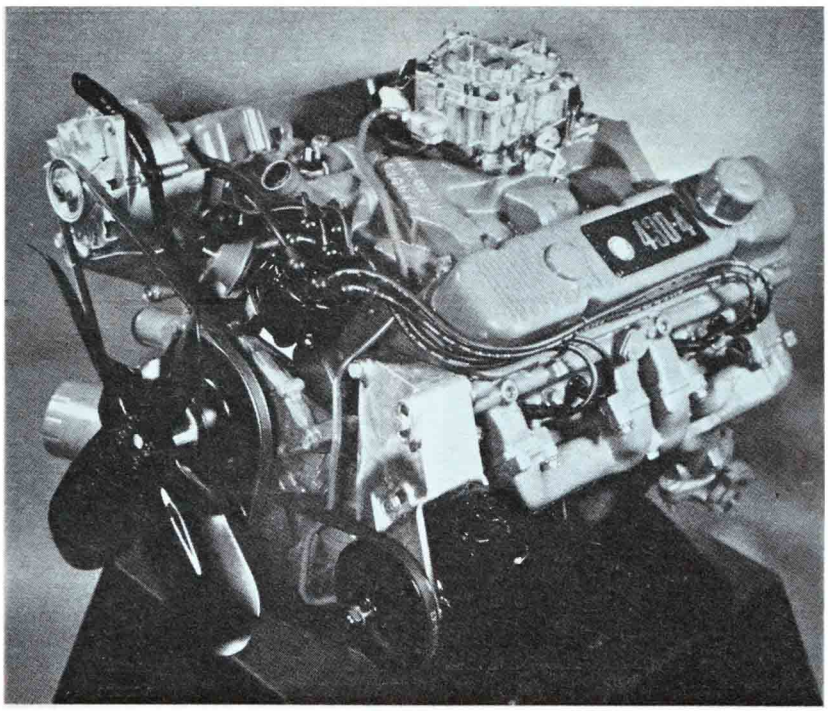
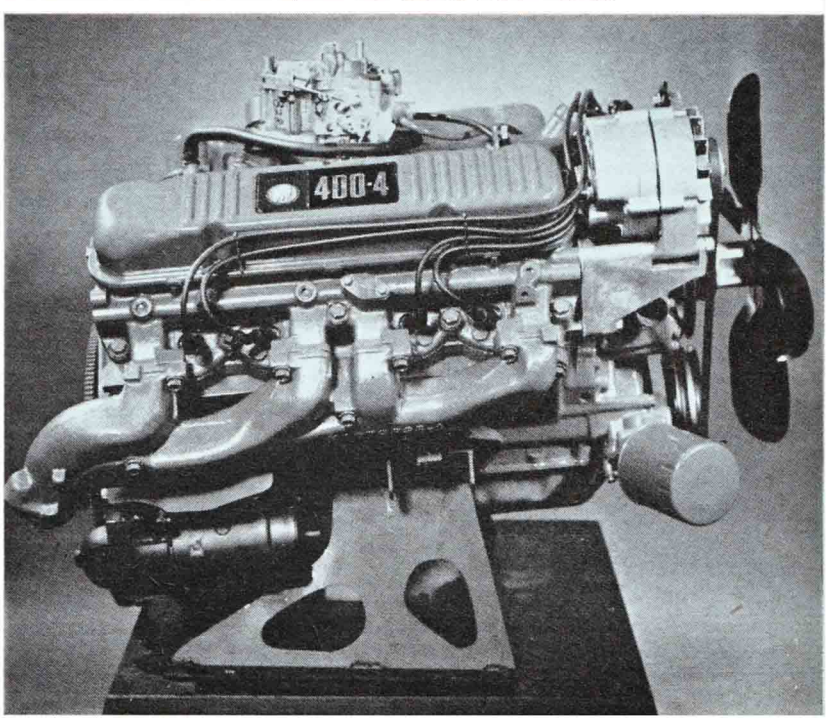


RATED AT 360 bhp at 5000 rpm, Buick's 430-cu. in. version of the new V-8 replaces the earlier 425 engine in Wildcat, Electra and Riviera lines.

BUICK'S NEW V-8

SMALLER DISPLACEMENT version, 400 cu. in., rated at 340 bhp at 5000 rpm, will be offered in Buick's 1967 Special Gran Sport production series.



Goodbye Pentroof, Hello Semi-Wedge

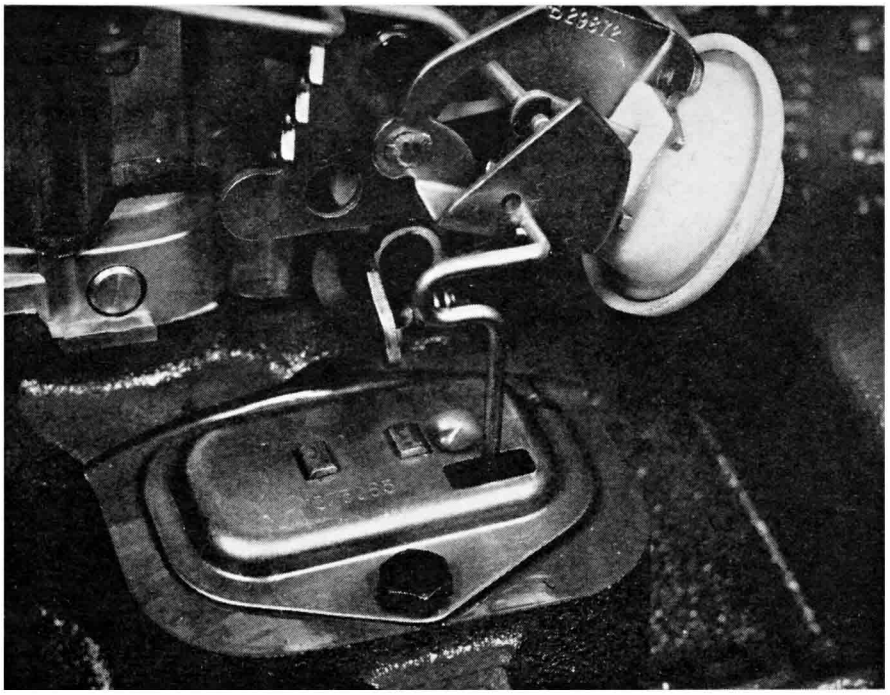
BY ROGER HUNTINGTON

IN A DAY when many auto industry observers are predicting that General Motors divisions will standardize on fewer basic engine designs, Buick brings forth a new V-8, built with nearly 100% new tooling, representing an investment of over $50 million! This isn't just an up-dating of an old design, to utilize old tools, as some of the other industry divisions have done recently. This is a really new engine. Very few parts are interchangeable from the earlier Buick V-8. The only basic dimension that is retained is the bore center span of 4.75 in. This was done because Buick engineers believed this is all that will be needed in the next 8-10 years. Bore staggering is reversed, so the old machines couldn't be used.

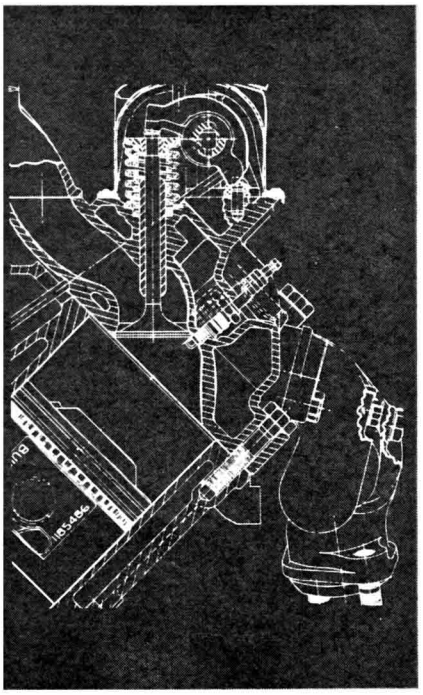
This new Buick design has not been compromised in any way to utilize existing parts or tooling.

In a way this is an unexpected development, in view of all the recent talk about more component standardization in GM divisions. Buick's head engine man, Cliff Studaker, explained the new look this way: "GM's strength lies in the autonomy of the divisions and the individuality of their products. This extends to engines and transmissions, as well as bodies. There are people in the front office who would like to see more standardization—and others who think we've gone far enough. We here at Buick felt we needed a new big V-8. The old design dated basically from 1953 and we had developed it about as far as we could. It took some selling—but we finally got the front office okay."

THE NEW Buick V-8 is available in two versions. One is of 400-cu. in. displacement, rated at 340 bhp at 5000 rpm for the Special Gran Sport series, and the other is of 430-cu. in. displacement, rated at 360 bhp at 5000 rpm for Wildcat, Electra and Riviera lines. The elder 401- and 425-cu. in. V-8s have been phased out completely, replaced by the new engine. The small 340-cu. in. V-8 will continue as basic power for the full-sized LeSabre series and as an optional engine in the compact Specials. The new 400- and 430-cu. in. engines are virtually identical, except for the bore size, pistons, rings, etc. Both have a stroke of 3.9 in.; bore diameters are 4.04 and 4.1875 in. respectively. Both have compression ratios of 10.25:1, and use the Rochester Quadrajet carbure- ▶



THE AUTOMATIC choke thermostat is located in the manifold casting and operates the choke through linkage to hasten shutoff after cold starts.



EARLIER 401 and 405 V-8s were of pentroof chamber design.

V-8

tor, with a massive 9.4 sq. in. of venturi area, but with the tiny primary venturis to provide good cruising fuel economy and throttle response. Both engines use the same camshaft, which has a duration of 298°-315°, an overlap of 61° and valve lift of 0.421 in. intake and 0.45 exhaust. This is in line with Buick's past policy of warming up the exhaust timing more than the intake, to retain a smooth idle with good top-end performance.

There are many significant differences between the new Buick V-8 and the old one. The first apparent difference is in combustion chamber design. The early engine was famous for the unique pentroof combustion chamber, with vertical valves on one side of the roof, operated by reversed rocker arms from pushrods that passed up through the heads very close to the bores—and with high-dome pistons to provide the desired compression volume and quench areas. The new engine uses a domed, "semi-wedge" chamber, with conventional rocker arm and pushrod placement, and a 15° angle between the valve and cylinder axes. It's very much like the small Buick V-8, which originally was tooled in 1960 as the 215-cu. in. aluminum engine.

Buick engineers seem to be going directly against the industry trend to the classic wedge chamber, with a large quench area opposite the spark plug. They have a good reason. The domed chamber with small quench area has considerably less surface area in relation to fuel mixture volume than the conventional wedge. This doesn't reduce the octane requirement; but the small surface offers less chilling for parts of the fuel charge. Hence there is less emission of unburned hydrocarbons; in other words, there is less contribution to formation of smog. The smog problem was a major factor in the decision to use this unusual domed combustion chamber. In fact, smog is having a very great influence on engine design all around Detroit these days. Industry engineers are afraid that over-enthusiastic lawmakers in Washington might legislate the piston engine out of existence. So, engine designers are trying to reduce smog emissions in every way possible, to lessen a rough future battle. Buick engineers believe this low-surface-to-volume chamber will aid the anti-smog cause.

THE SMOG problem has influenced the design of the new engine in other important areas. For example, the head castings are designed with air passages in place for the Thermactor afterburner system. This system will be mandatory on all cars in 1968. Coring the air passages into the head will save Buick a great deal of money at that time. The new intake manifold has its passages laid out in an "H" pattern, with the paired ports located toward the ends of the heads, instead of in the center as was the case previously. This provides ample room for large exhaust crossover passages to put heat under the carburetor for vaporization of fuel on cold starts. The choke thermostat now is buried in the manifold casting, operating through a linkage, rather than being located on the carburetor and fed from a hot-air tube. This allows the choke to shut off more quickly after a cold start. And, the choke won't reactivate itself after the car has been parked for 10 min. on a warm day. This will help hot starting and warm-up, as well as reducing unburned hydrocarbon emission.

The smog-busters have Detroit bustling—and the citizenry may receive better cars as a result.

To return to that combustion chamber and valve layout: Another reason for discarding the pentroof chamber with the vertical valves and reversed rockers was that port angles were not the best for today's super-breathing engines. Also, the pushrods coming up through the head castings severely limited the available space for large ports. Finally, putting the valves on just one side of the pentroof limited the diameter there, too. In a nutshell, the pentroof chamber was great on octane requirement, but it just didn't offer the potential to meet today's breathing requirements.

Look at the figures. Both intake and exhaust valves are 0.125 in. larger in head diameter, 2 and 1.625 in. respectively. Intake port sectional area is 11% larger and exhaust ports are a whopping 80% larger in area. Overall breathing efficiency is considerably

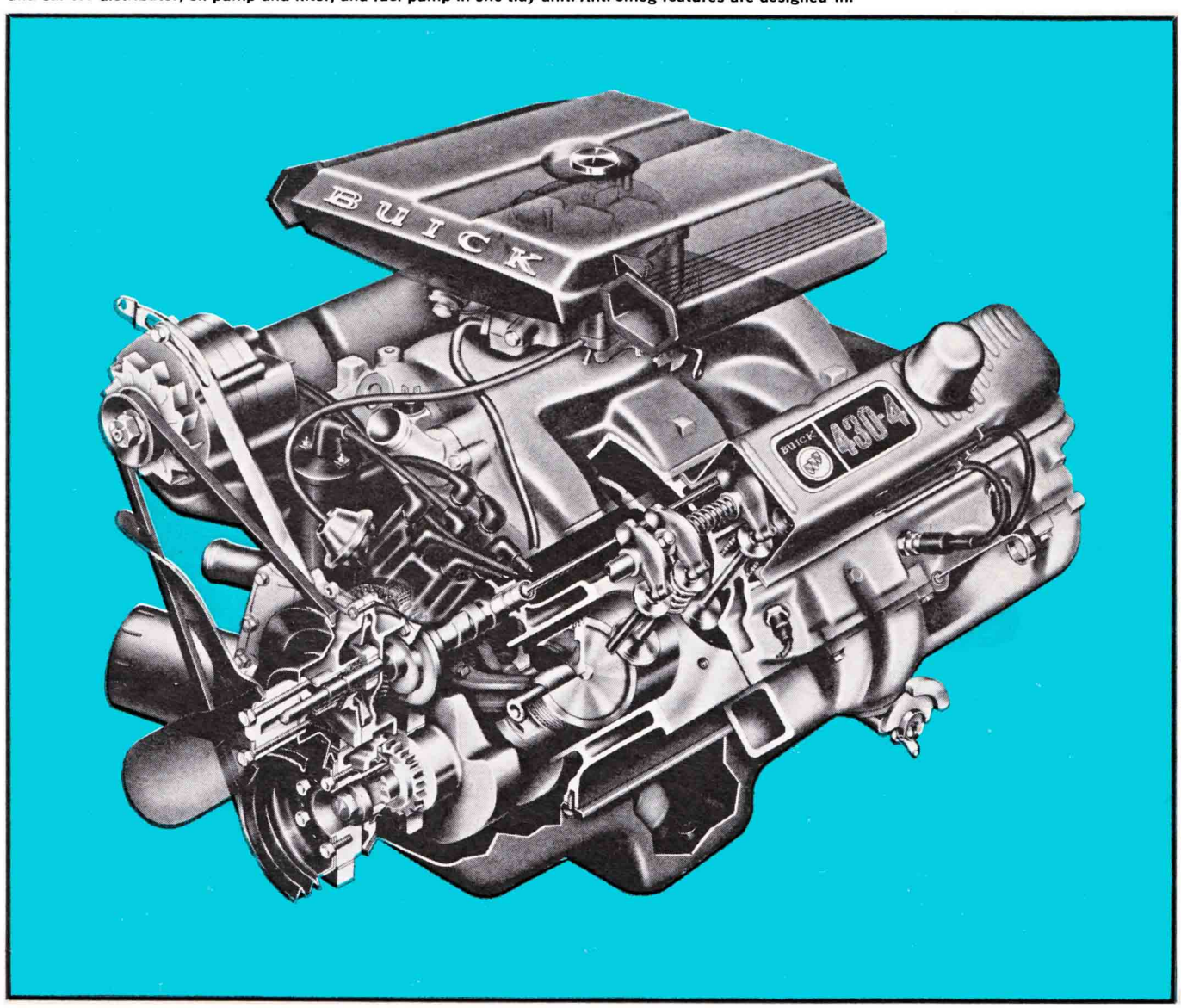
better. This allows a marked improvement in top-end horsepower while still using relatively mild valve timing that retains a good mid-range and bottom end. The small primary venturis on the Quadrajet carburetor contribute a great deal here. This port-cam-carburetion compromise for high and low end performance is always one of the toughest that faces any engine designer. Buick engineers have done an excellent job with this engine.

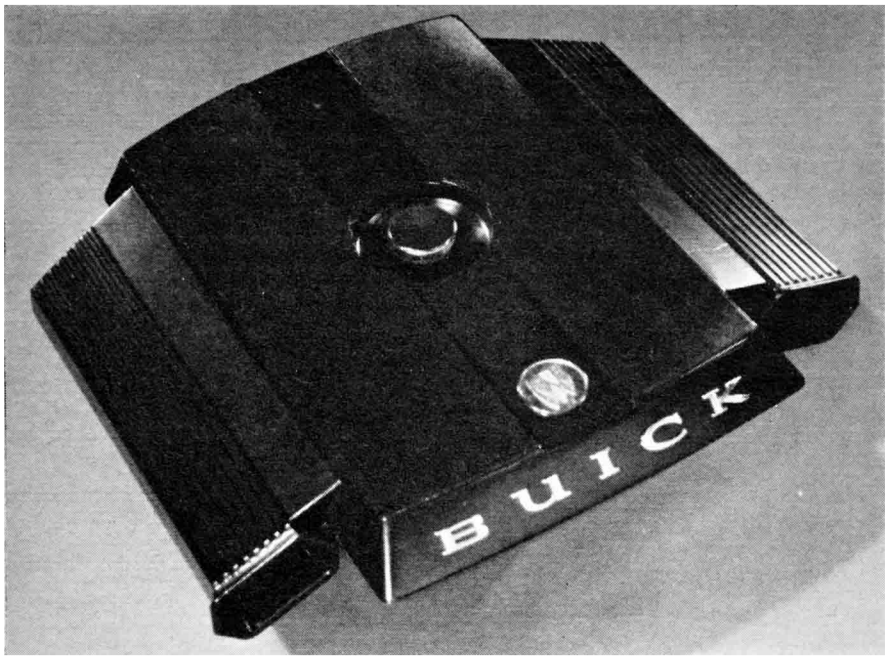
Nothing radically new is apparent in the valve gear. Buick has retained solid pushrods and die-cast aluminum rocker arms on rocker shafts in the face of the industry trend to stamped ball or spherical-joint rockers on pivot studs. Buick engineers did a lot of soul-searching on this aspect and at length decided that available production facilities favor conventional rockers. Cost is still fairly low and valve gear lubrication can be better controlled by bringing the oil through the rocker shaft, rather than up a hollow pushrod. One forward step was to cast the rocker shaft brackets integral with the head castings. Two-piece Perfect Circle valve stem seals are used to prevent oil loss down the stems. This is a refinement that wouldn't have been considered on volume-produced engines a few years ago.

THE MAJOR feature of the lower end is the cast nodular iron crankshaft and the huge (3.25-in.) main bearing journals, 0.75 in. larger than the previous engine's. The cast crank was chosen primarily to save money, because it's just as strong and reliable in passenger car service as is nodular iron, which is more flexible than forged steel. A cast-iron crank could lead to torsional vibration problems if it weren't made very stiff and strong. This is the main reason for the huge main bearing journals, which offer a great amount of "overlap" between the main and rod journals, and make the shaft very resistant to torsional stresses. Increasing the main bearing size is more practical than increasing the size of the rod journals. The latter increase complicates crank balancing, adds weight and creates space problems. Larger mains simply take mass from the crankcase webs and add it to the crankshaft. Hence there is relatively little weight added and no space or balancing problems arise. The only limitation would be excessive bearing rubbing speeds, which eventually could start lubrication problems. Buick engineers think the 3.25-in. main journal diameter is of sufficient size. Buick can enlarge displacement considerably and still provide adequate bearing area.

The new engine has many other special features. For example, the exhaust manifolds are highly refined. Internal passage dividers prevent overlapping exhaust pulses from adjacent cylinders from blocking each other. Incidentally, Buick engineers were the first to carry on extensive refinement of exhaust manifolds, starting with ▶

ACCESSORIES ARE located forward for accessibility. A die-cast aluminum assembly combines water pump with timing chain cover, and carries distributor, oil pump and filter, and fuel pump in one tidy unit. Anti-smog features are designed in.





A SINGULAR air cleaner of rectangular shape covers a Rochester Quadrajet carburetor on 400- and 430-cu. in. V-8s from Buick Division.

V-8

the double-Y manifolds of 1956. The new intake manifold casting also is the cam chamber cover, as on many other modern engines. An internal baffle sheet in the chamber prevents oil from splashing up on the hot underside of the manifold and coking. The usual long oil gallery under the camshaft has been eliminated to provide more space for the crankshaft. The oil feed to the mains and right lifter gallery now goes down the side of the block.

The new design follows the industry trend toward locating all accessories at the front of the engine for better accessibility. A neat die-cast aluminum front assembly combines the water pump with the timing chain cover, and carries the distributor, oil pump, oil filter and fuel pump in one compact assembly. The drives are from the forward ends of the crank and camshaft. The new cavitation-resistant water pump uses a single inlet and backward-curved impeller vanes.

Buick engineers are very serious about fulfilling their claim for the "tuned automobile." They have added considerable strength in main bearing bulkheads simply to make the engine smoother. Their new brackets for mounting the alternator, air conditioning compressor and power steering pump are made of die-cast aluminum, instead of simple steel stampings. These are more rigid and offer more inherent internal damping.

THE BUICK people have added one touch that's really advanced. They put two engine mount pads on the cylinder block, one 2 in. ahead of the other. It was determined that the small Gran Sport rode better and more quietly with the engine pivoted farther rearward than is the case with the larger cars! In effect, Buick uses the engine as an oscillating mass to damp body vibrations and shake. This is not really new, but Buick has gone the second mile by arranging to juggle the axis of oscillation to meet the requirements of different body styles.

Weight and size of the new Buick V-8 are very comparable with the previous engine. Buick engineers didn't intend this to be a true "thinwall" engine, because they think there's little to be gained by use of less than 0.187-in. basic casting wall thickness. Foundry complications are balanced against savings on machining. Buick has concentrated on reducing the number of casting cores—there are only three for each head casting; but there has been no attempt to make walls much thinner. Thus the new engine weighs within 8 lb. of the previous V-8. This is about 605 lb. with all accessories, plus the light flywheel (6 lb.) for the automatic transmission. The previous engine weighed a little over 610 lb. Basic external dimensions for the two engines are nearly equal. ■

CAMSHAFT, INTAKE manifold, heads and exhaust headers are interchangeable between the two engines. Bore and piston components differ. Buick Division invested approximately $50 million in new tooling to produce the 430-400 engine series.