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COMPLETE BOOK OF

ENGINES

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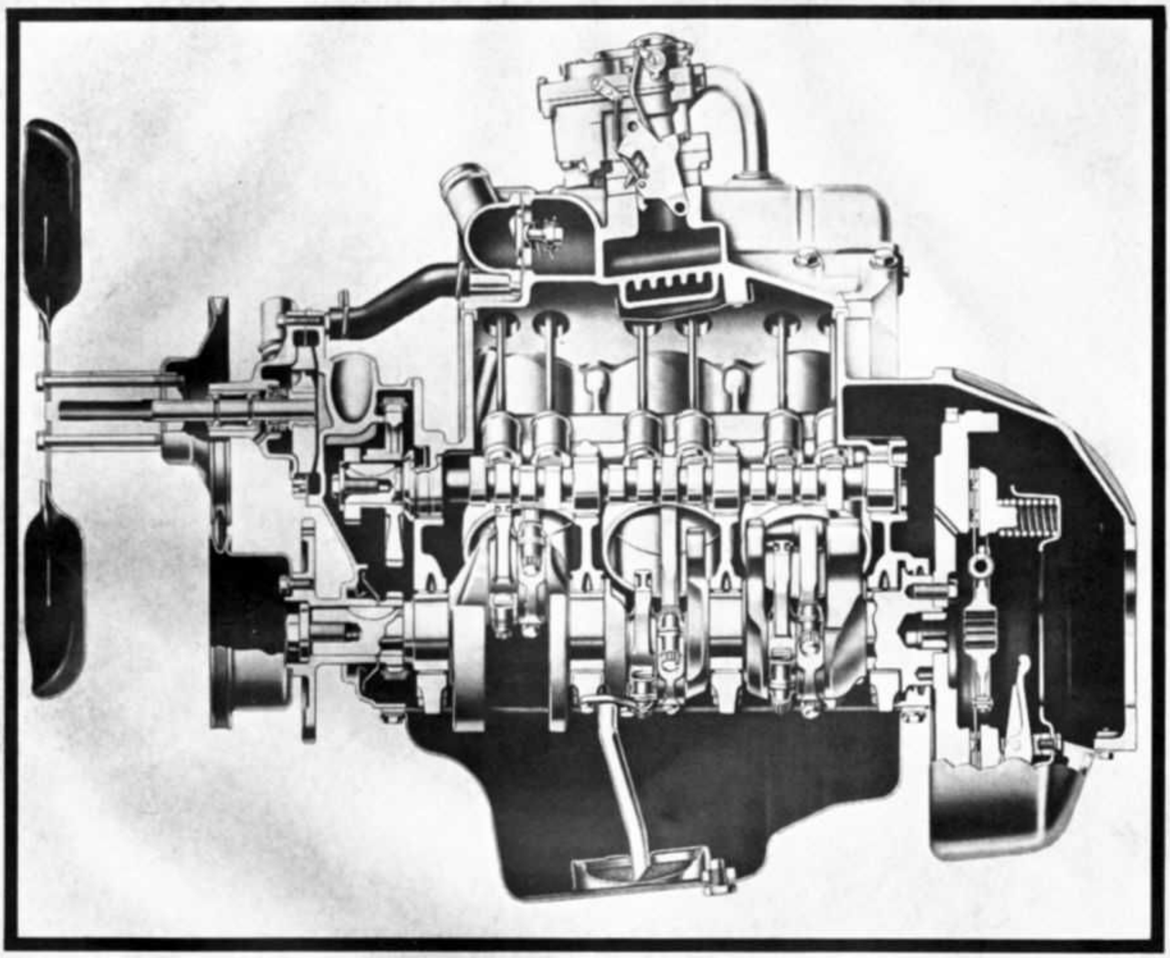
HOW TO GET MORE HORSE-POWER OUT OF EVERY FORD ENGINE! STEP-BY-STEP CHEVY SUPERTUNING PROCEDURES! MODIFYING THE PONTIAC OHC 6 & CHRYSLER HEMI. ALL SPECIFICATIONS!

BUICK V6 *225 cubic inches*



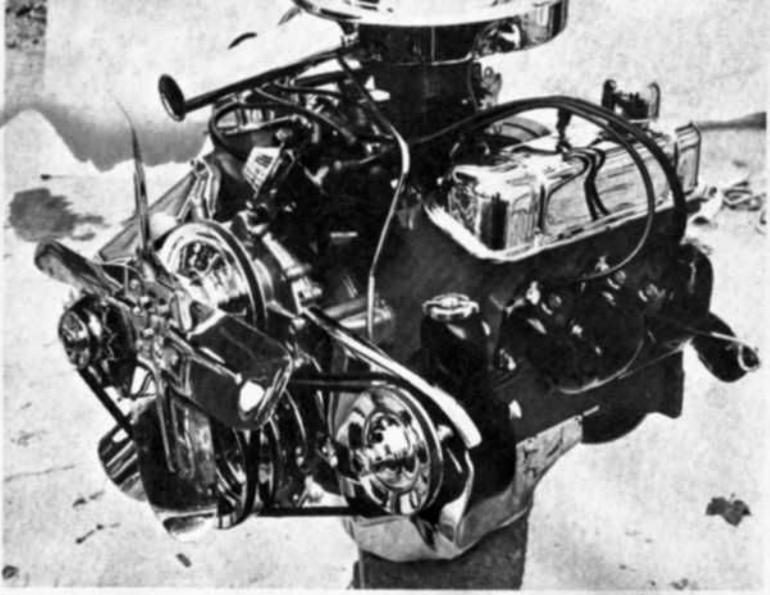
Buick's V6 is noteable for its compactness and light weight. Its ratio of weight to horsepower is much more favorable than any other in-line sixes on the market which are in a similar displacement bracket. The engine was originally designed for use in compacts to stretch out the available passenger space in the short-wheelbase models. It was also designed as an economy engine as its relatively low compression ratio allows the use of regular grade fuel. In 1966, Buick engineers substituted a twin-barrel caburetor and new intake manifold for the original single-barrel carburetor setup. The result was a gain of five horsepower in its output. For 1967 the engine is virtually unchanged in mechanical details and power output.

Type: Ohv V6.
Displacement (cu. in.): 225.
Horsepower @ rpm: 160 @ 4200.
Horsepower per cubic inch: 0.71.
Torque (lbs. ft.) @ rpm: 235 @ 2400.
Bore & Stroke (in.): 3.75 x 3.50.
Compression ratio: 9.0.
Carburetion: 1 - 2 bbl.
Approximate weight: 440 lbs.
Weight-to-hp ratio: 2.75.

GENERAL: The Buick V6 has its cylinders cast in a 90-degree configuration. Both the heads and block are cast iron. The overhead valves are pushrod actuated through hydraulic lifters. The bore is 3.750 inches and the stroke 3.40 to set the displacement at 225 cubic inches. Bore spacing is 4.240 inches. The engine develops 160 horsepower at 4400 rpm and 235 lbs. ft. torque at 2400 rpm. The compression ratio is 9.0:1.

PISTONS, RINGS, PINS, RODS: The camground pistons are cast aluminum alloy featuring a transverse slot and divorced skirt. Piston weight is 17.34 ounces without the pins and rings. The upper compression ring is cast iron with a chrome-plated finish and the second compression is made from similar material with a Lubrite finish. The oil control ring is uncoated steel and is backed up with a steel hump-type expander. Piston pins are extruded SAE 1018 steel and have a nominal .9395 diameter. These pins are a select floating fit in the pistons and a press fit in the connecting rods. The pin bores in the pistons are offset .040 inch toward the major thrust side of the cylinder walls. The connecting rods are cast from pearlitic malleable iron. Weight of these rods is 20.8 ounces. Removable steel-backed bearings have a M/400 aluminum surface and are .737 inch wide.

CRANKSHAFT: The short and stubby crankshaft is cast from pearlitic malleable iron and carried in four main bearings. The main bearing journals have a 2.4995 inch diameter and the bearing lengths are .864 with the exception of the #2 which absorbs the thrust and has a 1.057-inch length. The crankpin journals have a 2.000-inch diameter. The main bearings are steel-backed removable inserts. Lower #4 main bearing is faced with M/100 Durex and the balance of the bearings have M/400 aluminum surfaces. Because of its short length, there is no torsional vibration damper on the crankshaft.



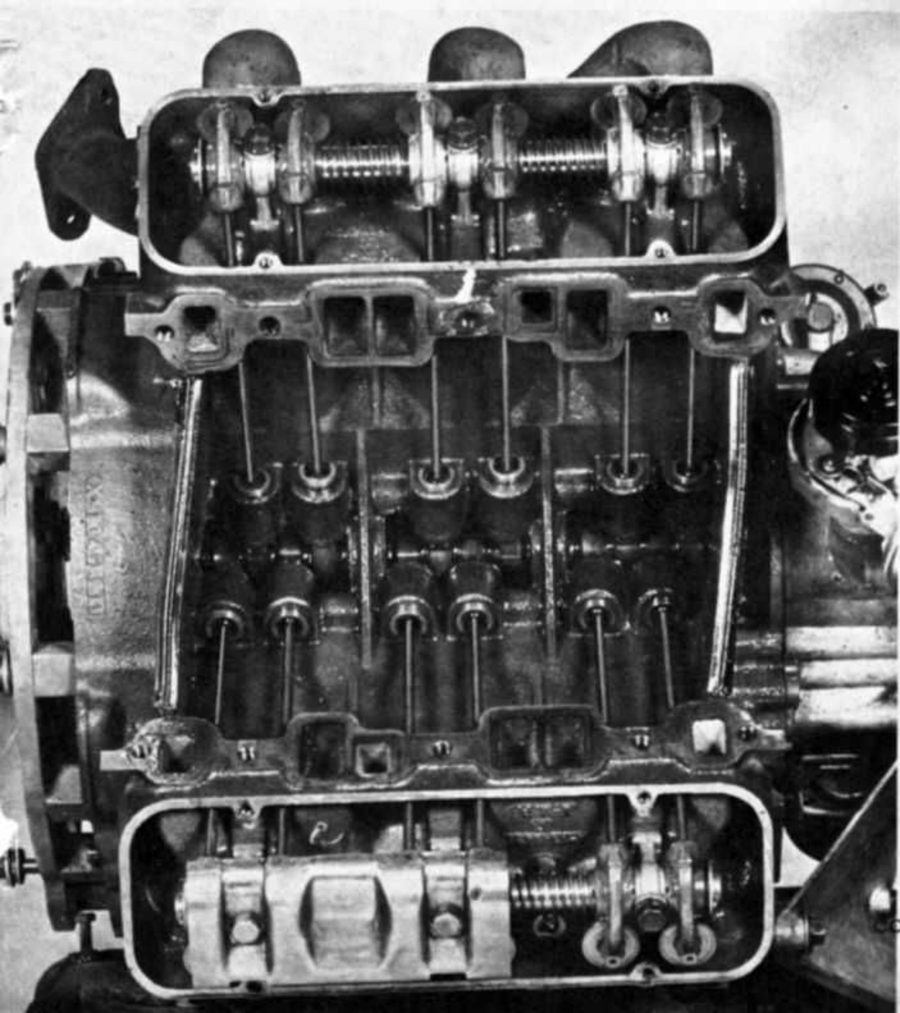
Chief characteristics of the Buick V6 are its light weight and compactness.

CAMSHAFT: The camshaft is cast alloy iron. Support for this shaft is provided by four steel-backed babbitt bearings. The silent chain drive meshes with a sintered iron sprocket on the crankshaft and a nylon coated aluminum sprocket on the camshaft. Lobes on this camshaft provide a 285-degree opening duration on the intake valves and 295 degrees on the exhausts. The lift on both intake and exhaust valves is .401.

VALVES: The intake valves are fabricated from SAE 1041 steel and have a maximum head diameter of 1.63. The exhaust valves are SAE 21-4N steel and measure a maximum of 1.38 inches across the heads. The valve stems have a small amount of taper with the smallest diameter at the valve head end. Single springs are used on both the intake and exhaust valves. Spring pressures with the valves is a nominal 64 pounds when the valves are closed and a nominal 168 pounds when the valves are open.

FUEL SYSTEM: Fuel is supplied to the carburetor by a mechanical pump which delivers 4.25 to 5.75 psi at 1800 rpm of the crankshaft. A porous metal filter is located at the engine and a plastic mesh filter is contained in the fuel tank. The carburetor is a Rochester two-barrel model 2GC with a 1.4375-inch diameter in both barrels.

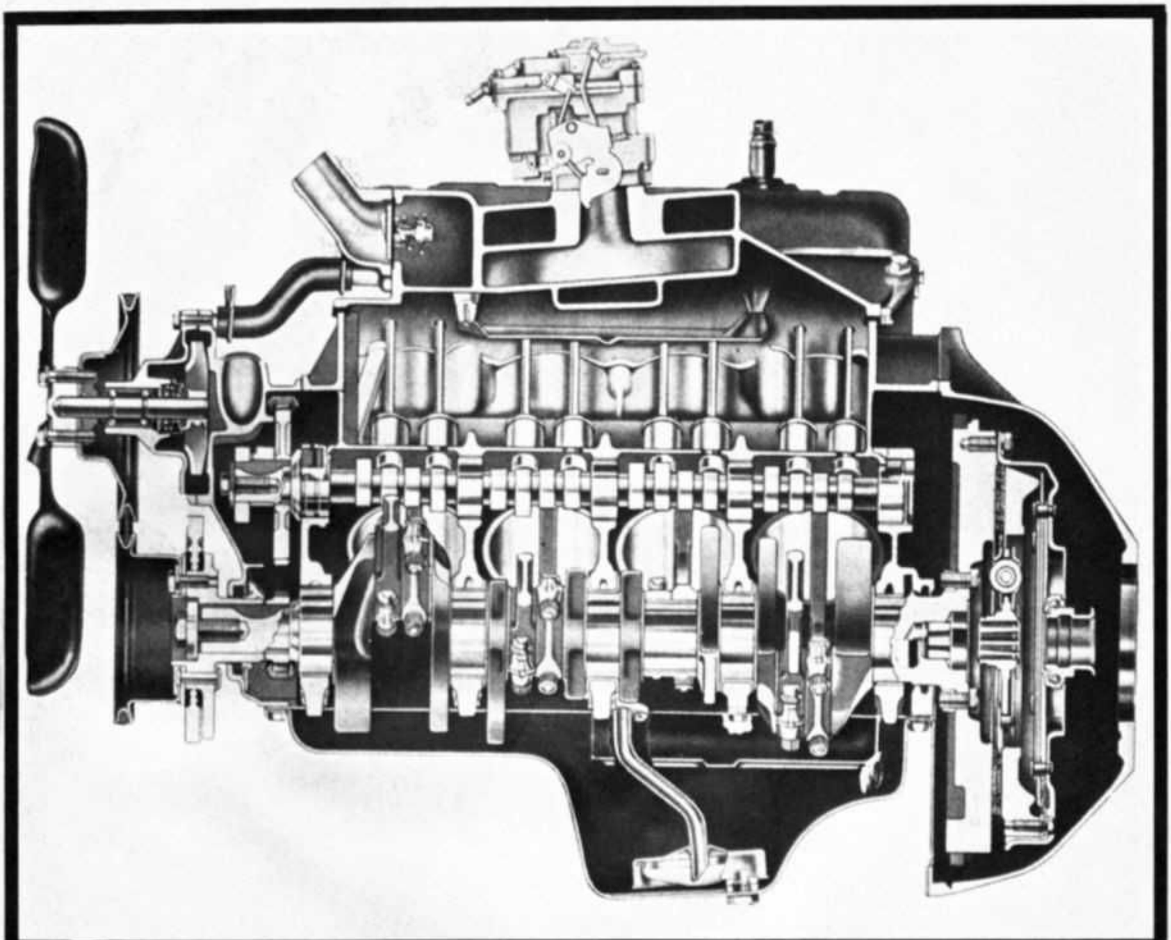
LUBRICATION SYSTEM: The lubrication system incorporates a full-flow oil filter. Oil is delivered by a gear-type which delivers 33 psi at 2400 rpm crankshaft speed. The main bearings, connecting rod bearings, camshaft bearings, and tappets are full-pressure lubricated. Cylinder walls and the timing chain are lubricated by a combination of jet nozzles and splash. Splash within the engine serves to lubricate the piston pins.



Exposed view of the V6 block shows the cam and valve train assembly. Note the unusual arrangement of the intake ports.

BUICK SMALL V8

300 and 340 cubic inches



The small Buick V8's used in the 1967 series of models are practically identical to the engines used in 1966. The 300-cubic-inch version is the standard V8 option in the Buick Special. The lowest horsepower version of the 340 is optional in the Special, Special Deluxe, and Skylark. The 220 hp, 340-cubic-inch model is standard in the Le Sabre and Sportwagon. The 260-hp, 340-cubic-inch version is optional in the Special, Special Deluxe, and Skylark. The 300-cubic-inch model bears a great deal of similarity to the Buick V6. It shares the same bore and stroke plus having many parts which are interchangeable. The 340-cubic-inch version follows the same basic design as the 300, has the same bore but longer stroke. Many parts are also interchangeable between the 300 and 340-cubic-inch versions.

Type: Ohv V8.
Displacement (cu. in.): A—300. B—340. C—340.

Horsepower @ rpm: A—210 @440. B—220 @ 2400. C—260 @ 4200.
Horsepower per cubic inch: A—0.70. B—0.64. C—0.76.
Torque (lbs. ft.) @ rpm: A—310 @ 2400. B—340 @ 2400. C—365 @ 2800.
Bore & Stroke (in.): A—3.75 x 3.40. B—3.75 x 3.85. C—3.75 x 3.85.
Compression ratio: A—9.0. B—9.0. C—10.25.
Carburetion: A—1 · 2 bbl. B—1 · 2 bbl. C—1 · 4 bbl.
Approximate weight: A—470 lbs. B—480 lbs. C—485 lbs.
Weight-to-hp ratio: A—2.24. B—2.18. C—1.87.

ENGINEERING EVOLUTION: The small Buick V8's are an offshoot in design from a 215-cubic-inch V8 with an aluminum cylinder block and heads which was introduced by the company in 1961. Production problems forced the abandonment of the aluminum block shortly thereafter. However, the cast aluminum heads were retained through 1963. The current engines have both cast iron cylinder blocks and heads.

GENERAL: The small Buick V8's have a 90-degree separation between the cylinder banks. The overhead valves are pushrod actuated through hydraulic lifters. In the 300-cubic-inch version the stroke is 3.40 inches and the stroke in the 340-cubic-inch models is 3.85. Both versions share a common 3.75-inch bore. The horsepower rating of the 300 is 210 @ 4600 rpm and the torque peak in this smaller engine is 310 lbs. ft. at 2400 rpm. The lowest powered of the 340-cubic-inch versions develops 220 horsepower at 4000 rpm and 365 lbs. ft. torque at 2800 rpm. The compression ratio in the 210- and 220-horsepower engines is 9.0:1 while the premium fuel 360-horepower engine utilizes a 10.25:1 compression ratio. The torque rating of this more powerful version is 365 lbs. ft. at 2800 rpm. The lower-horspower engines use a two-barrel carburetor while the 260-horsepower version is equipped with a single four-barrel unit.

PISTONS, RINGS, PINS, RODS: The cam-ground pistons are cast aluminum with a transverse slot and divorced skirt. Weight without the pins and rings is 17.34 ounces. The compression rings are cast iron with a chrome-plated finish on the top ring and a Lubrite treatment on the second ring. The oil-control ring is uncoated steel and is backed by a steel hump-type expander. Bores for the piston pins are offset .040-inch toward the major thrust side of the cylinders. The piston pins are extruded SAE 1018 steel and have a nominal .9395-inch diameter. These pins are a press fit in the connecting rods and a select floating fit in the pistons. The connecting rods are forged from SAE 1141 steel. Rod bearings are steel backed M/400 aluminum removable inserts which have a .737-inch length.

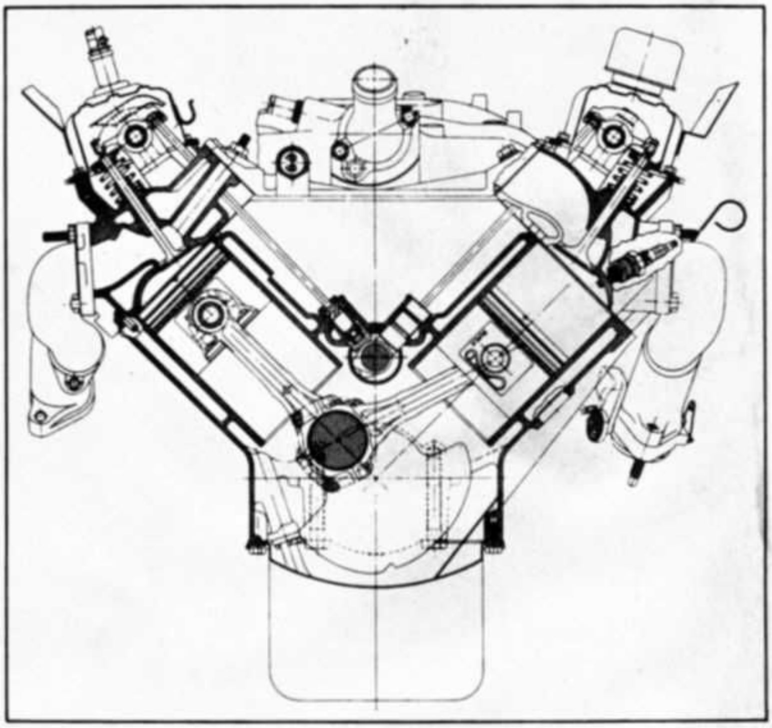
CRANKSHAFT: The crankshaft is cast from pearlitic malleable iron and is equipped with a rubber-absorption-type vibration damper at the forward end. Main bearings are removable steel-backed inserts. These inserts have a M/400 aluminum face with the exception of the lower #5 which has a M/100 Durex coating. The #3 main bearing which takes the crankshaft thrust is 1.057 inches long and the remainder have a .864 length. Main journals on the shaft have a 2.9995-inch diameter and the crankpin journals have an even 2-inch diameter.

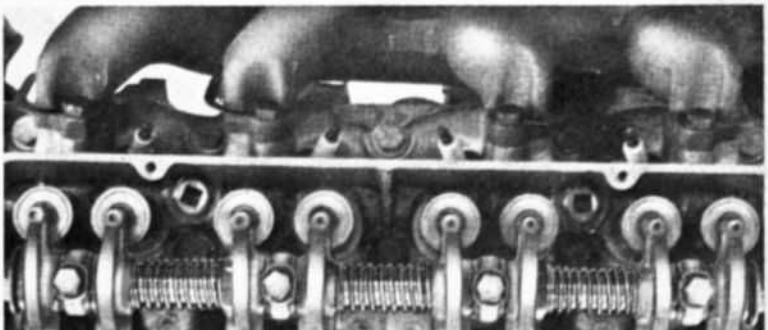
CAMSHAFT: The camshaft is cast iron alloy and is carried in five steel-backed babbitt bearings. Its silent chain drive meshes with a sintered-iron sprocket on the crankshaft and a nylon-coated aluminum sprocket on the camshaft. Lobe configurations on the shaft provide a 294-degree opening of the intake valves, a 293-degree opening on the intakes and a 76-degree overlap.

VALVES: The intake valves may be fabricated from SAE 1041, SAE 1047, or TS 8150 steel at the option of the manufacturer. The exhaust valves are SAE 21-4N steel. Overall head diameters of the intakes are 1.8125 and the exhausts have a 1.375 head diameter. The valve stems are slightly tapered with the largest diameter under the heads. Single valve springs are used which exert approximately 64 pounds in the closed position and about 164 pounds when the valves are open.

FUEL SYSTEM: A mechanical pump located on the engine delivers fuel to the carburetor through a pleated paper filter also located on the engine. Fuel pressure is in the range between 5.5 on 7.0 psi at 1800 rpm. The two-barrel carburetors used on the engines are Rochester 2GC's and the four-barrel carburetor used on the 360-horsepower engine is a Carter AFB. Barrel diameters in all carburetors are 1.4375.

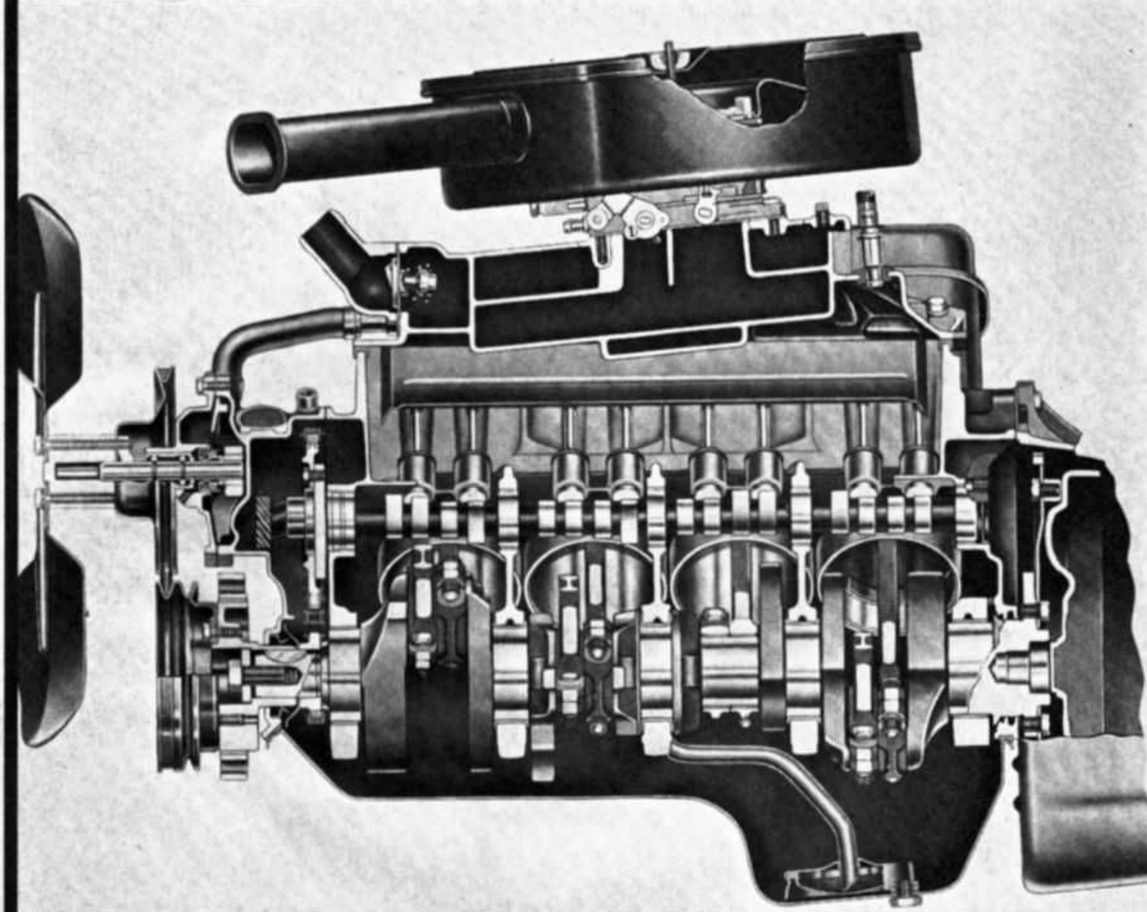
LUBRICATION SYSTEM: The engine lubrication system incorporates a full-flow oil filter. Oil is delivered by a gear-type pump which produces 33 psi at 2400 rpm. The main bearings, connecting rod bearings, camshaft bearings, and tappets are full-pressure lubricated. The timing chain and cylinder walls receive their oil from a combination of splash and jet. Piston pins are lubricated by oil mist within the crankcase.





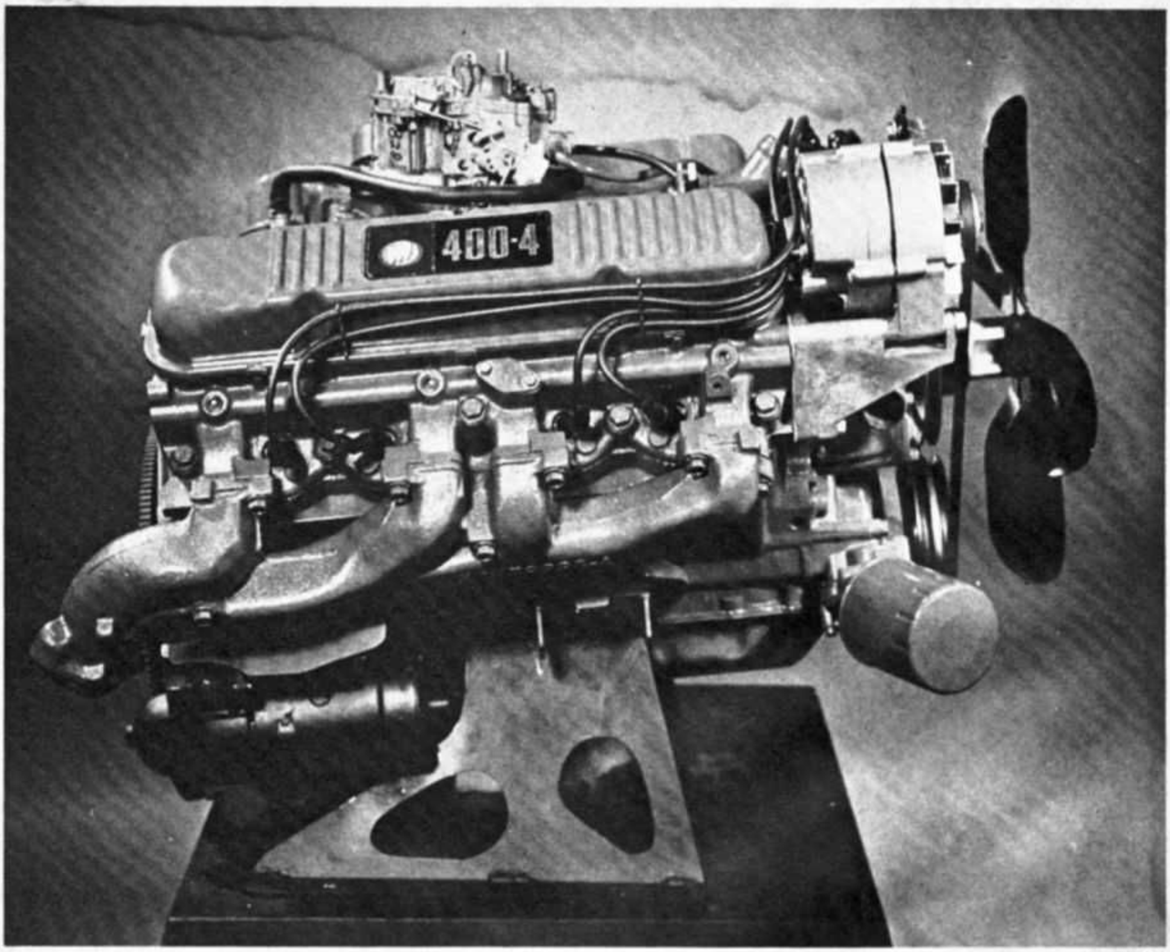
At top is a cutaway view of the small V8 crankshaft. The engine has five main bearings with #3 taking the thrust. Horsepower rating of the stock 300 is 210 hp, 220 hp for the straight 340. Photo above exposes the head assembly. Oil is supplied under pressure to the shaft bearings and valve lifters and under controlled volume to the rocker arm bearings and pushrods.

BUICK BIG V8 *400 and 430 cubic inches*



The 400-cubic-inch and 430-cubic-inch Buick engines available in the GS 400, Wildcat, Electra, and Riviera models for 1967 are all new powerplants which replace the 401 and 425-cubic-inch models offered in 1966. While the two engines differ in displacement, they are identical in basic design. The cylinder blocks provide a common stroke length and bore spacing. Differences in displacement are accounted for in the cylinder bores. Practically all internal parts in the engines are interchangeable with the exception of the pistons and rings.

Type: Ohv V8.
Displacement (cu. in.): A—400. B—430.
Horsepower @ rpm: A—340 @ 5000. B—360 @ 5000.
Horsepower per cubic inch: A—0.80. B—0.84.
Torque (lbs. ft.): @ rpm: A—440 @ 3200. B—475 @ 3200.
Bore & Stroke: A—4.04 x 3.90. B—4.1875 x 3.90.
Compression ratio: A—10.25 B—10.25.
Carburetion: A—1 - 4 bbl. B—1 - 4 bbl.
Approximate weight: A—640 lbs. B—650 lbs.
Weight-to-hp ratio: A—1.97. B—1.91.



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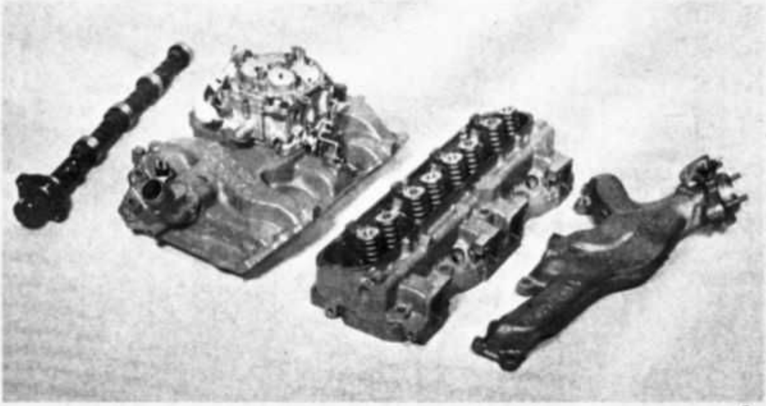
ENGINEERING EVOLUTION: The big Buick V8's are descendents of a 1953 engine which displaced 322 cubic inches. To keep pace with the growing trend towards larger engines the displacement was raised to 401 cubic inches in 1959. Overboring the basic block in 1963 produced a second version displacing 425 cubic inches. The 1967 models are greatly updated over the previous versions. Among the improvements are greater breathing ability and structural changes which increase the reliability factors.

GENERAL: The combustion chambers in the new engines feature a slanted saucer shape with the valves inclined at 15 degrees to the centerline of the cylinder. The cylinder heads also feature inlet parts which are 18 percent larger and exhaust ports 56 percent larger than their 1966 counterparts. Intake manifold passages have been redesigned to eliminate sharp bends. The engines have a common 3.9-inch stroke. Bore of the 400-cubic-inch model is 4.04 inches and the 430-cubic-inch engine is 4.1875 inches.

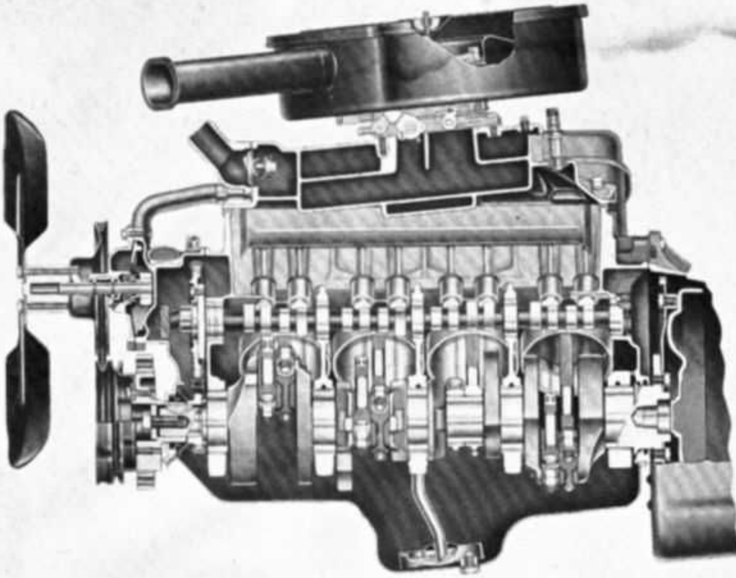
PISTONS, RINGS, PINS, RODS: The pistons are cast aluminum alloy with a transverse slot and divorced skirt. Pistons in the smaller version weigh 22.784 ounces and 24.352 ounces in the larger model. Pin bores in these pistons are offset .060 inch. The compression rings are cast iron with a molybdenum coating on the top ring and a Lubrite treatment



2

1. Displacement and carburetion of the 1967 Buicks are identified by a decal on the rocker arm cover. In this case, it's a 400-cubic-inch model equipped with a four-barrel quadrajet carburetor. Most internal parts of the 400 and 430-engines are interchangeable with the major exception of the pistons and rings.

2. Shown are the camshaft, intake manifold with Rochester Quadrajet carb, left bank head assembly and exhaust manifold of the smaller V8.



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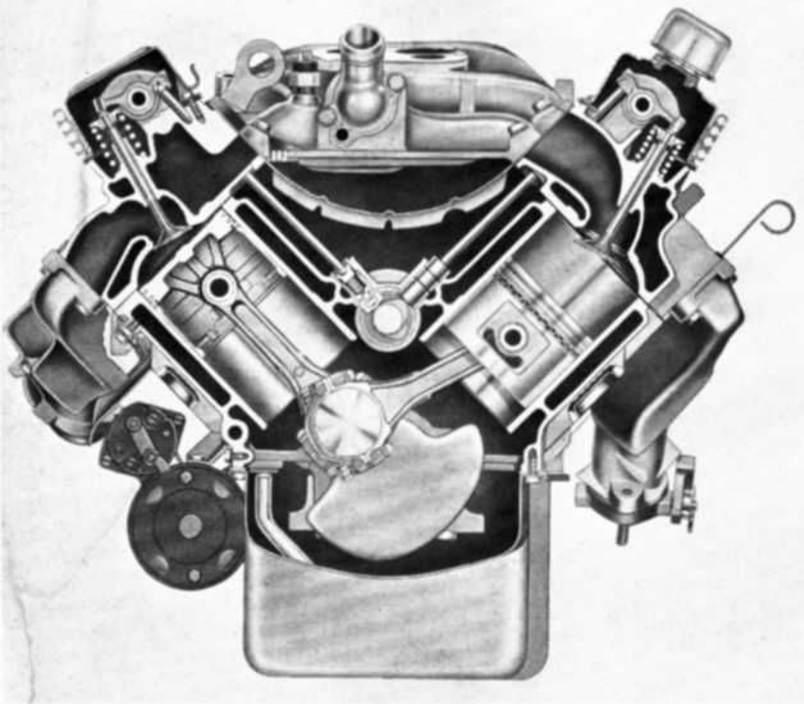


2

1. Identical in basic design, the only differences between this cutaway view of the Buick 430 and that of the Buick 400 shown on page 8 is the shape of the pan and the locations of the oil screen housing and oil pickup pipe.

2. Cross section of the 430-cubic-inch Buick V8 block. The combustion chambers have a slanted saucer shape with the valves inclined at 15 degrees to the centerline of the cylinder.

on the second ring. The oil-control ring is an abutment type with a steel expander. Piston pins are extruded SAE 1018 steel. These pins are a press fit in the upper ends of the connecting rods and float in the piston bores. Connecting rods are forged from SAE 1141 steel and weigh a nominal 6.6 ounces. Rod bearings are steel-backed M/400 aluminum inserts.

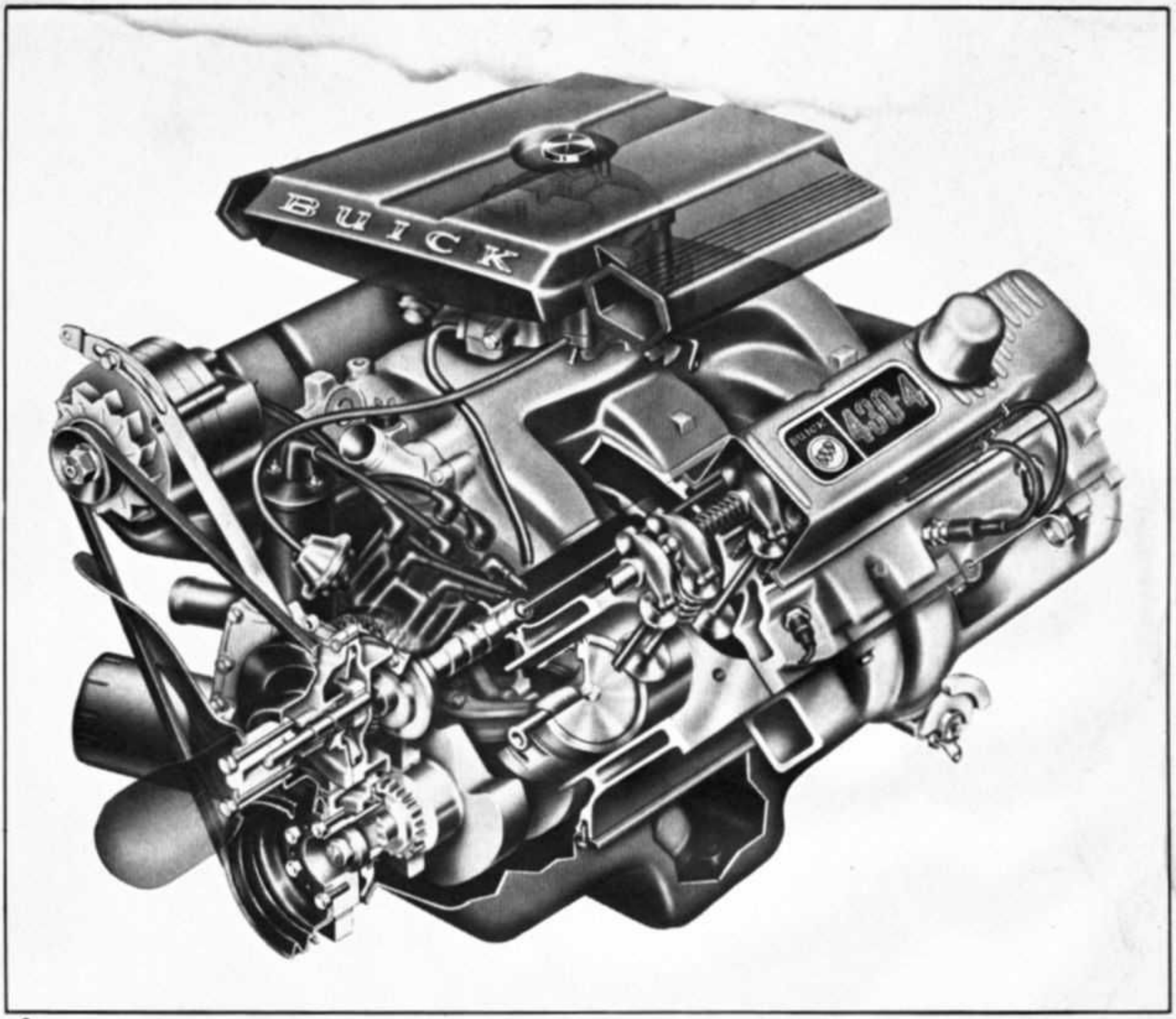
CRANKSHAFT: The crankshaft is cast from nodular iron. This shaft is extremely stiff by virtue of its 3.25-inch main bearing journals and 2.25-inch diameter crankpins. Main bearings are steel-backed removable inserts. The first four main bearings are faced with M/400 aluminum rear bearing has a 100A Durex face. The #3 bearing which takes the thrust is 1.047 inches long and the rear bearing is 1.143 inches long. The remainder of the bearings measure .865 inch in length.

CAMSHAFT: The cast iron alloy camshafts in both engines are identical and are supported in five steel-backed babbitt bearings. The timing chain engages a sintered iron sprocket on the crankshaft and a nylon-coated aluminum sprocket on the camshaft. Cam lobe characteristics provide an intake valve opening duration of 298 degrees of crankshaft rotation and 315 degrees on the exhaust valves. Valve opening overlap is 61 degrees. Intake valve lift is .4214 inch and exhaust valve lift is .4498 inch.

VALVES: Valves are also identical in both versions of the engines. Intake valves are SAE 1041 steel and have two-inch diameter heads. The exhaust valves are SAE 21-4N steel and have 1.6-inch diameter. Single valve springs are used on both intake and exhaust valves.

FUEL SYSTEM: Fuel is delivered by a mechanical pump producing 5.5 to 7.0 pounds pressure at 1800 rpm. A woven plastic filter is located in the fuel tank and a pleated paper filter is used in the carburetor inlet. Both engines are equipped with a four-barrel Rochester Quadjet carburetor with 1.375-inch diameter primary barrels and 2.250-inch diameter secondaries. The carburetors are fitted with new low restriction air cleaners.

LUBRICATION SYSTEM: High-pressure oil is fed from the pump to the oil filter mounted on the oil-pump cover. A two-gallery system provides high-pressure oil main and connecting rod bearings, camshaft bearings, valve lifters, and rocker arms. This oil is collected between the camshaft and the cylinder block, then fed through an angled hole in the camshaft which ejects oil just aft of the distributor driving gear. Oil thrown from the gears supply splash lubrication to the fuel pump eccentric and timing chain.



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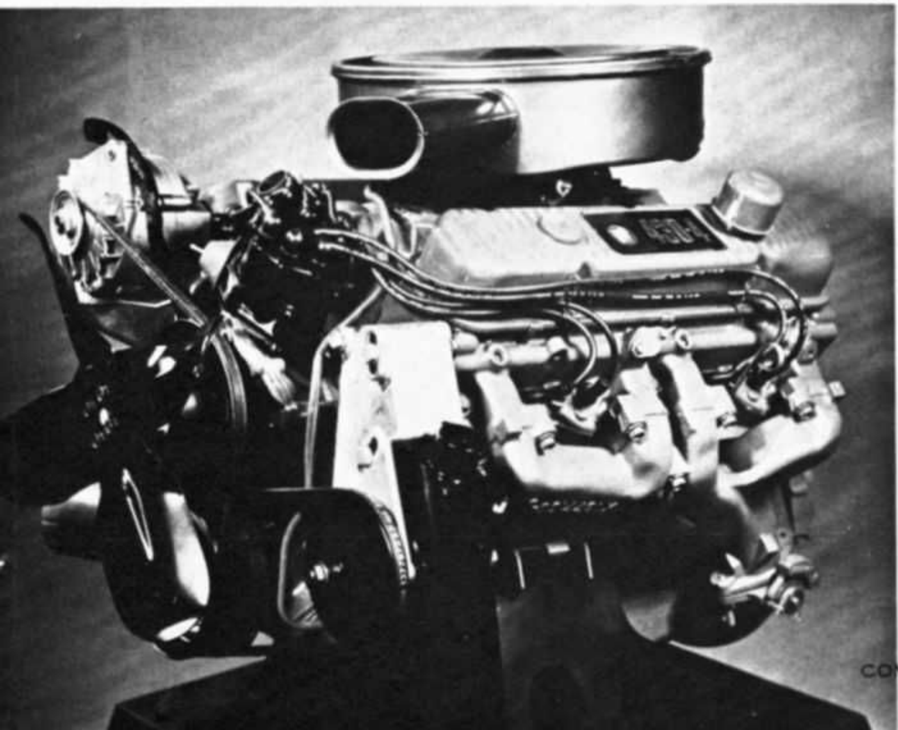

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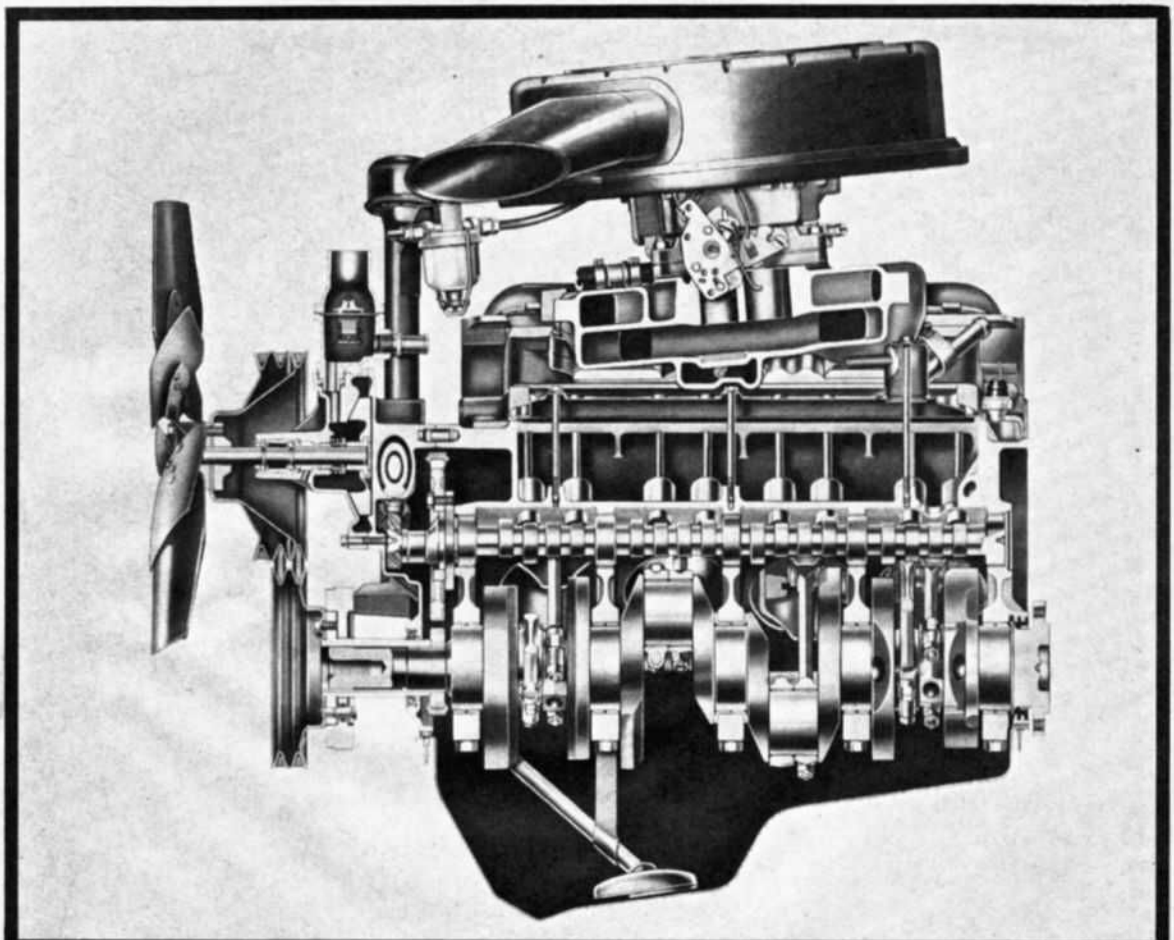
3 & 4. Another cutaway illustration of the 430-cubic-inch Buick V8 (figure 3) compared to an actual photo of the same engine (figure 4). Twin scoop air cleaner in the drawing is a later design than that of the prototype unit shown in the photograph.

CADILLAC V8 *429 cubic inches*



The 1967 version of the Cadillac engine, which is used to power all models of this luxury car, remains virtually unchanged from the previous year. Horsepower and torque ratings remain the same. Although the horsepower rating in terms of horsepower per cubic inch of displacement falls somewhat short of many other engines, its high torque and total horsepower output serves to provide highly satisfactory performance in the heaviest cars in the line. Despite its large size, the Cadillac engine features a very high horsepower-to-weight ratio. The relatively light weight is due in part to a cored-out crankshaft and a die-cast aluminum combination of accessory drive and chain cover. The engine is given extraordinary care in the various manufacturing, assembly, and inspection processes. Many of these processes are conducted in air-conditioned areas to insure precise measurements. Relatively low production rates and considerable leeway in cost allowances make a high degree of quality control possible in the production of this fine and reliable engine, worthy of Cadillac's trademark, "Standard of the World."

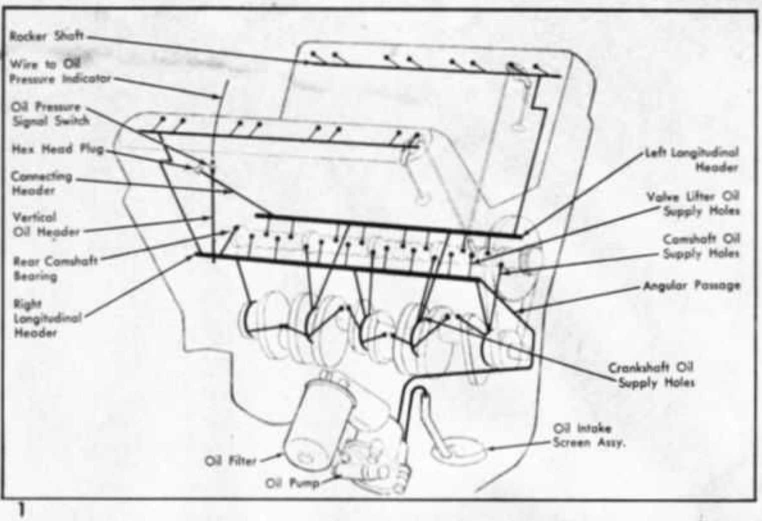
Type: Ohv V8
Displacement (cu. in.): 429.
Horsepower @ rpm: 340 @ 4600.
Horsepower per cubic inch: 0.79.
Torque (lbs. ft.) @ rpm: 480 @ 3000.
Bore & Stroke: 4.13 x 4.00.
Compression ratio: 10.5.
Carburetion: 1 4-bbl.
Approximate weight: 600 lbs.
Weight-to-hp ratio: 1.77.

ENGINEERING EVOLUTION: While basic design criteria and tooling for the current Cadillac engine were laid down in 1948, the engine bears little resemblance to the engine of that year because of a radical updating in almost every feature. The 1966 version was bored and stroked to its present displacement at the end of the 1963 model year when the displacement was 390 cubic inches.

GENERAL: The Cadillac engine is a 90-degree V8 design with pushrod-operated overhead valves. Its 429-cubic-inch displacement is derived from a 4.13 cylinder bore and 4.00 stroke. The 340-brake horsepower peak is reached at 4600 rpm and its maximum torque of 480 lbs. ft. is generated at 3000 rpm. Carburetion is provided by a single four-barrel carburetor. Compression ratio is 10.5:1. Both the cylinder block and cylinder heads are cast iron. The die-cast aluminum front cover encloses the timing chain and provides a mounting for the oil pump, oil filter, oil filler tube, and water pump. Total weight of the engine including all accessories is only about 600 pounds.

PISTONS, RINGS, PINS, RODS: The only 1967 design changes in the Cadillac involves slight modifications of the pistons and lower ring to improve oil control and some slight modifications of the valve train. These aluminum alloy pistons have a double T slot, are cam ground and Stannate-coated to resist scuffing when the engine is new. The piston pins are fabricated from SAE 1045 steel, have a husky nominal diameter, just a whisker under one inch, and are a press fit in the connecting rods. While the pins have a floating fit in the pistons within very close tolerances, adequate provision has been made for their lubrication. Broached grooves in the piston pin bores direct oil from the cylinder walls to the bores. These pin bores in the pistons are offset .062 inch toward the major thrust side of the cylinders to contribute to engine operational smoothness. The short and stocky connecting rods are fabricated from SAE 1041 steel and weigh a relatively light 19.36 ounces. At the lower end, the rod bearings are contained in a substantial base just over three-quarters of an inch wide.

CRANKSHAFT: The crankshaft is cast from pearlitic malleable iron and hollow cored for lightness without sacrifice of stiffness. A design concept was adopted in earlier models of the engine which prescribed counterweights only three inches in diameter and so disposed to avoid any bending of the shaft. Because of the engine's short stroke and small-diameter crankshaft counterweights, only a small sump and crankcase were required and thus the crank assumed a short and stiff configuration. Both of these factors contributed in reducing the overall weight of the engine. The main crankshaft bearing journals have a nominal three-inch diameter. Crankpin journals on the shaft have a nominal 2.25-inch diameter. The rod bearings are M-400 aluminum and the main bearings a combination of M-400 aluminum and M-100 babbitt. Thrust is taken on the center main bearing. A rubber absorption-type harmonic vibration damper is pressed on the snout of the crankshaft.



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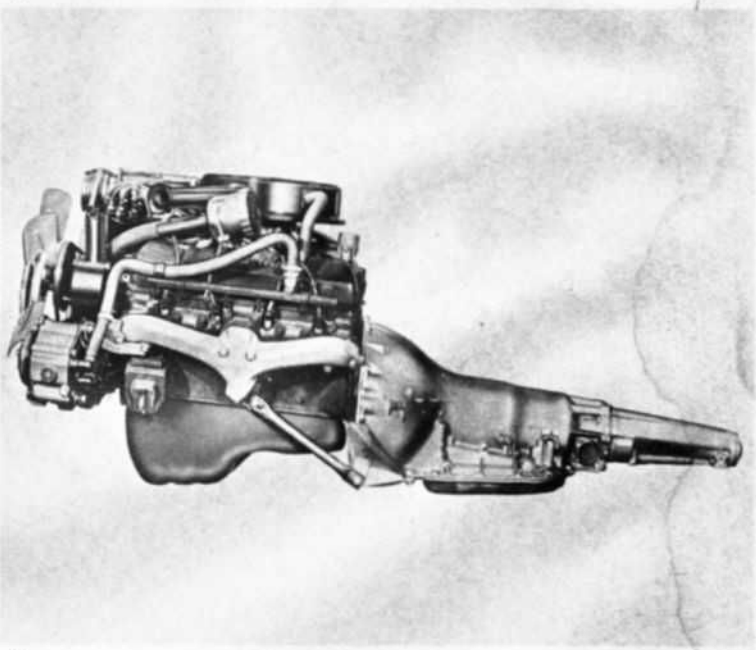

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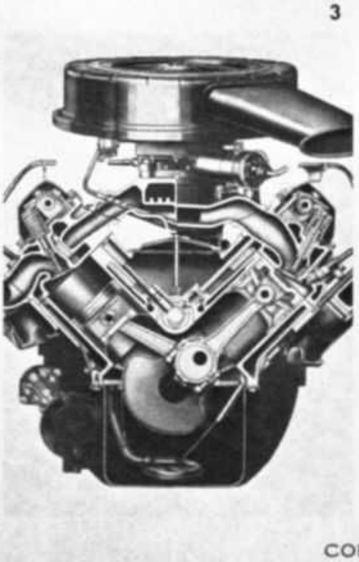
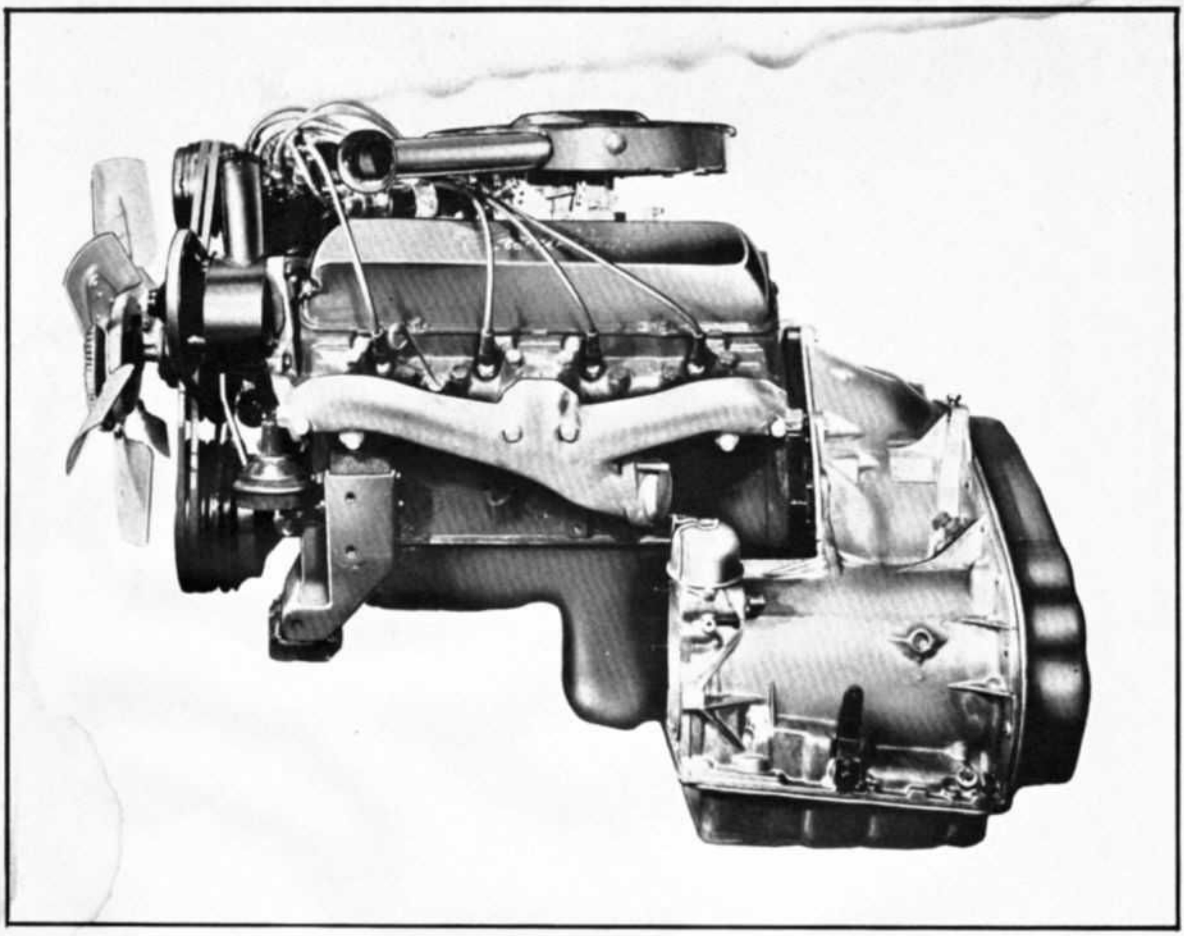


1. This shows the oiling system and oil flow in the Cadillac engine.

2. Despite the large size of the Cadillac engine, it has a very high horsepower-to-weight ratio. Engine shown is complete with power steering pump and air conditioning compressor.

3. Cutaway reveals cored-out crankshaft which eliminates a considerable amount of weight for engine assembly. Engine is given extraordinary care in various manufacturing and assembly processes. Controlled assembly conditions account for much more precise tolerances.



CAMSHAFT: The camshaft is cast from a General Motors-specified formulation of cast iron. Carried in five steel-backed babbitt bearings, it is driven by a silent chain. The crankshaft sprocket material is sintered iron and the camshaft sprocket is die-cast aluminum with nylon teeth. Camshaft lobe configurations provide a 290-degree duration on the intake valves, 332-degree duration on the exhaust valves and a 97-degree overlap. The lift is .427 on the intakes and .466 on the exhausts. While this cam action cannot be considered "mild," it apparently does nothing to detract from the smoothness of the engine throughout its entire rpm range.

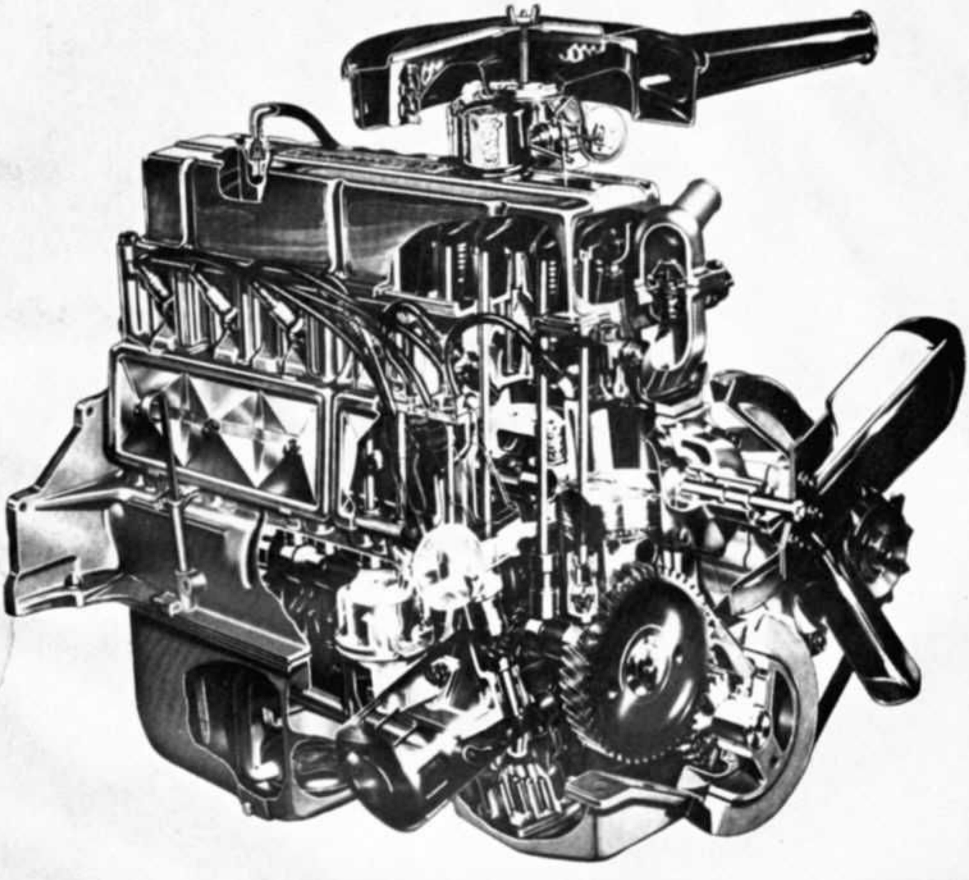
VALVES: The intake valves are SAE 1041 steel with aluminized heads and the exhaust valves are SAE 21-4N steel. Head diameter of the intakes is 1.875 inch and the exhausts measure 1.50-inch. Single valve springs are used and exert a 60 to 65-pound pressure in the closed position. The spring pressure when the valves are open is in the range of 155 to 165 pounds. Hydraulic valve lifters operate in guide holes drilled in the cylinder block. To insure the quietest possible operation, the valve lifter plungers and lifter bodies are selectively fitted in matched pairs.

FUEL SYSTEM: Fuel is delivered from the vehicle tank to the engine by a mechanical pump. Two fuel filters are used, one located in the tank and the other at the front end of the engine. The engine in cars without air-conditioning may be delivered with either a Carter 3093-S or a Rochester 7025030 four-barrel carburetor. Factory air-conditioned cars are equipped with either a Carter AFB 3904-S or Rochester 7025031. All of these carburetors share a 1.4375 primary barrel diameter and a 1.6875 barrel diameter in the secondaries.

LUBRICATION SYSTEM: The lubrication system incorporates the usual full-flow oil filter. Oil is delivered by a spur-gear pump which develops a normal 30 to 35-pound pressure at a vehicle speed of 30 mph. Oil from this pump flows through two longitudinal headers drilled into the right and left sides of the cylinder block. Branch passages from these headers feed the crankshaft, cam, and rocker arm shafts. Oil directed to the rocker arm shafts builds up pressure within the shaft passages. There are two holes in the rocker shaft for each rocker arm. One set of holes are at the bottom of the shaft, intersecting grooves under the loaded area of each rocker arm. The other set of holes are slightly offset with an angular passage in the rocker arms. This angular offset acts as a metering device to supply the upper end of rocker arms with the correct amount of oil. The timing chain receives its oil by a metered centrifugal flow provision and the cylinder walls are lubricated by an intermediate jet.

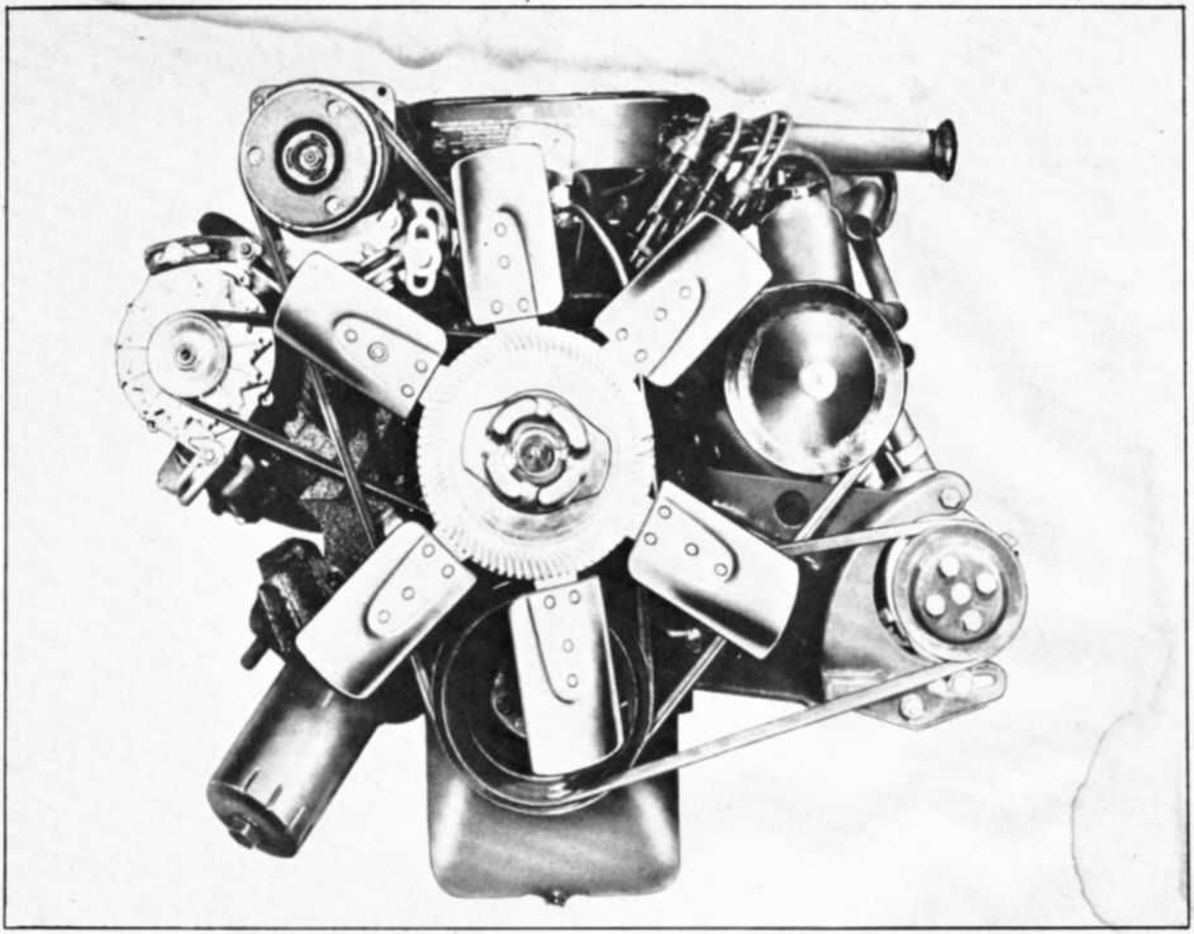
Above: Cadillac engine equipped with transmission and accessories for Eldorado front drive car. Eldorado uses the same engine as rear drive Cadillacs. The only difference is in the external parts, such as the oil pan, exhaust manifold, motor mounts, etc.

CHEVY 4 & 6 *4 has 153 cubic inches; 6 has 194 and 230*



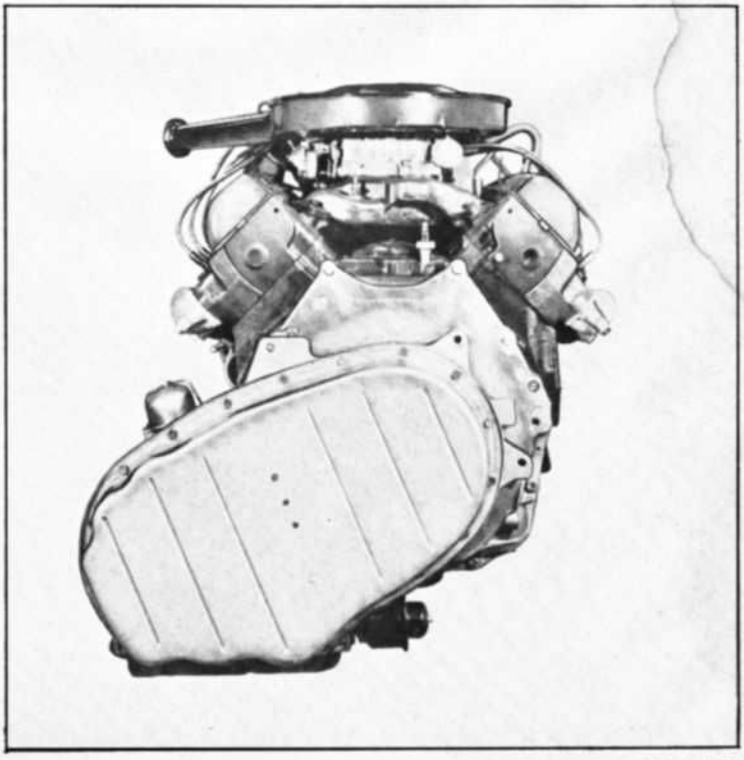
The Chevrolet four and small sixes are currently confined to usage in the Chevy II and Chevelle models. They were designed as economy packages and the larger of the sixes previously served as a standard engine in the full-sized Chevrolet models. The four-cylinder engine is essentially a chopped-down version of the sixes and many parts are interchangeable between all of the Chevrolet fours and sixes, including the 250-cubic-inch six introduced in 1966 and the 283-cubic-inch V8 of considerably earlier vintage. The four and the smallest of the sixes are especially noteable for their extremely compact overall dimensions. The basic concept of the engine was to produce exceptionally durable and economical units.

Type: A—In-line, Ohv 4. B,C—In-line Ohv 6.
Displacement (cu. in.): A—153. B—194. C—230.
Horsepower @ rpm: A—90 @ 4000. B—120 @ 4400. C—140 @ 4400.
Horsepower per cubic inch: A—0.58. B—0.61. C—0.60.
Torque (lbs. ft.) @ rpm: A—152 @ 2400. B—177 @ 2400. C—220 @ 16.00
Bore & Stroke: A—3.875 x 3.25. B—3.563. x 3.25. C—3.875 x 3.25.
Compression ratio: A—8.5. B—8.5. C—8.5.
Carburetion: A—1 1-bbl. B—1 1-bbl. C—1 1-bbl.
Approximate weight: A—365. B—460. C—465.
Weight-to-hp ratio: A—4.06. B—3.83. C—3.88.



Above: This shows the thermostatically controlled fan, and the many accessories driven by the front pulley. Clockwise, from left, are the alternator, air conditioner, power steering pump, and exhaust emission control pump.

Right: Rear view of the Cadillac engine equipped with Eldorado front drive transmission. Behind that large cover are two sprockets and a chain drive.

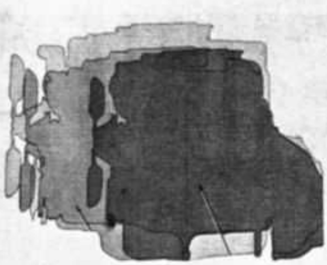


ENGINEERING EVOLUTION: The Chevrolet four and smallest six was introduced in 1962 for use in the Chevy II models. The larger of the two sixes was introduced in its current form in 1963.

GENERAL: The engines have an in-line configuration with pushrod-actuated overhead valves and hydraulic tappets. Cylinder blocks and cylinder heads are cast alloy iron. The combustion chambers have a modified wedge design with the valves in line and slightly tilted toward the manifold side. The cylinder bore spacing in all of these engines is 4.4-inches. The stroke in both the four and sixes is 3.25 inches. Cylinder bores in the four and largest six is 3.875 while the 194-cubic-inch six has a 3.563 bore. Horsepower developed by the engines in the order of their respective displacement is 90 at 4000 rpm, 120 @ 4400 rpm, and 140 at 4400 rpm. Torque peaks in the same respective order are 152 lbs. ft. at 2400 rpm, 177 at 2400 rpm, and 220 at 1600 rpm. All engines have a common 8.5:1 compression ratio. Carburetion is supplied by one single-barrel carburetor.

PISTONS: Pistons in all engines are cast aluminum alloy and have slipper-type skirts. All have flat head configurations. The heads on pistons in the four and largest six, however, are notched for clearance. The rings in all engines are similar. Compresison rings are cast iron alloy with a chrome-plate finish on the top ring and a wear-resistant finish on the bottom ring. The oil control ring is a multi-piece assembly consisting of two chrome-plated steel rails and a steel expander spacer. Piston pins in all engines are also identical. These pins are fabricated from chromium steel and have a .9270-.9273-inch diameter. The pins are locked in the connecting rods and float in piston bores which are offset .060 toward the major thrust side of the engine. Connecting rods are similar in all engines. The rods are drop-forged steel, weigh 12.5 ounces and have a nominal five-inch length Connecting rod bearings may be either copper-lead alloy or sintered copper-nickel-backed babbitt on steel backs. Overall length of the rod bearings is .807.

CRANKSHAFT: The crankshaft in the four-cylinder model may be either cast nodular iron or forged steel at the manufacturer's option. Rubber-mounted inertia dampers are used on all shafts except in the case of the four-cylinder model fitted with a cast iron unit. The four-cylinder engine has five main bearings and the sixes have seven bearings. Crankshaft thrust is absorbed by the #5



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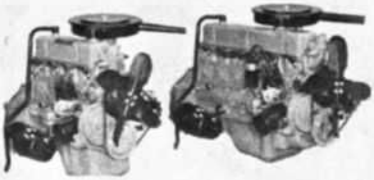

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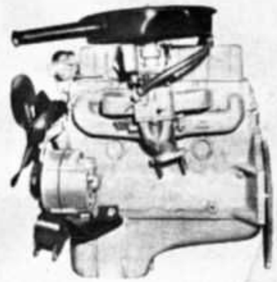

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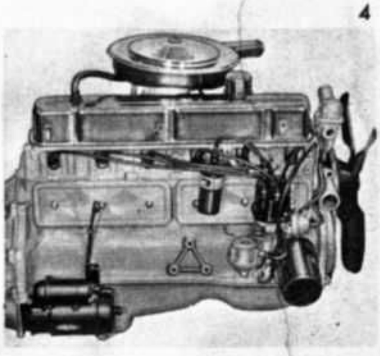

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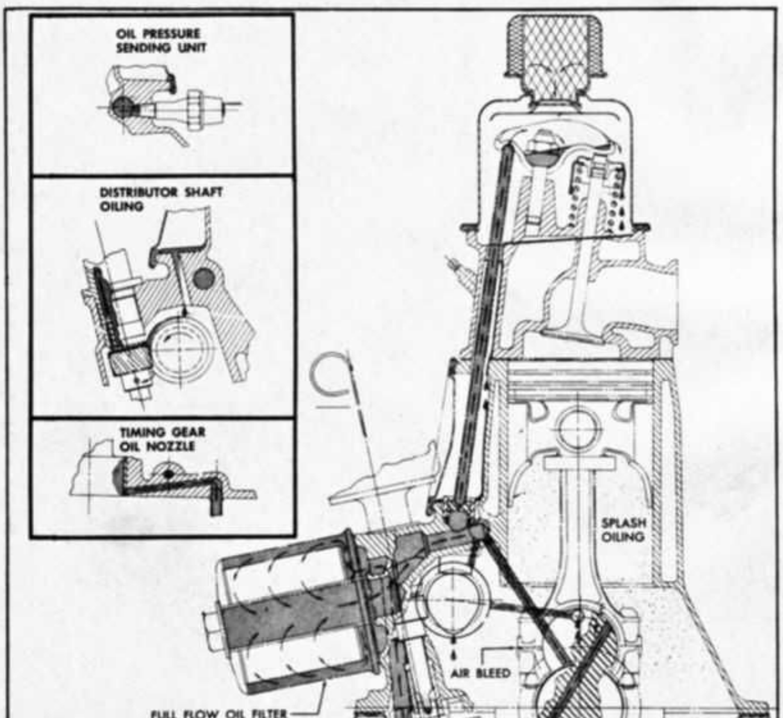


5

1. First engine is 153-cubic-inch power-plant offered as companion to larger six-cylinder in the Chevy II and Chevelle. Second engine is the 194-cubic-inch six-cylinder, while last engine is 230 six.

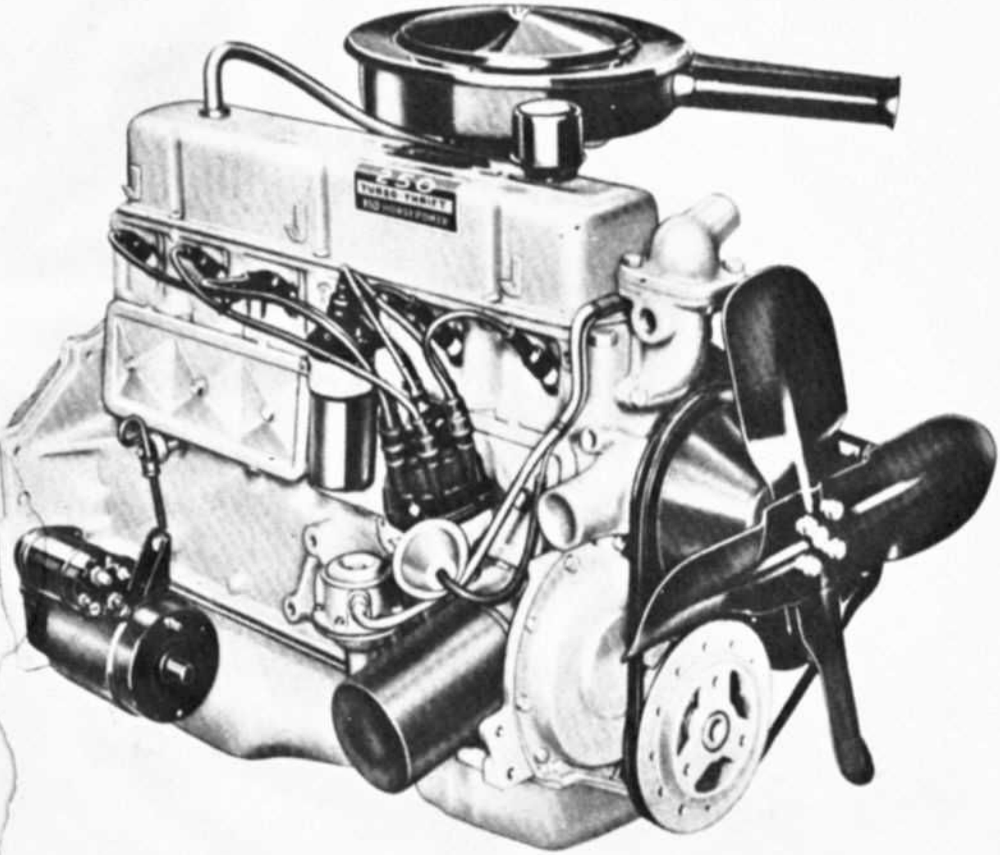
2. Four-cylinder (left) and six-cylinder Chevy II engines.

3. Small and compact four-cylinder is capable of 90 hp at 4000 rpm.

4. The 230-cubic-inch inline six is an exceptionally durable and economical unit.

5. Intricate oiling system used in the six-cylinder unit. Note also stamped steel rockers as used in the bigger Chevy V8's.

CHEVY BIG 6 *250 cubic inches*



The 250-cubic-inch Chevrolet six was considered one of the few all-new engines when introduced in 1966. Although this engine resembles the company's 230-cubic-inch model in basic design, there are sufficient departures in construction which gave the engine qualified status as a new product rather than an updating of an older one. The engine is obviously designed to provide an economy package with a horsepower output that represents a middle-ground between a four-cylinder model, two smaller sixes, and the 283-cubic-inch V8 presently in current production. The 1967 version of the powerplant is essentially similar to the 1966 model.

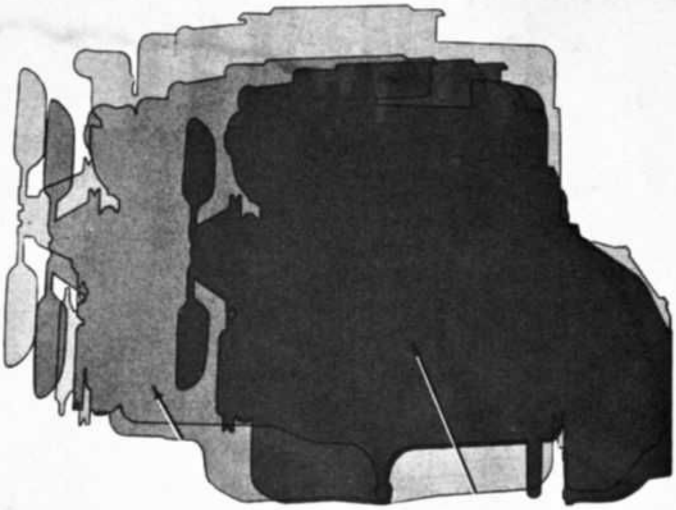
Type: In-line, Ohv 6
Displacement (cu. in.): 250.
Horsepower @ rpm: 155 @ 4200.
Horsepower per cubic inch: 0.62.
Torque (lbs. ft.) @ rpm: 235 @ 1600.
Bore & Stroke: 3.875 x 3.53.
Compression ratio: 8.5.
Carburetion: 1 1-bbl.
Approximate weight: 475 lbs.
Weight-to-hp ratio: 3.06.

ENGINEERING EVOLUTION: The new Chevrolet 250-cubic-inch six is almost identical in outward dimensions and appearances to the earlier-design 230-cubic-inch model. Internal differences are considerable. The crankshaft in the new engine has 12 counterweights intended to increase engine smoothness and decrease main bearing loading. Other differences include greater water-jacket space in the cylinder head in the area of the exhaust valves, a longer stroke which necessitated changes in piston and oil pan design, plus a camshaft with slightly different characteristics.

GENERAL: The engine has a six-cylinder, in-line configuration with pushrod actuated overhead valves and hydraulic tappets. Material used in the cylinder heads and block are cast alloy iron. The bore is 3.875-inches and the stroke 3.53 inches. It is rated at 155 horsepower at 4200 rpm and its torque peak reaches 235 lbs. ft. at 1600 rpm. The relatively low 8.5:1 compression ratio allows the use of regular fuel. Fuel and air are delivered to the cylinders by a single one-barrel carburetor. The entire design is characterized by the successful reduction in unnecessary weight and this is reflected in a very favorable ratio of weight-to-horsepower output.

PISTONS, RINGS, PINS, RODS: The pistons are cast aluminum alloy with a flat notched head and slipper skirt. Bare piston weight is 20.8 ounces. Both compression rings are cast alloy iron with a chrome-plate finish on the top ring and a special wear-resistant coating on the second ring. The oil-control ring is a multi-piece type consisting of two chrome-plated stainless steel rails and a steel spacer-expander. Piston pins are chromium steel with a .9270 - .9273-inch diameter. The pins are locked in the connecting rods and float in the piston pin bores. These bores are offset .060-inch toward the major-thrust side of the engine. The connecting rods are drop-forged steel and weigh only 12.5 ounces. Rod bearings may be either copper-lead alloy or sintered copper-nickel-backed babbitt on a steel shell. These bearings are .807-inch in length.

CRANKSHAFT: The 12-counterweight, seven-bearing crankshaft is cast from nodular iron. A rubber-mounted, inertia-type damper is used at the snout of this crankshaft. Main-bearing journal diameters measure 3.0004 inches and all main bearings have an equal .752-inch length. Crankshaft thrust is taken on the #5 bearing. Crankpin journal diameters are 1.999-2.000 inches.



The large silhouette is the big six, next is the small six, and then the Chevy II four cylinder. Outwardly, there is little difference in the two sixes, but inside is a great difference.

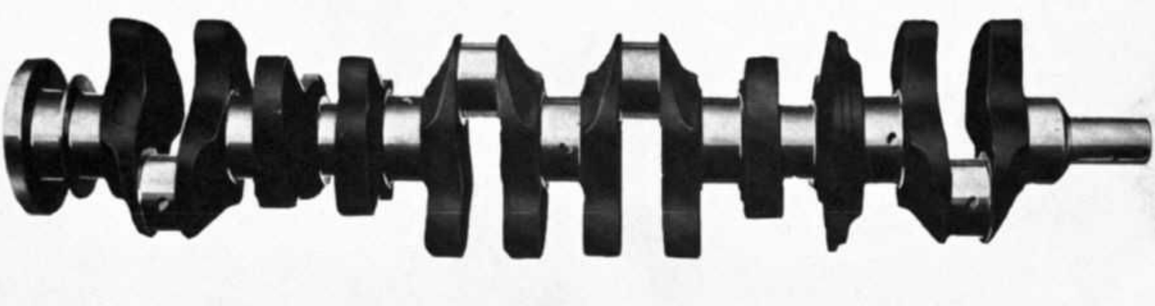
CAMSHAFT: The gear-driven camshaft is cast alloy iron and rides in four steel-backed babbitt bearings. A steel gear on the crankshaft meshes with a gear on the camshaft composed of a Bakelite and fabric rim on a steel hub. Lobe configurations on the shaft provide a 336-degree valve duration on both the intakes and exhausts with a 125-degree, 30-minute overlap. The lift on both intakes and exhausts is .388-inch.

VALVES: Both intake and exhaust valves are alloy steel. Maximum head diameters are 1.725 inches on the intakes and 1.505 inches on the exhausts. Valve seats in the cylinder head are machined to a 46-degree angle and the seating surface on the valves is finished to a 45-degree angle. Single valve springs are used which exert a 56- to 64-pound pressure in the closed position and a 180- to 192-pound pressure when the valves are open.

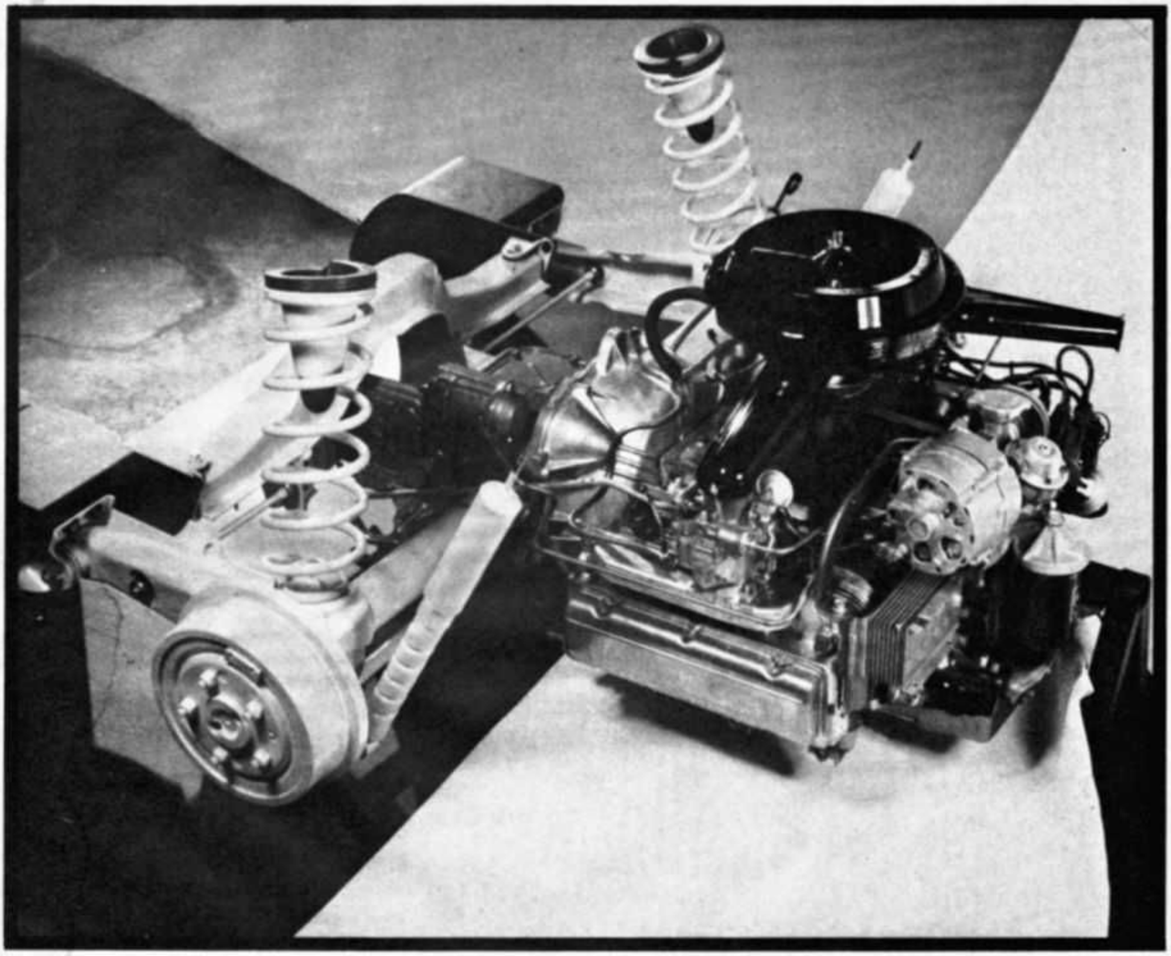
FUEL SYSTEM: Fuel is delivered to the carburetor by an engine-mounted mechanical pump at 3.5 to 4.5 psi. Filtering is accomplished by a fine-mesh plastic strainer in the gasoline tank and a sintered bronze filter in the carburetor inlet. When the engine is used with a manual transmission a Rochester 7026027 carburetor is employed. With Chevrolet's Powerglide automatic, a Rochester 7026028 is used. Both carburetors have a single 1.56-inch diameter barrel.

LUBRICATION SYSTEM: Oil is delivered to the full-flow-filter system by a gear-type pump which develops 30-45 psi at a 1500 rpm crankshaft speed. The main bearings, connecting rod bearings, camshaft bearings, and tappets are full-pressure lubricated. Cylinder walls are oiled by throw-off from the connecting rod bearings. The timing gears are lubricated by a nozzle in the system.

The 250-inch crank has seven mains and twelve counterweights which results in a much smoother running engine.



CORVAIR FLAT 6 *164 cubic inches*



The Chevrolet Corvair engine is completely unique in basic design concept when compared with other stock-car engines of American manufacture. It is the only current American engine with a flat-opposed, six-cylinder configuration; it is the only air-cooled engine; and the only engine utilizing aluminum in its cylinder heads and crankcase. The four-carburetor 140-horsepower and turbocharged 180-horsepower models available in 1966 have been dropped from production. The 1967 versions of the 95 and 110-horsepower models are relatively unchanged from those produced in 1965. These engines have proved to be reliable and highly efficient from both an economy and high-performance viewpoint.

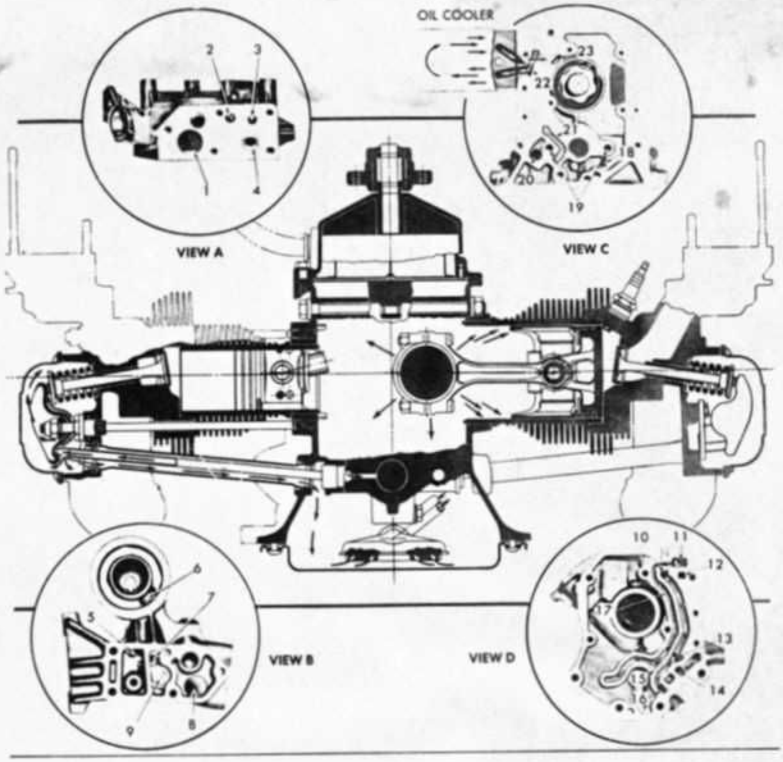
Type: Flat opposed, ohv 6.
Displacement (cu. in.): A—164. B—164.
Horsepower @ rpm: A—95 @ 3600. B—110 @ 4400.
Horsepower per cubic inch: A—0.57. B—0.67.
Torque (lbs. ft.) @ rpm: A—154 @ 2400. B—160 @ 2800.
Bore & Stroke (in.): 2.4375 x 2.94.
Compression ratio: A—8.25. B—9.25.
Carburetion: A—2 - 1 bbl. B—2 - 1 bbl.
Approximate weight: A—340 lbs. B—340 lbs.
Weight-to-hp ratio: A—3.57. B—3.10.

ENGINEERING EVOLUTION: The Corvair engine made its debut in the fall of 1959. This original version had a 3.375-inch bore and 2.60 stroke to establish the displacement at 140 cubic inches. In 1961 the displacement was increased to 145 cubic inches by enlarging the bore to 3.4375, and in 1964 the stroke was increased to 2.94 to establish the displacement at its current level of 164 cubic inches. During the 1959-1966 period there have been many modifications to improve the reliability and performance of the engine; however the basic configuration has remained unchanged.

GENERAL: The Corvair engine is a flat-opposed six with pushrod-operated overhead valves and hydraulic tappets. A box-like cast aluminum crankcase is the central structural member. This crankcase is divided along a vertical centerline and each half has three openings which accept the lower ends of individual cast-iron cylinder barrels. The crankcase halves are secured together by short bolts at the parting line. There are no conventional main bearing caps as the two halves of the crankcase surround the crankshaft journals and their bearings. Long studs thread into this crankcase to retain the cylinder barrels by passing through the cylinder heads. The heads are cast from aluminum in banks of three and are finned for cooling. The front of the engine is the flywheel end and a separate light-alloy bell housing is bolted to the crankcase. At the rear of the crankcase is another light-alloy housing which provides for the oil pump, primary oil galleries, and crankshaft seal. This housing also serves as a mounting for the distributor, alternator adaptor, fuel pump, oil filter tube, oil filter, and the cooling blower belt idler pulley. A cast aluminum cover, which serves as a base for the cooling-air blower, is secured to the top of the crankcase. The four versions of the engine produce 95 horsepower at 3600 rpm, 110 hp at 4400 rpm, 140 hp at 5200 rpm. Torque developed by these engines is 154 lbs. ft. at 2400 rpm, 160 lbs. ft. at 2800 rpm, 160 lbs. ft. at 3600 rpm, respectively. Compression ratios are 8.25 in the 95-hp model, 9.25-to-1 in the 110 hp version, and the same in the 140-horsepower engine.

COOLING SYSTEM: Cooling air for the engine is supplied by centrifugal-type blower mounted horizontally above the top center of the engine and driven by a V-belt from the crankshaft pulley. The blower impeller is an 11-blade magnesium casting with a 11.2-inch overall diameter. This blower delivers 1460 cubic feet of air per minute at a 4000 rpm engine speed. Cooling air is admitted to the blower through a circular opening in the sheet metal shroud which surrounds the engine. Leaving the blower, discharge air is passed downward through the cooling fins on the cylinder heads and barrels, then leaves the shrouding through two openings at the rear-bottom of the enclosure. Engine temperature is controlled by damper doors in the discharge openings which are actuated by thermostats.

PISTONS, RINGS, PINS, RODS: The cast-aluminum pistons have a flat-head configuration and are the slipper-skirt type.



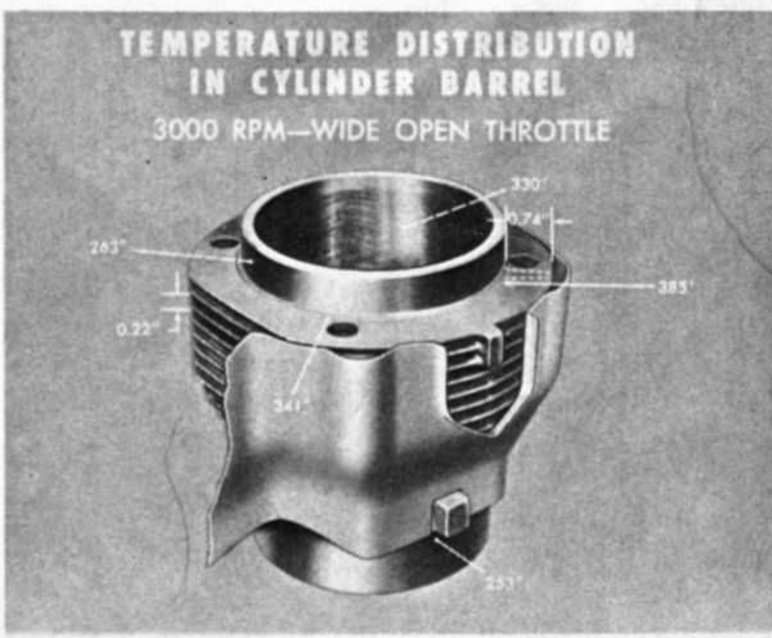
Engine Lubrication

View A Top face of engine rear housing
View B Bottom face of oil filter and Delcotron adapter
View C Rear of engine crankcase
View D Front face of engine rear housing

NOTE: • Face of oil filte and Delcotron adapter shown in View "B" mounts to top face of engine rear housing shown in View "A."
• Front face or engine rear housing shown in View "D" mounts to rear face of engine crankcase shown in View "C."

1. Oil Filler Inlet
2. To Oil Filter
3. To Oil Cooler
4. Oil Cooler By-Pass Valve
5. Oil Filter Outlet
6. Oil Filter Element Inlet
7. Oil Filter Inlet
8. Oil Filler Inlet
9. Oil Filter By-Pass Valve
10. To Oil Filter
11. Oil Cooler By-Pass Valve Exit
12. To Oil Cooler from the Oil Filter
13. Oil Pressure Regulator Entrance
14. Oil Pump Inlet
15. Oil Passage to Main Oil Gallery Left Side
16. Oil Pump Outlet
17. Oil from Oil Cooler
18. Entrance to Crankcase Sump
19. Main Oil Galleries
20. Oil Pump Suction
21. Oil Pump Outlet Cavity
22. Oil Cooler Inlet
23. Oil from Cooler to Main Galleries

1



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1. Corvair oil circulation system.

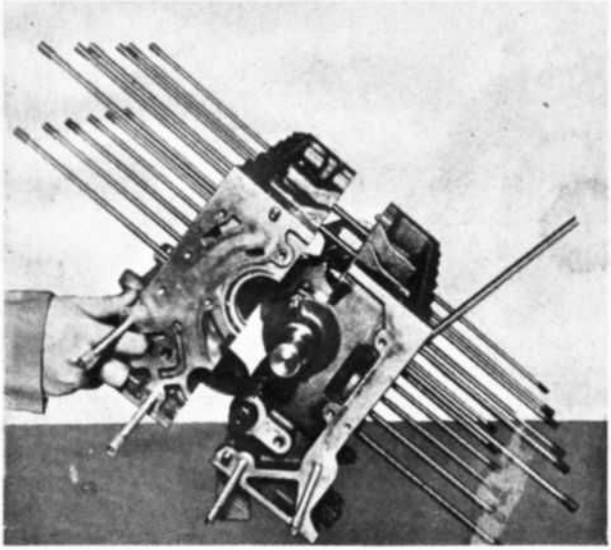
2. Cylinder temperature at different points.

These pistons weigh only 15.5 ounces without rings and pins. The top compression rings in the 95-and 110-horsepower versions are cast iron with a chrome-plated finish. In the 140-and 180-horsepower versions, they are cast iron with a chrome-plated finish. In the 140-and 180-horsepower versions, the top compression ring is a high-strength ductile iron with a molybdenum coating. The bottom compression ring in all versions is cast iron with a special wear-resistant coating. Oil control rings are a multi-piece type using two chrome-plated rails and a combination spacer-expander. The piston pins are chromium steel and have a nominal diameter of .800. These pins are locked in the connecting rods and a free-floating fit in the pistons. Pin bores are offset in the pistons .055 to .065 toward the major thrust side of the engine. The connecting rods are drop-forged steel. Bearings in these rods are premium aluminum and have a .639-inch length.

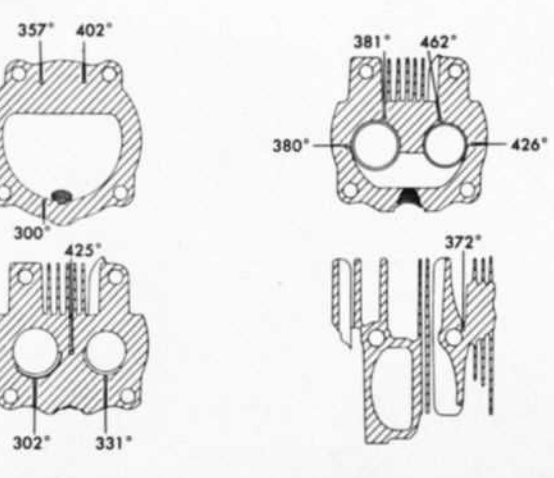
CRANKSHAFT: The crankshaft is forged alloy steel and has no counterweights. Balance is achieved by staggering the three pairs of throws at 60-degree intervals. A rubber-mounted inertia damper is used on the three higher-horsepower versions of the engine but omitted from the 95-horsepower model. Main bearing journal diameters are 2.1008 and the crankpin journals measure a nominal 1.80. Crankshaft thrust is absorbed by the #1 main bearing at the rear of the engine and has a .785-inch length. The other three bearings measure .752 in length. Material used for the main bearings is premium aluminum.

CAMSHAFT: The cast alloy iron camshaft has only nine lobes to actuate the 12 valves. Each of the exhaust lobes is double width to serve two valves. This is possible because of the alternate arrangement of the valves. The camshaft runs in bores machined into the crankcase and the aluminum crankcase material thus provides the bearing surface. Camshaft lobe configurations in the 95-horsepower version provide a valve opening duration of 312 degrees on the intakes, a similar opening on the exhausts, and a 98-degree overlap. In the 110- and 140-horsepower versions, the intake valve duration is 340 degrees, exhaust valves have a similar duration and the overlap is 118 degrees. The cam in the 180-horsepower version provides a duration of 372 degrees on the intakes and 360 degrees on the exhausts with a 152-degree overlap. The valve lift for both intake and exhausts on the 95-hp engine is .403. On the 110-and 140-hp versions the lift is .409, and the 180-hp model has a .3196 lift. The camshaft is a gear-driven by a steel ge..r on the crankshaft and cast aluminum gear on the cam.

Crankcase splits into two sections for shaft removal.



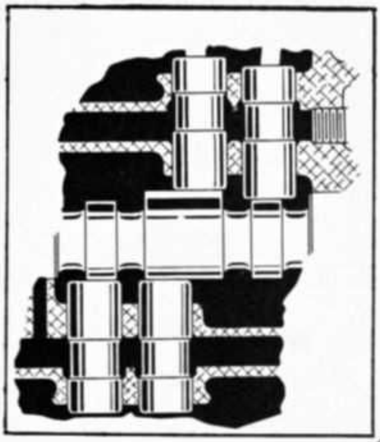
Head temperatures at various points.



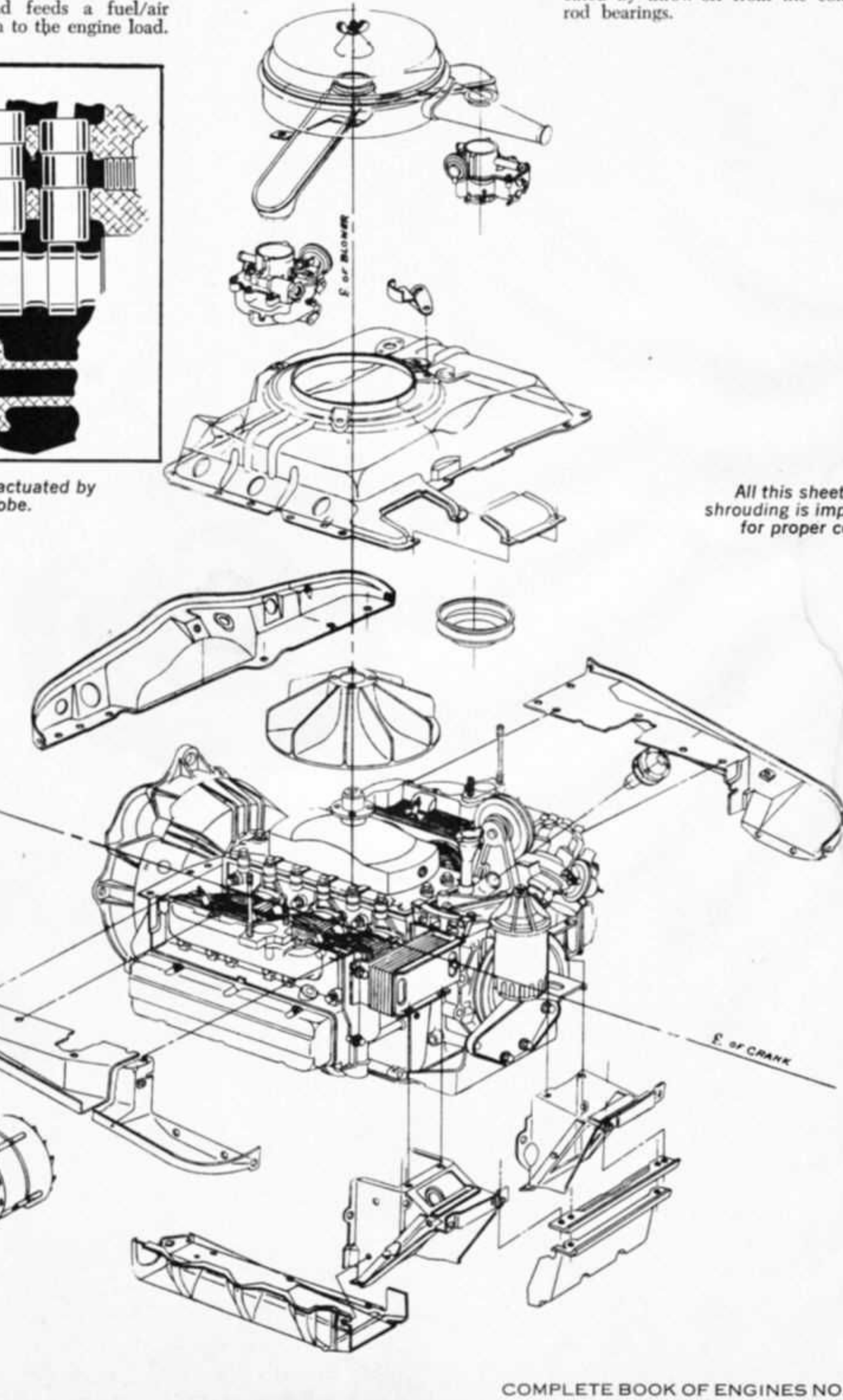
VALVES: The intake valves in all Corvair engines are high-alloy steel with an aluminized face. Maximum head diameters of the 95-,110-, and 180-hp versions are 1.345 inches, while the 140-hp engine intakes measure 1.725 at their maximum head diameter. Sintered-alloy iron inserts pressed into the relatively soft aluminum cylinder heads provide a seating surface for these intake valves. The exhaust valves in the 95-, 110-, and 140-hp versions are high alloy steel with a cobalt-based alloy face. Exhaust valves in the 180-hp model are a combination of a chromium-silicon alloy steel stem with a Superalloy (nimonic 80-A) head and neck. Seats for the exhaust valves in the cylinder heads are a cast chromium-steel alloy. Both intake and exhaust valves are provided with a wedging action in their seats by a 45-degree angle in the seats and a 44-degree angle on the seating surface of the heads. Maximum diameters of the exhaust valves are 1.245 in the 95-,110-, and 180-hp versions while the 140-hp version exhausts have a 1.365 maximum head diameter. Single valve springs used in all Corvair engines exert a 78 to 86 pound pressure in the closed position and 170-180 pounds in the open position. Harmonic spring oscillation is controlled by a damper located within the springs. Hydraulic valve lifters are a necessity in the Corvair engine because the different rates of thermal expansion and contraction between the iron cylinder barrels and the aluminum cylinder heads and crankcase would make a controlled maintenance of valve lash extremely difficult under various operating conditions.

FUEL SYSTEM: In all Corvair engines, the fuel is supplied by a mechanical pump developing 5.50 to 7.50 psi at the outlet. Filtering in all models is accomplished by a fine-mesh plastic strainer in the fuel tank. Additional filtering is obtained by a sintered-bronze filter in the carburetor inlets on the 95-,110-,and 140-horsepower versions. A throw-away, paper-element filter is used on the 180-hp model which is located between the fuel pump and carburetor. On the 95- and 110-hp versions of the engine two Rochester 7026023 single-barrel, downdraft carburetors are used, one of each manifolded to opposite banks of cylinders. The 140-horsepower version uses four similar Rochester models with a slight difference in jets to accommodate the use of manual and automatic transmissions. The four carburetors on the 140-hp version are manifolded so that pairs supply opposite banks of cylinders. Barrel sizes of the carburetors on the 95-,110-,and 140-hp models are 1.25. The 180-horsepower engine uses a single Carter 3880786, triple venturi, sidedraft carburetor with a 1.50-inch barrel diameter. The turbo-super-charger on the 180-hp engine consists of a die-cast aluminum centrifugal compressor impeller and a high-temperature cobalt-base alloy turbine mounted on a common shaft. The shaft is supported by a one-piece, aluminum alloy bearing which is full-pressure lubricated by the engine oil pump. The exhaust gases used to drive the turbo-charger are ducted from the exhaust manifolds to the turbine housing and are discharged through a large-diameter exhaust pipe and muffler. No special controls are used since the turbo-charger output has been matched to engine demands and feeds a fuel/air mixture in proportion to the engine load.

LUBRICATION SYSTEM: The lubrication system incorporates a full-flow filter and is supplied by a gear-type pump developing 30 psi at 2400 rpm. Full pressure lubrication is supplied to the main bearings, connecting rod bearings, camshaft bearings, and tappets. The timing gears receive their oil by throw-off from the front main and cam bearing surfaces. Cylinder walls are lubricated by throw-off from the connecting rod bearings.

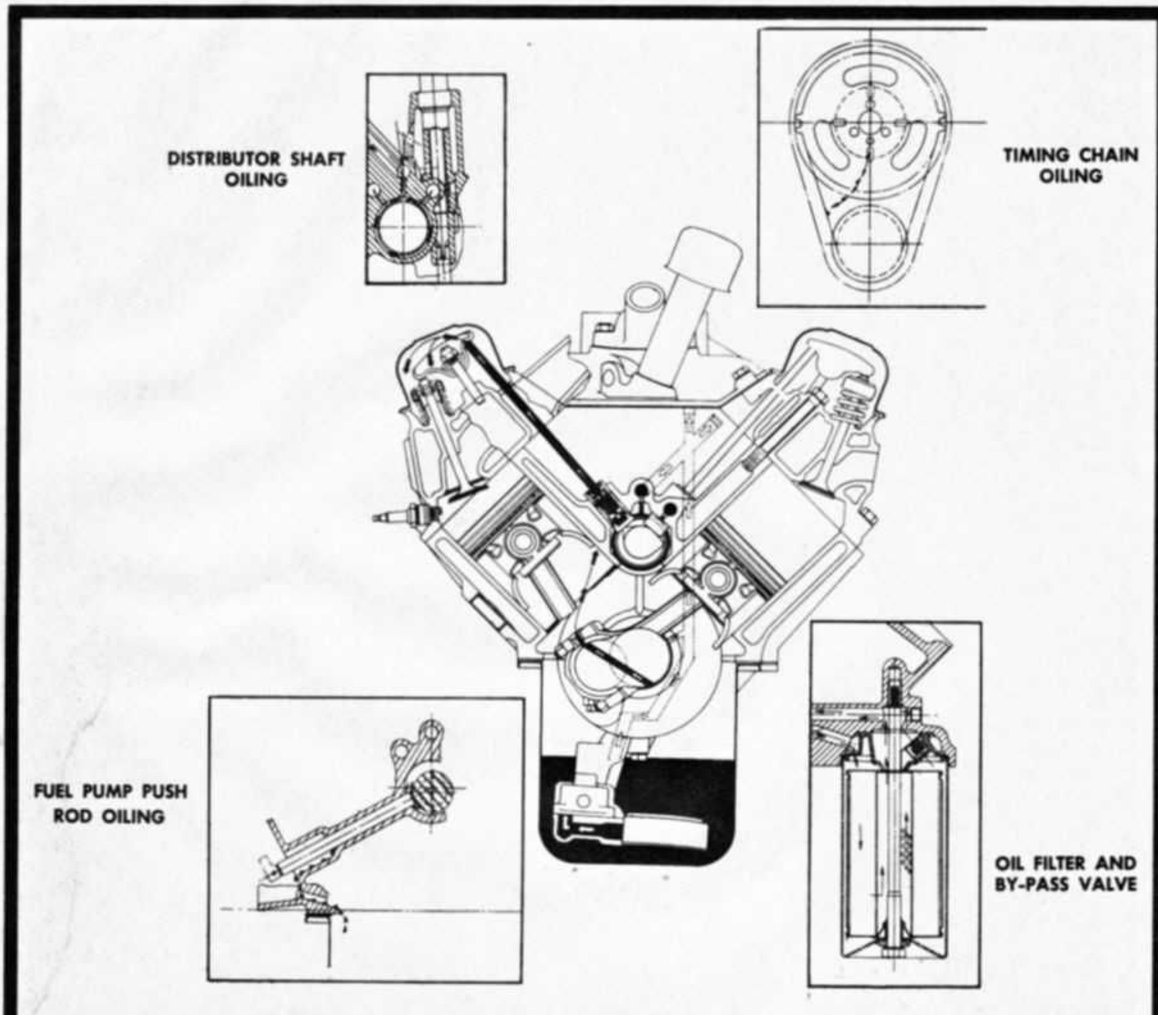


Two valve lifters are actuated by one extra-wide cam lobe.



All this sheet metal shrouding is important for proper cooling.

CHEVY SMALL V8 *283, 302, 327, and 350 cubic inches*



Often described as a "natural" because of its efficiency, the 283-cubic-inch Chevy engine remains a popular choice as an option in the full-sized Chevrolet, Chevelle, and Chevy II. A 300-hp version of the 327-cubic-inch series is standard in the Corvette. Optional choices of the 327 include a 275-hp model in the Chevrolet and Chevy II, a 325-hp version in the Chevelle, and a 350-hp version in the Corvette.

Type: Ohv V8.
Displacement (cu. in.): A—283. B—302. C,D,E,F—327. G—350.
Horsepower @ rpm: A—195 @ 4800. B—295 @ 6200. C—275 @ 4800. D—300 @ 5000. E—325 @5600. F—350 @ 5800. G—295 @ 4800.
Horsepower per cubic inch: A—0.68. B—0.98. C—0.84. D—0.92. E—0.99. F—1.07. G—0.87.
Torque (lbs ft.) @ rpm: A—285 @ 3200. B—NA @ NA. C—355 @3200. D—360 @ 34.00. E—360 @ 3600. F—360 @ 3600. G—380 @ 3200.
Bore & Stroke (in.): A—3.875 x 3.00. B—4.00 x 3.00. C,D,E,F—4.00 x 3.25. G—4.00 x 3.48.
Compression ratio: A—9.25. B—11.5. C—10.25. D—10.25. E,F—11.0. G—10.5.
Carburetion: A—1 · 2 bbl. B,C,D,E,F,G—1 · 4 bbl.
Approximate weight: A—580 lbs. B—590 lbs. C,D,E,F—610 lbs. G—620 lbs.
Weight-to-hp ratio: A—2.05. B—2.00. C—2.21 D—2.03. E—1.88. F—1.74. G—2.10.

ENGINEERING EVOLUTION: The smallest of the Chevrolet V8's was introduced as a 265-cubic-inch model in 1955 and shortly thereafter upgraded to 283 cubic inches. The 327-cubic-inch version is also a direct descendant of the early 265 as is evident from its basic design, very similar overall dimensions, and the 4.4-inch bore spacing which has been carried over from the original 265-cubic-inch model. The 283 and 327 are basically overbored versions of the 265; however, the stroke is greater in the 327 than in the 283.

GENERAL: The small Chevrolet V8's have a 90-degree cylinder bank configuration and overhead valves actuated by hydraulic lifters. These engines were designed to be very compact and light in weight. The cylinder block measures only 21.78 inches in length and 9 inches from the crankcase parting line to the cylinder-head deck. This cast iron cylinder block was designed to save all possible weight without sacrifice of strength. The parting line at the oil-pan bolting face of the crankcase is only ⅛ inch below the crankshaft centerline and accounts for the low profile of the engine. To add strength in the critical main-bearing areas, the main bearing caps are located in a broached longitudinal slot. There is little ribbing in the crankcase. By spreading the main bearing bolt centers, however, and providing a deep section at the back, an extremely stiff and strong block casting was obtained. The cast iron cylinder heads were also designed to eliminate all excess weight. A pair of these heads weigh slightly less than the single head on the Chevrolet 250-cubic-inch in-line six. Combustion chambers in the engines are wedge shaped. The wedge is extremely pronounced and the squish area very restricted. Good combustion chamber design in the basic engine is undoubtedly a major contributing factor to its basic performance.

PERFORMANCE: The 1967 283-cubic-inch model is rated at 195-horsepower at 4600 rpm and 285 lbs. ft. torque at 2400 rpm. The lowest-powered version of the 327 is rated at 275 horsepower at 4800 rpm and 355 lbs. ft. torque at 3200 rpm. Second engine in the 327-power-scale is rated at 300 horsepower at 5000 rpm and 360 lbs. ft. torque at 3400 rpm. Next in line is the 327 rated at 325 horsepower at 5600 rpm and 355 lbs. ft. torque at 3600 rpm. Topping the 327 group is the version delivering 350 horsepower at 5800 rpm and 360 lbs. ft. torque at 3600 rpm. The compression ratio in the 283 is 9.25 to 1. Compression ratio in the 275- and 300-horsepower versions of the 327 is 10.1 to 1 and 11.0 to 1 in the 325- and 350-horsepower models. The 283 has a twin-barrel carburetor and all of the 327's are equipped with four-barrel carburetors.

PISTONS, RINGS, PINS, RODS: Pistons in the 283 and the 275- and 300-horsepower versions of the 327 are cast aluminum alloy with flat heads and slipper skirts. Those in the two higher-horsepower 327's are impact-extruded aluminum with domed heads and slipper skirts. Pistons in the 283 weigh 20.32 ounces. Cast pistons in the 327 weigh 21.6 ounces and the extrusions weigh 20.64 ounces. Upper compression rings in the 283 and the two lower-powered versions of the 327 have a chrome-plate finish and those in the higher-powered version have a molybdenum inlay. The lower compression rings in the 283 and the two lower-horsepower 327's have a wear-resistant coating and in the higher horsepower models a chrome-plate finish is used. Oil control rings in all engines are a three-piece type with two chrome plated steel rails and a stainless steel expander spacer. Piston pins in all engines are chromium steel and have a nominal .9272-inch diameter. The pins are locked in the connecting rods and float in the pistons. Pin bores in the 283 and two lower horsepower versions of the 327 are offset .06-inch toward the thrust side of the engines. In the two higher horsepower versions of the 327, the pin bores are on center. Connecting rods are drop forged steel and weigh 14.56 ounces. Rod bearings in the 283 copper-lead alloy are sintered copper, nickel-backed babbitt on steel. In the 327's, these bearings are premium aluminum. All rod bearings have a .807-inch length.

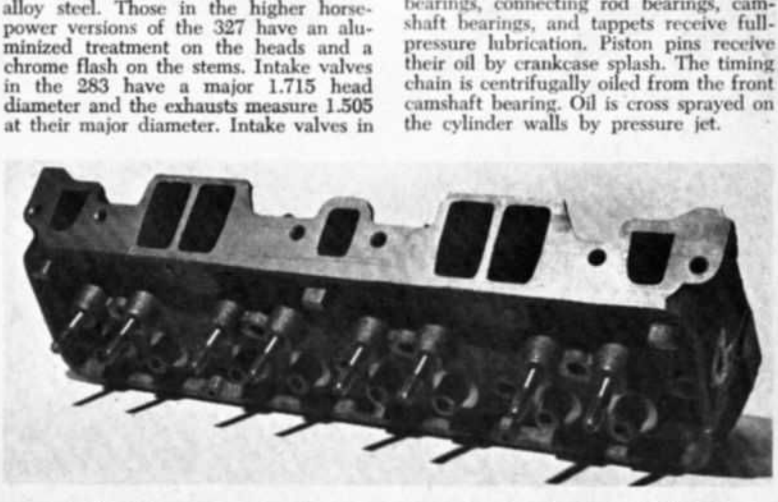
CRANKSHAFT: The crankshaft in the 283 is cast nodular iron and forged steel in the 327's. Main bearing journals have a nominal 2.3-inch diameter and the crankpins measure a nominal 2 inches. The main bearings are premium aluminum or copper-nickel-backed babbitt. Overall bearing length is .752 inch except for #5 which takes the thrust and measures 1.177 inches in length.

CAMSHAFT: The camshafts are cast alloy iron and ride in five steel-backed babbitt bearings. The timing chain meshes with a steel sprocket on the camshaft. In the 283, the camshaft sprocket is cast iron and in the 327's a cast-aluminum sprocket is used. Cam lobes in the 283 and in the 275- and 300-horsepower versions of the 327 give a 310-degree valve-opening-duration on the intakes and 320-degrees on the exhausts with a 90-degree overlap. The lift on the intake valves is .39 on the intakes and .41 on the exhausts. In the 325- and 350-horsepower models of the 327, the intake and exhaust valve duration is 322 degrees with a 114-degree overlap. Lift on both intake and exhausts is .3983 inch.

VALVES: Intake and exhaust valves are alloy steel. Those in the higher horsepower versions of the 327 have an aluminized treatment on the heads and a chrome flash on the stems. Intake valves in the 283 have a major 1.715 head diameter and the exhausts measure 1.505 at their major diameter. Intake valves in the two lower horsepower versions of the 327 have a 1.945-inch major diameter and the exhausts measure 1.505 at their major diameter. Intakes in the two higher horsepower 327's have a 2.070-inch major diameter and the exhausts measure 1.725 inches. Valve seats are finished to a 46-degree angle and the valve faces to 46 degrees. Single valve springs are used on all engines which exert 76 to 84 pounds when the valves are closed and 194 to 206 pounds when open. Spring dampers are employed to alleviate harmonic spring oscillations.

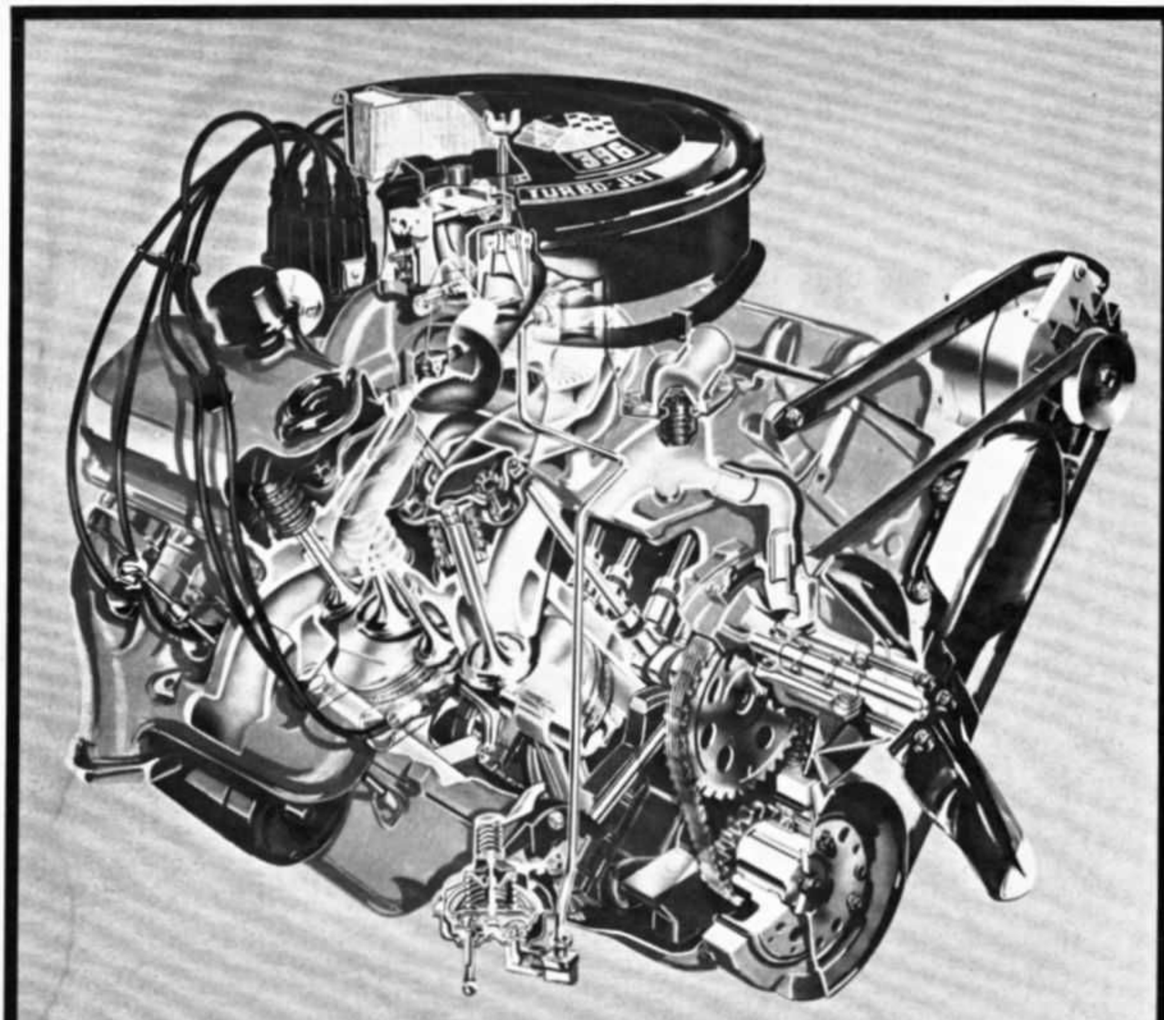
FUEL SYSTEM: Fuel is delivered by a mechanical pump on the engines which develops 5.25 to 6.50 psi. Filtering is accomplished by a fine mesh plastic strainer in the fuel tank and a sintered bronze filter at the carburetor inlet. A two-barrel Rochester carburetor on the 195-hp 283 has 1.44-inch diameter barrels. The 220-hp 283 is equipped with a four-barrel Rochester carburetion. This unit has 1.44-inch diameter in both the primary and secondary barrels. A variety of four-barrel carburetors is optional for the 275-hp 327. These include a Holley 3876747 with 1.44-inch primary and secondary barrels intended for use with a three-speed manual transmission. A Carter 3876749 and a Rochester 7026203 are intended for use when the 275-hp 327 is coupled to a four-speed manual transmission. Barrel diameters of the Carter are 1.562 in both the primaries and secondaries. The Rochester 7026023 has 1.38 primary barrel diameters and the secondaries measure 2.25 in diameter. When Chevrolet's Powerglide automatic transmission is coupled to the 275-hp 327 the carburetor may be a Holley 3875964, a Carter 3875966 or a Rochester 7026202. The barrel diameters of these carburetors are similar to those used with the manual transmissions. The 300-hp 327 is equipped with a Holley 3884505 and the 350-hp 327 with a Holley 3883914 four-barrel carburetor. Both primary and secondary barrel diameters are 1.562 inches in these units.

LUBRICATION SYSTEM: The engine lubrication incorporates a full-flow oil filter. Oil is delivered by a gear-type pump which develops 30 to 45 psi at a 1500 rpm crankshaft speed. The main bearings, connecting rod bearings, camshaft bearings, and tappets receive full-pressure lubrication. Piston pins receive their oil by crankcase splash. The timing chain is centrifugally oiled from the front camshaft bearing. Oil is cross sprayed on the cylinder walls by pressure jet.



Chevrolet head has retained wedge type combustion chamber since 1955.

CHEVY BIG V8 *396 and 427 cubic inches*



1

The lineup of big Chevrolet V8's offered as optional engines in the full-sized Chevrolet, Chevelle, and Corvette for 1967 remain structurally similar to those offered in 1966 except for minor revisions and some changes in horsepower rating. The 396-cubic-inch model rated at 325 horsepower is available in the Chevrolet and the Chevelle. A 350-horsepower version of the 396 is an exclusive option in the Chevelle. The 385-horsepower 427 is an option in the Chevelle. The 385-horsepower 427 is an option in the full-sized Chevrolet and the 390, 400, and 435-horsepower models are Corvette options.

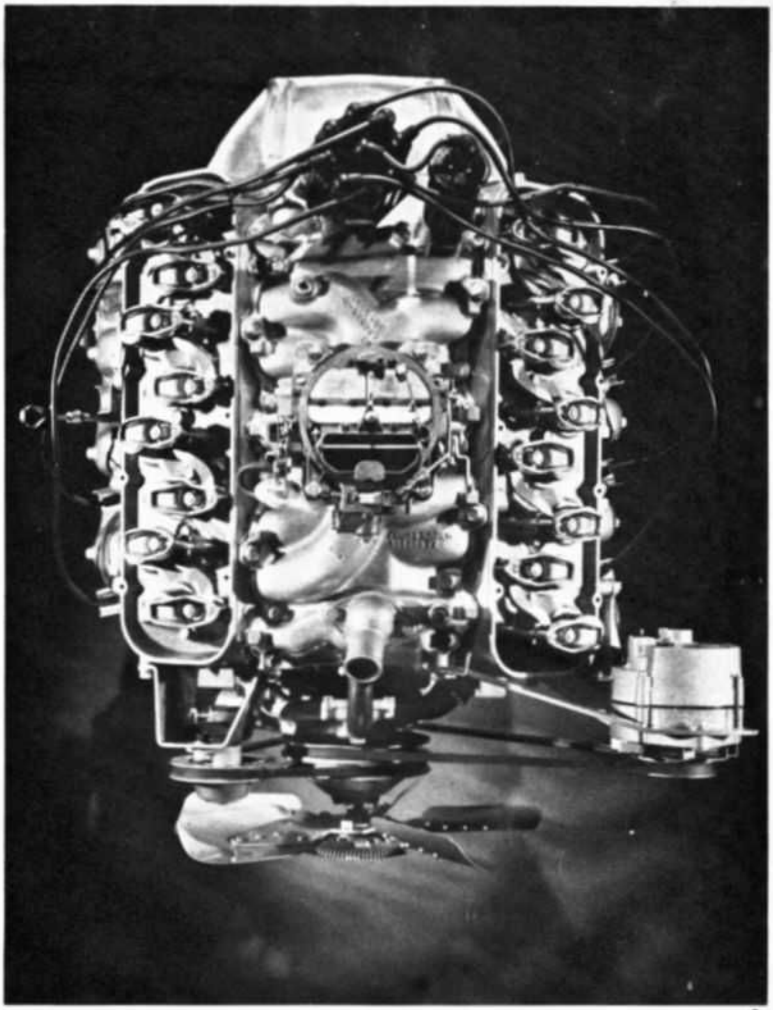
Type: OHV V8.
Displacement (cu. in.): A,B—396. C,D—427.
Horsepower @ rpm: A—325 @ 4800. B—350 @ 5200. C—390 @ 5400. D—400 @ 5400. E—435 @ 5800.
Horsepower per cubic inch: A—0.82. B—0.88. C—0.91. D—0.94. E—1.02.
Torque (lbs. ft.) @ rpm: A—410 @3200. B—420 @ 3600. C,D—460 @ 3600. E—460 @ 4000.
Bore & stroke (in.): A,B—4.00 x 3.25. C,D,E—4.25 x 3.76.
Compression ratio: A,B,C,D—10.25. E—11.0.
Carburetion: A,B,C,D—1 4-bbl. E,F—3 2-bbl.
Approximate weight: A,B—680 lbs. C—690 lbs. D,E—695 lbs.
Weight-to-hp ratio: A—2.09. B—1.94. C—1.77. D—1.74. E—1.60.

ENGINEERING EVOLUTION: The 396-cubic-inch Chevrolet engine was introduced in mid-1965 and its 427-cubic-inch companion made its debut at the beginning of the 1966 model year. The use of these engines in the company's automobiles led to a phasing out of the 409-cubic-inch engine which previously topped the line in displacement and power.

GENERAL: Probably the most unique feature in the big Chevrolet V8's lies in the arrangement of their valves which has led to them being dubbed as "porcupine heads." The intake and exhaust valves are tilted away from each other in both axis to improve the flow of intake and exhaust gases. This splayed valve pattern eliminates sharp bends in the valve ports and favors the induction and exhaust of gases by allowing the valves to open away from the rim of the combustion chambers and cylinder walls. The valves are push-rod-actuated through hydraulic lifters in all engines except the 435-horsepower 427 which uses solid tappets. All engines have cast iron cylinder blocks and heads set in a 90-degree V8 configuration. Bore spacing in both the 396 and 427-cubic-inch versions is 4.84 inches. The 396 has a 4.094-inch bore and the 427 bore measures 4.251 inches. A 3.76-inch stroke is common to both engines. Power ratings for the lower powered 396 is 325 horsepower at 4800 rpm and 410 lbs. ft. torque at 3200. The higher-powered version of the 396 is rated at 350 horsepower at 5200 rpm and 415 lbs. ft. torque at 3400 rpm. Lowest-powered version of the 427 is rated at 385 horsepower at 5200 rpm and 460 lbs. ft. torque at 3400 rpm. The next 427 is rated at 390 horsepower at 5400 rpm and 460 lbs. ft. torque at 3600 rpm. Next in line is the version developing 400 horsepower at 5400 rpm and 460 lbs. ft. torque at 3600 rpm. Top of the line is the engine delivering 435 horsepower at 5800 rpm and 460 lbs. ft. torque at 4000 rpm. This high-revving engine is fitted with a transistorized magnetic-pulse ignition system. All engines use four-barrel carburetors except the 400 and 435-horsepower 427's which are equipped with three twin-barrel units.

PISTONS, RINGS, PINS, RODS: Pistons in all of the engines have domed heads and slipper-type skirts. Those in the 435-horsepower 427 are impact extruded aluminum and all others are cast aluminum alloy. The top compression rings have a molybdenum inlay and the lower rings have a wear-resisting coating. The oil control rings in all engines are a three-piece type with two chrome-plated steel rails and a stainless steel expander spacer. The piston pins are chromium steel and have a .9895 to .9898-inch diameter. In the 435-horsepower 427 the pins are on center in the piston bosses and in the other engines are offset .055 to .065-inch toward the thrust side. Connecting rods are drop-forged steel. A special high-alloy steel is used in the 435-horsepower model. All rod bearings are premium aluminum.

CRANKSHAFT: The crankshafts are forged steel and are equipped with rubber-mounted inertia dampers. Main bearing journal diameters are a nominal 2.75 inches. The main bearings are a combination of premium aluminum and cop-



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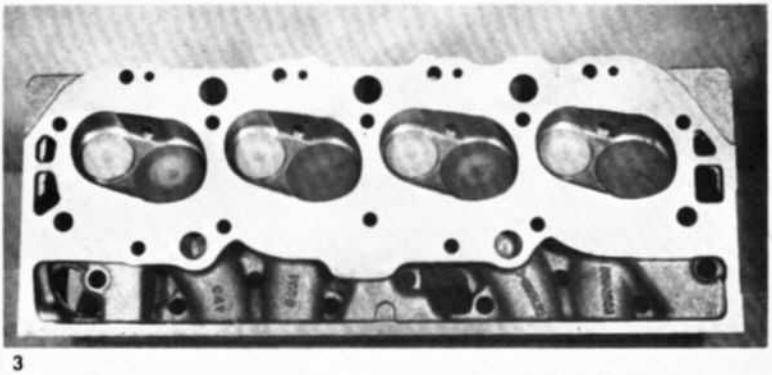

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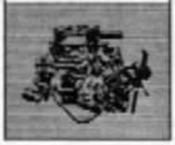
1. See-thru illustration of the 396-cubic-inch Chevrolet discloses the relationship of various internal mechanisms. Horsepower rating of the higher version is 350, while the lowest-powered version is rated at 325 horsepower.

2. Note the unusual "splayed" valve and rocker-arm arrangement of the Chevrolet 396 seen in this photograph taken from directly overhead. Carb shown is Rochester 4-barrel Quadrajet, but all '67's are standard equipped with Holley units.

3. Combustion chambers are 18 degrees off the longitudinal head axis and of the slightly modified wedge design. Spark plugs are nearly centrally located.



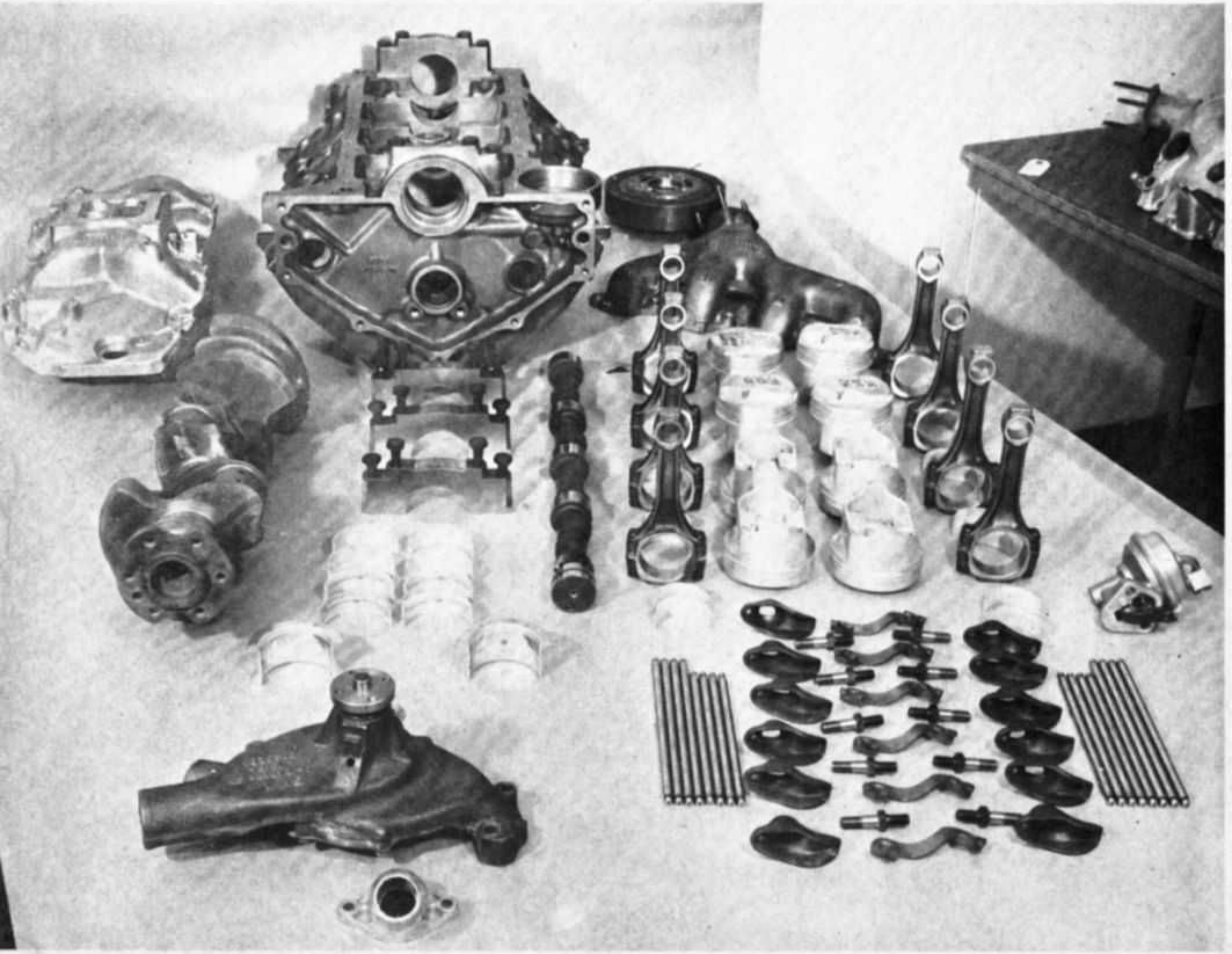
per-lead alloys. Main bearing length is .992-inch with the exception of #5 which measures 1.2525 inches. Main bearing caps in the 435-horsepower 427 are retained by four-bolt caps whereas all other versions of the engine use two-bolt caps. Crankpin journals have a 2.199 to 2.220-inch diameter.

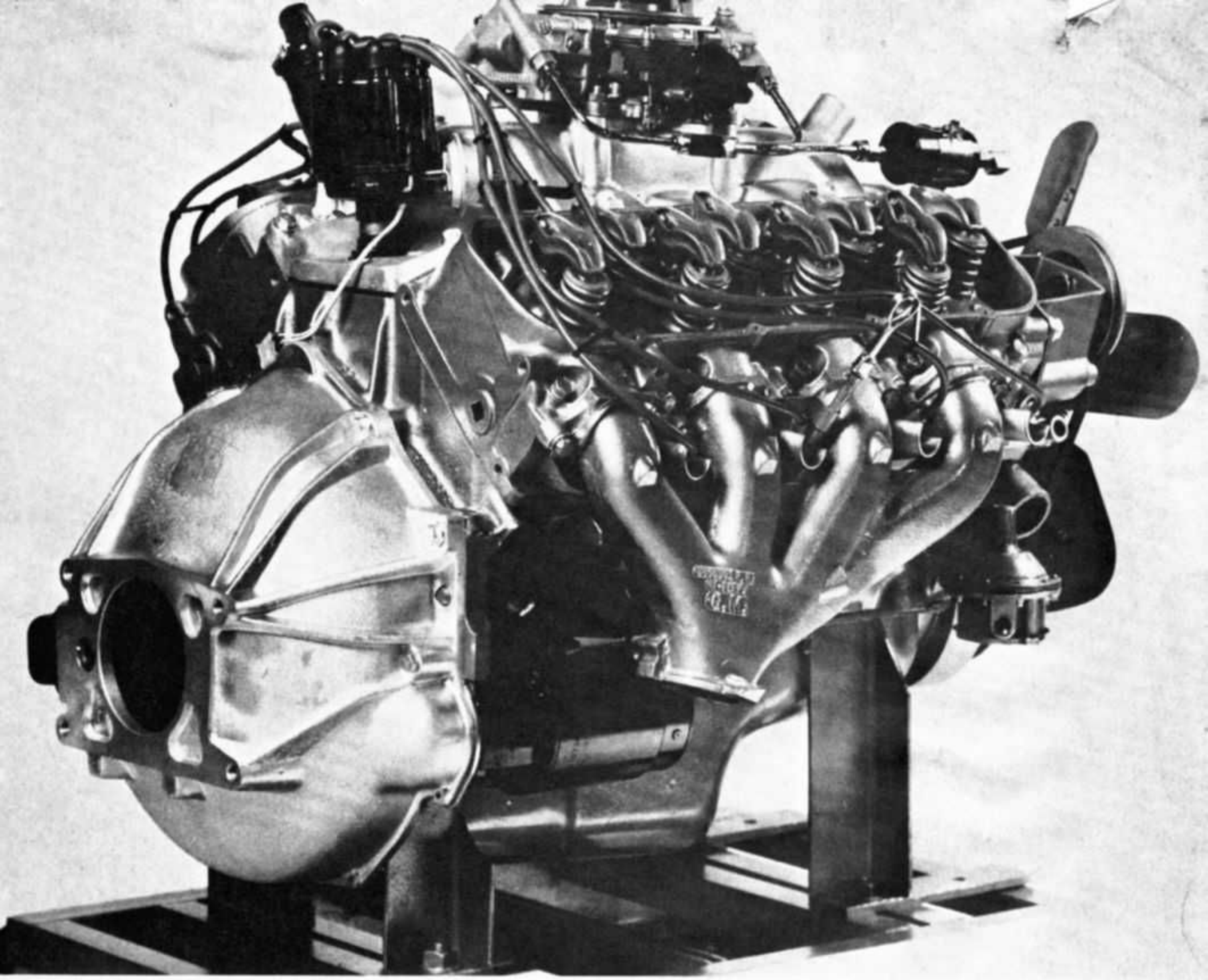
CAMSHAFT: The cast iron alloy camshafts are chain-driven and ride in five steel-backed babbitt bearings. A silent chain meshes with a steel sprocket on the crankshaft and a cast-aluminum sprocket on the camshaft. In the 325-horsepower 396 the intake and exhaust valve duration is 322 degrees with a 95-degree overlap. Valve lift on both the intakes and exhausts is a nominal .37 inch. The 435-horsepower 427 has a 316-degree opening on the intakes and 302 degrees on the exhausts with a 118-degree overlap. Valve lift on this high-performance engine is a nominal .52 inch on both intakes and exhausts. The balance of the engines have a 350-degree duration on the intakes and 352 degrees on the exhausts with a 95-degree overlap. Lift on the intakes is a nominal .46 inch and .48 inch on the exhausts.

VALVES: Intake valves are alloy steel and a special formulation of alloy steel is specified for the exhausts. Both intake and exhaust valves have aluminized faces and those in the 435-horsepower 427 have a chrome flash on their stems. Major head diameter of the intake valves in the 435-horsepower 427 is 2.195 inches and 2.070 in the other engines. Exhaust valves in all engines have a 1.725-inch major diameter. Valve seats are finished to a 46-degree angle and the seats to a 45-degree angle. Single valve springs operate in conjunction with oscillation dampers. Spring pressures on all engines are 94 to 106 pounds when the valves are closed and 303 to 327 pounds when the valves are open.

FUEL SYSTEM: Fuel filtering is accomplished by a fine-mesh plastic strainer in the fuel tank and a sintered-bronze filter in the carburetor inlet. An engine-mounted mechanical pump delivers fuel to the carburetors at 5.0 to 6.5 psi. Holley carburetors are used on all engines. The primary two-barrel units on the 400 and 435-horsepower models have 1.5-inch barrel diameters and the two secondary two-barrel units have 1.75-inch throat diameters. Four-barrel units used on the other engines have 1.561-inch primary and secondary barrel diameters.

LUBRICATION SYSTEM: Oil is delivered to the full-flow filtered system by a gear-type pump developing 50 to 75 psi at 2000 rpm engine speed. Main bearings, connecting rod bearings, camshaft bearings, and tappets receive full-pressure lubrication. The timing chain is centrifugally oiled by throw-off from the front camshaft bearing. Cylinder walls are lubricated by cross spray from pressure jets and the piston pins are oiled by crankcase splash.

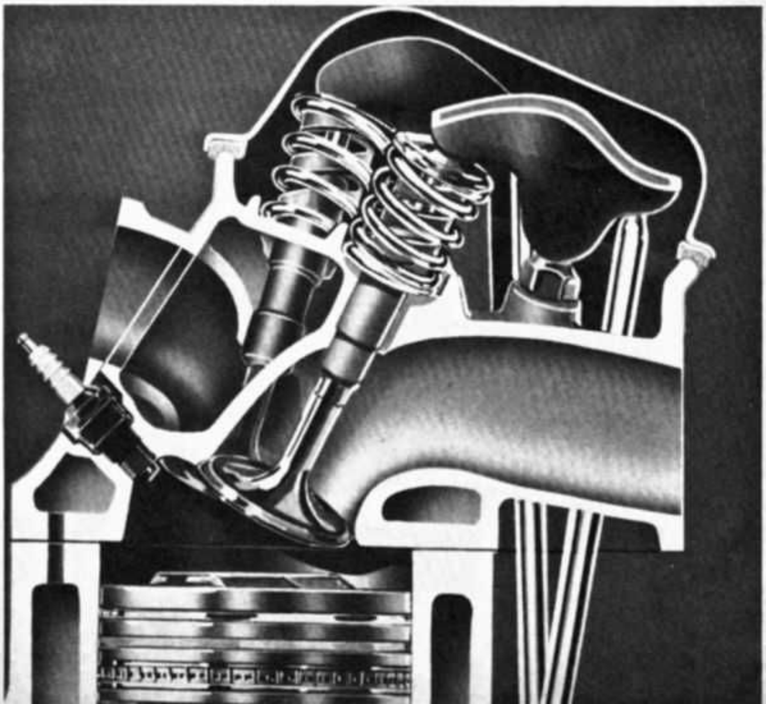




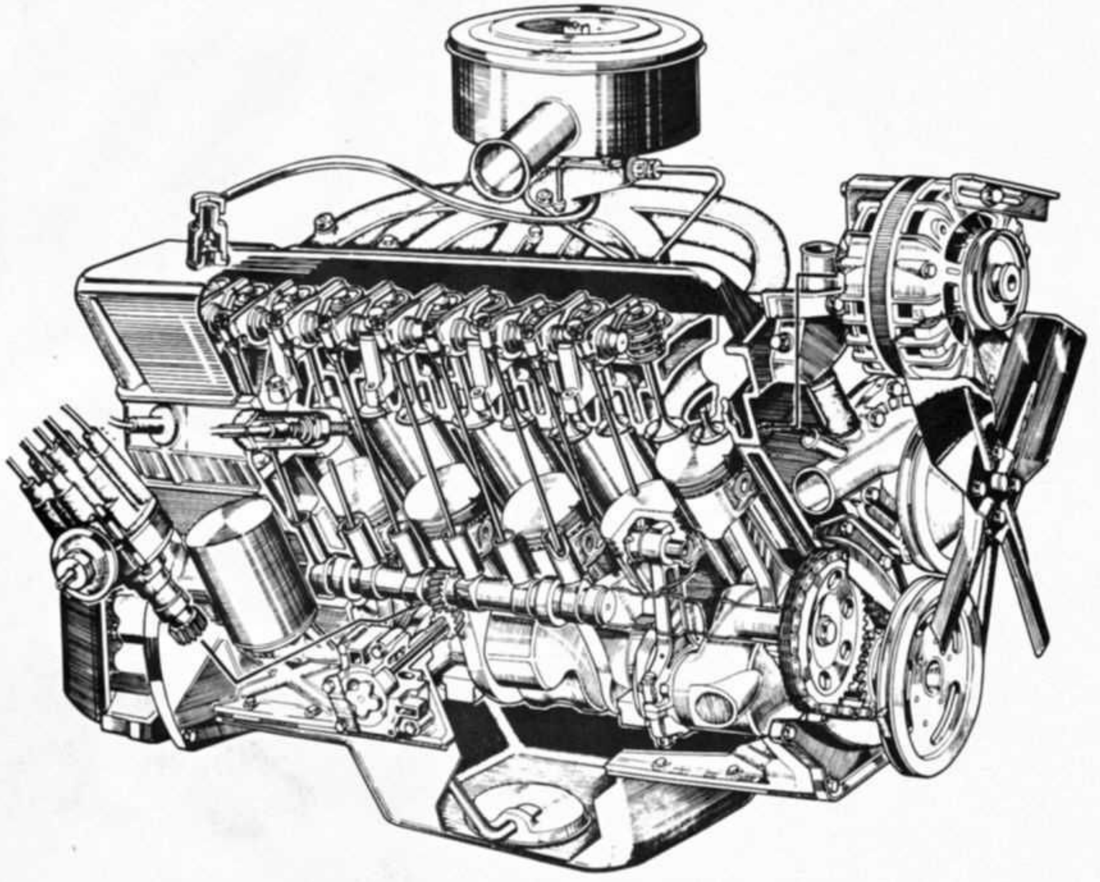
Above: Two versions of the 396-cubic-inch Chevrolet engine are available, one producing 325 horsepower, one 350 hp.

At left: The high performance V8 completely disassembled. Equipment includes aluminum inlet manifold, "header" type exhaust manifold, domed-head pistons and tilted intake and exhaust valves.

Right: Close-up of tilted valve setup. This unusual valve and rocker-arm arrangement led to the nickname of 'porcupine head' for the engine.



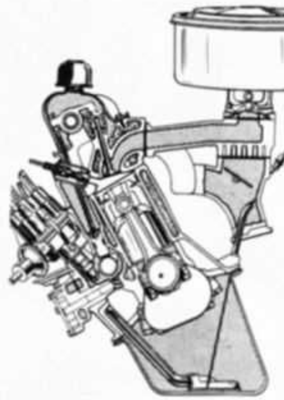
CHRYSLER SLANT 6 *170 and 225 cubic inch*



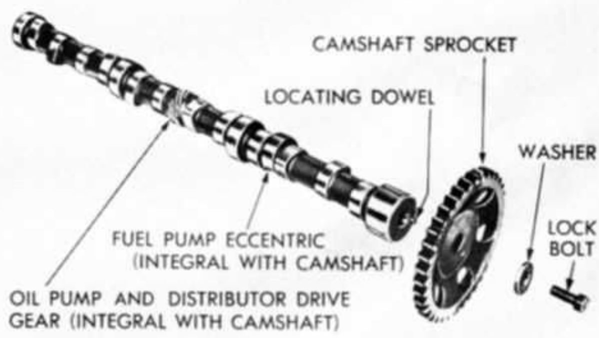
The two six-cylinder engines manufactured by the Chrysler Corporation have been continued virtually unchanged for 1967 except that the smaller engine has received a boost from 101 to 115 horsepower. The engines are unique in that their cylinders are inclined 30 degrees from the vertical. Advantages inherent in this design included the use of a lower hood line, the offsetting of accessories to reduce the total length of the engine and long intake passages between the carburetor and ports which contribute a ram effect to the induction system. The smaller slant-six is standard in the Dodge Dart and Plymouth Valiant. The larger engine is standard in the Dodge Coronet and the Plymouth Belvedere, Satellite, and Fury. This larger engine is also included in the options offered for the Dart and Valiant.

Type: Inclined, ohv 6.
Displacement (cu. in.): A—170. B—225.
Horsepower @ rpm: A—115 @ 4400. B—145 @ 4000.
Horsepower per cubic inch: A—0.68. B—0.64.
Torque (lbs. ft.) @ rpm: A—155 @ 2400. B—215 @ 2400.
Bore & Stroke (in.): A—3.40 x 3.125. B—3.40 x 4.125.
Compression ratio: A—8.5. B—8.4.
Carburetion: A—1 - 1 bbl. B—1 - 1 bbl.
Approximate weight: A—465 lbs. B—500 lbs.
Weight-to-hp ratio: A—4.04. B—3.45.

1. *The Chrysler slant six engine, with positive crankcase ventilation.*



2. *Cross-section of engine. Everything is slanted except the carburetor and oil filler cap.*



3. *Slant six camshaft. Camshaft sprocket is secured by only one bolt. A dowel keeps sprocket from turning on shaft.*

ENGINEERING EVOLUTION: The Chrysler Corporation sixes were introduced in 1960 as economy-class engines for use in the Dodge and Plymouth with an eye toward their adaptability for use in the compact versions of the lines. In 1961, Chrysler engineers developed a die-cast aluminum block for the 225-cubic-inch version of the engine. The aluminum block was soon dropped from production, however, because of manufacturing costs.

GENERAL: Both engines have an in-line configuration with the cylinders inclined 30 degrees from the vertical. Blocks and heads are cast iron. Bores in both engines are identical at 3.4 inches. In the 225, the stroke measures 4.125 inches which is a full inch longer than in the smaller engine. Bore spacing is 3.98 inches in the small engine. In the larger engine the bore spacing is 4.0 inches between the second, third, fourth, and fifth cylinders with a 3.98-inch spacing between the centers of the other two cylinders. The smaller engine develops 101 hp @ 4400 rpm and 155 lbs. ft. torque at 2400 rpm. The 225-cubic-inch version develops 145 hp at 4000 rpm and the torque peak is 215 lbs. ft. at 2400 rpm. Compression ratios are 8.5:1 in the smaller engine and 8.4:1 in the larger. Valves in both engines are actuated by solid tappets. Carburetion is provided in both versions by one single-barrel unit.

PISTONS, RINGS, PINS, RODS: The pistons are aluminum alloy which have been elliptically-turned and tin plated. A closed slipper-type design is used and the pistons have steel struts. Weight of these pistons is 16.4 ounces less the rings and pins. All three piston rings in the 170 are cast iron. The top compression ring is tin-plated and the second ring is Lubrite-coated. The oil control ring is uncoated and has a hump-type expander. Compression rings in the 225 are similar. However, the oil-control ring is a three-piece type with a stainless steel expander-spacer. Piston pins are high-manganese steel and have a .9008-inch diameter. These pins are a press fit in the connecting rods and float in the pistons. Pin bores in the pistons are offset .06-inch toward the right of the engine. Connecting rods are drop-forged steel and weigh 25.7 ounces in the 170 and 26.8 in the 225. Rod bearings are removable inserts with a lead-based babbitt face on steel backs. Overall length of these bearings is .985-inch.

CRANKSHAFT: The crankshaft is drop-forged steel and has a rubber-absorption-type damper at the front end. Main bearing journals have a 2.75-inch diameter and the crankpin journals measure 2.187-inches in diameter. Main bearings are lead-based babbitt on steel backs with the exception of #3 which takes the thrust and has a tin-base babbitt facing. The #3 bearing is 1.254-inch long and the others measure 1.034.

CAMSHAFT: The camshaft is hardenable cast iron with the oil pump and distributor drive gear cast integrally. Four steel-backed lead-based babbitt bearings support the shaft. The drive chain engages either a malleable cast iron or sintered-iron sprocket on the crankshaft and a cast iron sprocket on the camshaft. Camshaft characteristics identical in both engines. Intake valve lift is .371-inch, and exhaust lift is .364. Intake duration is 240 degrees and the exhaust duration 236 degrees with a 16-degree overlap.

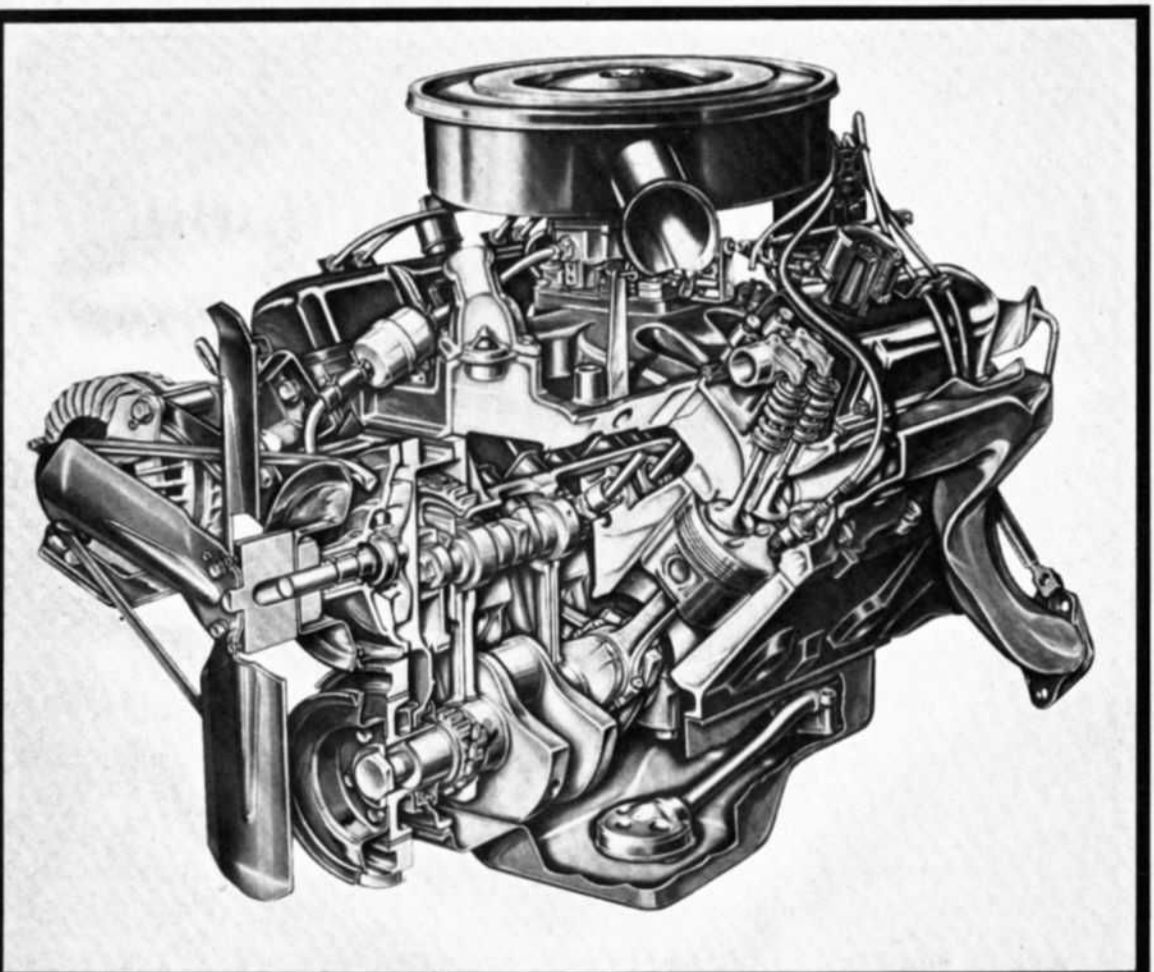
VALVES: The intake valves are SAE 1041 steel and have a 1.62-inch overall head diameter. Exhaust valves are forged from SAE 21-4N steel and their overall head diameter is 1.36-inch. Valve seats in the cylinder heads for the intake valves have a 45-degree angle and the seating faces of the valves are machined to a 45.5-degree angle. The exhaust valve seats are finished to a 47-degree angle and the valve seating faces to 47.5 degrees. Low-friction locks on the exhaust valves permits their rotation. Valve lash is specified at .013-inch on the intakes and .021 on the exhausts when the engine is hot. Single valve springs are used which exert 83 pounds when the valves are in the closed position and 177 pounds when the valves are open.

FUEL SYSTEM: Fuel is delivered to the carburetor by a mechanical pump on the engine which develops 4 to 5.5 psi. Filtering is accomplished by a plastic mesh strainer in the gasoline tank and a paper-element filter in the fuel line between the pump and carburetor. The 170-cubic-inch engine when coupled to a manual transmission uses a Ball and Ball BBS-4099S carburetor with a 1.56-inch barrel. When this engine is teamed with an automatic transmission a Ball and Ball 4100 S unit is used which has a 1.69-inch barrel diameter. The 225-cubic-inch version uses a Holley R-3271 A carburetor with the manual transmission and a Holley 3272 A unit with the automatic transmission. Both of these Holley units have a 1.69-inch barrel diameter.

LUBRICATION SYSTEM: The full-flow-filtered lubrication system is supplied by a rotary pump which develops 45 to 65 psi at a 2000 rpm engine speed. The cylinder walls and piston pins are lubricated by a metered jet spray and the tappets depend on crankcase splash for their oil supply. Full-pressure lubrication is supplied to the main-bearings, connecting rod bearings and camshaft bearings.

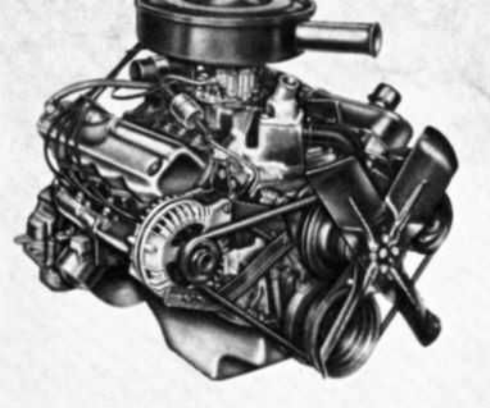
CHRYSLER SMALL V8

273 and 318 cubic inches



The small Chrysler Corporation V8's remain virtually unchanged for 1967. The 273-cubic-inch engine is relatively new in terms of model years. However, the 318, despite its earlier vintage, has been retained by the company because of its reputation for high reliability coupled with adequate performance characteristics.

Type: Ohv V8
Displacement (cu. in.): A,B—273. C—318.
Horsepower @ rpm: A—180 @ 4200. B—235 @ 5200. C—230 @ 4400.
Horsepower per cubic inch: A—0.65. B—0.86. C—0.72.
Torque (lb. ft.) @ rpm: A—260 @ 1600. B—280 @ 4000. C—340 @ 2400.
Bore & Stroke: A, B—3.63 x 3.31. C—3.91 x 3.31.
Compression ratio: A—8.8. B—10.5. C—9.0.
Carburetion: A—1 2-bbl. B—1 4-bbl. C—1 2-bbl.
Approximate weight: A—550. B—560. C—605.
Weight-to-hp ratio: A—3.06. B—2.38. C—2.63.



At left, a cutaway of the 1967 Chrysler 273-cubic-inch V8 and, above, the 318-cubic-inch powerplant. The engines are rated at 235 and 230 horsepower, respectively, unmodified.

ENGINEERING EVOLUTION: The 273-cubic-inch Chrysler Corporation V8 was introduced in 1964 to meet the demand for a high-performance engine in the Dart and Valiant compacts. While the 273 is a direct descendant of the earlier 318-cubic-inch engine and has a similar stroke, it differs in many details. The 273 differences lie in overall weight-saving accomplished by thin-wall casting techniques, manifolding improvements and the location of the valves. Valves in the 273 are in line as compared with offset valves in the 318.

GENERAL: Both engines have 90-degree V8 configurations. Cylinder blocks and cylinder heads are iron castings. The valves are pushrod operated through solid tappets. Bore spacing in both engines is 4.46 inches. The stroke is an identical 3.31 inches in both engines. However, the bore is 3.63 inches in the 273 and 3.91 inches in the 318. One of the 273's develops 180 horsepower at 4200 rpm and 260 lbs. ft. torque at 1600 rpm. The other 273 develops 235 horsepower at 5200 rpm and 280 lbs. ft. torque at 4000 rpm. Compression ratio in the lower-rated 273 is 8.8:1 while the higher-output version has a 10.5:1 compression ratio. Compression ratio in the 318 is 9.0:1. A single two-barrel carburetor is used on the 180 hp 273 and the 318. The 235-horsepower version of the 273 uses a four-barrel carburetor.

PISTONS, RINGS, PINS, RODS: Pistons in all three engines are aluminum alloy. They are closed slipper-type with steel struts, elliptically-turned and tin-plated. The 273 pistons weigh 18.6 and 19.9 ounces, respectively, without their rings and pins. Bare weight of the 318 pistons is 20.6 ounces. Compression rings on the 273 pistons are cast iron with a tin-plate finish on the top ring and a Lubrite coating on the second ring. The oil control ring in the 273's is a three-piece assembly consisting of two chrome-plated rails and a stainless steel expander-spacer. Compression rings in the 318 are also cast iron with tin-plating on both the top and second ring. The oil-control ring in the 318 is cast iron and backed by a hump-type expander. Piston pins in all engines are high-manganese steel and have a .9842-inch diameter. These pins are a full floating fit in both rods and pistons. The rods are bushed with a steel-backed bronze bearing. Pin bores in the pistons are offset .06-inch toward the right-hand side of the engine. The interchangeable connecting rods are drop-forged steel. Connecting rod bearings are a bi-metal grid and have a .843-inch length.

CRANKSHAFTS: The drop-forged crankshaft is interchangeable between the 273 and 318-cubic-inch versions and has a rubber-absorption-type damper at its front end. Main bearing journals have a 2.5-inch diameter and the crankpins measure 2.125 inches in diameter. The #3 bearing which takes the thrust has a 1.151-inch length and the #5 bearing has a 1.562-inch length. The other main bearings are removable inserts. Lead-base babbitt forms the face material.

CAMSHAFT: The camshafts are hardenable cast iron with the oil-pump and distributor-drive gear cast integrally. This shaft rides in five steel-backed, lead-base babbitt bearings. Drive is accomplished by a chain which meshes with a cast iron sprocket on the camshaft and either a malleable cast iron or sintered-iron sprocket on the crankshaft. Camshaft lobe configurations are different in all three engines. The 180-hp 273 has a 240-degree opening duration on both intake and exhaust valves with a 16-degree overlap. Valve lift on the 180 hp 273 is .395 inch on the intakes and .405 on the exhausts. The 235-hp 273 has a 248-degree duration on intakes and exhausts with a 26-degree overlap. Valve lift on this high-performance 273 is .415 inch on the intakes and .425 inch on the exhausts. Camshaft lobes in the 318 provide a 244-degree opening on the intake valves and 240-degrees on the exhausts with a 20-degree overlap. Valve lift in the 318 is .397 inch on the intakes and .403 on the exhausts. Valve lash in all engines is set at .013 inch on the intakes and .021 inch on the exhausts when the engine is hot.

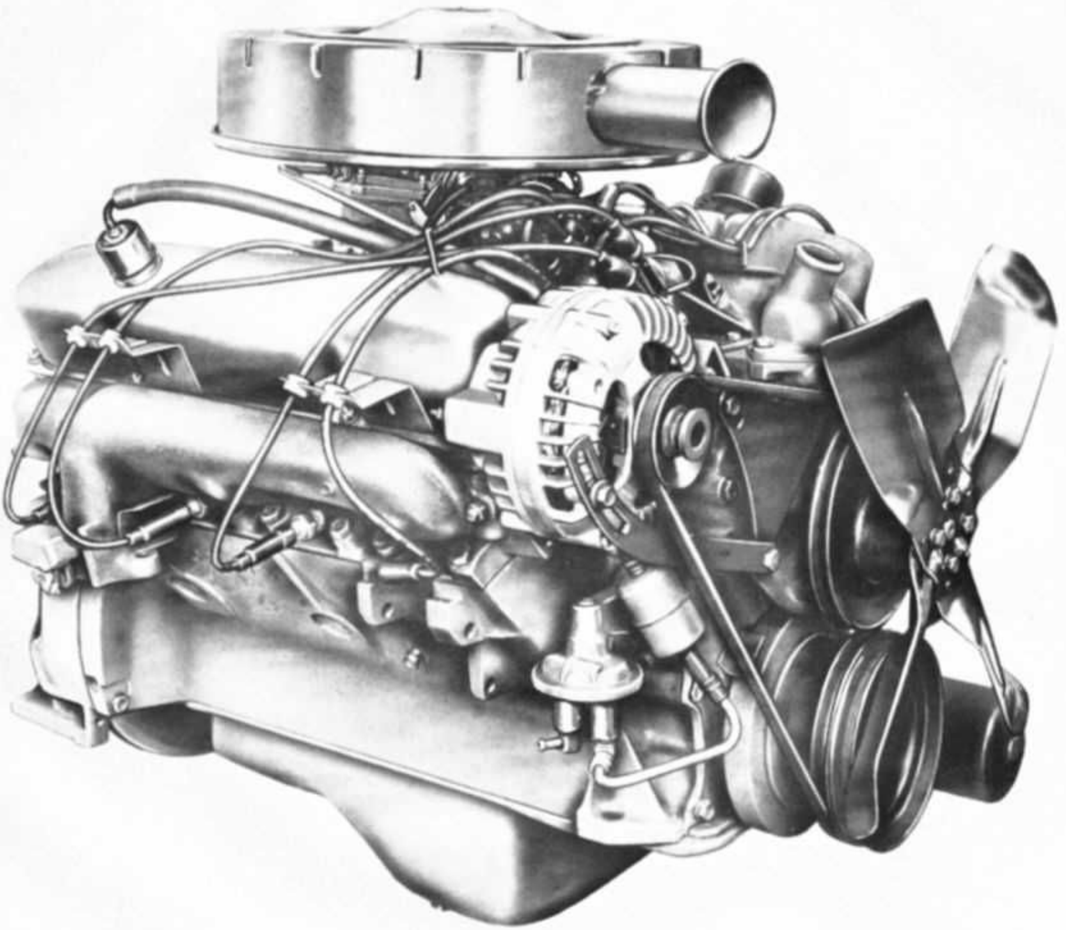
VALVES: Intake valves in the engines are SAE 1041 steel and the exhaust valves are SAE 21-4N steel. The intake valves in the 283's have a 1.78 inch overall head diameter and the exhaust valves measure 1.50 inches across their heads. In the 318, the intakes have a 1.84 inch head diameter and the exhausts a 1.56 inch diameter. Intake valve seats in all engines are machined to a 45-degree seat while the valves have a 45.5-degree seating face. The exhaust valves have a 47-degree seat and a 47.5-degree face. Valve spring pressures are 53 pounds when the valves are closed and 143.5 pounds when they are open. Low friction locks on the exhaust valves permits their rotation.

FUEL SYSTEM: Fuel is delivered to the carburetor by a mechanical pump on the engine which delivers 4.5 to 5.0 psi. A plastic mesh filter is located in the gasoline tank and a paper-element filter in the fuel line. A Ball and Ball BBD series carburetor is used in the 180-hp 273 which has 1.44-inch diameter barrels. The 235-hp 273 employs a four-barrel Carter AFB series model with 1.44-inch primary barrel diameters and a 1.56-inch diameter in the secondary barrels. In the 318, a Stromberg WW3 series unit is used which has 1.44-inch barrel diameters.

LUBRICATION SYSTEM: The engine lubrication system incorporates a full-flow oil filter. Oil is supplied by a rotary-type pump which develops 50 psi at 2000 rpm crankshaft speed. Piston pins and cylinder walls receive their oil by a metered jet spray and a jet also furnishes oil to the timing chain. Full-pressure lubrication is supplied to the main bearings, connecting rod bearings, camshaft bearings and tappets.

Below: The 273 Dodge Charger is equipped with a four-barrel Carter AFB series carburetor. The 318 employs a Stromberg WW3 series unit.

CHRYSLER B V8 *383 cubic inches*



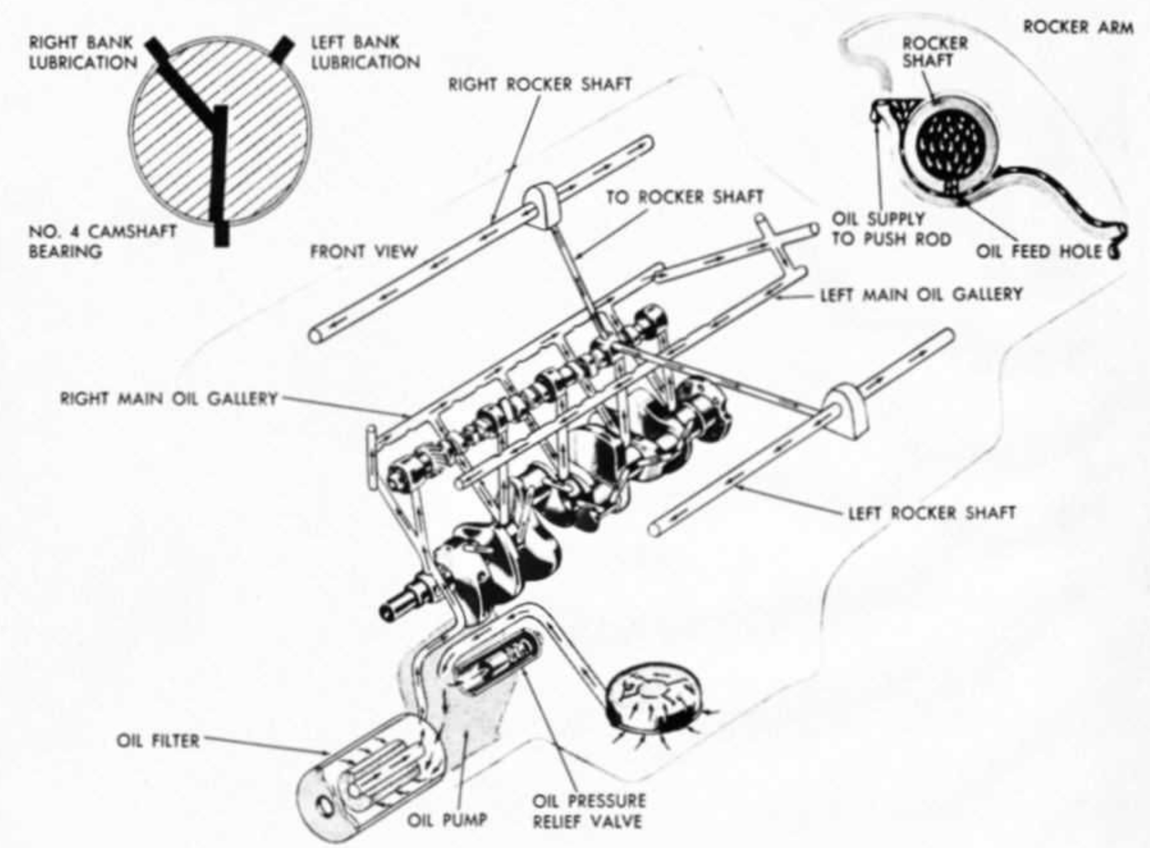
The Chrysler Corporation "B" – block engines which replaced the first generation of the company's hemi-head engines have proved their reliability and excellent performance over a period of eight years. The "B" block 413- and 426-cubic-inch versions were dropped from 1966 production and the 361-cubic-inch model has been dropped for 1967. The remaining engine of this type is the 383-cubic-inch model in two horsepower ratings. The 270 horsepower version is standard in the Chrysler line and along with the 325 horsepower model is available as an option in the Chrysler-Dodge, Plymouth lines.

Type: Ohv V8.
Displacement (cu. in.): A,B—383.
Horsepower @ rpm: A—270 @ 4400. B—325 @ 4800.
Horsepower per cubic inch: A—0.70. B—0.84.
Torque (lbs. ft.) @ rpm: A—390 @ 2800. B— 425 @ 2800.
Bore & Stroke (in.): A,B—4.25 x 3.38.
Compression ratio: A—9.2. B—10.0.
Carburetion: A—1 - 2 bbl. B— 1 - 4 bbl.
Approximate weight: A—650 lbs. B—660 lbs.
Weight-to-hp ratio: A—2.41. B—2.03.

ENGINEERING EVOLUTION: The Chrysler Corporation intermediate-sized V8's are a part of the family of "B" block engines introduced in 1958. These engines had wedged-shaped combustion chambers in contrast to the hemi-head V8's of similar size which preceded them. The block was designated to encompass a variety of displacements by virtue of its generous 4.8-inch bore spacing which ultimately reached 426 cubic inches.

GENERAL: The engine cylinder blocks and heads are cast iron and form a 90-degree V8 configuration. The overhead valves are pushrod actuated through hydraulic lifters. Bore is 4.25-inches and the stroke 3.38-inches. One of the 383's has a rating of 270 hp at 4400 rpm and produces 390 lbs. ft. of torque at 2800 rpm. The other 390 is rated at 325 hp at 4800 rpm and 425 lbs. ft. torque at 2800 rpm. In the 270 hp 383, the compression ratio is 9.2:1 and in the 325-hp version it is 10.0:1. The lower-powered version uses a two-barrel carburetor, while the more powerful 383 uses a four-barrel unit.

PISTONS, RINGS, PINS, RODS: The aluminum alloy pistons are the slipper type with steel struts. They are elliptically-turned and tin-plated. The piston weight is 26.9 ounces. Compression rings in all engines are cast iron with a tin-plate finish. The oil-control rings are a three-



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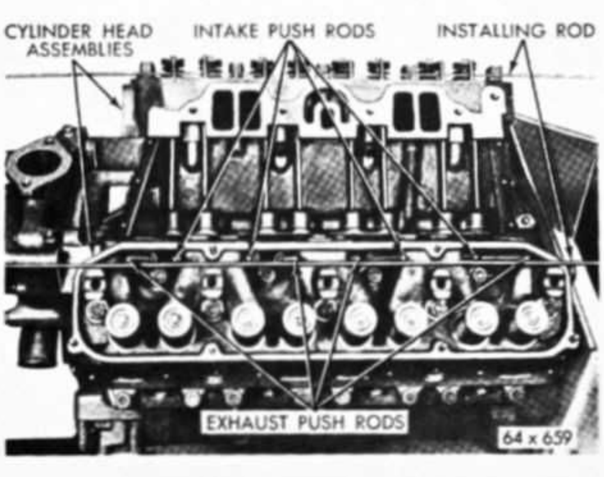
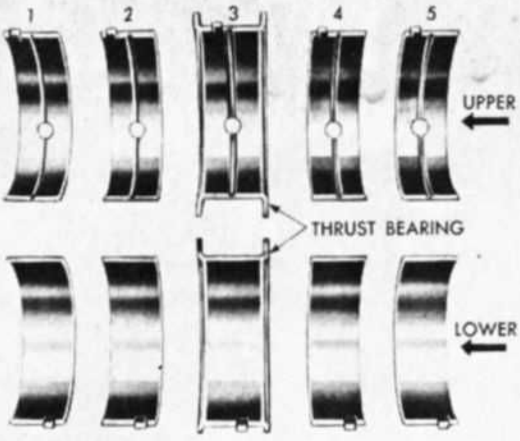


1. Oiling system on 361 and 383-inch V8's. Oil to rocker arms is meter through Number 4 camshaft journal. Oil only flows during the short time in each revolution that the holes line up.

2. Pushrods in position, ready for rocker arm shaft installation. Special installing rods hold pushrods in position for easier assembly.



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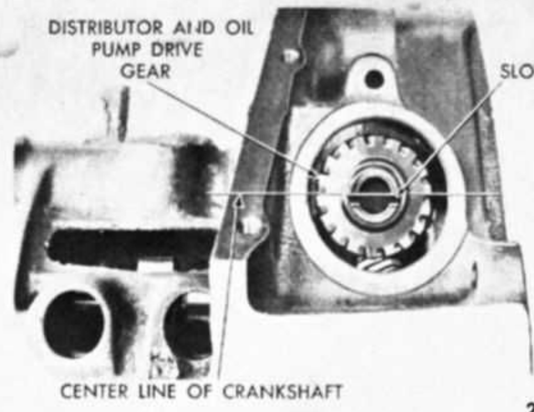

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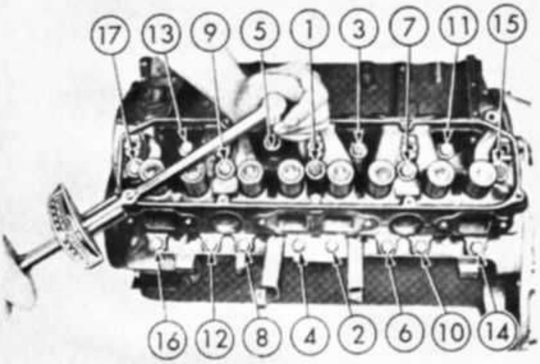

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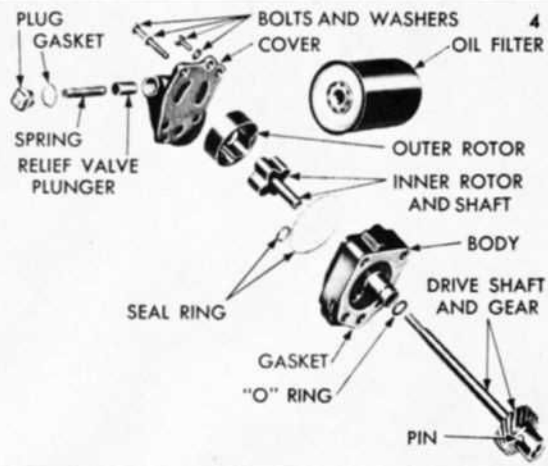


piece type with two chrome-plated rails and a stainless steel expander-spacer. Piston pins are high-manganese steel and have a 1.094-inch diameter. These pins are a press fit in the connecting rods and float in piston bores which are offset .09-inch toward the right side of the engine. Drop-forged steel connecting rods weigh 28.6 ounces. All connecting rod bearings are removable inserts. A lead-base babbitt facing is used in the lower-powered version and a tri-metal face in the 325-horsepower model.

CRANKSHAFT: The crankshaft is drop-forged steel. Rubber-absorption-type vibration dampers are used at the front end of the shafts. Main bearing journals measure 2.625 inches in diameter and the crankpins have a 2.375 inches diameter. The crankshaft thrust is taken by the #3 main bearing which has a 1.223-inch overall length. The remainder of the main bearings have a .944-inch length. These main bearings are removable, steel-backed inserts. Lead based babbitt is used as the bearing face material on all bearings.

CAMSHAFT: The camshaft is hardenable cast iron with the oil pump and distributor drive gear cast integrally. It rides in five steel-backed lead-base babbitt bearings. The drive chain is meshed with a malleable cast iron or sintered-iron sprocket on the crankshaft and a nylon-coated aluminum sprocket on the camshaft. The camshaft in both versions of the 383 provides a 256-degree duration on the intakes and 260 degrees on the exhausts with a 32-degree overlap. Valve lift is .425 inch on the intakes and .437 in the exhausts.

1. Main bearing from 361 and 383 Chrysler. Grooves in upper bearings provide an oil reservoir for more efficient oiling.

2. Cam driven oil pump and distributor drive gear.

3. When installing heads tightening sequence should be followed for an even distribution of torque. Head should be torqued in 15 lb. increments until final torque reading is reached.

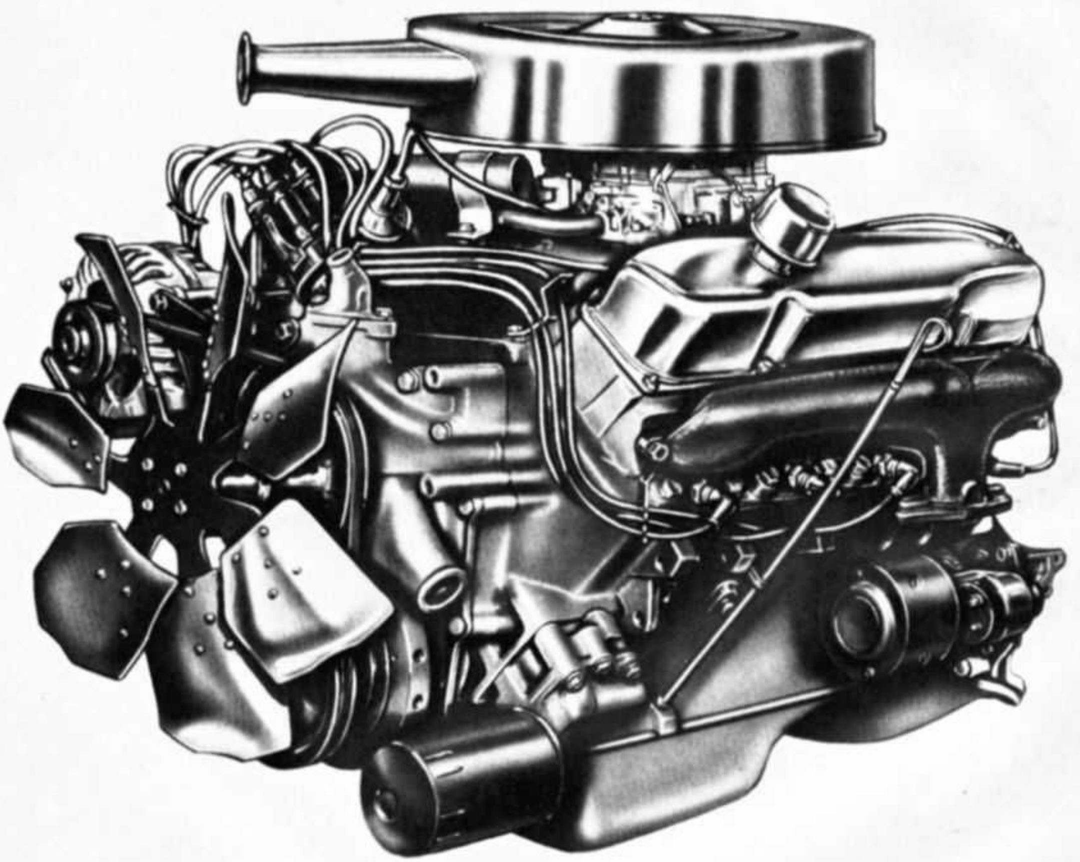
4. Oil pump and filter assemblies for the 361 and 383 Chrysler.

VALVES: Intake valves are SAE 1041 steel and exhaust valves are SAE 21-4N steel. Intake valves have an overall 2.08-inch head diameter and the exhausts measure 1.60 inches across the heads. Valve seats are finished to a 45-degree angle and the seating faces of the valves have a 45.5-degree angle. Single valve springs are used in all engines. The springs in the higher-horsepower engine are slightly stiffer than in the lower-horsepower model.

FUEL SYSTEM: Fuel is delivered by an engine-mounted mechanical pump which develops 3.5 to 5.0 psi. Filtering is accomplished by a plastic mesh strainer in the gasoline tank and a paper-element filter in the fuel line. The twin-barrel carburetor used on the 270 horsepower model is a Ball and Ball BBD series with 1.56 barrel diameters. The other engine uses a Carter AFB with 1.44-inch primaries and 1.56-inch barrel diameters.

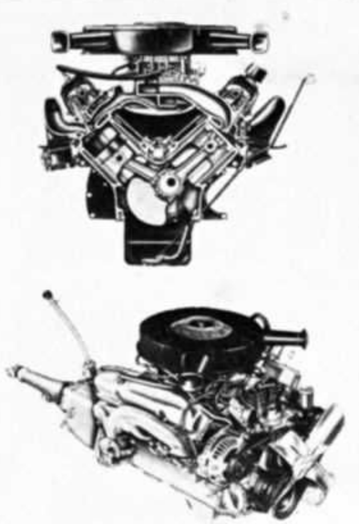
LUBRICATION SYSTEM: The lubrication system is the full-flow filtered type. Oil is delivered by a rotary pump developing 45 to 65 psi at 2000 rpm engine speed. A metered jet spray lubricates the cylinder walls and piston pins. A jet also delivers oil to the timing chain. Main bearings, connecting rod bearings, camshaft bearings, and tappets receive full-pressure lubrication.

CHRYSLER BIG V8 *440 cubic inches*



This 440-cubic-inch engine, which was made available for the first time in the 1966 model year, is the largest passenger car engine ever offered by the Chrysler Corporation. Two versions of the engine offered in 1967 are rated at 350 and 375 horsepower. The latter was rated at 365 horsepower in 1966. The difference in the horsepower ratings of the current models is partially accounted for by a low-back-pressure exhaust system used on the high-performance version.

Type: Ohv V8.
Displacement (cu. in.): A,B—440.
Horsepower @ rpm: A—350 @ 4400. B—375 @ 4600.
Horsepower per cubic inch: A—0.79. B—0.82.
Torque (lbs. ft.) @ rpm: A—480 @ 2800. B— 480 @ 3200.
Bore & Stroke (in.): A,B—4.32 x 3.75.
Compression ratio: A,B—10.1.
Carburetion: A,B—1 · 4 bbl.
Approximate weight: A,B—685 lbs.
Weight-to-hp ratio: A—1.96. B—1.83.



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ENGINEERING EVOLUTION: The Chrysler 440-cubic-inch engine is a direct descendant of the former 413-cubic-inch model. The engine has under-gone considerable upgrading over the 413 and improvements can be seen in the rod bearings, camshaft drive, and new foundry techniques using furan-resin bonded cores to give better control of cylinder-block wall thicknesses.

GENERAL: While these engines have different horsepower ratings, they are mechanically identical. The difference of 15 horsepower in their ratings is accounted for in a large diameter twin exhaust system and an unsilenced, twin-snorkel air cleaner used with the higher-rated version. The engine's displacement is derived from a 4.32-inch bore and 3.75-inch stroke. The cylinder bore spacing is 4.8 inches. The cast-iron cylinder block and heads form a 90-degree V configuration. Pushrods actuate the valves through hydraulic lifters. Horsepower ratings are 350 at 4400 rpm and 375 at 4600 rpm. Torque peaks are 480 lbs. ft. at 2800 rpm in the 350-hp version and 480 lbs. ft. at 3200 rpm in the 365-hp model. The compression ratio is 10.1:1. Carburetion is furnished by a single four-barrel unit.

PISTONS, RINGS, PINS, RODS: The aluminum pistons are the closed slipper-type with a steel strut, elliptically turned and tin plated. These big pistons weigh 30.0 ounces without rings and pins. The compression rings are cast iron with a tin-plate finish. The oil control ring consists of two chrome-plated steel rails and a stainless steel expander-spacer. Piston pins are high manganese steel and have a 1.094-inch diameter. These pins are a very close select floating fit in the pistons and a press fit in the connecting rods. Pin bores in the pistons are offset .09-inch toward the right side of the engine. The connecting rods are drop-forged steel and weigh 29.8 ounces. Rod bearings are removable steel-backed inserts with a bi-metal face in the lower-powered ver-

1. Chrysler 440-inch engine as used in Dodge high-performance models. Dodge calls this model the "Magnum" engine.

2. Valve timing diagram and Carter AFB carburetor used on 440-inch engine. In this setup the AFB uses a remote choke, mounted in a well in the intake manifold. The vacuum diaphragm, hose attached, is used to pull the choke partially open after the engine starts.

3. Some 440-inch engines use a Holley Model 4160 four-barrel carburetor instead of a Carter AFB. These cutaway drawings show the interior systems in the Holley 4160.

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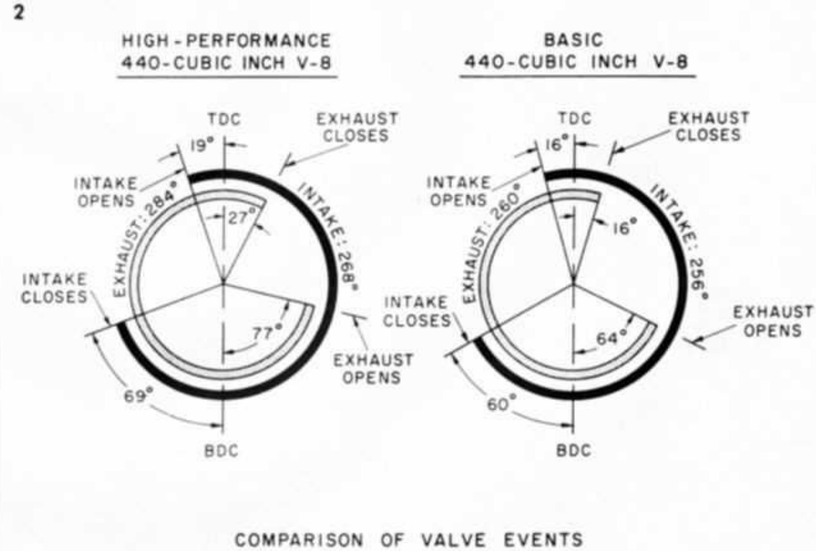

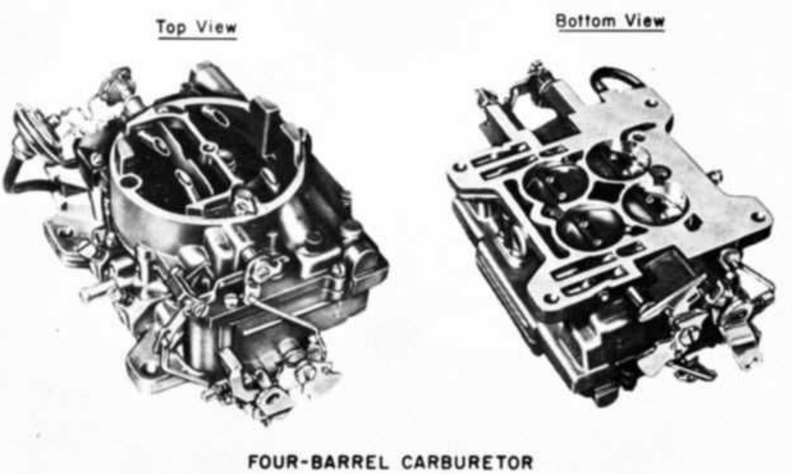

sion and a tri-metal face in the high-performance model. Overall length of the rod bearings is .927-inch.

CRANKSHAFT: The crankshaft is drop-forged steel and has a non-adhesion, rubber-type vibration damper on its snout. Main bearing journals have a 2.750-inch diameter and the crankpin journals measure 2.375 inches in diameter. The main bearings are removable steel-backed inserts and with the exception of the #3 bearing are .944-inch long. The #3 bearing is the thrust bearing and has an overall length of 1.221 inch. Lead-based babbitt is used on the face of these bearings.

CAMSHAFT: The chain-driven camshaft is hardenable cast iron with the drive gear for the distributor and oil pump cast integrally. There are five camshaft bearings which are lead-based babbitt on steel backs. The crankshaft sprocket may be either cast malleable iron or sintered iron at the manufacturers option and the camshaft sprocket is die cast aluminum with a nylon coating on the teeth. Cam lobe configurations in the 350 horsepower version provide a 256-degree duration on the intake valves and a 260-degree duration on the exhausts. The overlap is 32 degrees. Valve lift is .425 inch on the intakes and .437 on the exhausts. The camshaft in the high-performance model provides a 268-degree duration on the intakes, 284-degrees on the exhausts and a 46-degree overlap. The intake valve lift is .450-inch and the exhaust valve lift is .465-inch.

VALVES: Intake valves are chromium-silicon alloy steel and have a 2.08 overall head diameter. The exhaust valves are SAE 21-4N steel and have 1.60-inch head diameters. A low-friction lock on the exhaust valves permits them to rotate. Valve seats in the cylinder heads are finished to a 44.5-degree to 45-degree tolerance. Seating faces on the valves are finished to a tolerance of 45 to 45.5 degrees. Single valve springs are used on both versions, however, there are surge dampers on the high-performance model.

FUEL SYSTEM: Fuel is supplied to the carburetor by an engine-mounted mechanical pump which develops 3.5 to 5.5 psi. Filtration is accomplished by a plastic strainer in the gasoline tank and a paper-element filter in the fuel line. The carburetors are four barrel Carter AFB models. Primary barrels in both models have 1.44-inch diameters. Secondary barrel diameters in the less-powerful version are 1.56-inches and 1.69-inches in the high-performance model.

LUBRICATION SYSTEM: The full-flow filtered lubrication system is fed by a rotary-type pump which develops 45 to 65 psi at a 2000 rpm crankshaft speed. The piston pins and cylinder walls are lubricated by a metered jet spray. Main bearings, connecting rod bearings, camshaft bearings and tappets receive full-pressure lubrication. The timing chain oil is supplied by a jet.

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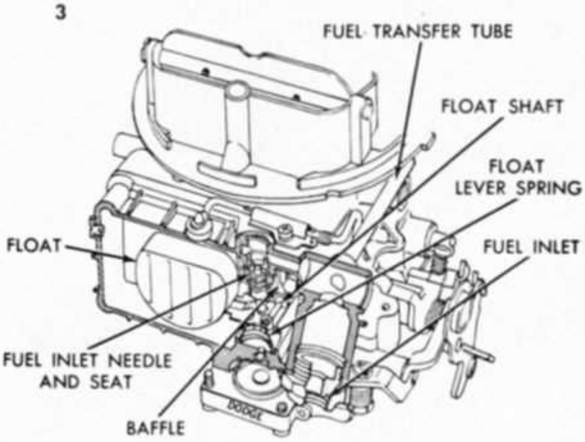
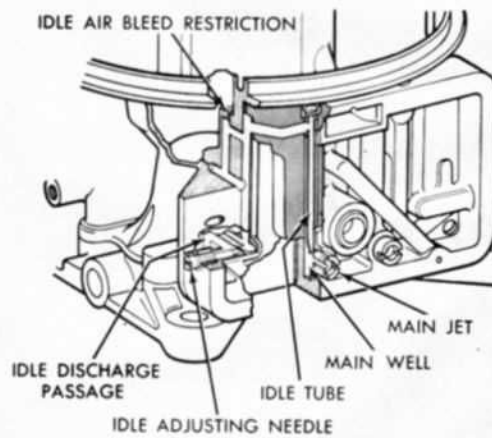
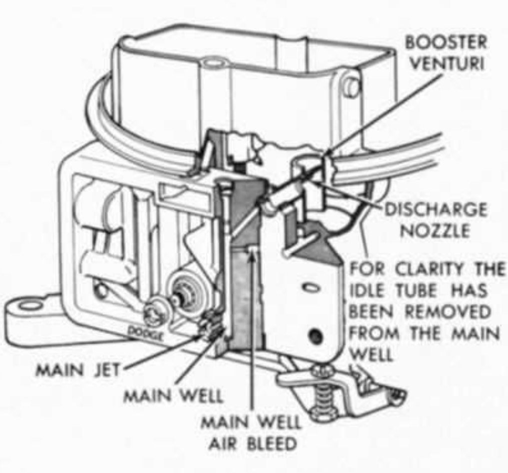


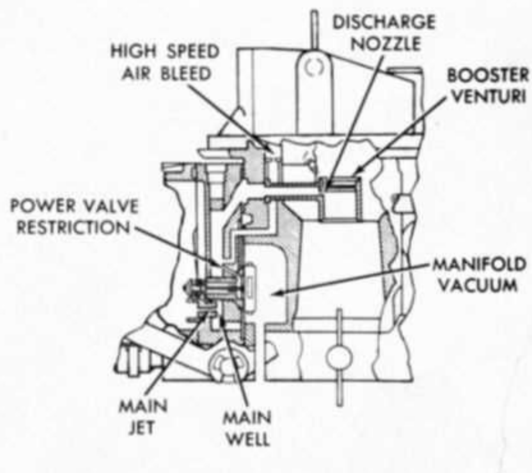
Primary Fuel Inlet System



Idle System

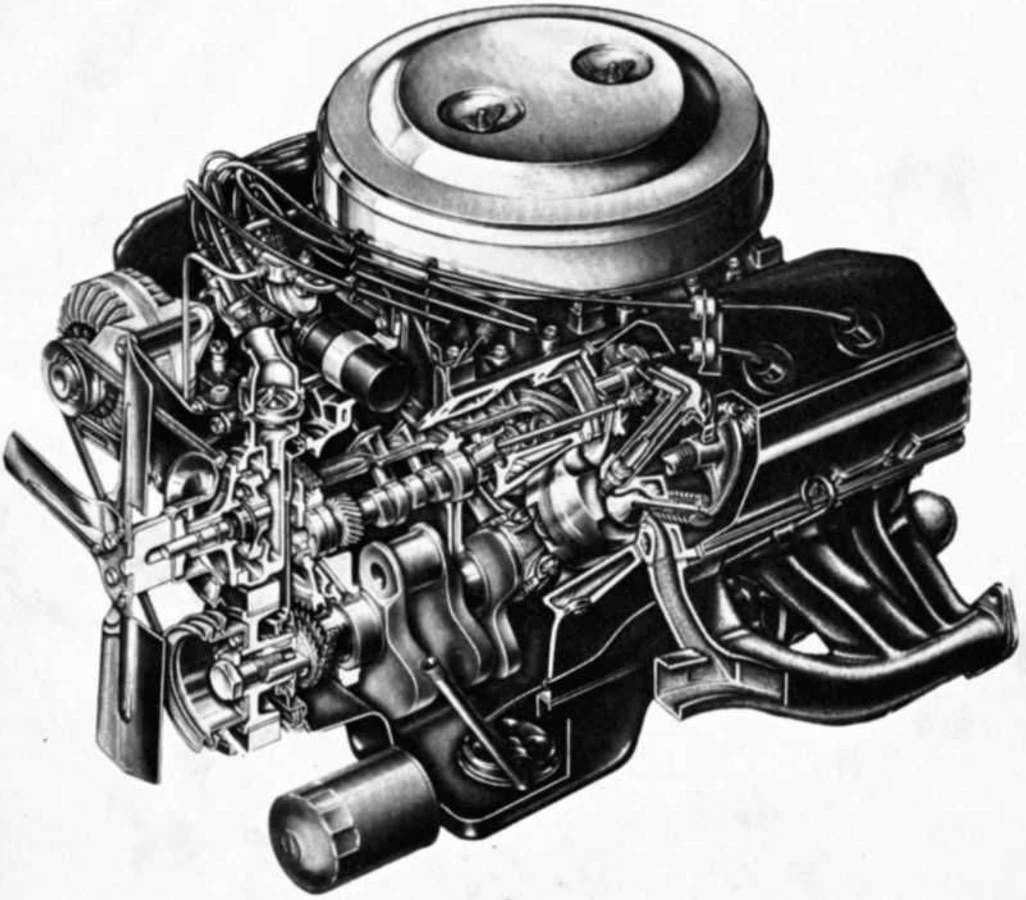


Main Metering System



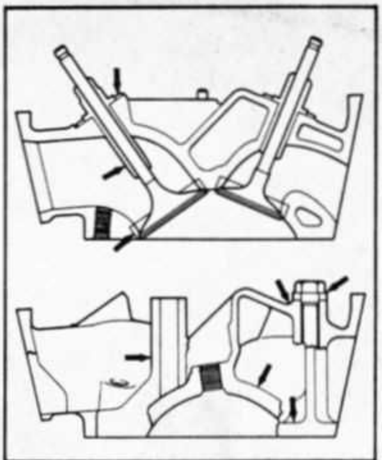
Power Enrichment System

CHRYSLER HEMI V8 *426 cubic inches*



The 1967 version of Chrysler's 426-cubic-inch engine is the only American production stock car engine with highly efficient hemispherical combustion chambers. It is one of the highest performance engines currently available in stock form and has been engineered with high reliability factors which harness its great horsepower and torque. The tremendous popularity of the hemi-head Chrysler Corporation engines between 1951 and 1958 led to a revival of the design in stock form for 1966 and remains relatively unchanged for 1967. The older engines have long been a prime favorite among racing competitors and in drag racing, highly modified versions of the "old-generation" hold the majority of records in their displacement class. The new hemi heads are definitely much stronger, larger and more powerful than their predecessors.

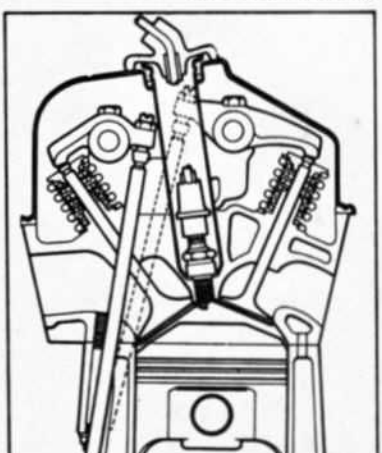
Type: Ohv (hemi-head) V8
Displacement (cu. in.): 426.
Horsepower @ rpm: 425 @ 5000.
Horsepower per cubic inch: 0.99.
Torque (lbs. ft.) @ rpm: 490 @ 4000.
Bore @ Stroke: 4.25 x 3.75.
Compression ratio: 10.25.
Carburetion: 2—4 bbl.



Cross-section of aluminum clyinder head used on drag machines. Arrows in upper figure show steel inserts used. Lower shows where casting thickness was increased and a washer added.

ENGINEERING EVOLUTION: The hemi-head Chrysler engines built in the 1951-1958 era displaced about 100 cubic inches less than the 1967 version. They were dropped from the line due to production costs and replaced with engines which incorporated a wedge-shaped combustion chamber design which eventually reached a 426-cubic-inch displacement and represented the highest performance engine produced by Chrysler. In 1964, the hemi-head design was revived on an extremely-limited production basis. There were two versions of this limited production hemi-head; one for oval track stock car racing and the other for drag racing. Neither of these engines was suitable for street use. In fact, the company cautioned users against running the drag engine for more than 15 seconds at full throttle. The 1967 hemi-head is actually a de-tuned version of the racing engine which has been made more docile for street use. In spite of this de-tuning, however, the high reliability factors built into the racing versions of the engine have been retained.

Arrangement of hemi combustion chamber, related parts. Note that spark plug does not line up with the bore, but is tilted slightly.

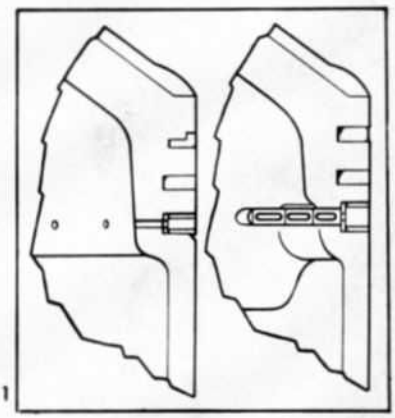


GENERAL: The Chrysler hemi-head has a cast iron cylinder block and cylinder heads set in a 90-degree V8 configuration. Valves are actuated by pushrods and rocker arms of unequal length. This is necessary because one set of rockers must reach across the top of the cylinders to contact the exhaust valves. The intake and exhaust valves are on opposite sides of the combustion chambers and inclined away from each other. Spark plugs are located at the top center of the combustion chambers. The bore is 4.25 inches and the stroke 3.75 inches. Advertised horsepower is 425 at 5000 rpm and the peak torque is 490 lbs. ft. at 4000 rpm. The compression ratio is a modest 10.25:1 when compared to the 12.5:1 ratio used in the racing engines. Carburetion is supplied by a pair of four-barrel carburetors. The engine starts and idles on two barrels of the rear carburetor only with the second set of barrels cutting in at wider throttle openings. The secondary barrels of both carburetors are velocity controlled and operated by air flow in the primaries. Thus the secondaries are operative only under maximum demand in the higher-rpm range.

PISTONS, RINGS, PINS, RODS: The pistons are forged aluminum with a horizontal slot and slipper skirt. Finishing operations on these pistons include elliptical turning and tin-plating. Piston weight less rings and pins is 29.5 ounces. The compression rings are cast iron with a chrome-plate finish. Oil control rings are a three-piece assembly consisting of two chrome-plated rails and a stainless steel expander-spacer. Piston pins are high-manganese steel and have a 1.0311 inch diameter. The pins float in both the piston and connecting rod which is bushed with a steel-backed bronze bearing. Pin bores in the piston are directly on center. The connecting rods are drop-forged steel and because of their husky cross-section weigh 38.2 ounces. Connecting rod bearings are a bi-metal grid type and have a .927-inch length.

VALVES: The intake valves are Silichrome XB alloy and have a 2.25 inches head diameter. Exhaust valves are SAE 21-4N steel with a Stellite face. Head diameter of the exhausts is 1.94 inches. Wedging action at the valve seats is provided by a 44.5-45 degree seat in the cylinder heads and a 45-45.5-degree angle on the valve faces. Valve lash is specified at .028 inch on the intakes and .032 inch on the exhaust when the engine is cold. A low-friction lock on the exhaust valves permits them to rotate. Dual valve springs are used on both sets of valves. The outer springs exert 105 pounds pressure when the valves are closed and 184 pounds when open. Inner springs exert 50 pounds when the valves are closed and 91 pounds when they are open. Surge dampers are used in conjunction with the inner springs.

FUEL SYSTEM: Fuel is supplied to the carburetors by a mechanical, engine-mounted pump at 6.0 to 7.5 psi. Filtering is accomplished by a fine-mesh plastic strainer in the gasoline tank and a paper-element filter in the fuel line. Primary barrel diameters in the Carter AFB carburetors are 1.44 inch and the secondary barrels have a 1.69-inch diameter.



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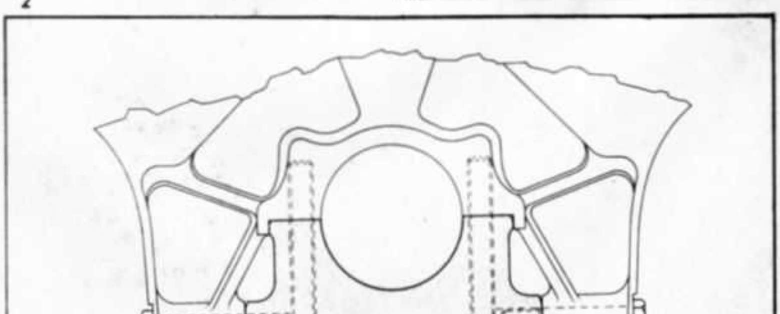
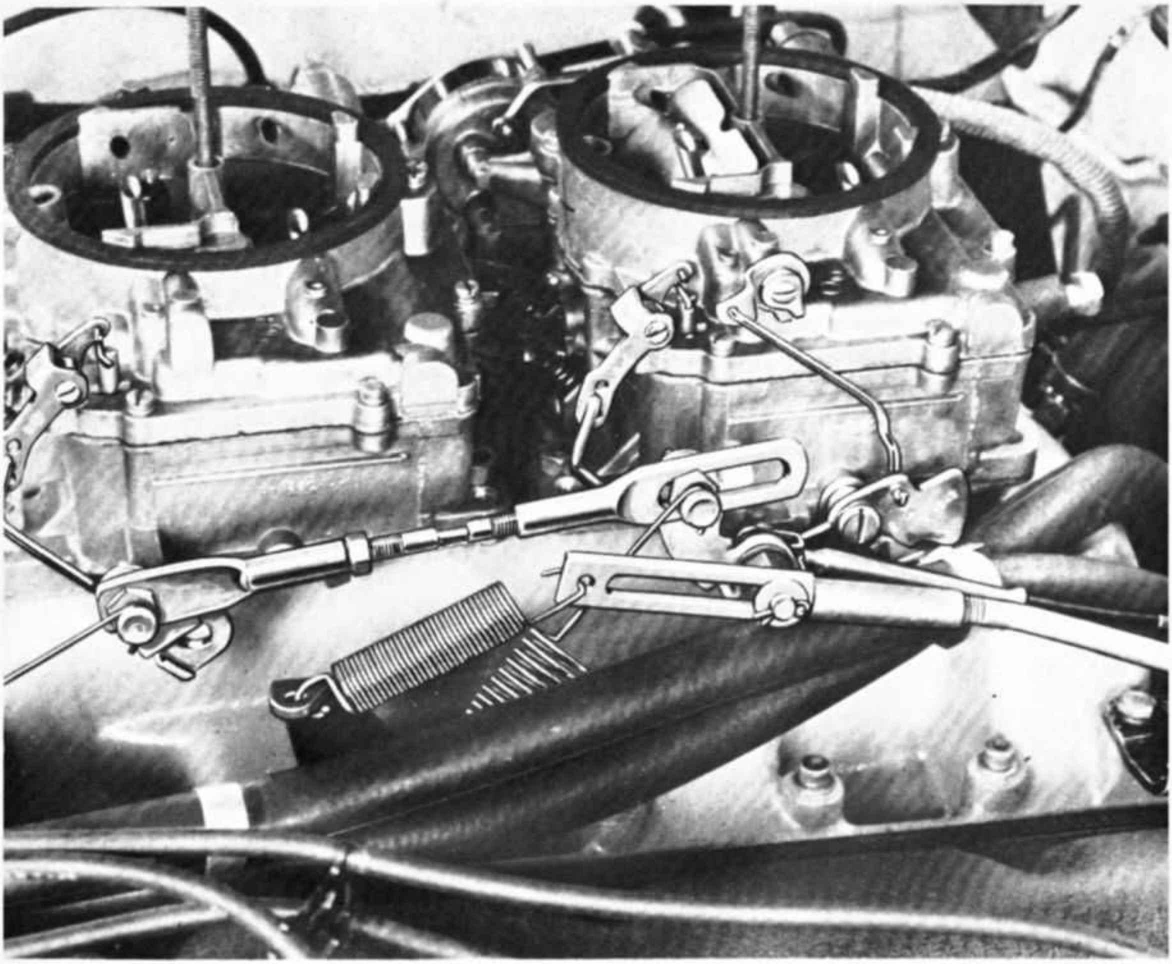


1. Cross-section of a track piston and a street piston. The track piston on the left uses first and second rings .062-inch thick and a third ring that fits in a .126 groove. Street pistons use a first and second ring .078 thick and a third ring that fits in a .188 groove. The narrower rings in the track job result in less wall drag.

2. To prevent distortion of main bearing caps and damage to bearings or crankshaft, caps are double-bolted with tie bolts placed so that shear strength of bolts is utilized.



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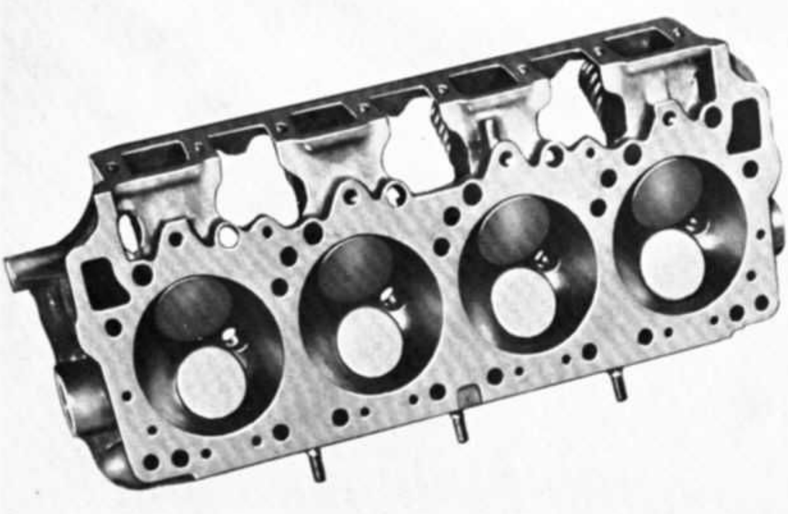

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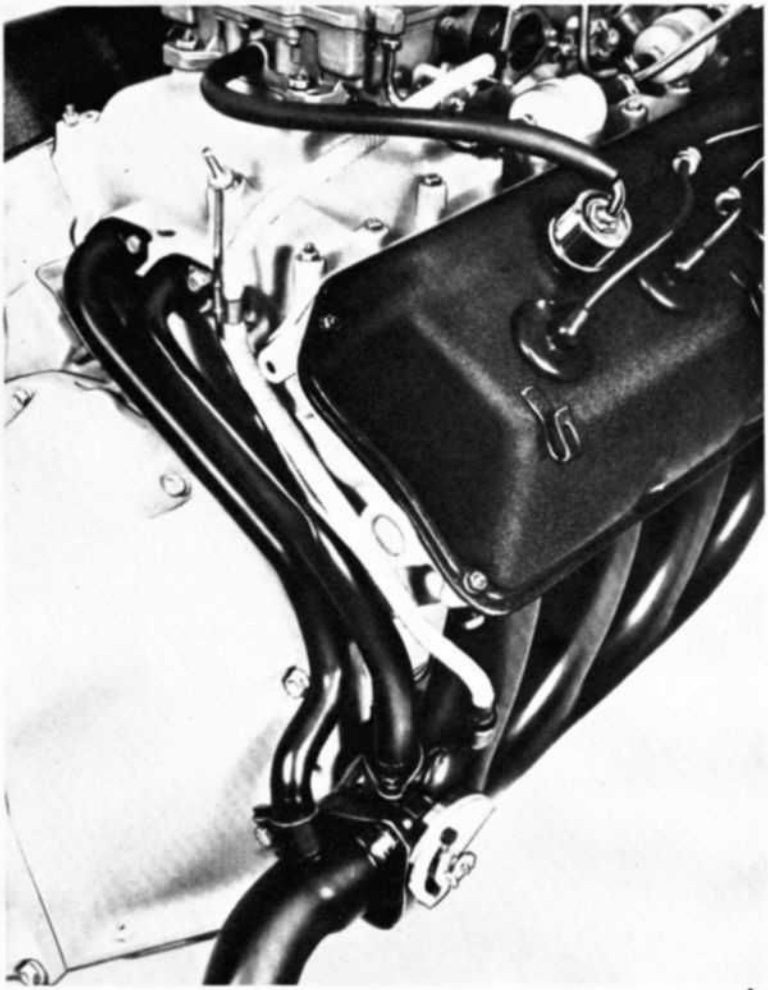
1. This linkage, plus the secondary linkage on other side of carburetors, results in a four-stage progressive opening. The rear primaries open first, then the front primaries followed by the rear secondaries, and finally the front carburetor secondaries.

2. Chrysler 426-inch hemispherical combustion chambers. Note how mixture will follow almost straight line from intake to exhaust port.



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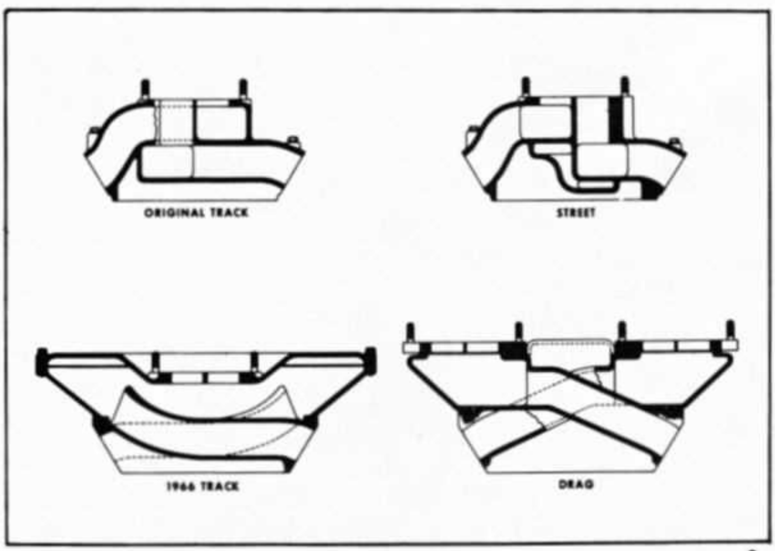
CRANKSHAFT: The crankshaft is drop-forged steel, has 2.75 inches main journal diameters and 2.375 inches crankpin-journal diameters. Main bearing lengths are .944 inch with the exception of #3 which absorbs the thrust and has a 1.223-inch length. These main bearings are of tri-metal construction consisting of lead alloy on a nickel-plate barrier on cast copper-lead. Main bearing caps on #2, #3 and #4 main bearings have an extra pair of bolts which give added support by anchoring the caps to the sides of heavily-webbed cylinder block.

CAMSHAFT: The camshaft is hardenable cast iron with the oil pump and distributor-drive gear cast integrally. Five lead-based babbitt bearings support the shaft. A double-roller chain meshing with a steel sprocket on the crankshaft and cast iron sprocket on the camshaft serves to drive the shaft. Cam lobe configurations provide a 276-degree duration opening on both intake and exhaust valves with a 52-degree overlap. The lift is .480 inch on the intake valves and .460 inch on the intakes at zero lash on the solid valve tappets.

LUBRICATION SYSTEM: Oil is delivered to the full-flow-filter system by a rotary pump developing 45 to 65 psi at 2000 rpm engine speed. Cylinder walls receive their oil by a metered jet spray and a jet serves to lubricate the timing chain. Full-pressure lubrication is delivered to the main bearings, connecting rod bearings, camshaft bearings and tappets.

1. The two black tubes leading up from the exhaust are the intake manifold heat system. Tube covered with white asbestos conducts heated air from the exhaust manifold to the choke. Also shown is the hose from the carburetor to the crankcase ventilation valve.



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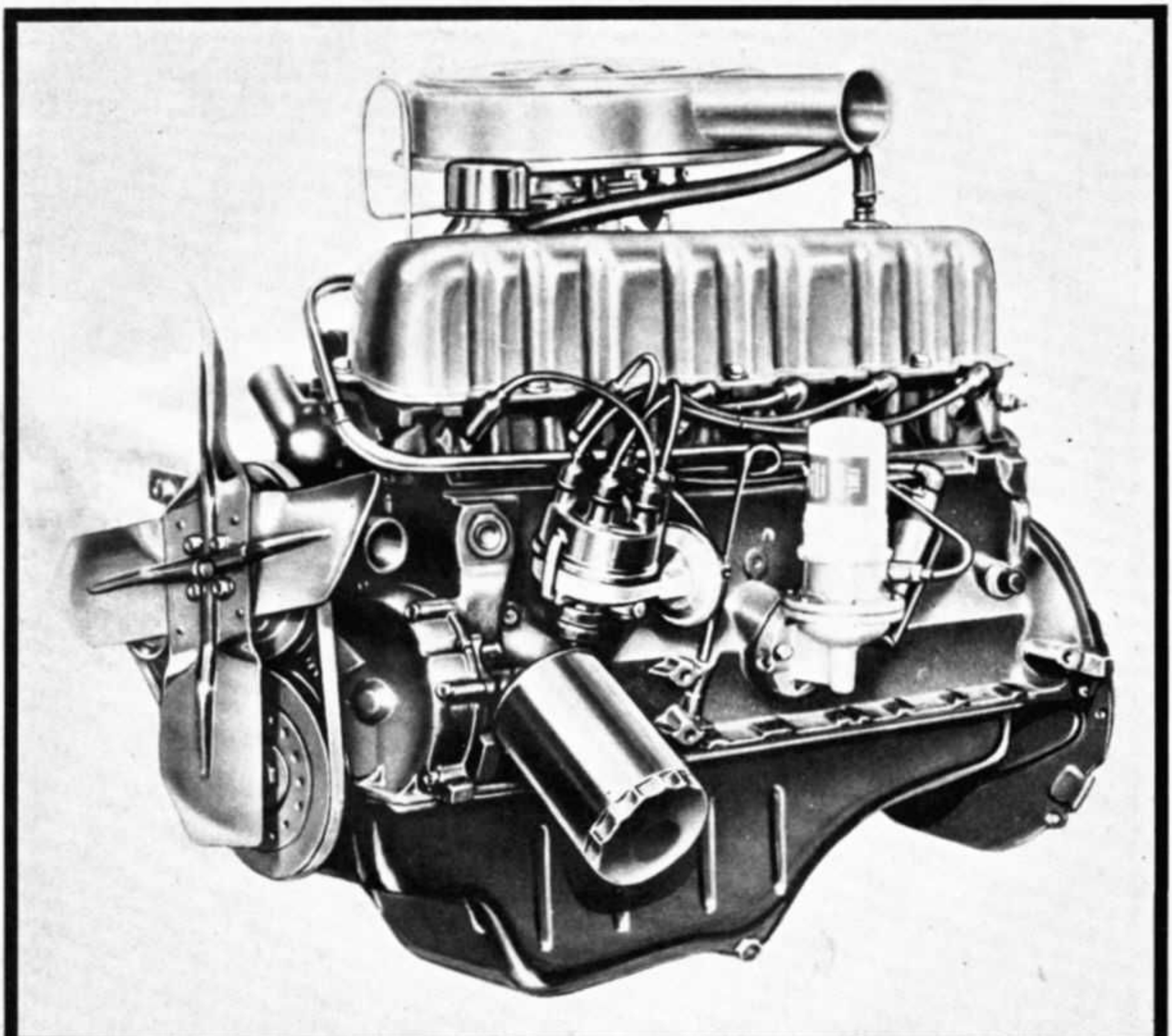
2. Cross-sectional views of the 1965 and 1966 Chrysler hemi-heads are shown here with the 1966 production model at the upper right and the 1966 stock car competition model at the lower left. The manifold at the upper left was used on the limited-production 1965 track racing engine and that at the lower right in the 1965 "acceleration trials" engine. Note long ram passages in the "acceleration trials" engine manifold. 1967 engines use same manifolds as 1966.

FORD SMALL 6 *170 and 200 cubic inches*



The small Ford Motor Company six-cylinder, in-line engines have been continued in production virtually unchanged for 1967. The smallest of the two engines is standard in the Ford Falcon and the larger is standard in the Fairlane, Mustang, and Mercury Comet. The larger engine is also one of the options offered for the Falcon. Both engines were designed specifically for use in the smaller Ford and Mercury. They feature excellent fuel economy and their relatively low compression ratios permit the use of regular-grade fuel.

Type: In-line, Ohv 6
Displacement (cu. in.): A—170. B—200.
Horsepower @ rpm: A—105 @ 4000. B—120 @ 4400.
Horsepower per cubic inch: A—0.61. B—0.60.
Torque (lbs. ft.) @ rpm: A—158 @ 2400. B—190 @ 2400.
Bore & Stroke: A—3.50 x 2.94. B—3.68 x 3.13.
Compression ratio: A—9.1. B—9.2.
Carburetion: 1 1-bbl.
Approximate weight: A—365. B—380.
Weight-to-hp ratio: A—2.44. B—3.17.

ENGINEERING EVOLUTION: The first small six incorporating the design features of these engines was introduced in 1960 as a powerplant for the Falcon compact. The original displacement was 144 cubic inches. However, this version was soon dropped in favor of the 170- and 200-cubic-inch models. The two engines are similar in elemental design but differ considerably in construction because the larger engine has a seven-bearing crankshaft in contrast to the four-bearing crank employed in the smaller engine.

GENERAL: The engines have a six-in-line configuration with overhead valves operated through pushrods and hydraulic tappets. Cylinder blocks and heads are cast iron. The bore in the 170 is 3.504 inches and the stroke measures 2.94. In the 200, the bore is 3.684 and the stroke 3.13. Output of the smaller engine is 105 horsepower at 4400 rpm and 158 lbs. ft. torque at 2400 rpm. The larger engine develops 120-hp at 4400 rpm and the torque peak is 190 lbs. ft. at 2400 rpm. Bore spacing in both engines is 4.08 inches. The compression ratio in the smaller engine is 9.1:1 and in the larger engine is 9.2:1. Both engines are fed by one single-barrel carburetor.

PISTONS, RINGS, PINS, RODS: The pistons in both engines are aluminum alloy slipper-types with steel struts. They are cam-ground and tin-plated. Weight of these pistons is 16.5 ounces in the 170 and 17.1 ounces in the 200. All top compression rings are cast iron alloy with a molybdenum-filled groove. The second compression rings are also cast iron alloy but have a scraper groove and are phosphate-coated. Oil control rings are a three-piece type with two rails and a blue-steel expander spacer. The oil-ring rails are chrome-plated steel with an oxide coating. Piston pins in both engines are identical. These pins are heat-treated SAE 5015 alloy steel and have a .9120-inch diameter. The pins float in the piston bosses and are a press fit in the connecting rods. Pin bores in the pistons are offset .0625 toward the major thrust side of the engine on the right. The connecting rods are forged SAE 1041 steel with separately-forged caps. These rods are interchangeable between the two engines and weigh 18.65 ounces. The bearings are replaceable inserts with an unplated copper alloy on steel backs. Overall bearing lengths are a nominal .77-inch.

CRANKSHAFT: The crankshafts in both engines are precision-molded cast iron alloy and are fitted with a rubber-floated vibration damper. Shafts in both engines have identical 2,485-inch main bearing and 2.123-inch crankpin journal diameters. Crankshaft thrust in the smaller four-bearing engine is taken by #3 bearing and by #5 bearing in the seven-bearing engine. Main bearing lengths measure 1.015 with the exception of the thrust bearings which measure 1.270 inches. All bearings are steel-backed, micro-babbitt, replaceable inserts.

CAMSHAFT: Camshatts in both engines are a precision-molded special alloy iron which have been induction hardened and phosphate coated. The shaft rides in four steel-backed babbitt bearings. A drive chain meshes with a sintered-iron or steel sprocket on the crankshaft and a cast iron sprocket on the camshaft. The 170 camshaft provides a 240-degree valve opening on both exhausts and intakes with a 27-degree overlap. In the 200-cubic-inch model, the cam gives a 252-degree opening duration on both sets of valves with a 28-degree overlap. The lift on both intakes and exhausts in both engines is .348 inch.

1

VALVES: The valves are identical in both engines. Intake valves are SAE 1047 steel and the exhaust valves are austenitic steel. The heads of both intake and exhaust valves have been given an aluminized treatment. Overall head diameter of the intakes is 1.649 inches and the exhausts measure 1.388. Both seat and valve faces are finished to a 45-degree angle. Single valve springs are used which exert 54 pounds pressure when the valves are closed and 150 pounds when the valves are open. Valve locks on both intakes and exhausts are designed to allow the valves to rotate on their seats.

FUEL SYSTEM: An engine-mounted mechanical pump delivering 4 to 5 psi supplies the carburetor. Fuel is filtered by two plastic-element filters, one of which is located in the gasoline tank and the other in the fuel line. The single-barrel carburetors used on both engines are of Ford manufacture and have similar 1.437-inch barrel diameters.

LUBRICATION SYSTEM: The full-flow-filtered system is supplied by an oil pump which delivers 45 to 55 psi at 2000 rpm engine speed. Main bearings, connecting rod bearings, camshaft bearings, and tappets receive full-pressure lubrication. Piston pins are lubricated by oil mist within the crankcase. A pressure stream of oil lubricates the cylinder walls and the timing chain is lubricated by splash.

1. The small Ford six's range from 105 horsepower to 120 at 4400 rpm.

2. Arrows in the diagram below follow the path of air flow in Ford's positive crankcase ventilation system.

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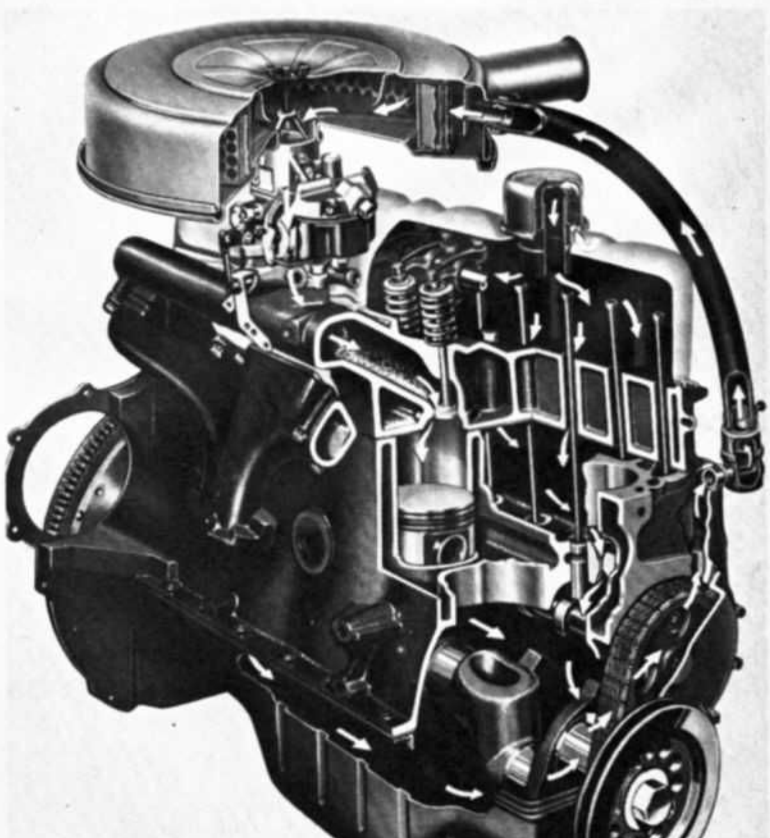
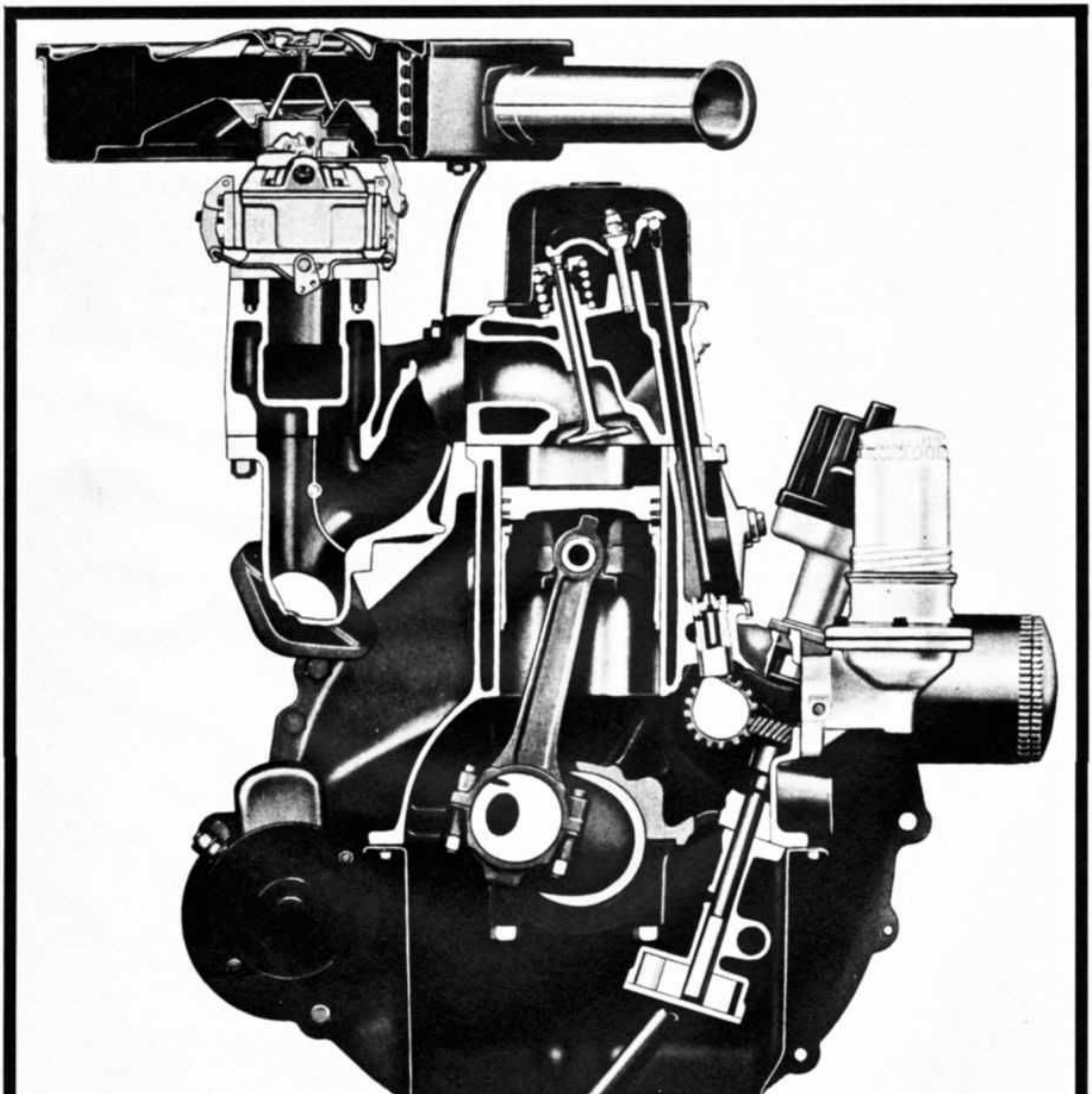


FORD BIG 6 *240 cubic inches*



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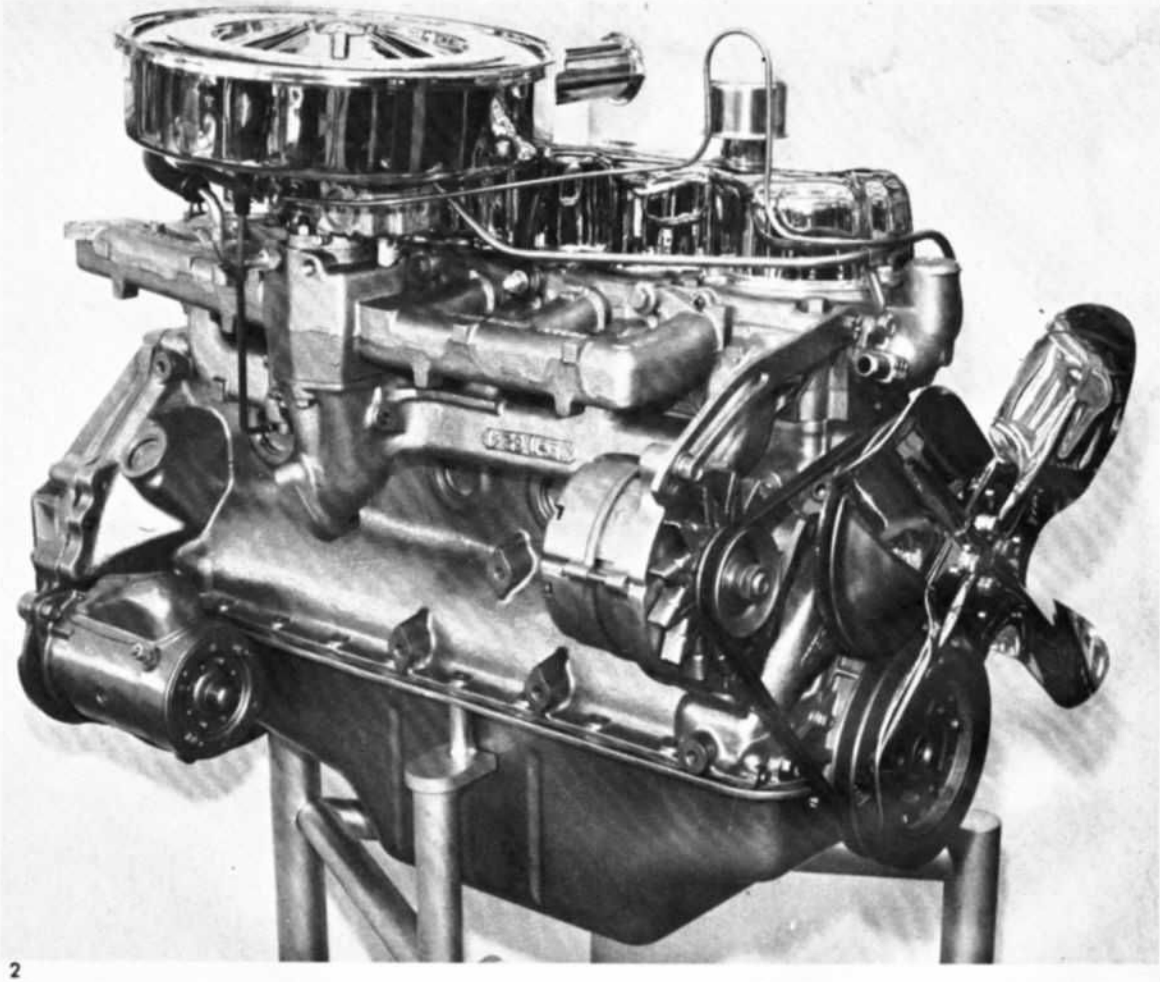
The 240-cubic-inch Ford Motor Company six was an all-new engine at the beginning of the 1965 model year and has remained virtually unchanged for 1967. The engine is standard in the full-sized Fords. The engine was designed to provide acceptable performance characteristics combined with good fuel economy. Its relatively low compression ratio also allows the use of regular-grade gasoline.

Type: In-line, Ohv 6
Displacement (cu. in.): 240
Horsepower @ rpm: 150 @ 4000
Horsepower per cubic inch: 0.62
Torque (lbs. ft.) @ rpm: 234 @ 2200
Bore & Stroke: 4:00 x 3.13
Compression ratio: 9.2
Carburetion: 1 1 bbl.
Approximate weight: 450
Weight-to-hp ratio: 2.93



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ENGINEERING EVOLUTION: The Ford 240-cubic-inch six was introduced in 1965 as a replacement for a 223-cubic-inch model which made its debut in 1952. The new engine has a seven-bearing crankshaft, a much shorter stroke, and weighs approximately 50 pounds less than its original counterpart. Its horsepower output per pound of weight and ratio of displacement to horsepower stamp the engine as being highly superior in design and construction to its predecessor. The short stroke in the new engine which reduces connecting rod length and the overall height of the cylinder block plus thin-wall casting techniques have aided in holding the total weight of the engine to approximately 450 pounds.

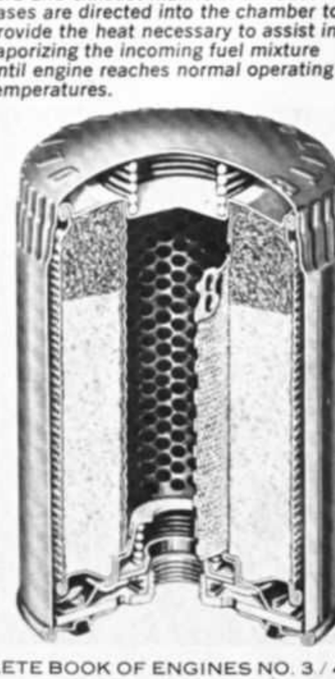
GENERAL: The engine has an in-line, six-cylinder configuration with overhead valves actuated through pushrods and hydraulic tappets. Cylinder block and heads are cast iron and the cylinder bores are spaced on 4.48 inch centers. Bore is four full inches and the stroke 3.13 inches. Horsepower is rated as being 150 at 4000 rpm and the torque peak of 234 lbs. ft. is reached at 2200 rpm. Compression ratio is 9.2:1. One single-barrel carburetor is used to feed the fuel and air mixture.

PISTONS, RINGS, PINS, RODS: The pistons are aluminum alloy with steel struts and solid skirts incorporated into an autothermic expansion-control design. Finishing operations on these pistons include a cam-ground configuration and tin-plating on the rubbing surfaces. The bare weight of these pistons is 21.2 ounces. Both compression rings are cast iron. The upper ring is chrome-plated and the second ring has a scraper groove and is phosphate-coated. The oil-control ring is a three-piece assembly consisting of two chrome-plated and oxide-coated rails plus

3. A "heat riser" is cast into the intake manifold center section between the carb and exhaust manifold. Exhaust gases are directed into the chamber to provide the heat necessary to assist in vaporizing the incoming fuel mixture until engine reaches normal operating temperatures.

1. A front cross section view of the Ford Big 6. The crankshaft is supported by seven main bearings with the crankshaft end thrust controlled by the flanges of the No. 5 main bearing. Pistons are of the autothermic, semi-dish type design. Intake and exhaust valve assemblies are the rotating type.

2. All Ford engines utilize a full-flow Autolite filter, shown here in a cutaway illustration. It filters the entire output of the rotor-type oil pump before the oil enters the engine. A relief valve permits oil to bypass the filter if it becomes clogged. The filter also has an anti-drain back feature.



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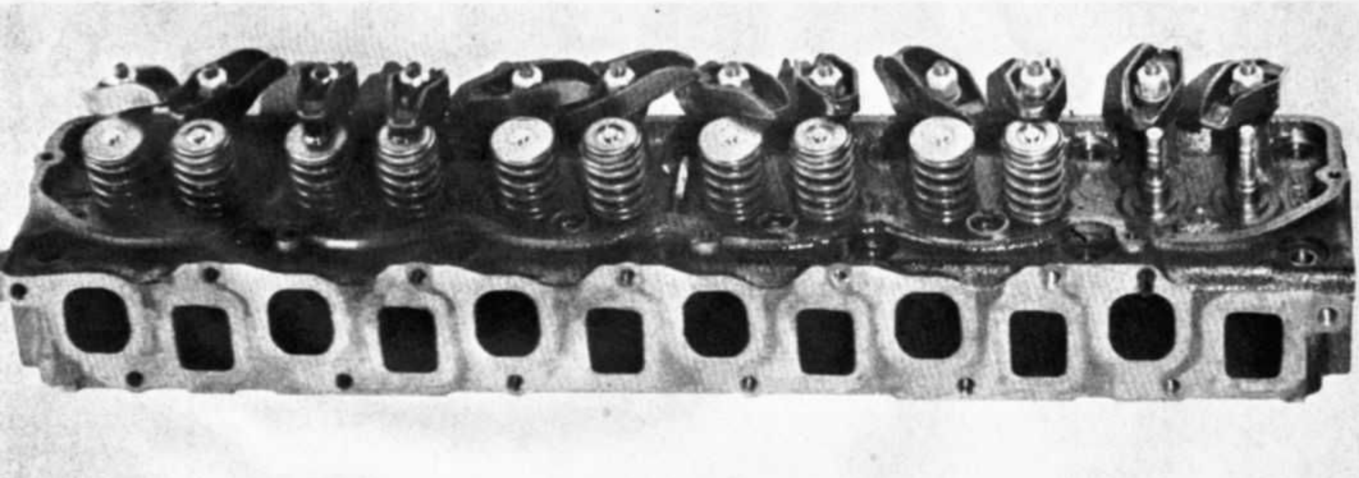
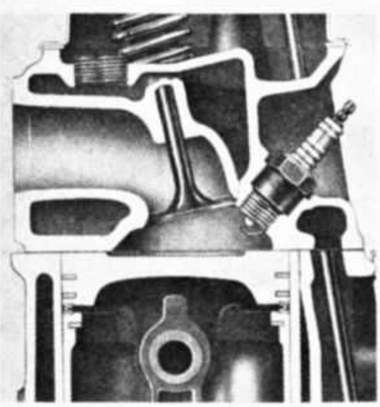
At left: Air flow is indicated by arrows in this schematic of the intake and exhaust manifold.

Below: Cylinder head and valve assembly. The valve train is actuated by hydraulic valve lifters. Two types of interchangeable valve lifters are used on the 1967 Ford engines.





Above: A cutaway section of the head and block assemblies showing the relationship of the intake valves, spark plugs and pistons.

a blued-steel expander-spacer. Piston pins are SAE 5015 alloy steel and have a .9121-inch diameter. These pins are a press fit in the connecting rods and float in the pistons. Pin bores in the pistons are offset .0625 inch toward the right-hand side of the engine. Connecting rods are forged from SAE 1041 steel. Rod weight is 26 ounces and they measure 6.7947 inches in length. The rod bearings are replaceable inserts with unplated copper-lead alloy on steel backs. Rod bearings measure .795 inch in length.

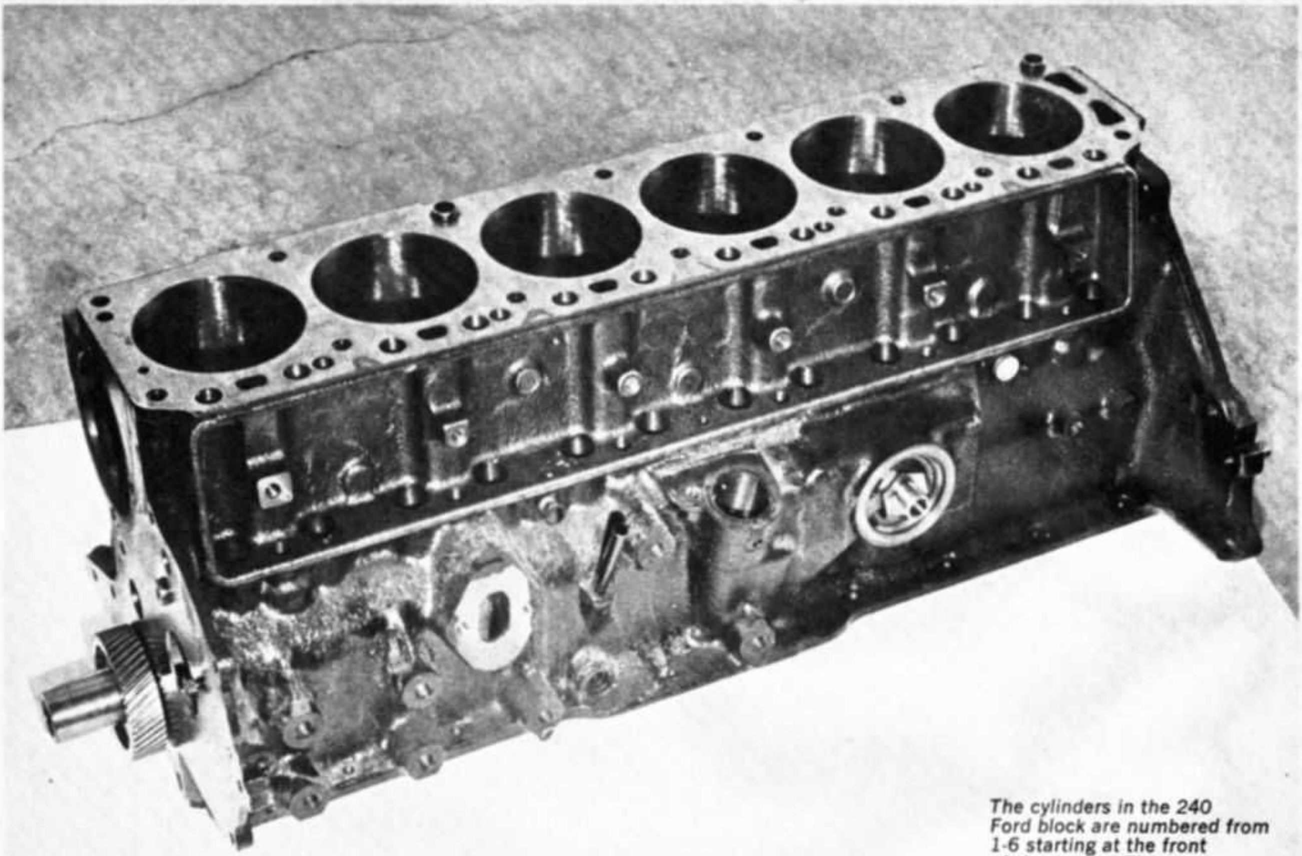
CRANKSHAFT: The seven-bearing crankshaft is precision-molded alloy iron with a rubber-floated vibration damper at the front end. The end thrust is absorbed by the #5 bearing. Main bearings are steel-backed-babbitt replaceable inserts. Bearing lengths are .965 inch with the exception of #5 which has a 1.194-inch length. Main bearing journals have a 2.3986-inch diameter and the crankpin journals measure 2.1232-inches in diameter.

CAMSHAFT: The camshaft is precision-molded special alloy iron which has been induction hardened and phosphate coated. This shaft rides in four steel-backed, lead-base babbitt bearings. Camshaft drive is accomplished with a chain which meshes with a cast iron sprocket on the crankshaft and a steel-hubbed phenolic sprocket on the camshaft. This cam provides a 254-degree opening on the intake valves and a 268-degree duration on the exhausts with a 40-degree overlap. The lift on the intakes is .376 and .400 on the exhausts.

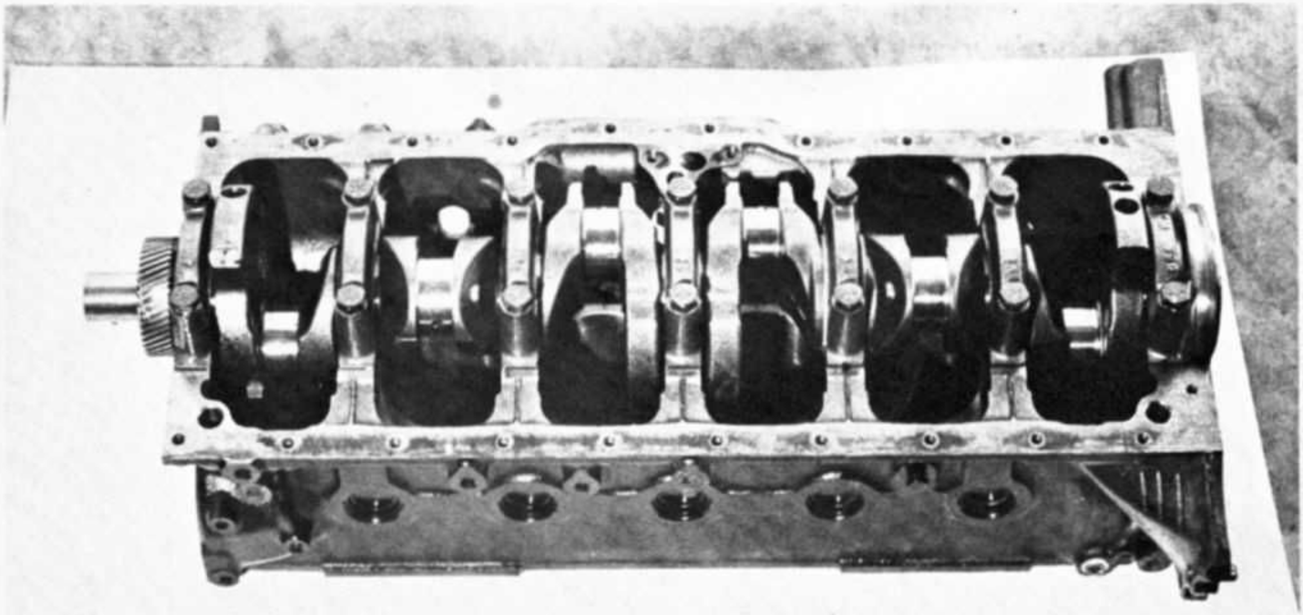
VALVES: The intake valves are 1047 steel and the exhaust valves are cast austenitic steel. Both sets of valves have aluminized heads. Major head diameter of the intakes is 1.787 inches and the major head diameter of the exhausts is 1.566. No provision is made for the valves to rotate in their seats. Both seats and valve faces for both sets of valves are finished to a 45-degree angle. Single valve springs are used which exert 76-to-84-pound pressure when the valves are closed and 180-to-200 pounds when they are open.

FUEL SYSTEMS: Fuel is delivered to the carburetor by an engine-mounted mechanical pump which delivers 4.5 to 5.5 psi. Filtering is accomplished by two woven nylon and Monel cloth filters, one of which is located in the fuel tank and the other in the fuel line. The carburetor is of Ford manufacture and its single barrel has a 1.6875-inch diameter.

LUBRICATION SYSTEM: The lubrication system is a full-flow filter type and is supplied by a rotor-type pump which develops 50 to 60 psi at 2000 rpm engine speed. The piston pins are lubricated by oil mist in the crankcase. A pressure stream from jets furnishes oil to the timing gear chain and cylinder walls. Full-pressure lubrication is supplied to the main bearings, connecting rod bearings, camshaft bearings, and tappets.

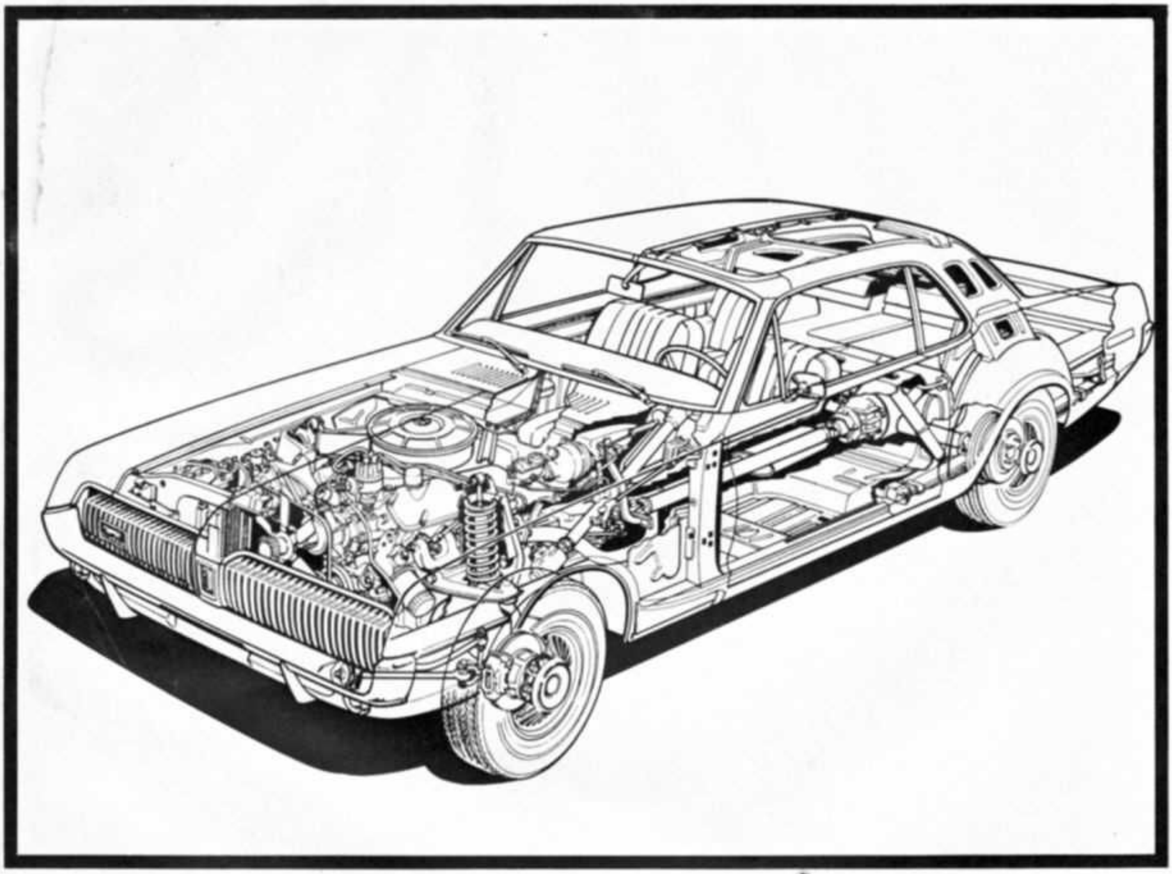


The cylinders in the 240 Ford block are numbered from 1-6 starting at the front of the engine. The firing order is 1-5-3-6-2-4.



The crankshaft is supported by seven main bearings, and the engine incorporates a positive crankcase ventilation system.

FORD SMALL V8 *289 cubic inches*

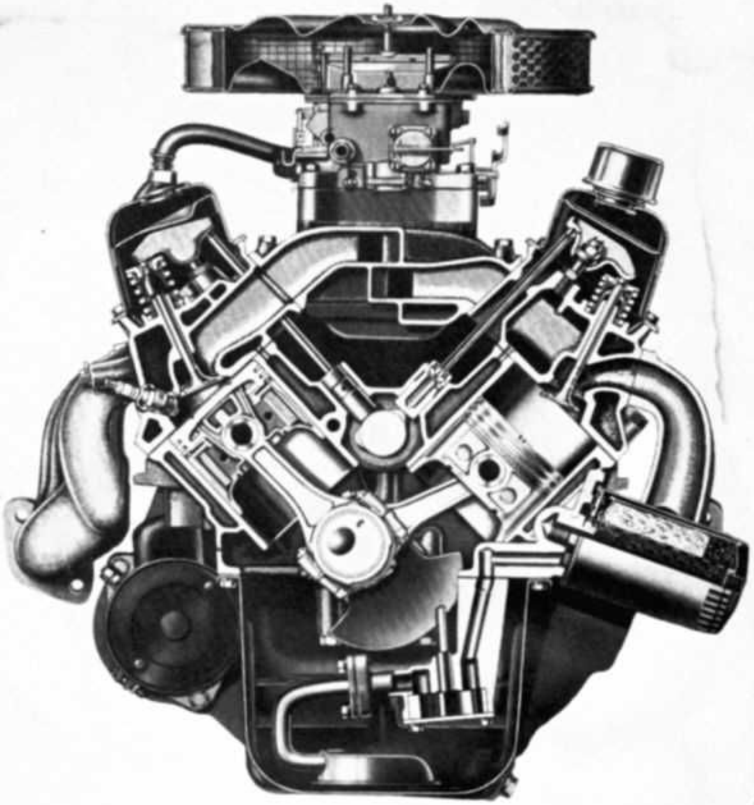


The Ford Motor Company's small 289-cubic-inch V8 remains unchanged in horsepower ratings and mechanical details for 1967 except that a 271-horsepower version has been dropped from production. The 200-horsepower version is offered as an optional engine in the Falcon, Fairlane, Galaxie, Mustang, Mercury Comet. It is standard in the Mercury Couger. The 225-horsepower version is optional in the Falcon, Mustang and Cougar. Because of its dual-barrel carburetor and low compression ratio the 200 horsepower version must be typed as an economy-class engine which functions on regular-grade fuel. The 225-horsepower model represents a middle-ground in performance, economy.

Type: Ohv V8
Displacement (cu. in.): 289
Horsepower @ rpm: A—200 @ 4400. B—225 @ 4800. C—271 @ 6000.
Horsepower per cubic inch: A—0.69. B—0.77. C—0.93.
Torque (lbs. ft.) @ rpm: A—282 @ 2400. B—305 @ 3200. C—312 @ 3400.
Bore & Stroke: 4.00 x 2.87
Compression ratio: A—9.3. B—10.1. C—10.5.
Carburetion: A—1 2-bbl. B.C—1 4-bbl.
Approximate weight: A—485. B—490. C—490.
Weight-to-hp ratio: A—2.43. B—2.45. C—1.81.

ENGINEERING EVOLUTION: The small Ford V8 was originally introduced in 221- and 260-cubic inch engines which were dropped in 1964 in favor of a new 289-cubic-inch model. Because of its intended use in the smaller Fords as an optional engine, the new engine was developed with compactness and lightweight as a major element in its design envelope. The greater displacement Ford engines use a Y-block design wherein the parting line of the cylinder-block casting is below the centerline of the crankshaft to provide a deeper cross-section in the main-bearing webs. In the 289, the Y-block design was discarded in favor of a parting line on the centerline of the crankshaft. While the main bearing webs are not as deep as in the Y-block design, they gain their strength by an increase in thickness. This increase in web thickness adds some weight but is considerably less than it would be in a Y-block design.

GENERAL: The engine has a 90-degree V8 configuration with pushrod-operated overhead valves. Hydraulic lifters are



1. Cross-section of 289 high-performance V8 with four-barrel carburetor. This engine uses solid lifters.

2. The Cobra manifold has Holley carbuburator with venturi vacuum operated secondaries. The standard manifold uses a Ford carburetor with mechanically operated secondaries.

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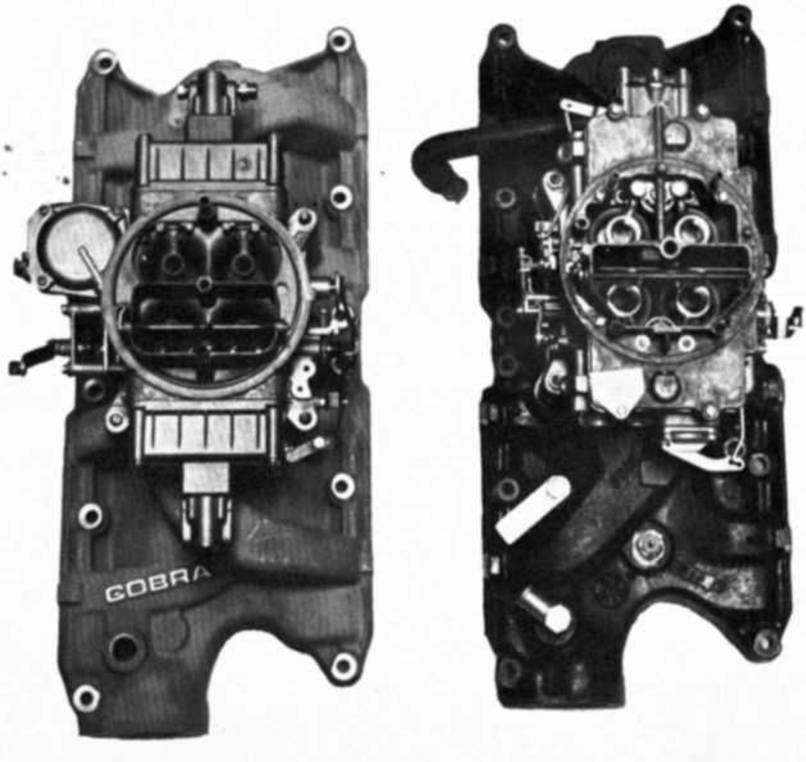

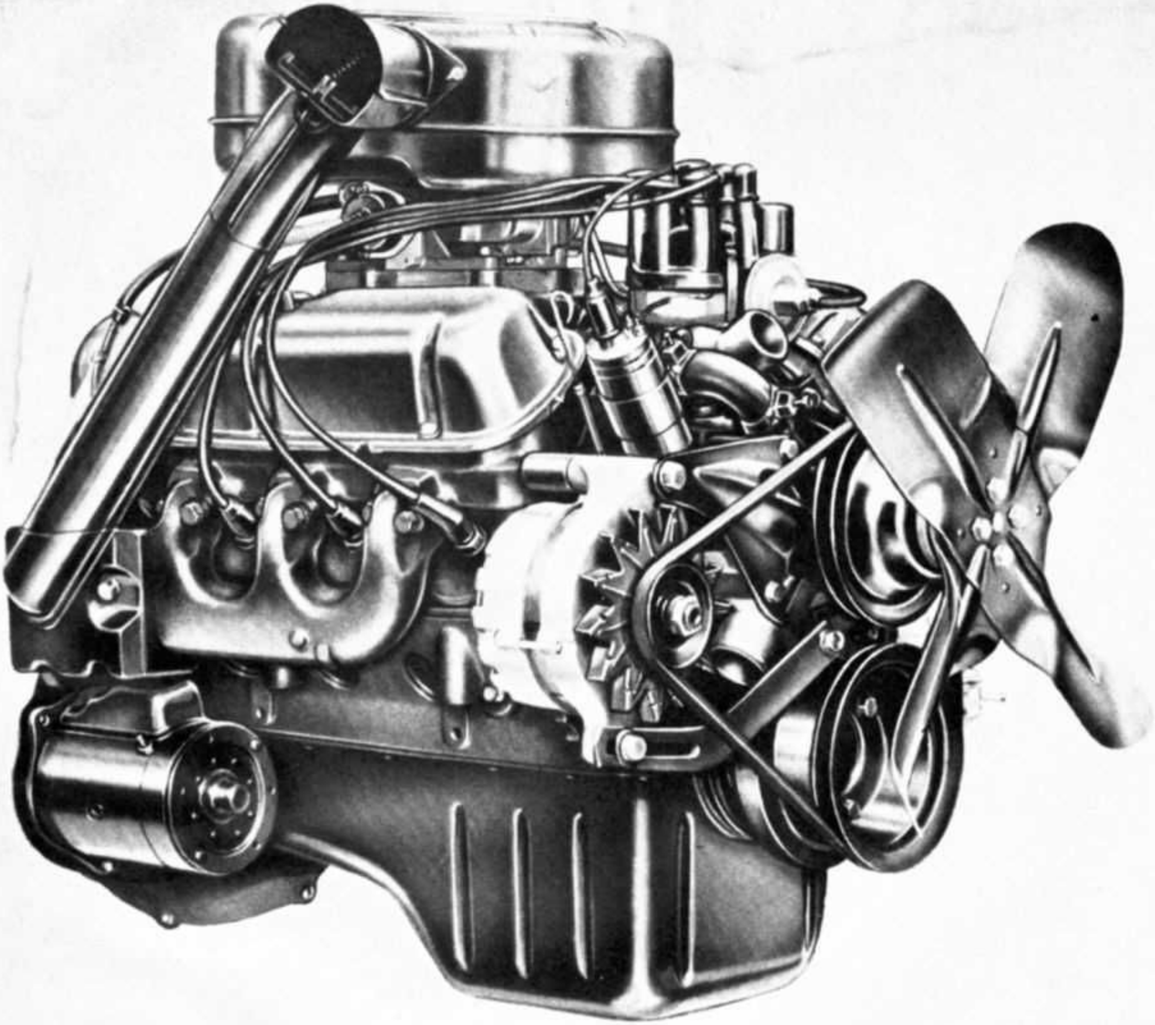

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used in the two versions. Thinwall casting techniques employed in the block and heads plus an aluminum timing-chain and accessory-drive cover contribute to the relatively light weight of the engine. The bore is an even four inches and the stroke is 2.87. This stroke is the shortest of any in any engine currently on the American market and also contributes to a reduction in engine weight because it allows the use of short connecting rods and reduces the overall size of the cylinder block casting. The very high bore-to-stroke ratio gives other advantages which include a low piston speed, reduced frictional losses, and the use of large valves to promote good breathing characteristics. The engines are rated at 200-hp at 4400 rpm, 225-hp at 4800 rpm. Torque peaks are 282 lbs. ft. at 2400 rpm and 312 lbs. ft. at 3400 rpm respectively. Compression ratios are 9.3:1 and 9.8:1. One two-barrel carburetor is used on the lower-powered version and the 225-horsepower model is fed by a four-barrel unit.

PISTONS, RINGS, PINS, RODS: The aluminum alloy pistons have been cam-ground and tin-plated. An autothermic design incorporates steel struts and a slipper-type skirt. Bare piston weight is a nominal 21.4 ounces. The compression rings are cast iron with molybdenum-filled groove in the top ring and a phosphate coating on the second ring. This second ring is designed with a scraper groove. The oil control rings are a three-piece assembly consisting of two chrome-plated, oxide-coated steel rails and a blue-steel spacer-expander. Piston pins are heat-treated SAE 5015 alloy steel and have a .9121-inch nominal diameter. Pin bores in the pistons are offset .0625 toward the right-hand side of the engine. The pins are a press fit in the connecting rods and are free to float in the pistons. Connecting rods are forged from SAE 1041 steel and have a 5.155-inch center-to-center length. The rods in the two models weigh a nominal 19.86 ounces. Connecting rod bearings are plated copper-lead alloy on steel replaceable inserts. Connecting rod bearing length is .721-inch.

CRANKSHAFT: The crankshaft is precision-molded cast iron and is equipped with a rubber-floated vibration damper. Main bearing bores in the cylinder block are offset so that the right bank leads .84-inch. The main bearing journals measure 2.2486 inches in diameter and the crankpin journals have a 2.1232-inch diameter. Main bearing lengths are .885 with the exception of the #3 bearing which takes the thrust and has a 1.132 overall length. All bearings are replaceable inserts with plated copper alloy on steel backs.

CAMSHAFT: The camshaft is precision molded from a special alloy iron, induction hardened, and phosphate coated. This shaft rides in five steel-backed babbitt bearings. Babbitt used for the bearings is SAE 15 lead-base. The timing chain meshes with a sintered iron or steel sprocket on the crankshaft and camshaft sprocket consisting of an aluminum body with molded nylon teeth. Camshaft lobes provide a 266-degree opening duration on the intake valves and a 256-degree duration on the exhausts with a 40-degree overlap. The lift provided by this camshaft is .3684 on the intake valves and .380 on the exhausts.

VALVES: The intake valves in both versions are SAE 1047 steel with aluminized heads. These valves have a maximum head diameter of 1.788. Valve seats in the heads are machined to a 44-degree, 30-minute tolerance and the valve faces to a 45-degree, 30-minute to 45-degree, 45-minute tolerance. Exhaust valves are cast austenitic steel with aluminized

2

1. Ford 289-inch engine equipped with four-barrel carburetor and heated carburator air intake. Heated air helps prevent carburetor icing.

2. Valve train showing the valve in wide-open position. Rocker arm has ball seat adjustable with self-locking nut. Oil for lubrication comes through hollow pushrod, through hole into rocker arm.

3. Block dimensions show compact size of 289 engine and will help in blueprinting or custom installations.

heads. Maximum head diameter of exhaust valves is 1.457. Single valve springs are used in both engines. Valve springs exert 71 to 79 pounds pressure when the valves are closed and 161 to 177 pounds when they are open. Valve keepers are designed so that both the intake and exhaust valves may rotate.

FUEL SYSTEM: Two plastic element fuel filters are used. One of these is located in the gasoline tank and the other in the fuel line at the carburetor. An engine-mounted mechanical pump delivers fuel at 4.5 to 5.5 psi. Ford-design carburetors are used on both versions of the engine. The two-barrel caburetor on the 200-horsepower version has 1.437-inch barrel diameters. The four-barrel unit on the 225-horsepower model has 1.437-inch primary barrels and 1.562 secondaries.

LUBRICATION SYSTEM: The full-flow filter lubrication system is fed by a rotor-type pump which develops 50 to 60 psi at 2000 rpm engine speed. Main bearings, connecting rod bearings, camshaft bearings, and tappets receive full-pressure lubrication. The timing chain is splash-oiled. Piston pins are lubricated by oil mist in the crankcase and the cylinder walls by a pressure stream.

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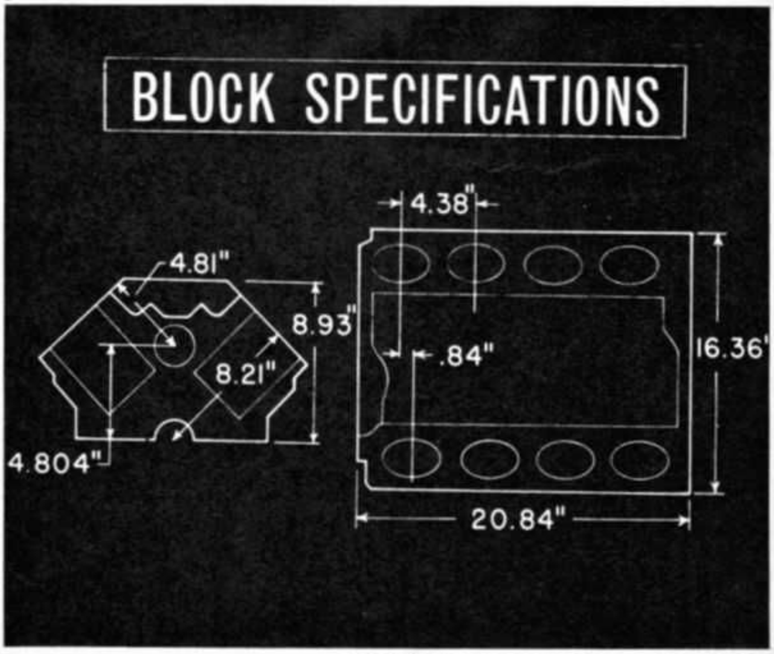
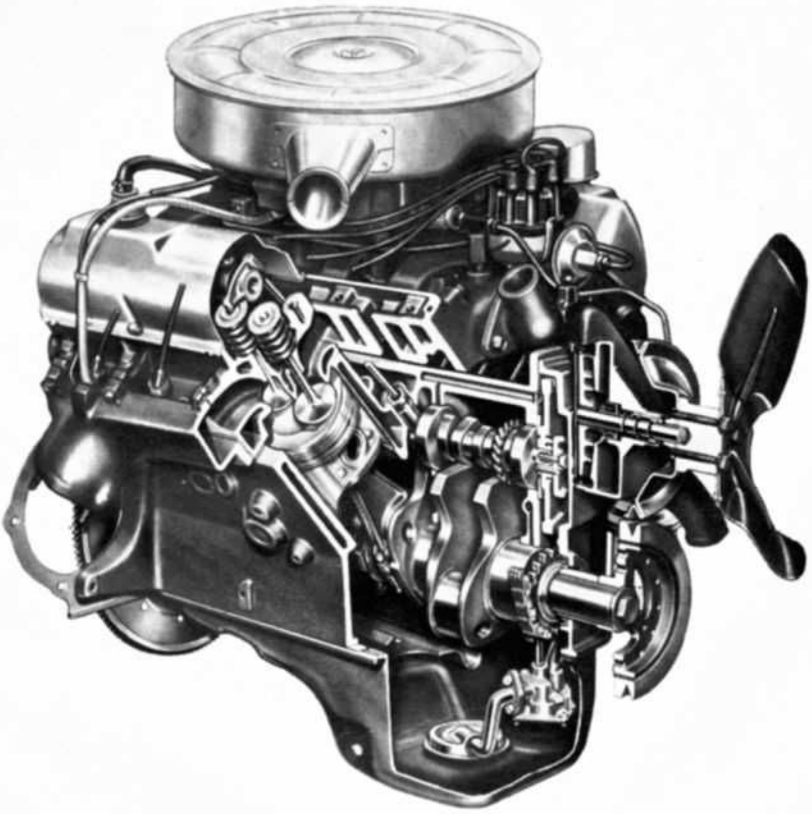
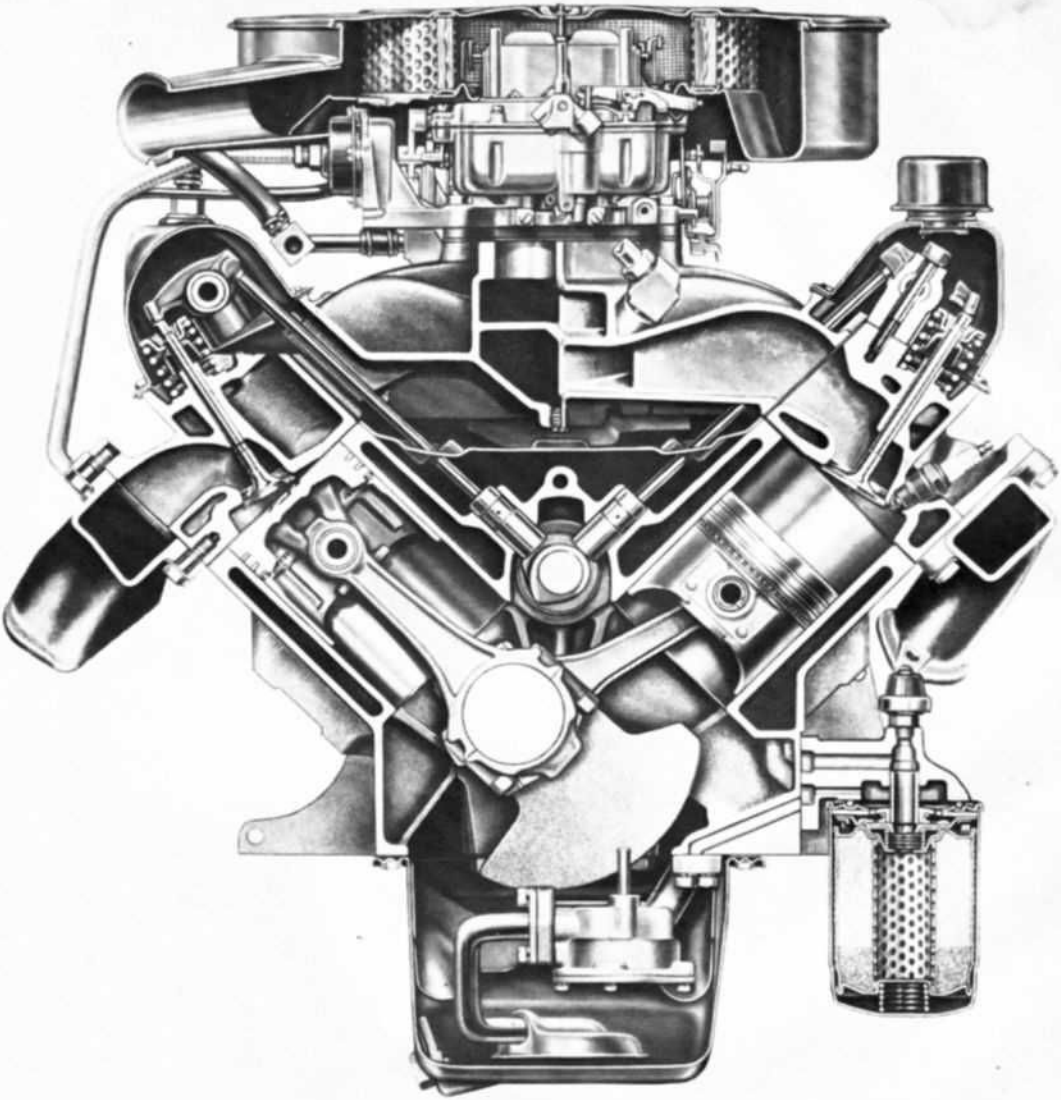


FORD BIG V8 *352, 390, 410 and 428 cubic inches*



The Ford Motor Company big V8's are a closely related family of engines with a wide variety of horsepower outputs. Use of the 427-cubic-inch models is confined to an option in the full-sized Fords and the 410-cubic-inch engine is used exclusively in the Mercury. The 390-cubic-inch, 315-horsepower model is standard in the Thunderbird. Other engines within the classification are either standard or optional in the balance of the Ford and Mercury lines.

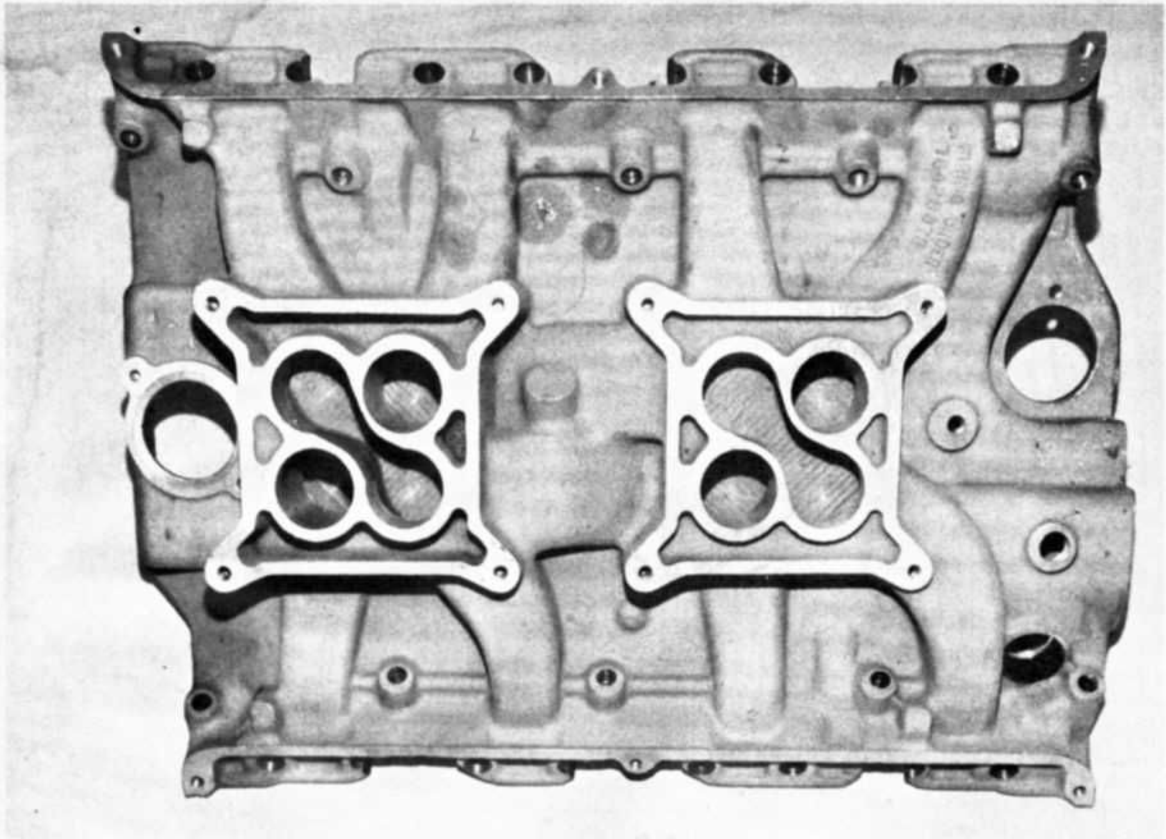
Type: Ohv V8.
Displacement (cu. in.): A,B,C,D—390. E—410. F—428. G,H—427.
Horsepower @ rpm: A—270 @ 4400. B—315 @ 4600. C—320 @ 4800. D—335 @ 4800. E—330 @ 4600. F— 345 @ 4600. G— 410 @ 5600. H—425 @ 6000.
Horsepower per cubic inch: A—0.69. B—0.80. C—0.82. D—0.86. E—0.80. F—0.80. G—0.96. H—0.99.
Torque (lbs. ft.) @ rpm: A—403 @ 2600. B—427 @ 2800. C—427 @ 3200. D—427 @ 3200. E—444 @ 2800. F—462 @ 2800. G—476 @ 3400. H—480 @ 3700.
Bore & Stroke (in.): A,B,C,D—4.05 x 3.78. E—4.054 x 3.984. F—4.13 x 3.93. G,H—4.24 x 3.79.
Compression ratio: A—9.5. B,C,D,E,F—10.5. G,H—11.1.
Carburetion: A—1 - 2 bbl. B,C,D,E,F,G—1 - 4 bbl. H—2 - 4 bbl.
Approximate weight: A—660 lbs. B,C,D—665 lbs.
Weight-to-hp ratio: A—2.44. B—2.11. C—2.08. D—1.99.



From the forward end, the big Ford 428 V8 cross-sectional view showing crank, pistons, carburetor, and valve setup.

ENGINEERING EVOLUTION: The present breed of Ford Motor Company big V8's had their origin in 1958 with the introduction of a 352-cubic-inch model. During 1961, the 390-cubic-inch model reached the market. This model has been retained with considerable evolutionary improvement. The 410 and 428-cubic-inch models were introduced for the 1966 model year and the 427-cubic-inch models are the offshoot of an earlier engine designed for NASCAR racing and later produced as two de-tuned versions of the original. A clue to the similarity of all engines in the group can be seen in their common 4.63-inch bore spacing.

GENERAL: All engines in this family have cast iron cylinder blocks and heads set in a 90-degree, V8 configuration. The valves are pushrod operated through hydraulic lifters with the exception of the 427-cubic-inch versions which use solid tappets. Cylinder blocks have a "Y" configuration which derives such a description from the fact that the cylinder banks form the upper arms of the "Y" and the deep skirt, which extends below the crankshaft centerline forms the lower leg. This deep skirt has ribs which tie into the main bearing webs and thus provides a very stiff crankcase to aid in preventing crankshaft distortion. The 270-horsepower, 390-cubic-inch version is a regular fuel engine using a 9.5 to 1 compression ratio and two-barrel carburetor. Four barrel carburetors and a 10.5 to 1 compression ratio are utilized in the 315 and 320-horsepower models of the 390. The 410-cubic-inch, 330-horsepower engine, and the 428-cubic-inch, 345- horsepower model has a four-barrel carburetor and 10.5 to 1 compression ratio. A pair of four-barrel carburetors is used on the 425-horsepower 427 and the lower-powered engine is fed by a single four-barrel unit. Both of the 425's have a 11.1 to 1 compression ratio.



PISTONS, RINGS, PINS, RODS: The pistons in this family of engines are an autothermic type cast from aluminum alloy with steel struts. If the finishing operations, they are cam ground and tin plated. A major difference in the various pistons is the solid skirt design used in the other engines. The compression rings are cast alloy iron. Top rings are chrome-plated and have a molybdenum-filled groove. The second rings have a scraper groove and are chrome-plated. Oil-control rings are a three-piece assembly consisting of two chrome-plated and oxide-coated steel rails with a rustless steel expander-spacer. The piston pins are heat-treated SAE 5011 alloy steel and have a .9752-inch nominal diameter. These pins float both in the pistons and connecting rods. Pin bores in the pistons are offset .0625-inch toward the major thrust side of the engine. The connecting rods are forged from SAE 1041 steel and have bronze bushings at their upper ends for the piston pins. Connecting rod bearings have a nominal .741-inch length and are replaceable inserts with plated copper-lead alloy on steel backs.

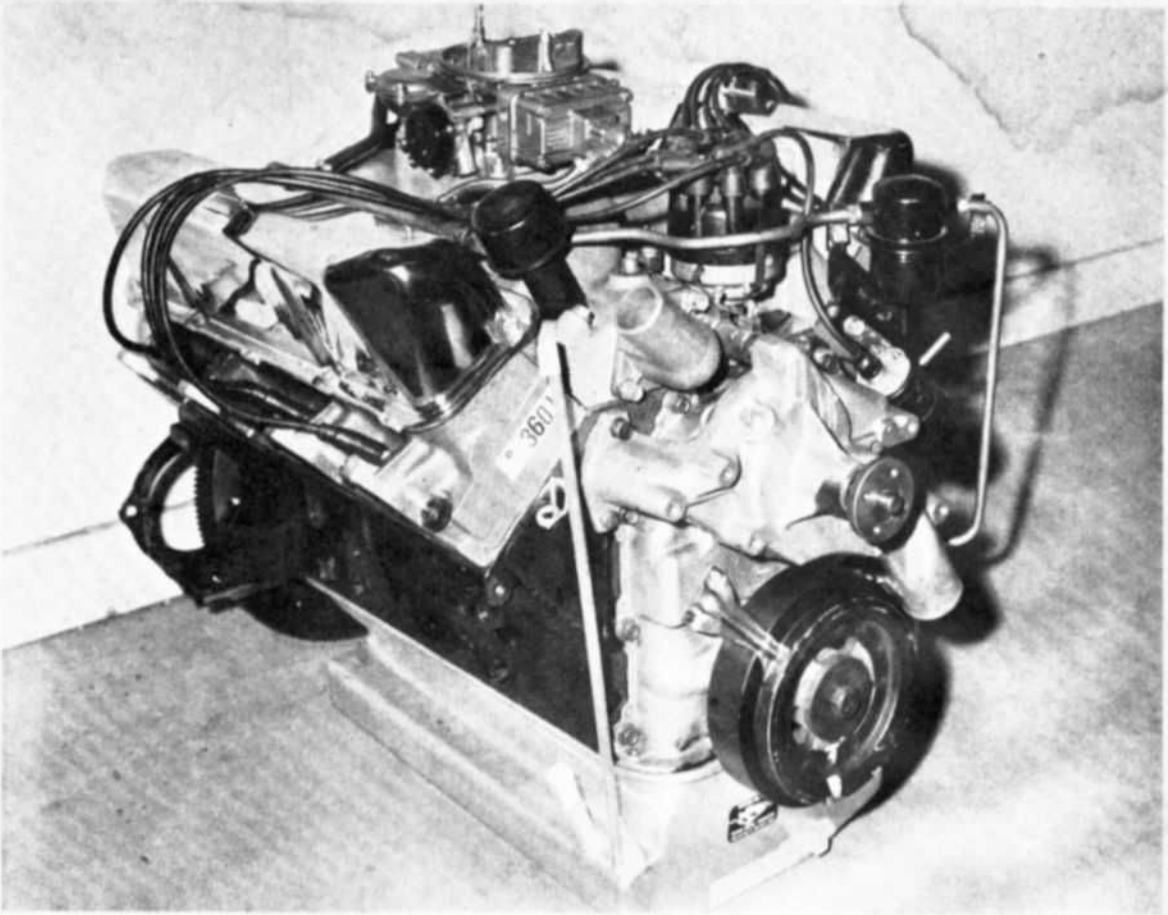
CRANKSHAFT: The crankshafts are precision-molded alloy iron and are equipped with elastic-suspended vibration dampers. Main bearings are replacable inserts with plated copper-lead alloy on steel backs. The crankshaft thrust is taken on the #3 bearing which has a 1.119-inch length. The remainder of the bearings have a .907-inch length. Main bearing journals meausre 2.7488-inch in diameter and the crankpin journals have a nominal 2.4384-inch diameter.

CAMSHAFT: The camshafts are precision-molded from special alloy iron, induction-hardened, and phosphate-coated. These shafts ride in five steel-backed, lead-based babbitt bearings. The drive chain meshes with either a sintered-iron or steel sprocket on the crankshaft and a sprocket on the camshaft which has a die-cast aluminum body with molded nylon teeth. Camshaft characteristics in the 270-horsepower, 390 engine produce a 256-degree duration on the intake valves, 266 degrees on the exhaust valves, and a 36-degree overlap. The camshafts in 315-horsepower 390, 330-horsepower 410, and 345-horsepower 428 produce a 256-degree duration on both exhausts and intakes with a 37-degree overlap. In the Cougar 320-horsepower 390, the intake and exhaust valve opening duration is 270 degrees with a 44-degree overlap. The 427-cubic-inch models have a 324-degree duration on both intakes and exhausts with a 96-degree overlap.

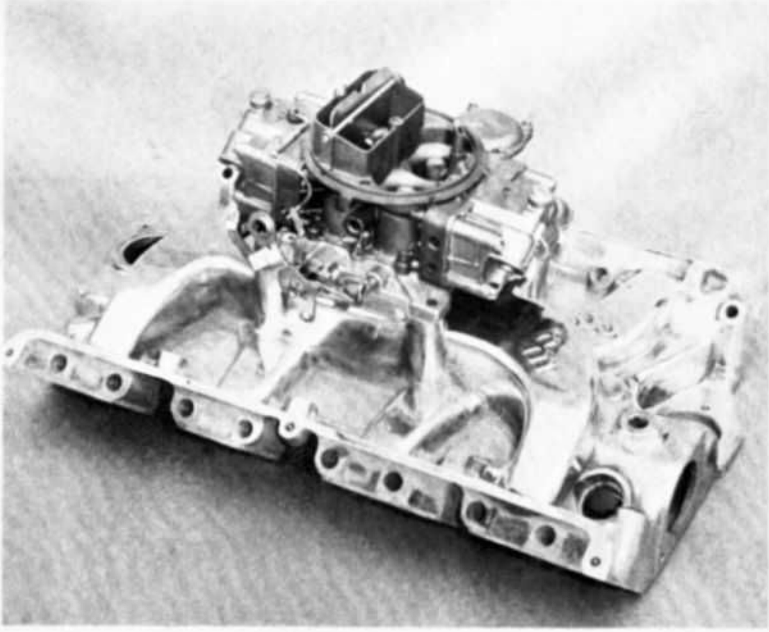
VALVES: The intake valves in all engines are a special alloy steel with aluminized heads. Exhaust valves are cast austentic steel and also have aluminized heads. Major head diameter of the intakes in all engines except the 427's is 2.037 inches and the major exhaust valve head diameters in all engines is 1.566 inches. The intakes in the 427's measure 2.097 inches at their major diameter. All engines use single valve springs and these are supplemented by dampers in the 427-cubic-inch models.

Double 4-barrel manifold used by the high-performance enthusiasts. Alternate for NASCAR use and racing Cobra is the single high-riser unit (not shown).

FUEL SYSTEM: The fuel system is fed by a mechanical engine-driven pump. Plastic mesh or wire-cloth filters are employed in the fuel tank and at the carburetor inlets. The two-barrel carburetor used on the 270-horsepower 390 has 1.437-inch barrel diameters when the engine is coupled to a manual transmission and 1.562-inch barrels when teamed with an automatic Four-barrel units used on 320-horsepower 390 and 345-horsepower 428 have 1.562-inch barrel diameters. The four-barrel carburetor on the 390-horsepower 315 has 1.437-inch barrel diameters and the secondaries measure 1.562 inches. Both primary and secondary barrel diameters in the 410-cubic-inch Mercury engine measure 1.437 inches.



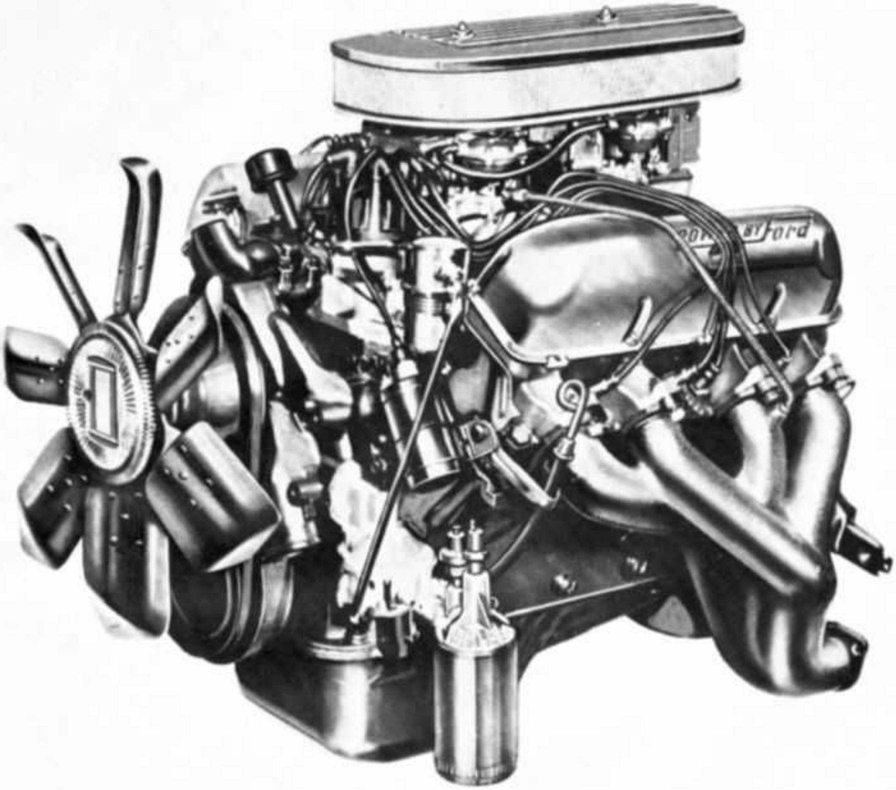
Above: Here is a 427 Ford ready for shipment.



Right: Holman & Moody, Stroppe make this aluminum high-rise manifold for use with the Holley 780 CFM carburetor.

LUBRICATION SYSTEM: Main bearings and connecting rod bearings, camshaft bearings and tappets receive full-pressure lubrication. Cylinder walls are oiled by pressure steam. The timing chain is splash-lubricated and the piston pins by crankcase oil mist.

FORD BIG V8 *427 cubic inches*



The Ford Motor Company continued to offer two versions of this big V8 for 1967, both with 427 cubic inches of displacement. The 427 is virtually unchanged in power output rating and construction from the engine available in 1965 and 1966. Both versions of the engine are ultra-high performance powerplants. To contain the stresses developed by their high power output, the engines incorporate materials and design details which contribute to the high reliability factors essential to this class of powerplants.

Type: Ohv V8.
Displacement (cu. in.): A,B—427.
Horsepower @ rpm: A—410 @ 5600. B—425 @ 6000.
Horsepower per cubic inch: A—0.96. B—0.99.
Torque (lbs. ft.) @ rpm: A—476 @ 3400. B—480 @ 3700.
Bore & Stroke (in.): A,B—4.23 x 3.78.
Compression ratio: A,B—11.1.
Carburetion: A—1 4-bbl. B—2 4-bbl.
Approximate weight: A—680. B—685.
Weight-to-hp ratio: A—1.66. B—1.61.

ENGINEERING EVOLUTION: The 427-cubic-inch Ford engine stem from the 352-cubic-inch powerplant introduced in 1958. The major basic differences which distinguish the 427's from other big Ford V8's lies in the fact that the 427's are set up to be used for ultra-performance duty. They are generally beefier inside, having heavy-duty connecting rods and a forged steel crankshaft held in place by cross-bolted main bearing caps.

GENERAL: The 427-cubic-inch Ford engines have cast iron cylinder blocks and heads set in a V8 configuration. Valves are pushrod actuated through solid lifters. The cylinder blocks follow Ford's "Y-block" design wherein the parting line of the casting falls below the centerline of the crankshaft. Bore is 4.23 inches and the stroke 3.78 inches. The lower-horsepower version is rated at 410 horsepower at 5600 rpm and 476 lbs. ft. torque at 3400 rpm. Ratings for the more powerful version are 425 horsepower at 6000 rpm and 480 lbs. ft. torque at 3700 rpm. Both versions have an 11.1 to 1 compression ratio. The 410 horsepower model is equipped with a single four-barrel carburetor and the other engine is fitted with two four-barrel units.

PISTONS, RINGS, PINS, RODS: The pistons are cast aluminum autothemic type with steel struts and solid skirts. In the finishing operations, these pistons are cam ground and tin plated. Compression rings are cast alloy iron. The top ring is chrome plated and has a molybdenum-filled groove. Lower compression rings have a scraper groove and are phosphate coated. The oil-control rings are a three-piece assembly consisting of two chrome plated steel rails and a blued-steel expander-spacer. Piston pins are SAE 5015 steel and have a .9752-inch diameter. These pins float both in the pistons and in bronze bushings in the connecting rods. Pin bores in the pistons are offset .0625 inch toward the right isde of the engines. Connecting rods are forged from SAE 1041 steel. The connecting rod bearings are replaceable inserts with copper lead alloy on steel backs. These bearings have a .741-inch length.

CRANKSHAFT: The forged crankshaft is fitted with a rubber-floated, inertia-type vibration damper. Main bearings are replaceable inserts with plated copper-lead alloy on steel backs. These bearings measure .907 inch in length with the exception of #3 which takes the thrust and is 1.119 inches long. Main bearing journals have a 2.7488-inch diameter and the crankpins measure 2.4384 inches in diameter.

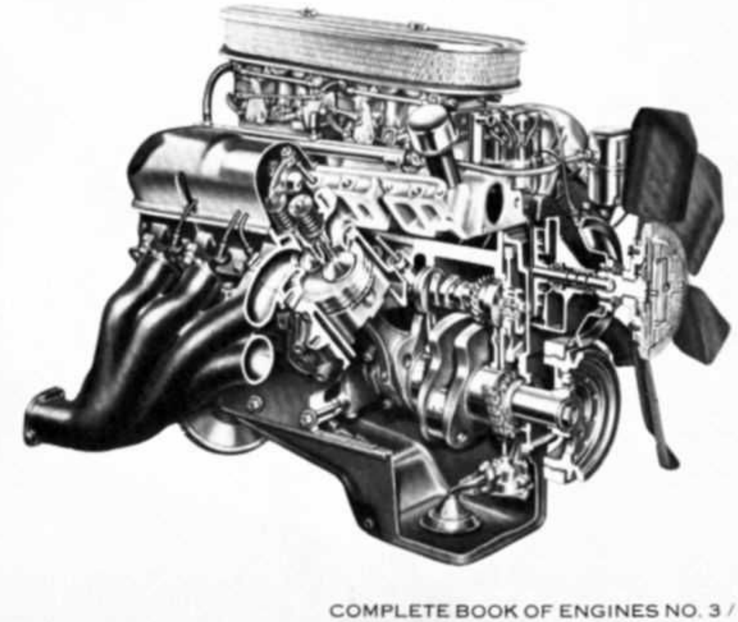
CAMSHAFT: The camshaft is precision molded special alloy iron and rides in five lead base babbitt bearings with steel backs. A silent chain drive meshes with a sintered iron or steel sprocket on the crankshaft and a sprocket on the camshaft which has a die cast aluminum body and molded nylon teeth. The camshaft lobe configuration is identical in both versions of the engine. Valve opening duration on both intake and exhaust valves is 324 degrees. There is a 96-degree valve opening overlap and the lift on both sets of valves is .524 inch.

VALVES: Intake valves are a special alloy steel with aluminized heads and chrome plated stems. Major head diameters on the intakes are 2.097 inches. The seats and faces of these intakes are finished to a nominal 30-degree angle. Exhaust valves cast austenitic or forged 21-4N steel with aluminized heads and chrome plated stems. Major exhaust valve head diameters are 1.66 inches. The exhaust valve seats are finished to a nominal 45 degrees and the heads to 44 degrees. Single valve springs and oscillation dampers are used on both exhaust and intakes. The single springs exert 80 to 90 pounds pressure when the valves are closed and 255 to 280 pounds when open. Unlike the smaller Ford V8's, no provision is made to rotate either the exhaust or intake valves on their seats. Valve lash is specified as .025 to .028-inch when the engine is hot.

FUEL SYSTEM: Fuel filtering is accomplished by two woven nylon and Monel cloth filters, one of which is located in the fuel tank and the other in the fuel line, downstream from the fuel pump. The mechanical, engine-mounted pump delivers fuel at 5.5 to 6.5 psi. Holley carburetors used on the engines have 1.56-inch barrel diameters.

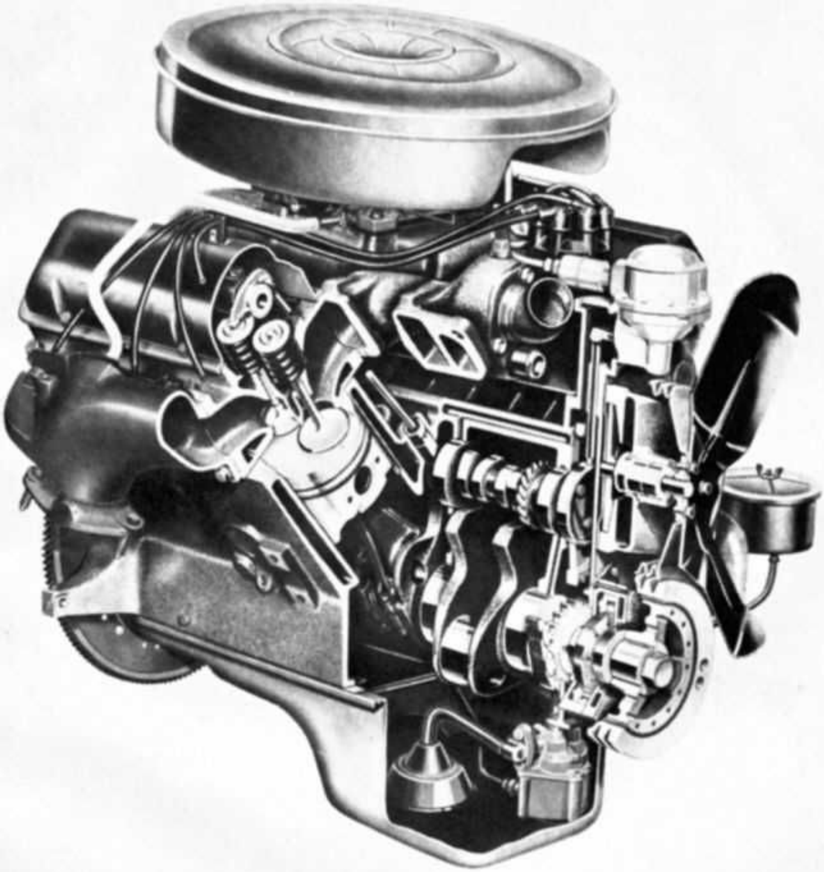
LUBRICATION SYSTEM: The engines have a full-flow filter system supplied by a rotor-type oil pump. Main bearings, connecting rod bearings, and camshaft bearings receive full pressure lubrication. The tappetts, timing chain, cylinder walls, and piston pins are lubricated by splash and oil mist.

Cast aluminum piston used in 427-inch V8. These pistons have solid skirts with a steel strut insert.



The Ford 427-inch V8 with dual Holley four-barrel carbs. The carbs are turned backwards from the usual position. Notice the fuel log and heavy-duty fuel filter with replaceable element.

LINCOLN V8 *462 cubic inches*



The 1967 Lincoln V8 is the largest and heaviest engine on the current American market. This engine is essentially similar to the 1966 model except for some minor changes in the carburetion system. Designed to propel a vehicle weighing in excess of two and a half tons, the engine's very high torque at relatively low crankshaft speeds make it ideal for this purpose. Excellent engineering plus meticulous attention to manufacturing, inspection, and testing details, give the engine a high measure of smoothness and reliability. Typical of such procedures is a program which schedules a partial disassembly of each engine after a test period for inspection plus a run-in period during which final adjustments are completed.

Type: Ohv V8.
Displacement (cu. in.): 462.
Horsepower @ rpm: 340 @ 4600.
Horsepower per cubic inch: 0.73.
Torque (lbs. ft.) @ rpm: 485 @ 2800.
Bore & Stroke: 4.38 x 3.83.
Compression ratio: 10.25.
Carburetion: 1 4 bbl.
Approximate weight: 750.
Weight-to-hp ratio: 2.21.

ENGINEERING EVOLUTION: The present Lincoln engine had its' origin in 1958 but has undergone thorough evolutionary and engineering improvements which make it practically unrecognizable from the original version. In 1965, the engine displaced 430 cubic inches and developed 320 horsepower. Increases in both bore and stroke have brought it to its present huge displacement. This upgrading in displacement was accompanied by many improvements including a redesigned block casting, new cylinder heads, new intake manifold, larger valves, improved carburetion and a new camshaft.

GENERAL: This 90-degree V8 has push-rod-operated overhead valves and hydraulic lifters. The cast iron cylinder block has been redesigned to accommodate the larger bore, longer stroke, and a larger bell housing. New cast iron cylinder heads have water passages surrounding the spark plugs and exhaust ports approximately double the previous size for improved cooling. The combustion chamber design which incorporates flat-machined cylinder heads with the mating cylinder block surface at 10 degrees to the cylinder axis forms the chamber entirely within the block. A wedge shaped configuration of the piston crown forms the combustion chamber squish area. The bore of this big engine is 4.38 inches and the stroke 3.83. Maximum horsepower is 340 at 4600 rpm and the peak torque is 485 lbs. ft. at 2800 rpm. Compression ratio is 10.25:1. Fuel and air mixed in a single four-barrel carburetor.

PISTONS, RINGS, PINS, RODS: The pistons are tin-plated aluminum alloy with slipper type skirts. Both compression rings are cast alloy iron. The top ring has a molybdenum-filled groove while the second ring has a scraper groove and is phosphate coated. Oil control rings are a three-piece type with two chrome-plated, oxide coated steel rails and a stainless steel expander-spacer. Piston pins are SAE 5015 steel and have a nominal .975-inch diameter. These pins are a press fit in the connecting rods and a close-tolerance select floating fit in the pistons. Pin bores in the pistons are offset .0575 to .0675 toward the right hand side of the engine. Connecting rods are SAE 1041 steel forgings. The bearings are copper-lead alloy, steel-backed replaceable inserts. These bearings are selectively fitted at the time of assembly. Connecting rod bearing length is a nominal .86 inch.

CRANKSHAFT: The crankshaft is precision-molded alloy iron and is equipped with a rubber-floated vibration damper. Main bearings are replaceable inserts with copper-lead alloy on steel backs. Crankshaft thrust is taken on the number three bearing which has a 1.119-inch length. All other bearings measure .995 in length. Bearing centers are offset so that the right bank of cylinders leads by one inch. Main bearing journals have a 2.8999-inch diameter and the crankpins have a 2.5997-inch nominal diameter.

CAMSHAFT: The camshaft is induction-hardened, precision-molded alloy iron. Its five bearings are lead-base babbitt on steel backs. The drive chain meshes with a sintered-iron or steel sprocket on the crankshaft and a sprocket on the camshaft which has an aluminum body and molded nylon teeth. Camshaft lobe configurations provide a 276-degree valve opening on both intakes and exhausts with a 47-degree overlap. The lift on both sets of valves is .442 inch.

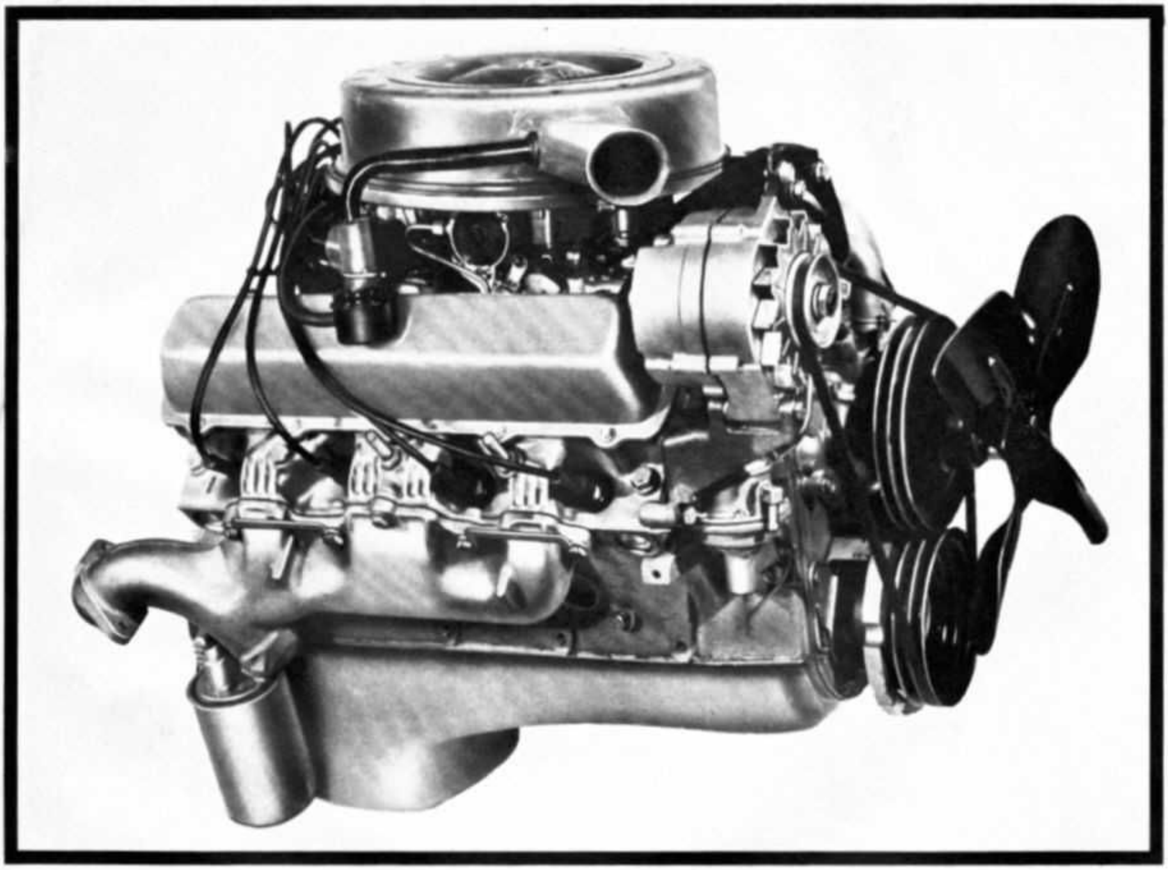
VALVES: The intake valves are silicon-chromium alloyed steel. Major head diameter of the intakes is 2.037 inches. Exhaust valves are cast austenitic steel with aluminum-coated heads. Major head diameter of the exhaust valves is 1.660. Single valve springs are used which exert 70 pounds pressure when the valves are closed and 205 pounds when open.

FUEL SYSTEM: Fuel filtering is provided for by a plastic-mesh strainer in the fuel tank and a disposable paper-element filter in the fuel line. A unique feature of the engine is its thermostatically controlled, self-cooling fuel pump. Above 120°F under hood temperature a by-pass valve begins to open, allowing fuel to circulate through the pump and return to the tank. In addition to carrying heat away from the pump, the fuel circulation eliminates bubbles in the fuel line and thus reduces the possibility of vapor lock. The intake manifold is designed to place the primary barrels of the carburetor in a central position to provide an equal flow to all cylinders at low and cruising speeds. Secondary barrels of the carburetor are offset toward the rear and deflectors in the primary barrels serve to balance the flow when all four barrels are functioning. Carter four-barrel C6VF series carburetors are used with various jet combinations to meet altitude and extra equipment power demands. Primary barrels in these carburetors have 1.562 inch diameters and the secondaries are 1.687 inches in diameter.

LUBRICATION SYSTEM: The full-flow filter system is supplied by a rotor-type pump developing 45 to 62 psi at 2000 rpm engine speed. Main bearings, connecting rod bearings, camshaft bearings and tappets receive full-pressure lubrication. Cylinder walls are oiled by an indexed pressure stream, the timing chain by a reduced pressure stream and the piston pins by oil mist.

Big Lincoln engine bears little or no resemblance to the rest of the Ford family of powerplants. Combustion chambers are in the piston crowns and head surfaces are flat, somewhat reminiscent of the Chevrolet 409. Designed primarily for high torque loads at relatively low revs, the bottom end is massive with excellent connecting rod design. Moderate power boosts and higher peak speeds would be easy to attain with little or no loss in smoothness and low rpm operation.

OLDS SMALL V8 *330 cubic inches*



Except for minor changes, the small 1967 Oldsmobile V8 remains basically similar to the engine introduced for the 1965 and 1966 model years. The engine is optional in the intermediate sized F-85, Cutlass, and Cutlass Supreme. In its 250-horsepower version it is standard in the full-sized Delmont 88. These 250 and 310-horsepower models are intended for use with regular grade fuel and the other versions are designed for use with premium grade fuel.

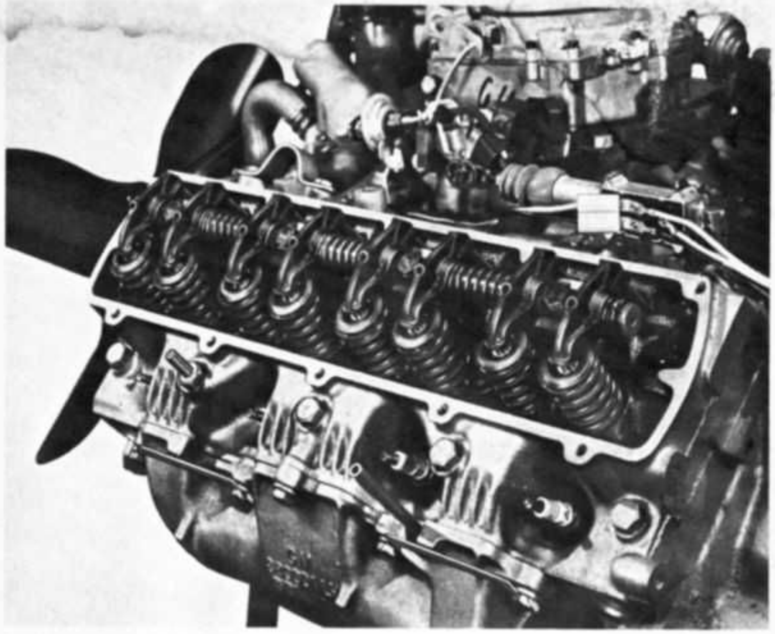
Type: Ohv V8
Displacement (cu. in.): 330.
Horsepower @ rpm: A—250 @ 4800. B—260 @ 4800. C—310 @ 5200. D—320 @ 5200.
Horsepower per cubic inch: A—0.75. B—0.78. C—0.93. D—0.96.
Torque (lbs. ft.) @ rpm: A—335 @ 2800. B—335 @ 2800. C—340 @ 3600. D—360 @ 3600.
Bore & Stroke: 3.9385 x 3.385.
Compression ratio: A,C—9.0. B,D—10.25.
Carburetion: A,B—1 2-bbl. C,D—1 4-bbl.
Approximate weight: A,C—560. B,D—565.
Weight-to-hp ratio: A—2.24. B—2.17. C—1.81. D—1.77.

ENGINEERING EVOLUTION: The 330-cubic-inch Oldsmobile V8 can trace its ancestry back to the fall of 1948 when Oldsmobile and Cadillac created a revolutionary change in American engine design with the first of the short stroke V8's. In 1964, the present 330-cubic-inch version of the original "Rocket" engine went through considerable upgrading in basic design so that the engine would complement the lively intermediate series of Oldsmobiles.

GENERAL: The cast iron cylinder block and cast iron heads are arranged in a V8 configuration. The valves are pushrod-actuated through hydraulic lifters. The bore is 3.9385 inches and the stroke 3.385 inches. The lowest-rated engine develops 250 horsepower at 4800 rpm and 335 lbs. ft. torque at 2800 rpm. This engine has a two-barrel carburetor and 8.5 to 1 compression ratio. The next engine in the power lineup delivers 260 horsepower at 4800 rpm and 235 lbs. ft. torque at 2800 rpm. This engine has a two-barrel carburetor and 10.25 to 1 compression ratio. The third engine on the power scale delivers 310 horsepower at 5200 rpm and 340 lbs. ft. torque at 3600 rpm. This regular fuel grade engine has a four-barrel carburetor and 9.0 to 1 compression ratio. Top-powered engine in the lineup develops 320 at 3600 rpm. It is equipped with a four-barrel carburetor and has a 10.25 to 1 compression ratio.

Latest thin-wall casting techniques are used in the manufacture of the 330-cubic-inch Oldsmobile block for lighter weight and better casting.

PISTONS, RINGS, PINS, RODS: The aluminum alloy pistons are autothermic type with steel struts. Finishing operations on the pistons include cam grinding and tin plating. Both compression rings are cast iron with chrome-plating on the upper ring and a Parco Lubrite treatment on the lower ring. Oil control rings are a three-piece assembly with two chrome-plated steel rails and a stainless steel expander-spacer. Piston pins are SAE 1019 steel and have a .9803 to .9807-inch diameter. Pin bores in the pistons are offset .06 inch toward the right-hand side of the cylinder bore centerlines. Connecting rods are SAE 1140 steel. Bearings in these rods are steel-backed Moraine M-100 babbitt. Overall length of the rod bearings is .821 to .831 inch.



Valve train of the 330 uses a solid steel rocker shaft which is supported by four aluminum blocks. The oil supply is fed through hollow push rods.

CRANKSHAFT: The crankshaft is an A.I.S.I. 1049 modified alloy. In the 310- and 320-horsepower models, a rubber-absorption-type vibration damper is used but is eliminated from the 250- and 260-horsepower versions. The crankshaft end thrust is taken by main bearing #3 which has a 1.010-inch overall length.

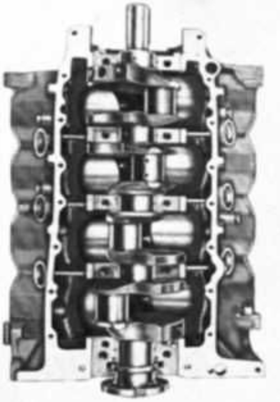
Bearings #1, #2, and #4 measure .975 inch in length and the rear bearing is 1.624-inch long. All main bearings are Moraine M-100 babbitt on steel backs. Main bearing journal diameters are 2.5 inches in diameter and the crankpins have a 2.12-inch diameter.

CAMSHAFT: The cast alloy iron camshaft rides in five steel-backed babbitt bearings. A silent drive chain meshes with a steel or sintered-iron sprocket on the crankshaft and either a cast iron or an aluminum-hubbed, nylon-toothed sprocket on the camshaft. Camshaft lobes in the two lower-powered models provide a 250-degree valve opening duration on the intake valves and a 264-degree duration on the exhausts with a 36-degree overlap. Valve lift with this camshaft is .389 inch on the intake valves and .390 inch on the exhausts. In the two higher-horsepower models, the camshaft provides a 278-degree valve opening duration on the intakes and 282 degrees on the exhausts with a 52-degree overlap. Lift on both sets of valves with this camshaft is .433 inch.

VALVES: Both intake and exhaust valves have 45-degree seats in the cylinder heads and a 46-degree angle on their faces. Single valve springs are used in conjunction with harmonic oscillation dampers. In the closed valve position, these springs exert 80 pounds pressure when the valves are closed and 187 pounds when they are open.

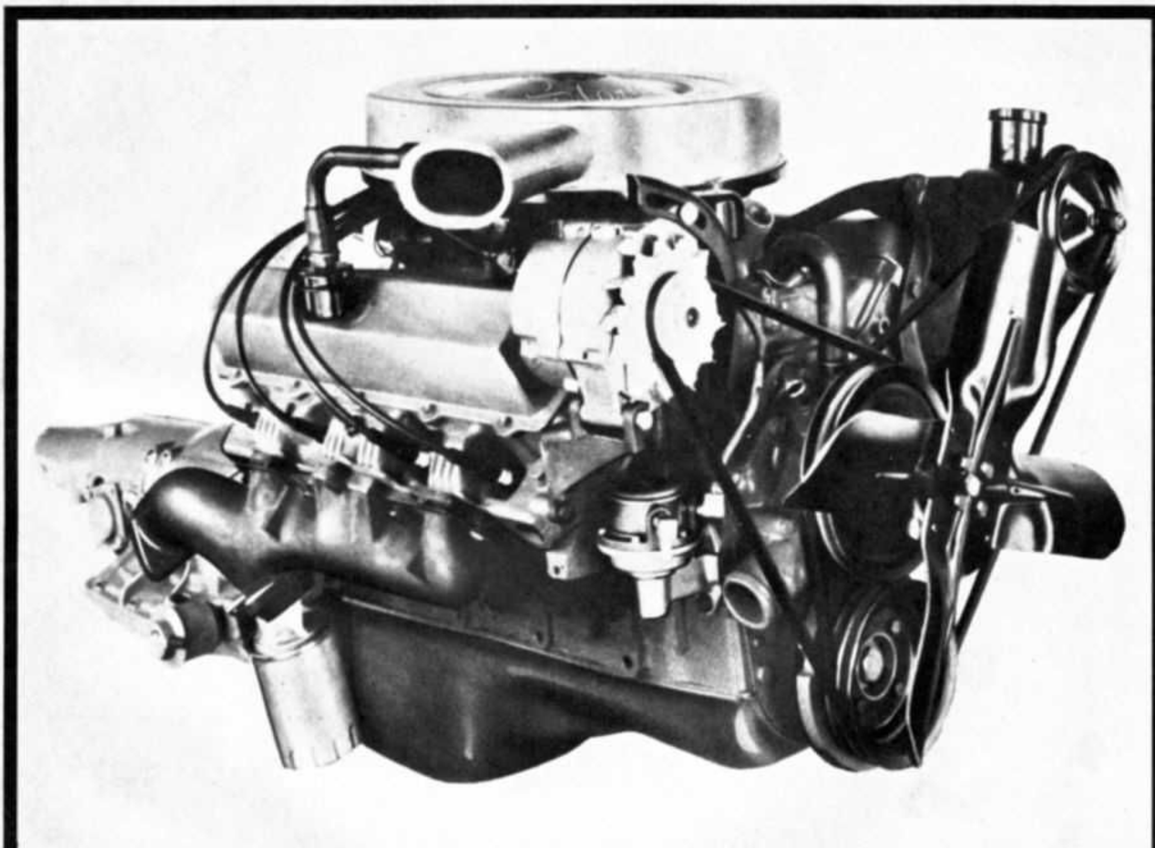
FUEL SYSTEM: Fuel filtering is accomplished by a plastic mesh unit in the fuel tank and a sintered-bronze filter in the carburetor inlet. The engine-mounted mechanical pump delivers fuel at 7.75 to 9 psi to the carburetor. Two-barrel carburetors used on the 250- and 260-horsepower engines are Rochester 2GC models with 1.6875-inch barrel diameters. The four-barrel Rochester 4MV units used on the 310- and 320-horsepower engines have 1.375-inch primary barrel diameters and 2.25 secondaries.

LUBRICATION SYSTEM: The lubrication system incorporates a full-flow filter. Oil is delivered by a gear-type pump which develops 30 to 45 psi at a 50-mph vehicle speed. Main bearings, connecting rod bearings, camshaft bearings, and tappets are full-pressure lubricated. A nozzle directs oil to the timing chain. Piston pins are lubricated by crankcase splash and the cylinder walls by throw-off from the connecting rod bearings.



Five rigid main webs in the cylinder block of Oldsmobile's new Jetfire Rocket support the forged steel crankshaft.

OLDS BIG V8 *400 and 425 cubic inches*



The big Oldsmobile V8's offered for 1967 are essentially similar in basic design and construction to those offered in 1966. A 400-cubic-inch model is offered for exclusive use in the Oldsmobile 4-4-2. The 300-horsepower, 425-cubic-inch model is a regular-fuel-burning engine and is standard in the Delta 88. The 360-horsepower version is standard in the 98 series. A version of the 425-cubic-inch series, rated at 385 horsepower, is the standard engine in the front-wheel-drive Toronado.

Type: Ohv V8.
Displacement (cu. in.): A,B—400. C,D,E,F,G—425.
Horsepower @ rpm: A—300 @ 4600. B—350 @ 5000. C—300 @ 4400. D—310 @ 4400. E—365 @ 4800. F—375 @ 4800. G— 385 @ 4800.
Horsepower per cubic inch: A—0.75. B—0.87. C—0.70. D—0.72. E—0.85. F—0.88. G—0.90.
Torque (lbs. ft.) @ rpm: A—425 @ 3000. B—440 @ 3600. C—430 @ 2400. D—450 @ 2400. E—470 @ 3200. F—470 @ 3200. G—475 @ 3200.
Bore & Stroke (in.): A,B—4.000 x 3.975. C,D,E,F,G—4.125 x 3.975.
Compression ratio: A,B—10.5. C—9.0. D—10.5. E—10.25. F,G—10.5.
Carburetion: A—1 - 2 bbl. B—1 - 4 bbl. C,D—1 - 2 bbl. E,F,G—1 - 4 bbl.
Approximate weight: A—610 lbs. B,C,D— 620 lbs. E,F,G——630 lbs.
Weight-to-hp ratio: A—2.03. B—1.77. C—2.07. D—2.00. E—1.73. F—1.64.

ENGINEERING EVOLUTION: The big Oldsmobile V8's can also trace their beginning back to the original short-stroke "Rocket" engine introduced in the 199 model year. Although basically similar in design to the 330-cubic-inch V8's built by the company, the 400- and 425-cubic-inch models are characterized by larger and heavier component parts. Typical of these differences between the large and small V8's is a crankshaft in the larger engines which has three-inch main bearing as compared to 2⅛-inch journals in the smaller engines.

GENERAL: The cylinder block and cylinder heads are cast iron and set in a conventional 90-degree V8 configuration. Overhead valves are pushrod-actuated through hydraulic lifters. The bore in the 400-cubic-inch model is 4.00 inches and the stroke measures 3.975 inches. A similar stroke is used in the 425-cubic-inch models but the bore is 4.125 inches. The 400-cubic-inch model develops 350 horsepower at 5000 rpm and 440 lbs. ft. torque at 3600 rpm. This engine has a 10.5:1 compression ratio and is equipped with a four-barrel carburetor. The regular-fuel version of the 425 develops 300 horsepower at 4400 rpm and 432 lbs. ft. torque at 2400 rpm. It is equipped with a single two-barrel carburetor and has a 9.0:1 compression ratio. Next in the 425 lineup is an engine with a two-barrel carburetor and 10.25:1 compression ratio which develops 310 horsepower at 4400 rpm and 450 lbs. ft. torque at 2400 rpm. The next in the 425 line has a 10.25:1 compression ratio, four-barrel carburetor. This engine delivers 365 horsepower at 4800 rpm and 470 lbs. ft. torque at 3200 rpm. Second from the top of the line is a 425 delivering 375 horsepower at 470 lbs. ft. torque at 3200 rpm. The most powerful 425 in the group develops 385 horsepower at 4800 rpm and 475 lbs. ft. torque at 3200 rpm. All three of the top-power-rated engines are fitted with four-barrel carburetors. The 365-horsepower model has a 10.25:1 compression ratio and the other two top-rated engines have 10.5:1 compression ratios.

PISTONS, RINGS, PINS, RODS: The pistons are cam ground and tin-plated aluminum alloy with steel struts. Compression rings are cast iron with a chrome-plated finish on the upper ring and scuff-resistant coating on the second ring. Oil control rings are a three-piece type with two chrome-plated steel rails and a steel expander-spacer. Piston pins are SAE 1019 steel and have a .9803-.9807-inch diameter. These pins are locked in the connecting rods by a press fit and float in the pistons. Pin bores in the pistons in the 400-cubic-inch engine are offset .06 inch toward the right hand side of the cylinder bores. This pin offset in the 425-cubic-inch models is .075 inch. The connecting rods are SAE 1140 steel. Rod bearings are removable steel-backed inserts with a Moraine 400 aluminum alloy bearing surface. Overall length of the bearings is a nominal .826 inch.

CRANKSHAFT: The crankshafts are A.I.S.I. 1049 modified steel. A rubber-tuned vibration damper is used on the snout of these shafts. Crankshaft end thrust is taken on #3 main bearing which has 1.194-inch overall length. Bearings #1, #2 and #4 have a .975-overall length and the rear bearing measures 1.624-inch in length. The main bearings are removable steel-backed inserts with Moraine 400 aluminum alloy bearing faces. Main bearings are three inches in diameter and the crankpin journals have a nominal 2.5-inch diameter.

CAMSHAFT: The camshafts are cast alloy iron and ride in five steel-backed bearings. In the 385-hp, 425-cubic-inch model, the bearing faces are a General Motors-specified babbitt formulation and in the other engines Durex M100 bearing metal alloy is used. The silent chain drive engages a sintered iron or steel sprocket on the crankshaft and either a cast iron or aluminum-hubbed, nylon-toothed sprocket on the camshaft. In all engines except the 375-horsepower 425-cubic-inch model, the camshaft provides a 278-degree valve opening duration on the intakes and a 282-degree duration on the exhausts with a 52-degree overlap. The intake and exhaust valve lift with this camshaft is a nominal .43 inch. The 375-hp 425 camshaft provides a 286-degree intake valve opening duration, 280-degree exhaust valve duration, 50-degree overlap, 472-inch lift on the intakes and .461 lift on the exhausts. Although the camshaft in the 385-horsepower model appears to provide a milder action than that in the 375-hp version, larger intake valves in the 385-horsepower engine partially account for the difference in power output.

VALVES: Intake valves in all engines are either SAE 1041 or 1047 steel. Seats and faces of the intakes are finished to a 30-degree angle. Major head diameter of the intakes in the 385-horsepower engine is 2.067 inches. In all other engines the major head diameter is two inches. Exhaust valves in all engines are a General Motors special alloy steel. Major head diameters of the exhaust valves in all engines is 1.629 inch. Seats for these exhaust valves is finished to a 45-degree angle and the valve seating faces have a 46-degree slope. Single valve springs operating in conjunction with oscillation dampers are used in all engines and have similar pressure characteristics. These springs exert 76 to 84 pounds pressure when the valves are closed and 180 to 194 pounds when the valves are open.

FUEL SYSTEM: Fuel filters include a Saran element unit in the fuel tank and a sintered bronze element unit in the carburetor inlet. All carburetors are Rochester units. The two-barrel models used on the 300-horsepower and 310-horsepower engines are 2GC models with 1.375-inch barrel diameters. The four-barrel, Model 4MV units used on all other engines have 1.375-inch primary barrel diameters and 2.25 inches diameter secondaries.

LUBRICATION SYSTEM: The full-flow-filter system is fed by a gear-type oil pump which develops 30-45 psi at a 50 mph vehicle speed. The cylinder walls and piston pins are splash lubricated. Oil is fed to the timing chain through a nozzle. The main bearings, connecting rod bearings, camshaft bearings, and tappets are full-pressure lubricated.

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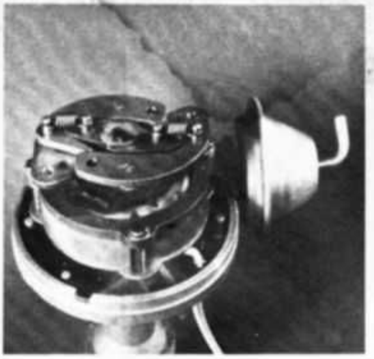

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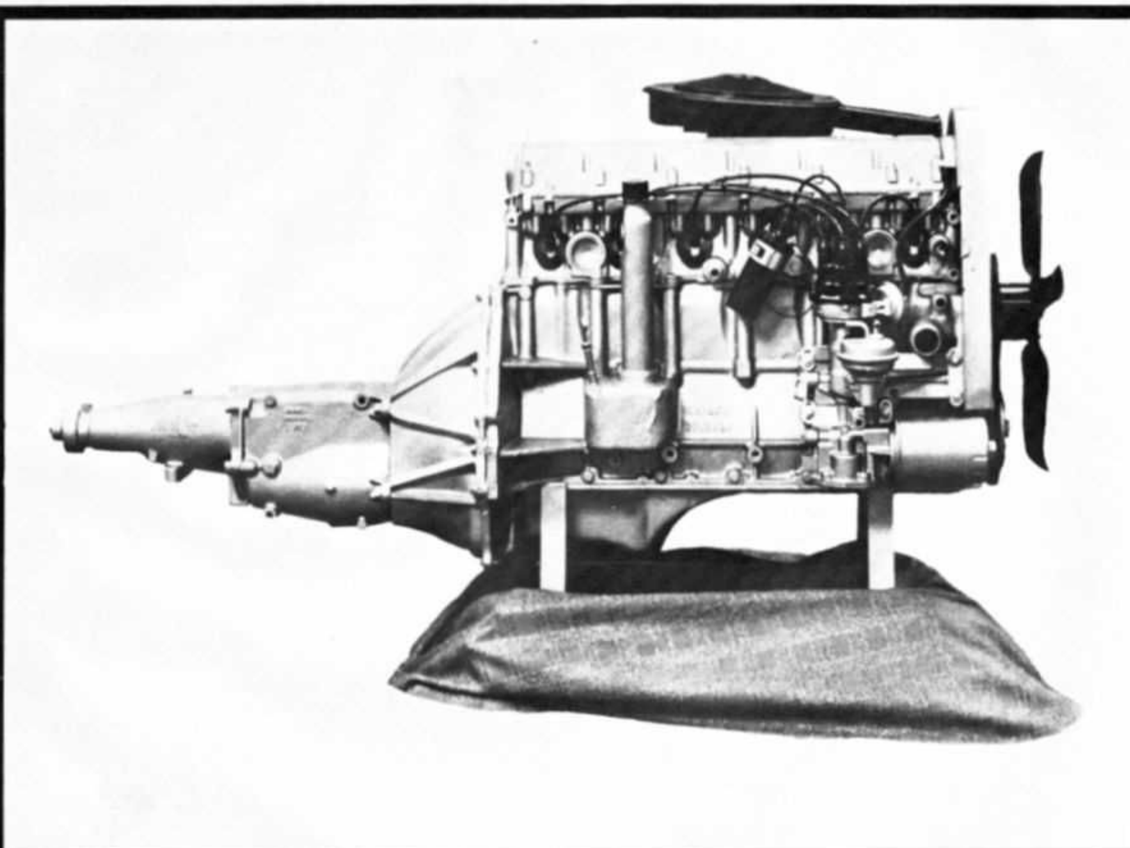
3

1. Optional capacitor discharge distributor with cap and rotor removed. Timer core, pickup coil replace conventional points and condenser.

2. Capacitor discharge distributor, control unit, and coil. An ordinary coil can not be used with this system. The coil looks similar to an ordinary coil, but internally it is completely different.

3. Rear view of Oldsmobile Toronado front-drive transmission with drive cover removed. This is not a roller chain, but a silent chain of the type used on timing gears.

PONTIAC TEMPEST 6 *230 cubic inches*



The 1967 Pontiac Tempest single overhead camshaft in-line six is unique in both its design and horsepower output. In standard form it develops more horsepower than any other stock-production, in-line six and in its high-performance version produces more power than several of the small V8's on the American market. Introduced for the 1966 model year, the engine is essentially unchanged except for a horsepower increase in the high-performance version. The Pontiac six also enjoys the distinction of being the first production overhead camshaft engine of American manufacture in over three decades or in the days of the Wills St. Claire and the Stutz. Pontiac engineers, in designing the engine, have solved the problems akin to high production costs normally associated with this highly efficient engine configuration.

Type: Single overhead camshaft 6.
Displacement (cu. in.): A,B—230.
Horsepower @ rpm: A—165 @ 4700. B—215 @ 5200.
Horsepower per cubic inch: A—0.7. B—0.93.
Torque (lbs. ft.) @ rpm: A—216 @ 2600. B—240 @ 3800.
Bore & Stroke (in.): A,B—3.875 x 3.25.
Compression ratio: A—9.0. B—10.5.
Carburetion: A—1 · 1 bbl. B—1 · 4 bbl.
Approximate weight: A—490. B—495.
Weight-to-hp ratio: A—2.97. B—2.30.

ENGINEERING EVOLUTION: Because the 1966-1967 Tempest engine is unique in its design, it has no immediate family tree. The use, however, of a notched belt overhead camshaft drive is not an American innovation, having been used for some time with great success in the German Glas single overhead camshaft engine.

GENERAL: The Tempest in-line six has a cast iron cylinder block and cylinder head. Overhead valves are inclined slightly in the roofs of the wedge-shaped combustion chambers. The wide-lobed camshaft rides in a seven integral bearings in a die-cast aluminum housing on the top of the cylinder head. The neoprene/fiberglass notched belt which drives the overhead camshaft also drives an accessory cluster containing the fuel pump, oil pump and distributor drive. Bore is 3.875 inches and the stroke measures 3.25. The standard engine produces 165 horsepower at 4700 rpm and 216 lbs. ft. torque at 2600. In the high-performance version the horsepower is 215 at 5200 rpm and the torque is 240 lbs. ft. at 3800 rpm. Compression ratio in the standard version is 9.5:1 and 10.5:1 in the high performance version. The lower-powered engine uses one single-barrel carburetor and the 207-hp version uses a four-barrel carburetor.

PISTONS, RINGS, PINS, RODS: The aluminum alloy pistons are a cam-ground and tin-plated slipper type. Compression rings are cast iron. The top compression ring has a molybdenum-filled groove and the lower ring has a Lubrite finish. Oil-control rings are three-piece assemblies with two chrome-plated steel rails and a stainless steel expander-spacer. The piston pins are SAE 5015 steel and have a .9272-inch diameter. These pins are locked in the connecting rods by a press fit and float in the pistons. Pin bores in the pistons are offset .063 inch toward the righ-hand side of the engine. Connecting rods are either SAE 1037 or 1038 steel. The rod bearings are removable steel-back inserts with a Moraine 100-A face in the less-powerful model and 400-A in the high-performance model. Bearing length is .837 inch.

CRANKSHAFT: The seven-bearing crankshaft is nodular iron and is fitted with a rubber-mounted vibration damper. Crankshaft thrust is taken by the #7 bearing which has a 1.01 inch overall length. The remaining six bearings are .80 inch long. These bearings are replaceable inserts with Durex 100-A on steel backs. Main bearing journals have a 2.30 inch diameter and the crankpin journals have 2 inch diameters.

CAMSHAFT: The camshaft is hardened cast iron alloy and rides in seven main bearing surfaces formed by the aluminum camshaft housing. Notched pulleys on the crankshaft and camshaft which engage the camshaft drive belt are also hardened cast iron. To resist the effects of oil and to prevent stretch, the notched camshaft drive belt is neoprene reinforced with fiberglass cord. The drive belt and pulleys are run without lubrication and are encased in a housing designed to exclude both foreign matter and oil. Camshaft characteristics vary in the two versions of the engine. The standard engine camshaft provides a 228-degree valve opening duration on both intake and exhaust valves with a 14-degree overlap. In this lower-powered version the valve lift is a nominal .4 inch on both sets of valves. The high-performance engine camshaft provides a 244-degree opening duration on both intakes and exhausts with a 26-degree overlap and nominal .438 inch lift.

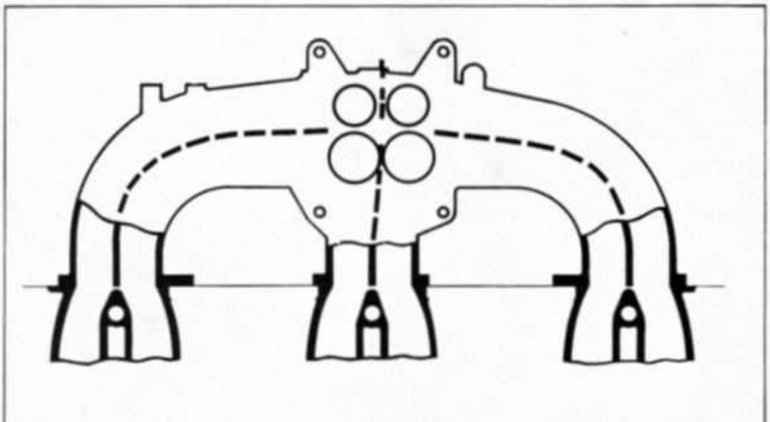
Unique valve arrangement of the overhead six. The valve "lifter" is an adjuster only. It does not move with the valve train.

VALVES: The valves are actuated by short 1.5:1 ratio rocker arms which contact the camshaft lobes between zero-lash, hydraulic pivots on one end and the valve stems on the other. Both intake and exhaust valves are similar in both versions of the engine. Intake valves are SAE 1041 steel with an aluminum treatment on their seating faces. Major head diameter of the intakes is 1.923 inch. Faces of the intakes are finished to a 29-degree angle and the seats of the cylinder head are machined to a 30-degree angle. The exhaust valves are 21-2N steel and also have an aluminized face plus chrome-plated stems. Major head diameter of the exhausts is 1.603 inch. The seats for the exhaust valves are finished to a 45-degree angle and the faces to a 44-degree angle. Single valve springs used in the 165-horsepower engine exert 92 to 102 pounds when they are open. Inner springs develop 28 to 34 pounds when the valves are closed and 101 to 108 pounds when they are open and 184 to 200 pounds when closed. Dual springs are used on the high-performance version. The outer springs exert 59 to 65 pounds pressure when valves are closed and 133 to 143 pounds when open. Inner springs exert 28 to 34 pounds when valves are closed and 97 to 103 pounds when open.

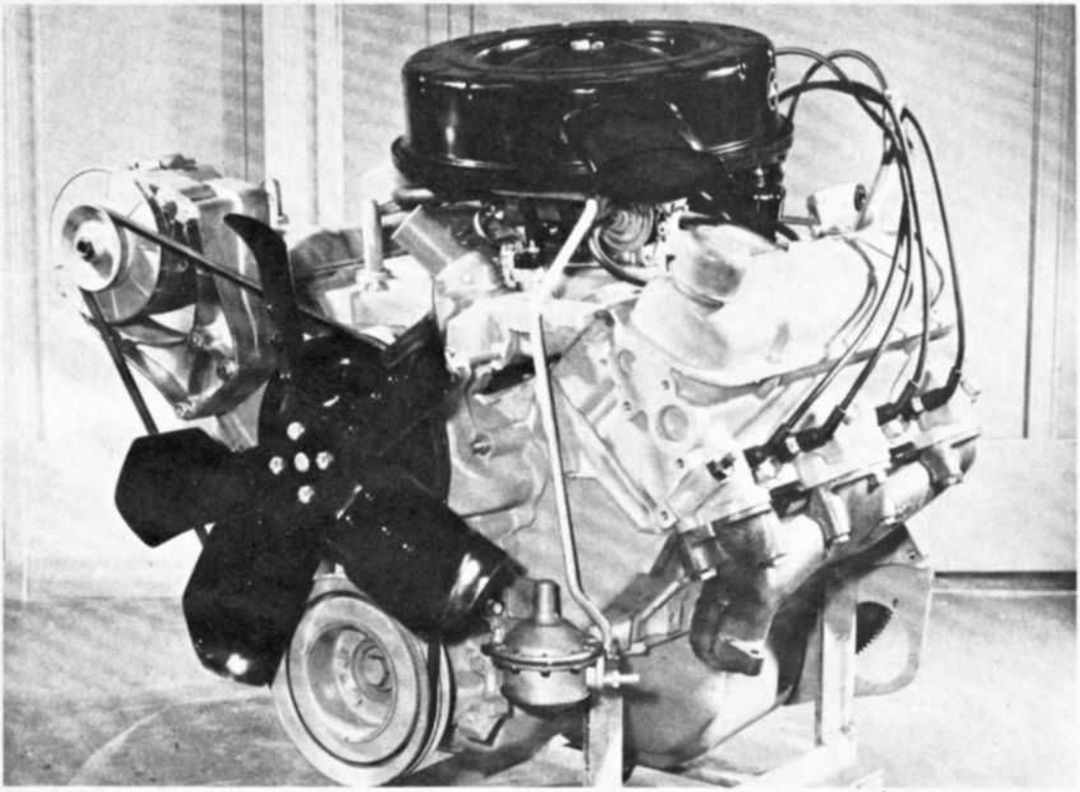
FUEL SYSTEM: Fuel is delivered to the carburetor by a mechanical pump which develops 4.0 to 5.5 psi. A plastic fabric strainer in the fuel tank and a sintered-bronze filter in the carbuetor inlet accomplish filtration. The single barrel Rochester carburetor on the standard engine has a 1.75-inch barrel diameter. A Rochester Quadra-Jet four barrel carburetor on the high-performance version has 1.30-inch primary barrel diameters and very large 2.25-inch secondaries. To give good low-speed throttle response in the four-barrel carbureted engine, the secondary barrels are controlled by air velocity in the primaries rather than by throttel position and thus adjust the fuel/air mixture flow to engine load demands.

LUBRICATION SYSTEM: Oil is delivered to the full-flow-filter lubrication system by a spur-gear pump which develops 26 to 36 psi at above 2800 rpm engine speed. Main bearings, connecting rod bearings, camshaft bearings and tappets receive full pressure lubrication. The piston pins are oiled by splash and the cylinder walls by a metered jet.

Dark portion shows layout of runner routing for the single-barrel version of intake manifold while light and dotted portion of drawing shows the setup for use with 207-hp four-barrel.



PONTIAC V8 *400, and 428 cubic inches*



The Pontiac line of powerplants for 1967 remains essentially similar to those offered for 1966. Displacement of the former 389-cubic-inch models has been increased to 400 cubic inches and the 1967 421-cubic-inch models now displace 428 cubic inches. A wide variety of horsepower ratings is available in the 400-cubic-inch models with various combinations of compression ratios and carburetion. Two of the 400-cubic-inch models have an identical horsepower and torque rating. However, the peaks occur at different engine speeds, as a result of the use of the Firebird 400 ram-air package.

Type: Ohv V8.
Displacement (cu. in.): A,B—326. C,D,E,F,G,H,I,J,K,L—400. M,N—428.
Horsepower @ rpm: A—250 @ 4600. B—285 @ 5000. C—255 @ 4400. D—265 @ 4600. E—290 @ 4600. F—325 @ 4800. G—325 @ 5200. H—333 @ 5000. I—335 @ 5000. J—350 @ 5000. K—360 @ 5100. L—360 @ 5400. M—360 @ 4800. N—376 @ 5100.
Horsepower per cubic inch: A—0.76. B—0.87. C—0.64. D—0.66. E—0.73. F—081. G—081. H—083. I—0.84. J—0.88. K—0.90. L—0.90. M—0.84. N—0.88.
Torque (lbs. ft.)@ rpm: A—333 @ 2800. B—359 @ 3200. C—379 @ 2400. D—379 @ 2400. E—428 @ 2500. F—410 @ 3400. G—410 @ 3600. H—445 @ 3000. I—441 @ 3400. J—440 @ 3200. K—438 @ 3600. L—438 @ 3800. M—472 @ 3200. N—462 @ 3400.
Bore & Stroke (in.): A,B—3.72 x 3.75. C,D,E,F,G,H,I,J,K,L—4.12 x 3.75. M,N—4.12 x 4.00.
Compression ratio: A—9.2. B—10.5. C,D—8.6. E—10.5. F,G—10.75. H—10.5. I—10.75. J—10.5. K,L—10.75. M,N—10.5.
Carburetion: A—1 - 2 bbl. B—1 - 4 bbl. C,D,E—1 - 2 bbl. F,G,H,I,J,K,L,M,N—1 - 4 bbl.
Approximate weight: A—600 lbs.
Weight-to-hp ratio: A—2.40.

ENGINEERING EVOLUTION: Because the 1966-1967 Tempest engine is unique in its design, it has no immediate family tree. The use, however, of a notched belt overhead camshaft drive is not an American innovation, having been used for some time with great success in the German Glas single overhead camshaft engine.

GENERAL: The Tempest in-line six has a cast iron cylinder block and cylinder head. Overhead valves are inclined slightly in the roofs of the wedge-shaped combustion chambers. The wide-lobed camshaft rides in a seven integral bearings in a die-cast aluminum housing on the top of the cylinder head. The neoprene/fiberglass notched belt which drives the overhead camshaft also drives an accessory cluster containing the fuel pump, oil pump and distributor drive. Bore is 3.875 inches and the stroke measures 3.25. The standard engine produces 165 horsepower at 4700 rpm and 216 lbs. ft. torque at 2600. In the high-performance version the horsepower is 215 at 5200 rpm and the torque is 240 lbs. ft. at 3800 rpm. Compression ratio in the standard version is 9.5:1 and 10.5:1 in the high performance version. The lower-powered engine uses one single-barrel carburetor and the 207-hp version uses a four-barrel carburetor.

PISTONS, RINGS, PINS, RODS: The aluminum alloy pistons are a cam-ground and tin-plated slipper type. Compression rings are cast iron. The top compression ring has a molybdenum-filled groove and the lower ring has a Lubrite finish. Oil-control rings are three-piece assemblies with two chrome-plated steel rails and a stainless steel expander-spacer. The piston pins are SAE 5015 steel and have a .9272-inch diameter. These pins are locked in the connecting rods by a press fit and float in the pistons. Pin bores in the pistons are offset .063 inch toward the righ-hand side of the engine. Connecting rods are either SAE 1037 or 1038 steel. The rod bearings are removable steel-back inserts with a Moraine 100-A face in the less-powerful model and 400-A in the high-performance model. Bearing length is .837 inch.

CRANKSHAFT: The seven-bearing crankshaft is nodular iron and is fitted with a rubber-mounted vibration damper. Crankshaft thrust is taken by the #7 bearing which has a 1.01 inch overall length. The remaining six bearings are .80 inch long. These bearings are replaceable inserts with Durex 100-A on steel backs. Main bearing journals have a 2.30 inch diameter and the crankpin journals have 2 inch diameters.

CAMSHAFT: The camshaft is hardened cast iron alloy and rides in seven main bearing surfaces formed by the aluminum camshaft housing. Notched pulleys on the crankshaft and camshaft which engage the camshaft drive belt are also hardened cast iron. To resist the effects of oil and to prevent stretch, the notched camshaft drive belt is neoprene reinforced with fiberglass cord. The drive belt and pulleys are run without lubrication and are encased in a housing designed to exclude both foreign matter and oil. Camshaft characteristics vary in the two versions of the engine. The standard engine camshaft provides a 228-degree valve opening duration on both intake and exhaust valves with a 14-degree overlap. In this lower-powered version the valve lift is a nominal .4 inch on both sets of valves. The high-performance engine camshaft provides a 244-degree opening duration on both intakes and exhausts with a 26-degree overlap and nominal .438 inch lift.

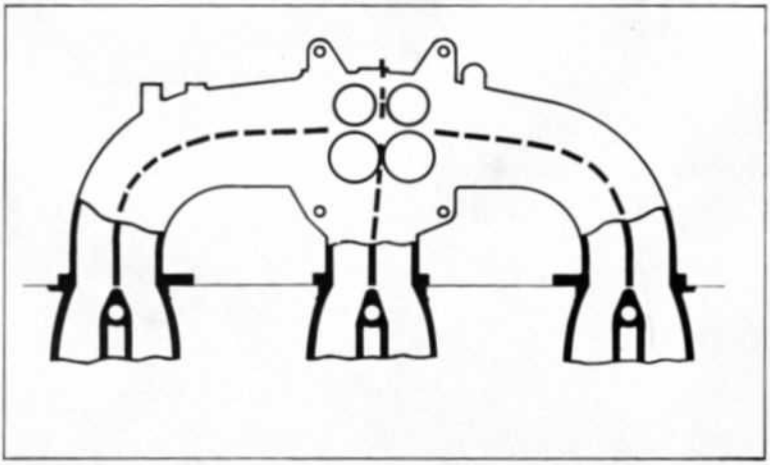
Unique valve arrangement of the overhead six. The valve "lifter" is an adjuster only. It does not move with the valve train.

VALVES: The valves are actuated by short 1.5:1 ratio rocker arms which contact the camshaft lobes between zero-lash, hydraulic pivots on one end and the valve stems on the other. Both intake and exhaust valves are similar in both versions of the engine. Intake valves are SAE 1041 steel with an aluminum treatment on their seating faces. Major head diameter of the intakes is 1.923 inch. Faces of the intakes are finished to a 29-degree angle and the seats of the cylinder head are machined to a 30-degree angle. The exhaust valves are 21-2N steel and also have an aluminized face plus chrome-plated stems. Major head diameter of the exhausts is 1.603 inch. The seats for the exhaust valves are finished to a 45-degree angle and the faces to a 44-degree angle. Single valve springs used in the 165-horsepower engine exert 92 to 102 pounds when they are open. Inner springs develop 28 to 34 pounds when the valves are closed and 101 to 108 pounds when they are open and 184 to 200 pounds when closed. Dual springs are used on the high-performance version. The outer springs exert 59 to 65 pounds pressure when valves are closed and 133 to 143 pounds when open. Inner springs exert 28 to 34 pounds when valves are closed and 97 to 103 pounds when open.

FUEL SYSTEM: Fuel is delivered to the carburetor by a mechanical pump which develops 4.0 to 5.5 psi. A plastic fabric strainer in the fuel tank and a sintered-bronze filter in the carbuetor inlet accomplish filtration. The single barrel Rochester carburetor on the standard engine has a 1.75-inch barrel diameter. A Rochester Quadra-Jet four barrel carburetor on the high-performance version has 1.30-inch primary barrel diameters and very large 2.25-inch secondaries. To give good low-speed throttle response in the four-barrel carbureted engine, the secondary barrels are controlled by air velocity in the primaries rather than by throttel position and thus adjust the fuel/air mixture flow to engine load demands.

LUBRICATION SYSTEM: Oil is delivered to the full-flow-filter lubrication system by a spur-gear pump which develops 26 to 36 psi at above 2800 rpm engine speed. Main bearings, connecting rod bearings, camshaft bearings and tappets receive full pressure lubrication. The piston pins are oiled by splash and the cylinder walls by a metered jet.

Dark portion shows layout of runner routing for the single-barrel version of intake manifold while light and dotted portion of drawing shows the setup for use with 207-hp four-barrel.



ENGINEERING EVOLUTION: Basic design pattern for the present 326- and 400-cubic-inch engines was established in 1958 with the introduction of a 287-cubic-inch engine. The 1958 model had a 3.25-inch stroke. Some of its distinguishing features were a very short and stiff crankshaft, a crankcase which was well braced in the highly-stressed main bearing areas, and a lightweight valve train. The original engine had a two-barrel carburetor, an 8-to-1 compression ratio and developed 180 hp at 4600 rpm. In 1956 the bore was increased to raise the displacement to 317 cubic inches and 1957 the stroke was lengthened to provide 347 cubic inches. In 1958, the bore was again increased to provide 370 inches, and again in 1959 to provide 389 cubic inches. An increase in bore to 4.12-inches now sets the displacement at 400 cubic inches.

Introduced for use in the 1963 and later Tempest compacts, the 326-cubic-inch version is structurally similar to the 389 but has 3.72-inch bore. The stroke of both engines is 3.75 inches.

Pontiac's big 428-cubic-inch V8 was originally introduced in 1962 and at that time was considered as having the greatest horsepower potential of its day. The 1967 factory offerings of this model are rated at 356, and 376 hp.

GENERAL: The Pontiac's V8's have a cast iron cylinder block and heads set in a 90 degree V8 configuration. Regular-fuel versions of the engines include the 250-horsepower 326 equipped with a two-barrel carburetor and 9.2 compression ratio and two 400-cubic-inch models rated at 255 and 265 horsepower that have 8.6 compression ratios and two-barrel carburetors. A 290-horsepower 400 also has a two-barrel carburetor but the compression ratio is 10.5 to 1. All other engines in the group have four-barrel carburetors. Compression ratios in the 325, 335, and 360-horsepower 400's is 10.75:1. The ratio in the balance of the group is 10:5:1.

PISTONS, RINGS, PINS, RODS: The pistons are a cam-ground, aluminum alloy, tin-plated, slipper-type. Compression rings are cast iron and in all engines the top ring has a molybdenum-filled channel. Lower rings have either a Parko Lubrite or tin-plate oil control rings and a three-piece assembly with two chrome-plated steel rails and a stainless steel expander-spacer. Piston pins are SAE 1016 steel and have a .9802-inch diameter. These pins are locked in the connecting rods by a press fit and float in the piston. Pin bores in the pistons are offset .063 inch toward the thrust side of the engine. The connecting rods are Arma steel. Connecting rod bearings are steel-backed removable inserts. In the 335 and 360-hp 400's and all of the 428 engines, the bearing face material is Moraine 400-A. In the other engines Moraine 100-A bearing face material is used.

CRANKSHAFT: The crankshafts are nodular iron and are equipped with rubber-floated vibration dampers. Crankshaft thrust is taken on the #4 main bearing which has 1.13-inch overall length. Bearings #1, #2 and #3 are .094-inch long and the rear #5 bearing has a 1.59-inch length. These bearings are steel-backed removable inserts and with the exception of the lower half of the #4 bearing have a Durex 100-A bearing metal face. The lower half of #4 has a Moraine 400-A facing. Main bearing journals have a three-inch diameter and the crankpins measure 2.25 inches in diameter. The crankshaft used in the 428 engines differ slightly in that #4 bearing has an overall length of 1.19 inches. The main bearing journals on this very rigid crankshaft have a large 3.25-inch diameter. Connecting rod bearing journals measure 2.5 inches in diameter.

CAMSHAFT: The camshafts are hardened cast alloy iron and ride in five bearings consisting of high-lead babbitt on steel backs. A silent chain meshes with a carburized and hardened steel sprocket on the crankshaft and a sprocket on the camshaft which has an aluminum alloy body and nylon-coated teeth. The camshaft in the 326 degree valve opening duration on the intake valves and a 277-degree duration on the exhausts with a 47-degree overlap. Valve lift in these engines is a nominal .375 on the intakes and a nominal .410 on the exhausts. Camshafts in the two-barrel carburetor versions of the 40 cubic inch models and the 326's are identical. The camshafts in the 400's with four-barrel carburetors when teamed with manual transmissions and the 428 cubic inch models provide a 273-degree duration on the intake valves and 289-degree duration the exhausts with a 54-degree operlap. The four-barrel carburetor 400's when coupled to an automatic transmission have a ,273-degree duration on the intakes, 282 degrees on the exhausts and a 55-degree overlap.

VALVES: Intake valves are SAE 1041 steel with an aluminum treatment on their faces. Exhaust valves are SAE 21-2N steel and also have aluminized faces. Major head diameter of the 326 intakes is 1.923 inches and the exhausts measure 1.643 inches. The major head diameter of the intakes in the 400 and 428 engines is 2.113 inches and the major head diameter of the intakes is 1.643 inches. Dual valve springs are used in all engines.

FUEL SYSTEM: Fuel filtering is accomplished by a plastic fabric unit in the fuel tank and a sintered bronze element in the carburetor fuel inlet. The engine-mounted mechanical fuel pump delivers 5 to 6.5 psi fuel pressure to the carburetors. Twin-barrel carburetors have 1.688-inch barrel diameters. Four-barrel units on the 400-cubic-inch models have 1.438-inch primaries and 1.688-inch secondaries. The 428, four-barrel units have 1.375-inch primaries and 2.25-inch secondaries.

LUBRICATION SYSTEM: The full-flow-filter lubrication system is supplied by a gear-type oil pump which develops 30 to 40 psi above 2600 rpm in the 326- and 389-cubic-inch engines, while larger 421 develops 45 to 50 psi above 2600 rpm engine speed. Main bearings, connecting rod bearings, camshaft bearings, and tappets are full-pressure lubricated. The timing gear chain and cylinder walls receive their oil through metered jets. Oil splash lubricates the piston pins.

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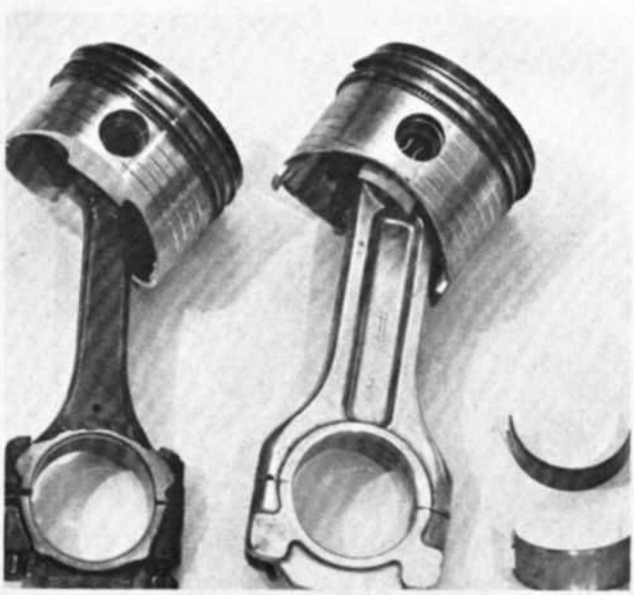

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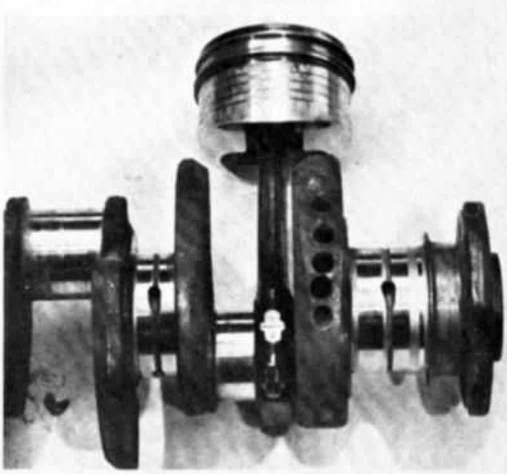
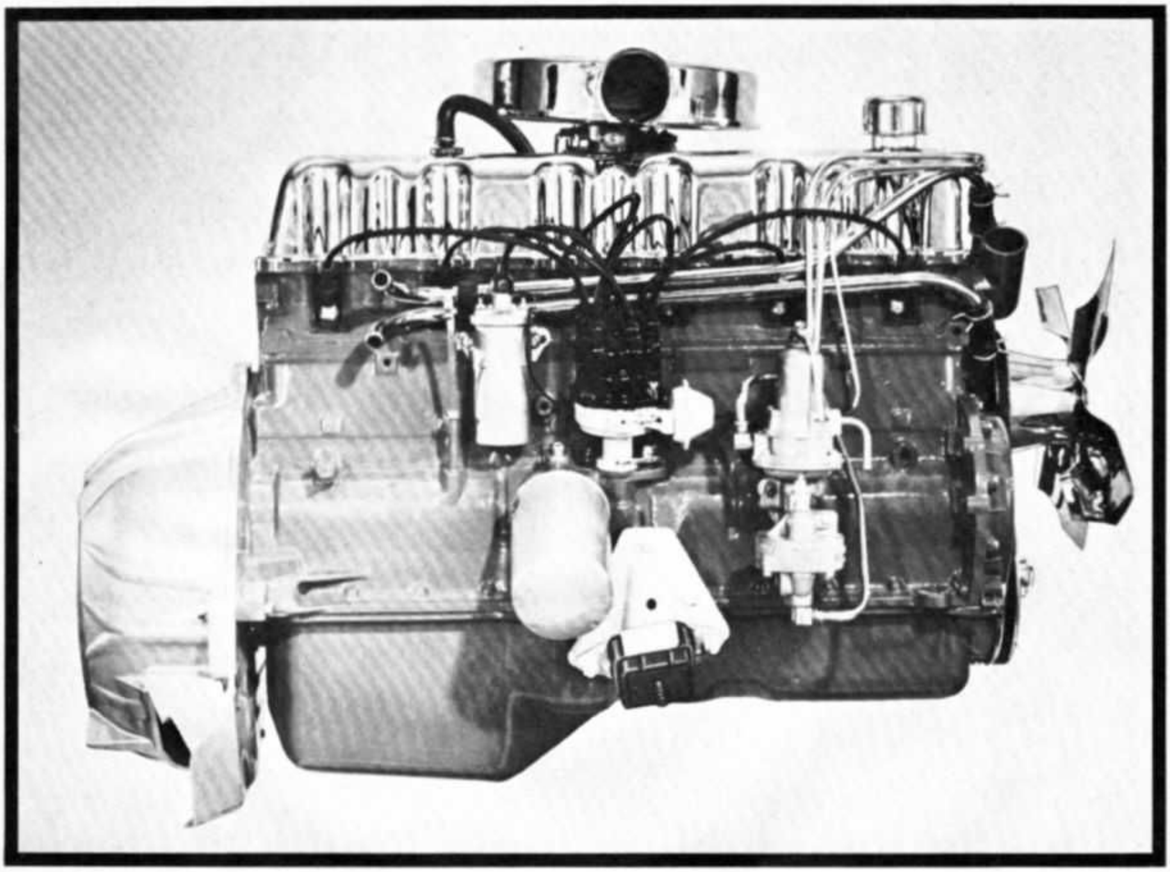


1. Rod on left is from Don's Speed Shop, Gardena. Rod on right is earlier M/T aluminum product.

2. Pontiac crankshaft reveals grooving of the mains and "spooning" the oil.

RAMBLER 6 *199 and 232 cubic inches*



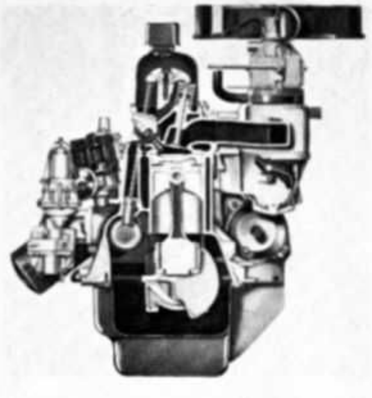
The 199-cubic-inch six, built by American Motors, was introduced in 1964 as the standard engine for the Ambassador series. In 1966, two 196.6-cubic-inch engines were dropped from the Rambler line and the 128-horsepower 199-cubic-inch engine is now the standard engine in the Rambler American. The 232-cubic-inch, 145-horsepower version of the engine is standard in all models except the American and Ambassador convertible. This engine is optional in the American. A 155-horsepower model is optional in all models except the V8-powered Ambassador convertible. These three 1967 six-cylinder engines are virtually unchanged in construction and design from their 1965 counterparts.

Type: In-line Ohv 6
Displacement (cu in): A—199. B, C—232.
Horsepower @ rpm: A—128 @ 4400. B—145 @ 4300. C—155 @ 4400.
Horsepower per cubic inch: A—0.64. B—0.62. C—0.66.
Torque (lbs. ft.) @ rpm: A—182 @ 1600. B—215 @ 1600 C—223 @ 1600.
Bore & Stroke: A—3.75 x 3.00. B, C—3.75 x 3.50.
Compression ratio: 8.5.
Carburetion: A,B—1 1 bbl. C—1 2 bbl.
Approximate weight: A—440. B,C—450.
Weight-to-hp ratio: A—3.44. B—3.10. C—2.99.

ENGINEERING EVOLUTION: The introduction of the 1965-1966 Rambler sixes marked the end of an era. Modern in every phase of in-line, six-cylinder design, these engines have replaced the last of the L-head sixes on the American market. The 195.6-cubic-inch flathead six, which was rated at 90 horsepower, has now passed into obscurity after more than 20 years of reliable service. A counterpart of the L-head, with appropriate redesign to incorporate overhead valves, has also left the American automotive scene.

GENERAL: Cylinder head and block in the in-line Rambler sixes are cast iron. The overhead valves are pushrod-actuated through hydraulic lifters. To contribute to engine smoothness, the very heavy crankshaft is supported by seven main bearings and has eight counterweights. Unlike their predecessors, the new sixes incorporate a short-stroke design to permit the use of larger valves and thinwall casting techniques to reduce overall weight of the block and head. The combustion chambers are wedge-shaped and the piston heads are dish-shaped. Bore in both displacement versions is 3.75. The stroke in the 199 is 3 inches and 3.5 inches in the 232-cubic-inch models. Compression ratio in all models is a low 8.5:1 so that the use of regular-grade gasoline can contribute to their economical operation. The 199 develops its 128 horsepower at 4400 rpm and 182 lbs. ft. torque at 1600 rpm. Output of the lower-powered 283 is 145 horsepower at 4300 rpm and 215 lbs. ft. torque at 1600 rpm. The 155-hp 283 develops its horsepower peak at 4400 rpm and is rated at 223 lbs. ft. torque at 1600 rpm. A single-barrel carburetor is used on the 128- and 145-horsepower models while the 155-hp version employs a single two-barrel carburetor.

PISTONS, RINGS, PINS, RODS: The pistons are tin-plated aluminum alloy with steel inserts and solid skirts. Compression rings are alloy iron with a Parco Lubrite coating. The upper ring also has molybdenum-filled face. The oil control rings are a three-piece type with two chrome-plated steel rails and an expander-spacer. Piston pins are SAE 1016 steel and have a .9305 – .9308 inch diameter. These pins are locked in the connecting rods by a press fit and float in the pistons with a "palm-press" fit clearance. Pin bores in the pistons are offset .0625 inch toward the major thrust side of the engine. The connecting rods are cast malleable pearlitic iron. Bearings on these rods are steel-backed removable inserts with a sintered copper-lead alloy face. The overall length of the connecting rod bearings is .884 inch.



The heavy rigid crankshaft is carried in seven main bearings and has eight counterweights. The result is almost zero bearing load.

CRANKSHAFT: The seven bearing crankshaft is cast from malleable pearlitic iron and is equipped with a rubber- and friction-type vibration damper. End thrust is taken by bearing #3 which has a 1.268 inch overall length. The other six bearings measure .981 inch in length. All main bearings are steel-backed removable inserts with a micro-babbitt alloy bearing surface. Main bearing journals have a 2.4988-2.4995 inch diameter. The crankpins measure 2.094-2.0955 inch in diameter.

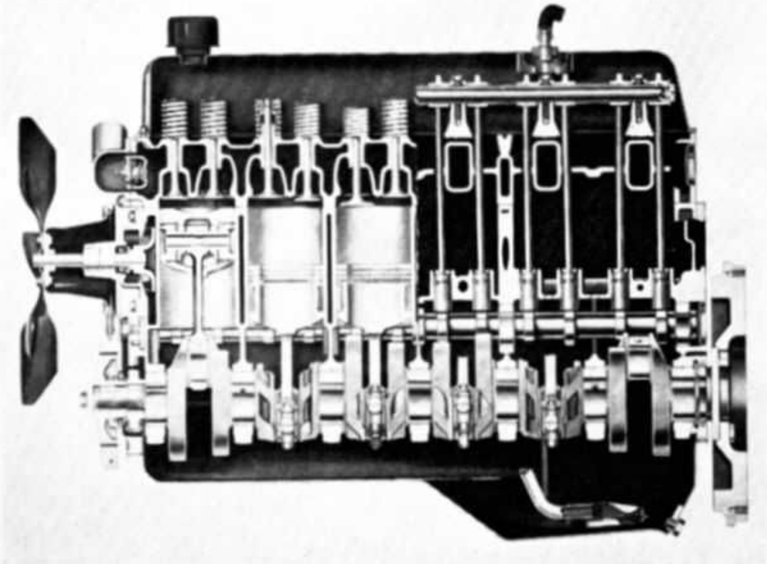
CAMSHAFT: The special alloy iron camshaft rides in four steel-backed, micro-babbitt-alloy removable bearing inserts. A silent chain engages a sintered-iron sprocket on the cranksnaft and a die cast aluminum sprocket with molded nylon teeth on the camshaft. The camshaft in all engines provides a 244-degree valve opening duration on both intake and exhaust valves with a 23-degree overlap. Valve lift on both intakes and exhausts is .375 inch.

VALVES: Intake valves are a silicon-chromium steel alloy. Head diameters of the intakes is 1.787 inches. The intake valve seats are finished to a 30-degree angle and the seating faces to a 29-degree slope. Exhaust valves are SAE 21-4N steel and have 1.406-inch head diameters. The exhaust valve seats are finished to a 45-degree angle and the valve faces to a 44-degree angle. Single valve springs are used which exert 85 to 91 pounds pressure when the valves are closed and 150 to 160 pounds when the valves are open. Valve locks are designed so as to allow both sets of valves to rotate on their seats.

FUEL SYSTEM: An engine-mounted mechanical pump feeds the carburetor at 4 to 5.5 psi. Fuel filtering is accomplished by a plastic spool-type filter in the gasoline tank pickup tube and a 15-micron paper-element filter located on the inlet side of the fuel pump. With a manual transmission, the 199-cubic-inch engine uses a Holley 1931, Model 3251 carburetor and a Holley 1931, Model 3250-1 with an automatic transmission. Both of these single-barrel carburetors have a 1.5-inch barrel diameter. The single-barrel carburetor used on the 145-hp 232 when it is coupled to a manual transmission is a Holley 1931, Model 3253 with a 1.5-inch barrel diameter. When coupled to an automatic transmission, the carburetor on the 145-hp 232 is a Carter RBS, Model 3882S with a 1.375-inch barrel diameter. The 155-hp 232 uses a Carter WCD, Model 3888S twin-barrel unit with 1.1875-inch barrel diameters for both manual and automatic transmission applications.

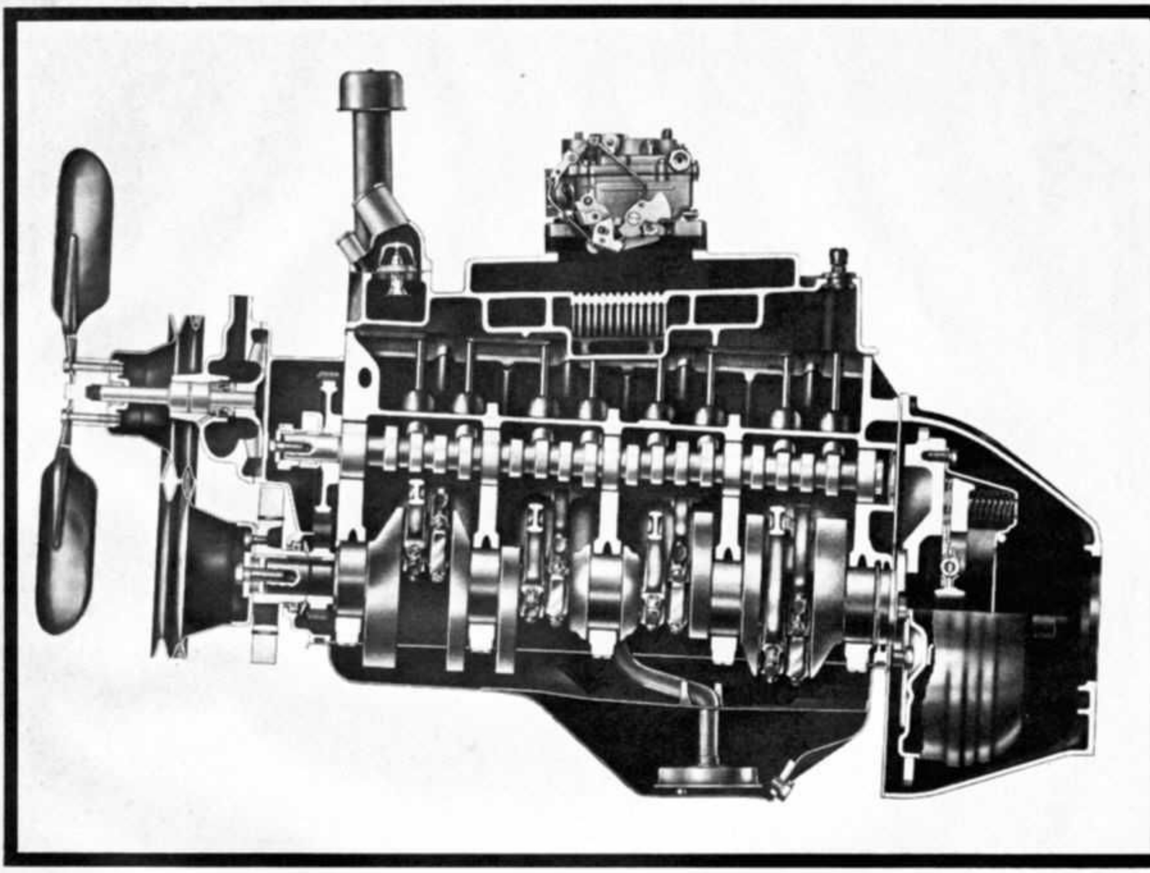
LUBRICATION SYSTEM: The full-flow-filter type lubrication system is fed by a gear-type pump which develops from 13 psi at 600 rpm engine speed to the 60 psi setting of a pressure-release valve. Main bearings, and tappets receive full-pressure lubrication. The piston pins are splash oiled. A pressure jet furnishes oil to the timing chain. Cylinder walls are lubricated by throw-off from an oil groove in the mating surface between the lower end of the connecting rods and their bearing caps.

Thinwall casting techniques hold weight to a minimum, a short stroke is used, and the large valves permit good breathing through the wedge-shaped combustion chambers.



RAMBLER V8

290 and 343 cubic inches



American Motors V8's for 1967 are very similar to the 290 and 327-cubic-inch models available in 1966. These new versions of the engines are offered in both regular and premium-fuel models. The economy models have two-barrel carburetors and 9 to 1 compression ratios. Four-barrel carburetors, a 10 to 1 and 10.2 to 1 compression ratios, are utilized in the premium fuel versions. The 343-cubic-inch V8, which was introduced on Ambassador, Rebel, and Marlin models at the start of the 1967 model year, is now available in the compact Rambler American line. The 343 with four-barrel carb develops 280 horsepower.

Type: Ohv V8.
Displacement (cu. in.): A,B—290. C,D—343.
Horsepower @ rpm: A—200 @ 4600. B—225 @ 4700. C—235 @ 4400. D—280 @ 4800.
Horsepower per cubic inch: A—0.68. B—0.77. C—0.69. D—0.82.
Torque (lbs. ft.) @ rpm: A—285 @ 2800. B—300 @ 3200. C—345 @ 2600. D—365 @ 3000.
Bore & Stroke (in.): A,B—3.75 x 3.28. C,D—4.08 x 3.28.
Compression ratio: A—9.0. B—10.0. C—9.0. D—10.2.
Carburetion: A,C—1 - 2 bbl. B,D—1 - 4 bbl.

ENGINEERING EVOLUTION: The American Motors Corporation V8's were originally designed in 1956 with an eye toward the future. A 4.75-inch cylinder bore spacing has allowed using the basic block for a wide range of cylinder bores and resulting displacements. One of the outstanding design features which has characterized these engines during their evolution is contained in their intake manifolds and porting. There is little variation in the mixture distribution to individual cylinders and the engines thus attain a very high degree of volumetric efficiency.

PISTONS, RINGS, PINS, RODS: The tin-plated, aluminum alloy pistons have flat tops, steel inserts, and slipper-type skirts. Both compression rings are alloy iron with a Parco Lubrite treatment. Additionally the top compression ring is chrome-plated on its outside diameter. The oil control ring is a three-piece assembly with two chrome-plated steel rails separated by a combination spacer-expander. Piston pins are SAE 1016 steel and have a .9305 to .9308-inch diameter. These pins are locked in the connecting rods by a press fit and are a select "palm-press" floating in the pistons. Pin bores in the pistons are offset .0625 inch toward the major thrust side of the cylinders. The connecting rods are cast pearlitic malleable iron. Bearings for these rods are removable, sintered copper-lead alloy inserts with steel backs. The overall length of the rod bearings is .867 inch.

CRANKSHAFT: The crankshaft is also cast pearlitic malleable iron and is fitted with a rubber and friction-type vibration damper. End thrust is taken on bearing #1 which has a .956-inch overall length. The other four bearings measure .950-inch in length. All main bearings are removable inserts with a micro-babbitt alloy on steel backs.

CAMSHAFT: The camshaft is cast from a special alloy iron and rides in fire steel-backed, micro babbitt alloy bearing inserts. A silent drive chain meshes with a sintered-iron or steel sprocket on the crankshaft and as procket on the camshaft which has a die-cast aluminum hub and molded nylon teeth. The camshaft lobe configurations provide a 266-degree valve opening duration on both intake and exhaust valves with a 44-degree overlap. Lift on both sets of valves is .425 inch.

VALVES: The intake valves are silicon-chromium alloy steel. Head diameter of the intakes is 1.787 inch. Intake valve seats are machined to a 30-degree angle and the seating faces of the heads to 29 degrees. The exhaust valves are SAE 21-4N steel. Head diameter is 1.406 inches. Exhaust valve seats are finished to a 44-degree angle. Single valve springs are used which exert 85 to 93 pounds pressure when the valves are closed and 189 to 203 pounds when open. The design of the valve locks frees both sets of valves to rotate on their seats.

FUEL: SYSTEM: Fuel filtering is accomplished by a plastic spool filter in the fuel tank pickup tube and a 15 micron paper-element filter in the inlet side of the fuel pump. An engine-mounted mechanical pump delivers fuel at 4 to 5.5 psi to the carburetor. The two-barrel Holley carburetors used in the engines have 1⅛-inch barrel diameters. Four venturi Carter AFB carburetors used on the premium-fuel models have 1-7/16-inch primary and 1-11/16-inch secondary barrel diameters.

LUBRICATION SYSTEM: The full-flow-filter system is fed by a gear-type pump which develops 10 psi at 600 rpm engine speed. Maximum oil pressure is cut off at 60 psi by a pressure-relief valve. Main bearings, connecting rod bearings, camshaft bearings, and tappets are full-pressure lubricated. Piston pins are splash oiled. The timing chain is lubricated by a pressure jet and the cylinder walls by a stream from an orifice in the connecting rods.

1. American Motors' new 343-cubic-inch V8, introduced on Ambassador, Rebel ,and Marlin models at tbe start of the 1967 model year, is now available in the compact Rambler American line. It is offered in American sedan, hardtop, and convertible models with four-barrel carburetor and four-speed floor shift transmission only. The 343 with four-barrel carburetor develops 280 horsepower.

2. Typhoon 290-inch-engine was introduced as a '66½ engine and reflects performance thinking in its port design and combustion chamber shape. Construction and design are of the latest type with thin-wall casting, threaded rocker studs, and compact configuration.

3. Modification potential would appear to be excellent. Test figures and behavior of top-of-the-line Ambassador show that more power and snap have been injected into the older 327.

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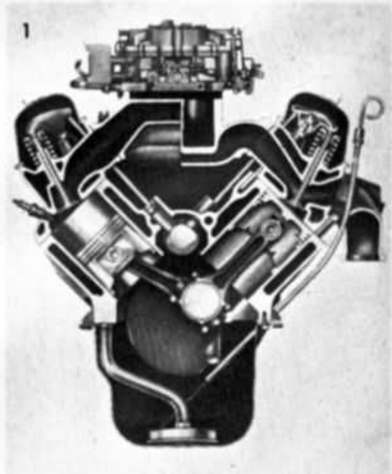

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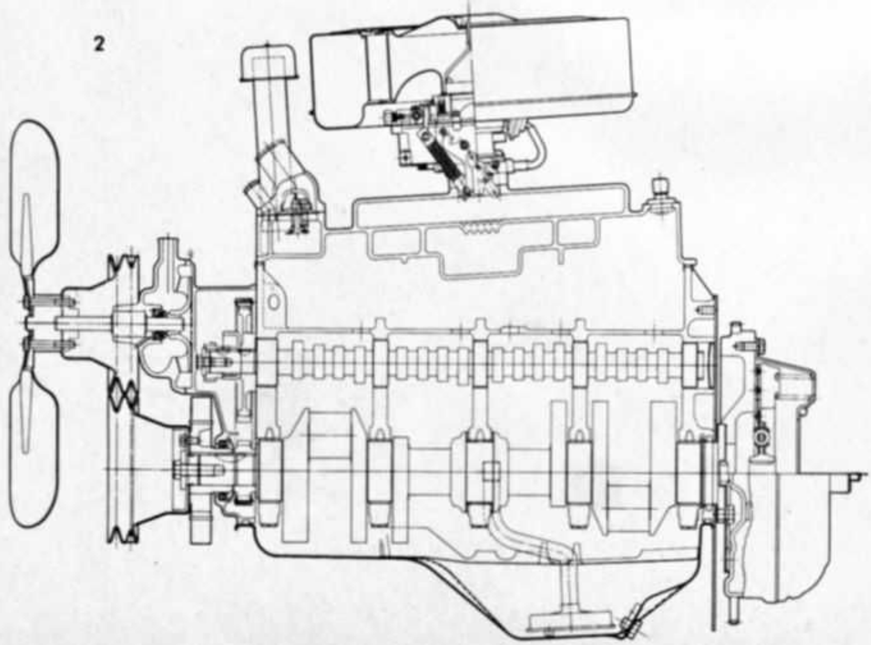

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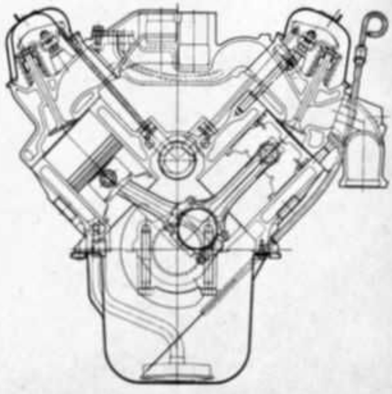


GO, PONY, GO!

by Ak Miller

For some reason or another, or maybe several, people have ignored the Ford Six as material for modifying since about 1959. Introduced in 1958 in 144 and 170-cubic-inch sizes, the engine was treated to a small flurry of activity which shortly died down even though in 1960 a bored out 170 built by Verne Houle powered Bill Burke's Class D streamliner to a record average of 205.949 mph. Nobody else seemed to want to play the sixes game until now. However, now is a different story, a story by Ak Miller, *doyen* of hot rodders and Ford's performance advisor. Now that Ford's six-cylinder line of engines has been equipped with seven main bearings, Ak felt that the subject should be re-opened. What he found out was that there was more go for less dough in Ford's small six than has been since the day of the Flathead. Best let him tell it in his own words. Gentlemen, meet Ak Miller:

Ford performance items for the current lineup of Ford V8 engines are easy to come by, but when we consider such equipment for the six-cylinder series, the cupboard is completely bare.

The reasons for this are quite simple. Six-cylinder engines are usually found in the lower-priced models, and their basic image is one of economy. Thus, the combination of low price and economy offers a great vehicle for the person interested in a fine, economical mode of transportation and one with an ample amount of horsepower.

However, there are scores of six-cylinder lovers who come up with the question, "How do I get just a little more power and what will it cost me?"

To these people we would like to offer our experiences with a 1967 200-cubic-inch Mustang equipped with a standard three-speed transmission (2.99 in first and 1.75 in second) and a differential gearing of 3.20.

I personally felt this car would give us a good starting base since it offered an attractive body style, a very rugged three-speed all-synchro gearbox, and had been blessed with the most robust seven main crankshaft six-cylinder engine ever conceived.

In the beginning, I drove the car 2000 miles to stabilize the engine which, by the way, came with the full California Thermactor smog equipment. After bringing the engine right up to factory specifications, I took a run on my electric chassis dynamometer and recorded 65 horsepower at the rear wheels. Weighed against the 120 advertised horsepower, this sounds as if some guy at the factory forgot to give us a full load. But such was not the case, and I would like to digress here for a moment to explain a few pertinent facts about horsepower measurement.

There are three basic means of ascertaining horsepower gains. One, of course, would be to remove the engine and run a full series of tests on a regular engine dynamometer stand. However, sometimes these figures cannot be correlated to the installed horsepower by the individual who read the data, due to the fact that the installed horsepower is naturally somewhat less because of exhaust inefficiencies, underhood breathing, and drag due to accessories.

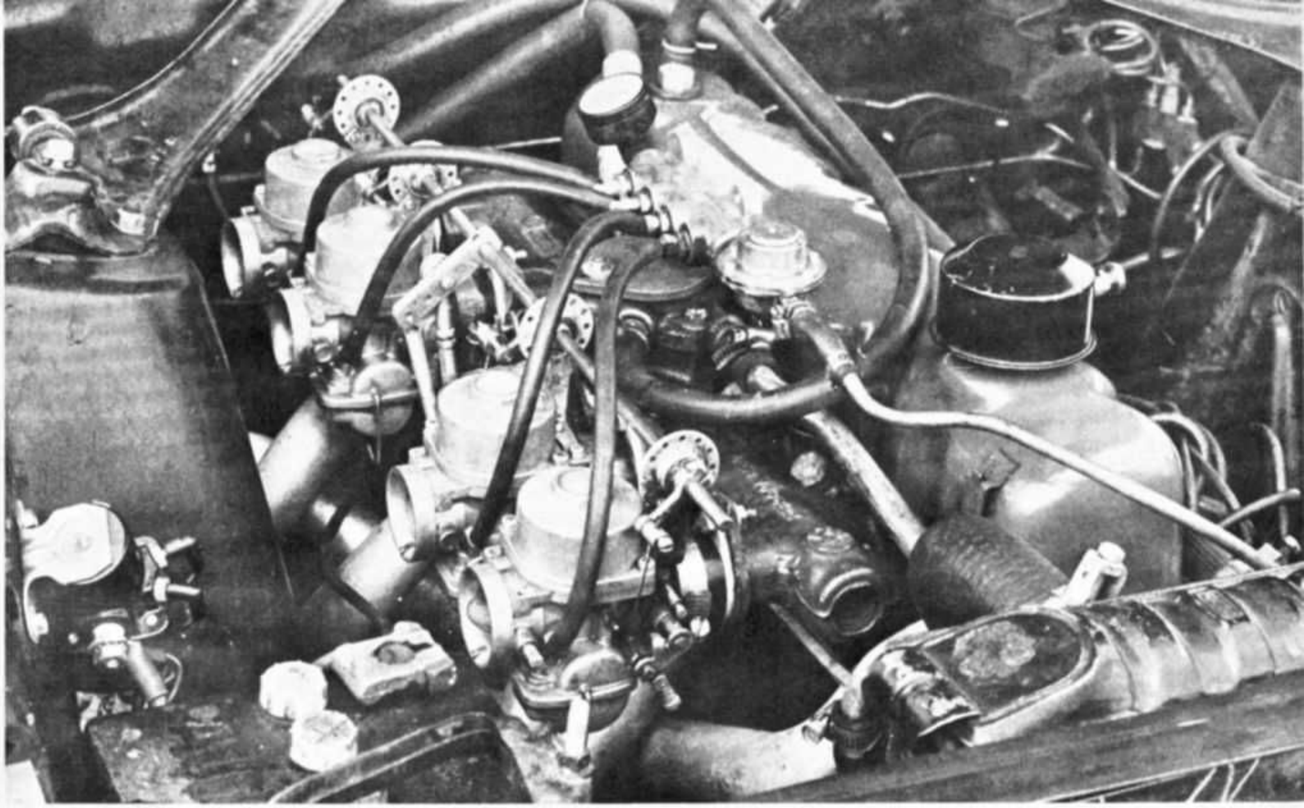
Another method is the practical one of trial and error by taking the car to the drag strip, or by top speed runs, then evaluating the horsepower gains by comparing the performance gains.

The last choice is, of course, the chassis dynamometer. We felt this method was the best way to test the actual installed horsepower of the engine by measuring the output at the rear wheels. The unit we used was an electric dynamometer utilizing 18-inch rollers. Horsepower readings were obtained by a torque arm working through a potentiometer, the current being supplied by two synchronous generators driven by the rollers.

It is very difficult to come up with a 100 percent formula for converting chassis horsepower figures into actual crankshaft horsepower, so we will not concern ourselves with this matter here. We'll merely give the actual meter readings from the horsepower scale as well as the various rpm at which the readings were obtained. Thus, we will have a comparison of "before and after" readings as well as a general curve where one can readily see in what rpm range the changes are most effective.

Our first run on the dyno gave us a rear wheel rating of 65 horsepower at 4000 rpm. The air-fuel ratio meter read 14:1. From past experience, this had proven to be quite lean on our particular meter so we immediately decided the first step would be to richen the

Roping more horses for Ford's small six



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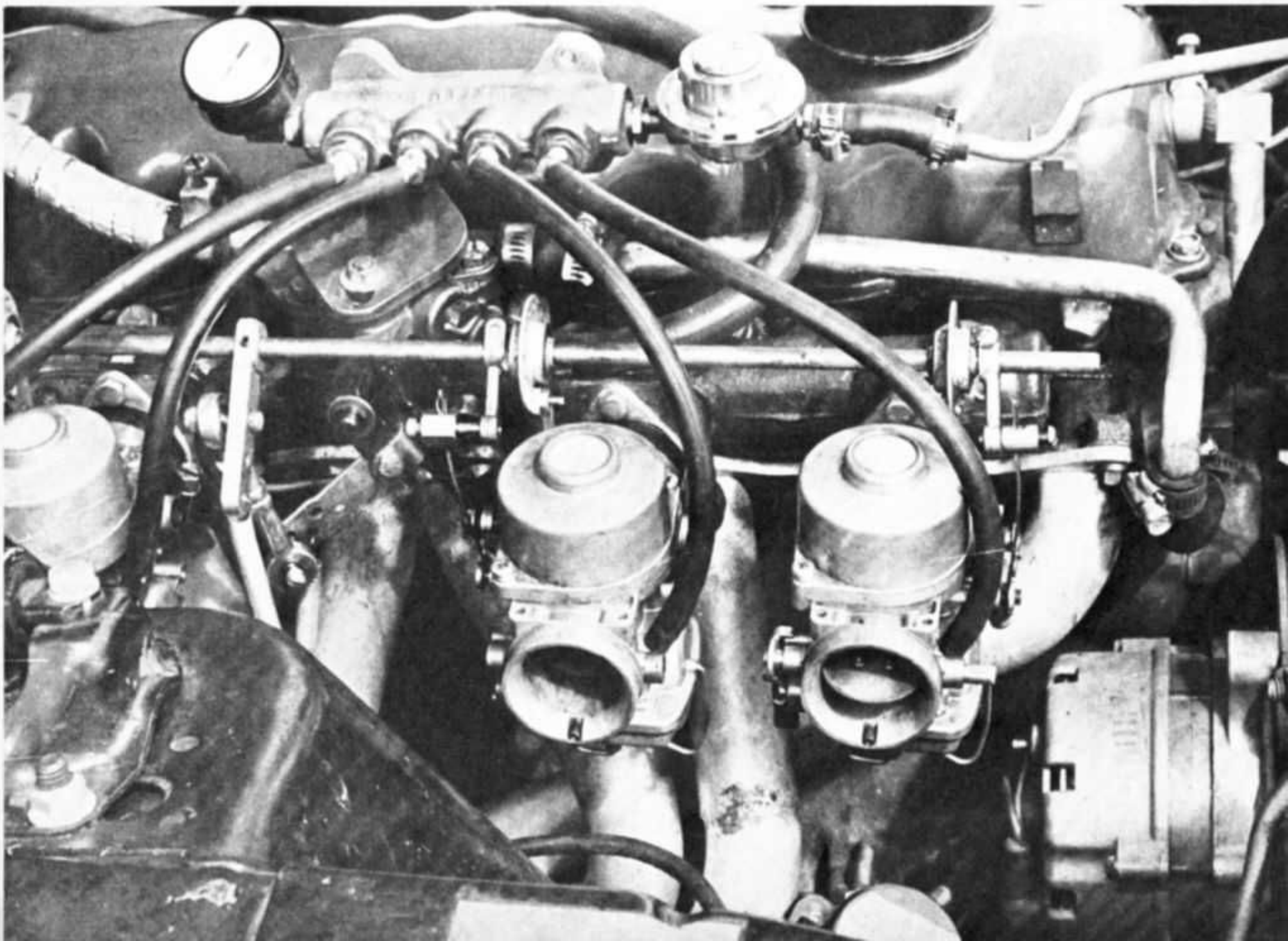

mixture slightly for a little better horsepower reading. The standard jet was found to be 62F, so we decided to enlarge the jet size to 63½. Our second run on the dyno brought the air-fuel ratio to 13.4:1 and netted us a reading of 71 horsepower at the rear wheels (which proved to us we were headed in the right direction).

The next step was to ascertain if we had gone far enough, so we decided to drill the main jet out to a size .067. This produced a further increase to 75 horsepower at the rear wheels with an air-fuel ratio of 12.5:1. So as not to confuse the issue, I should state that my selection would be the .065 jet size for all-around usage where one would seek horsepower and good economy simultaneously.

We then took a check on the spark lead and its effect on the horsepower we were getting at the rear wheels. An initial lead of 10 degrees offered us the best all-around ignition setting, even though factory specifications called for 5 degrees.

By removing the air cleaner, we were able to come up with an additional one horsepower rating, which in this day and age is not bad. We were also curious about the Thermactor device, so we disconnected this unit and took another test. Lo and behold, we neither gained nor lost a significant amount of power. This should be a revelation to all of the people who have cars equipped with anti-smog devices – they do not seriously affect the horsepower output of the car. On the other hand, I must confess that such units do not help the idle nor the low-speed running. However, where they are required by law, I would most certainly recommend you leave them as is and be certain they are operating properly.

At this stage, our little six-banger was producing 76 horsepower at the rear wheels, and the only expenses incurred were drilling the main jet and removing the air cleaner. So our gain from 65 to 76 horsepower had been extremely economical. For the next changes, we had to dip into the till.

Listening to the exhaust setup on this engine, we realized it was designed with some inherent back pressure. This is not all bad, as some engines operate very well with a slight amount of back pressure. However, since we were trying to uncork some horsepower, it was decided to attack this system "headers on." We took the car to Doug's Headers and asked if they had a setup for a 200-cubic-inch engine. Since Doug's is one of the biggest in the business, we felt he would offer some sort of header for this engine. But, once again, the cupboard was bare – the six-cylinder engine had not been included when it came to performance goodies. Doug, being a practical man, offered to make a setup for experimental purposes. He set about the job in a most workmanlike manner and came up with a setup that sounds exactly like an XKE Jaguar, or as we here in California sometimes call them, a "Tijuana Ferrari." All in all, a very pleasing sound, and certainly one that is not objectionable in any way to the law or the occupants of the car, was produced. In fact, I found my middle-aged foot acting like a young whippersnapper's just to hear the beautiful tone.

So back we went to the dyno to see what gains we had made with the header system. Much to our surprise, we recorded 86 horsepower, or a net gain of 10 horsepower at the rear wheels for a cost of around $125. This certainly proved to be a most worthwhile venture since we not only gained gobs of horsepower, we also got a good-sounding exhaust that scares every Camaro six for miles around.

The thought then occurred that we could use a larger carburetor to great advantage. Nestled as it is in a very low hood compartment, this becomes somewhat of a problem since the carburetor has to be extremely small to allow room enough for an ample-sized air cleaner. We found the solution at our local Ford dealer parts bin in the form of a carburetor from the 240-cubic-inch six-cylinder Ford engine. This carburetor gave us a throttle bore diameter of 1.687 with a venturi of 1.290. The standard unit had a throttle bore of 1.437 and a venturi of 1.100. Since this carburetor was of the same height and air horn size as the standard unit, we figured it just had to work and certainly could do nothing but good in the horsepower department. When trying to install it, we found we had to open up the aluminum heater manifold that sits underneath the carburetor to match the newer and larger carburetor opening. This was accomplished by tapering it out to the size of the new throttle bore. We also noticed the air cleaner would hit the new choke location on the larger carburetor, so we had to work a dimple into' the bottom plate just above the automatic choke housing to make this fit. When we tried to hook up the accelerator linkage, we noticed the arm on the carburetor would have to be bent a little toward the horizontal position to line up. This was accomplished by heating the thottle lever and bending it to a horizontal position. This all sounds like a lot of changing, but actually the whole

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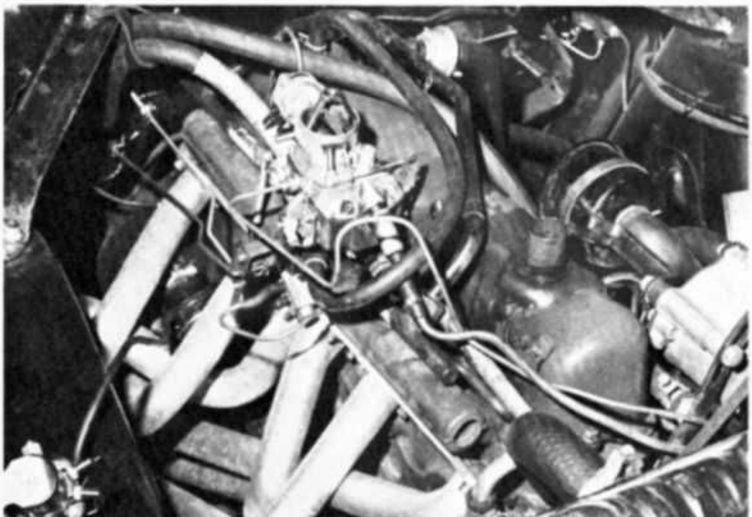


1. Here is the way the little six looked in its final form with four Keihin carbs, headers, and cam. In this stage it produced 125 horses at the rear wheels. Stock hp: 65!

2. Closer view of the inexpensive Keihin carburetors which are a stock item for the 450 Honda motorcycle. Note the pressure limiting valve needed due to small bowls.

3. This is the economy setup with its single-barrel Ford carburetor plus headers. Would you believe 30 more horses plus a bonus of better-than-stock fuel mileage?

job can be accomplished by any competent mechanic in less than an hour.

To make the automatic choke heat-line hookup we used a universal stove that clamps onto an exhaust tube. Then we used a piece of steel tubing covered with asbestos to make the bi-metal spring in the automatic choke operate as it was designed to do.

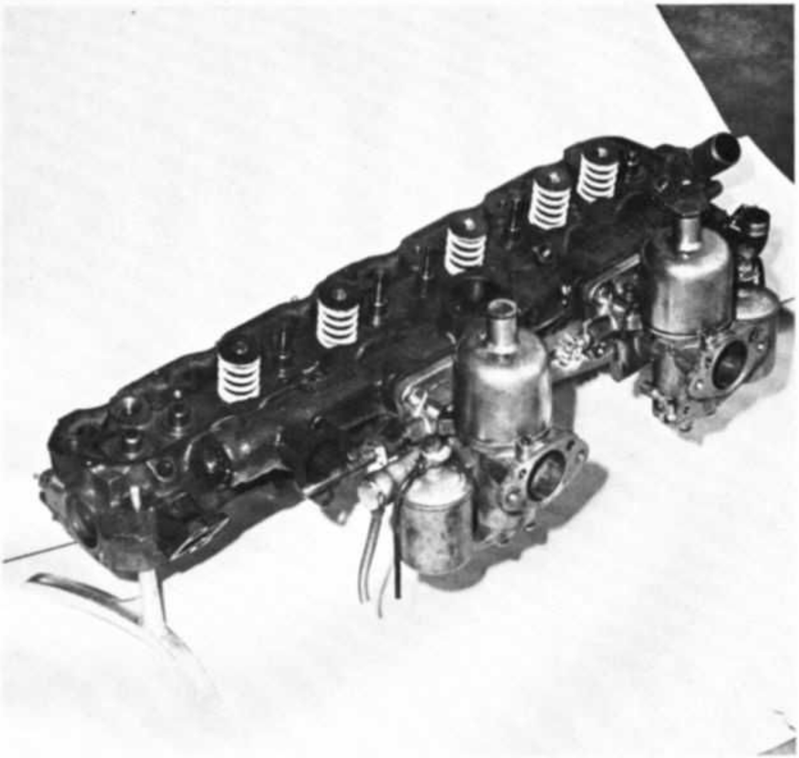
Once again, we went back to the dyno, hooked up the air-fuel ratio gauge and recorded a reading of 90 rear wheel horsepower at 4000 rpm (a gain of four horsepower).

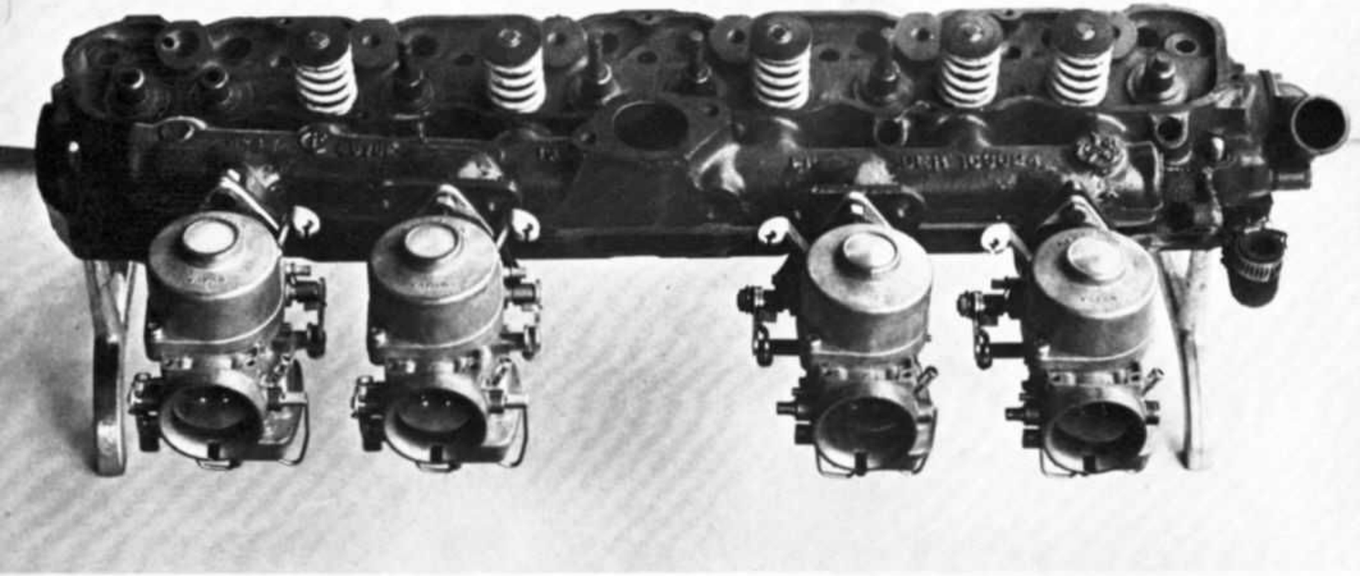
The carburetor we used was Ford part number C7AZ-9510-AA and is available from any Ford dealer for $25.60. This is certainly a most reasonable expenditure for an additional four horsepower at this stage of tuning. The air-fuel ratio, by the way, with stock jetting in the new carb, was 13:1, so we were more than satisfied because a carburetor than can be installed and not have to be rejetted is a rarity when doing this type of work. We should note that this particular carburetor was jetted for us with Thermactors. Jet sizes are usually .003 richer on such units.

About this time, our local hot rod club was having an annual economy run and we decided to enter the little Mustang six – not knowing what it would do. Since we had changed the exhaust and carburetion, we were ready to accept almost any figure. Much to our delight, the Mustang registered 35.9 miles per gallon over 200 miles of Southern California coastline. Now before you call me a liar, let me explain that 50 pounds of air was used in the

TOP: One of the best carburetion hookups was this pair of British S.U. HD-6 carbs with their 1¾-inch bores. These are a standard item on certain Jaguars, Austin Healeys, Volvos, and MGB's.

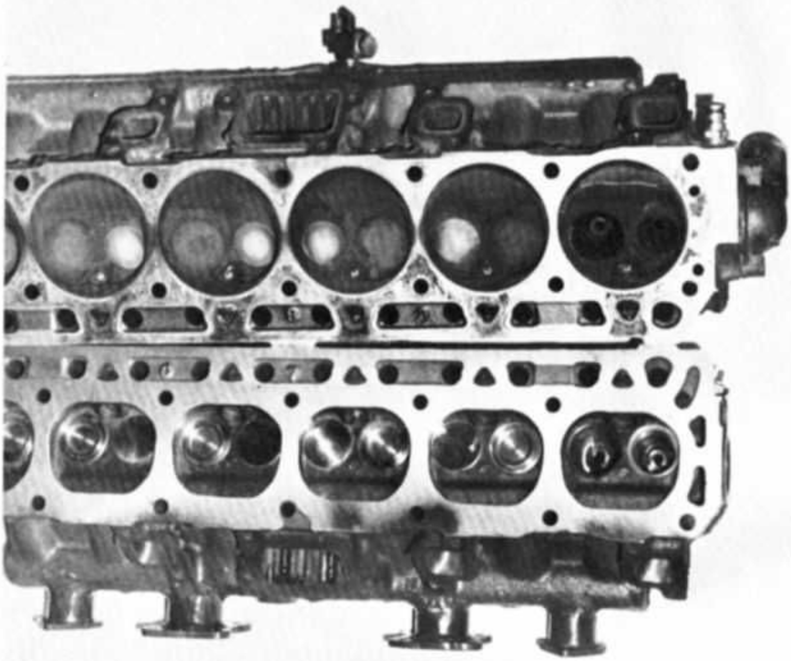
BOTTOM: Another view of the Honda 450 Keihin carburetors without their attendant plumbing and linkage. Choke butterflies were later removed since they were found to be unnecessary.





TOP: Comparison between milled and unmilled heads shows that the chambers are a modified Ricardo step design, not a true wedge. A cut of .060-inch produced a compression ratio of 10.5 to 1.

BOTTOM: View from the top of the head shows how the stubs for the new carburetion were brazed into the integral cast manifold that is a feature of the small Ford six engines.

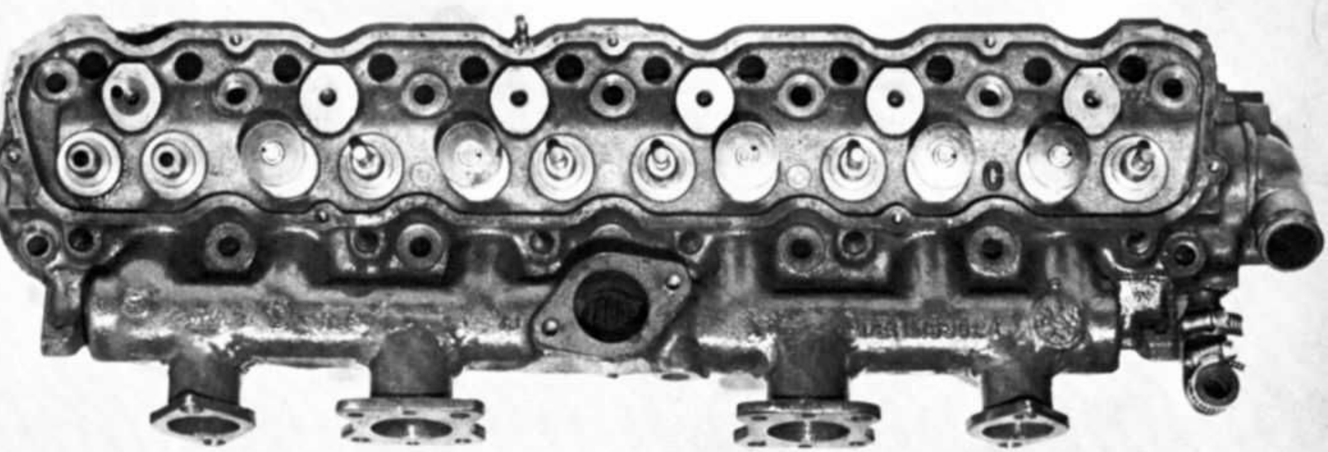


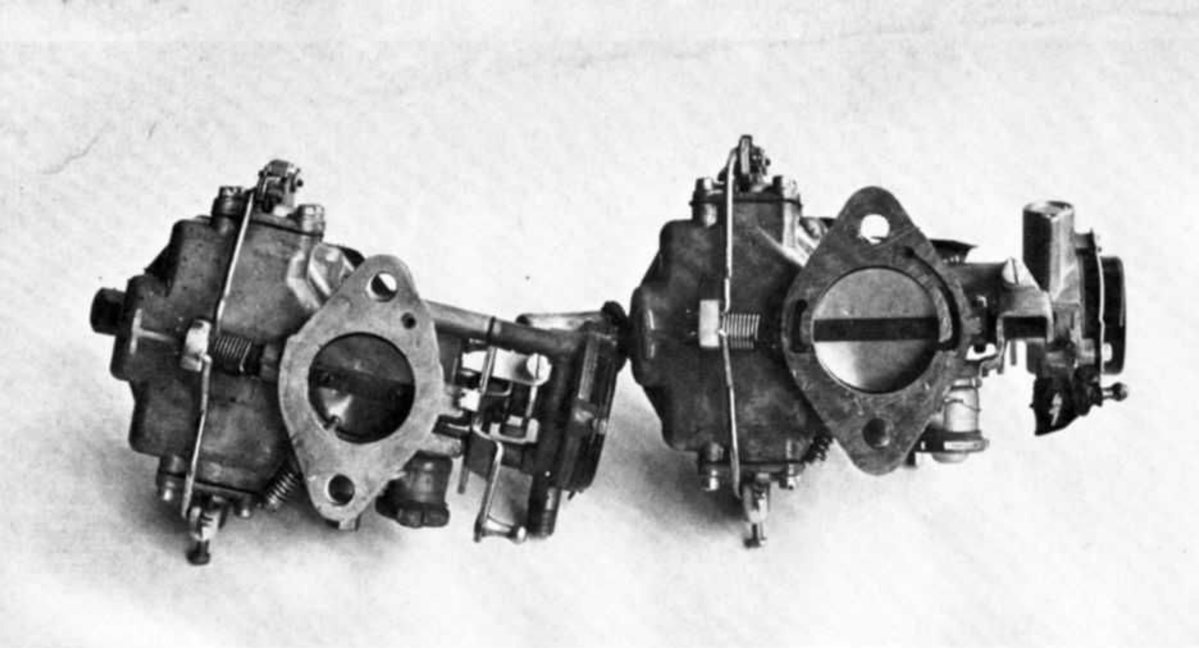
tires (for low rolling resistance), and coasting was allowed whenever possible. The overall average speed was 45 miles per hour and the gas tanks were sealed. The nearest competitor registered 27 mpg. The cars were all carefully inspected for obvious infractions such as added gas tanks, etc., and when the final results were in, the Mustang was able to keep its reputation as an economy winner while performing with 90 hp at the rear wheels (compared to the 65 hp it started life with).

Our next step was to increase the compression. To do this in the most economical manner, head milling proved to be the only way out. Since we were still getting such fantastic mileage, we felt we could well afford premium gasoline so we decided to mill the cylinder head .060. The standard head cc'd at 54. After milling .060, it was 44. Standard compression ratio was 9.2 After the head was milled, the compression ratio was 10.5 which gave us an accepted ratio for average high test or premium fuels.

Since we milled the cylinder head .060, in order to retain the correct adjustment on our hydraulic lifters, we needed shorter pushrods which were not available, so we installed ½-inch flat washers measuring .062 inches thick under each rocker stand. This worked out very satisfactorily although the rocker angle was not absolutely correct. The setup cost practically nothing. While we had the head off, a good valve job was had by all.

The amazing thing about this engine was its ability to start before you ever





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got the switch turned on. It has been the quickest starting unit I have ever worked with, and the added compression seemed to enhance this quick starting ability.

At this time, we were eagerly anticipating what horsepower the compression change had wrought. Since we had increased the compression ratio, it was only normal to assume we would need a slightly colder plug. So a set of Autolite BF32's were installed in place of the standard Autolite BF82's. Before we got the car on the dyno, I could tell the tremendous increase in the torque of the engine. It would literally want to lie on its side during fast acceleration. This little six-banger with a light flywheel and clutch grabs rpm like a full-house 289 Ford V8.

In subsequent checkout, the car gave us a maximum horsepower of an even 100 at the rear wheels (still at 4000), and the acceleration and general feeling of the car were staggering.

We were so impressed by its performance that we immediately decided to go out and run a series of acceleration checks so that we might compare our revitalized Mustang with the current crop of six-bangers offered by other manufacturers. The accompanying table compares our figures on the Mustang six with road test figures found in leading automotive publications for the Camaro and Barracuda.

mph	Mustang Six	Camaro Six	Barracuda Six
0-30	3.4	4.8	4.3
0-40	5.3	6.2	6.6
0-50	7.6	8.7	9.8
0-60	10.2	11.4	13.6
0-70	15.2	15.6	19.6
0-80	19.9	21.7	27.9
0-90	27.6	31.0	39.0

At this point, someone is probably

1. Bottom view of the 200-inch carb, left, and the 240-inch unit shows the diffrence in throttle bore size. Jetting was correct in the larger carburetor for the new application.

2. Carb heater manifold had to be modified only slightly to take the bigger carburetor. Tapering the bore is one way but it could also be opened up all the way through if wanted.

3. Keihin is a simple carburetor but effective. Major parts from top are main throttle body, vacuum slide and needle, bowl cover, vaccum cover and disassembled needle, and jet components.

4. Under side of the Keihin throttle body shows the interior of the float with the main jet installed. Throttle and air adjustments are simple and accessible.

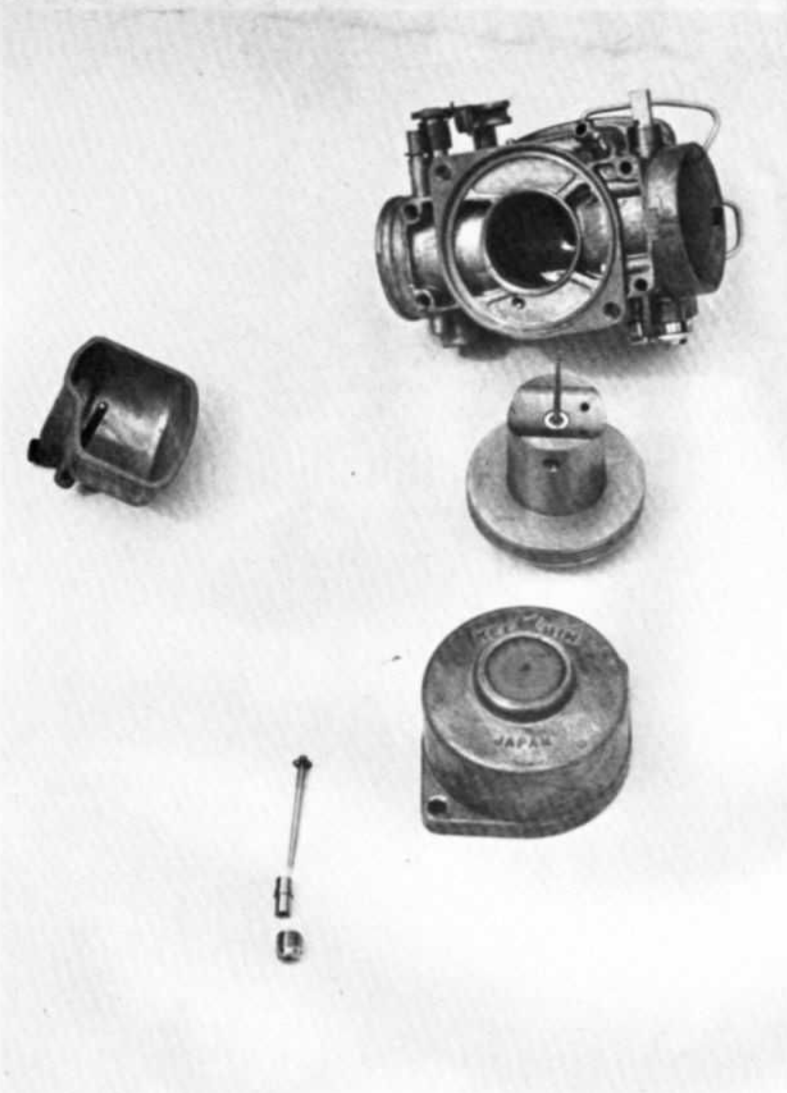
5. Metering needle at left is the adjustable type mentioned in the text. Spring washer adjusts the depth the needle seats in the vacuum slide and amount lifted from main jet.

asking the question, "How long will it stay together?" My answer is, "Forever!" This six, unlike earlier engines, employs seven mains and has enough bearing area to support the Golden Gate Bridge. The size of all the rotating and reciprocating parts add up to but one conclusion: It is the most rugged six-cylinder engine that has been offered on the market for many a moon and it has durability with a capital "D."

The behavior of the car at this point was every bit as good as it was in its stock form. The first comment by people driving it usually is, "It just has to be an eight – it's too smooth." With a 0-60 time that will give its big brother a hard row to hoe, one can only say that changing of the car's personality had been well worth the expense and effort. After all, getting the gas mileage this little bear gets, we can save the money we spent on the performance goodies in short order.

As inexpensive as this project was turning out, we decided that we should go on to more and better things.

Automatically, our first thoughts were of the camshaft, which in the case of the stock unit is designed strictly for maximum torque and economy. In this area, it just cannot be beat. However, the horsepower range comes to a screaming halt at 4000 rpm, and since we were desirous of going on up to 5500 rpm, we consulted with Mr. Ed Iskenderian. We told Ed we did not wish to destroy the inherent smoothness and tractability of the little six and would like a hydraulic action cam to maintain valve train silence. He responded by placing in our hands just exactly the cam we had asked for. The specifications are as follows: 260 degrees duration, .408 lift, 42 degrees



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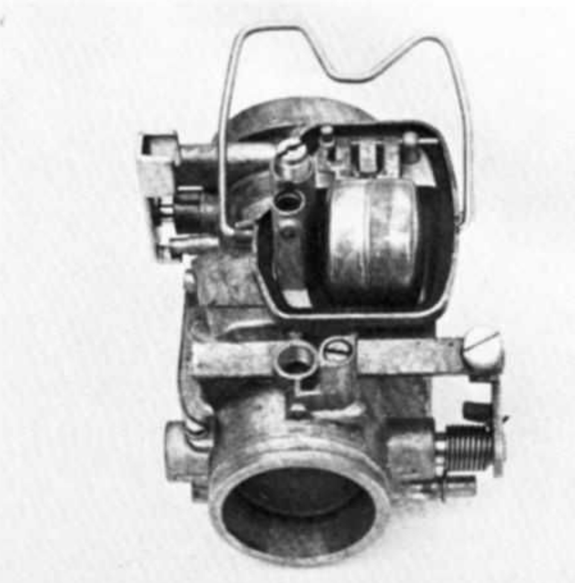

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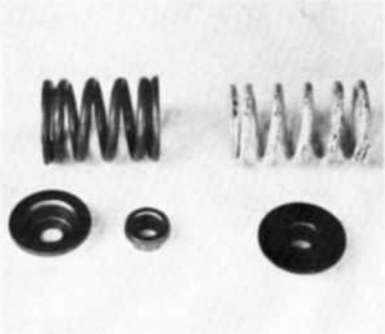


Stock spring is at left, compared to 289 high-performance valve spring and retainer used with the Isky cam

overlap, intake opens 21 legrees BTDC, intake closes 59 degrees ABC, exhaust opens 59 degrees BBDC, exhaust closes 21 degree ATDC. By comparison, the stock cam has 256 degree duration, .368 lift and 28 degrees overlap.

When changing the cam, we had to add a little more spring pressure for the added rpm, so we came up with some stock Ford items that are not only dirt cheap but were perfect for this combo. We used the valve retainers from a 1962 260 Ford (part number C20Z-6514-A, 12¢ each). We also used the standard springs from a 289 Ford (part number B6A-6513-A, 43¢ each). Multiplying these prices by the six cylinders, you can see what I mean by a reasonable price for springs and retainers . . . all from your friendly Ford dealer.

Spring pressure worked out at 90 pounds (valve closed) and 190 pounds open. Having installed the cam and springs, we observed a five horsepower increase. However, we were running the engine at 4500 rpm. Then we noticed a favorable by-product of the change; we were now able to rev the little six up to 5500 rpm with no hydraulic pump-up. At the same time we put the cam in, we had also installed push rods (part number CODE-6565-B) and adjustable rockers (part number CODZ-6564-A) from the earlier Falcon engines. They are of the same ratio but gave us a handy method of adjusting push rod lengths when changing cams. I would certainly recommend this changeover.

During the test on the cam, we noticed that the ignition (in its stock form) was rather unwilling to cope with anything over 5000 rpm since point float was encountered. We cured this situation by adding more point pressure with the installation of dual springs tailored to 36 ounces of tension. This stabilized the points up to our desired goal of 5500 rpm.

At this time, we felt the little six was crying for more fuel so we decided to investigate the possibility of adapting vacuum control slide-type side-draft carburetors. We hoped these would cure the low hoodline problem as well as take care of the inevitable flat spots encountered when using large venturi areas on small engines. Since the cylinder head employs an integrally cast manifold, it was absolutely necessary to do a little work in this area. We decided to remove the head and secure some stock exhaust flanges with short pieces of attached tubing. We then proceeded to the local boneyard and came up with two 1¾-inch SU British carburetors from a Jaguar. We noted that the cast aluminum air cleaner (manifold and all) could be placed into the engine compartment very nicely. So we cut the steel tubes off (approximately 1 inch in length), mounted the SU's on these tubes and centered the whole setup on the intake manifold. Then we scribed a pattern, drilled out the necessary holes and brazed the flanges onto the intake manifold. Since the manifold is of thin-wall casting, the brazing was a very simple job, and anyone (even in East Snowshoe, Montana) could perform the same operation with dispatch.

I also wanted to try some other slide venturi carburetors; namely, those used on the 450 Honda motorcycle. Since they are only 37mm in size, I decided I would have to try four, so I added a couple more flanges for the tests.

Meanwhile, back at the barn, we had the setup all ready for the tryout with the two SU's. After installing two carburetor rebuild kit (for $13), we were ready to go racing. By the way, the used SU carbs cost us $20. New, they are $55 each.

The throttle hookup was relatively simple. We merely clamped a 5/16-inch throttle arm onto the SU shaft, ran a direct rod to the standard Ford bellcrank and everything worked out nicely.

Our first test with the SU's indicated a lean mixture condition, so a visit to our local Jaguar dealer turned up some SY needles that worked out perfectly for this installation.

Our theory about the slide valve carburetion netted us a very fine batch of horsepower plus a couple of big carburetors that you can stick your foot in anytime and any place. They don't cough, hesitate, or spit back . . . they just GO! When making the changeover, it is advisable to use the manual choke setup which is operated most easily by a Bowden cable.

Our final rating showed an additional 10 horsepower. The added carburetion was letting the engine really come on in the higher rpm bracket, and we were belting out a solid 115 rear wheel hp at 4800 rpm. Translated into a 0-60 time, this amounted to a 9.4-second clocking (or close to a second off our previous time). A trip down the quarter-mile netted 81 mph in the low 16-second bracket. One further benefit here; the gas mileage was beginning to show a decline, but not as much as one might suspect as the car was still capable of a consistent 18 to 20 mpg at normal cruising speeds.

With the carburetion and cam changes, the engine still had a more-than-reasonable idle at a steady 600 rpm, leading me to believe this setup could be used very nicely with the little C-4 automatic transmission.

When we had put on an additional 1000 miles or so with this setup, the urge to go to the four Honda Keihin carburetors became too strong. By having previously brazed the four flanges onto the manifold, the transition was only a matter of two or three hours' work. When installing the Honda carburetors, I noticed they did not care too much for high pulsating fuel pressure (due to their small float assemblies), so I installed a regulator to limit their fuel pressure to three pounds. This did the job very nicely. The first runup on the dyno indicated lean mixture conditions in the medium rpm range. This was cured by removing the .028mm jets and replacing them with .042's. The main jets were subsequently enlarged to .070, and a set of adjustable needles were installed. These are available from Honda agencies. The metering rods have five notches for adjustments, and we downed the "number two" notch (from the top) to be the ideal setup.

These changes seemed to bring the air-to-fuel ratio into balance, so we decided to give the little six a full blast on the dyno and see what we could get in the way of additional horsepower. I was also very interested to find out what the small carburetors would do for horsepower in the lower rpm ranges, so we took a reading at 2800 rpm and netted 75 hp at the rear wheels. At 3800 rpm we had 105 hp, and at 4800 rpm we reached the top of the ladder at 125 hp. This proved to us that our idea on the soundness of this type carburetion was right. When you jump on the throttle with these little bears, it is just like having fuel injection. It feels like all the horsepower unloads at once. In driving the car on the road, we found we could still stabilize the idling very nicely at around 600 rpm. As a matter of fact, the idlyings adjustment on these Keihin carbs proved to be something to behold. This setup came with a smoother idle than 99 percent of all the stock cars I have ever played with. We did, however, encounter flat spots in the extreme low end of the rpm range. But, after all, when playing around with 5.8 square inches of carburetion on such a small engine, one must learn to expect that all cannot be "peaches and cream." To offset the flat-spot disadvantage, the price of these units is only $25 each.

To explore still further the possibility of using side-draft carburetion, I decided to check a couple of the Tillotson diaphragms used on the American Harley-Davidson motorcycles. This is a very simple, straightforward carburetor of 1⅝-inch venturi dimensions. Testing proved this arrangement to be capable of equalling the SU's in all-out horsepower, but having more flat spots than a shaker full of dice.

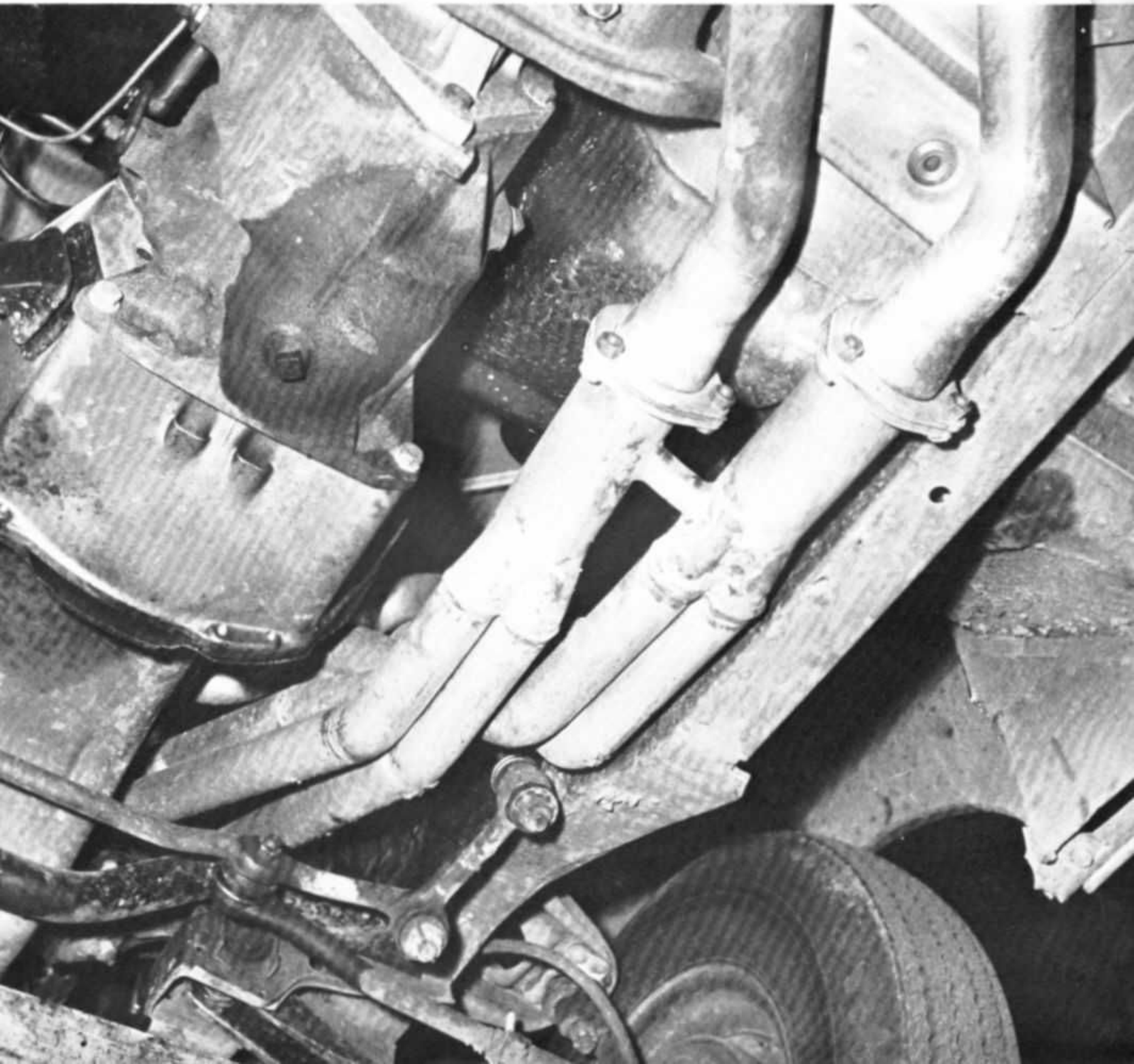
The general behavior of the car in normal stop, go, and cruising ranges was a most pleasant surprise. Later tests proved this car to be capable of 84 to 85 mph in the quarter-mile. With 4 to 1 gearing and 27-inch rubber, 5500 rpm could be had at any time, and this is 110 mph. This performance proved more than equal to several versions of the 289 2-V and 4-V jobs that we found willing to try us on for size.

I also tried the 4 to 1 gearing in conjunction with the four-speed tranny, and my conclusions would be to forget this setup since it wreaks havoc with gas mileage and certainly is not conducive to good smooth road speeds of 70 mph. I would recommend staying with the three-speed synchro with the 3.20 rear gear set. As for the remainder of the work, take your pick. It all proved very exciting and rewarding for me since I have always felt that true hot rodding is venturing into the unknown or unusual.

I have gained a tremendous respect for the latest version of the seven-main, six-cylinder engine. I sometimes wish one could purchase such a package, call it a GT six, add some minor heavy-duty equipment to the chassis, and this little job would give a good accounting of itself when compared to many foreign sporty jobs that cost much more.

As we close our hood and road off into the setting sun, we can only say come on and join the six-cylinder parade for more fun with less money than you ever could imagine!

Underside of car shows the routing of the equal-length headers used.



GOIN' FOR 7500!

by John Christy

When we published the Complete Book of Engines No. 2 last year, the 289 Ford with comparatively minor modifications done by the Gospel According to Shelby American was capable of 350 horsepower. The full-race engine with Webers, a roller cam, and rev kit could come up with a shade over 400.

Since that time good things have happened both at Ford and at Shelby American. With changes that are more quantitative than qualitative except in the gasworks, the Trans-American sedan race engines are producing 390 horsepower and rapidly heading for 400 while the fully modified racing engines are headed for 450. Where once the reliable limit in terms of rpm was 6500 and 7000 for short bursts and sprints, it will now hold 7000 revs for hours on end.

The main reason for this dramatic increase is that Ford engineering has given seekers after power more to work with in basic material. This is an assembly known as the "heavy-duty" package, something we could barely hint at earlier. This package consists of a block that is basically the same as the regular 289 High-Performance unit but with a casting that is thicker in the deck area and other high stress points. Nodular iron, similar to that used in cast cranks, replaces the gray iron block material formerly used in the main bearing caps. The net result is a much stiffer block assembly that is not only a boon to the track racer in terms of reliability but should also be good news for those who would like to use something other than a Chevrolet in the up-and-coming Junior Fuel dragster class.

With this block assembly go a number of other good things. The most readily apparent of these is a new head with several very obvious changes and one not so obvious. The first thing that strikes the eyeball is the fact that the ports are cast to the dimensions that were formerly gained only by painstaking work with a grinder. What this means will be pretty understandable to anyone who has had to grind out a port or pay to have it done; a rough dressing to take out the big lumps and a polish to finish the job produces the same result that takes hours on the regular High-Performance head. With more grinding an even bigger port than was previously possible can be produced, again good news for the fuel burners.

Turning the head upside down gives another clue. The smallish, kidney-shaped chamber with its somewhat masked plug has been recast. The chamber is now opened up to the dimensions used in the old head as cut for use with a stroker assembly. The plug is unmasked and the valves come stock at 1.875 inches for the intake and 1.625 for the exhausts as compared to the 1.77-inch intakes and 1.445 exhausts in the standard HP head. A word of caution: bigger you can't get into this or any other 289 Ford head without the expensive procedure of drilling out and offsetting the guides and flycutting the head. The risk is high and results are not likely to be worth the effort.

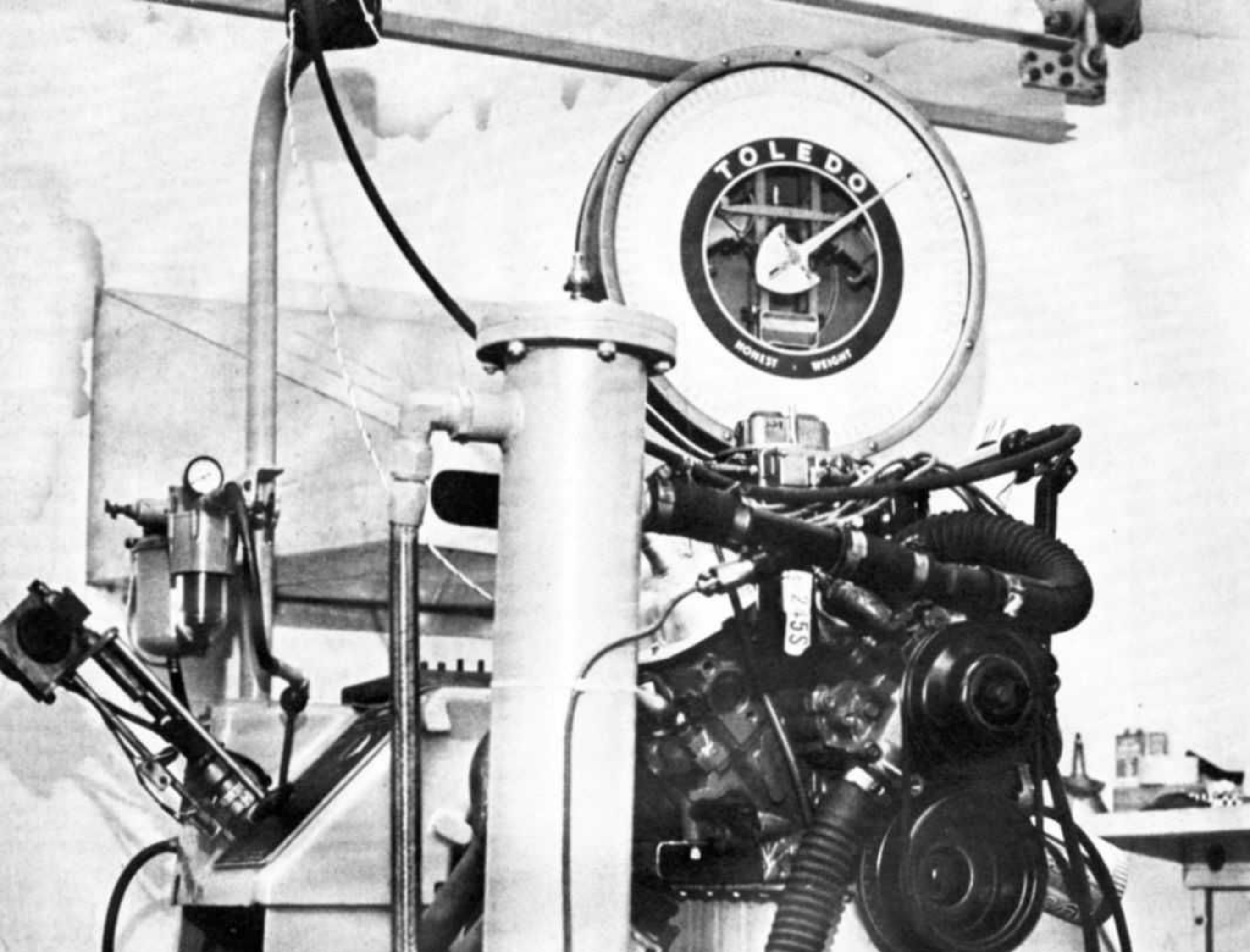
With this big chamber something had to be done to bring the compression ratio back up and it was. Under this head are new deflector or pop-up forged pistons that, in spite of the deflector, are 200 grams lighter than the regular eyebrowed HP pistons used in the past. Linking these pistons to the crank are new cantilever wristpins with tapered interior bores and a rod similar in nearly all respects to the HP rod but with a small though very important difference. Where the earlier rod had a straight mill cut at the big end shoulder for the rod bolt head seat, the new one is spot faced in this area and a round bolt used. The reason for this is that the mill cut created a stress raiser point with resultant occasional rod failure. Spot facing puts two fillets at this critical point, stopping the failure.

This engine assembly is the basis from which the Shelby people build the current racing engines for the Mustang sedan racers and for the big rear engine Sports Racing cars. As of this writing it is not available in any Ford car but the parts can be obtained through Shelby or Shelby dealers.

Two items other than this new block assembly help to account for the increase in power. First among these is a new dual four-throat manifold that is, believe it or not, NOT a double-runner 180-degree item. Instead, it is designed to act at the top end of the rev scale as if it were a true port-per-cylinder unit similar to the four dual Weber setup. It takes two 600 CFM Holley carburetors set to act progressively, transfer pass-

RPM that is - - with new hardware for the old hoss.

PERFORMANCE



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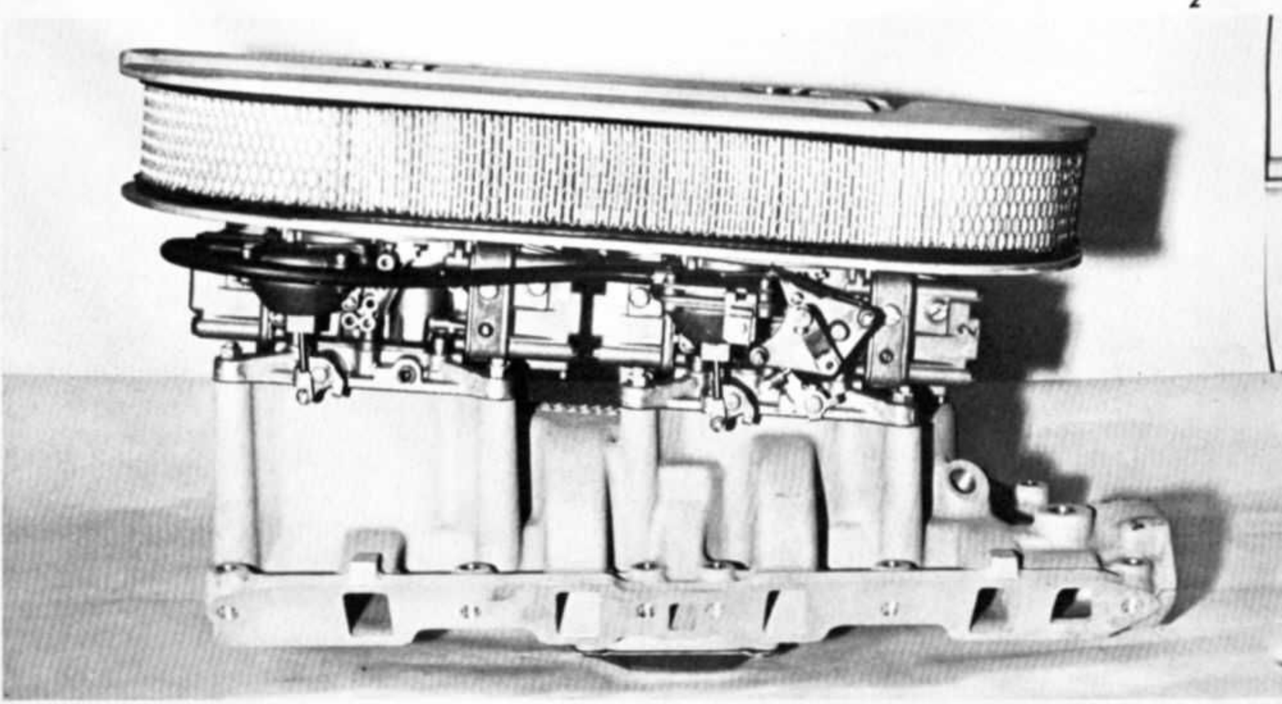

1. On the Heenan-Froude dyno, the new HD-type 289 heads for 400 horses, gulping 1200 cubic feet of air per minute and staying together at 7000.

2. The latest hot setup for the street is the C4OZ-6B068-E kit that comes complete with two 460 CFM Holleys and all the necessary gaskets and linkage.

3. New competition manifold, left, compared with the older single carb high riser. With two 600 CFM Holleys wide open it gives throat-per-cylinder operation but progressive low-speed action.

4. Underside of the new manifold shows that it is equipped for heat and could be used for street.

ages within the manifold acting to give even distribution in the intermediate stages until all eight throttle bores are open at which point each bore feeds an individual port directly. This particular manifold and carburetor combination is primarily for competition and has not been checked out for street use. The carburetors used in the competition version are Holley numbers R-2804-AS for the primary and R-2805-AS for the secondary. It could be that these could be adjusted in their opening sequences for street use on this manifold. The total assembly carries Ford and Shelby part number C6ZZ-6B068-A. There is a kit designed expressly for street use bearing part number C40Z-6B068-E. This is also a dual four-barrel manifold but with the double-runner 180-degree design and carries a pair of 460 CFM Holleys with Holley part numbers R-3361-A and R-3360-A for primary and secondary respectively. It comes as a complete kit which includes virtually everything for instant mounting including a large dual air cleaner and all the necessary gaskets.

The second of the new power-producing bolt-ons is a new set of headers with equal-length pipes dumping into a 3½-inch collector with a 62-inch extension. Uncorked, with the 62-inch extension these pipes are good for an additional 18 horsepower over the older GT 350 headers. The collectors are flanged to fit a pair of head-pipe reducers so that they can be connected to mufflers.

Most interesting about this new hardware is that it can be adapted either wholly or in part to the regular High-Performance 289 engines already in use. The new rods can be used with no other changes as can the wristpins and we cannot recommend them too highly, particularly where really hard use is contemplated. The rods should also be considered a must for a Junior Fueler; pins, of course, will depend on the piston used in such a case. The new pistons will require the use of the HD heads or, if you are careful you can cut the High-Performance heads to the same configuration although it is a rough job. The new heads, of course, can be used with any deflector-type piston. Another word of caution here is that if the new pistons are used, the crank will have to be rebalanced due to their considerably lighter weight. The recommended bob-weight is 760 grams. Normally the 289 Ford block does not need line boring – in fact the Shelby people have yet to see one that does although they have done it for safety reasons on rare occasion. However, if the main caps on the regular HP block are replaced, either with the nodular iron ones for the HD engine or with steel, line boring will be mandatory.

Primarily the main secret of getting the 289 to produce power is a good job of blueprinting. The big reason for this is that the tried and true method of adding cubic inches is strictly limited. It has been said before but it bears repreating that the boring bar is NOT

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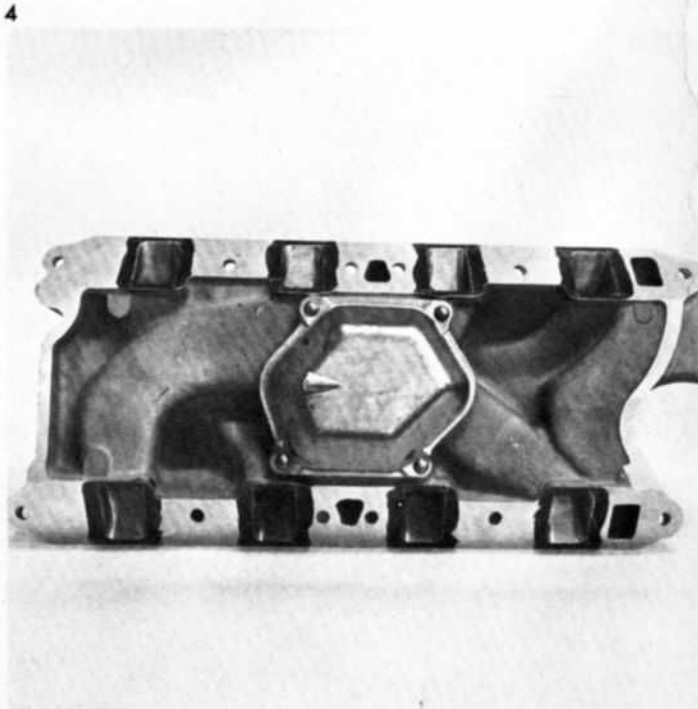

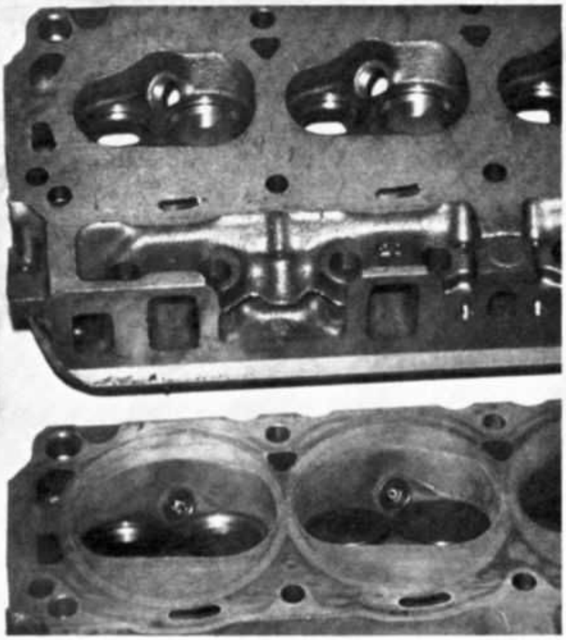

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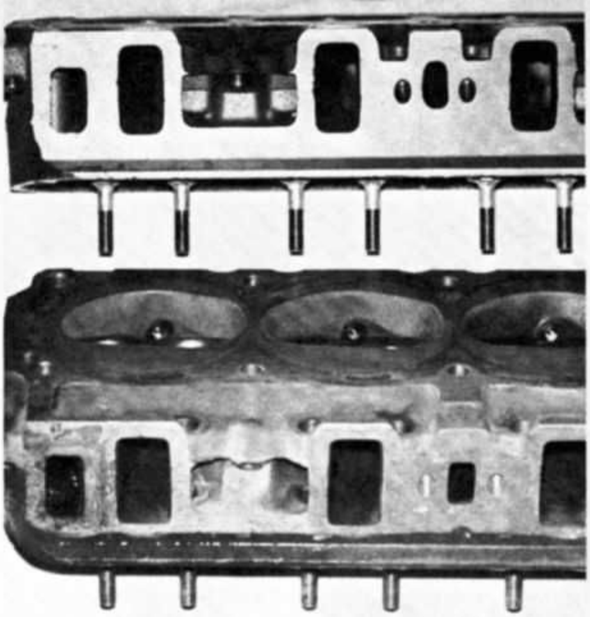

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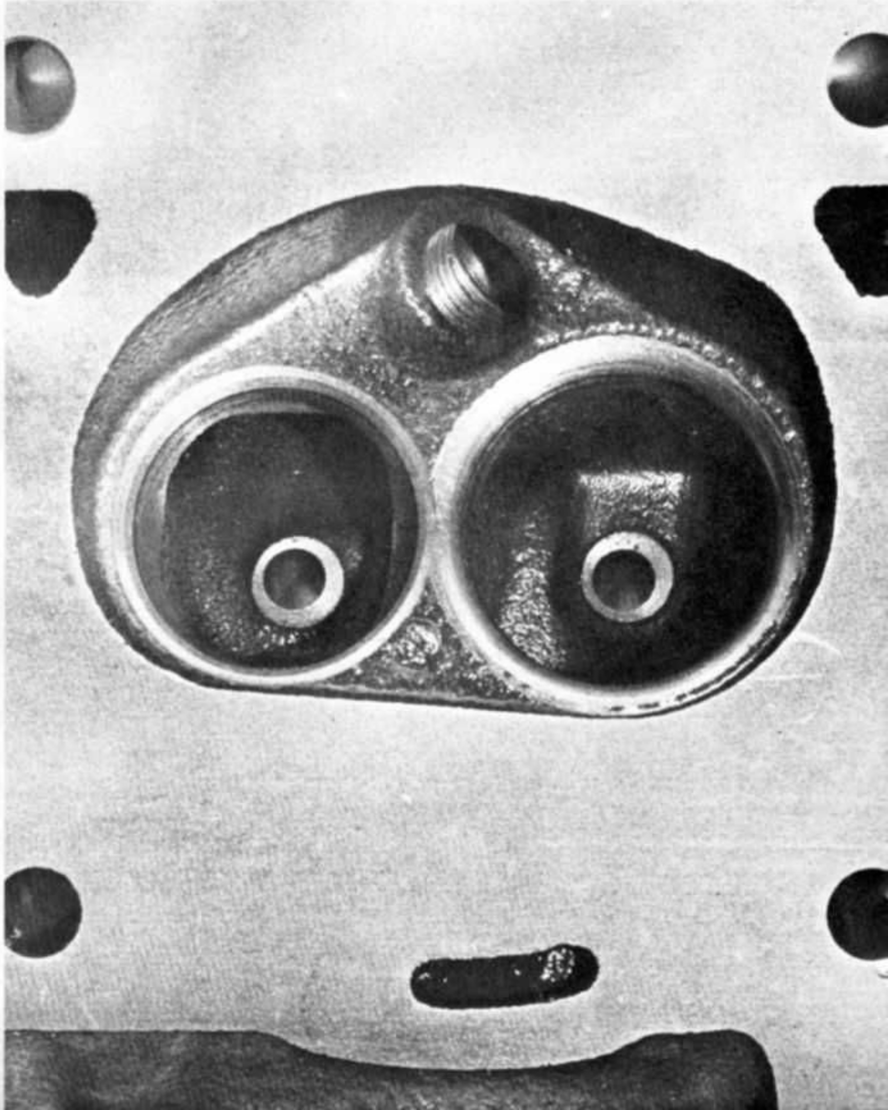


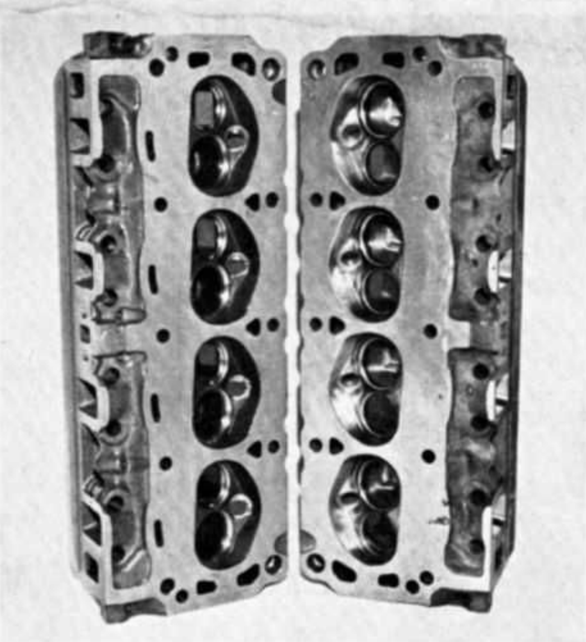
1. Comparison between the high-performance head, top, and the new heavy-duty head shows the open chamber and unmasked plug of the latter.

2. HP head, top, has obviously smaller intake ports, particularly in width than does the HD head.

3. Another view of the HD combustion chamber shows the very large valve seats and unshrouded area around them. Larger valves would be impossible.

4. Comparison between ported HD head, right, and the stock head indicates how little work must be done to achieve what used to take serious die-grinder work and polishing.

5. Another view of ported head, left, and unported HD head shows that only polishing is needed. Enlargement is only about 1/16-inch in width and height.



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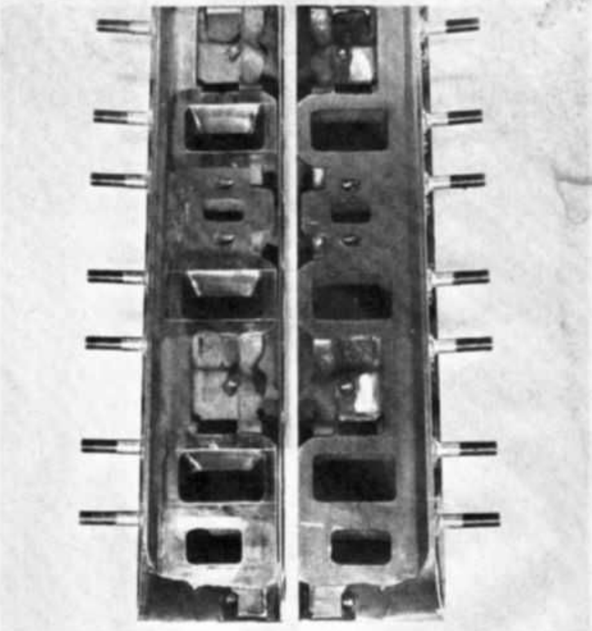

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the way to go with Ford's thinwall castings. A cut of .030-inch is *maximum* and hardly worth the effort. We've seen more than one case where exuberance with the boring tool got the operator wet at less than .045-inch! A stroke increase can be done but this, too, should be limited to a quarter-inch or so. A total stroke of three inches, .230 over stock, will give 301 cubic inches. The reason for urging caution here is that overly lengthened strokes can and have done main bearing web damage even when a main girdle is used. This has primarily occurred in track and road racing where the torque-time factor assumes great importance. In the case of drag racer particularly in a light Junior Fueler, this may not be the case. In any event the Junior Fuel engine is limited to 310 cubic inches anyway so there is no need for a gigantic stroke. A main bearing girdle is good insurance in any case and is specifically required of all fuelers and supercharged cars at many strips.

As mentioned the 289 responds best to a good blueprinting, both for the Heavy Duty and the High-Performance engines. In the case of the former all that's needed internally is a cam and even here the factory provides one that is more than adequate for street use. It's the one used in the 271-horsepower HP engine and goes under part number C3OZ-6250-C. For road racing and week-end warrioring a hotter Shelby cam, number S7MR-6250-A can be used and is recommended for use with the new HD head and pistons. For really serious work cam number S1CR-6250-2 can be used, but forget it for street use. These are the result of Shelby and Ford computer work, dyno tests, and racing. For drag racing or fuel use, cams by such manufacturers as Engle, Crower, Crane, Racer Brown, Iskenderian, and others may well provide an answer. It wouldn't be a bad idea to shop around, giving the manufacturers the full information on your engine and the use for which it is intended, particularly when nitrated fuels are contemplated.

For use with gasoline the factory pistons, both the Hi-Perf eyebrowed variety and the deflector HD type are more than adequate. The HP pistons have a cast-in steel expansion control strut and can be run at .0048-inch clearance. The HD pistons are forgings and must be given a looser fit of .0055 to .006 inch.

The first step in all cases with the 289 block is to check deck heights and surface trueness by preassembling. You will undoubtedly find that a parallel surfacing is necessary if only to make sure there aren't any divots or bumps. Next up is honing, both for proper clearancing and to get the right crosshatch pattern in the bore. At this time a small hone run through the tappet bores, bringing them out .001-inch larger is good insurance against tappet seizure, a small thing that can have expensive consequences. The next thing is to drill and tap the upper water transfer passages above each cylinder to take an Allen-type pipe-thread plug. Do the same thing at the front of the block where there are soft plugs blocking the ends of the oil galleries. For strictly street use, plugging these holes and galleries isn't necessary, but for any type of racing use it can be vital. The small water passages are quite close to the bores and are the source for many of the heat problems and gasket woes people have had. The oil gallery plugs are long-tried practice and very definite insurance for any engine, Ford or otherwise.

With all this done, wash the block with solvent and then with hot water and detergent followed by a scalding rinse, making sure all oil and water passages to be free of chips and other unwanted material. There's nothing that will make you feel more stupid than to find a waterpump full of core sand or an oilpump full of chips and broken gearteeth. With everything clean, oil all machined surfaces lightly to prevent rust.

Balancing is an absolute must. Because the Ford crank is designed out of balance this is taken care of by out-of-balance damper and flywheel. When all are properly mated the assembly is back in balance so all three items must be checked and treated as a complete unit. At the same time this is being done have the crank grooved on the mains and all oil holes chamfered and cleaned. Micro-polishing is also an excellent idea.

In fitting up the crank there is a definite sequence. You can, of course, follow the procedure of the mass rebuilders and pop the bearing halves into their respective caps and journals and bolt 'er up. But you've paid to have this crank balanced, grooved and polished and it's nice to *know* it fits. Mike the finished crank and select

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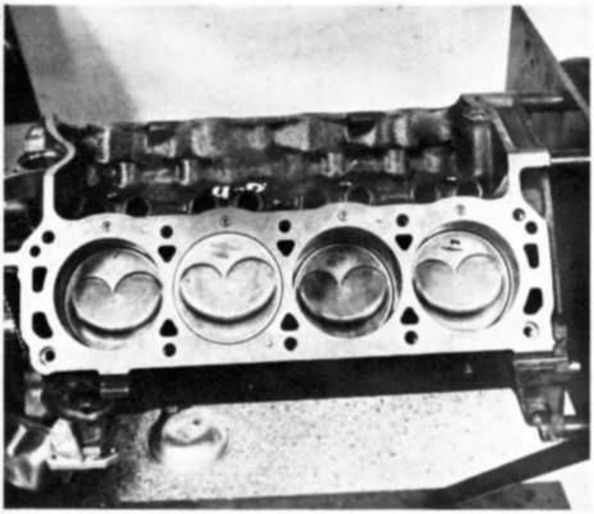

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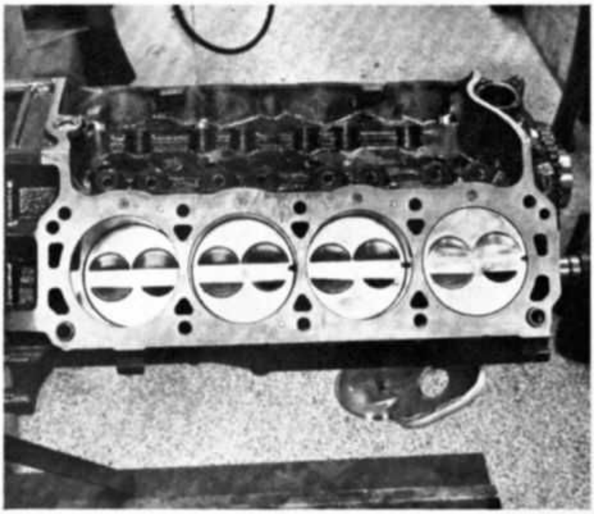

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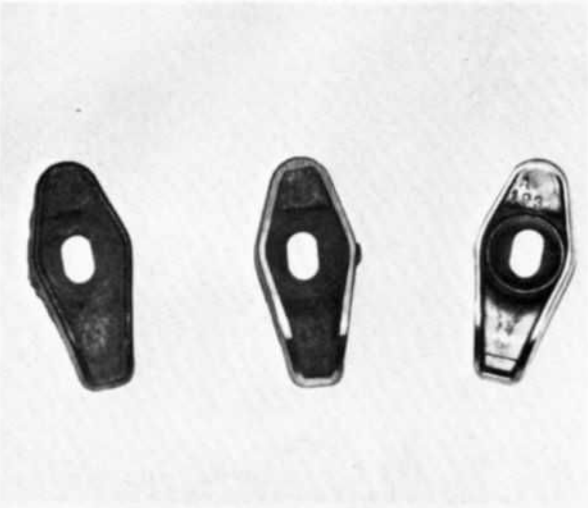

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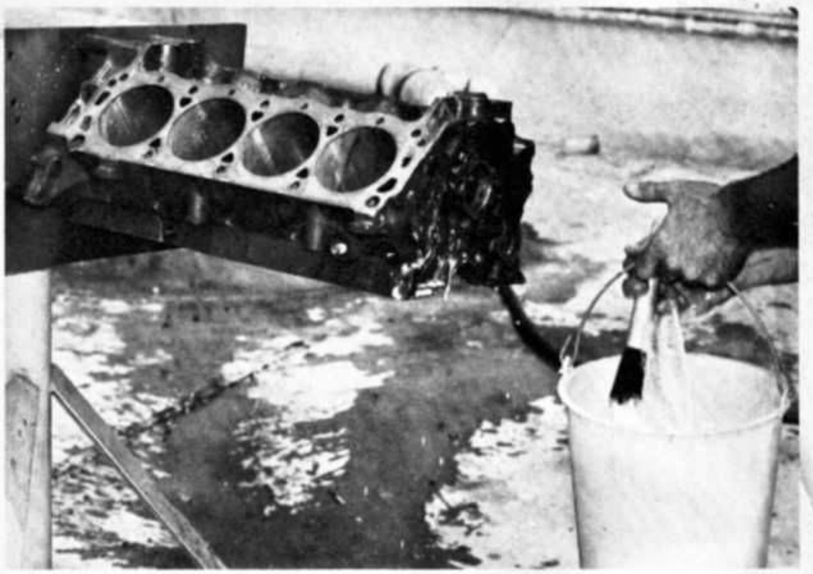

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1. A seemingly small but very important difference can be seen in the new HD connecting rod, right, compared with the older HP rod. Bolt seat is spot faced instead of mill cut.

2. Obvious difference between HD piston and HP stem, right, is the deflector top. Piston is forged, pin cantilevered.

3. Four little bumps all in a row. The deflectors give a c.r. near 12 to 1.

4. Earlier high-performance engine with flat-tops got its compression ratio by restricting the combustion chamber.

5. Crank remains the same for both HP and HD engines. It should be micro-polished and grooved at the mains.

6. HP rockers should be Magnafluxed and edge-ground or polished, center & right.

7. To avoid tappet seizure, bores should be honed out .001 inch.

8. Upper water relief holes in block should be tapped, plugged with screws.

9. Cleanliness is vital. After machine work, wash block with detergent.

bearings that will give a .002 to .0021-inch clearance. Put these in their respective places and without the crank bolt up the caps tightly to give the bearings their proper crush. You can now measure them with an inside micrometer or dial gauge. If you don't have these instruments, remove the caps, lay the crank in and check with Plastigage. For the final assembly lube the crank and all bearings heavily with STP and torque the caps down to 60 pounds, the center or thrust main last. This should have .010-inch side clearance if it doesn't, figure out a way to get it. When all is done the only drag should be that caused by the block half of the rear oil seal.

We mentioned the piston assembly fit using the Ford-built slugs. If you go to custom pistons the fit will probably be looser in all cases, generally ranging from .0080 to as high as .010. In the Ford high-performance pistons, the eyebrows on upper sides will have to be fly-cut deeper if any head shaving has been done or any cam used other than the stock factory high-performance stick. Factory pistons of both types use a pin that is press-fitted, steel on steel, to the rod. The fit in the piston should be a loose finger-push with a lubed pin. Custom pistons generally come with a full-floating pin that requires that the rods be submitted for bronze bushings. If you purchase these from such establishments as the Crank-Shaft Company, C&T Automotive, Mickey Thompson, Ansen, Bell and others, they can pin-fit the rods and pistons at the time of purchase which can save a lot of running around. In all cases if at all possible, use the new Heavy Duty rods. Clearance for the rods is .003 and end play at least .008 inch. Rod bolt torque should be 45 pounds.

The real key to performance is in the head assembly. If at all possible the head to get is the HD variety; the savings in machining costs will probably offset the price of the deflector pistons needed. The head is available in as-cast form with unpolished chambers, ports and valves as a straight Ford item. A better bet both in the time and money department unless you are ready to go the full custom spring, valve and roller route is the Shelby S7MR-6049-A kit. This contains all retainers, keepers, PC seals, shims, and fitted valves. This is a polish-it-yourself item but everything else has been done. A fully finished head with all the goodies including swirl-polished valves with hard-chromed and centerless ground stems is also available to order. This head has also had the upper water relief passages welded and the mating surface has been milled .030 inch. If you don't have access to the tools or have a porting service nearby, the finished item is the way to go. In the end it is probably cheaper even though they list at above $400 a pair. By the time you have all the machine-work done, the valves made, springs and retainers purchased, and all the other ancillary work done the stock heads at around $250 a pair will run as high or higher and you're still experimenting. One more point should be brought out; for 1967, Ford has a rocker that looks like a real goodie with a slotted end that fits over the valve stem and prevents walking or side-slip. Don't use it except with hydraulic tappets and light spring loadings. The original High-Performance rocker is much stronger but be careful to Magnaflux these items and flash grind the upper edges. There's a high rejection factor here so don't use any that haven't been "magged" and found clean. Enough has been written about the treatment of the regular High-Performance heads that we won't repeat it here. Further information can be found in *Complete Book of Engines #2*, *Hot Rod Magazine Yearbook #6*, and *Hot Rod Engines* (Signet Q3069).

We mentioned the crank installation earlier as well as the rod installation. Now it's time to turn the block upside down again for the final buttoning and checking. The oil pump should have the relief shimmed .200-inch to bring the hot oil pressure up to 60-65 psi—it normally runs about 45-50. It's a good idea to check the pump base plate though these are usually perfectly flat and smooth. Two pieces of insurance are highly recommended. One is the safety wiring of the bolts on the pump mounting flange and on the pickup flange. The second item is a reinforcing plate in the curve of the pickup tube (see illustration) as well as another small one that attaches to the front main cap. With everything safety wired and checked put the pan on and button it up. These pans are normally deep-sumped but can be improved. A cast pan is available that carries two extra quarts and is baffled and gated. If you want to play with tin snips and a torch, you can do it yourself.

On the top end, as we have mentioned, you have a choice of anything from a single four-barrel high riser as used on the '65 and '66 GT 350, the two previously mentioned dual fours through a four-Weber intake system available from Shelby. Mickey Thompson and Edelbrock both have dual four-barrel cross-ram systems among others. Hilborn makes an injector setup that should be ideal for the Junior Fuelers. On the blower front Paxton makes a street-type supercharger marketed exclusively through Shelby dealers that is advertised to produce up to 40 percent more power on a 271-horse 289. For the serious minded competitor, Mickey Thompson markets a blower manifold and kit to take the GMC Roots-type 'charger. Virtually any of the supercharger injectors will work with this setup. Depending on the class you want to run the engine in and the rules of the association, the sky is the limit in the gasworks for the 289.

To light things off, the Ford High-Performance centrifugal advance distributor with one coil works without fail on gas burners up to 7000 rpm and above. For dragging in the various modifiel classes and especially for alcohol and nitrated fuels it would be best to go to one of the custom igniters or one of the several magnetos built for it. With the Rootes blower this is the only way to go since the standard ignition interferes with the blower mounting. In this case the stub shaft of the distributor is left in place to drive the oil pump and the opening covered. A Schieffer magneto mounts on the timing gear cover and is driven by the cam.

A whole book could probably be written on the small-block Ford and certainly that much has seen print. We only hope we've pointed you along the right road.

1. Install main bearings without crank to obtain proper crush, then measure with dial gauge or calipers.

2. Good insurance: Safety wire all oil pump mounting bolts including base and pickup flange capscrews.

3. A light gusset on pickup tube will prevent embarrassing and expensive failure in the oiling department.

4. Be especially careful when torquing manifold corner bolts. The unsupported ears can be easily snapped off.

5, 6, 7. We thought we'd toss off an idea for those who have anti-smog air injector heads. These have not only a bump for the injector but a wide flashing around the edges. Ak Miller shows how a few minutes with a grinder can help. Notice darkened area (6) where manifold and ports were mismated.

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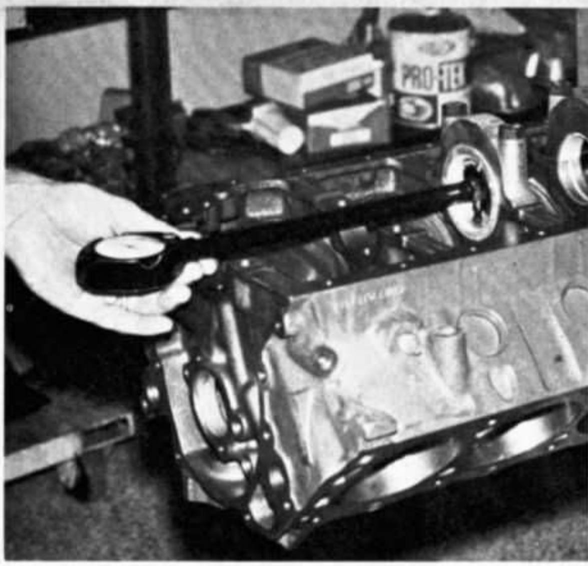
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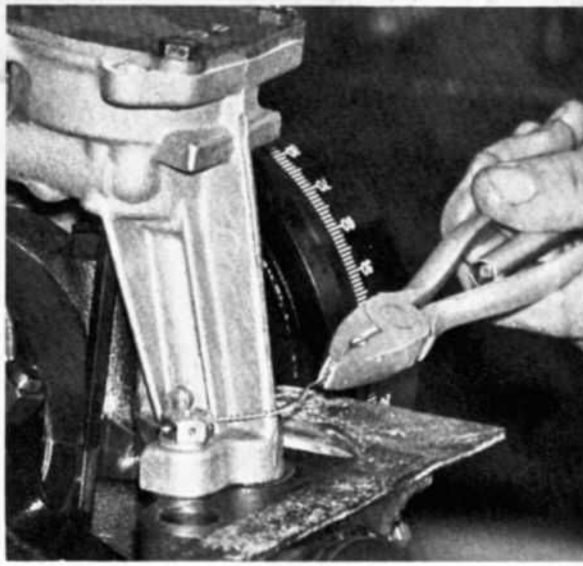
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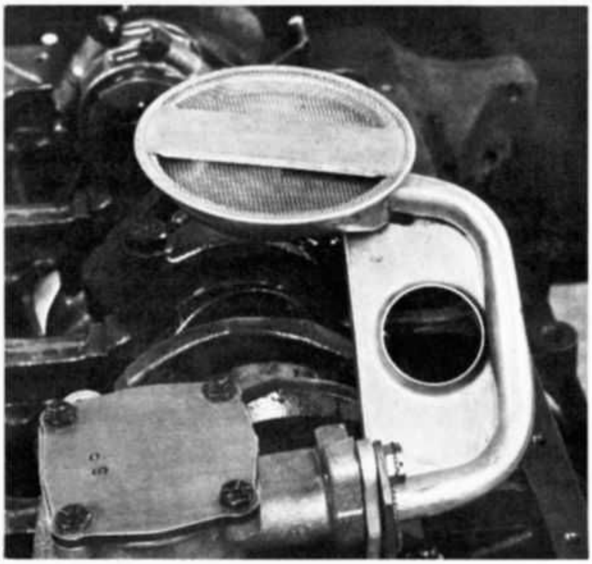
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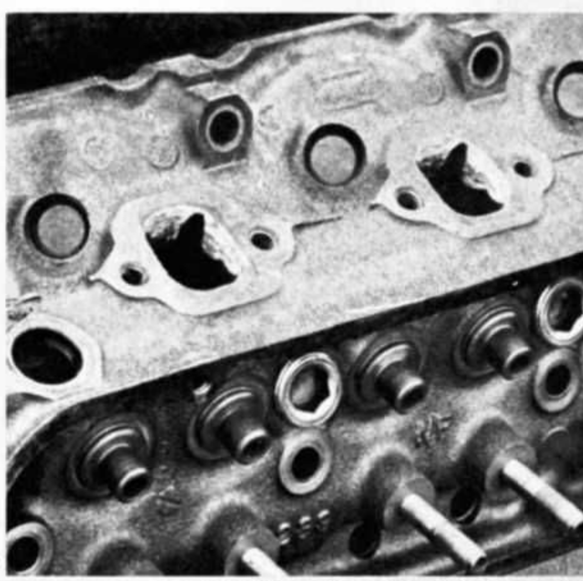
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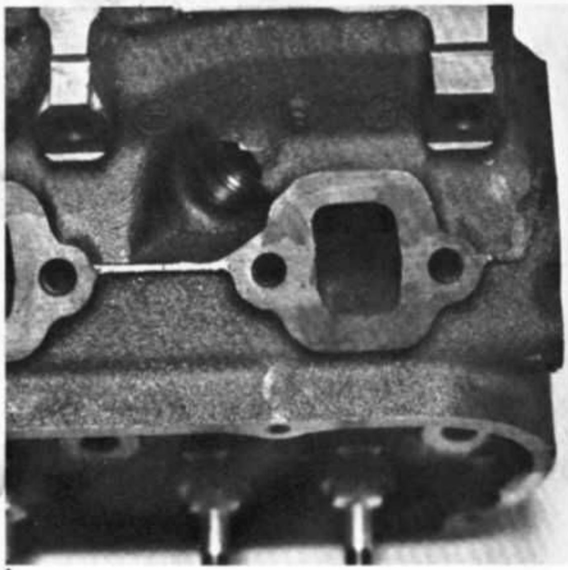

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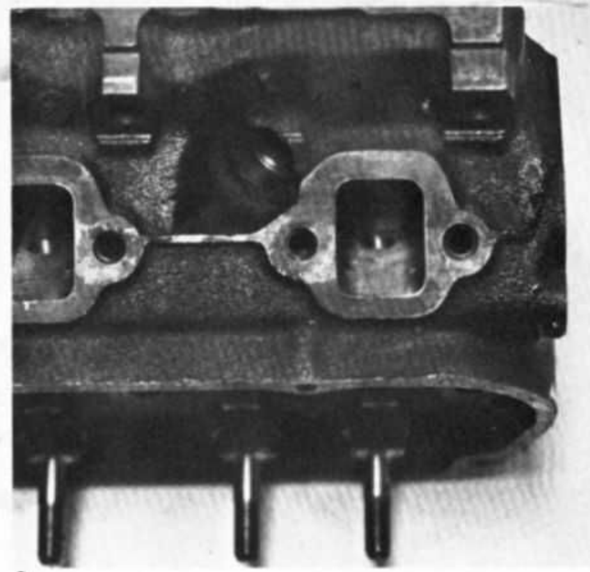

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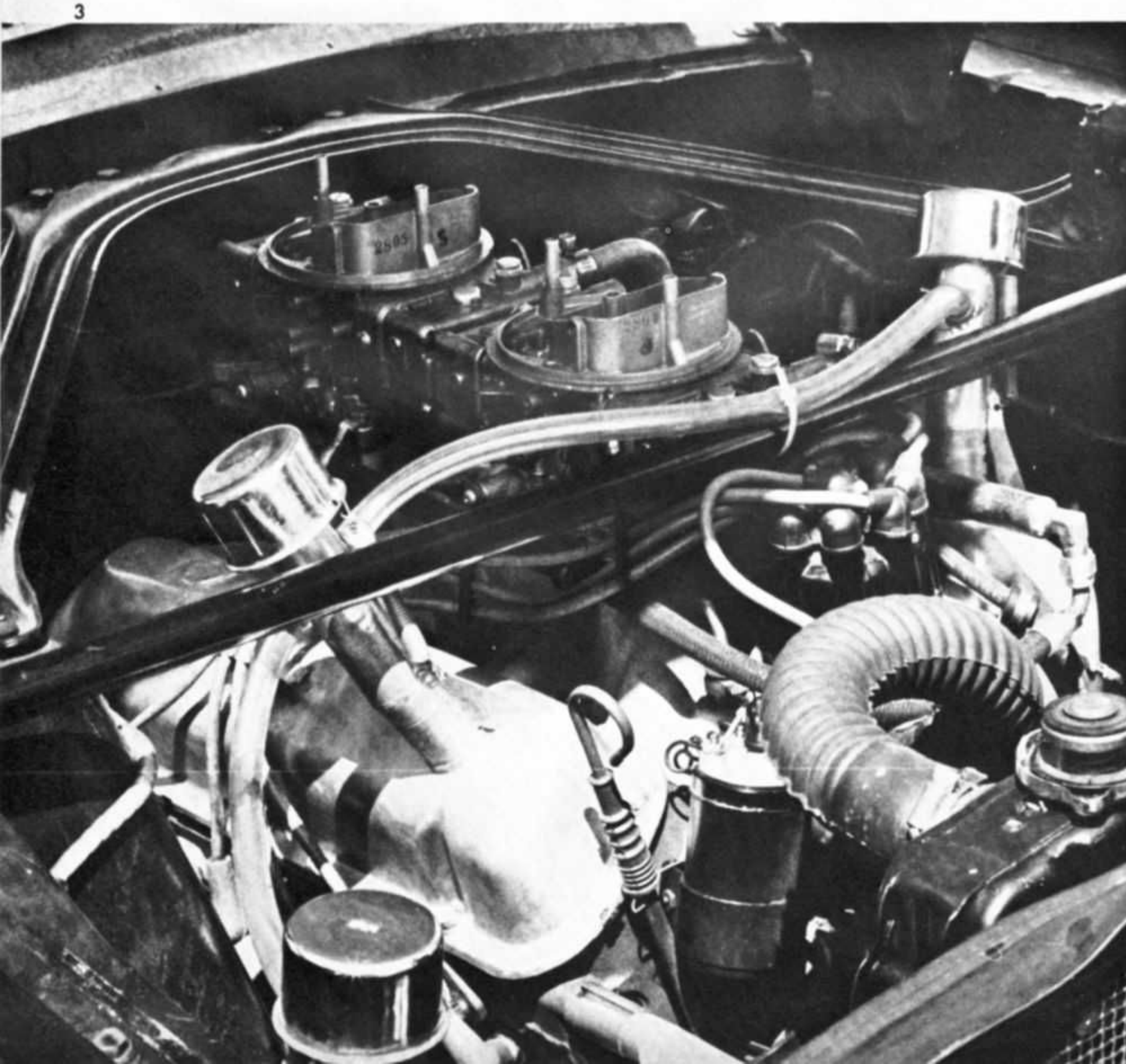

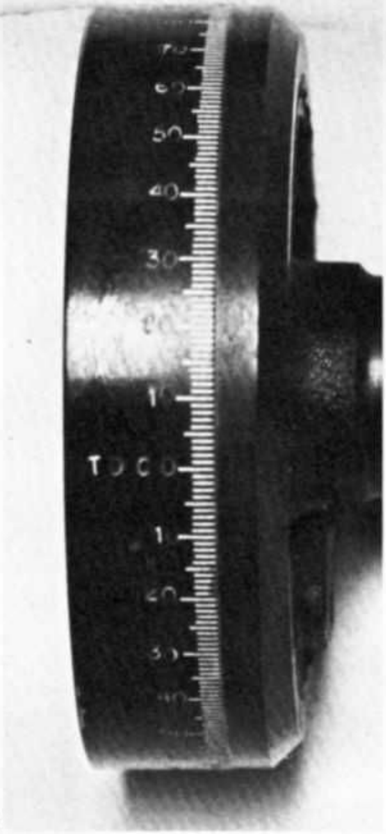

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TORQUING SPECIFICATIONS

Operation	Thread Size	Installation Torque
Bolt — Rocker arm cover to cylinder head	1/4-20	3-5 ft.lbs.
Bolt — Oil pan		
Bolt — Pressure plate to flywheel	5/16-18	12-20 ft.lbs.
Bolt — Cam sprocket to camshaft	3/8-16	30-35 ft.lbs.
Nut — Rocker arm adjusting		
Bolt — Flywheel to crankshaft	7/16-20	78-85 ft.lbs.
Bolt — Main bearing cap	7/16-14	60-70 ft.lbs.
Plug — Oil pan drain	1/2-20	15-20 ft. lbs.
Bolt — Crankshaft damper to crankshaft (hand start — run down with impact wrench	5/8-18	120-140 ft.lbs.
Spark plug	18MM	12-25 ft.lbs.
Oil filter cartridge	Tighten ½ turn after gasket contact	
Insert — Oil filter mounting to block	1-1/16-12	60-100 ft.lbs.
Bolt — Exhaust manifold to cylinder head	3/8-16	13-18 ft.lbs.
Nut — Carburetor mounting	5/16-24	12-15 ft.lbs.
Bolt — Distributor hold down	5/16-18	12-15 ft.lbs.
Bolt — Generator mounting bracket to cyl. head	3/8-16	30-35 ft.lbs.
Bolt — Front cover	5/16-18	12-15 ft.lbs.
Bolt — Oil filler tube bracket to generator bracket (hand start run-down with impact wrench)	1/4-20	6-9 ft.lbs.
Nut — Connecting rod Hand torque 40-45 lbs.	3/8-24	40-45 ft.lbs. ref.

GENERAL TORQUING SPECIFICATIONS

Thread Size	Torque Ft.Lbs.	Thread Size	Torque Ft.Lbs.
1/4 - 20	7 - 9	7/16 - 14	45 - 50
1/4 - 28	6 - 9	7/16 - 20	50 - 60
1/4" Pipe	23 - 28		
5/16 - 18	12 - 15	1/2 - 13	60 - 70
5/16 - 24	15 - 18	1/2 - 20	70 - 80
3/8 - 16	23 - 28	9/16 - 18	85 - 95
3/8 - 24	30 - 35	5/8 - 18	120 - 145

1. Stock exhaust port in HP head is small and restricted with heavy flashing as in the anti-smog heads.

2. Photo shows how neatly the port can be cleaned up. This is a ported HP head. HD head has ports this size.

3. Here she is, all installed and ready to stomp the opposition. This one powered the Bebring Trans-American winner in a wire-to-wire run.

4. Degreed damper is an excellent idea and can help in timing in the field. This is an off-the-shelf item available from Shelby-American or Shelby dealers.

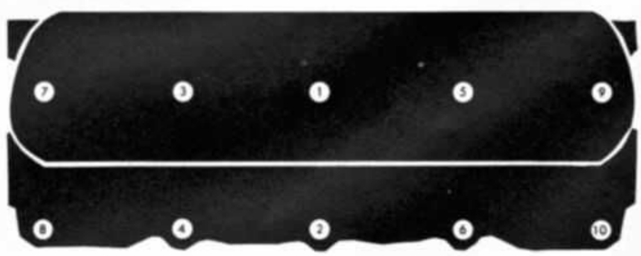
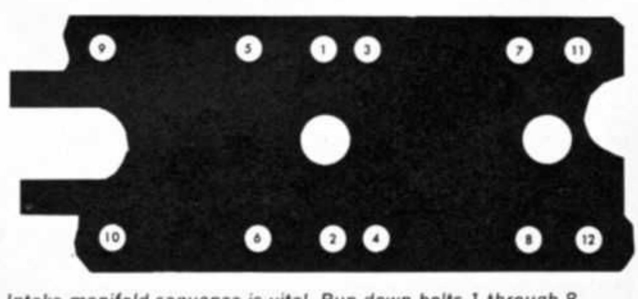


Diagram shows head torquing sequence should be done in three stages: first step—40-50 lbs.; second stage—50-60 lbs.; final stage—70 lbs. maximum. Use oiled threads.



Intake manifold sequence is vital. Run down bolts 1 through 8 to 11 lbs. first. Then torque 9 through 11 to 11-12 lbs. Follow by torquing 1 through 8 to 18 lbs., leaving corners at 12.

FORD'S SERIOUS WEDGE

by John Christy

Unlike the other big block engines in the Ford family, the 427 was developed with competition uppermost in mind but within the design parameters of the other production engines. This, of course, was for cost reasons; much of the machine work can be carried out on the regular lines and all of the external parts are absolutely standard or optional versions of standard items.

However, the 427 did not spring from the same tree as did the others. This one is a direct descendant of the 406, introduced in 1961. With a triple two-barrel intake manifold the 406 came over the counter with a rating of 405 bhp and was the most powerful engine ever offered by Ford up to that time. The NASCAR version which was limited to one quad carb was rated at 385 horses but in blueprinted form actually produced quite a bit more. The bore, at 4.13 inches, was the same as the current 428 and the stroke was the same 3.784 inches as the other current big block engines except the 428. These engines had steel cranks though not the reservoir type currently found in the 427. It would be easy enough to update a 406 with the new cranks and, of course, the late model 427 rods. The 406 did *not* have the crossbolted mains found in the current racing engines and for this reason represents an intermediate between the standard passenger car mills and the 427. It does have an oiling system similar to that of the 427 so that problem needn't crop up. As originally laid down the 406 built peak horsepower at 5800 rpm so obviously it was meant to turn up 6000 and with the late rods and crank could probably go higher safely.

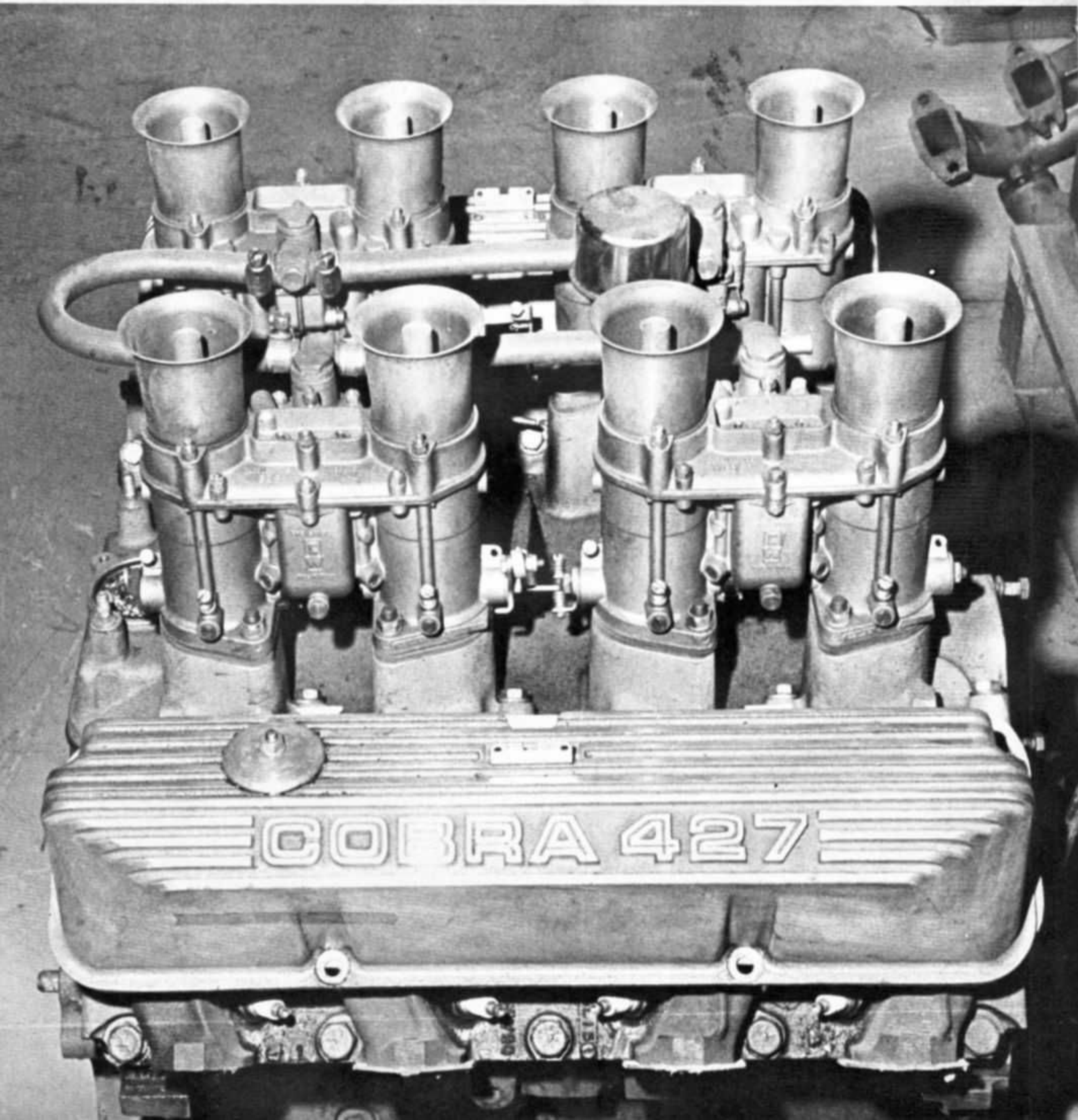
The 406 was superceded late in 1963 by the 427. This one was almost but not quite as we know it today, being the one mentioned earlier with the dimensionally larger heads. At the end of 1964 this equipment was discontinued and the Series 2 and 2A were brought into being. This one has machined combustion chambers as it comes from the factory and ports that beggar the word "huge." The reason we go into all this history is so that we have an idea of what bits we can work with and which ones were discontinued for good reason. Also of interest to the hot rodder but not easily obtainable without a certain amount of dickering is the lightweight 427. This one grew out of the Cobra development program and the Ford GT Mk II and IV. The heads and front cover and pump assemblies are of aluminum and considerably lighter. If weight is a consideration this equipment might help. There is one drawback, however. To make room for the necessary valve seat inserts the valves must be slightly smaller than those in the latest iron heads. Due to the port configurations these aluminum heads will flow equally with the factory version of the iron head but if reworking for blower use is the aim the iron head is probably the better bet of the two. On the plus side is the fact that the light valve will allow the engine to buzz 7000-plus while the others dictate a 6500 limit.

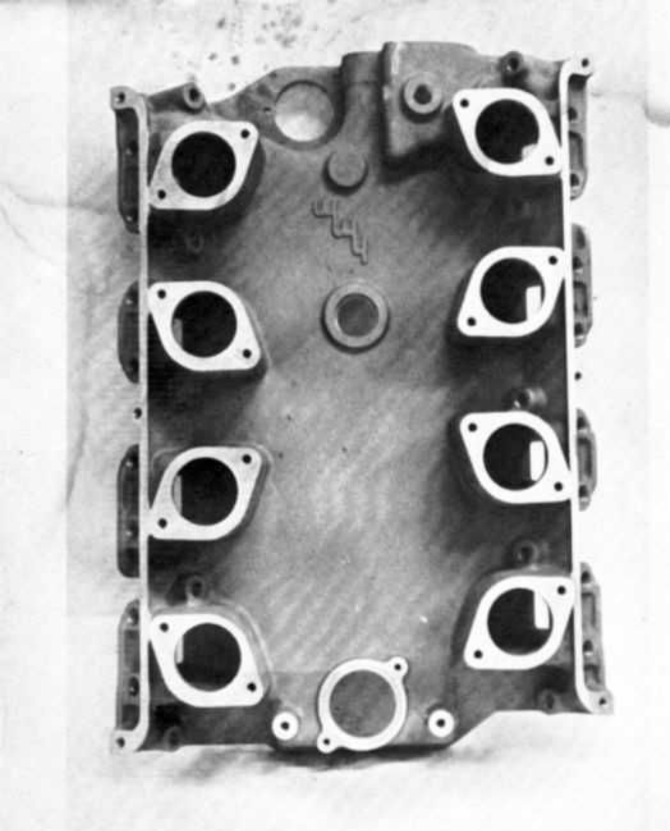
The most fascinating thing about the 427 is that virtually all the "trick stuff" is there in its over-the-counter form. This is not to say that more can't be done. It can, but a properly blueprinted and assembled 427 with nothing but factory parts can and has propelled a fully street equipped 3400-pound car across the Bonneville salt at better than 200 mph.

There are some people who feel that 427 inches isn't big enough. Unfortunately for these people, Ford engines do not take kindly to over-exhuberance with the boring bar. FoMoCo pioneered in the field of thinwall castings and the process is used throughout the line. The largest factory oversize piston is a mere .015 of an inch which is worth barely six cubic inches. Because of the oil reservoirs in the throws the limit to which the crank can be stroked is ⅜ or .375 of an inch. This will produce an arm of 4.159 inches. Thus with the largest safe overbore and the largest safe stroke the total displacement is just at 470 cubic inches. When this is done the center main should be counterweighted and the journals hard chromed. As previously mentioned, bearing clearances should run .0035 on the mains and .003 on the rods when the steel rods are used. On an engine that is to be buzzed, stroked or not, a neat trick was worked out by those running the SOHC Hemi 427 which uses the same crank. The crankpins are ground to Chrysler 392 hemi

Bonneville, Daytona, LeMans, Sebring. Funny? Ask the man who didn't own one.

PERFORMANCE





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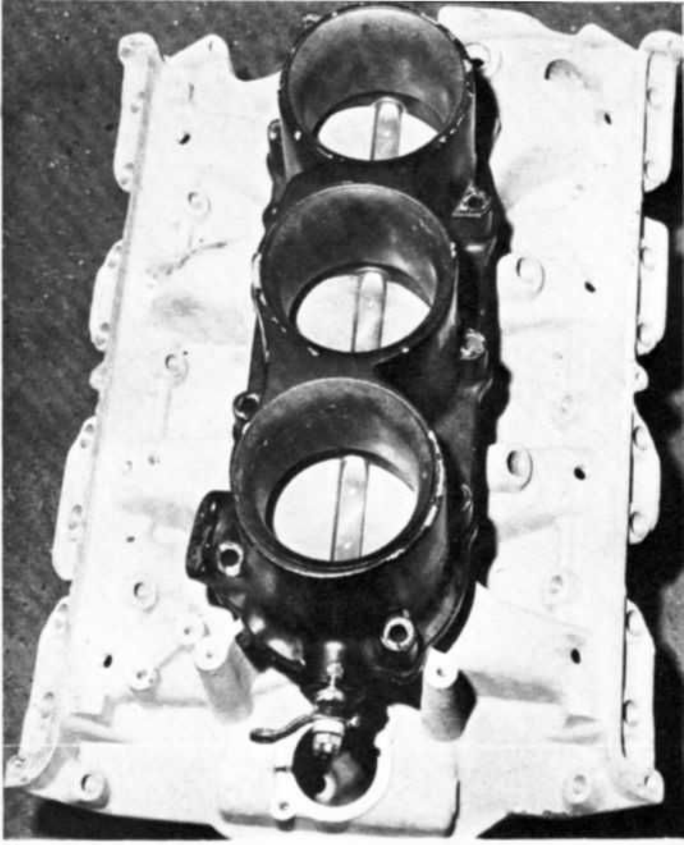

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specs which are just *that* much wider and *that* much smaller in diameter. This reduces the bearing surface speed and widens the load area. Of course it also means that custom rods must be used. Mickey Thompson, Ansen, the Crankshaft Co., Carrillo and others can supply these, the first in forged aluminum and the others in steel. When a stroker is used, two things must be done. Since the factory obviously felt that 427 inches was big enough, there is just enough clearance at the bottom of the cylinders for the rods and also in the area of the cam. With a long arm there isn't any, so notches have to be cut in the upper cylinder lip ¼-inch deep and ¾-inch wide. A cam with a smaller base circle is also necessary, information on which can be had from the crank grinder.

Just about any kind of camshaft has been used in this engine. Ford's hottest factory grind for this is C5AE-6250D which gives a .524-inch lift and 324 degrees duration. Another excellent cam is the Holman, Moody, Stroppe 310 flat tappet stick. All the better known commercial grinders have their own varieties or will grind to specification but it's best to stay away from the super-long duration grinds beloved of the blown fuel burners in other engines.

All kinds of ways of feeding the 427 are available. You can use the single or dual four-barrel high risers with the appropriate Holleys that Ford builds. In fact, Ford's choice of manifolds is so wide that not too many commercial manufacturers even bother. You have a single quad, low and medium rise, a triple dual (6-V) and the double quad or 8-V, all flanged for the 4150 and 4160 series of carburetors and all available over the Ford parts counter or, if you're lucky, from a wrecking yard. Holman-Moody has a manifold for the 48 IDA Webers that we did not recommend for the other big block engines but do for this one because this is the one for which it was designed. The prime use is for boats and other sustained high-rpm operation such as the banked ovals and Bonneville. Unless the carburetors are venturied down and/or equipped with long stacks it isn't too good for other types of operation, especially the street. As this is being written experiments are being made with Tecalemit-Jackson and Lucas injection both for the 427 and 428. These English injectors have a wider range than the American types or the Webers but so far they are strictly experimental in this particular instance and unavailable though they have been

1. Complicated-looking bunch of 48 IDA Webers on preceding page fits on this simple manifold (H-M Marine).

2. Experimental home-made injector using dual 4-V manifold; aircraft inlet venturis shows one possibility.

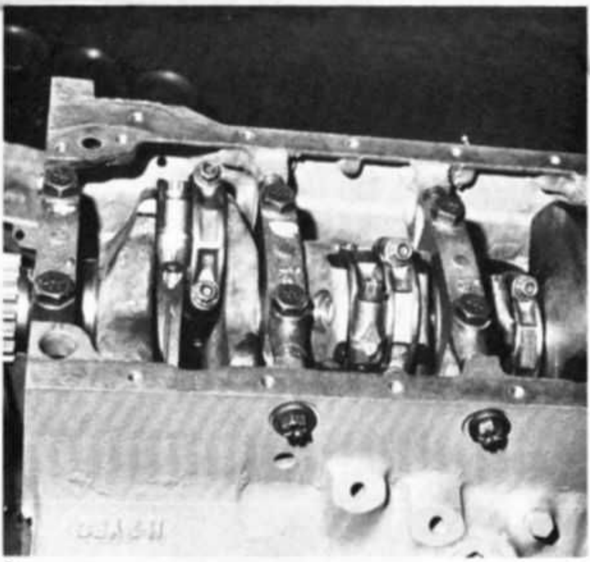
3. Easy external identification of 427 is by the three crossbolt heads.

4. Latest 427 rods use locator rings and 12-point bolts threaded into the heavy, rounded shoulders.

5. Larger bore, deflector pistons with valve reliefs are features of the box-stock 427 engine.

6. Another view of the meaty lower end showing the reservoir crank.

7. Compare ports and tappet valley of 427 with that of 428 in following section; note no gallery drilling.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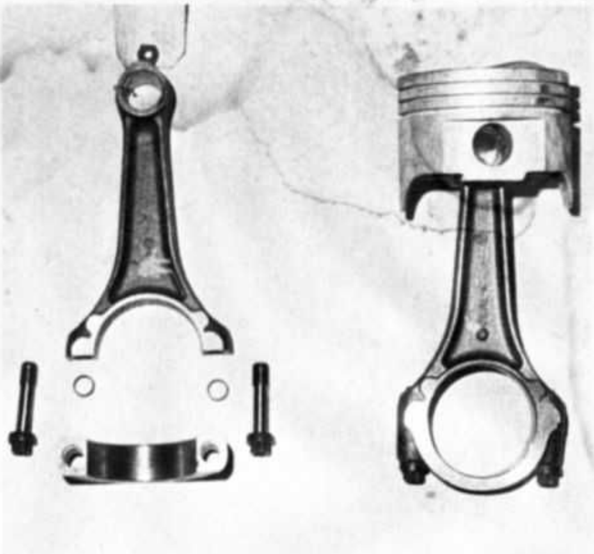
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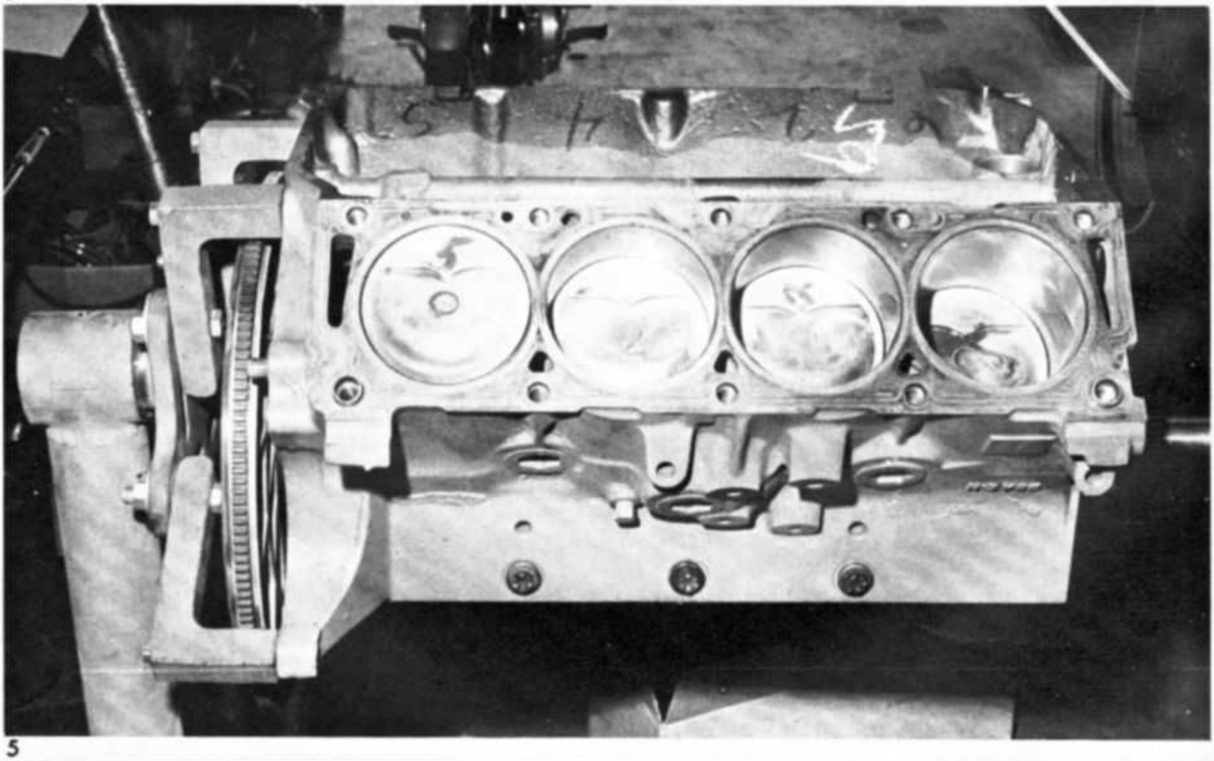
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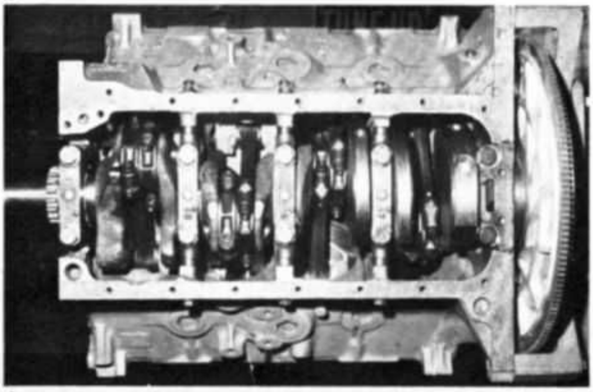
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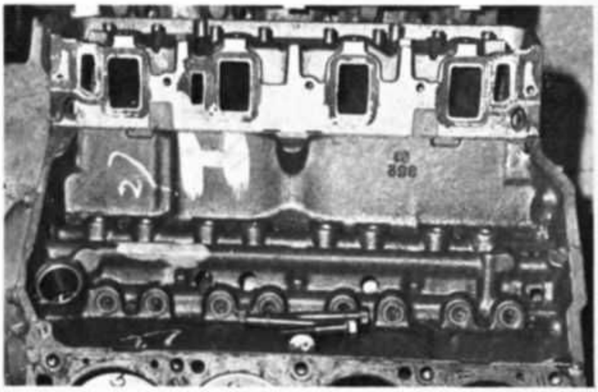
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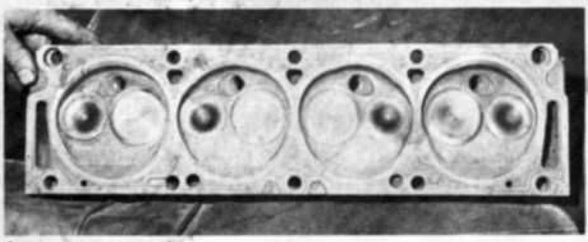

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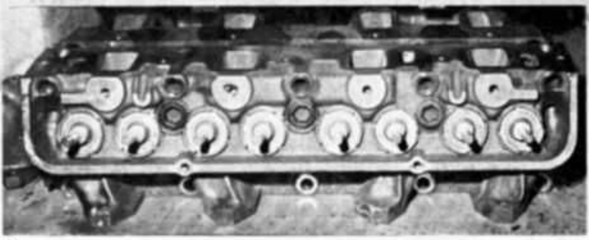

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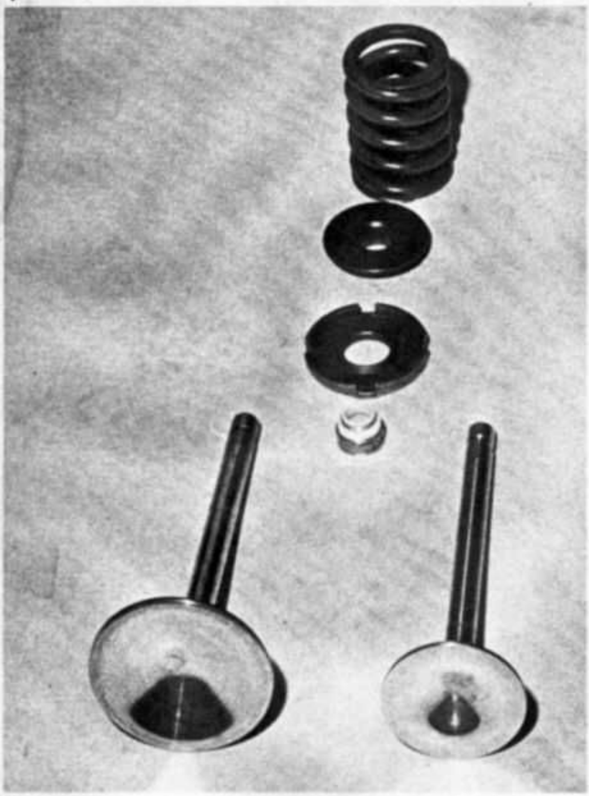

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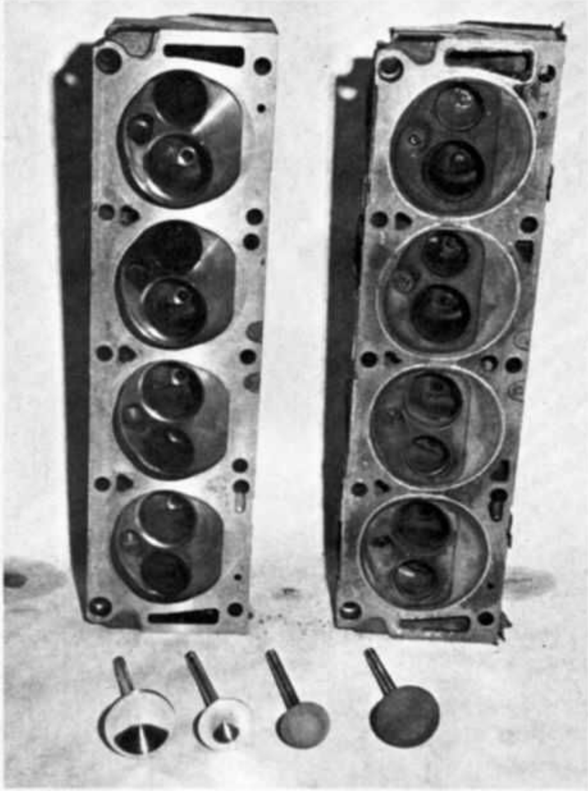

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widely used on other, smaller engines. A new dual quad intake manifold was seen on the GT Mark IV (ex J-car) at Sebring that is different from the regular variety. A manifold similar to the 289 dual quad competition unit was tried and it didn't work out for some reason. Apparently what's good for a small goose isn't necessarily good for a great big gander so they developed a different method. This one dumps fuel from a pair of Holleys that looked to be at least of 750 cfm rating or higher into open plenums in the manifold from which branches lead to individual ports. This is still an experimental item also but it shows that a certain amount of carving and a bigger shot of air/fuel mixture than is standard might be helpful. Not only is this manifold experimental but it has *round* ports and obviously needs a head with matching round ports. So, even if it does become available don't expect to drop it on your present engine – like the '64 high riser, you'll need the heads (and probably pistons) to match. That car was running the gamut from 20 to 200 mph every three minutes for 12 hours which ought to be some indication of the potential.

The ultimate in feeding the 427, of course, is the blower route. Cragar makes the blower manifold that most kit manufacturers use. We won't go into the permutations of the injector set ups for blower use but suffice to say that Enderle, Hilborn and Crower injectors have all proved out well as has Holman-Moody's water-cooled supercharger, both with straight blower injection and with a combination of blower and port injectors. In all cases it is best to get the advice of the injector manufacturer for any particular application. The main point is that this engine will take the pressure. It won't breathe like a hemi for all-out dragging but for most other applications it is a power to be reckoned with. If you don't believe us, ask the man who doesn't own one.

1. Stock 427 heads feature Teflon stem seals and steel spring seats.

2. Tuliped, lightweight valves and fully machined combustion chambers are part of the original package.

3. Disassembled view of the valve group shows, from top, spring, spring retainer, seat, seal and valves.

4. Comparison between the 427 head, left, and 428 head shows the difference in combustion chambers and valve sizes, especially exhaust valve.

427 COBRA II ENGINE
LIGHTWEIGHT RACING CONFIGURATION

SPECIFICATIONS:

General Engine

Piston displacement	427 cu. in. (7000 cc)
Compression ratio (normal)	10.4:1
Brake horsepower	485 @ 6500 RPM
Torque—ft. lbs.	480 @ 3500 RPM
Bore and Stroke—in.	4.234 x 3.78
Initial ignition timing	6° BTDC
Oil pressure—hot @ 2000 RPM	35—65 PSI

Cylinder Head

Material	Aluminum alloy
Intake valve head dia.	2.090 in.
Exhaust valve head dia.	1.650 in.
Combustion chamber volume	85—88 cc

Valve Mechanism

Valve clearance—int. & exh.	.025 in. hot
Valve spring set height	1.80—1.82 in.
Valve spring pressure	255—280 lbs. @ 1.32 in.

Carburetion

Carburetor type	Holley 780 CFM 4V
Primary main jets	No. 85
Secondary main jets	No. 85
Secondary linkage	Manual, positive return

TORQUE LIMITS — FT. — LBS. (OILED THREADS)

Bolt, oil pan	10-12
Bolt, rocker cover	4-7
Bolt, pressure plate	15-20
Bolt, distributor hold-down	5-8
Bolt-cross, main bearing cap	38-42
Bolt, intake manifold	22-25
Bolt, exhaust headers	20-23
Bolt, connecting rod	58-60
Bolt, cam sprocket to cam	35-45
Bolt, cam thrust plate to block	12-15
Screw, rocker arm adjusting	7-15
Bolt, flywheel to crankshaft	75-85
Bolt, main bearing cap	95-105
Plug, oil pan drain	15-20
Bolt, damper to crankshaft	70-90
Bolt, rocker shaft hold-down	45-50
Plug, spark (dry threads)	15-25

Connecting Rods:

Connecting rod vertical clearance	.0015-.002 (.0018 desired)
Rod side clearance (2 rods)	.014-.024
Refer also to main bearing color chart.	
Bearing bore	Red, Blue
Crankpins	Red 2.4384-2.4388, Blue 2.4380-2.4384

Valves:

Valve seat runout	.0015 T.I.R.
Valve seat width	.09-.07 exhaust, .08-.06 intake
Valve spring set height	1.80-1.82
Valve load	80-90 lb. @ 1.82 in., 255-280 lb. @ 1.32 in.

Camshaft:

End play	.006-.008
Inside diameter (with bearings)	2.1258-2.1268
Taper (bearing)	.0002 maximum
Taper (journal)	.0002 maximum
Out of round (journal)	.0006 maximum
Clearance	.001-.003

Distributor:

Gear backlash	.002-.007
Shaft end play (assembled) in engine	.004-.020

Carburetor: (Holley 780 CFM)

Jets (nominal)	secondary .101—(#85), primary .089—(#78)
Main bearings — All	.0015-.002
Taper, main bearing bores with inserts	.0018 maximum
Crankshaft end play	.004-.008
Piston to bore clearance	.015-.030
Bore diameter	4.2328-4.2364
Taper, top to bottom	.001 maximum
Out of round	.001 maximum
Wrist pin diameter	.9750-.9757
Piston Pin bore diameter	.9754-.9757
Wrist pin clearance	.0005-.0007
Piston to deck clearance	.015-.030
Run out of flywheel at clutch periphery after assembly to crankshaft	.010 (max.) total indicator reading
Pilot bearing in crankshaft	.0005-.0027 (tight)
Starter ring gear, lateral runout after assembly	.030 (max.) total indicator reading

The following figures may help in compression ratio calculations. Piston to deck height is to be measured two (2) places on the piston: .100 in from cylinder bore edge front and back (parallel to the crankshaft centerline).

Deck Height	Volume to Subtract
.010 in.	7.10 cc's
.015 in.	6.00 cc's
.020 in.	4.90 cc's
.025 in.	3.80 cc's
.030 in.	2.70 cc's
.035 in.	1.60 cc's
.040 in.	0.50 cc's

Combustion chamber volume with valves and spark plug in place is:

66 — 76.3 (14:1 max.)
72.1 — 76.3 (13:1 max.)

Combustion chamber volume in calculated by the following formula:

Head Volume — (Dome-Deck) + Gasket = Total Volume

"Dome-Deck" noted above (volume to subtract)

Head:

Flatness overall at centerline in any 6 inches .006 T.I.R., .003 T.I.R.

Torque —
- 1st step — torque to 30-40 ft.-lb.
- 2nd step — torque to 50-60 ft.-lb.
- 3rd step —torque to 70-80 ft.-lb.
- 4th step — torque to 95-100 ft.-lb.

Nut — Connecting Rod .... 58 ft—lbs. 85 ft—lbs and 100 ft—lbs max.

TUNING FOR 427 DRAG STOCK CAR

427 — 8V LOW PROFILE

Series 1 Non-Machined Combustion Chambers and Bumper Pistons

Head volume — recommended	63.87 cc
— legal minimum	61.46 cc
Block deck clearance — recommended	.015"
— legal minimum	.010"

Distributor — maximum safe full advance — 38°. If preignition or detonation prevails, retard lead as necessary.

Install intake manifold gaskets with blocked heat risers. Part No. C3AZ-9441-B

Series 1A Non-Machined Combustion Chambers and Pop-Up Pistons

Head valume — recommended 73.31 cc, legal minimum 66.00 cc
Block deck clearance — recommended .015", legal minimum .010"
Distributor — maximum safe full advance — 34°. If preignition or detonation prevails, retard lead as necessary.

Carburetors and Fuel System

600 cfm Holleys
62 main metering jets
.070" secondary jets
.038" top bleed holes in secondary plates
.021" pump discharge nozzles
Stock .039" power valve passage
Adjust accelerator pump diaphragm to allow maximum displacement
Slightly preload accelerator pump arm
Install 1-½" bowl vent tubes
Back off automatic chokes
Try removing accelerator pump arm on rear carburetor
Install electric fuel pump at tank to obtain 5½ — 6 psi at fuel filter
Install truck flex line between steel fuel line and fuel pump
Cut one end off and slip over and clamp to the steel line
Part No. C1TZ—8493—F

427 — 8V HI-RISER

Series 2 Machined Combustion Chambers and Pop-Up Pistons

Head volume — recommended	73.31 cc
— legal minimum	66.00 cc
Block deck clearance — recommended	.015"
— legal minimum	.010"

Distributor — maximum safe full advance — 38°. If preignition or detonation prevails, retard lead as necessary.

Carburetors and Fuel Systems

715 cfm Holleys
77 main metering jets
71 secondary jets
Block primary and secondary power valves
Seal primary and secondary bowl vents
Install .021" pump discharge nozzles
Adjust accelerator pump diaphragm to allow maximum displacement
Slightly preload accelerator pump arm
Install 1½" Bowl vent tubes
Back off automatic chokcs
Try removing accelerator pump arm on rear carburetor
Install electric fuel pump at tank to obtain 5½-6 psi at fuel filter
Install truck flex line between steel fuel line and fuel pump
Cut one end off and slip over and clasp to the steel line
Part No. C1TZ—8493—F

427 — 8V MEDIUM RISER

Series 2A Machined Combustion Chambers and Pop-Up Pistons

Head volume — recommended	73.31 cc
— legal minimum	66.00 cc
Block deck clearance — recommended	.015"
— legal minimum	.010"

Distributor — maximum safe full advance — 38°. If preignition or detonation prevails, retard lead as necessary.

Carburetors and Fuel Systems

715 cfm Holleys
77 main metering jets
71 secondary jets
Install electric fuel pump and set for 5½ — 6 psi at fuel filter

Camshaft

Intake opens	40° B.T.D.C.	Exhaust opens	72° B.B.D.C.
Intake closes	72° A.B.D.C.	Exhaust closes	40° A.T.D.C.

.500 — lift at valve
.025 — valve lash, both intake and exhaust
Valves — light weight, 7000 r.p.m. — intake and exhaust
Lifter and Push Rods — special light weight
Crankshaft — heavy duty steel
Rods — heavy duty with special rod bolts
Block — oil galley relocated to left side

ALL ENGINES

Critical Dimensions

Piston skirt clearance	.007"
Rod bearing clearance	.0025"
Main bearing clearance	.0025"
Rod end clearance	.025"
Wrist pin clearance	.0007"
Valve spring height closed	1.820" ± .010"
Valve spring pressure closed	90 lbs. @ 1.82"
Valve spring pressure open	280 lbs. @ 1.82"
Valve seat and face angle — intake	30°
— exhaust	45°
Valve seat with — intake	.035" at outer edge of valve (drap strip racing only — .070" for street use)
— exhaust	.050" at outer edge of valve (drag strip racing only — .080" for street use)

Hand hone cylinder wall approximately five minutes per cylinder with 150-180 grit stone
Install viscous drive fan, No. C3AZ-9441-B
Install light weight fabricated headers
Install BF—32, BF—22, BTFI, or BF—601 spark plugs depending upon heat range required. Gap at .035"

Critical Bolt Torques

Bolt — Cylinder Head	100 ft—lbs. (Tighten in following steps:)
Bolt — Intake Manifold	28 ft—lbs. 30 ft—lbs. 50 ft—lbs. 70 ft—lbs
Nut — Connecting Rod	58 ft—lbs. 85 ft—lbs and 100 ft—lbs max. 65 ft—lbs. On series 2A
Cross Bolt — Main Bearing Cap	42 ft—lbs. Refer to shop manual for cylinder head and cross bolt
Vertical Bolt — Main Bearing Cap	105 ft—lbs. torque sequences.
Bolt — Rocker Shaft Hold Down	50 ft—lbs.

Balance

Critical Static Weights
- Piston — 658 gms
- Connecting Rod — 762 gms (pin end — 235 gms, crank end — 527 gms)
- Weight of oil in crankshaft end — 4 gms

Series 2A engine
- Connecting Rod — 795 to 806 gms (pin end — 243 to 249 gms. crank end — 552 to 557 gms)
- Weight of oil in crankshaft end — 4 gms

Have dynamic balancing performed.

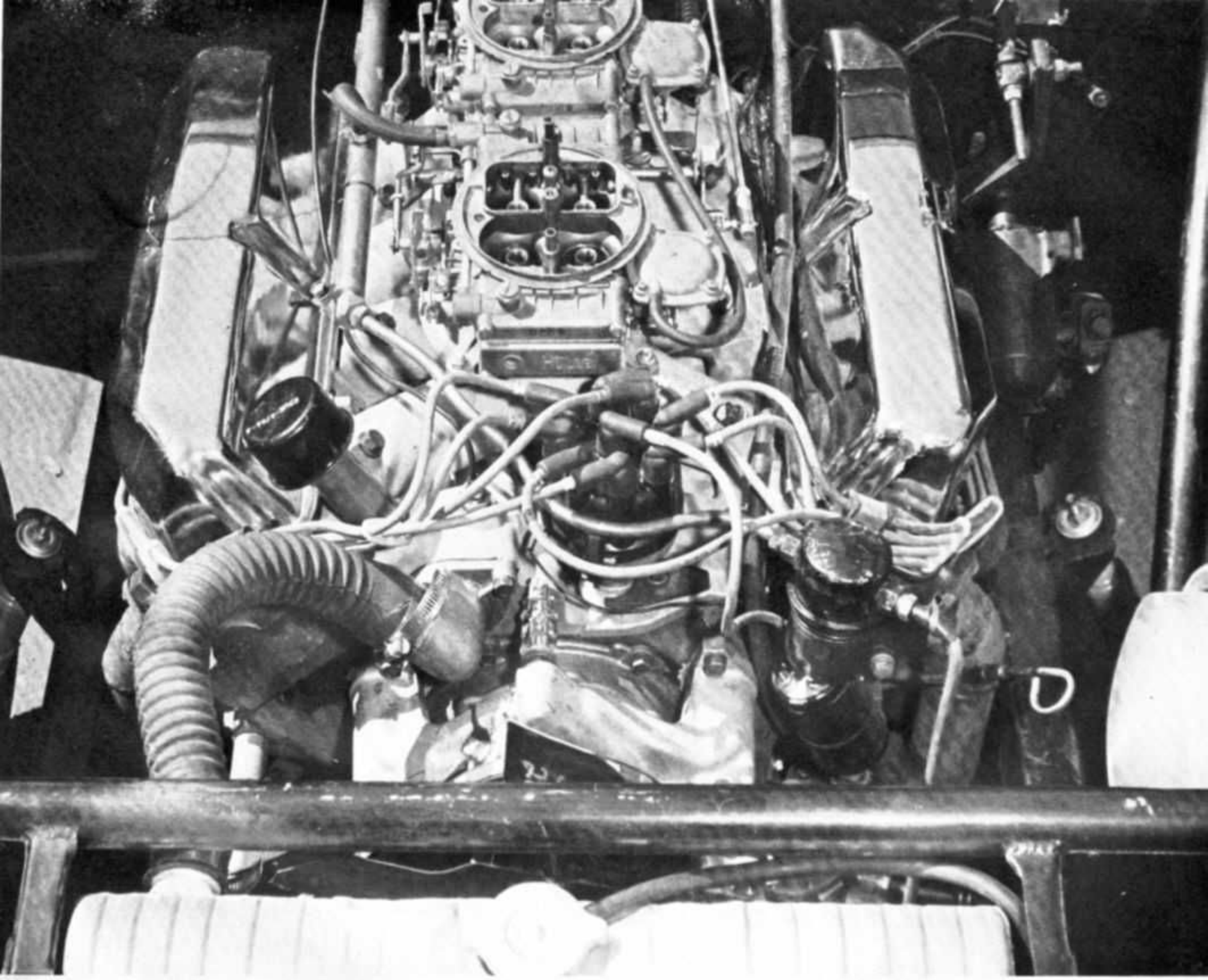
Distributor Curve

Dist. R.P.M.	250	750	800	1125	2000
Dist. Degrees	0°	0°	2½°	5°	9°

Rear Axle

Select proper gear and tires to obtain 6500 engine r.p.m. at last timing light for Series 1, 1A, and 2; 7000 r.p.m. for 2A.

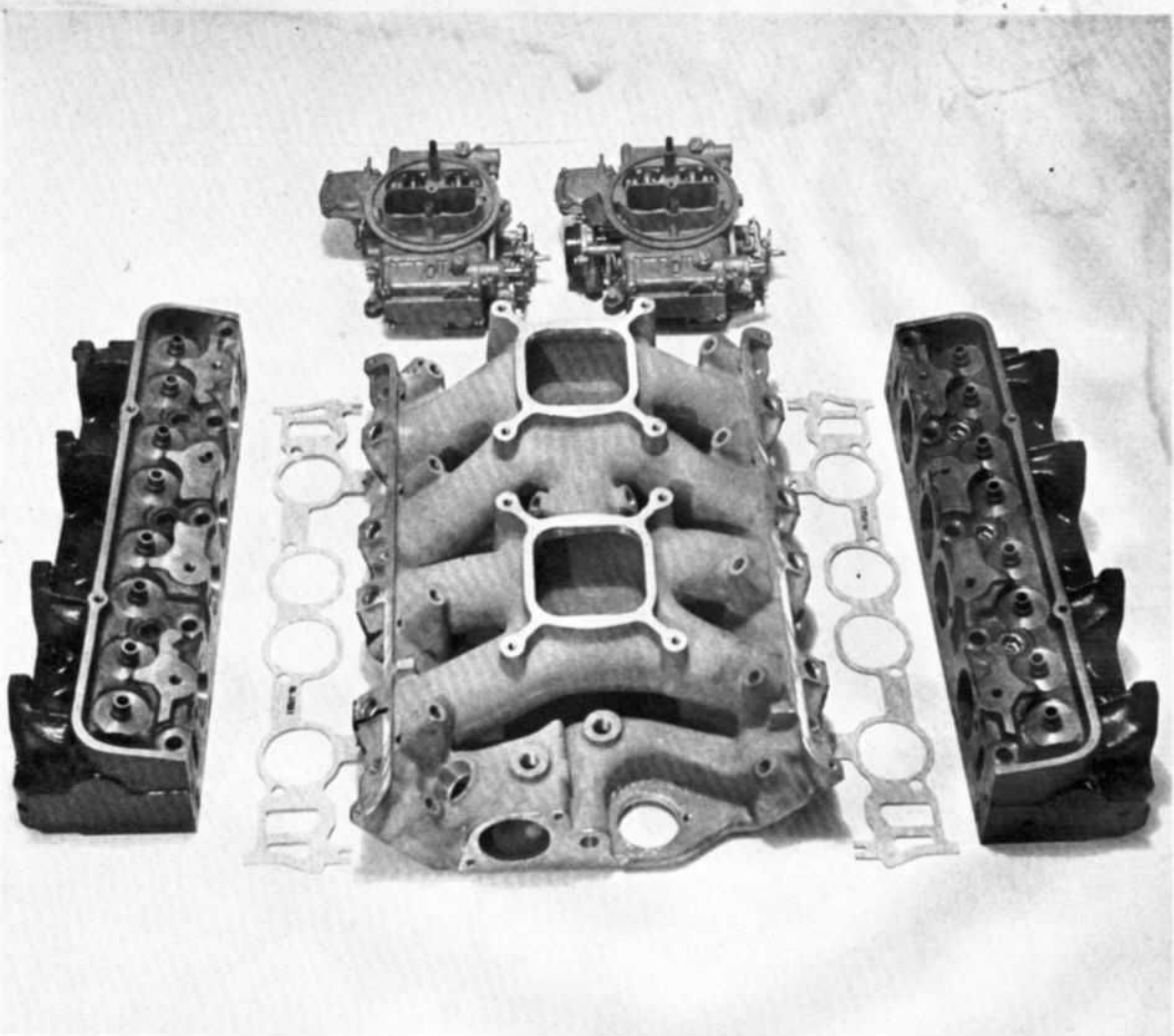
Use Detroit Automotive Products limited slip differential and Ford high performance differential lube — Service No. C2AZ—19580—D Ford Part No. M2C57—A). The proper lube comes in one-gallon cans.



Above, the 427 tunnel port engine looks fairly standard at first glance. Closer inspection reveals the separate runners and completely different manifold pattern that tells you something is different. It created more than a mild stir at Daytona but it is an available option and therefore legal for NASCAR stock car racing.

Mentioned earlier was the new hot setup in heads and manifolds for the 427 as used in the GT Mark IV at Sebring and in the stocker driven by Mairo Andretti at the Daytona 500. Officially known as the 427 CID V8 tunnel port assembly, this head and manifold group is now available either as part of a complete engine (Part Number C70E-6007-T-361-A) or as a kit to bolt on existing engines. Suggested list price of the complete engine is the kit parts are in the accompying $1,564.36 part numbers and prices for table. An interesting point is that while the plenum chamber type of manifold was used at Sebring and in the stocker at Daytona, a more conventional double-runner design was used at LeMans. According to sources close to Ford, the plenum type of manifold was fine at the top end but lacked the range and versatility of the double runner.

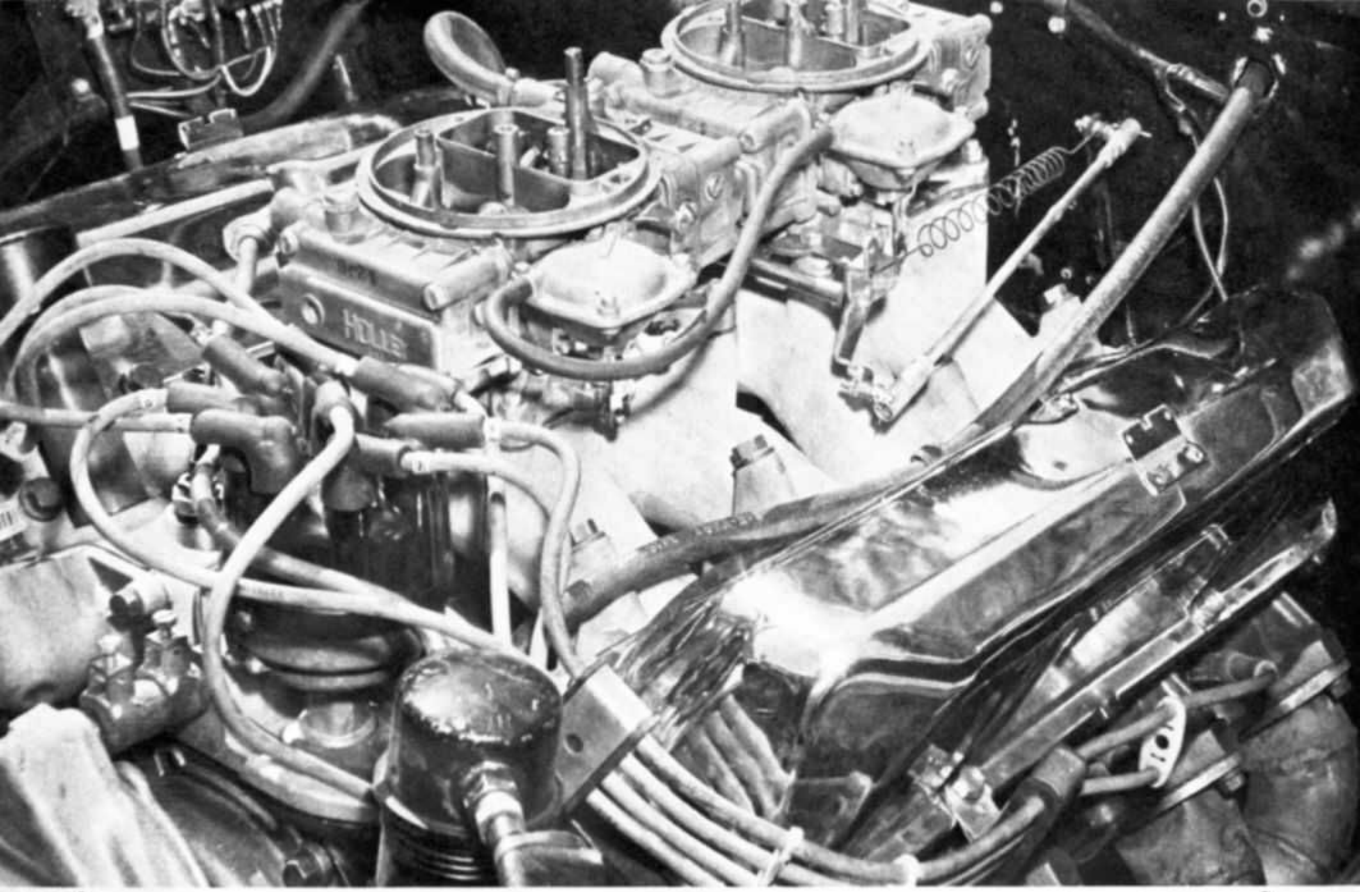
The chief advantage of the system is that it eliminates the tortuous twisting of the intake ports to avoid the pushrods. The ports in the head go straight into the chambers rather than taking a bend as in the regular midriser heads. To accomplish this, as can be seen in the photos, tubes are cast into the manifold runners to accommodate the pushrods, the area and shape of the ports and their straightness being sufficient to more than offset any turbulance they might create. Recommended carburetion with the tunnel port kit is a pair of progressive Holley 652 CFM four-throat carburetors, although it could be that a slightly larger size could be user for dragging, Bonneville or other sustained total high-rpm use. Percentage gains claimed are modest, the results are anything but.



Here are the major (but not all) parts of the tunnel port kit. An idea of the port area can be gathered from the gaskets. At LeMans a different manifold with 180-degree routing gave a broader range with more area under the power curve. The result was greater flexibility but with some sacrifice in terms of peak horsepower. This one is good for drags, Bonneville.

TUNNEL PORT KIT

Description	Part Number	Suggested Retail
RPO Engine Assembly	C70E-6007-T-361-A	$1564.36
Cylinder Head Assembly	C70E-6049-K	251.98
Intake Manifold Assembly	C70E-9424-A	152.12
Intake Manifold Cover	C70E-9C483-A	8.86
Gasket-Intake Manifold Cover	C70E-9C484-A	.71
Gasket-Intake Manifold	C70E-9439-E	.83
Bolt-Intake Manifold Mtg. 3/8-16 x 4.00 (8 required)	56152-S	.20
Bolt-Intake Manifold Mtg. 3/8-16 x 2.75 (2 required)	56147-S	.20
Bolt-Intake Manifold Mtg. 3/8-16 x 2.25 (2 required)	56145-S	.20
Bolt-Manifold Cover (14 required)	MS-24678-10	.60
Complete Component Kit		$678.11



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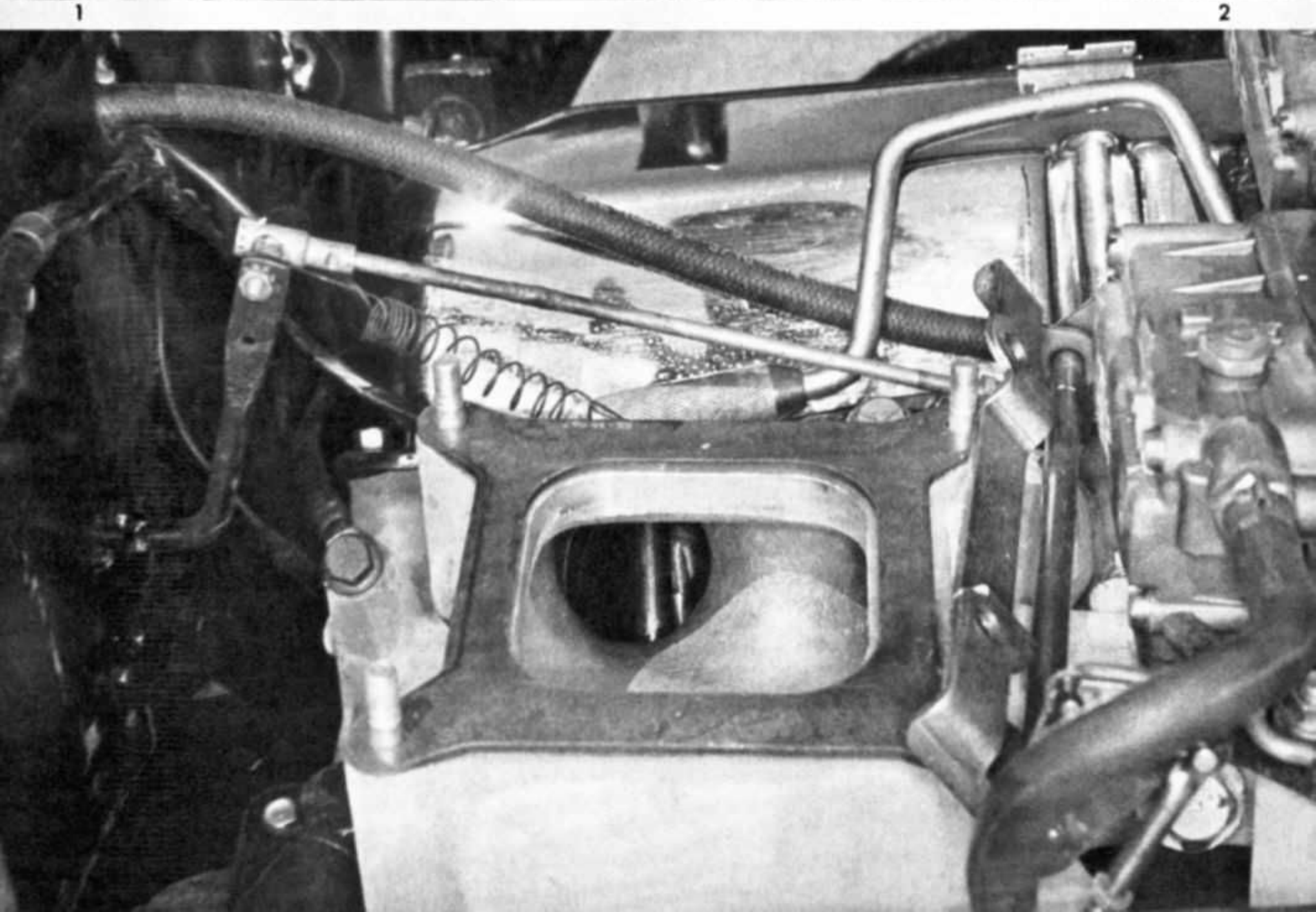

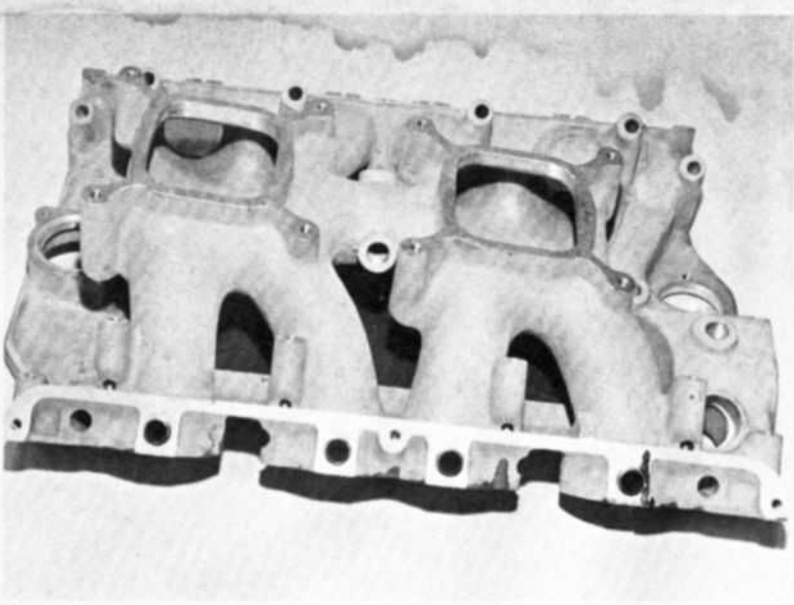

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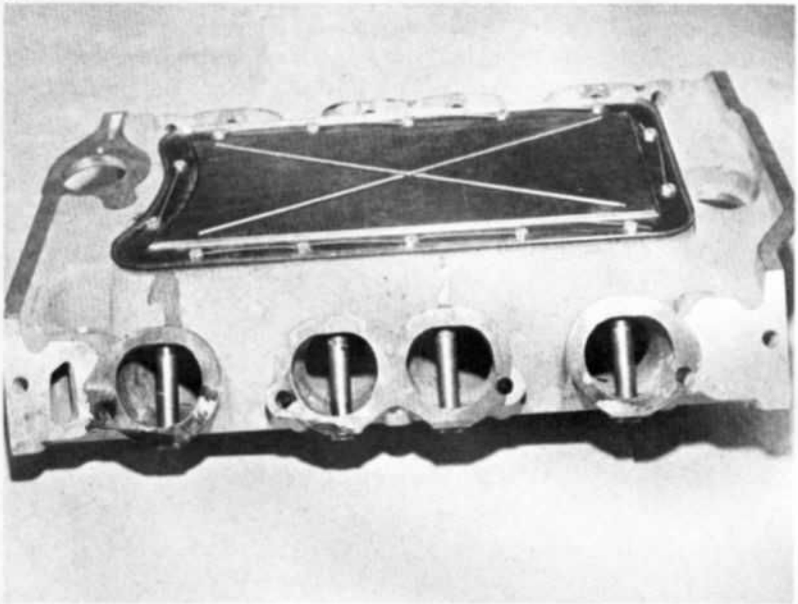

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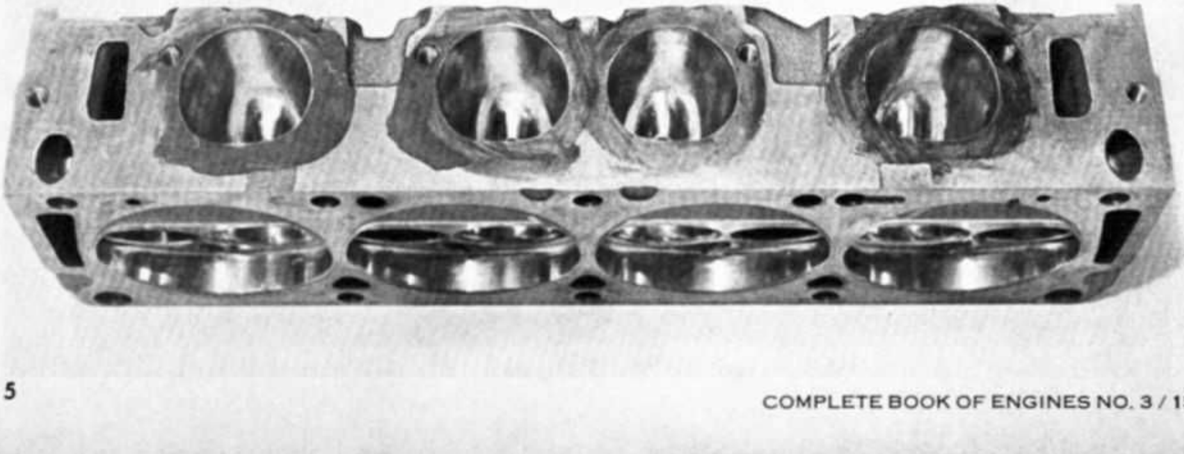
1. Another view of the complete assembled package shows better how the tunnel port engine differs from the standard square port layout.

2. View through the rear plenum gives a clue to the direct porting. Obstruction is pushrod tube.

3. Bare manifold shows the wide open plenum chambers and balance runner.

4. Pushrod tubes running through the manifold ports do not disrupt the airflow to any extent, may even help.

5. Major porting is unnecessary; only a polishing job to remove any burrs should be done. This one is almost too slick. Heads are already factory air-flowed.



5

INTERCHANGEABILITY PLUS!

by John Christy

Though most definitely NOT designed as racing engines, the 352, 390, and 428 (7-liter) engines can be given an extra dose of horsepower. Much of the equipment designed for the 427 high-performance engine can also be used. However, if intake and exhaust equipment designed for the 427 is used, a pretty severe porting job must be done just to match up with the stock ports in these manifolds or headers; the 427 heads come stock with ports you can practically walk through. Another word that comes from bitter experience is that all modifications should be of the kind that produces power through higher torque rather than high-winding engine speeds. The reason for this is twofold. First, the oiling system is completely different in these blocks from the dual gallery system in the 427. These engines were designed specifically for hydraulic tappets and the passage to the rear main bearing is partially blocked to provide the needed pressure to the "soft" lifters. This is fine up to about 5500 rpm but any sustained running or repeated running over that figure can and has produced oil starvation, depriving the last two rods of lubrication. The inevitable result is that number eight rod will end up sticking out of the left rear of the block. Very messy and expensive.

This brings us to the second part. The rods used in these engines are not the same as those in the 427 even though the stroke is the same as that of the 390. They are of the older type with a narrow I-beam section and considerably less meat in the shoulder area. This means that for any serious heavy-duty work these rods are marginal at best. It's not so bad in the 352 and 390 but in the 428, if the interior is left stock, it is best to hold the revs below 5500 maximum and use a tall gear.

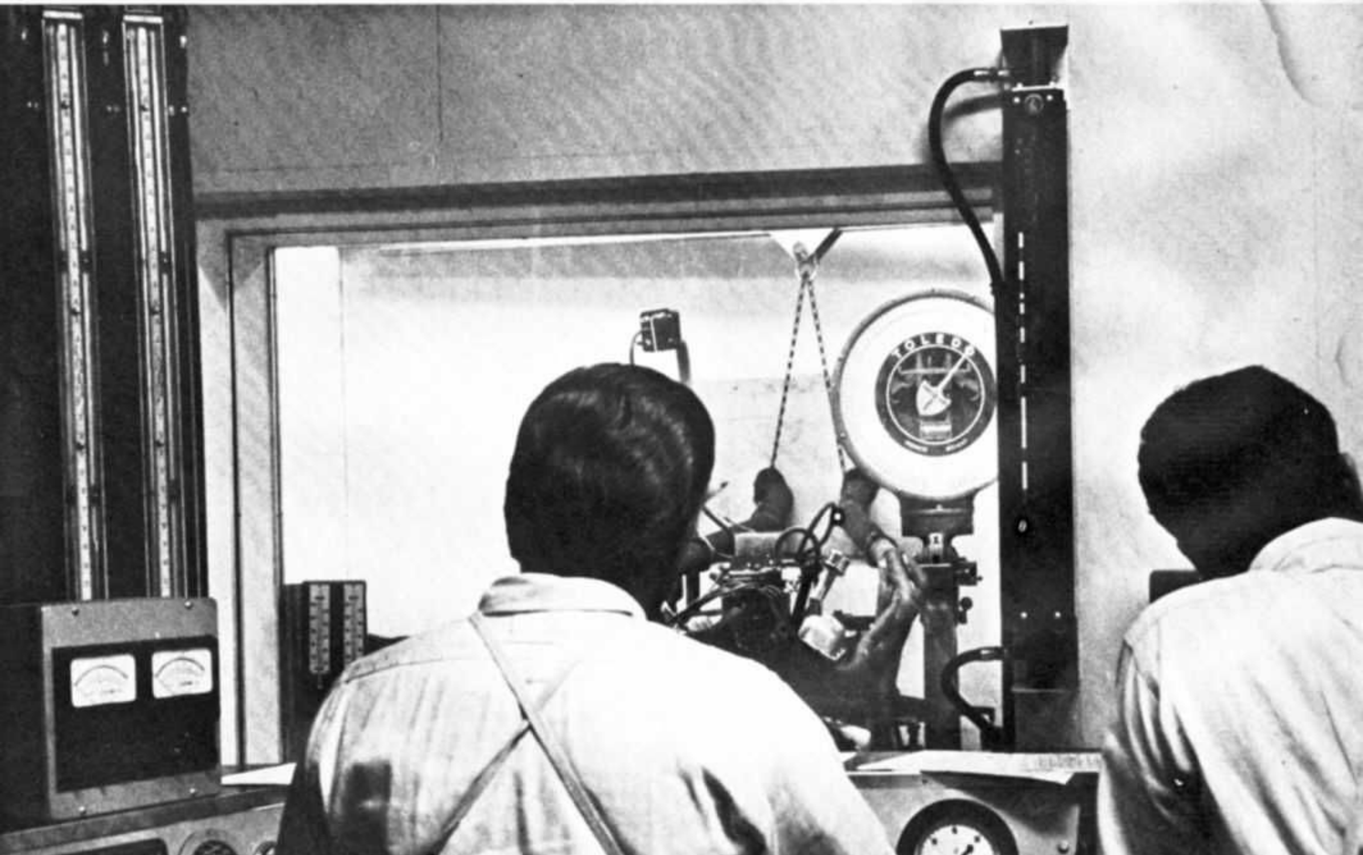
Now that we've handed you the bad news and turned you off, we'll give you the good part and turn you back on again. Perhaps the nicest thing about working with the Ford family of engines is the almost infinite interchangeability of parts. Virtually all of the heavy-duty parts listed for the nearly unbreakable 427 NASCAR-type wedge except the pistons will drop right into or onto all of the others, even the 332 engine that first appeared in 1958. The only thing you have to resign yourself to if you start mixing any reciprocating or rotating parts is a trip to the balancer's emporium or the freight bill to same if you're not within marching distance to one of these shops.

If you can possibly see your way to it, get the crank and rods for the 427. The crank is steel and has oil reservoirs in each rod throw and is a far stronger and more reliable unit than the nodular iron cranks used in the regular line. In any event, get a set of the 427 rods which are forged steel and far beefier in the shank, shoulder, and cap areas. They also have a much better rod-bolt design. Once the oil problem at the rear main is solved this crank and rod combination will let you have 6000 rpm or more without the fear of that rod sticking through the left rear of the block. If you stick with the nodular iron crank, by all means have the mains grooved and oil holes chamfered when you send or take the bits and pieces to the balancer, even for a strictly street machine. There's always that odd moment when the urge to stick your foot in it becomes intolerable and home can be a long way away when you have to walk.

This is as good a time as any to talk about the oil situation. The 427 was designed as a race engine and, as with the crank, the engineers took care to see that oil and lots of it goes through the block in as efficient a manner as possible. The other engines are direct descendants of the 332 block brought out in 1958 and are strictly passenger-car movers. There is one main oil gallery running down the center of the block and from this, passages run outward to the tappet galleries and down to the mains. These passages are partially blocked to provide full pressure to the tappets as we mentioned earlier. One method around this is to use solid lifters and remove the plugs in the passages, allowing full flow to the rear main. Another would be to drill small holes in these plugs, allowing some of the pressure to bleed off. This would be a matter of trial and error to allow just enough through without robbing the soft tappets of their needed pressure. One recommendation from Ak Miller, Ford's performance consultant, is that the oil pump used in the 428 be used in all the engines whatever their displacement. Don't try to use the 427 pump in anything but a 427 – it's entirely different.

Sorry, but we've got to do the Cassandra bit just one more time. Even with the oil problem solved and all this good stuff laid in the engine it's best

Sauce from the 427 pot makes hot soup for Ford's 352, 390, and 428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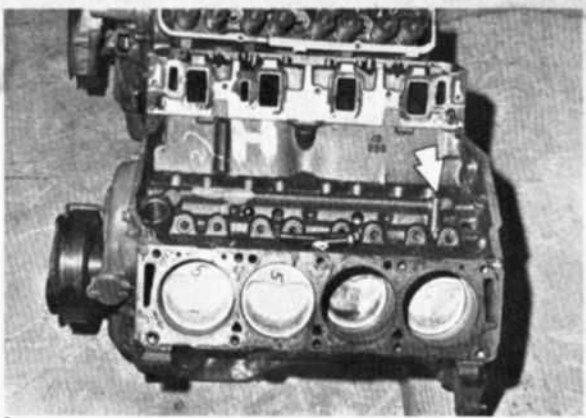

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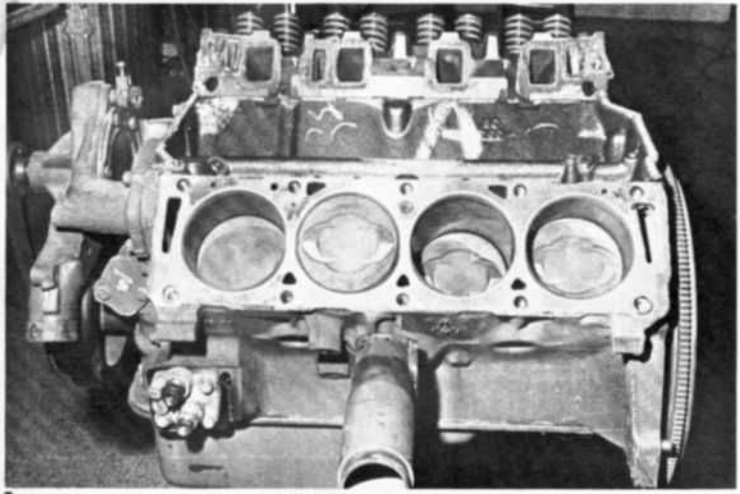

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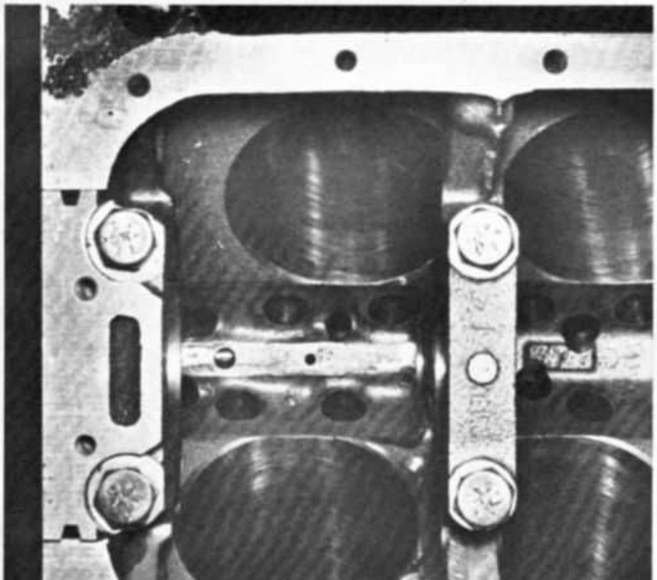

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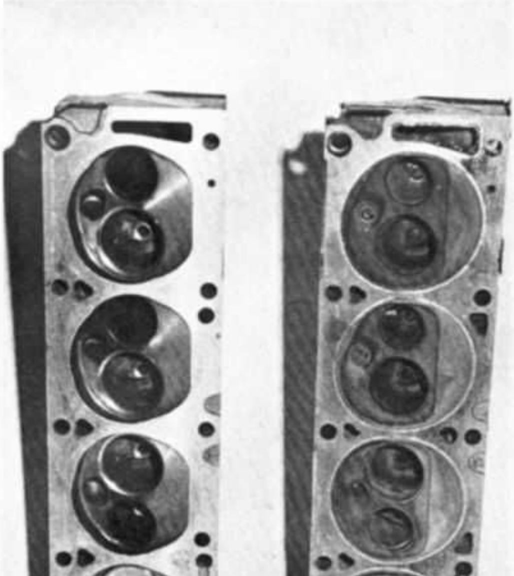

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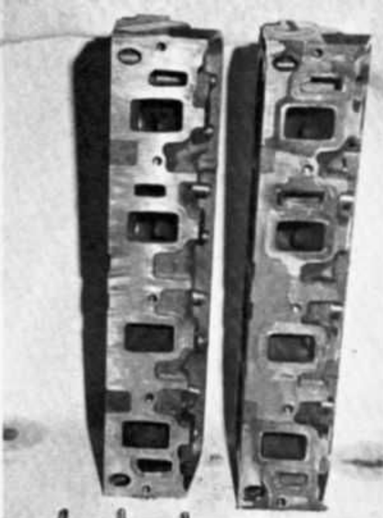

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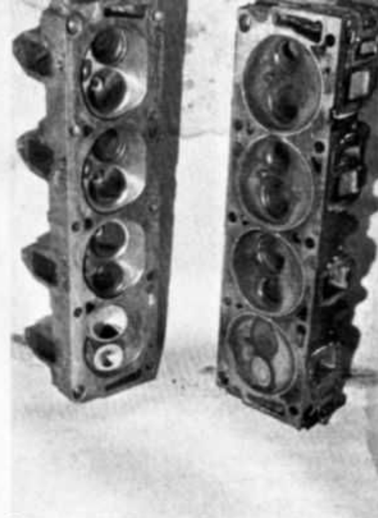

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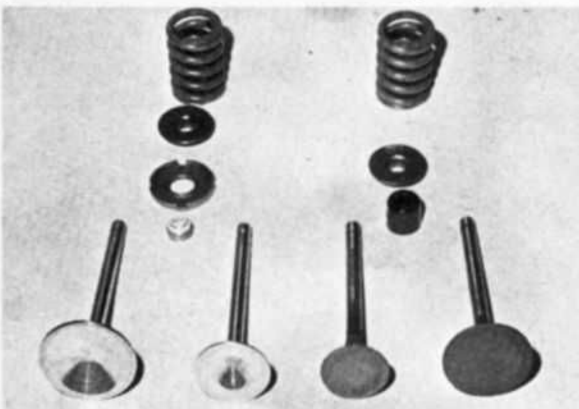

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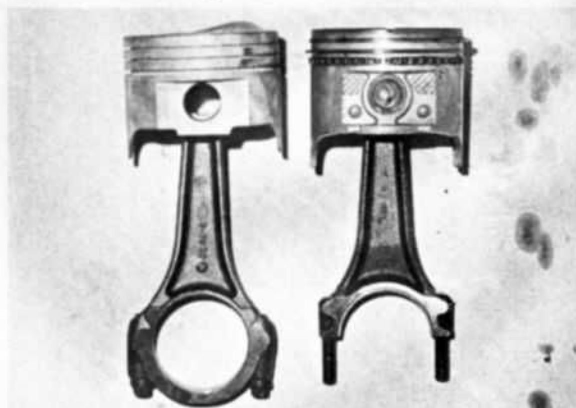


11

not to get too enthusiastic in R's department. When you're turning that crank it should be remembered that you're throwing a lot of heavy hardware around down there. All that's holding things in are gray iron main caps with two bolts apiece, not those neat nodular iron caps with all their crossbolts that you find in the 427 race engine. There were a few 390 police engines made several years ago that were fitted with crossbolted caps but they aren't common. If you find one, grab it quick – it's a rare and valuable item. Failing a lucky find such as this, steel main caps and a line-boring job will help, but by far the best way to hold things together if competition, part time or full time, is in the offing is by means of a steel bearing girdle. It is required on many strips for fuel and supercharged cars and an especially good idea for boats. These girdles, available from most speed shops and crank specialists, not only support the main caps but also strengthen the lower part of the block casting.

In preparing the lower end, proper clearancing is as important as balancing. The stock clearances are on the small side even on the 427 and must be opened up. If requested the balancer will micro-polish the journals and crankpins to whatever clearance you want. Normally, the crankpins will measure .0028 or less and the mains will run .0025 or less. The crankpins or rod journals should be brought to .0030 and the main journals to .0035. Equally important and unfortunately forgotten by many is the side clearance or end play of both rods and mains. The rods should have at least .018 to .025 inch, measured between each pair. The mains or crankshaft end play which can run stock anywhere from .004 to .008 inch should be brought to .010, measured at the center main which is the thrust bearing. All this should be done at the time of the balancing operation. The

1. Without the manifold the 428 and smaller engines are distinguishable by small ports, drilled gallery (arrow).

2. For comparison, here is the 427 with its big ports, solid lifters and undrilled center gallery (arrow).

3. The 390 and 428 pistons are notched for valve relief and dished in center. They are reversible, side for side.

4. Bottom end of the 428. Compare with the similar view of the 427 in the previous section.

5. Close-up of the main webs and caps on the 352, 390, 428 series shows the absence of cross-bolting.

6. Head of the 427, left, shows the extra finishing in comparison with the standard series head.

7. Ports in the 427 look to be nearly the same as in the standard series, right, but they're 1/8-inch bigger.

8. The 427 head, left, has valve guides and spring seats machined for seat insert and Teflon stem seals.

9. Another chamber comparison view shows how the standard series head could be modified with much work.

10. Valve gear is completely different between the two engines. Standard engines should be changed for switch.

11. Differences between rods are obvious. Whatever else is done, 427 rods, left, should be used in place of the standard item except for strictly non-competition street use.

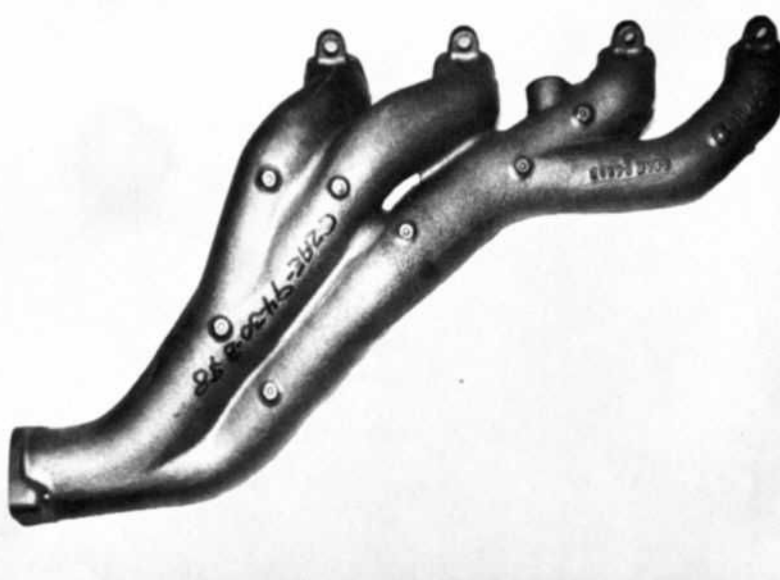
1

1. Not even Shelby-American recommends winding the 428. Red-line on these GT-500's is held at 5500 rpm.

2. Cast headers for the 427 will fit other big-block Fords where there is room for them between the fender wells.

3. If you are going to make your own headers, notice the routing difference from right to left side.

2



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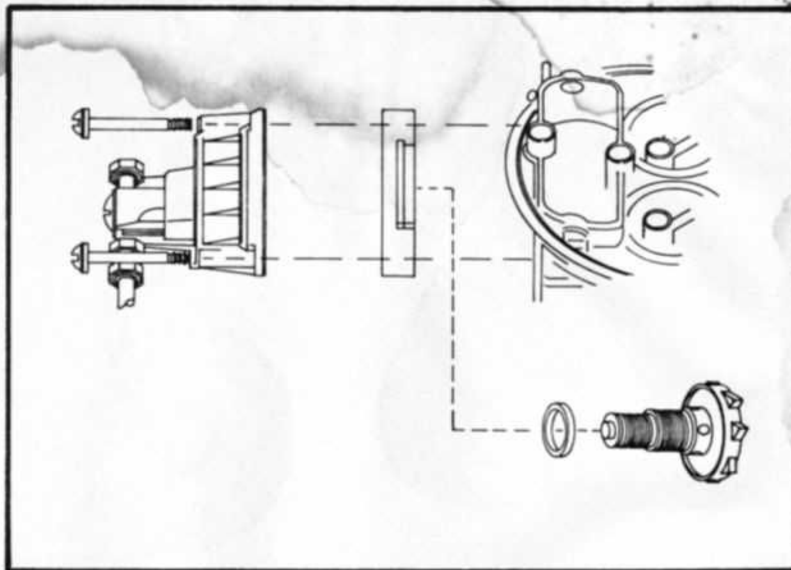
local crank-grinder may not do it but the specialty shops such as C&T or the CrankShaft Company will as a matter of course do these clearancing operations and will make sure the radii at the ends of each journal are well rounded and not too abrupt. At the risk of pointing out the obvious, when installing the rods always be sure that the rounded edge of the bearing is toward the outside of the journal. You know this and we know this but it's surprising how many people fail to check and get them in backwards with later unpleasant results.

If you are happy with 11 to 1 compression ratios you can stick with stock pistons but the normal clearances are pretty tight. It will have been best if the bores were miked and then honed to give .008-inch clearance with the Ford pistons and at least .010 with custom items. Although the stroke sizes are the same, the pop-up pistons from the 427 race engine won't work in the 390. Remember that the rod lengths are the same for all the big engines which is why they can be interchanged with the super tough 427 rods. The corollary to this is that the diameter of the 427 piston is much larger than that in the 390, so you can't use them in anything but a 427 unless you want them sticking a tenth of an inch into the water jacket. Sorry about that. Any of the custom piston makers can supply you with a piston that will give about any ratio you want. For street and gasoline-burning the cast pistons are fine and somewhat lighter than forged pistons. If you plan on alcohol with nitro or even alk by itself alone, forgings are the only way. The same thing applies to supercharged applications if any pressure above about five or six psi is intended.

We said earlier that any of the big block bits would fit any other big block engine. This is actually a sort of little white half-truth in one respect. The Ford High-Performance book states that the triple two-barrel and the dual four-barrel manifolds cannot be used on the Number C6AE-6049-A and 6049-J heads. Actually they will, but the ports on these heads are narrower than those in the manifold. If you don't mind port turbulence, the manifolds can be bolted right on and will seal perfectly but if you want to be really right a little carving will produce a good match. There is one setup that *won't* mix with other equipment, however. These are the high-riser manifolds and heads from the 1963-64 competition 427 engine. The head number is C4AE-6049-F and its matching manifold C4AE-9424-F for the dual four-barrel and 9424-G for the single four-barrel high-riser. These heads are dimensionally bigger than the '65 and later heads and must be used with the appropriate manifold. The manifolds, of course, will not work with 352, 390, late 427 and 428 engines unless these heads are also used.

That's about the last of the bad news – all the rest looks pretty good. First, there are those intake manifolds. The triple two-barrel, part number C4AZ-6B068-A, B, and C (the last letter denotes various emission control hook-ups and, in the case of the B designation for automatics prior to the C-6) will fit anything in the line with the provisos mentioned earlier. The same goes for the dual four-barrel (Ford designation: 8-V). This kit carries part number C6AZ-6B068-B. The neat thing about



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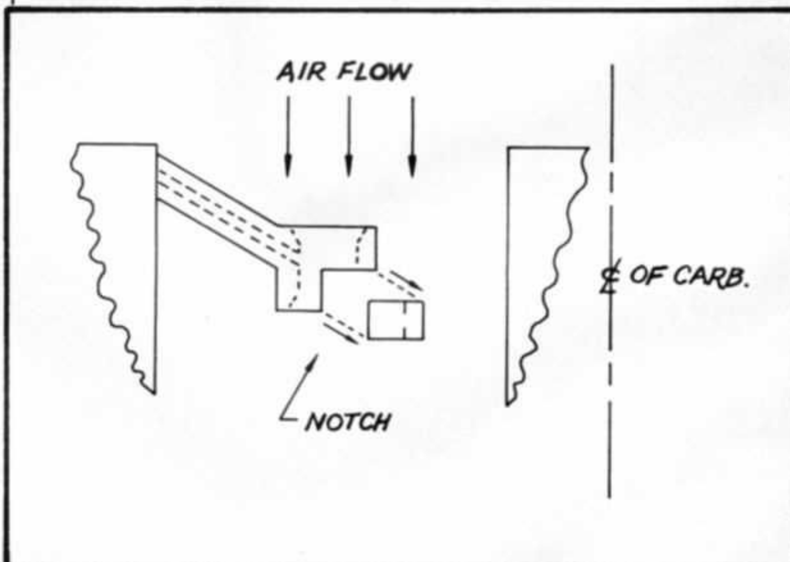
1. For single-carb use in racing, the 780 CFM Holley is recommended. Block off power valve with O-ring as shown.



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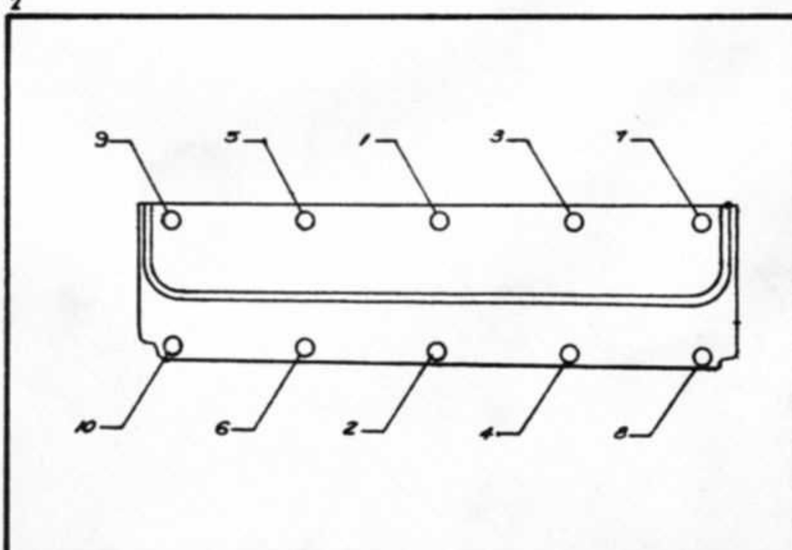
2. When using the 780 CFM carb, better metering is gained by notching the nozzle bars as indicated here.



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3. Torquing sequences are important. This is the sequence for all Ford big block heads. See previous section.

these is that they are complete kits with carburetors, linkage, gaskets, and all those minor but important items that people always forget to pick up when they order this sort of equipment separately. If you have a full-size Ford or Fairlane, you can also use the factory cast headers but they wont fit in Falcons and Mustangs – you'll have to go to the header manufacturers for those and, because of their greater versatility, the custom items might be a better bet all the way around.

In terms of heads, the best bet by far are the Series 2A heads for the 427 which have ports you can walk through and valves that are 2.195 inches and 1.733 inches for the intake and exhaust, respectively. The intakes aren't all that much bigger than standard but the exhausts are. These also have machined chambers which saves work or money or both. They should be used with pop-up pistons and, if the valve springs they come with are used, it's best to use the cam and solid lifters for the 427 as well, although with the 352 and 390 the timing and lift provide a cylinder filling that is pretty wild. If you opt for reworking the original heads and intend the engine for the street a good bet is one of the two soft tappet cams or one of the ones made by many of the commercial grinders. The Ford items are No. C6AZ-6A257-A which is a full kit and gives a duration of 270 degrees and a lift of .480 (zero lash). A little tougher is C60E-6250-A. Using a stock 390 at 315 bhp as a baseline, this cam used with the 8-V induction system will deliver 355 horses or better and has the added advantage of not losing any power in the lower speed ranges which some hot cams will do. If the heads were reworked, pop-up pistons installed, the block properly blueprinted, and the ignition advance curve tailored, it is probable that this figure would be much higher. The good thing about this is that this power comes in and peaks under 5500 rpm and maximum torque occurs at 3200 revs.

Actually, if you take the time to go through the high-performance parts lists you will find that Ford has a number of cams and lifter combinations from mild to the strong 324-degree duration, half-inch lift bump stick used in the competition engines. Another source of interesting items can be found in the truck parts lists. A good f'rinstance along these lines can be found in the Modified and Sportsman Stockers in the NASCAR circuit. These engines are limited to 400 cubic inches and you'd better believe they aren't using bored out 390's with the exception of the rare "police" crossbolted unit but who ever heard of a 396 Ford? There's no such animal but you can make one. The 360 heavy-duty truck crank is steel and can be fitted to the 427. Result: a wildly oversquare 396 that will twist up tighter than the valve gear will permit.

ENGINE TYPE

	170-1V	200-1V	240-1V	289-2V	289-4V (Prem. Fuel)	289-4V (Hi-Perf.)
Bore	3.50	3.68	4.00	4.005	4.005	4.005
Stroke	2.94	3.13	3.18	2.870	2.870	2.870
Comp. Ratio (Max.)	9.1:1	9.2:1	9.2:1	10.02:1	10.73:1	11.6:1
BHP (Max.)	105 @ 4400	120 @ 4400	150 @ 4000	200 @ 4400	225 @ 4800	271 @ 6000
Torque (Max.)	158 @ 2400	190 @ 2400	234 @ 2200	282 @ 2400	305 @ 3200	312 @ 3400
Cyl. Head Vol.	48.32cc	48.32cc	66.00cc	51.99cc	47.70cc	47.70cc
Head Gasket Vol.	4.43cc	16.15cc	7.48cc	12.79cc	12.85cc	6.00cc
Deck Clearance (below block)	.025	.012	.018	.0015	.0015	.0015
Vol. from Deck Clearance	4.65cc	2.4cc	7.48cc	6.06cc	2.29cc	2.29cc
Total Combustion Chamber Volume	57.40cc	66.8cc	80.42cc	70.84cc	62.81cc	55.99cc
Piston Top Type	Flat	Dished	Dished	Dished	Flat and Eyebrowed	Flat with Notches
Displacement of Piston Dome or Recess			5.58cc			
Camshaft Part No.	C5DE6250A	C5DE6250A	C5AE6250B	C4AE6250A	C4AE6250A	C30E6250C
Rocker Arm Ratio	1.5:1	1.5:1	1.61:1	1.60:1	1.60:1	1.60:1
Valve Lash	hyd.	hyd.	hyd.	hyd.	hyd.	.016-.022(I) .018-.024(E)
Intake (open-close)	9°BTC-51°ABC	7°BTC-65°ABC	12°BTC-62°ABC	16°BTC-70°ABC	Same as 289-2V	46° @ .0077 84° @ .0101
Exhaust (open-close)	42°BBC-18°ATC	55°BBC-21°ATC	60°BBC-28°ATC	52°BBC-24°ATC	Same as 289-2V	94° @ .0077 36° @ .0101
Overlap	27°	28°	40°	40°		82°
Lift (at valve)	.348	.348	.376(I), .400(E)	.368(I), .380(E)	Same as 289-2V	.4574
Duration	240°	252°	254°(I), 268°(E)	266°(I), 256°(E)	Same as 289-2V	310°
Valve Spring Pressure & Height Intake (open) (close)	150 @ 1.22 54 @ 1.59	150 @ 1.22 54 @ 1.59	200 @ 1.325 84 @ 1.700	177 @ 1.39 79 @ 1.78	Same as 289-2V	247 @ 1.32 88 @ 1.77
Exhaust (open) (close)	150 @ 1.22 54 @ 1.59	150 @ 1.22 54 @ 1.59	207 @ 1.300 84 @ 1.700	177 @ 1.39 79 @ 1.78	Same as 289-2V	247 @ 1.32 88 @ 1.77
Cyl. Head Casting No.	C6DE6090C	C6DE6090C	C6AE6090C	C60E6090N	C60E6090N	C50E6090A

In the realm of non-Ford equipment there is a lot that can be fitted but, unless a lot of bottom end strengthening as outlined earlier is done, shouldn't be. The source of most of this equipment is Holman, Moody, Stroppe. It is designed primarily for use on their blueprinted 427-based marine engines, but with due care some can be used on the 352, 390 and 428. If you want to spend the money on a lot of glossy intake plumbing they make a manifold for four 48 IDA Webers but we find it hard to recommend this layout on these engines simply because they only begin to do their job at the point at which the engine should be red-lined. There are numerous blower kits that can be used but again caution should be exercised and the blower should be overdriven to a considerable extent so that it builds its pressure in the range where the engine is within its safe operating speed. Unfortunately, the more a blower is overdriven the more power it takes to operate and it could be a case of diminishing returns.

Let's face a fact or two. This family of engines was designed for street use, not for racing. Nowhere does the old question that "speed costs money so how fast do you want to go?" hold more truly than here. If you want to go real fast, start out with a 406 or a 427, preferably the latter. However, if you want a good healthy street engine that is still capable of the odd blast down the strip there is nothing wrong with the 352-428 series provided due care is used in assembling it. Just bolting on the trick stuff is a short way to becoming the owner of 700 pounds of scrap iron. The same attention to detail should go into one of these that would go into assembling a regular racing engine; in fact, due to the inherent weaknesses it is even more important here. The corollary to these somewhat unpleasant facts is that if the engine is to be used primarily on the street there is no point in spending the money for a racing engine. These engines can be safely put together to produce more power than you can use outside of Riverside, Pomona, or Bonneville. Also, being torquers rather than screamers they are pretty strong in the stoplight grand prix department. A final important point is that they are not only cheaper in the original cost but also they will pull a taller final drive gear happily. This means less fuel in normal driving which can become mighty important with these big bangers. After playing around with a high-performance 427 on the street you can get awfully tired of being able to pass anything but a gas station.

There's a lot to be said in favor of this particular Ford family; after all, the 428 is used in the Shelby GT 500 and the police seem to like the 390. As long as you don't expect to grab the Grand National championship or Top Stock you can be happy with it, too.

(Factory Designations)

352-4V	390-2V	390-4V	390-4V (Prem. Fuel)	427-4V	428-4V (Police)	427-8V
4.00	4.05	4.050	4.050	4.232	4.13	4.232
3.50	3.784	3.784	3.784	3.784	3.984	3.784
9.3:1	10.0:1	11.0:1	11.0:1	14.0:1	11.0:1	14.0:1
250 @ 4400	275 @ 4400	315 @ 4600	335 @ 4800	410 @ 5600	360 @ 5400	425 @ 6000
350 @ 2800	405 @ 2600	427 @ 2800	427 @ 3200	476 @ 3400	459 @ 3200	480 @ 3700
73.1cc	70.1cc	68.00cc	68.00cc	66.0cc	68.0cc	66.0cc
6.34cc	11.0cc	11.00cc	11.0cc	7.72cc	11.0cc	7.72cc
.034	.0005	.0005	.0005	.010	.0005	.010
7.36cc	1.36cc	1.36cc	1.36cc	6.0cc	1.19cc	6.0cc
87.00cc	95.14cc	84.52cc	84.30cc	67.12cc	92.16cc	67.12cc
Flat and Eyebrowed	Dished	Flat and Eyebrowed	Notched with Center Recess	Pop-up	Dished	Pop-up
	13.92cc	4.16cc	3.94cc	12.4cc	11.97cc	12.4cc
C3AE6250U	C6AE6250B	C6AE6250B	C60E6250A	C5AE6250D	C3AE6250M	C5AE6250D
1.73:1	1.73:1	1.73:1	1.73:1	1.76:1	1.76:1	1.76:1
hyd.	hyd.	hyd.	hyd.	.025-.028 (I)-hot .025-.028 (E)-hot	Same as 427-4V	
22°BTC-68°ABC	16°BTC-60°ABC	Same as 390-2V	18°BTC-72°ABC	8°30' @ .100 cam lift 36°30' @ .100 cam lift	46°30' BTC-85°30' ABC	Same as 427-4V
68°BBC-22°ATC	55°BBC-21°ATC	Same as 390-2V	68°BBC-22°ATC	39°30' @ .100 cam lift 11°30' @ .100 cam lift	88°30' BBC-37°30' ATC	Same as 427-4V
44°	37°		40°	96° (theoretical)	78°	
.408	.437		.481	.524	.516	
270°	256°		270°	324° (theoretical)	306°	
198 @ 1.42 104 @ 1.82	255 @ 1.38 90 @ 1.82	Same as 390-2V	281 @ 1.32 90 @ 1.82	280 @ 1.32 90 @ 1.82	Same as 427-4V	Same as 427-4V
198 @ 1.42 104 @ 1.82	255 @ 1.42 90 @ 1.82	Same as 390-2V	281 @ 1.32 90 @ 1.82	280 @ 1.32 90 @ 1.82	Same as 427-4V	Same as 427-4V
C6TE6090G	C5AE- C6AE6090A, J, L	C60E6050R C6AE6090A, J, L	C60E6090R C6AE6090A, J, L	C5AE6090F, R	C6AE6090A, J, L	C5AE6090F, R

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