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.

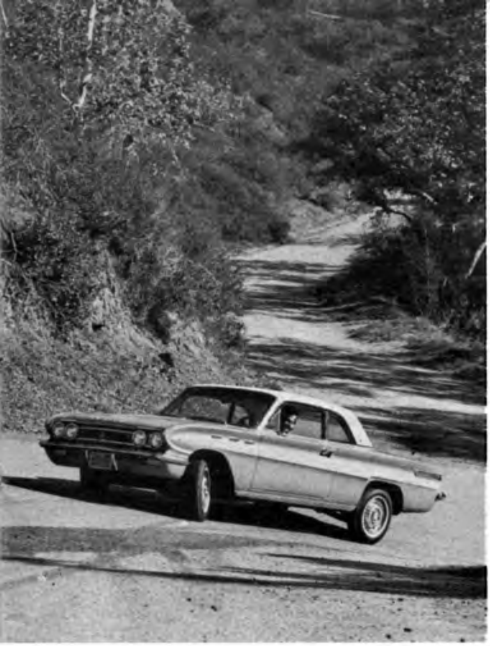
Basically, the Buick and Olds V8's are the same. That is, they are produced by the same casting methods, utilize the same block, crankshaft, rods, oil pumps and other components below the cylinder heads, sport the same 3.50 x 2.80 bore and stroke, the same 215-cubic-inch displacement and allow interchanging 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.

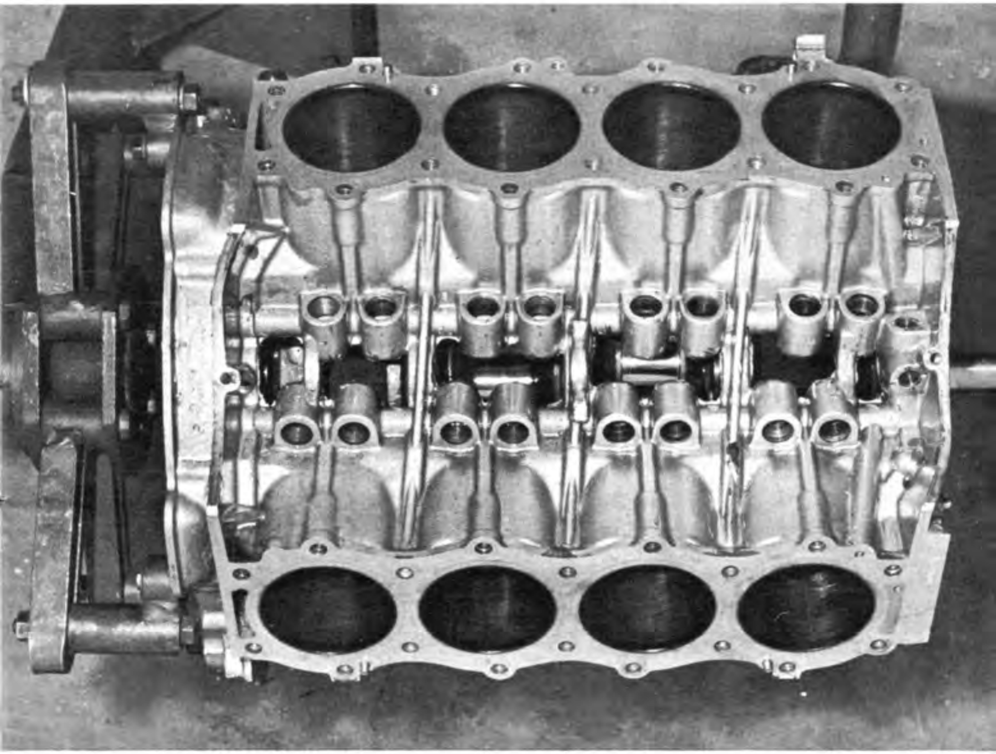
The all-aluminum V8 was produced after a great deal of engineering study and research into comparatively inexpensive casting methods and design. Needless to say, there were many problems both before and after production began, just as there always is with an entirely new engine built from scratch. Some 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.



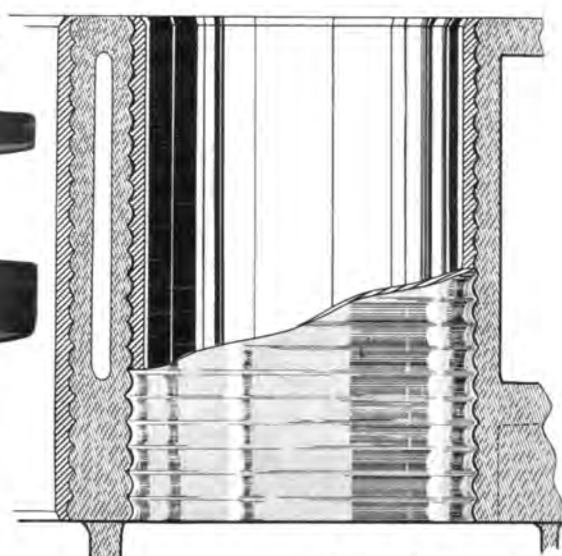
aluminum is softer than cast iron, it became necessary to provide cylinder walls with a surface that would withstand constant scrubbing and wear of the pistons.

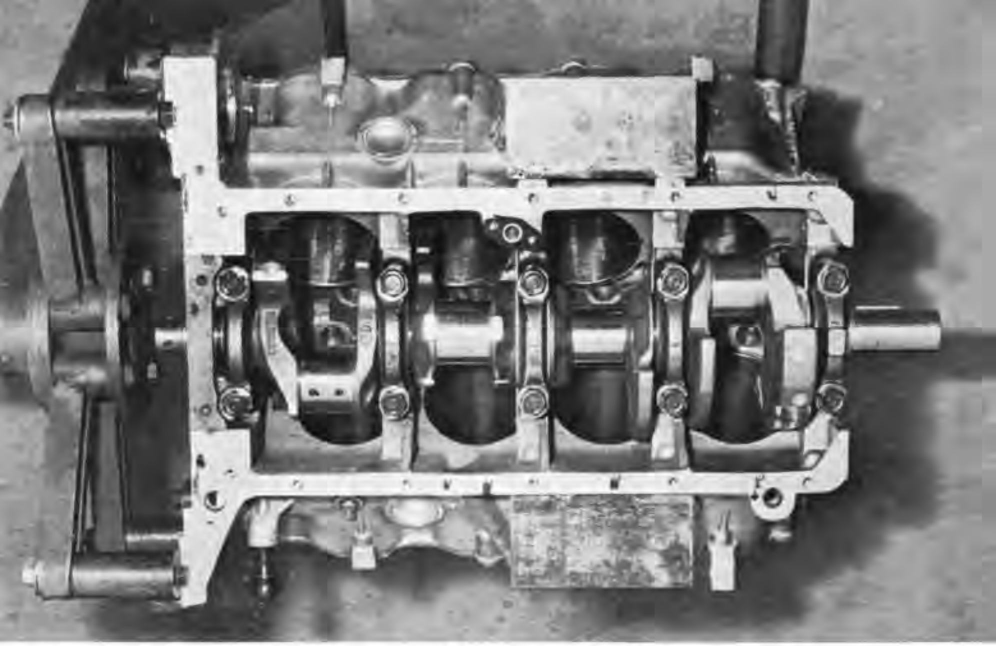
To solve this, cast-iron sleeves were used, but rather than just pressing them into the block, a method was devised whereby the sleeves are actually cast in the molds where molten aluminum is poured around them. To further insure that the sleeves would be locked in, they were made with outside grooves 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.





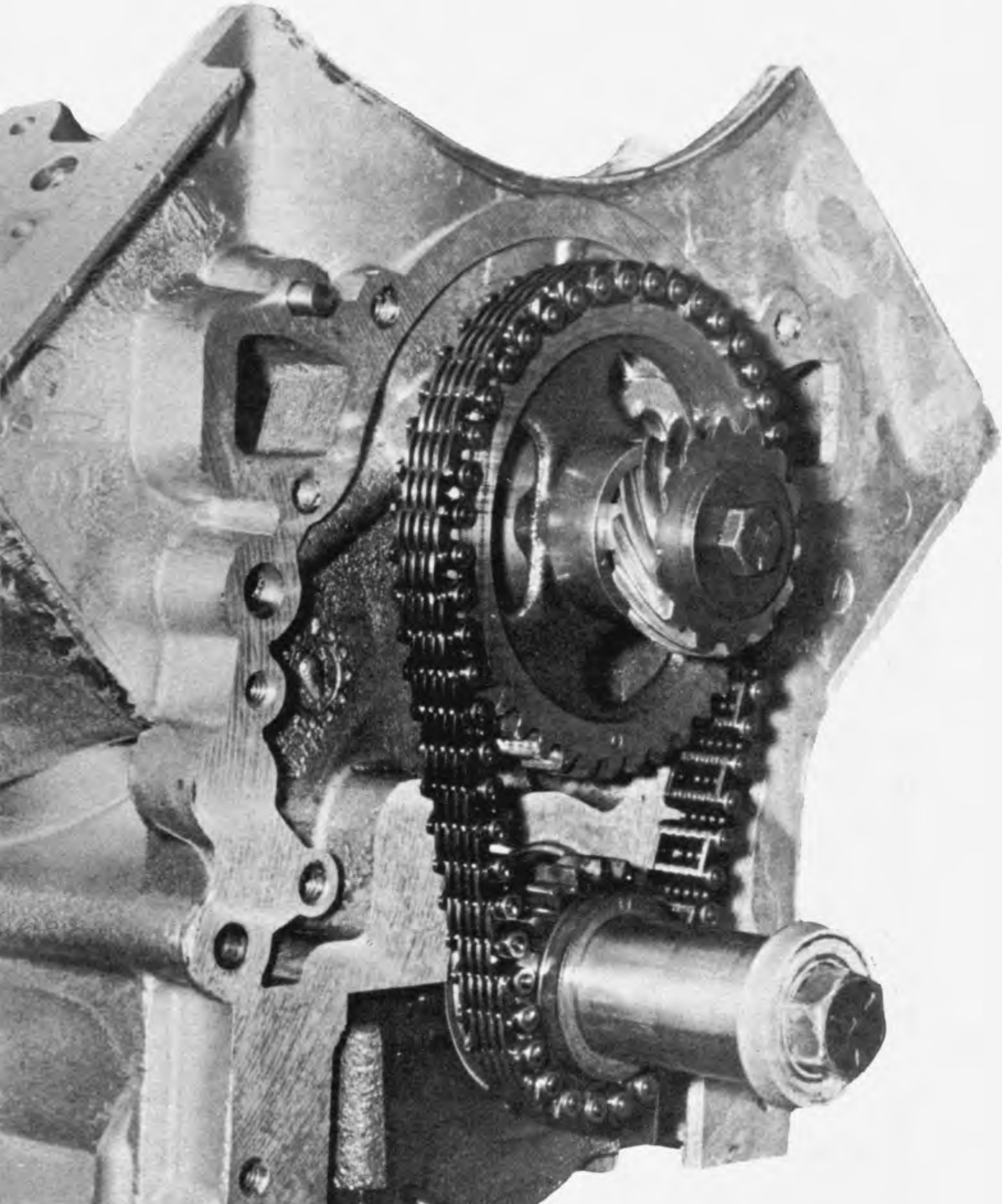
Despite lightweight block, bottom end is rugged enough for strong increase in power.

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.

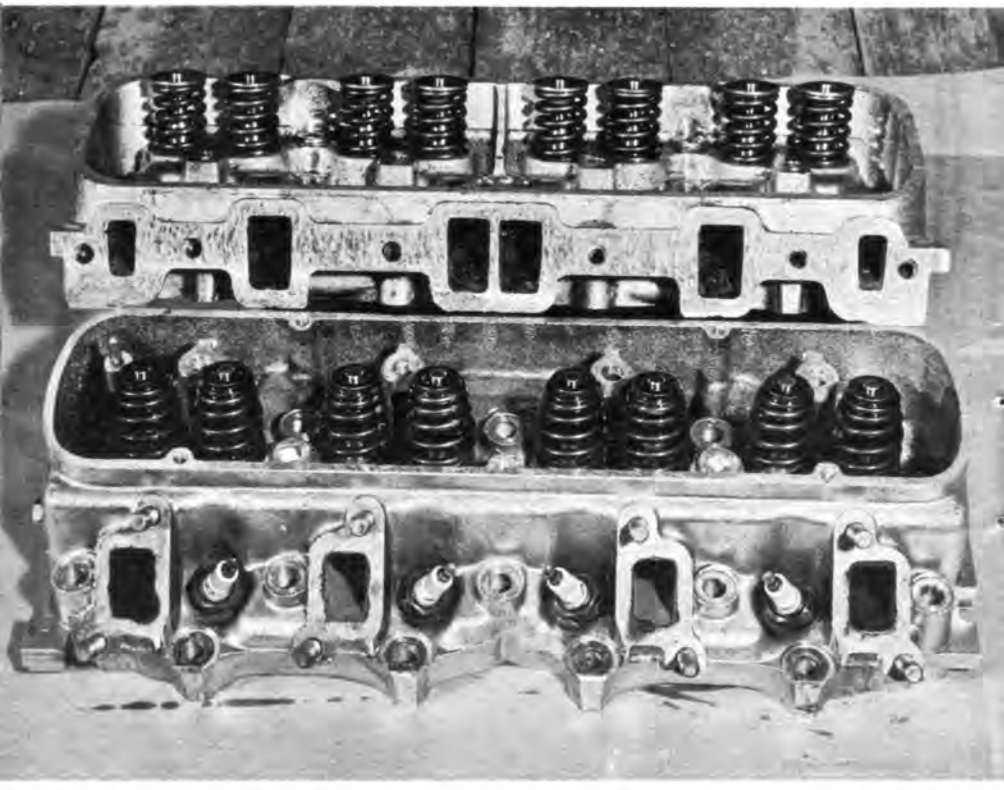
haust ports so that the manifolds are interchangeable. There is a slight difference in the exhaust ports themselves, however, with Buick retaining a smaller, somewhat restricted port beneath the valve and flaring out as it approaches the exhaust manifold.

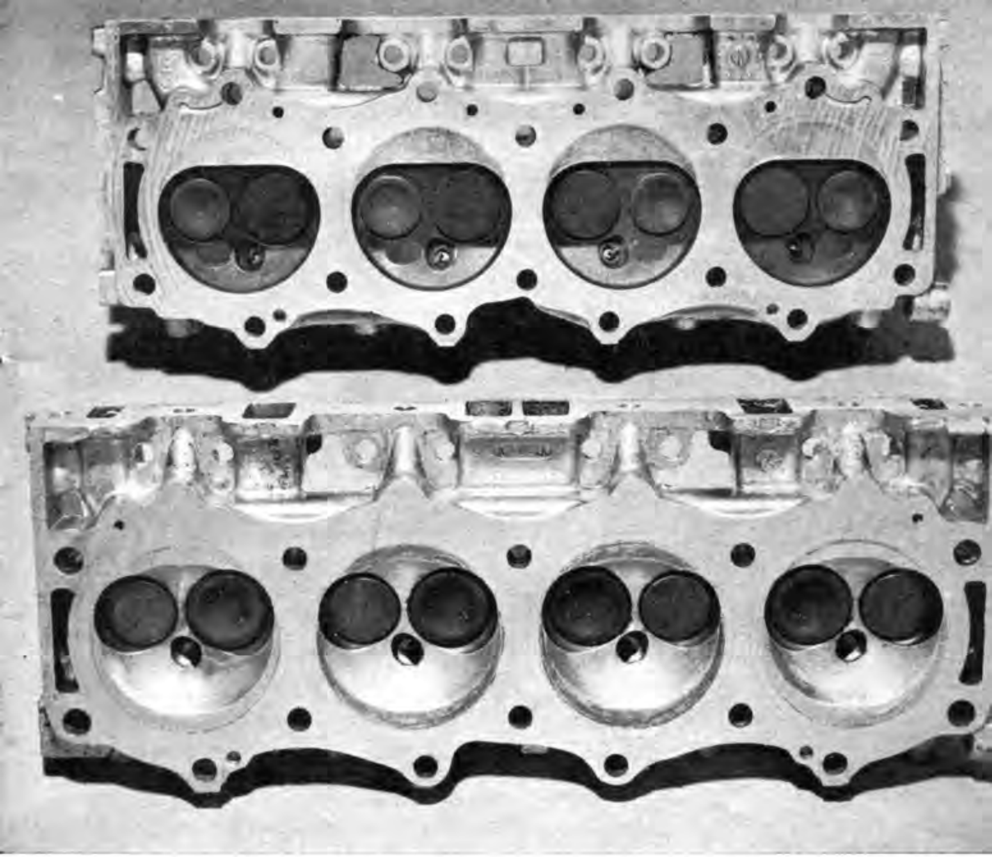
With so many of these components interchangeable, considerable performance increase can be accomplished with a bit of careful planning, such as swapping the dish-type Buick pistons for the Oldsmobile's flat-top design which will raise compression ratio considerably. We'll go into more detail on this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



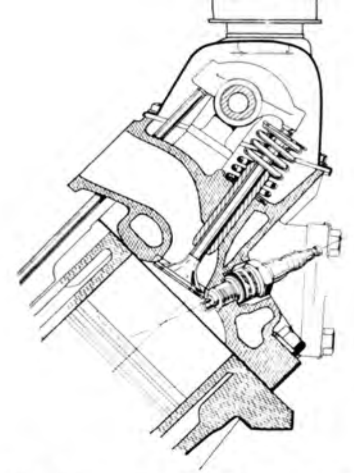


Special, top, has characteristic Buick combustion chambers, F-85 has normal wedge.

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.

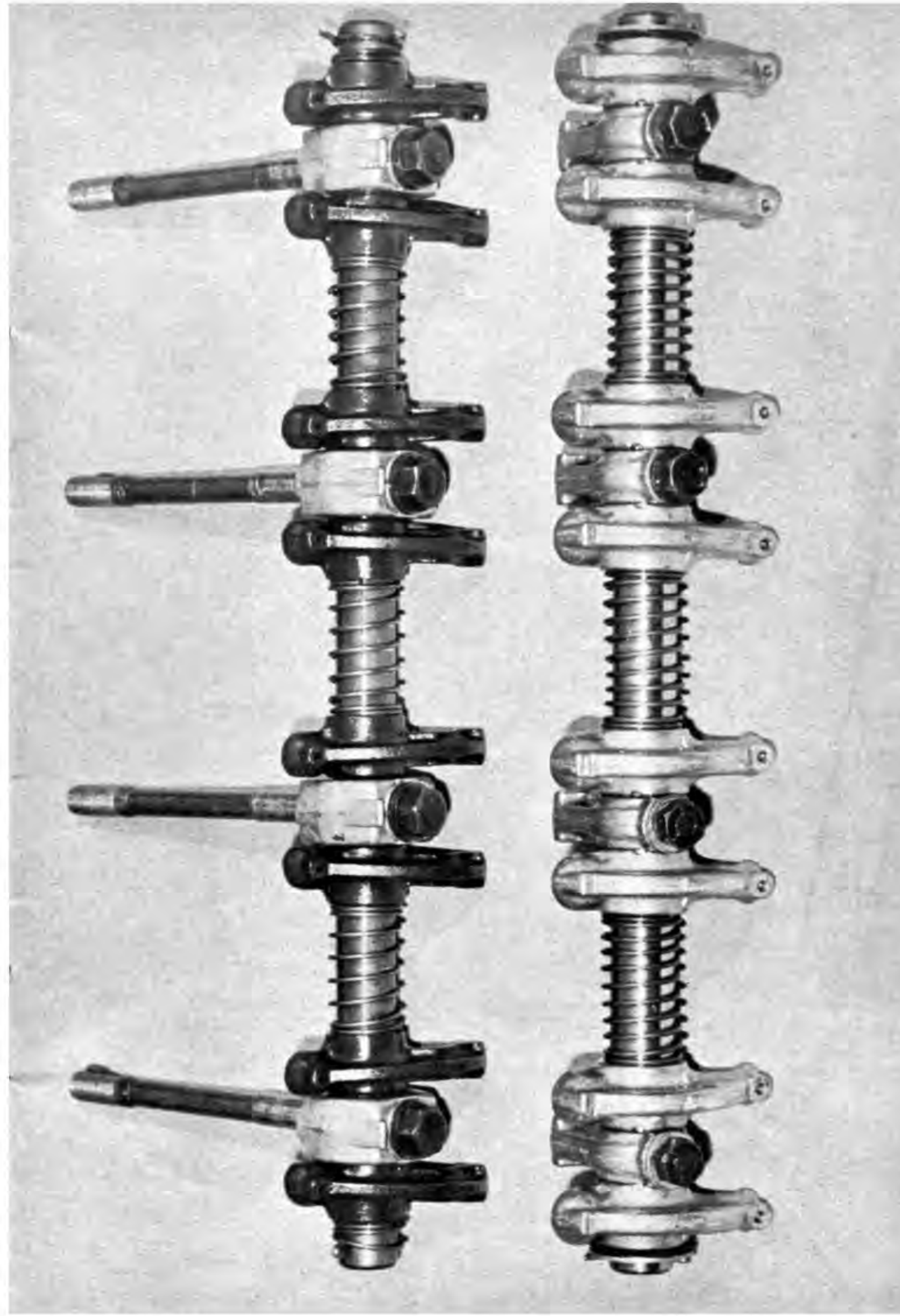
We've already pointed out that the Buick and Olds manifolds are interchangeable, though not identical. Carburetion, however, is the same, with both engines employing Rochesters. The two-barrel is standard, of course, and the four-barrel carb is offered with the DeLuxe Buick Special and is standard on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

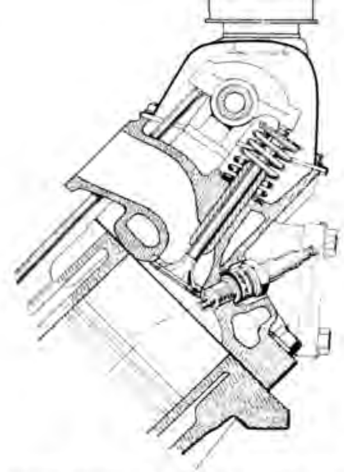
A Delco-Remy coil and distributor ignition system is used with the engine while recommended spark plugs are AC 45FFS for the 155 hp engine and 44 FFS for the Skylark. The distributor starts its initial advance at 450 rpm, reaching its maximum of 28 degrees at 3700 rpm. Initial timing is set at 7.5 degrees 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. ■





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