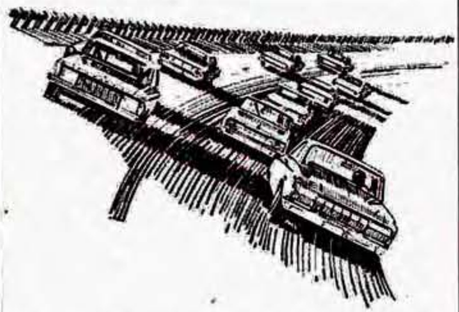
WHAT MAKES PLYMOUTH'S "HEMI" SO HOT?

PLYMOUTH'S "HEMI" ROCKS THE STOCK-CAR CIRCUIT

In the Spring of 1964, when three specially prepared Plymouths placed 1, 2, 3 in the Daytona "500", then proceeded to gobble up virtually every competitor on stock-car track and drag strip, the impression began to spread that Plymouth had "pulled a fast one" on the industry, and come out with something entirely revolutionary.



Plymouth finishes 1, 2, 3 in the 1964 Daytona "500".

Plymouth had taken a big step forward, but not overnight.

As a matter of fact, the hemispherical combustion chamber dated back to identification with such a famous American automotive name as Deusenberg. And in Indianapolis racing history the "Hemi" type of engine made its mark in conjunction with such names as Deusenberg and Miller.

European automotive records rank the hemispherical combustion chamber high in association with such famous names as Mercedes, Ferrari, and Alfa-Romeo.

PLYMOUTH BUILDS THE FIRST PRODUCTION "HEMI"

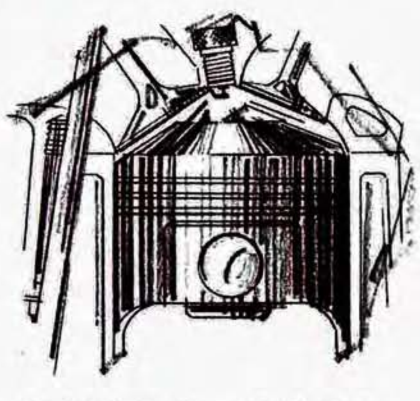
And those with even a reasonably good memory, who may not be able to reach that far back in racing lore, should still be able to recall that as far back as 1951 Chrysler came out with a development known as "FirePower".

This landmark in combustion engineering was billed as "the most powerful . . . the most efficient engine ever developed."

That marked the debut of what became known as the "Hemi". Like all startling inventions, on close examination, it appeared to be deceptively simple.

On the surface, it appeared that all Chrysler had done was to angle the top of the combustion chamber in each cylinder to permit the use of larger intake and exhaust valves, locate the spark plugs in a central position, and insure almost straight-through gas flow.

But it wasn't all that easy.



Detailed cross-section of the hemispherical combustion chamber.

MANY YEARS FROM DRAWING BOARD TO TEST TRACK

In fact, although the general public may not realize it, and may even find it impossible to credit five years of experimentation went into this one Chrysler development alone, from drawing board to test track.

And, before it was released to the public, this engine was put through *more than one million miles* of testing on dynamometers in the laboratory, and on all kinds of roads, under all sorts of weather conditions, in every section of the country.

This is the kind of painstaking thoroughness that Chrysler Corporation engineering has come to be synonymous with down through the years.

But the "Hemi" was expensive to build. It was distinctly not a low-price engine. So it was not introduced to the Plymouth line at that time because of its cost and weight.

THE "HEMI" WAS AHEAD OF ITS TIME

Transmissions and gear ratios posed another problem, and production of cars of a decade-and-a-half ago did not have the types of transmissions or gear metals that lent themselves easily to the performance demands of the new "Hemi".

And the problems of manifolding were anything but minor. In addition, the engine, with the metals available for block and head construction, didn't permit the most efficient power-to-weight ratios desirable.

And Plymouth engineering, in typical fashion to stay competitive, was finding new and better ways to manufacture powerful lighter engines.

But the "Hemi", for all its expensive construction and weight, has proved it could do several highly desirable things that every car manufacture wants his production models to be able to do. Among them the delivering of more horsepower and greater torque than conventional engines of comparable size.

"HEMI" PROVED EXCEPTIONAL IN MANY WAYS

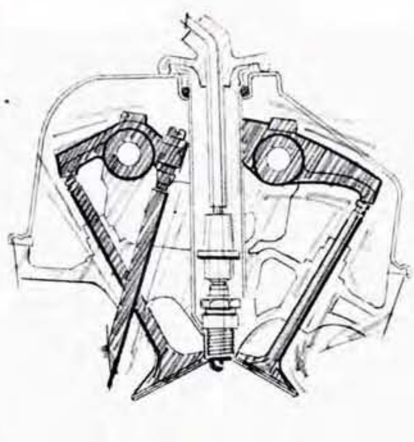
It proved its exceptionally high volumetric efficiency. This, in very simple terms, is the ability of an engine to draw into the cylinder, and to mix and ignite, the largest mixture possible of air and fuel, so that it may be efficiently transferred into power. This is attained through the very large valves. Free-flowing intake and exhaust ports. The almost complete absence of carbon formation. The efficient valve timing. And the highly effective cooling system that completely surrounds the valve ports.

It also showed unusually high thermal efficiency. This is an engine's ability to utilize the heat energy available in the fuel mixture. The "Hemi" enjoys this extra-high efficiency because of its complete combustion of fuel, the minimum heat loss through the surface of the chamber, and the short flame travel which significantly reduces the time required to effect combustion.

The "Hemi" also manifested superior combustion characteristics primarily due to the size and shape of the chamber, and the size and location of the valves and spark plug. This shape permits the widely separated valves, the location of the spark plug near the center of the compact, symmetrical chamber.

"HEMI" VALVE DESIGN INCREASES VALVE LIFE

Another engineering achievement responsible for the brilliant performance of the "Hemi" is its valve train. It can be modestly claimed as the finest ever designed for a push-rod V-8 engine.



Detailed cross-section of "Hemi's" unique mechanical valve train.

The "Hemi" design also offers increased valve life through greatly decreased valve-operating temperatures. Valve durability is also noticeably increased due to the wide spacing of the valves in the rigid chamber dome, which minimizes valve-seat distortion. Small diameter stems help reduce valve train inertia; and valve heads have a special shape for minimum air flow resistance.

Bear in mind that 15 years ago the original "Hemi" engine was acclaimed "the most powerful . . . the most efficient engine ever developed." It was the first American *production* version of an engine with a hemispherical combustion chamber, and still is.

WHAT EVER HAPPENED TO THIS "WONDER ENGINE?"

And, if the "Hemi" was all this good, what ever happened to it? Its stock production was discontinued because of numerous cost and weight factors.

Although it was "phased out" of production, the "Hemi" still remained in great demand for use as a drag-racing power plant for years after its production was discontinued in 1958.

As a matter of fact, demand for the "Hemi" persisted and increased so over the years from 1958 to 1963 that it was decided to produce it again in quantity in the Spring of 1964.

There is one big difference. The early "Hemi" was a passenger-car engine specially modified to make a racing engine out of it. The "Hemi" of today, the one you can buy at any Plymouth Dealer's for *your* new Plymouth, is a racing power plant modified to make it practical for use in a conventional passenger car.

And what happened with this new "Hemi"?

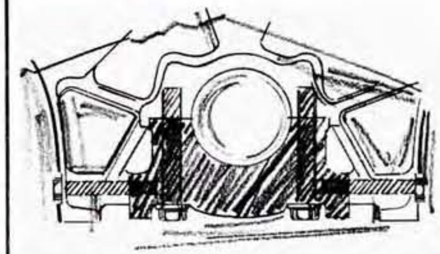
THE "HEMI" BOUNCES BACK WITH A BANG

Well, as we mentioned at the beginning of this booklet, it created a stir wherever it appeared in competition. Enough of a stir to make many a car buff wonder if it takes a "Hemi" to beat a "Hemi", it being admitted that if you want the utmost performance in a gasoline-burning combustion engine, you have to go to a hemispherical combustion chamber head.

The 1964 specially prepared "Hemi's" triumphs included the already mentioned 1, 2, 3 finish in the Daytona "500" of that year. The World Series of drag racing, both Spring and Winternationals the same year. And the speed record at Bonneville for closed stock cars in the Fall of the year, with "Grandpa" Norm Thatcher at the wheel.

HERE'S WHAT MAKES THE "HEMI" TICK

And the "Hemi" you can buy today excels its predecessors in almost every conceivable way. It is a beefed-up engine. It can take greater loads. It has strongly reinforced bearing caps. In short, it can take more of a beating, mile after mile, day after day, than ever before.



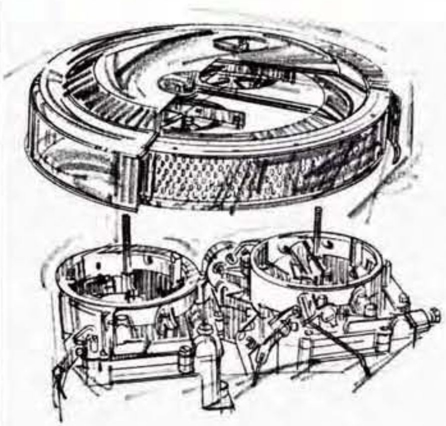
Detailed cross-section of the reinforced bearing caps that help carry heavy loads.

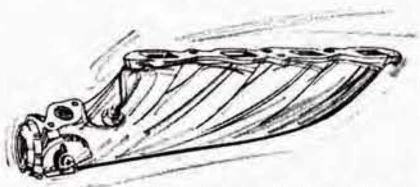
Broadly, its characteristics are these: It is of 426 cubic inches displacement, and is rated at 425 horsepower at 5000 rpm, and develops a torque of 490 lbs-ft at 4000 rpm.

It has twin 4-barrel carburetors, non-silenced low-restriction air cleaner, and low-restriction intake manifold and exhaust headers. And many of its internal components are patterned after those used exclusively in the "426" competition engines.

Mechanical tappets and push rods are of lightweight construction to reduce valve train inertia. The rocker arms are of forged steel for maximum strength and high-speed endurance, and are lubricated by oil metered into the rocker shafts through oil passages drilled in the cylinder heads.

Special heavy-duty chassis components provide the firm ride and handling precision one expects from high-performance cars. Driveability has been given careful attention. Several features have been included to insure easy starting, normal handling in city traffic, and reliable service.





A closeup of the "breathing" and fuel-feeding mechanism of the "Hemi."

SPECIAL CARE GIVEN TO "HEMI" PRODUCTION

Components for the "Hemi" are carefully selected to meet production specifications established especially for these engines. And they are assembled on a special line, by skilled technicians with years of experience in the building of special-purpose power plants.

Typical of the special care that goes into the building of these engines are the following:

- Flushing and cleaning of all cylinder blocks in a special block washer operating at extra-high pressure.
- Select fitting of all engine bearings and other critical engine components to maintain required clearances.
- Regular power checks on a special dynamometer as required for statistical quality control.
- Disassembly and inspection of power-checked engines to insure a consistently high level of manufacturing quality.
- In addition, several special-purpose manufacturing and testing operations have been established expressly for the "Hemi", to insure maximum smoothness and service life under a wide range of driving applications.

For those who wish further details and exact specifications of just what makes this "Hemi" the greatest thing on wheels, they may be found in full at the back of this booklet.

THE "HEMI" FLEXES ITS POWERFUL MUSCLES

And in case all this accumulation of engineering-type data has sort of fogged up the issue of just what the "Hemi" will do, get this.

Just how hot is this "Hemi"?

Well, in late September, 1965, the first '66 Plymouth Belvedere equipped with a street-version "Hemi" and driven by Bob Summers did two measured-mile runs at Bonneville Salt Flats at an average speed of 156.35 mph. This is a new Class B American closed-stock-car record.

Bob Summers pushing his "Hemi" to 156.35 mph at Bonneville Salt Flats.

In mid-season, Richard Petty returned to competition on the NASCAR circuit with his specially prepared Hemi-powered Belvedere, running only on short tracks of one mile or less. Yet in 14 races he qualified on the pole eight times, and in six of those times set a new qualifying lap record.

As a matter of hot fact, he set an unofficial world's record for a one-mile closed course, 116.260 mph, in this series of wins. Out of the 14 races, Petty took five 1sts, four 2nds, and two 3rds.

And before 1965 had ended, specially equipped Hemi-powered Belvederes had taken 13 firsts out of 18 USAC-sanctioned stock-car events, to give Belvedere the undisputed Manufacturers' Championship title for '65. And that included a victory in the Pike's Peak Hill Climb.

Not only did Norm Nelson, the "Great Dane", finish first in the USAC Championship point standings, but Paul Goldsmith. in another Hemi-powered Belvedere finished so close behind in second place that it took the final race of the season to decide who was first, and who second. And Jim Hurtubise in another Hemi-powered Belvedere finished a solid fourth.

Norm Nelson, top man in the USAC's championship point standings for '65.

"HEMI" LEAVES ITS MARK ON DRAG STRIPS, TOO

And specially prepared Plymouths equipped with the "Hemi" were making their presence felt on the nation's drag strips, too. Richard Petty, in his custom-built, Hemi-powered Barracuda, won the B/Altered Class in the last NHRA Springnationals.

Richard Petty wins NHRA '65 B/Altered Class in his Hemi-powered Barracuda.

Then, in August of last year, at Palmdale, California, Shirley Shahan pushed her Hemi-powered "Drag-on Lady" to an S/SA top speed mark of 129.30 mph.

In October of last year Plymouth's "Hemi" was still making the competition eat its dust on the drag strips. At Long Beach the custom-built "Hemi-Cuda", campaigned by the Southern California Plymouth Dealers, became the quickest, fastest stock-bodied, stock-wheelbase drag machine going by doing a 168.53 mph top in 9.06 seconds.

Southern Cal. Plymouth Dealers' "Hemi-Cuda" cranking up 168.53 mph.

YOU CAN BUY THIS "HEMI" AT YOUR PLYMOUTH DEALER'S

How hot is Plymouth's "Hemi"?

So hot that you may have lost sight of the fact that in the "Hemi" for 1966 we are again talking about a car you can buy in your Plymouth Dealer's showroom. This is a car built to sell to the performance-minded buyer.

So hot that the Plymouth engineers who built it glow all over with pride whenever the "Hemi" comes up for discussion. Plymouth's "Hemi" is just that good. Hot enough to have been chosen the proud pace car for the Daytona "500" this year.

How hot is Plymouth's "Hemi"?

We think we've given you a pretty fair idea in this booklet. But you'll never really know until you've actually tried one. Why not ask your Plymouth Dealer for full particulars on this hot "Hemi" right now?

SPECIFICATIONS

ENGINE

Type........90°V
Number of Cylinders........8
Bore........4.250"
Stroke........3.750"
Compression Ratio........10.25
Piston Displacement........426-cubic-inch
Engine Output:
Horsepower........425 hp @ 5000 rpm
Torque........490 lb-ft @ 4000 rpm

COMBUSTION CHAMBER SPECIFICATIONS

Combustion Chamber
Volume.....Min. 168 c.c.; Max. 174 c.c.
Distance from Top of
Piston to Block Deck.... .502 to .547"
Maximum Variation between
Cylinders........30 psi

CYLINDER NUMBERING

Left Bank........1-3-5-7
Right Bank........2-4-6-8

CYLINDER BLOCK

Material........Tin-Alloyed Cast Iron
Cylinder Bore........4.250"-4.252"
Cylinder Bore
Finish........20 to 35 Micro Inches
Tappet Bore Diameter..... .9050"-.9058"

INTAKE MANIFOLD

Material........Cast Aluminum
Type........Double Level

CRANKSHAFT AND MAIN BEARINGS

Type........Forged Counter-Balanced, Shot-Peened and Chemically Treated (Hardened Journals)
Bearings....Tri-Metal—Copper-Lead Alloy with Steel Backing (MS-2355)
Diameter Main Bearing
Journal........2.7495-2.7505
Diameter Crankpin........2.374-2.375
Clearance....0015 to .0025 (Selective Fit)
End Play........002" to .0085"
Finish at Rear Seal
Surface........Diagonal Knurling
Interchangeable
Bearings........Lower Nos. 1, 2, 4 5
Upper Nos. 2, 4, 5
Main Bearing Bolt Torque........100 lb-ft
Main Bearing Tie Bolt Torque.....45 lb-ft

CONNECTING RODS AND BEARINGS

Rods:
Type........Drop-Forged "I" Beam
Length........6.861"
Weight........1084 Grams
(less bearing shells)
Bearings:
Type........Tri-Metal—Copper-Lead Alloy with Steel Backing (MS-2355)
Diameter and Length....2.376" x .927"
Clearance........ .0015" to .0025"
Side Clearance (2 rods).... .009"-.017"

CAMSHAFT

Drive........Double Roller Chain
Bearings........Steel-Backed Babbitt
Number........5
Thrust Taken by........Cylinder Block
Clearance........001"-.003"

CAMSHAFT BEARINGS

Journal Diameter (mean)
No. 1........1.9985"
No. 2........1.9825"
No. 3........1.9675"
No. 4........1.9515"
No. 5........1.7485"
Bearing Clearance........ .001"-.003"

TIMING CHAIN

(Special Roller Type)
Adjustment........None
Number of Links........66
Pitch........⅜
Width........ .86"

VALVES—Intake

Material........Silicon-Chrome XB
Head Diameter........2.25"
Stem Diameter........ .309"
Stem-to-Guide Clearance..... .002"-.004"
Angle of Seat........45°
Lift........ .460"
Duration........276°
Lash (Cold)*........ .028"

VALVES—Exhaust

Material......21-4N Chrome-Manganese with Welded Stellite Face
Head Diameter........1.94"
Stem Diameter........ .308"
Stem-to-Guide Clearance..... .003"-.005"
Angle of Seat........45°
Lift........ .460"
Duration........ 276°
Lash (Cold)*........ .032"

VALVE SPRINGS

Number........16 (inner); 16 (outer)
Free Length...2.20" (inner); 2.47" (outer)
Installed Height...Min. 1.83"; Max. 1.89"
Load When Compressed:
Valve Closed: Inner.....47-53 @ 1.635"
Outer...102-108 @ 1.86"
Valve Open: Inner.......86-96 @ 1.175"
Outer.....179-189 @ 1.40"
Valve Spring Diameter: Outer......1.090"
Surge Damper........Spiral Type

TAPPETS

Type........Mechanical
Clearance (in block)........ .0010"-.0023"
Body Diameter........ .9035"-.9040"

PISTONS

Type........Domed-Forged Aluminum
Material........Extruded Aluminum Alloy, Tin-Coated
Clearance at Top of Skirt. .0025" to .0035"
Weight........843 Grams

PISTON RINGS

Number of Rings per Piston........3
Compression........2
Oil........1
Ring Slide Clearance
Top Compression........ .0015"-.003"
Second Compression...... .0015"-.003"
Oil Ring (Steel Rails)...... .0002"-.005"

*Due to the high overlap, long duration and high lift of the camshaft, special care must be taken to be sure each tappet is on the base circle of its cam lobe when clearance is set.

SPECIFICATIONS (cont'd)

CYLINDER HEAD

Material..........................Cast Iron
Combustion Chamber......Hemispherical
Valve Seat Run-Out (maximum).... .002"
Intake Valve Seat Material........Integral
Intake Valve Seat Angle...............45°
Intake Seat Width............ .060"-.080"
Exhaust Valve Seat Material.......Integral
Exhaust Valve Seat Angle..............45°
Exhaust Seat Width............. .05"-.07"
Cylinder Head
  Gasket Material..........Stainless Steel
Cylinder Head Gasket
  Thickness When Compressed.... .025"
Cylinder Head Bolt Torque....†70-75 lb-ft

ENGINE LUBRICATION

Pump Type..........Rotary Full Pressure
Capacity............................**5 qts
(add 1 quart with filter change)
Pump Drive.......................Camshaft
Oil Pressure........1000 rpm—8 psi (hot)
45-65 psi (cold) @ 40-50 mph
Oil Filter Type.....................Full-Flow

FUEL PUMP

Type..............Mechanically Operated,
Diaphragm Type
Pressure...........................6-8 psi

CARBURETOR

Type.................Two, 4-bbl Downdraft
Model....................AFB-4139S Front
AFB-4140S Rear
Throttle Bore
  Primary.............................1 7/16"
  Secondary..........................1 11/16"
Main Venturi
  Primary.............................1 3/16"
  Secondary..........................1 9/16"
Idle Speed (engine hot)..........750 rpm
Idle Mixture (both screws open).1-2 turns

IGNITION SYSTEM

Distributor Type..........Double Breaker,
Automatic Advance
Basic Timing....................12° B.T.C.
Advance—Centrifugal.... 0° @ 1000 rpm
  (Crankshaft Degree   9° @ 1400 rpm
  @ Engine rpm).........17° @ 2800 rpm
Advance Automatic—
  Vacuum (Distributor
  Degrees @ Inches of
  Mercury)...................0° @ 6" to 9"
4.5° to 7.5° @ 12"
8.25° to 11° @ 15"
Breaker Point Gap......... .014" to .019"
(use dwell meter for final setting)

Dwell Angle
  One Set Points..................27°-32°
  Both Sets Points.................37°-42°
Breaker Arm Spring
  Tension...................17 to 21.5 oz.
Rotation.................Counterclockwise
Spark Plugs—Type...................N-9Y
  —Size........14MM ¾" Reach
  —Gap.................. .035"
Firing Order...............1-8-4-3-6-5-7-2
Coil   PN 2444242........PN 2444241
Primary Resistance @ 70°-80°
  1.65-1.79 Ohms........1.41-1.55 Ohms
Secondary Resistance @ 70°-80°
  9400-11700 Ohms..9200-10600 Ohms
Ballast Resistor
  Resistance @ 70°-80°F.0.5 to 0.6 Ohms
Current Draw
(coil & ballast resistor in circuit)
  Engine Stopped...............3.0 Amps
  Engine Idling..................1.9 Amps

CLUTCH

Free Play Adjustment...½" Min.; ¾" Max.

REAR AXLE

Axle Shaft End
Clearance.......... .013 Min.; .023" Max.
Ratio.......................3.23 Automatic
3.55 Manual

TORQUEFLITE TRANSMISSION

Line Pressure...90 psi @ 1000-1100 rpm

OIL (engine).........Only oils labeled "For Service MS" should be used.
NOTE: SAE 30 is recommended for acceleration trials.

TRANSMISSION FLUID

Manual................SAE 80-90 Gear Oil
TorqueFlite..Use Automatic Transmission Fluid Type "A" Suffix "A"

CAPACITIES—Transmission

Manual—Four-Speed...............7½ pts
TorqueFlite.........................18 pts

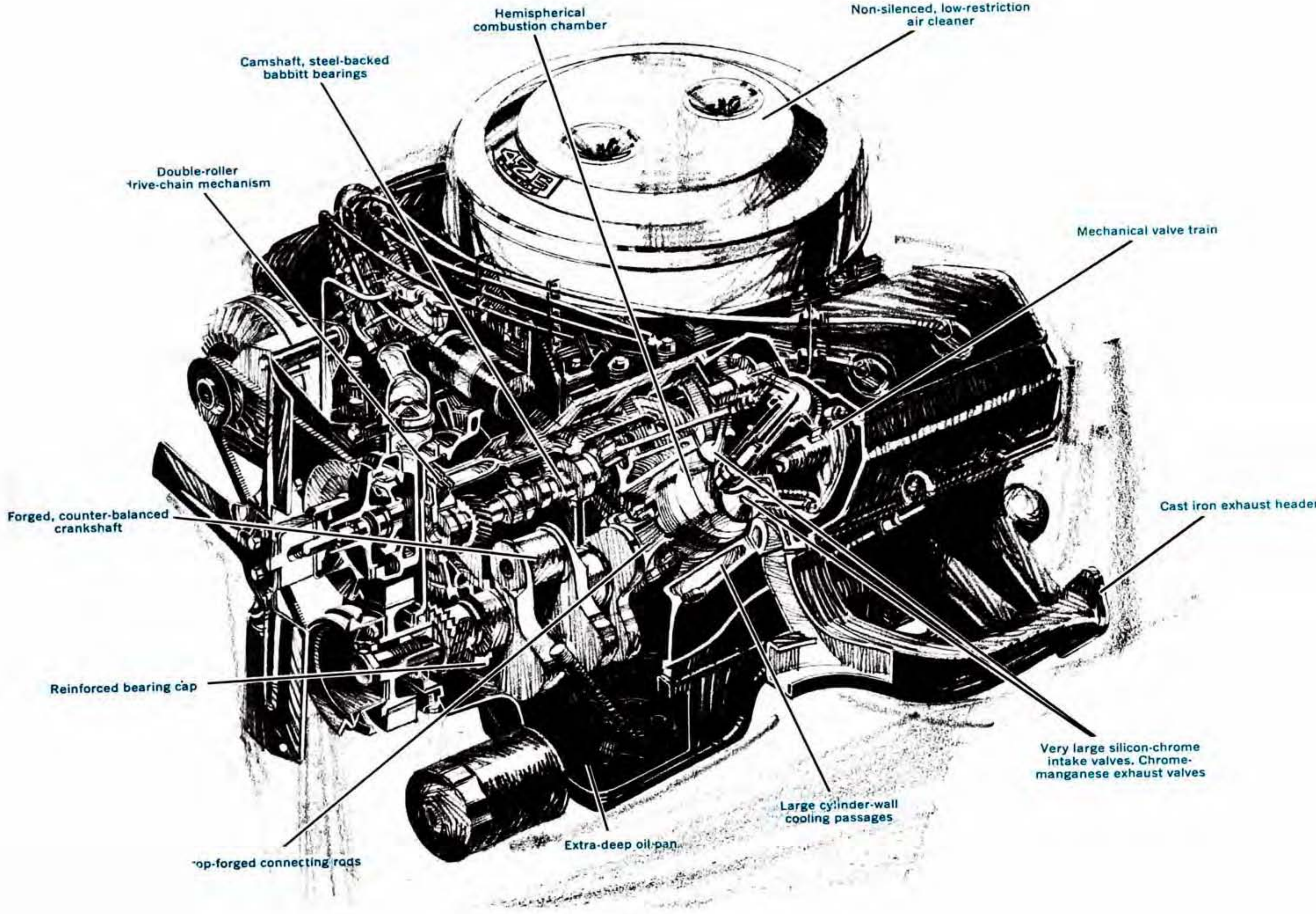
BOLT & NUT TORQUE SPECIFICATIONS

Cylinder Head Bolts............70-75 lb-ft
Main Bearing Bolts...............100 lb-ft
Main Bearing Cross Bolts..........45 lb-ft
Connecting Rod Bolts.........80 + 5 lb-ft
Torque Converter Plate to
  Converter Screws................65 lb-ft
Torque Converter Plate
  to Crankshaft..................110 lb-ft
Intake
  Manifold.....Has three different torque requirements depending upon location of manifold bolts—refer to Service Bulletin

**Check oil level indicator (dip stick) and change if necessary to correspond to correct level. Maintaining proper oil level is necessary during acceleration trials.

†Uses new, special-hardened cylinder-head bolt washers.

Cutaway of portion of the "Hemi" showing the bewildering complexity of the automotive power plant that is accepted by many car enthusiasts as "the most powerful . . . the most efficient engine ever developed."


Hemispherical combustion chamber
Non-silenced, low-restriction air cleaner
Camshaft, steel-backed babbitt bearings
Double-roller
rive-chain mechanism
Mechanical valve train
Forged, counter-balanced crankshaft
Cast iron exhaust header
Reinforced bearing cap
Very large silicon-chrome intake valves. Chrome-manganese exhaust valves
Large cylinder-wall cooling passages
Extra-deep oil pan
op-forged connecting rods

PLYMOUTH DIVISION CHRYSLER MOTORS CORPORATION

Plymouth

Litho in U.S.A.