MUCH MORE MUSCLE FOR 1966

BY ROGER HUNTINGTON

THERE'S ONLY one really *all-new* passenger car engine out of Detroit this fall. That's the new overhead-camshaft Tempest Six. It is not really a "high-performance" engine by today's standards, even in its power-pack version. Displacement, at 230 cu. in., isn't enough to earn the performance tag. However, there are plenty of refinements in other existing engines to hold performance enthusiasts' interest. The new ohc Pontiac engine may be a vital breakthrough which will greatly influence future big-inch performance engines. If the overhead cam performs well in this engine, it could set a pattern for undreamed-of revs in large, short-stroke V-8s in succeeding years.

OHC Pontiac Six

There has been much speculation as to *why* Pontiac has produced an overhead camshaft for an engine not designed for super performance and very high revs. Unless the designer utilizes the low valve gear reciprocating mass with an overhead cam to obtain a higher usable rev range, it would seem the expense is not justified. And yet other observers say an ohc engine is potentially cheaper because valve lifters, pushrods and rocker arms are eliminated. However, the Pontiac ohc Six employs finger-type cam followers and hydraulic plungers to maintain tension on the followers and eliminate valve noise. This isn't economy! Some saving must result, however, because pushrods are absent and finger-type cam followers are simpler than conventional rocker arms. But Pontiac's design doesn't realize the full potential cost saving with the ohc layout. The belt-operated cam, special distributor and oil pump drives cost more to produce than equivalent units for conventional pushrod engines. The new engine definitely is not a cost-saver. Whisperings are, however, that Pontiac saves $28 per engine as compared to the manufacturing cost of the Chevrolet pushrod Six for 1965. Incredible!

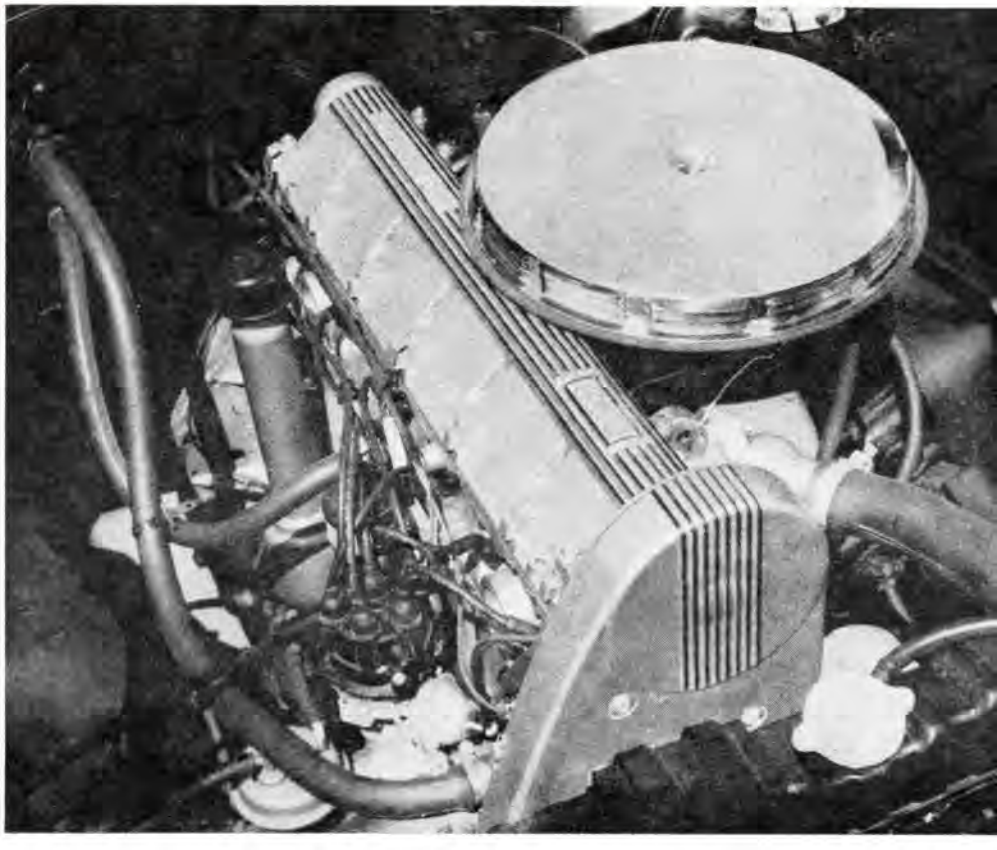
It appears Pontiac introduced the overhead cam as a shrewd engineering gimmick. Pontiac has made a lot of money in the past few years with youth-oriented performance and styling features. This ohc could be one of the smartest moves of all. The new 207-bhp power-pack ohc Six won't approach acceleration of the GTO; but many young people will buy '66 Tempests simply for the ohc engine. Image is the thing. Pontiac brass are past masters at interpreting and feeding this demand.

Just what can one expect in performance from this new 230-cu. in. ohc Six? Valve diameters are very large for a Six (1.92 intakes, 1.60 exhausts), and ports are wide. Breathing is excellent with the Quadrajet 4-barrel carburetor. Valve timing must be of shorter duration with a Six, as compared to a V-8, to achieve an acceptable idle. The high performance cam for the power pack has a duration of only 244°. This is a limiting factor, though not necessarily for the modifier who desires something extra from his engine.

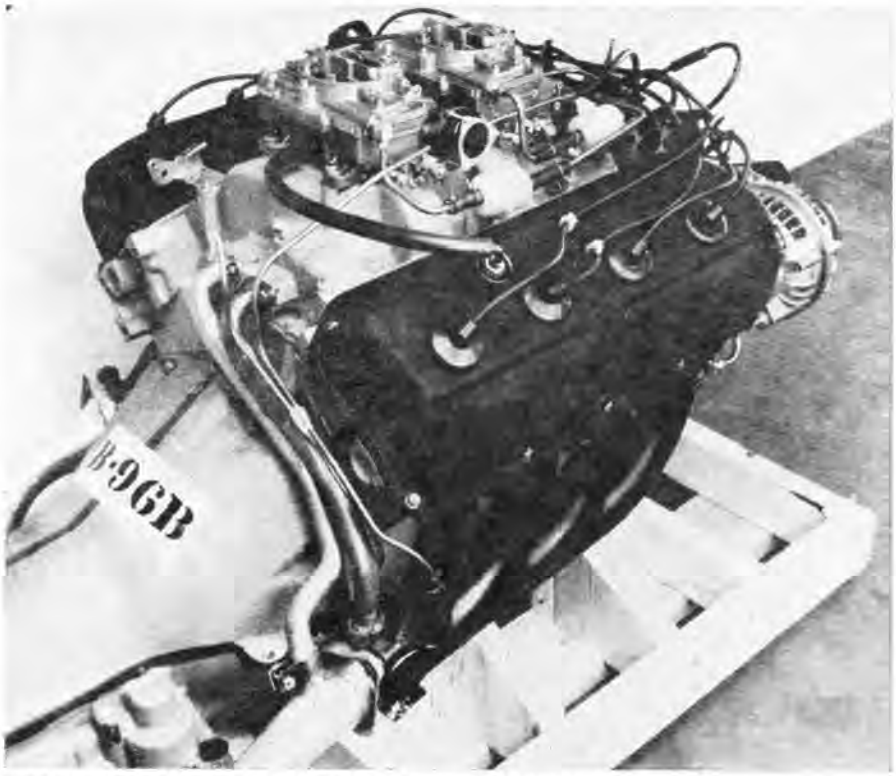
Just where the usable rev limit of the ohc Six will be remains to be seen. Much valve gear reciprocating weight has been eliminated. However, valve weight itself is a very great factor in valve float at high revs. This weight hasn't been reduced in the ohc Six. Valve mass must be multiplied by the square of the rocker arm ratio in calculating reciprocating inertia forces in a pushrod engine. Hydraulic plungers which maintain zero valve lash pump up when valves begin to float, as do hydraulic lifters, to produce another limiting factor. But the ohc Six should reach a high rpm bracket, perhaps 6000-6500 rpm in factory form and certainly 7500 rpm with the lash plungers locked out as the modifiers soon will learn. More than 9000 may be possible with lightweight valves and stronger valve springs.

A safe prediction is the new ohc Tempest Six will be quite successful ▶

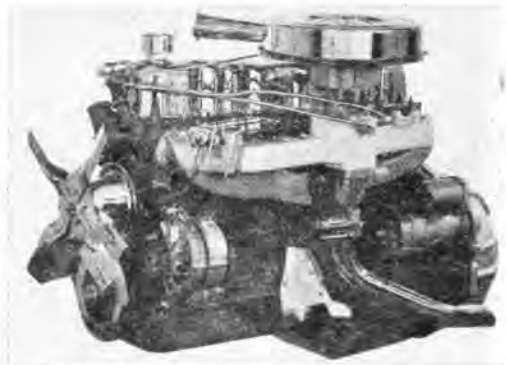
Hemi-Heads, Overhead Cams and Boring Bar Put Hot New Engines Under Several New Hoods



ONLY ENGINE which can claim all-new status is Pontiac Six fitted with overhead camshaft driven by belt.



STREET HEMI is detuned version of Chrysler Corporation's 426 racing engine available in Dodge Coronets and Plymouth Belvederes.



RAMBLER'S base engine is 199-cu. in. version of 7-main bearing Six.

CUTAWAY of Street Hemi shows chamber shape, new manifold.

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in stock car classes on dragstrips where cars are classed on advertised horsepower. Some tuners probably will produce astonishing performances in modified classes limited to the 4 and 6-cyl. engines.

A Hemi for the Street

For months rumors have circulated that Chrysler would convert its famous 426 hemi-head racing engine for street use. Now, the Street Hemi is here—optional in all '66 mid-size Dodges and Plymouths, except station wagons. The engine promises to be far and away the strongest street engine in the industry.

It was quite a challenge to tame this wild engine for reasonably practical street use, at least without subduing all its tremendous performance potential. The toughest problem was that the heads were designed for minimum weight and incorporated no cored-in exhaust crossover passages to feed an intake manifold hot-spot. A heated manifold is very essential for smooth, responsive street performance in all kinds of weather. The logical answer would have been to water-heat the manifold. But Chrysler engineers found it simpler and more convenient to pipe hot gases up from the right exhaust manifold outlet to a cored chamber in the manifold under the rear carburetor. There is a thermostatic valve in the exhaust outlet to control the amount of exhaust heating. Small pipes lead the gas up to the manifold and back. It was only necessary to heat the rear carburetor chamber because progressive throttle linkage lets the engine run 90% of the time on just the rear barrels of the rear carburetor. At wider throttle openings the front barrels of the rear carburetor open and, eventually, the front carburetor barrels open for reasonably smooth flexibility. But, without some heat to vaporize the fuel in cool, wet weather, it's an impossible situation.

Otherwise the street conversion is quite straightforward. Compression ratio was reduced from 12.5 to 10.25:1, to operate on premium gasoline. Forged pistons were slotted to allow closer clearances and less piston noise. Camshaft duration was cut from 312 to 276°. Solid lifters remain in use. Exhaust valves are Stellite-faced for longer life. The dual-4-barrel ram-type intake manifold used on the racing engines is replaced with a simple 180°-type in-line dual quad, cast in aluminum with rear exhaust heating as earlier described. This was a better compromise between large venturi area and a compact installation with a simple throttle linkage. The engine is said to be surprisingly responsive and smooth at the low end. Exhaust is scavenged through brand new streamlined cast-iron manifolds, specially designed to fit in all the various chassis with a minimum of flow restriction. Individual port passages are kept well separated to prevent flow interference from overlapping exhaust pulses.

This new Street Hemi, on paper, appears to be a lot of engine. Huge valves and ports and minimum of breathing restriction inside the combustion chamber, coupled with the free-breathing carburetion, should assure plenty of top end performance. The compression ratio of 10.25:1 is nearly as high as is practical considering available pump fuels. The camshaft is compromised toward the performance side. Exhaust manifolds, joined to dual outlet lines, provide a free waste gas passage. Times of 5.5 sec. for 0-60 mph seem probable. Is that enough for a 4000-lb. street machine?

Ford's New "428"

Ford has a new "4V-428" engine to augment the high-performance 427 option, to be available as optional equipment in all full-size Mercurys and Fords and to be standard in the new 7-Litre series. This could be classed as a high-performance street engine; but it is really not in the same class with the Chrysler Street Hemi. The Ford design is much milder. It is common belief that this new engine is just a de-tuned high-performance 427—with the cubic inch designation changed to 428 to separate the designs. This is not true.

The new 428 is the former 390-cu. in. block with a larger bore and stroke. The stroke has been increased 0.2 in. from 3.78 to 3.98, whereas the high-performance 427 retains the 3.78 stroke to hold down piston speed. Also, the new 428 is fitted with the heavy-duty block and lower-end parts. There is little interchangeability between the two engines. The displacement isn't actually 428 cu. in. on the new engine; it is nearer 426. Ford used the 428 designation to separate that engine from other 7-liter Ford, Chrysler and Chevrolet engines.

Is the 428 a strong street engine? Perhaps. A fairly mild hydraulic cam, 10.5:1 compression and a medium-size 4-barrel carburetor are used. Dual exhausts help, though no special free-breathing exhaust headers are used. Low-speed torque should be good with the long stroke. Ford can go considerably bigger with this engine in the future with that long 3.98-in. stroke. With a bore of 4.23 in., as in the 427, the result would be 448 cu. in. with the long-stroke crank! This is a 1967 possibility. The 428's advertised rating of 345 bhp at 4600 rpm doesn't seem exaggerated, so the engine might perform well in the C and D/Stock classes at the dragstrip.

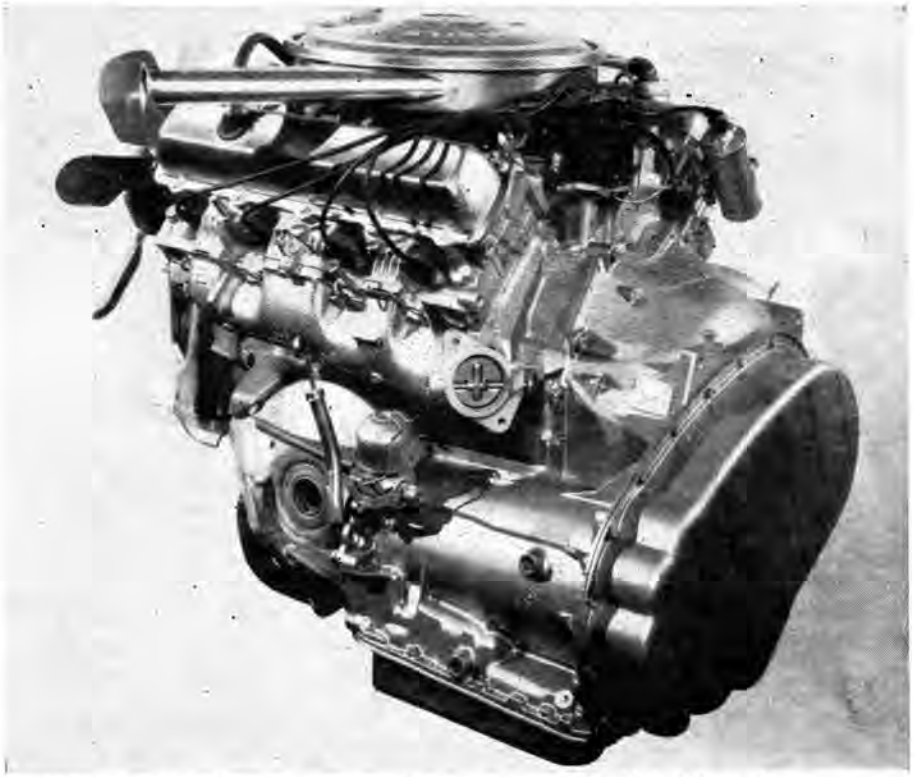
Chevrolet's New 427

GM is supposed to be out of racing, but Chevrolet's new 427 engine looks really strong! It's last year's high-performance 396 engine with 0.156 in. larger bore. Nothing much else is changed. The high-performance version still has the big 2.19-in. intake valves, 1.72 exhausts, ports big enough to stick an arm through, a huge Holley 4-barrel carburetor on a big-port aluminum manifold and beautiful free-breathing exhaust headers. Chevrolet uses an 11:1 compression ratio and a long-duration solid-lifter cam on this street engine.

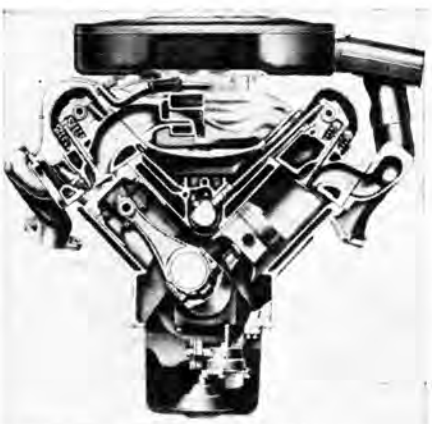
Quite a bit of special over-the-counter speed equipment is offered for the basic engine. California speed component suppliers are tooling great guns for the 427 right now and factory engineers are busy behind closed doors. Some of this factory-developed performance equipment may be marketed through Mickey Thompson and other special equipment outlets. This should be sufficient to make 427 Chevrolets competitive on the NASCAR tracks next year. Racing observers predict that Chevrolet will be a leading competitor in 1966. Possible? Well over 600 bhp will be required of winners.

Whether this new 427 Mk. IV high-performance engine is practical for street use is difficult to say. It may be as much so as the new Chrysler Street Hemi. If one desires something a little more docile, Chevrolet offers the same block de-rated to 390 bhp at 5200 rpm. This unit features a 10.25:1 compression ratio, 2.07-in. intake valves and smaller ports, a milder hydraulic cam and a smaller Holley 4-barrel carburetor. Both engines are available in all full-size Chevrolets and the Corvette. The A-body Chevelle is limited to the 396-cu. in. version of the engine, with ratings up to 360 bhp. The most powerful combination available in the Chevy II is a 350-bhp version of the 327 engine.

Chevrolet may not be racing these days, but the company serves any measure of performance on any platter!



THOUGH THE engine is not new, the transmission arrangement is. This is Oldsmobile Toronado's power package with automatic and differential wrapped around side.



LARGEST production engine is this 462-cu. in. powerplant for Lincoln.

EXCLUSIVE to Mercury is special 410-cu. in block from 390 family.

Bigger Engine for Big Cars

It's interesting to note the continuing trend to more cubic inches in 1966 engines, especially for the heavier medium and high-priced cars. A year or two ago it appeared displacement figures might level out at approximately 430 cu. in., but inches still increase.

Chrysler has enlarged the bore of the 426 block for 440 cu. in. The combination uses a 10.1:1 compression ratio, a single 4-barrel carburetor, a mild hydraulic cam and dual exhausts for a 350-bhp rating. At first the new engine was slated for the luxury Imperials and senior Chrysler models only. Then at the last minute it was extended as an option on full-size Dodges and Plymouths. This appears to be a very responsive street and highway engine. Mid-range torque should be tremendous.

Mercury has lengthened the stroke of the 390 block to produce 410 cu. ▶

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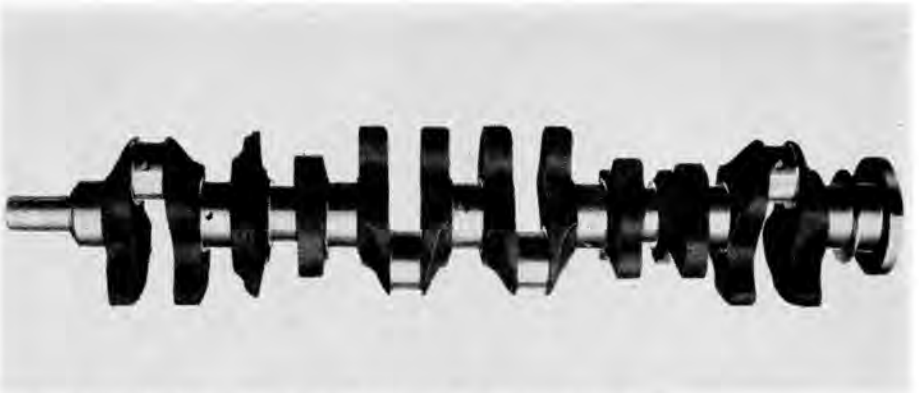
in. for 1966 senior lines. This 330-bhp engine has the same 3.98-in. stroke as the new 428 engine, but has a smaller bore. It is interesting that Mercury uses nearly square bore/stroke ratios after maintaining large bores with short strokes for many years. The lengthened stroke is the only way Mercury can produce the increased displacement without tooling up for entirely new cylinder blocks. On high-performance engines, when bore is increased, designers usually attempt to maintain the stroke to limit piston speed. However, on this large luxury car engine, which seldom will exceed 3500 rpm, 450 cu. in. may be obtained by permitting longer strokes in existing blocks without experiencing undue piston speed problems.

Lincoln has raised displacement of its engine from 430 to 462 cu. in. by increasing both the bore and stroke. This huge engine, with 4.9-in. bore centers, weighs nearly 750 lb. Displacement could be increased, but the engine is too big and heavy and expensive for use in anything but a luxury car, hence it has no particular future in the performance picture.

It's the *trend* that's interesting. Engineers are learning that huge piston displacements can be had with existing blocks by lengthening the stroke beyond measurements thought practical only a short time ago. Blocks can be modified to provide clearance, deck heights can be raised to control rod angularity, and journal diameters can be increased to maintain crankpin overlap and crank torsional rigidity. The increased displacement can be combined with a numerically lower axle ratio for a better compromise between engine smoothness and vibration, fuel economy, and acceleration and response when an adequate 3-speed torque converter is used.



WHEN CHEVROLET lengthened the stroke of its Six to achieve 250 cu. in., this new crankshaft with 12 counterweights (instead of 4) resulted.

A Big Little Engine

Along this same line, Buick has raised displacement of its small 300-cu. in. V-8 to 340 cu. in. for the full-size LeSabre and mid-size Special series. This engine uses the basic tools and the same bore centers established for the tiny 215-cu. in. aluminum V-8 in 1961. Buick has stretched the design nearly to the limit on this latest enlargement. The bore already was out to the limit at 3.75 in. Hence, stroke was lengthened 0.45 in. by raising the block deck height, lengthening the rods and increasing the main bearing diameter from 2.5 to 3 in. to maintain overlap. The result is a big engine with small dimensions and low weight. Weight was increased less than 20 lb. with the longer stroke, which still leaves it under 500 lb., the lightest cast-iron V-8 in the industry.

Transmission Developments

This isn't the year of new transmissions. Lincoln offers a modernized 3-speed torque converter which is smaller, lighter and cheaper than the former model. Chrysler has strengthened the TorqueFlite, which is available with the new Street Hemi for the two-pedal acceleration fan. Chevrolet couldn't produce its 3-speed Powerglide in time for the early '66s, but it will be in limited production by spring. Meanwhile, the GM Turbo Hydra-Matic will serve with the big 396 and street 427 engines. Chevrolet also has new gearsets for the Muncie 4-speed, including a new wide-ratio set with 3.11 low gear for use with small-displacement engines in heavier cars.

Perhaps the most significant transmission development for '66 is Ford's new "Sportshift" 3-speed automatic for high-performance compacts. A console shift lever permits the driver to up-shift *and down-shift* almost at will through the three gears. Or the lever can be placed in Drive for automatic shifting in the usual way. Former automatics have had safety devices to limit engine rpm on up and down-shifts. Ford's new arrangement permits complete selection of a given gear at any time by the driver, so engine braking can be used by down-shifting, as well as going beyond the normal shift point when maximum acceleration is desired. This could start a trend. ■

FREE-BREATHING Chevrolet 427 now puts that division in 7-liter category. Engine appeared last year as 396 cu. in.

DOUBLE BOLTED main bearing caps illustrate the extra sturdiness in 427 Chevrolet's lower end.