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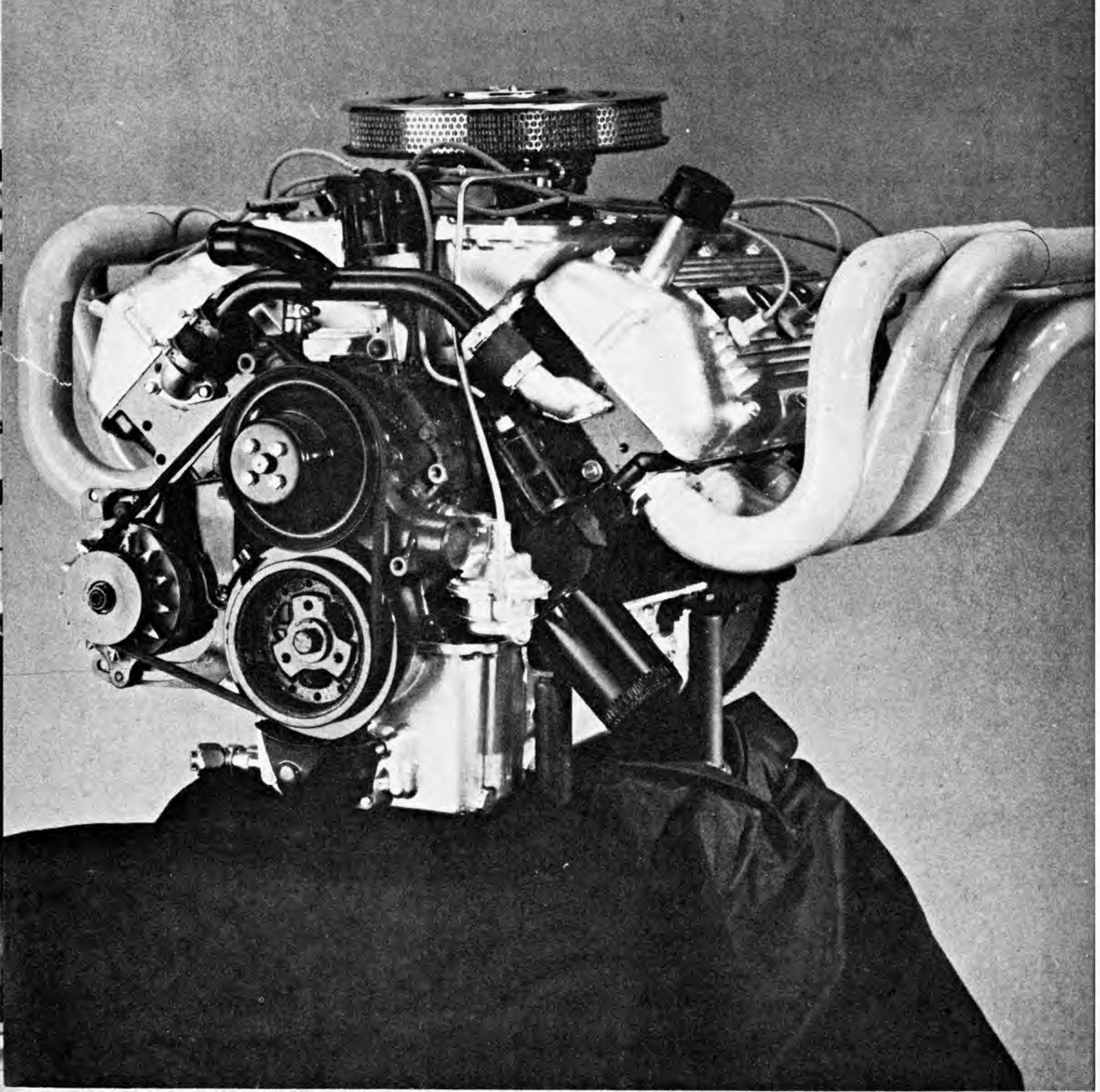
Ford Has Arrived!



BY ROGER HUNTINGTON

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This short, simple order has turned the Ford Racing Dept. upside down. It means that future Ford competition engines (except the Indianapolis job) are going to have to be closely based on volume production designs.The exotic overhead-cam 427 that you buy in a crate for $3400 is out the window. So is the "tunnel-port" wedge 427 that was used for NASCAR and drag racing, but was installed in only a handful of Ford passenger cars. And the tunnel-port 302 engine for the Trans-Am Mustang sedan racers is going to have to go "production" pretty quick.

But the really big news that is coming out of this policy is a wild high-performance version of the new 429-cubic inch Thunderbird luxury V-8 (also used in Fords, Mercurys and Lincolns in '69). This is a brand new engine that was just introduced a year ago, and production is building up rapidly on both the 429 and 460-cubic inches versions. You're going to start seeing a lot of it around the Ford diggings now. The new high-performance 429 is being prepared for NASCAR track racing next season–plus it will take the place of the OHC 427 in drag racing. And it will be pushed for the big Can-Am sports-racing cars to compete against the all-aluminum Chev 427 that is dominating this season.

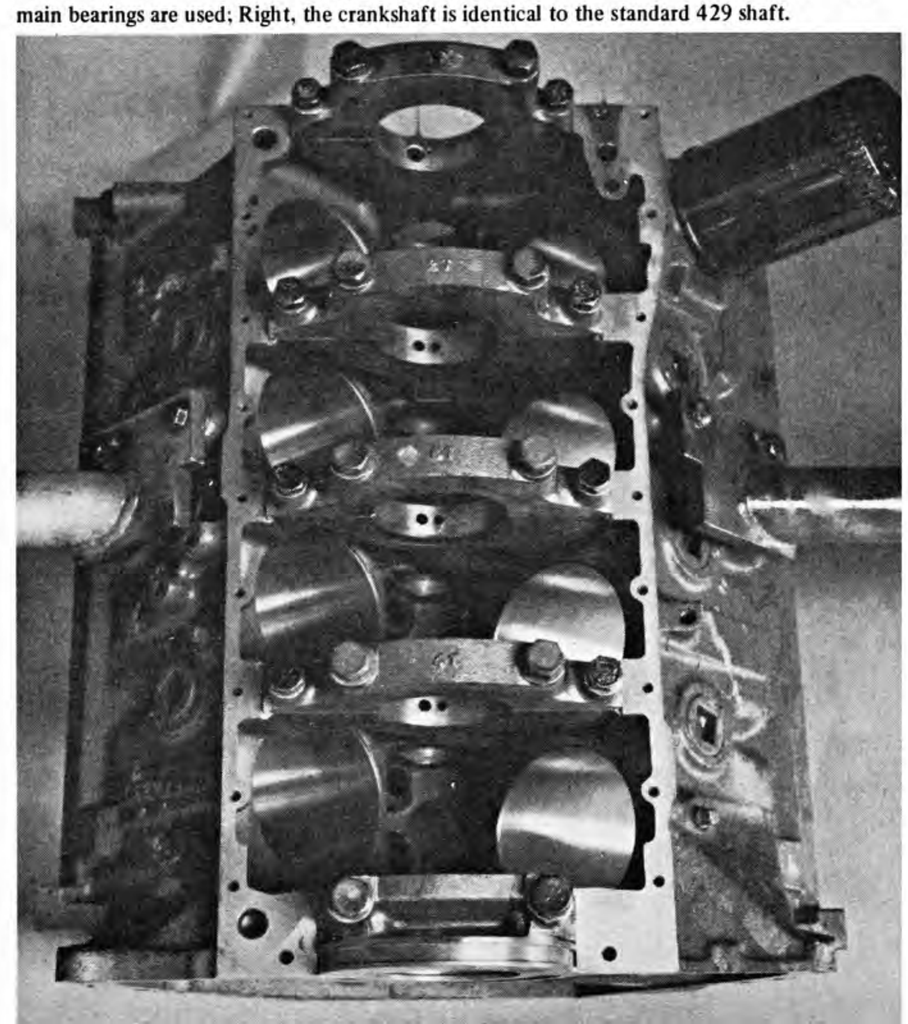
And of course, Knudsen's policy requires a definite *street* version of the HP 429 engine. Which you're going to get. NASCAR rules require a minimum production of 500 cars with a given basic engine before that engine is approved as "stock." Present plans call for putting the first 500 "street" engines in Mustangs and selling them primarily for drag racing–either in the Stock or Super/Stock division (depending on whether NHRA officals approve the combination as "stock"). This series of 500 cars with the engine could make it legal for several categories of "production" car racing around the world.

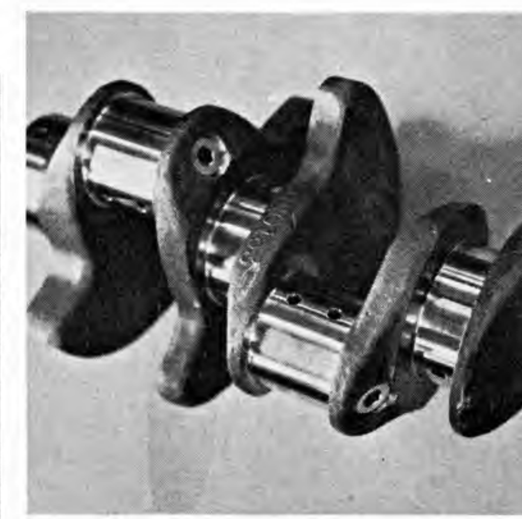
But from this point on just how much you will see of the new 429 engine on the street scene is debatable. Ford officials declare that they're really going to run this new HP version down the production line and build a lot of them. The special HP components are being designed with this in mind. It is expected that the engine will be as plentiful on the streets by 1970 as the famous Chrysler 426 Street Hemi. This would mean more than 60,000 cars a year with this engine. That's a lot of horsepower.

And if the crazy thing goes as good as it looks on paper, there's no question that Ford products are going to rule both the streets and drag strips within two years. We predict great things for this one. Ford officials say that the current 428 Cobra Jet engine is just a temporary answer to fill a crying need for a stronger Ford street and strip racer. But this engine is nothing compared to the new HP 429.

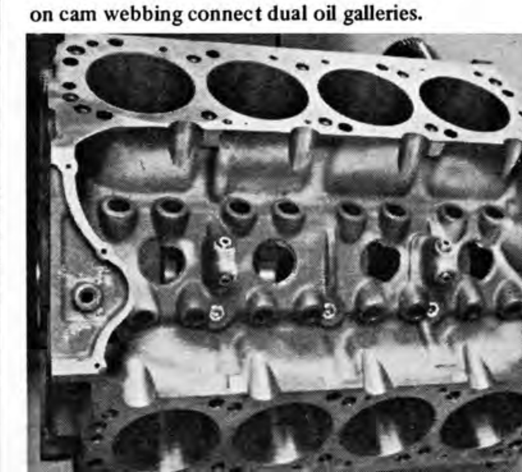
The CJ will be phased out as soon as production builds up on the 429. But Ford expects the HP 429 to beat a lot

Left, Ford's 429 cube NASCAR engine develops 650 hp at 7200 rpm. Below, huge four-bolt main bearings are used; Right, the crankshaft is identical to the standard 429 shaft.





Special bosses cast into the cylinder block on cam webbing connect dual oil galleries.



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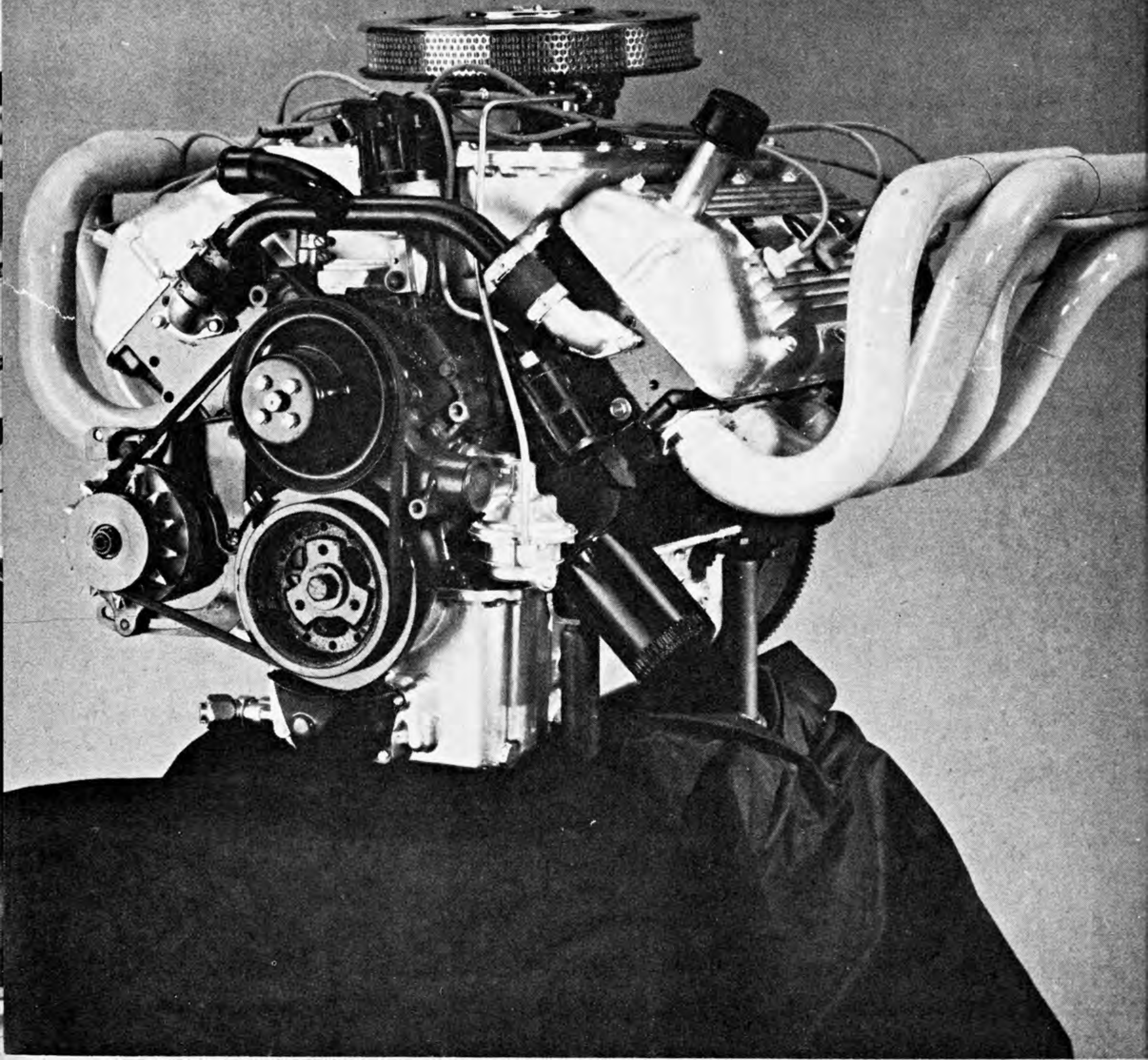

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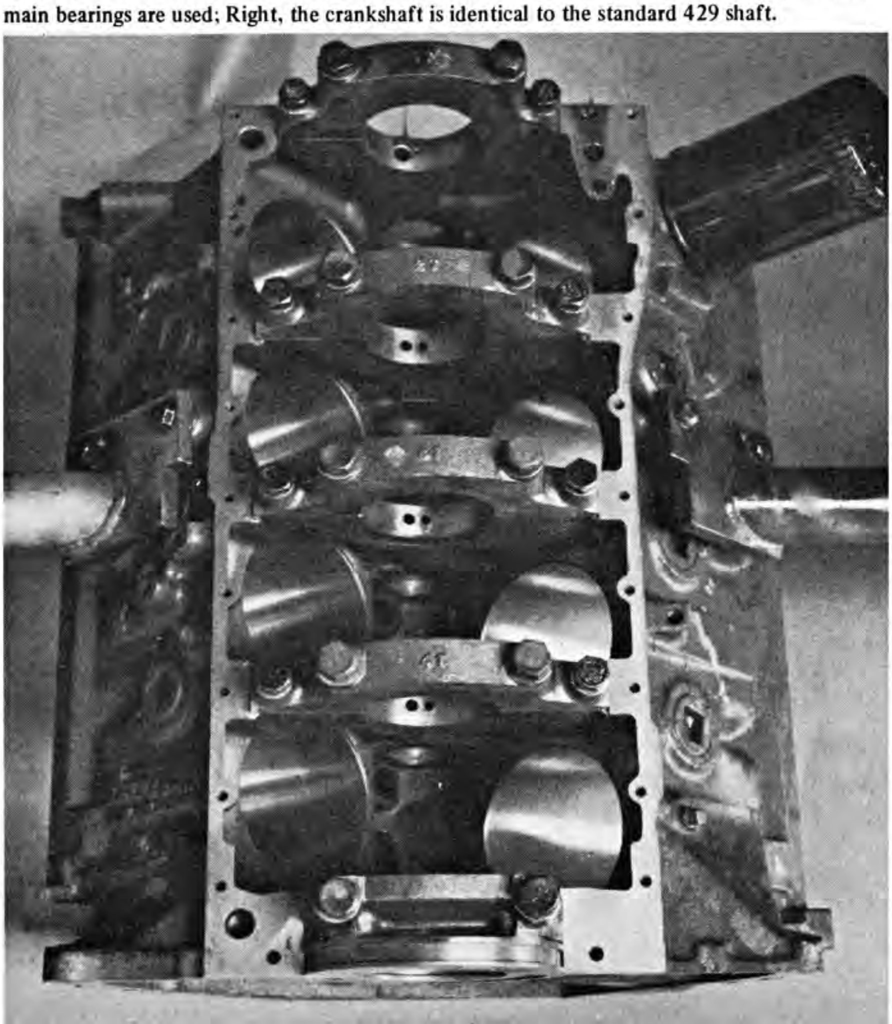

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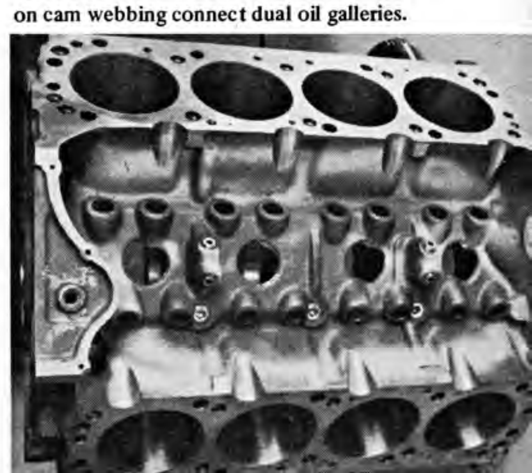
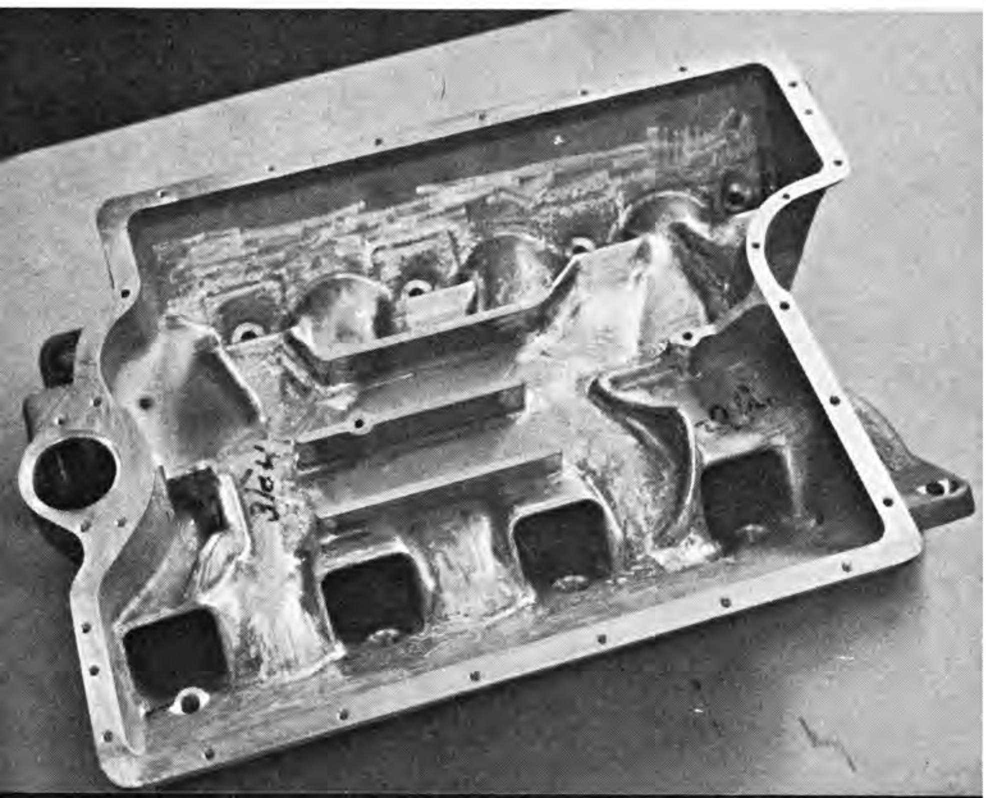


more than the CJ – like the Mopar Street Hemi and the 427 Chev. Guys who think an L-88 Camaro is the last word in performance will want to get a feel of a 429 Mustang before buying another car!

The secret of the new engine is in the unique cylinder head design. It's really a true "hemi" design (that is, a hemispherical-shaped combustion chamber with inclined valves) but the layout is entirely different than the Chrysler hemi. The Ford valves are inclined in two planes and the intake and exhaust valve axes are staggered along the length of the engine, rather than being right across from each other as on the Chrysler. The new head is basically laid out like the production 429 head (and something like the Chev 427 head), but the valve angles are much steeper. This leaves room for much larger valves and ports, straighter ports, more water jacketing–while still using the original block deck layout and pushrod positioning. (So production tooling could be used.) And of course a big secret in the pushrod layout is the fact that they spread outward as they go up from the cam–instead of going straight up as on other engines–and this gives a lot of room between them for huge intake port passages. (The 427 Chev has rectangular ports because the pushrods go straight up.)

the HP 429 is being prepared for NASCAR



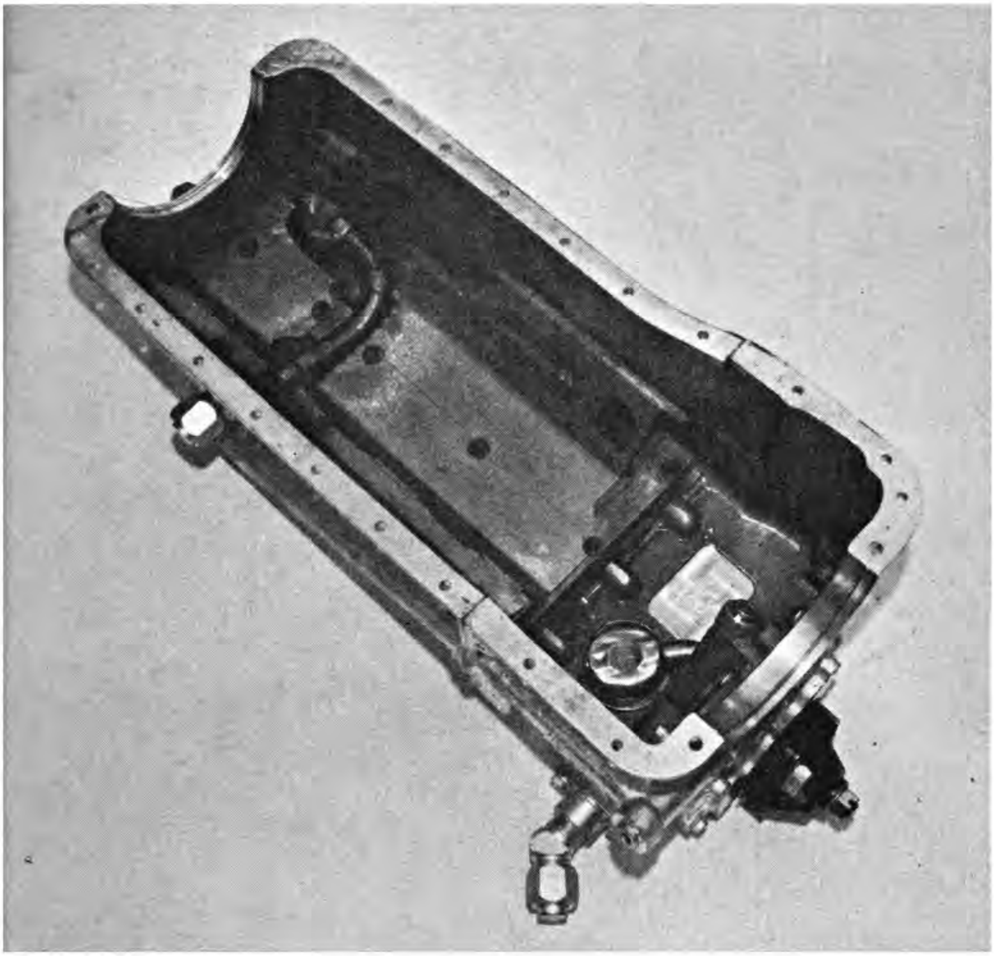
You have to see the size of these ports to believe it. The intakes are perfectly round, with a diameter of 2-7/16-inch at the manifold flange! This means a port *area* of *4.7 square inches!* To get some idea of how big that is, keep in mind that the "big round" ports on the OHC 427 Ford engine have 3.5 square inches of area. This is a third bigger yet than that! The exhaust ports have a general D shape (like the OHC 427) which Ford engineers found would flow more air on the exhaust side than a perfectly round port. Though a round port flowed better on the intake side. The difference, of course, was due to odd flow characteristics in and out of a poppet valve. The Ford people spent a lot of time getting the exact port shapes and sizes for optimum air flow, with no sharp curves inside the head and a gentle "venturi" lip just outside the valve to fill the port throat where the valve stem sticks through it. The Ford people have done tremendous things on port design in the last three years.

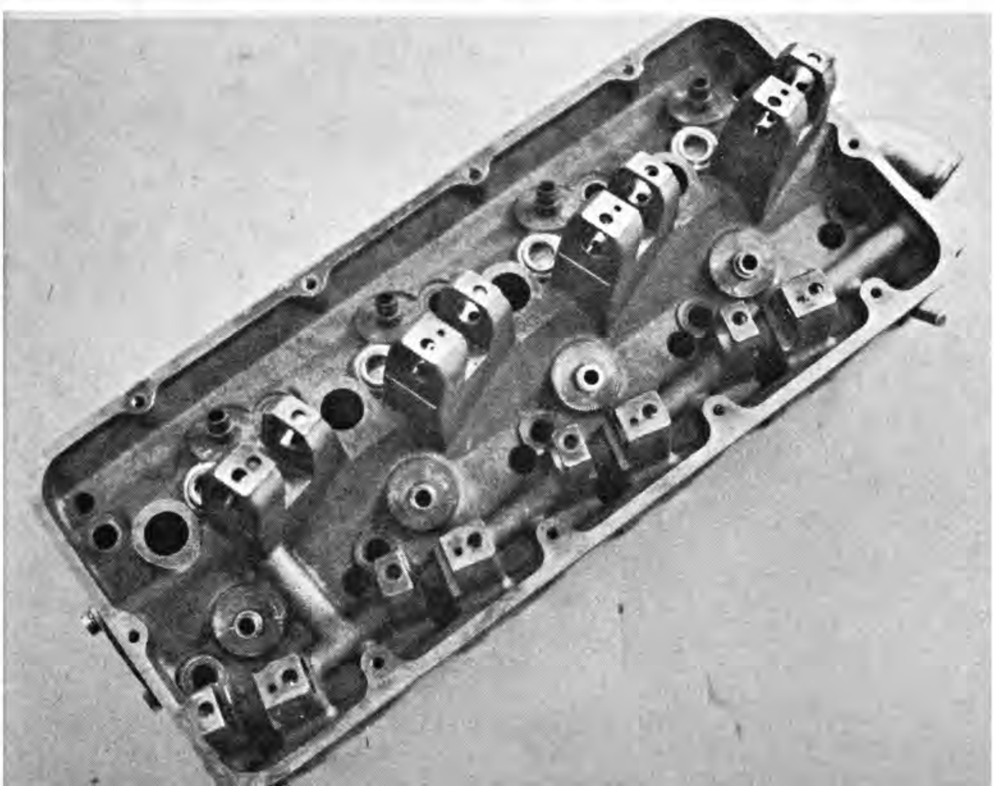
And those valves. The intakes have a head diameter of 2.40-inch–biggest that have ever been put in a modern automobile engine. Exhausts are 1.90-inch. Both valves are hollow stem, filled with sodium for cooling. (The sodium liquifies under heat and sloshes up and down to carry heat form the valve head back up the stem.) The larger a valve is the harder it is to cool it, because there's so much mass of metal in relation to the heat transfer area at the valve seat. The sodium filling was necessary to keep the valves cool and prevent detonation with

Top, beefed rods of SAE 4340 Chrome-nickel steel are used, with ½-inch alloy rod bolts and doweled caps. Below, inside of Ford's short-track manifold for single four-barrels.

12.5-to-1 compression ratio. And yet with the hollow stem the total valve weight is less (including the sodium) than a solid valve would be.

The combustion chamber is a kind of skewed hemisphere shape, with two edges pulled in to give a small quench area. (See photos) The spark plug is between the valves near the center, to give quick combustion and short flame travel. They had to use 14 mm plugs because there wasn't room for conventional 18 mm types. Plugs are inserted through passages down through the cast magnesium rocker cover. The passages seat against gasketed joints on bosses on the head casting. The cylinder bores are "dry-decked" with o-ring seals to prevent gasket failure.





The head valve gear is unique in using short individual rocker shafts for each valve, supported on small cast brackets bolted to the head casting. (Though the prototype heads have brackets cast integral with the head.) They couldn't use straight rocker shafts like the Chrysler hemi because the valves are tilted in two planes. Normally you would solve this by using stud-mounted, ball-joint rockers, like the production 429 does. But Ford engineers don't trust ball-joint rockers on an all-out race engine because lubrication is scanty, the rockers aren't as stiff and you can pull studs out of the head with stiff valve springs. These little individual rocker shafts have pressure lubrication to each one, they're very strong, and the rockers are strong forged steel, shot-peened, with bronze bushings. Nothing is going to break here, even with 320 pounds of valve spring pressure, and your revs.

The prototype heads were cast iron—but the prodution and race heads will be cast in aluminum—with hard steel valve seat inserts and soft steel valve guides pressed in. The reason is obvious: These heads are pretty massive things with the wide-spread valve angles. They weigh about 80 pounds each in iron. Aluminum will save about half of this, or a total of 80 lbs. for the whole engine. When you add the light magnesium rocker covers, aluminum intake manifold, and aluminum oil pan and front oil pump assembly—you have a total engine weight of only a little over 600 lbs. That's about the same as a NASCAR 427 engine with iron heads. They've been able to hold the line on weight while adding a lot more power and reliability.

And get this: The same heads will be used on the NASCAR and street versions of this engine! No cutting corners to save cost on the street jobs, like we've seen so often in the past. This is Knudsen's new policy in full force. The whole HP engine design has been engineered with volume production in mind.

You see this even more in the cylinder block and lower end. The HP 429 blocks will be cast with thicker main bearing bulkheads, but will be machined on production lines. Main bearing caps

Top, unique dry-sump lubrication system uses shallow cast aluminum pan. Below, valves are operated through rockers on short individual shafts carried on brackets in heads.

are retained by four bolts instead of two, and they're a special ductile nodular iron to keep from cracking. The crankshaft is exactly like the standard 429 except it's forged instead of cast, uses a hard steel alloy, and the crankpins are cross-drilled for full circle lubrication to the rods. The pistons are forged, of course, with contoured tops to fit up in the combustion chamber and give a high compression ratio. They're no heavier than 427 racing pistons, though the bore is considerably larger. This is because the skewed combustion chamber allows deeper forging on the underside of the piston.

The connecting rods are something else—they're huge, beefy things. Forged from SAE 4340 chrome-nickel,vacuum-melt steel alloy. Melting the steel in a vacuum keeps most of the impurities out of the blend, and gives an alloy of much higher strength, ductility, and a more even grain structure in the forging. The stuff is expensive now. But Ford engineers say the scrap rate on vacuum-melt forged parts is so low that it practically pays for itself that way. These new alloy materials could be a sign of things to come on future engines out of Ford. The new rods also feature large high-alloy 1/2-inch bolts, doweled caps, and upper ends with bronze bushings for a floating piston pin. Early prototype rods were drilled for pressure lubrication to the pin (like some aircraft engines); but this was not found necessary.

The new lubrication system is very interesting and significant. For one thing they want to use hydraulic lifters

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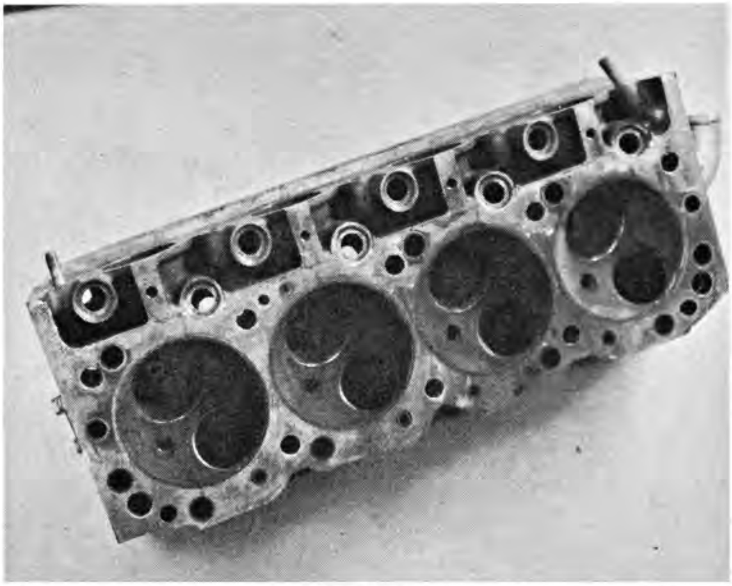
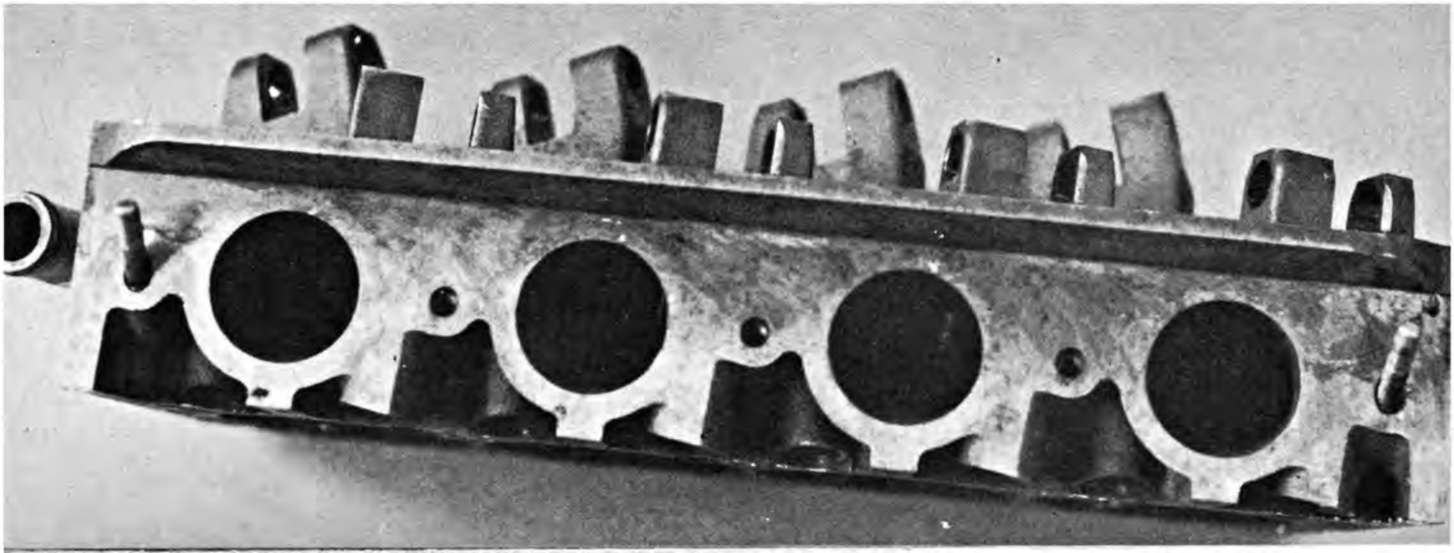
The big question is "What kind of performance?" Ford is cagey, though obviously excited they won't make any wild predictions

Rocker arms are forged high-alloy steel for maximum strength.



429 heads have hemispherical combustion chambers with staggered valves.

Intakes are huge round holes equally spaced along head. Diameter is 2-7/16-inch, for gigonda flange port area of 4.7 square inches.



a four-speed in a '55-'57 Chevrolet. It's a bolt-in swap with either the T-10 or Muncie, as both have the same bolt pattern as your original '55 '57 stick bell housing. A specialty floor gearshift linkage tops it off. Another popular one is a four-speed in a '56 or '57 Ford, especially models with the 312 cubic inch Thunderbird engine. Here you would have to use a T-10 four-speed to fit the original bell housing bolt pattern. The new Ford T&C would require changing the bell, too, or using a special adapter. And, of course, the T-10 would need to be a *Ford* version of this one, as GM and Chrysler versions have a different bolt pattern. There are quite a few of these around in the junkyards, however, as Ford used the T-10 from '61 through '64. This is also a bolt-in swap if you can find the Ford T-10.

Quite a few fellows are interested in putting four-speeds in Dodge and Plymouth stick-shift models of the early '60s. This is a bit more complicated because Chrysler didn't use the same bell housing bolt pattern for four-speed and three-speeds. You will need to swap the bell housing, too. But otherwise the job is straight forward, and only requires a special bracket to adapt the rear trans mount to the four-speed. The best way to go on this one is to look for a GM or Chrysler-version T-10 in the junkyards, and then use a '63 factory bell housing for the A or B block. You can buy a used T-10 for $150 or so, where there is very little chance of finding a junk Chrysler four-speed.

And so it goes. Lots of trans swap possibilities. And here's a good way to hop up your performance and fun with a minimum of expense and complication. A trans swap is many times easier than an engine swap. Good luck!

25 HP BOLT-ON continued

good cleaner such as the open top Stellings setup and there should be at least 1-inch clearance between the top of the air cleaner and the hood. On many Chevelles there is enough room for a Ram Air setup which can do wonders at high speeds for the 396/427.

To finish off the bolt-on hop up the timing should be corrected to anywhere from 38 to 42 degrees total with a suitable curve and Sunoco 260 in the tank. Then you should be able to reap the benefits of the newly-found 25 horsepower.

FORD continued

for the street engines, to prevent over-revving and give Ford some protection on the five-year/50,000-mile engine warranty. But of course solid lifters will be used in the race engines. It's tricky to provide for both types in one basic engine because a normal oil gallery with solid lifters in the normal lifter bores. Thus it's necessary to plug that gallery with solid lifters, and then feed the main bearings from a separate gallery —instead of from the same one as usual. The new HP 429 block has *two* galleries on each side of the cam, one feeding the lifters and one the mains. The lifter gallery is plugged with O-ringed threaded plugs on the production line on race engines. It requires some casting modification and extra drilling, but it gives an extremely reliable lubrication system under all conditions. The race engines also use a gear-type oil pump instead of the usual gerotor type, because it isn't damaged by dirt and small pieces of metal so easily.

Perhaps the most exotic thing about this whole engine is the dry-sump lube system on the race versions. In a "dry-sump" system you have a second set of oil pumps to pull the oil out of the crankcase and pump it into an external tank for storage. The normal pressure pump pulls it out of the tank and feeds it to the engine bearings. This arrangement has several important advantages for a race engine: (1) The oil supply is not affected by oil sloshing around in the pan on hard corners or under braking or accelaration; (2) you can carry a larger supply of oil in the external tank, so you don't have to add oil in the pits during the race; (3) the oil tends to run little cooler and the temperature is more even; and (4) if you blow the engine the oil doesn't spill out on the track, as there is never more than a half cup or so in the sump. Ford engineers thought a long time before they went to the effort and expense of putting a dry-sump system on this new engine; but it was finally decided to go full steam. It was felt that the system would be a benefit in drag and sports car racing as well as on the NASCAR tracks.

The new system uses a rather shallow two-piece cast aluminum sump, with the oil "scavenge" pumps (to pull the oil out) in the front, driven by a small Gilmer cog belt from the crank pulley. This is a dual scavenge pump like the one used on the 427 LeMans engine—three gears side-by-side with the center gear working with both the outside gears to make two separate pumps. Simple, light, compact and fool-proof. You use two scavenge pumps because they need twice the capacity of the pressure pump in order to keep the sump cleared (since they're pumping a lot of air and foam as well as solid oil). The pressure pump is in the stock position, driven from the cam in the normal way.

The street engines will *not* use this dry-sump system. There is no need. They will use a special 8-quart oil pan and heavy-duty gerotor-type pump. Special block drilling is necessary to get oil to the rocker shafts in the head, as the valve gear is lubbed through hollow pushrods on the standard 429. A full-flow oil filter is used on all engines.

There will be three distinct intake manifolds for the HP 429. The 1969 NASCAR rules allow only a single four-barrel carburetor with maximum 1-11/16-inch throttle bores—so the 850 cfm Holley carb will be used on all engines here. But Ford engineers felt they needed different manifolds for short tracks and fast speedways to get the most from the new free-breathing engine. Their short-track job is much like Chrysler's "tub"-type ram manifold for the NASCAR Hemi. There's a big chamber under the carb with crossover ram passages from the chamber to each head port. The ram length from chamber to valve is about 15 inches, so this manifold gives excellent mid-range torque from 4000 to 6000 rpm, for coming off the turns on slow tracks. But for strictly top-end power at Daytona and on the other fast speedways you want minimum passage lenth and the least possible skin friction. For this they're using a simple "runner" manifold. (like the new Offenhauser 360-degree hot rod manifolds.)

For the street you will get a more conventional over-and-under 180 degree type of manifold, using a single four-barrel holley carb of probably 735 cfm capacity (same as the current 428 Cobra Jet). But it will be a hi-riser type for minimum restriction, and the port passages are huge. It was a problem to provide exhaust heat to the manifold for winter driving. They ended up by bringing the exhaust gas in the back through steel tubes from a by-pass valve in the base of the exhaust manifold. (Same as they did on the Chrysler Street Hemi.)There was no othersimple way to do it. No exhaust heat ports in the heads, and no room under the manifold for the necessary porting.

Now the big question: What kind of performance? Ford engineers are cagey. They're obviously excited; but they

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(Continued from Page59)
don't want to make wild predictions. They will say that even the early prototypes were considerably stronger and more durable than either the OHC 427 or the tunnel-port wedge 427. And we know these engines will develop between 580 and 620 hp at 7000 rpm on one big four-barrel carb. Ford engineers admit to 650 horses at well over 7000 under the same conditons–on pump gas with an 850 cfm Holley and .600-inch valve lift. Maximum safe revs are above 8000. Where it will go with fuel injection, exotic fuels, supercharges, etc.–who knows? Or even in the street versions: With a 735 cfm Holley, hydro cam, and a decent exhaust system with 2-1/2-inch pipes and dual low-restriction mufflers . . . we can see 500 horses at 6000!!

Will that do for a starter?

GIANT KILLER continued

Valve Train

Train Production high-performance push rods have a hardened steel inserted tip in one end, and should be installed with this end up. The high-performance rocker arm has a raised letter 'O' forged in the pallet end and a polished pallet. Valve springs should be installed at 1.70-inch height, and should have 110 psi load at installed height for Camshaft #3927140. New rocker arms and balls will burn sooner than than run-in parts. If necessary to change a rocker and ball, *always* install a good used run-in rocker and ball. If no good used ones are available, move an intake rocker and ball over the burned exhaust position and install the new parts on an intake position which runs cooler.

Intake Manifold

The Z-28 intake (#3917608) is an aluminum high rise tuned unit, designed to accept a single Holley four-barrel carburetor. Any size Holley from 500 - 960 cfm can be mounted. Stock is a 780 cfm Model *4053* or *3943*. No manifold porting is necessary, but opening up of ports to match manifold gasket and head ports is recommended. Do not remove the center divider from the manifold below the carburetor. Recently released for service is a 2 x 4 barrel intake manifold with two 600 cfm Holley carburetors under part number 3940077 (carburetor conversion unit). These carburetors are jetted satisfactory for competition as released.

Carburetor

Use the #3923289 Z-28 or similar .780-800 cfm Holley carburetor. This carburetor has 1-11/16" throttle bores. Satisfactory jetting for most running conditions is #72 jets in both primary and secondaries. If richer or leaner mixture is desired, change all jets up or down in size. If necessary, the 600 Holley from earlier model solid-lifter cam 327's can be used. Jetting should be similar to production for 327 model. Connect secondaries to operate mechanically by putting a small bolt in the secondary return quadrant on left side of carburetor if mechanical secondaries are desired. A vacuum-eliminator kit is available. (See parts testing)

The ultimate all-around street-strip carburetion setup is a dyno-jetted Holley 950 cfm three-barrel mounted on an Edelbrock high-riser manifold designed primarily for the three-barrel. The three-barrel should not be run out of the box, as it must be jetted for your particular installation. A vacuum-eliminator (secondary) kit should also be installed to insure positive secondary throttle operation (for strip operation where 5000 rpm and higher starts will be made).

Fuel Pump

If possible, use an electric fuel pump to boost the engine mechanical fuel pump. The 1963-65 Corvette high performance fuel pump is the most satisfactory Chevrolet product for high performance usage.

The electric fuel pump to use is the M/P *Super-Pumper*, which delivers 75 gallons of fuel per hour and has a built-in pressure regulator. It's actually two electric pumps with a common regulator. It should be mounted at the gas tank for maximum efficiency.

Flywheel and Clutch

Optionally available from Chevrolet is a 15-pound modular from flywheel #3866735 and heavy duty 10.5-inch clutch #3886066 (cover) and #3886059 (clutch disc). This flywheel and clutch are presently released for the 427-cubic-inch L-88 aluminum head engine so are more than adequate for 302 usage.

Because of the high-rev potential of the small-block Chevrolet motor, it's *highly recommended* that an explosion-proof Schiefer Aluminum clutch, pressure plate and disc be installed in place of the stock HD parts. It's also a must to install a good, *NHRA*-approved scattershield such as the Lakewood unit, when going racing.