaces, where the machined surface of the head meets the contour inside the combustion chamber that tends to cause spark knock and pre-ignition problems.

Except where really way-out modifications, such as the Mickey Thompson Indianapolis car are concerned, the Buick V8 has a good bottom end. With some of the modifications mentioned in the preceding paragraphs, some owners are getting as high as 235 hp with rpm as high as 6500, without experiencing any bottom end trouble, so there doesn't seem to be any present need for more beefing of rod and crank assemblies.

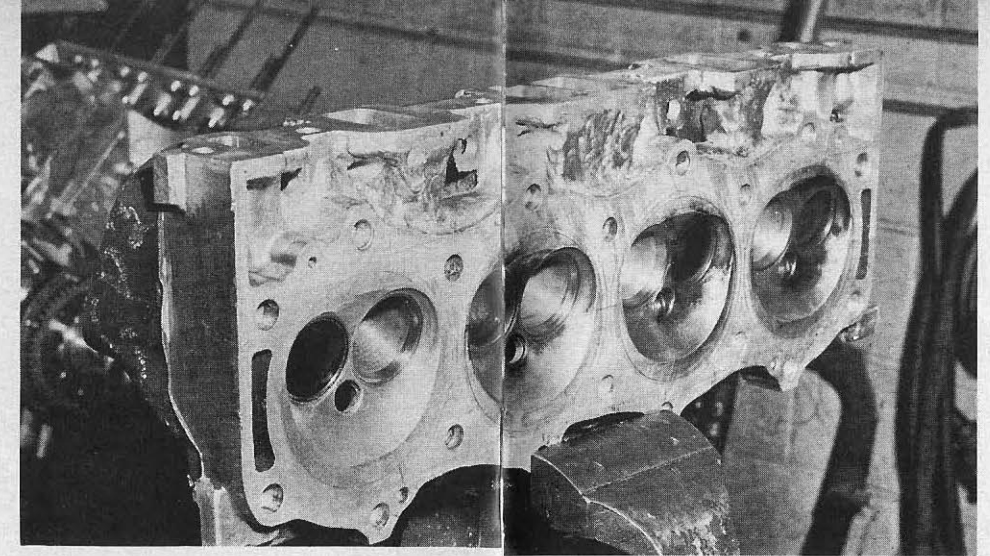
Boring .020 is recommended if and when it is necessary but is not too practical just for the sake of increasing displacement. The increase wouldn't be that great and many experts feel that there is more to be gained elsewhere. Of course if the engine is to be used for all-out competition in a dragster or for track racing or sports car courses, then a bigger bore has advantages. In this case though, it's more than .020 and modifications usually include replacing the cast iron sleeves.

Since Oldsmobile brought out its turbocharger for the F-85 there has been some speculation as to its value

Scarab exhaust headers are tuned in both length and shape for efficient operation.



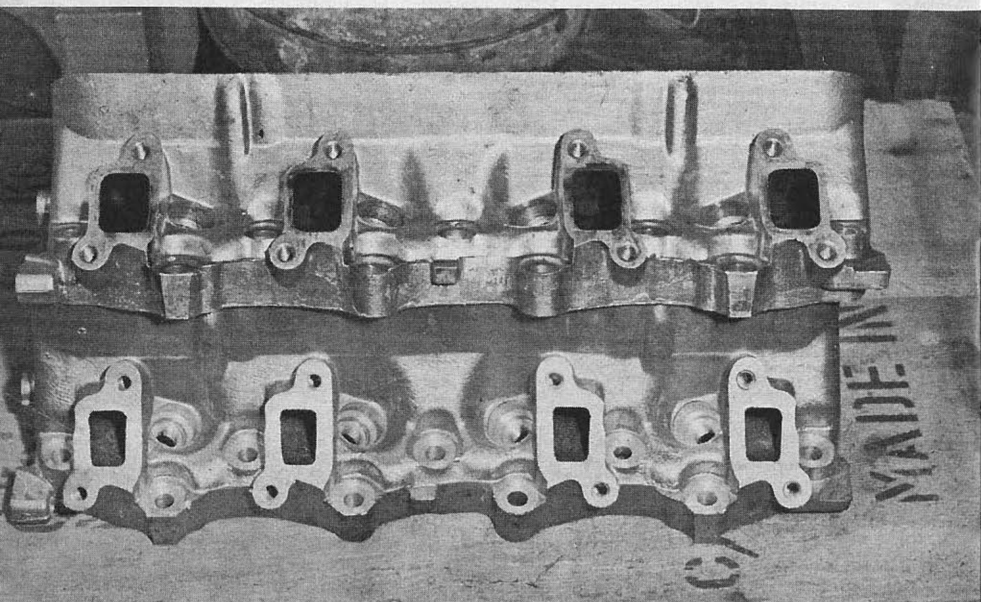
Like Reventlow, Mickey Thompson modified Buick heads for enlarged valves.



on the Buick Special. It is adaptable, of course, since the manifolds basically are the same and all the bolt holes line up. With just some minor changes it can be adapted to the Buick. However, this is a costly operation. The turbochargers don't come cheap and it is doubtful if the performance increase is worth it. As it stands at this writing, the turbo-equipped F-85 is running well behind the Special at the drags in most cases. This probably can be attributed to the initial acceleration lag which is typical of turbochargers. It takes a few seconds for the added boost to come in, and those extra few seconds spell the difference between winning and losing at the drags.

In addition to the modifications covered in the preceding paragraphs, weight saving advantages can also improve performance of the V8 and V6. Both engines are extremely light to begin with, and additional weight can be saved by trimming the flywheel, running without the starter, etc.

As mentioned earlier, both the V8 and V6 will fit almost anywhere and they bolt right up to a variety of gearboxes such as the Warner T-10 four-speed or the Warner T-85 heavy-duty three-speed. It is a good idea here to consider a heavy-duty Chevy clutch also, especially if drag racing is to be part of the picture. Quite a few Buick owners running the drags have gone this route, since the Chevy clutch offers more surface and less trouble under these strenuous conditions.



We've talked about some of the way-out modifications such as the Reventlow Scarab and Mickey Thompson's Indianapolis Buick, and we've mentioned engine swapping. Let's take a look at some of these in more detail.

One of the neatest swap jobs we've seen since the V8 was made available was an installation to a Mercury Comet. *Hot Rod Magazine* photographer Eric Rickman went all out on this modification, dressing up the completed job with breather-equipped chrome valve covers produced by Edelbrock at $54.45 a pair; Stellings-Hellings chrome air cleaner; and cad plating of all hardware.

The aluminum Skylark V8 was chosen for this installation, and it is coupled to the aluminum Olds F-85 Hydra-Matic gear box with an Ansen Posi-Shift stick. The basic engine has been stepped up with oversize pistons, Mickey Thompson manifold and four-barrel carburetor and DuCoil ignition. Rick also used a pair of hardened steel ignition drive gears from Clay Smith Engineering, since the stock gears have shown appreciable wear with high speed running. For exhaust improvement, he went to headers.

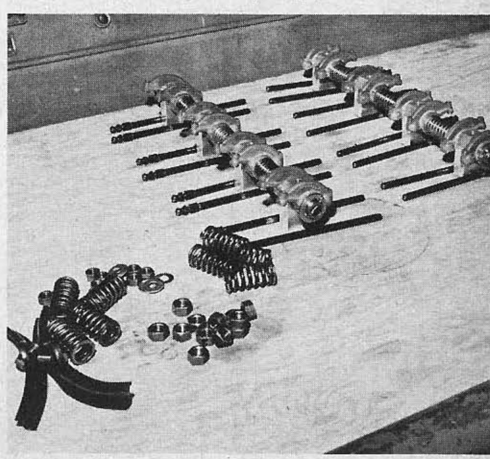
Compare Thompson's exhaust porting (l) with Reventlow's at top of previous page.

The all-out competition engines that went into both the Thompson Indianapolis car and Reventlow's Scarab were the result of many hours of experimenting, planning and fabricating. Although the Thompson engine is bigger than the sports car version (255 cubic inches against 239), they share some of the same engineering modifications and are comparatively close in horsepower output . . . around 300 hp.

All of the work was based upon proven fact rather than theory to achieve the best possible results. As brought out previously, one of the weaker points of the aluminum V8 is its breathing capacity and this is where the bulk of major modification work was done.

Two variations were tried with the Scarab engine, one retaining stock bore and stroke and the 215 cubic inch displacement while the other was bored .060 over and had 0.20 inch added to

Thompson used stock rockers, shaft, with special lightweight springs, retainers.



the stock 2.80 stroke. On the dyno, with pump gasoline, the big-bore job produced close to 300 horses as compared to 242 for the 215-cubic-incher. Thompson's engine, which runs on methanol, was right around the 300 hp mark.

As mentioned, most of the gain in horsepower was the result of improved breathing. To achieve this, Scarab engineers approached the problem with methodical efficiency. Stock heads were checked on a flow bench, a device for accurately measuring the volume of air passing through intake manifold, valves, exhaust manifold and exhaust pipe. It also can accurately measure the rate of flow. Needless to say, this is important in determining modifications necessary for the best advantages.

Valve seats were given 0.125 inch more diameter for bigger valves which came from the six-cylinder Pontiac engine. They were not left stock, however. The stems underwent machining which trimmed and lightened them and the heads were refaced to 45 degrees. Valve guides made from an aluminum-bronze alloy were machined and bored to accommodate the new valves, and were installed by press fitting them into the block.

The entire combustion chamber was reworked, eliminating sharp edges and making room for the ⅛-inch larger valves. Exhaust ports also were cleaned up and enlarged slightly while intakes were increased ¼ inch in height and ⅛ inch in width.

Both the Scarab and Thompson Buicks were fitted with specially fabricated intake manifolds, and Thompson also experimented with fuel injection. The Scarab uses four two-barrel Weber carbs, working through a cross-feed manifold. This means that the passages are crossed so that the two left carbs feed the right bank of cylinders while those on the right feed the left bank.

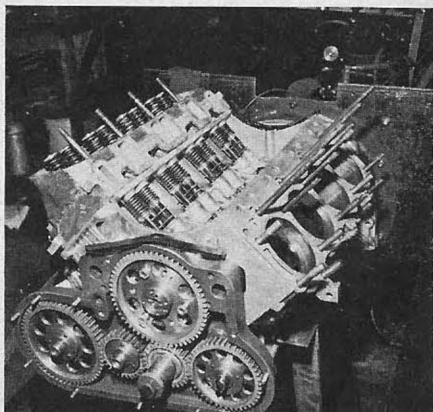
Exhaust is not unlike the modification described earlier in this chapter. Tuned length tubes of 1½ inches in diameter and 34 inches in length carry exhaust gases into a three-inch OD tailpipe which is 23 inches in length.

It is interesting to note that hydraulic lifters were retained in the 215 cubic inch version of the Scarab-Buick which bears out the fact that these are fairly efficient. The lifters used in this particular case were from the '53 big Buick engine, and despite the fact that they are generally not compatible with either the Engle or Racer Brown camshaft used, some modification work permitted rpm's as high as 7500. The modification consisted of setting leak-down to maximum and then partially compressing the lifter in the adjustment process. Camshafts themselves have a duration of from 280 degrees to 290 with a .375-inch lift.

With the .060 overbore, it was necessary to fit special pistons, and these came from JE. They are cast aluminum, with a compression ratio of 11.5-to-1. Piston pins are the full-floating type.

Some beefing was added to the bottom end. Although the stock aluminum V8 has extra long bolts for main bearing webs, the block was drilled and tapped so that ⅜-inch longer bolts could be used for additional strength and support. Main bearing inserts were grooved and a 10-quart oil sump was fabricated into the block. Overheating problems were solved through the use of a vertical flow radiator and an oil cooler, and it was necessary to drill additional water passages between the head and block. Oil pump flow capacity also was increased.

Special gear assembly provides accessory drive in Thompson's Indianapolis Buicks.

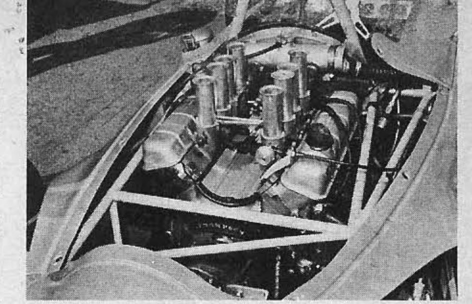


The ignition and water pump drive gears, mentioned earlier as a possible trouble spot at sustained high speeds, were replaced with hardened steel gears. And Reventlow's engineers even went one step further by fabricating an external oil line which connects to an aircraft fitting in the housing and keeps a continual flow of lubricant on the gears.

Like most racing engines, the Scarab Buick employs magneto ignition, this one, a Vertex mag supplied by Joe Hunt magnetos of Los Angeles. Electric fuel pumps also are used.

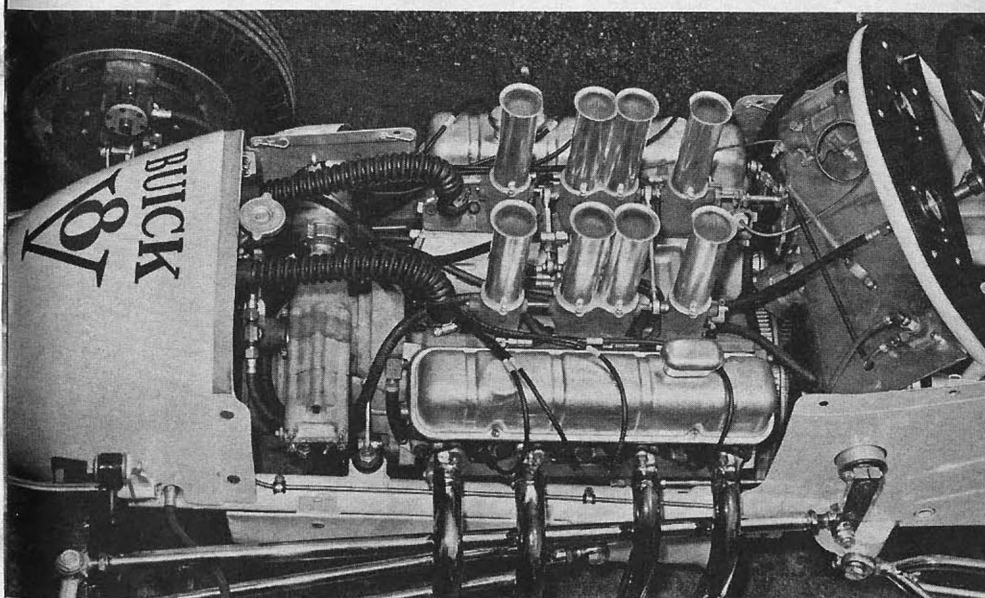
Final carburetion for the 239-cubic-inch engine is by four 58 DCOE Webers with 1.85-inch venturis, which gave considerably more horsepower than the 45 DCOE's with 1.57-inch venturis tried earlier.

Performance of the Scarab and Thompson Buicks has been impressive to say the least. Still, it's far from the end of the line. The engine still is comparatively new and there is no telling how much more performance can be gleaned as more and more enthusiasts adopt this little power plant for their ventures over the nation's drag strips and oval tracks. ■

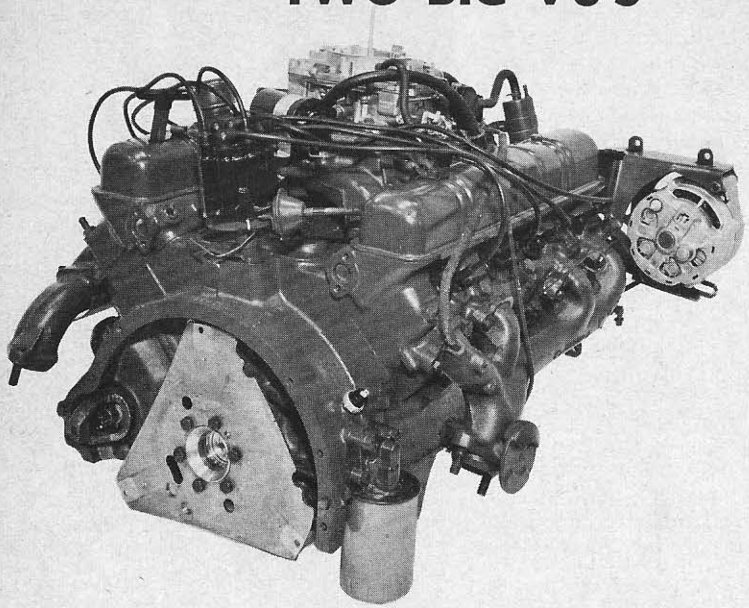


Rear-mounted Thompson Buick displaces 255 cu. in. to meet Indy regulations.

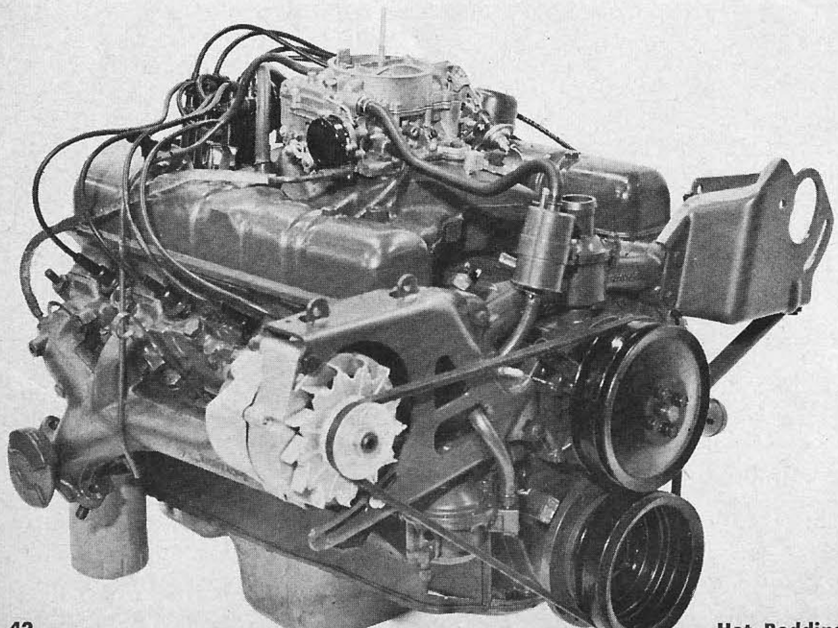
Buick aluminum V8 has also been tried in dirt track cars but with inconclusive results.



TWO BIG V8'S



Latest Buick engine packs 425 cu. in., close to NHRA, NASCAR limit of 427 cu. in. Did Buick have racing plans that went awry? Unit is optional in full-sized Buick models.



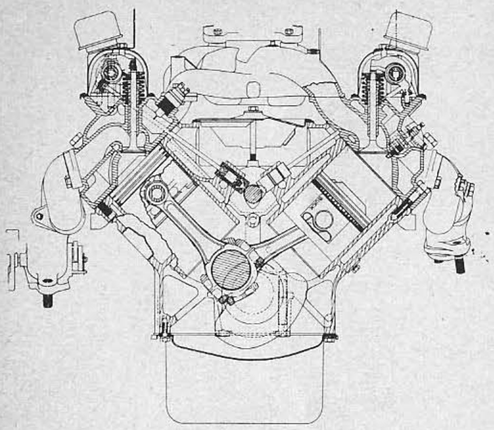
Typical of big Buicks powered by 401-cu. in. V8 is '63 Wildcat, which has 325-hp unit.

BUICK'S current "senior" engine, the 401-cubic-inch V8 which is standard on the LeSabre, Invicta, Wildcat, Electra and Riviera, is a direct descendant of the 1953 ohv mill which had a displacement of 322 cubic inches. It was raised to 364 cubic inches in 1957, and the current 401 was incorporated in 1959. Basically, however, the engine is the same with the exception of a block change in '57 which relates that engine more closely to the present V8.

Technically, Buick's 425-cubic-inch mill, which was brought out mid-way through the 1963 model year should be called the senior engine. But since it is offered only as an optional engine on the Invicta, Wildcat and Riviera, we'll refer to it as an option here. The basic difference is in the bore and a few other minor points, and the 425 probably will become the standard power plant for 1964, on some models at least.

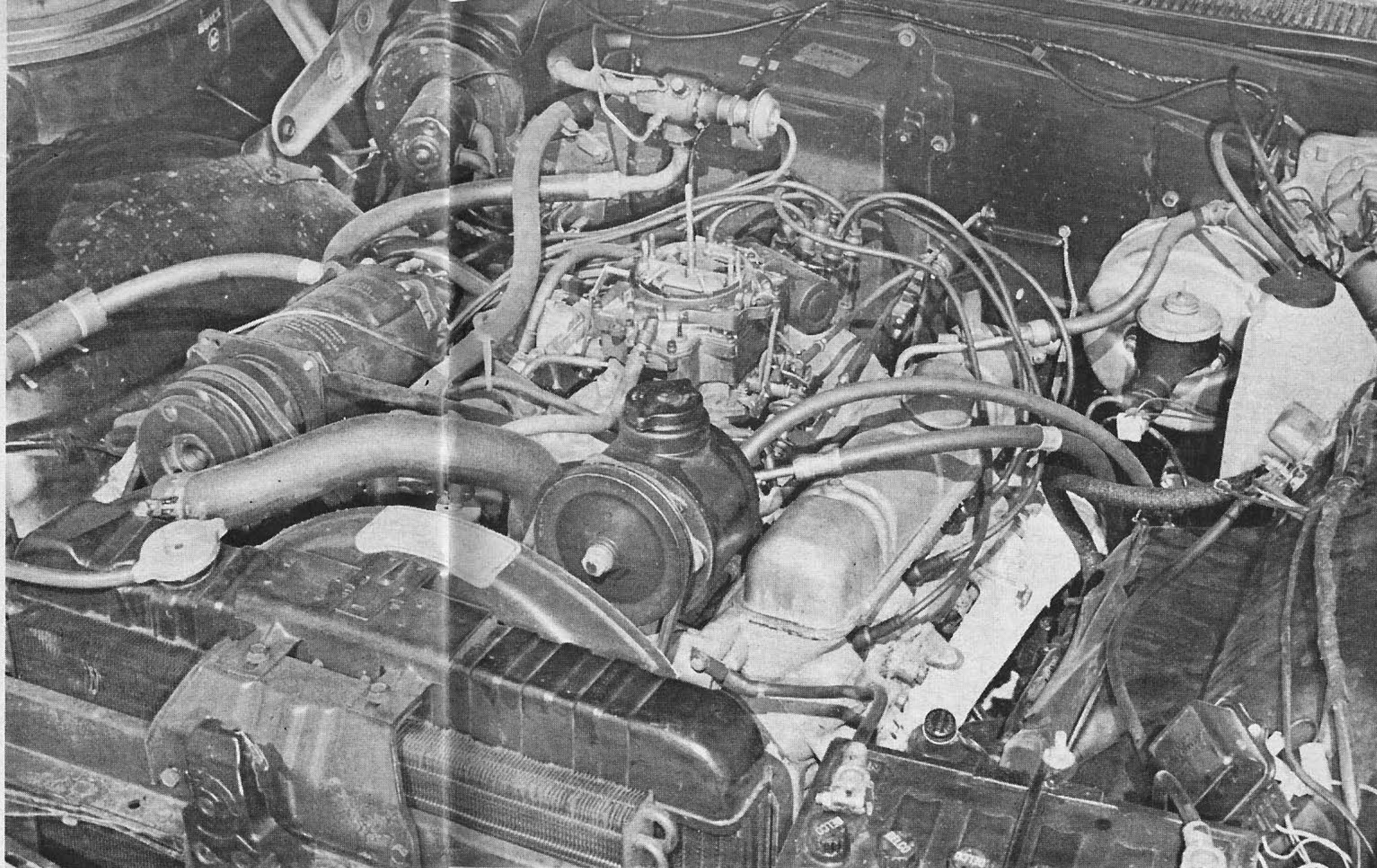
The 401 has a 4.1874 x 3.64 bore and stroke with 10.25-to-1 compression. It produces an advertised 325 hp at 4400 rpm using four-barrel carburetion, and has a torque rating of 445 lb/ft at 2800 rpm. The two-barrel version, standard for the LeSabre, is rated at 280 hp. Buick also offers an economy version which produces 265 hp with 9-to-1 compression and two-barrel carburetion.

The 425 has a 4.325-inch bore but retains the same 3.64-inch stroke as the 401, and is rated at 340 hp. Four-barrel carburetion and 10.25-to-1 compression are standard. Different casting methods were used on the 425 block, however, to give more density to the cylinder walls. Porosity with the bigger bore caused some problems with the rings which delayed production of the engine and made it a mid-year option.



Big 425 (above) is basically same as 401 but is bored out .138 to get more inches.

325-hp version of 401 (right) is standard in all big Buicks but low-priced LeSabre.



It was supposed to have been standard on the '63 Riviera. These problems have been solved, however, with the different casting and by going to a chrome top and bottom ring. Also, the number two compression ring now has an expander for more pressure.

Both engines employ the same SAE 1145 forged steel crankshaft with a rubber absorption vibration damper. It has .004-.008-inch end play and a 2.2495 pin diameter. There was no change in main bearing journal diameter with the bigger bore, however, and the 2.4985-inch diameter used for the 401 is incorporated on the 425. Main bearings have a recommended clearance of .0005-.0021-inch. End thrust is taken by number three.

Connecting rods also are the same in both engines. They are forged SAE 1141 steel, weighing 24.384 ounces and have a length of 6.220 inches from center to center. Clearance limits for the steel-backed, M/400 aluminum bearings is .0002-.0023, with .005-.012-inch end play. Earlier rods are interchangeable and have the necessary meat for competition. The '57 rods for example can be used with the late pistons for a ¼-inch stroke.

Pistons for both engines are made of the same cast aluminum alloy. They are cam ground with divorced skirt, but here the similarity ends. The 425 slugs naturally are bigger and weigh more, 25.31 ounces as compared to 23.68 ounces for the 401. Also, the 425 has a 5/16-inch dome while the 401 uses a ⅜ dome.

Clearances also are different. Top land for the 401 slug is .029-.037 with .001-0016 top skirt clearance and .002-.0036 bottom skirt clearance. Pistons for the 425 have a top land of .034-.042 with .0013-.0019 clearance for the top skirt and .0023-.0039 for the bottom. Pins are pressed into the rods without bushings and are made from SAE 1118 steel. They have a .00075-.00125-inch clearance in the rod and are the same 3.520-inches in length for both engines. Diameter is .9994-.9997.

Cylinder heads which also are cast iron, have a relatively large combustion chamber—semi-hemispherical in shape—which has been incorporated into the aluminum V8. The valve train also is the same with the exception of the camshafts. Both cams are cast iron alloy with five main bearings and are driven by nylon coated aluminum gears. The difference in timing, however, can be seen in the following specifications:

	401	425
Intake		
opens BTC	28 degrees	29 degrees
closes ABC	87 degrees	81 degrees
duration	295 degrees	290 degrees
Exhaust		
opens BBC	76 degrees	71 degrees
closes ATC	46 degrees	48 degrees
duration	302 degrees	299 degrees
Overlap	74	77
Lift @ zero lash	431	431

Hydraulic lifters are standard throughout the Buick engine line, but the export kit which was produced in 1957 is still available for changeover to solid lifters. The same type of taper valves used in the aluminum V8 are used in the 401 and 425 engines, although the dimensions are bigger, of course.

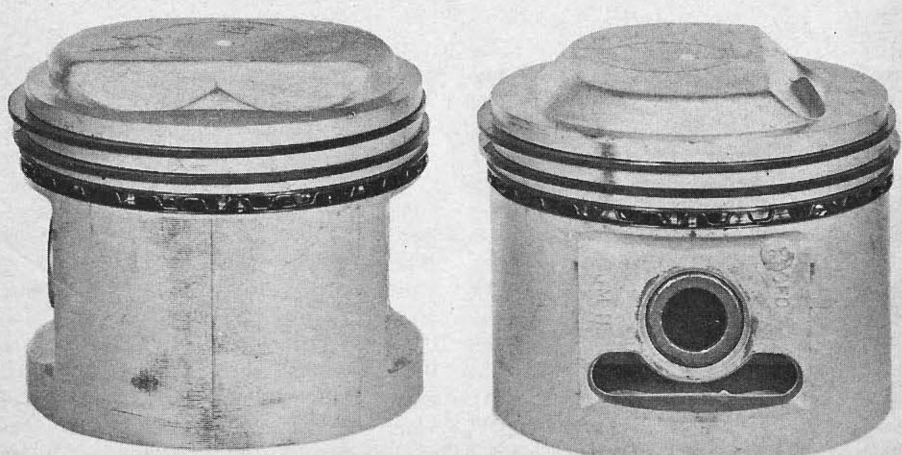
Both the 401 and 425 intake valves are 1.875-inches in diameter and have an overall length of 4.785-inches. Stems taper from .3730 plus or minus .0005 to .3720, plus or minus .0005. Clearance in the guides is .001 to .003 at the top and .002 to .004 at the bottom. No inserts are used in the 45-degree seats as they are with the aluminum engine.

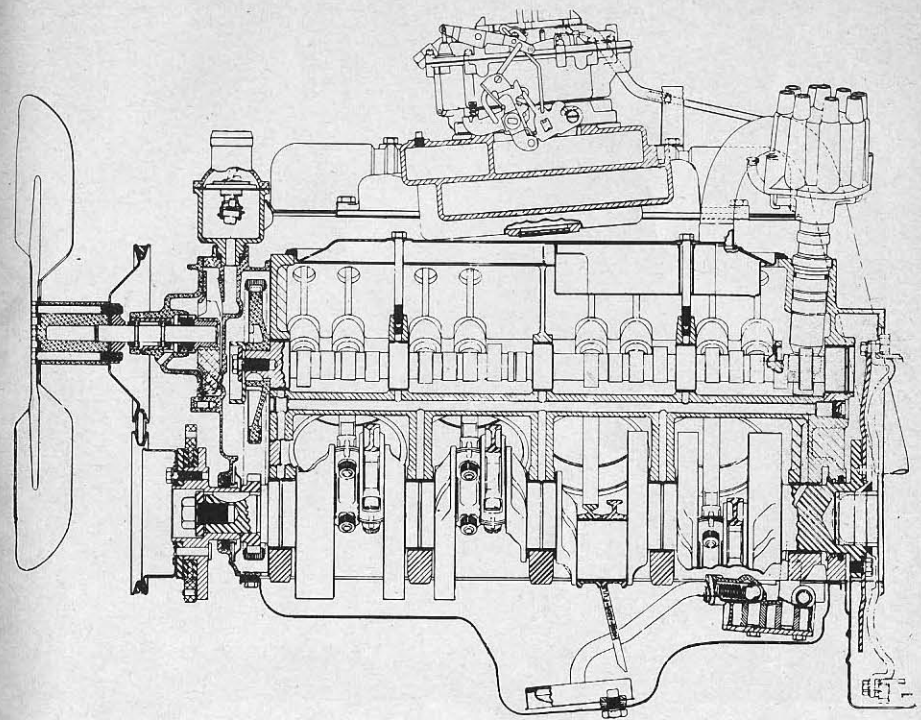
Exhaust valves have a head diameter of 1.500 inch and an overall length of 4.785 inches. Stems are tapered from .3725 to .3715, plus or minus .0005 at both ends. Top clearance in the guides is .0015 while bottom guide clearance is .0025.

Unlike the aluminum V8, the 401 and 425 valves use both an inner and outer valve spring, with the same pressure recommended for both the intakes and exhausts. Outer pressures are 46 pounds with the valve closed and 101 pounds with the valve open. Inner tension is 25.5 pounds closed and 76 pounds open.

Buick uses two makes of carburetors again this year. The two-barrel which is standard on the LeSabre is a 2GC Rochester while the four-barrel unit used on the Invicta, Wildcat and Riviera is an AFB Carter. The Electra uses a 4GC Rochester as its standard carburetor. All use the same secondary barrel size of 1.6874 and all of the four-barrel units have a 1.5625 primary barrel size of 1.6874 and all of the four-barrel units have a 1.5625 primary barrel size.

Aluminum alloy pistons for 425 are cam ground with divorced skirt, have 5/16" dome.





With nominal rating of 340 hp, 425 should have potential for greater development.

Polyurethane air cleaners are used on all Buick engines for 1963. The fuel pump has a pressure range of 5.25 to 6.50 pounds, and two fuel filters are used, one in the tank itself and the other—with replaceable pleated paper —is located on the engine.

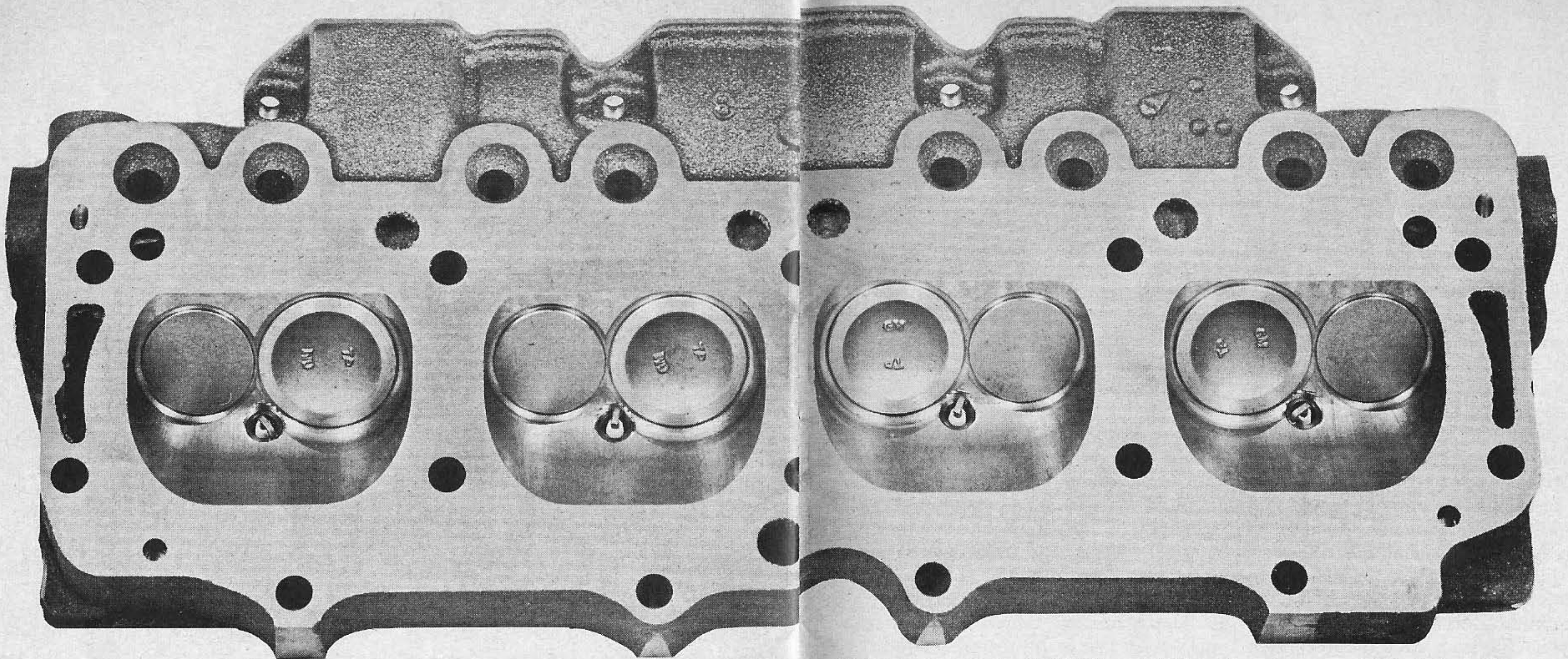
Both the Wildcat and Riviera engines are equipped with dual exhaust systems as standard equipment, and employ a separate resonator. The LeSabre, Invicta and Electra have single exhaust with a crossover feeding into single reverse flow mufflers. Exhaust pipes are laminated tubing with a 2.25-inch o.d. The dual exhaust system is optional, of course, on all models except the Buick Estate Wagon.

Heart of the 401 and 425 lubrication system is a gear driven oil pump of the non-aerating type. Normal oil pressure for both engines is 40 pounds at 2400 rpm. Main bearings, connecting rods, camshaft bearing and tappets oil are pressure lubricated by this system. A full flow filter is also used.

Both engines are fired by Delco-Remy single coil ignition with a centrifugal and vacuum advance distributor. Centrifugal advance starts at 550 rpm, with intermediate points of zero to four degrees being reached at 900 rpm. Maximum is 22 degrees at 3800 rpm. Initial spark lead is 12 degrees BTC at 400 rpm.

Recommended setting for the breaker points is .013 to .019-inch and the breaker arm tension, which is important to good performance, should be 19 to 23 ounces.

AC spark plugs are standard, of course, on all Buicks, and the same



Characteristic Buick combustion chambers, shown in 425 head, are semi-hemispherical.

Valve system (below) of 401 and 425 engines incorporates both inner/outer springs.

standard heat range (44S) is recommended for both the 401 and 425. Recommended gap is .030-.035 and the plugs should be torqued from 25 to 30 lb/ft.

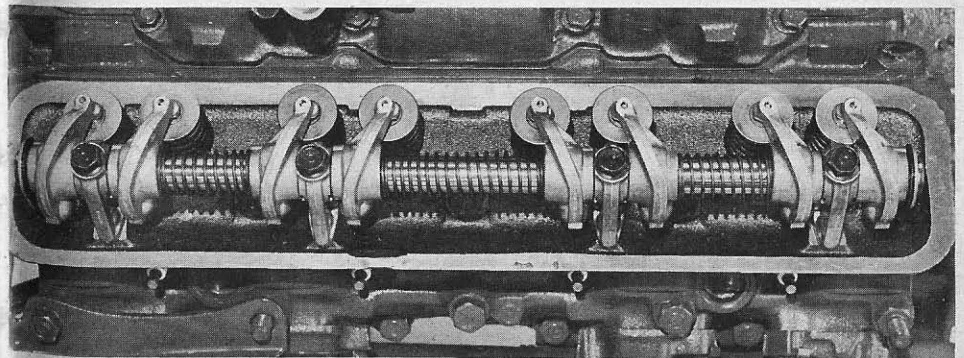
While the big Buick V8 does not enjoy the performance image created by, say, the big Pontiac, its wide range of power makes it more than suitable for competition. The bottom end is exceptionally strong and has given amazingly little trouble in cases where the engine has been subjected to the severe strains of track racing. Main bearings and rod bearings seem to give exceptionally good wear and no trouble.

In track racing, one of the most successful operations with the big Buick has come with a series of sports cars known as "Ol' Yaller," built in Los Angeles by Max Balchowsky, one of the foremost experts on the Buick engine. Max's cars have dusted off most of the top production sports cars from Europe in sports car events on the West Coast, and Max does it running basic stock components. We'll discuss some of his methods in another chapter.

As for drag racing, Lennie Kennedy, the 50-year-old enthusiast from Pomona, Calif., showed the younger set just what can be done with a stock big Buick by waltzing off with a roomful of drag trophies. He also earned second place in NHRA's world point championship for stockers two years ago, driving his Buick against the highly rated Chevrolets, Pontiacs, Fords, Dodges and Plymouths.

Then there is Tommy Ivo's all-out dragster, a tremendous piece of engineering that employs four big Buicks for power and covers the quarter-mile at better than 175 mph. Strictly an exhibition car (NHRA drag rules do not permit the use of more than one engine), Ivo's creation incorporates the full-house treatment to each of the engines, and we'll discuss these, too in another chapter.

Whether retained in its stock form or used for racing on the strip or track, the big V8 has plenty of form, and its reputation for dependability and durability has been proven time and again over the years. ■



TUNING FOR SPEED

In this chapter we will deal with the Buick engine in its stock form, touching on modification points that are permitted for the drag strip. Major modifications for the Special V8 have already been covered in a preceding chapter, and we'll discuss major modifications for the big V8 in the chapter that follows.

Meanwhile, whether your particular interest centers around competing at the drags or just having an engine that performs at its maximum potential on the highway, tuning methods discussed here will apply. Some of the major tuning methods discussed may fall in the realm of modifications which, in a sense, they are. But such modifying (which qualifies as tuning according to NHRA rules) is permitted since it does not involve the actual altering of components. Instead, it deals with going completely through the engine and correcting any variations from precision specifications that are always bound to occur with mass production. Setting an engine to exact specs on an assembly line is both costly and time consuming, and so manufacturers instead stay within certain tolerances which allow some leeway on the plus or minus side. These are the points that can and should be adjusted for best performance.

Before we get into major tuning, however, let's examine the possibilities of gaining some performance through minor tuning. The starting point here, naturally, would be with carburetion and ignition. Obviously, since we are talking about *stock* tuning, we have to stick to stock carburetion which, on the hotter Buicks is a single four-barrel.

Two of the throats serve as primaries while the remaining two are secondary which are set up to come in at high speeds for the additional air and fuel supplies needed within the combustion chamber. For economy purposes, the stock Buick carb has leaner jets in the primaries, since they are used for cruising at speeds near or below 40 mph. For drag racing, where full power is applied at the starting line, it usually is necessary to richen the mixture by going to larger size primary jets. Such things as atmospheric conditions, altitude, etc., have a bearing on how rich or lean a mixture should be so there is no set jet size to be recommended. Instead, it has to be a trial and error method, beginning with one stage richer and going up or down until the best results are obtained.

However, a good rule to remember is that the mixture must be rich enough to supply maximum energy to the pistons but not too rich so as to prevent clean, even burning. It must be on the lean side of the maximum power ratio of air/fuel mixture so the engine can accelerate quickly. Too rich a mixture will cause the engine to become sluggish and a decrease in rpm—and consequently speed and ET will result. Incidently, NHRA drag rules permit the use of any jet size.

The two-barrel carburetor found on some Buicks has been designed mainly for economy. However, these can be made to do a better performance job by drilling the power jet orifice approximately .003 larger for a bit richer mix-

Lennie Kennedy drove his '61 Invicta to second place in NHRA Stock Car Championship.

ture under heavy acceleration. Some playing can be done with flat level setting, but this should not vary too much from factory recommendations.

In any case, whether you're running a two- or four-barrel, another rule of thumb at the drag strip is that dense, cool air calls for an increase in jet size. When the weather is hot and dry, a smaller jet usually works better. Here again, the trial and error method is best according to conditions, and you're better off to make small changes each time rather than to go overboard either way.

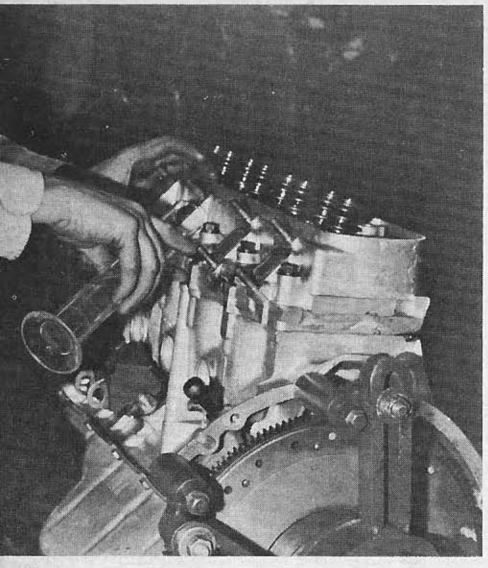
For street operation, of course, carburetion mixture should be richer than that used for short, quarter-mile acceleration runs which make up the sport of drag racing, so the combination that works well at the strip may not be the answer for highway running where the richer mixture helps keep the combustion chamber cool.

It goes without saying that cleanliness and special care in disassembling or assembling a carburetor are musts. A slip of the screw driver can cause scratches or burrs which will impede the flow of the fuel/air mixture, cause the floats to hang up or prevent the needle valve from seating properly. Any such imperfections should be removed along with any sign of dirt or grit.

One of the welcome loopholes in NHRA drag rules is that any type of battery-operated ignition is permitted. While the stock Buick ignition is efficient and dependable, considerable advantage can be gained with some of the optional ignition accessories now available through speed shops, such as dual coil, dual point units. When these are used, however, considerable care should be taken in setting the breaker point gaps. Under no circumstances should they be set by blocking off one set and setting the other. This pushes the camshaft angle off center due to point spring pressure and when the points are released the cam angle will change on the one set first. It is best just to disconnect the wire connecting both points and set each one individually, while both points work against the distributor cam.

Regardless of the type of ignition you use, stock or otherwise, there are some basic maintenance points that should be observed. The counterweights must be free in the distributor, the shaft and bushing should be checked for wear and free movement, the points must be properly aligned and the rubbing block should be trued, especially when installing new points. Spring tension on the breaker points also is important and should be checked regularly, especially if the engine is used in competition. Improper tension allows the rubbing block to float away from the cam lobe, preventing uneven cylinder firing through the rpm range. All Buick mills, including the V6 have a recommended spring tension of 19 to 23 ounces and are best set on the high set for competition.

Condensers seldom give trouble on an engine but, once in a while, one with the wrong capacity will show up and cause excessive point wear and possible minute misfiring. It is always wise,



Procedure involved in major tuning is exact check of compression ratio by measuring cylinder volume at TDC, BDC.

when seeking maximum performance, to check condenser capacity to make sure it checks out with factory specifications. It can be checked on a distributor strobe which should be used when setting the cam angle for the proper advance rate.

The advance curve is important to any type of operation because it determines the length of time the air/fuel mixture has to burn in relation to piston position. Actually, what we try to accomplish is to cause maximum pressure against the piston head on the power stroke, when the piston starts down. Too much advance, however, ignites the mixture too early and causes pressure to be exerted before the piston reaches the top of its compression stroke. Excessive detonation usually results.

On the other hand, if too little advance is used, the mixture is ignited too late and the piston is past TDC too far to take advantage of the combustion pressure. And the further down the piston moves the more effectiveness the pressure loses.

The way to get correct spark advance at both low and high speeds is to find the initial lead that gives the best low end performance, and then limit the automatic advance mechanism in the distributor so that the maximum degree is correct for high engine speeds. With the Buick engine, recommended initial timing—7.5 degrees at 1050 rpm for the V6 and aluminum V8 and 12 degrees BTC at 400 rpm for the big V8's—has been found to be close to correct for the drag strip.

Some competitors use more on the theory that the more initial lead you have the better the car comes off the line. This is partly true, but it must be blended into a curve that is correct for top end power also. For the best and most accurate curve, the distributor should be placed on a Strobe and checked out electronically. The rate of advance can be totally controlled by increasing or decreasing spring tension on the distributor counterweights.

Timing, of course, should never be done by guesswork. It is necessary to use a timing light for accuracy, and most competitors who run consistently well go a step further by having the harmonic balancer "degreed" for really accurate reading. Most machine shops are equipped to do this and it involves stamping the balancer in one degree increments for easy reading.

Spark plugs are one of the most important components to good performance and efficiency and therefore should receive careful attention. Choosing the right plug with the correct heat range that is compatible with the type of driving encountered is very essential and should be complemented by proper

cleaning and gapping. Some drivers swear by one brand while others are partial to another make. We won't go into a lengthy discussion here on the merits of one brand over another. All of the top manufacturers, Champion, Autolite, AC, etc., have been in the business a long time and all produce dependable products so we'll leave the brand choice up to the individual. It has been found, however, that the plugs recommended by the manufacturer generally are best suited to an engine.

Buick recommends AC plugs for all its engines, with varying recommended heat ranges. The V6 for example lists the AC 44S as its standard plug while the 155-hp aluminum V8 lists the 45FFS and the Skylark V8 lists the 44FFS. For the big V8's, the AC 44S is recommended. These are basic recommendations, however and, as pointed out, will vary according to the driving conditions. For sustained high speed running, for example, a colder plug definitely should be used, while at the drag strip the basic plug may prove to be just what the doctor ordered. Generally, one step colder than the recommended plug works well at the strip, and a .032 gap works well for both strip and street. For sustained high speed running it may be necessary to close the gap to .028 or .030. Some experimenting usually provides the right answer.

Reading plugs to determine whether the carburetor mixture is too lean or too rich has many advantages if you know what to look for. It is a practice that has become exceedingly difficult with the more recent power-tip innovations which place the porcelain portion of the plug almost in the combustion chamber. In order to read a plug correctly, it is necessary to get it out of the engine immediately after a run, after the engine has been cut clean. That is, turning off the ignition while the engine is at high speed and slipping the transmission out of gear. If the car is allowed to decelerate with the ignition on or the crankshaft is still rotating, temperature loss and effects of the richer idle mixture will cause a false reading.

Immediately after the car has stopped the plugs should be pulled and read. If the mixture is too lean there won't be any carbon on the insulator, and the insulator may show an indication of overheating with a shiny, glazed appearance and a very light tan color. If the mixture is too rich, the insulator will have a wide band of carbon around it that is black in color. The correct mixture usually will bring out a narrow band of dull black or grey carbon deposit around the insulator where it joins the shell.

Incorrect heat ranges also can be determined by reading the plugs. When it is correct, the plug will be free of deposits and will take on a nice light chocolate or tan color. Too cold a plug will be indicated by dull-surfaced deposits around the insulator which can cause fouling while too hot a plug will be indicated by a cracked or split insulator or one with shiny deposits around it.

That pretty well covers some of the basic or minor tuning which can add to the Buick's overall performance. Additional gains are possible through the use of exhaust headers but, unfortunately, ready-made units for the Buick are hard to come by. Many owners wind up fabricating their own or having the work done at specialty shops.

For someone going the full route on major tuning by placing all components at their exact specifications and taking advantage of factory tolerances, it is first necessary to completely disassemble the engine so that various parts can be checked. The amount of variations found will dictate the amount of reworking necessary, and it usually involves machining and reworking with special tools and equipment. It can become costly but can hardly be passed up if maximum performance is the ultimate.

One of the initial areas to check is deck clearance, which is the distance from the top of the piston to the top of the cylinder block when the piston is at top dead center (TDC). Since this affects accurate compression ratio it is important that it be made to conform with exact specifications, and you will generally find that the specified deck clearance is off from that specified.

This can be due to a number of reasons. There may be a variation in the crankshaft; the connecting rods may not all have the exact same length when measured from center to center; compression heights of the pistons may not match exactly; or there could be a variation in the height of the cylinder banks, one being higher than the other or one being higher at one end than it is at the other. Any of these dimensions can vary according to manufacturing tolerances and each must be checked and then corrected so that all measurements of the same kind will be the same.

With these parts then installed in the block, the actual deck clearance can be accurately measured and the block can then be reworked as necessary with a machine for milling the cylinder banks. Specified deck clearance for the V6 is .0256-.0274; for the 155-hp V8, .0150-.0168; and for the 200-hp V8, .0067-.0085. All of these are measured *below* the surface of the block. For the big car's 401- and 425-cubic-inch engines, the tolerance is .0323-.0341 *above* the surface of the block.

Connecting rods should be checked first, both for length and diameter, and roundness of the big ends, since any changes in diameter will affect rod bearing clearances. Clearance limits for the V6 and aluminum V8 engines are .0002-.0022, and are the same for the big V8. When setting up for competition, most mechanics will give these more freely on the crankshaft. This allows adequate lubrication without being too loose so as to fling oil into one of the cylinders. Rod and piston alignment also should be checked to insure maximum freedom of movement inside the cylinder.

Crankshaft reworking is best done by companies that specialize in crankshaft stroking and reworking. Variations in main bearing journal and crankpin diameters, roundness and alignment and in stroke length and crankpin spacing should all be corrected and this is usually done by grinding the journals and pins undersize slightly. It is a good idea, too to have the bearing surfaces hard-chrome plated before they are finished to size. This will add to wear resistance and enable all the journals and pins to be finished in their standard sizes. All Buick engines, including the V6, list a main bearing clearance of .0005 to .0021.

Advance casting and machining methods used for production line pistons has practically eliminated the possibility of compression height variations, which is a good deal because variations of any consequence could prove costly. Compression height is measured from the center of the pin bore to the top of the piston head, and this should be checked especially when buying new pistons. The best way to overcome any variations is to exchange the ones that are off so that a matched set can be put together. It is practically impossible, and quite costly, to try and machine dome-type slugs such as those used on the big Buick in order to match them.

Equally important is the installation of pins through the pistons and into the connecting rods. Each of the Buick engines uses a pressed fit and it is vital that they be given ample clearance to prevent any possibility of their binding. A Sunnen hone, used by most shops fit. The V6 and aluminum V8 engines have a recommended pin clearance of .0003 to .0005 in the piston and .0007 to .0015 in the rod. The big V8 lists .0005 to .0001 clearance in the piston and .00075 to .00125 in the rod.

NHRA rules permit an oversize bore of .060-inch, and a great many competitors take advantage of this, since it gives a slight increase in displacement. Engines that are bored the allowable amount should be finished so as to permit fitting of oversize pistons with ample clearance in the cylinder. Blocks that are not bored still should be honed to increase the clearance for standard pistons.

Since reworking of the road, crank, etc., destroys any balancing that was built in at the factory, it is necessary to completely rebalance the crankshaft assembly before reassembly is started. There are many shops around the country that specialize in precision engine balancing. When the block and crank assemblies are reassembled, it is important that rod caps be installed on the same rod from which it was removed. Bearing inserts must be installed carefully and it is necessary to use a ring compressor when installing piston rings. These should have adequate clearance in their grooves and must be installed with the correct sides up.

NHRA rules prevent grinding or polishing of the valve ports if the engine is to compete in stock classes at the drags but there is considerable rework that can be done to the cylinder heads, including the all-important valve job. If the engine has been run for a long period of time, it is best to check the valve guides and if they are worn, they should be replaced.

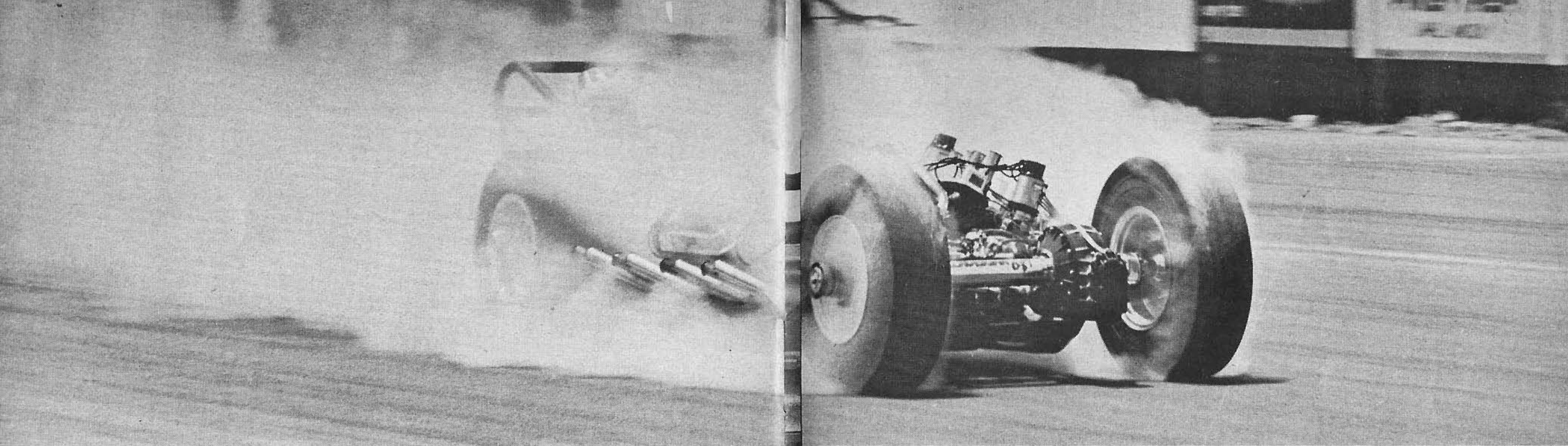
Unless you are well skilled with valve grinding equipment, you are better off to leave the major valve work to a specialty shop. A bad valve job can do more to spoil performance than of the correct angles and concentric with the stems, and seats should be ground a few thousandths of an inch smaller than the diameter of the face for proper seating.

Valve springs should be checked on a special spring testing machine for the correct pressure and also should be straight and of the correct length as specified. This includes the inner springs which are used on the big Buick, though not on the V6 and aluminum V8. Springs that do not measure up to specifications should be replaced. Spring length is measured while the springs are in place on the head. Special shim washers that fit between their lower end and the head are available from most parts houses and are made in different thickness which can be mixed in any way required to increase or reduce spring length where necessary.

The camshaft should be carefully inspected for straightness and, if the engine has been run for any length of time, it is best to check the lobes for signs of wear or damage. Correct alignment of camshaft bearing journals is just as important as the alignment of the crankshaft and its bearings. Care should be taken to prevent the lobes from scratching the soft bearing surfaces during removal or installation.

Finally, the intake manifold heat riser should be blocked with special gaskets for maximum performance. This produces a colder manifold and, consequently, a denser charge of air/fuel into the cylinders for more efficient combustion. This will affect starting and initial running on cold mornings if the engine is to be subjected to street use, but this generally is secondary to anyone contemplating maximum performance.

Ports in the exhaust manifold or headers should not overlap the exhaust ports in the heads since this tends to disrupt the flow of exhaust



TV's Tommy Ivo built spectacular dragster with four Buick engines, four-wheel drive.

BLASTING WITH BIG BUICKS

QUITE a few Buick exponents have turned their talents to modifying the big Buick V8 for all-out competition. One of these is Tommy Ivo, the hot rodder and motion picture and TV actor who earned himself a reputation on the nation's drag strips where he is known as "Instant" Ivo.

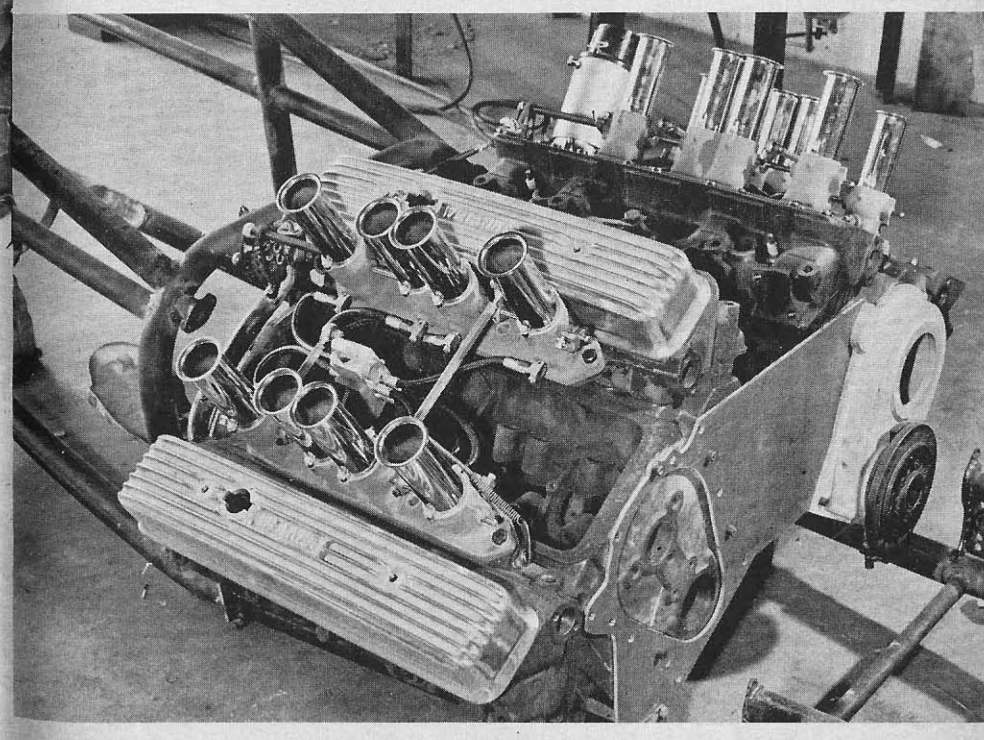
Tommy has had some interesting machinery since he ventured into the drag racing business, but the best conversational piece by far has been his four-engined creation which was built for show and for exhibitions at the strip. It is a sparkling hunk of machinery powered by four 401 Buick mills bored and stroked to 454 cubic inches for a total displacement of 1,816 inches!

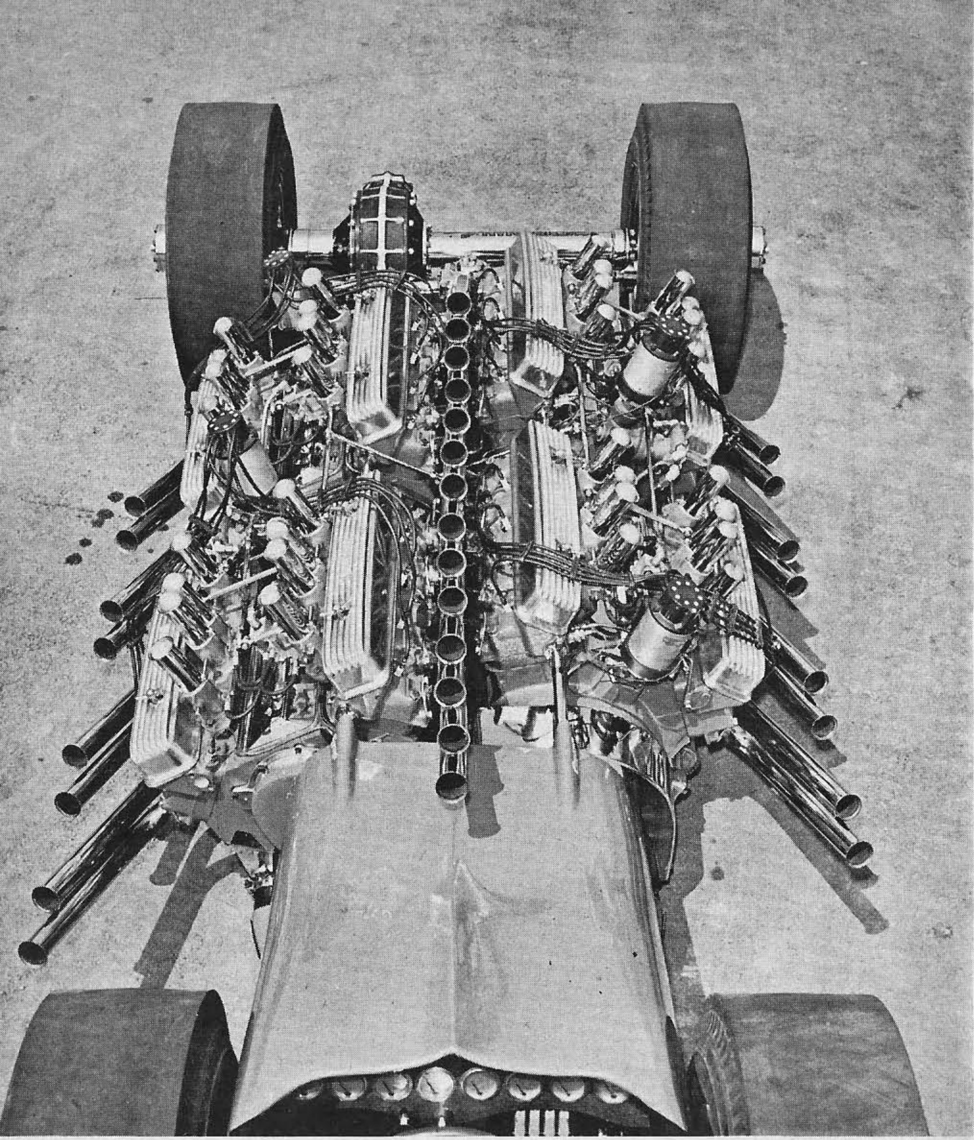
The total car weighs 3555 pounds in full racing trim and the engines offer a combined rating of 1720 horsepower. That figures out to an amazing 430 hp per engine!

Getting down to specifics, the engines are connected in tandem by specially designed sprockets and double roller chain, with the right bank driving the rear wheels and the left engines providing power to the front wheels.

Each engine has been given the "full house" treatment, with C-T Automotive chromed and stroked crankshafts,

Earlier, Ivo had tried to content himself with only two Buick engines bolted together.

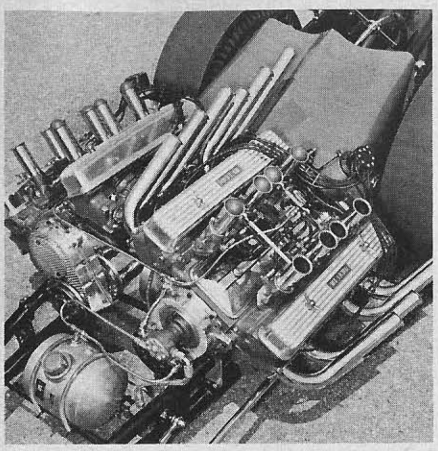




Ivo engines are bored and stroked to 454 cu. in. each for huge total of 1,816 cu. in.

Iskenderian cams with kits, Jahns pistons and Grant piston rings. Stock '56 rods were used but the engines are fed by Hilborn injectors and are fired by modified Vertex magnetos by Joe Hunt. Weiand front engine covers also are used as were Gotha rocker arms and adjustable pushrods.

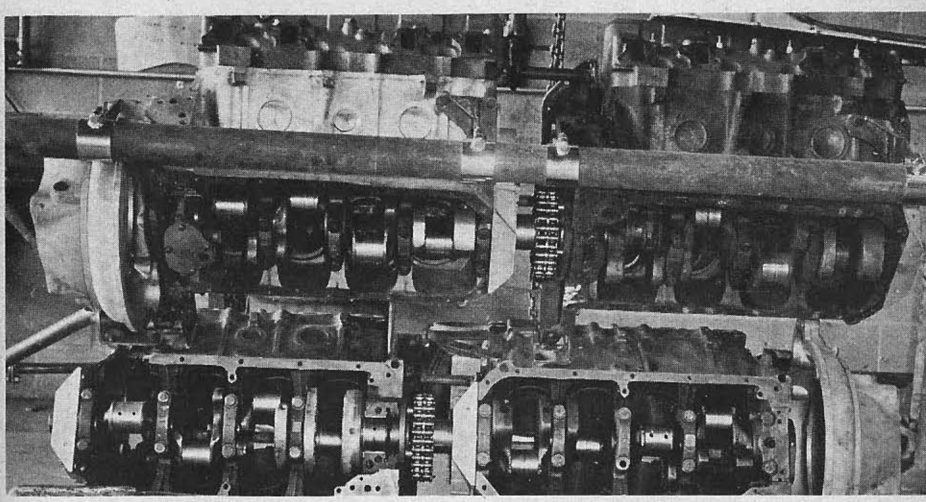
The front drive works through a Halibrand Championship-type rear end which is connected to a double disc Schiefer flywheel/pressure plate assembly. Front wheels were fabricated from Buick rims and sheet metal discs,

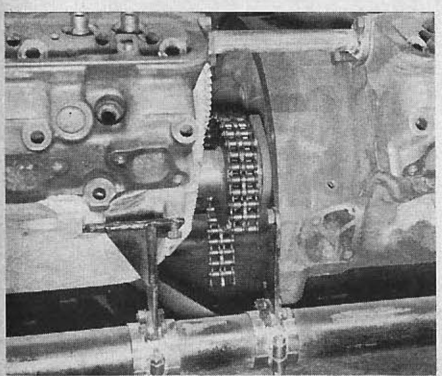


In twin-engined dragster, flywheels were geared together. Single clutch, in back of one engine, transmitted power to rear.

Four-engined car (below) has each pair of engines chained in tandem. Left-hand set drives front, right-hand pair drives rear.

Close-up (bottom) shows details of double roller chain and how it fits big sprocket on each engine to keep them both in sync.

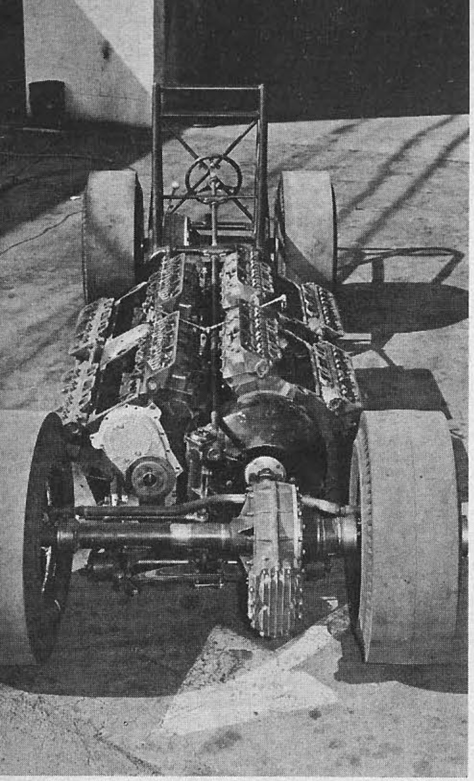




and steering is from a '53 Mercury.

Rear drive works through a Ford truck rear end which is connected to the right bank of engines by a Cragar adaptor. Rear wheels are magnesium by Halibrand Engineering.

The frame was built by Kent Fuller of Los Angeles and consists of three-inch chrome moly tubing with a .156 wall. Bob Sorrell fashioned the body work and upholstery was completed by Tony Nancy. It is all fully stitched Scotch grain leather. The overall car is valued at $13,000.



Chassis for Ivo's "Showboat" was work of Kent Fuller. "Rear" end from Halibrand's catalog is used to gear front wheels. Car, seen on opposite page, has aluminum body by Bob Sorrell, upholstery by Tony Nancy. And, lest we forget, four Buick engines supplying total of 1720 hp.

In its many appearances at various strips throughout the nation, the big Showboat has hit speeds in excess of 170 mph with ET's in the low nine second bracket, not as good as the average AA/Dragster running the strips these days but exceptionally good considering the massive 3555 pounds being hauled down the quarter-mile. Turned loose on a long straightaway course with the proper gearing and there's no telling what the top speed would be.

Another confirmed Buick enthusiast, mentioned earlier, is Max Balchowsky whose Buick-powered "Old Yaller" sports cars have hung up a fantastic string of victories in sports car competition throughout California and other parts of the nation. Max's cars have taken on and beaten some of the best big bore sports cars from Europe.

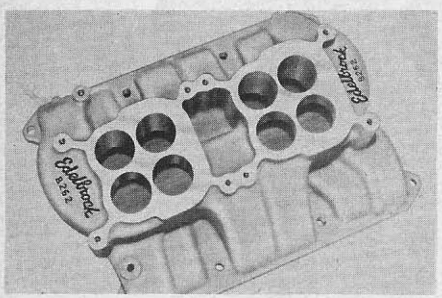
Max is quite a perfectionist at his work, and probably is one of the leading authorities on the Buick engine outside the factory. As a matter of fact, he probably could teach factory engineers some interesting secrets.

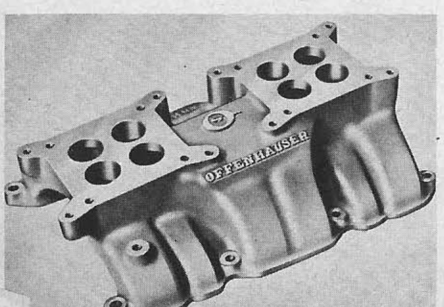
Most of his engines are built up from stock components, given the Balchowsky treatment that seems to work like a magic wand. He attributes his partiality to Buicks to a long and successful experience with these engines, starting with the straight eights of years gone by.

"Buick engineers have been working with eight-cylinder engines for a long time," he told us. "And they were responsible for perfecting the overhead valve engine as we know it today. It stands to reason, then, that Buick engineering is among the best."

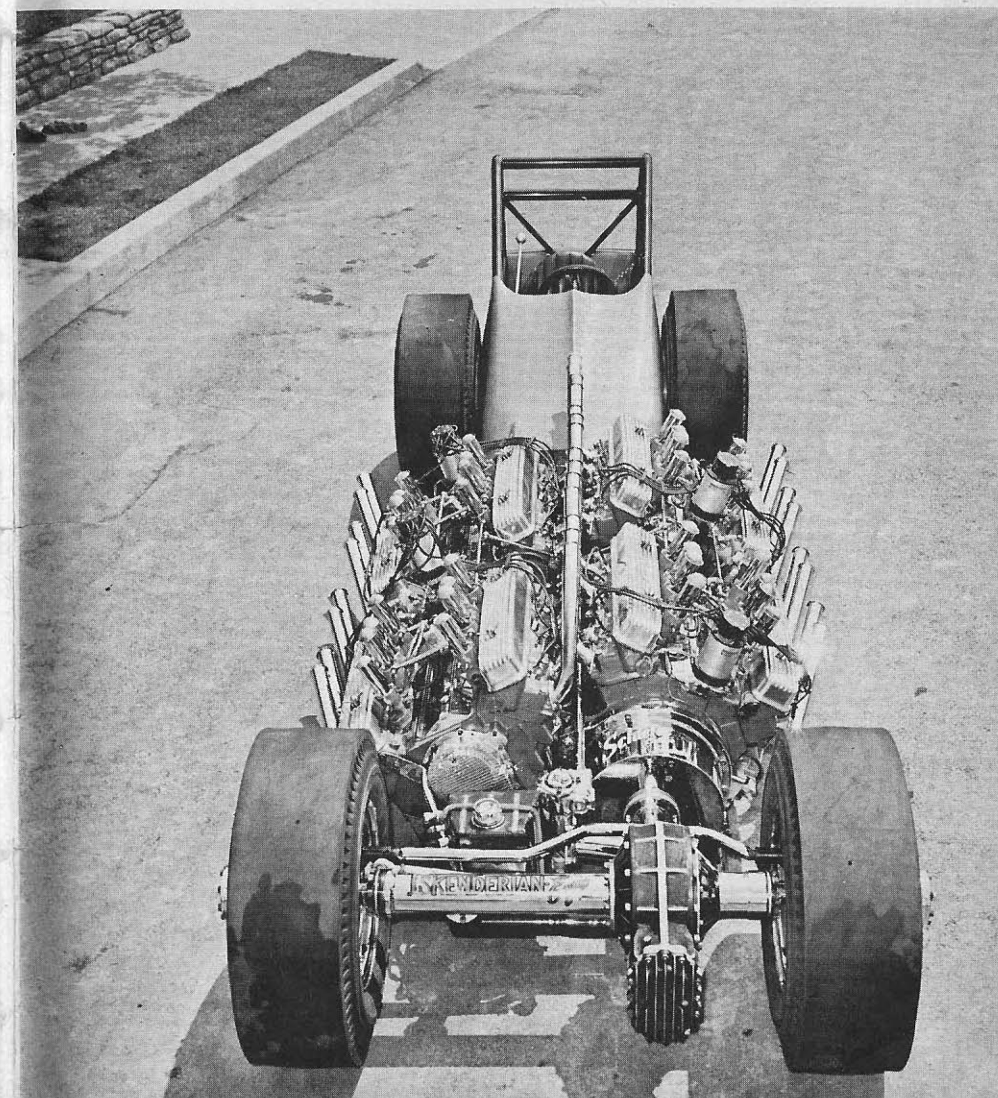
Actually, many of the tuning modification procedures described in the preceding chapter go into Balchowsky's engines along with some of his own refinements. The crankshafts, for example, are grooved back about 20 degrees for more efficient lubrication and main bearings from '56 or earlier are used since they, too, are grooved.

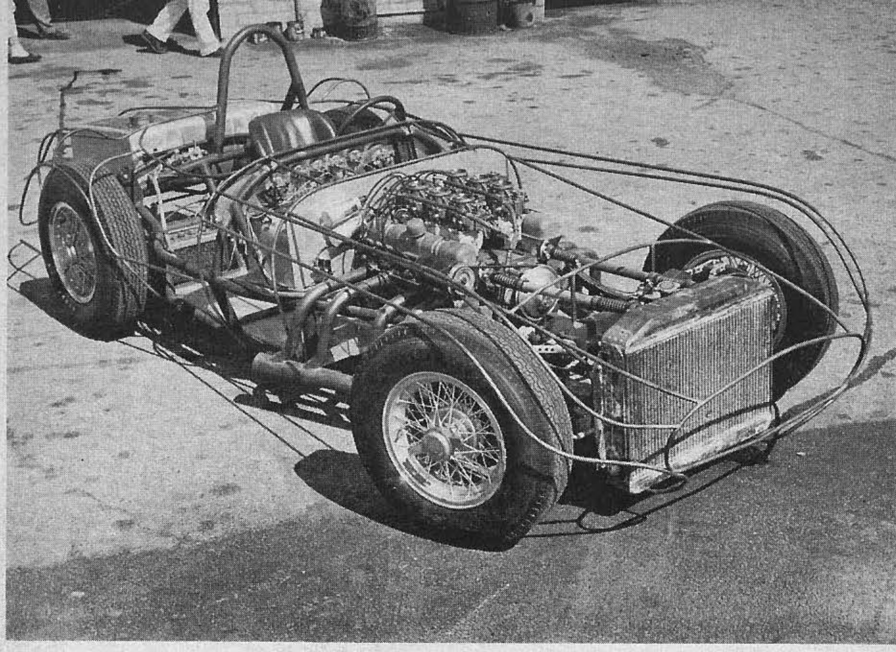
He also copper plates the main caps and bolts with a 3/10-inch coating and gives them more clearance. The copper plating is especially helpful in road racing competition where the mains and oil temperatures are subjected to more heat. Rather than disassembling the entire lower end to check for bearing wear and overheating, it is necessary only to drop the pan and look at





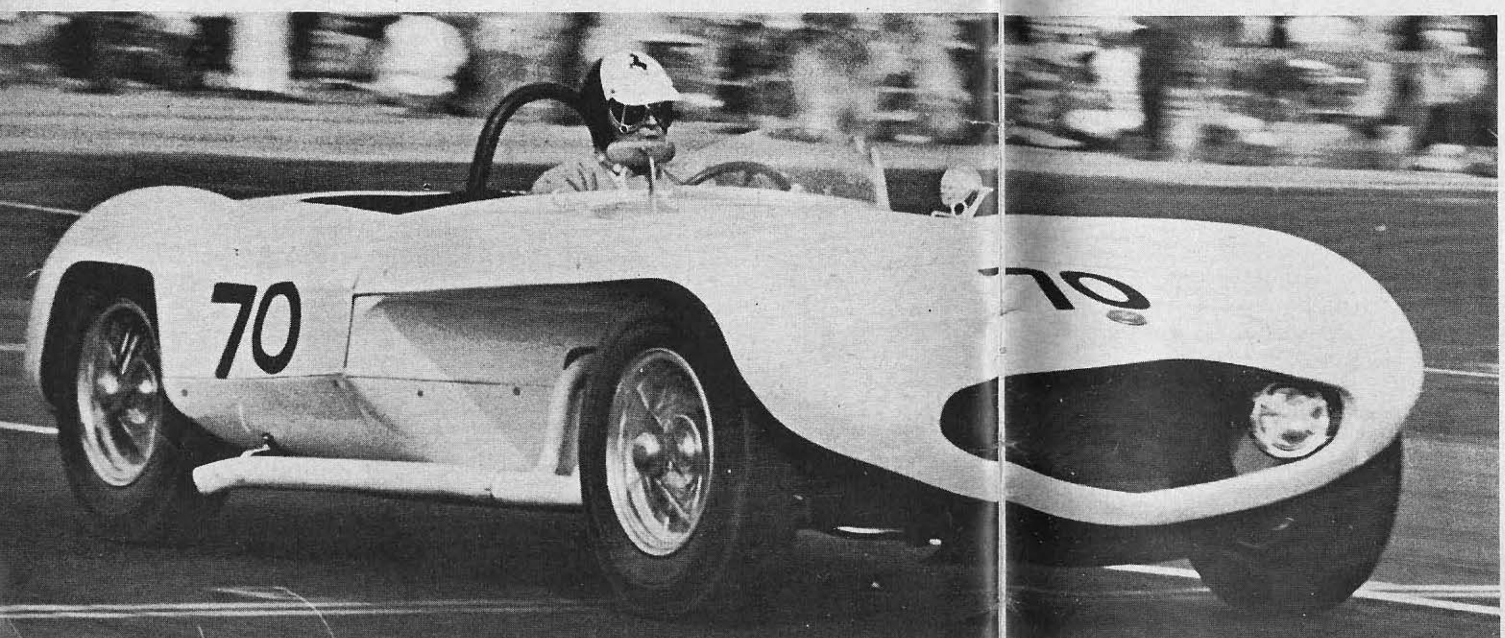
Dual four-barrel manifolds for Buick 401 are available from Edelbrock (above) for $92.50; Offenhauser (below) for $89.50.



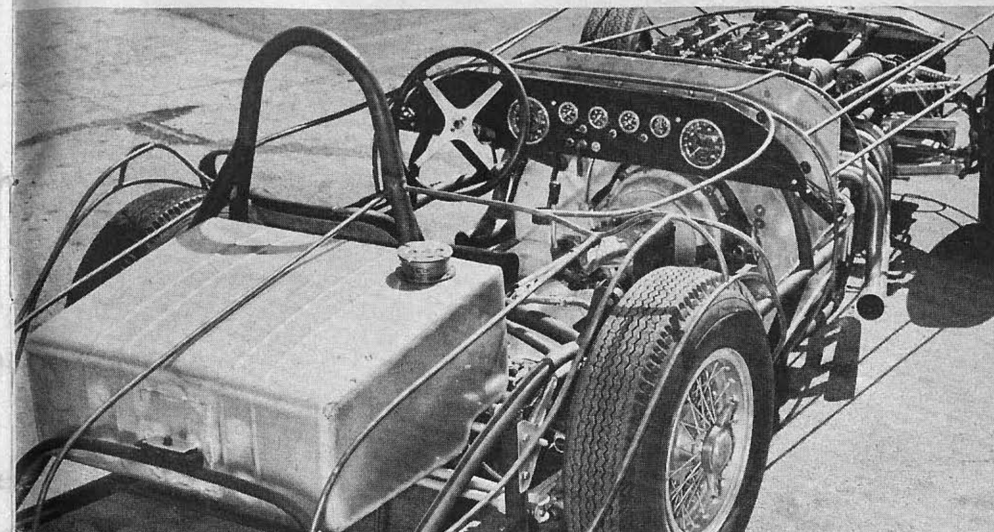


Max Balchowsky has used Buick V8's since '53. Shown is structure of his latest car.

Third car in Balchowsky's "Old Yaller" series is seen here in action at Pomona, Calif.



"Old Yaller" Mark II was driven by such top aces as Dan Gurney, Carroll Shelby, Bob Drake. Below is chassis of Mark IV.

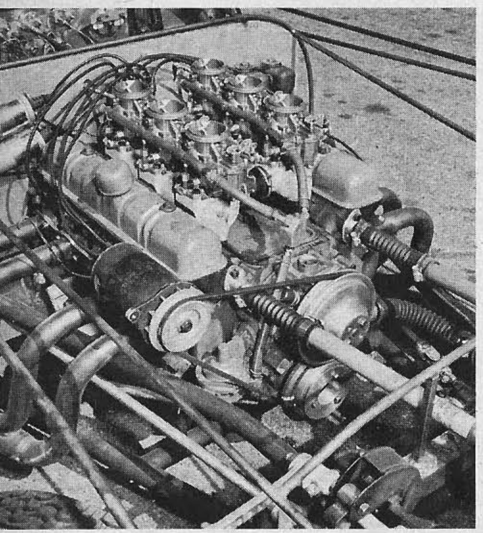


the copper color coating. A deep purple color indicates too much heat and usually calls for a more thorough examination. This way you save time and the trouble of stretching the cap bolts since it isn't necessary to take them apart as often.

Oil pressure usually is kept at 40 pounds which is normal even for a completely stock engine. The oil pick-up in the pan is changed, however, so that it reaches lower, and because of sloshing which results from taking left and right-hand turns at high speed during a road race, the pan itself is baffled.

Most of Balchowsky's modification work is done in the cylinder heads and combustion chamber and with carburetion. Heads usually are milled .040 and excess material is removed from around the intake valves. Stock valves are retained but are lightened considerably and are run with 185 pounds of spring

First "Old Yaller" proved worth of Buick power by winning more trophies than any other one car ever entered in road races.



Buick engine in Balchowsky's Mark IV has 430 cu. in., develops 350 hp at 5800 rpm.

Consistent success has marked careers of all of Balchowsky's "Old Yaller" cars.

pressure.

Valve stems are chrome plated which improves lubrication and helps eliminate valve float at high rpm. Friction between the stems and valve guides is greatly reduced, and wear becomes practically non-existent. This is a fairly inexpensive operation, too, and one well worth considering by the owner who is going after all-out performance. The .0002 inch or so of hard chrome applied to the stems does not impair stem to guide clearance.

Valve lifters are solid, from the 1957 export kit, or from Iskenderian who also produces a very efficient hydraulic lifter. Rocker arms also are stock although the pushrods are specially made chrome moly manufactured by the Smith Brothers of Covina, Calif.

Surprisingly, Max does not run a great deal of compression on his engines, usually 11-to-1. He does, however, believe in a fairly radical camshaft, and turns his engines as high as 7200 rpm.

Until recently, his engines were usually equipped with a six carburetor manifold employing Stromberg 97 carbs rejetted for road racing purposes. As this is being written, however, Max is experimenting with a three two-barrel manifold which he plans to market. Made of aluminum, it weighs only ten pounds and has large passages that produce a ram effect and really improve performance. The manifold has been set up to accommodate three two-barrel Rochesters, making a fairly economical package for the amount of added horsepower it gives.

Designed with or without heat, the new manifold probably will sell for $90, which is about par for some of the dual four-barrel setups that are available. Considerable savings can be made in the carburetor, however, since the two-barrel Rochesters list for about $29 apiece while Stomberg 97's, which also will fit, go for about $32.50. The four-barrel AFB sells for around $80. ■