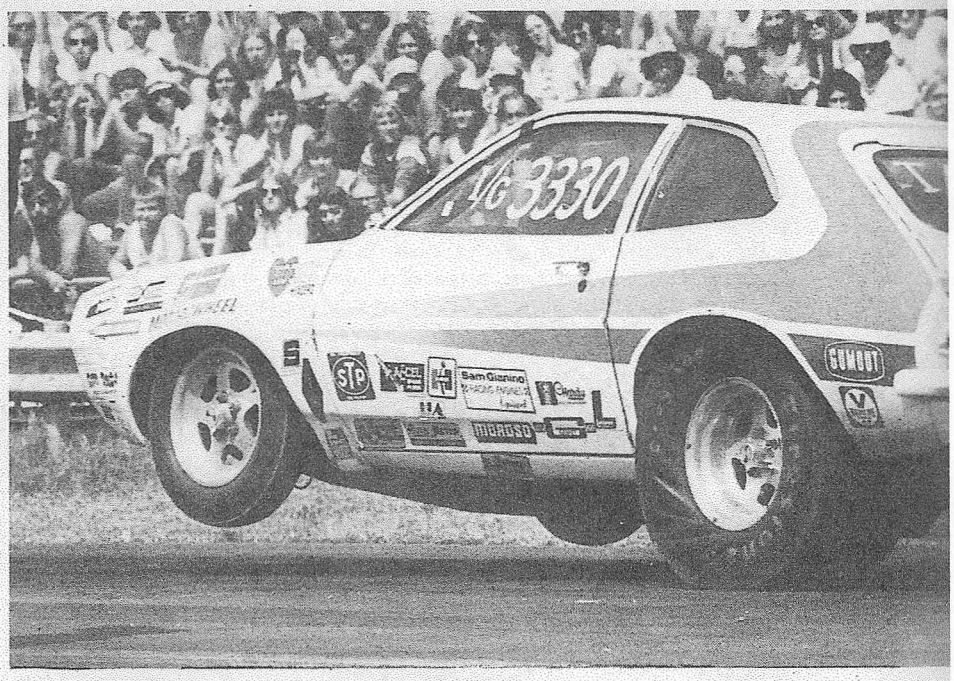
HOW TO BUILD A 500 HP SIX-CYLINDER FORD

By Leonard Emanuelson



Bruce Sizemore estimates that his six-cylinder Ford is putting out in excess of 500 hp, and considering the win record of his I/G Pinto, who are we to argue?

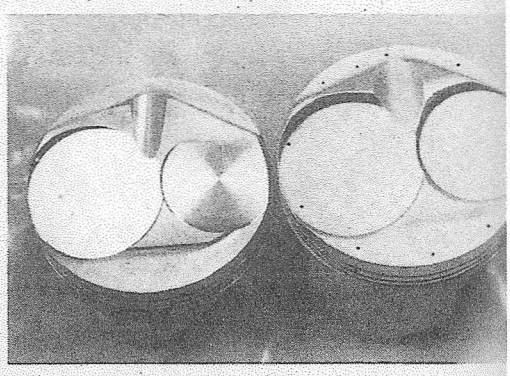
"The Index System is a method of handicapping race cars based upon their calculated performance potentials rather than constantly changing National records." — NHRA's National Dragster. NHRA uses the Index System to determine how much of a head start a slower car should get when racing a higher class car. Logically, the higher class car has a lower index factor because it would have a quicker ET than a car lower in that class. This logical sequence holds true almost entirely through the Index System chart with one blaring exception. An I/Gas competitor must run against a 9.90 factor while a higher classed H/Gas competitor has been assigned a 10.90 factor, a full second slower!

The person responsible for messing up the system is Bruce Sizemore, Farmington Hills, Michigan. Bruce, who was once involved with the Ford high-performance program, is now in Ford Motor Company's car market research department. For the past few years he has been giving everyone fits in Modified Eliminator with his six-cylinder Ford-powered race cars. His I/Gas Pinto is so quick that he even has to give the H, G, F and E/Gassers a head start, not to mention a number of Modified Production classes which by rights should be quicker. But Bruce didn't sit around and feel persecuted; instead, he tuned up the old six and became the '75 NHRA Modified World Champion.

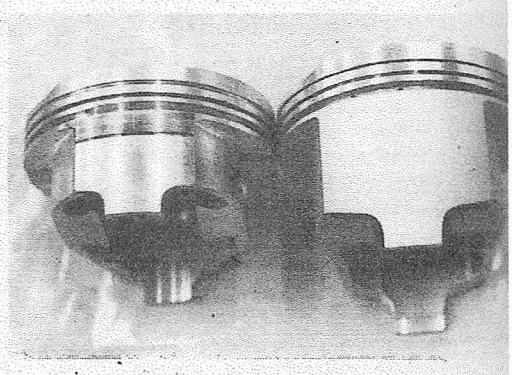
Many readers remember Bruce's '71 Maverick H/MP car, aptly named "Preparation H," which held the national record. Except for the engine it remained very similar to a '71 Maverick, whereas Bruce's present I/Gasser, a '74 Pinto, is a race car from the ground up. Essentially it is a Don Hardy Pro Stock Pinto with the substitution of some rectangular tubing in the chassis to make it legal for Modified Eliminator. It uses a ladder bar rear suspension which is less complicated than the four-link system. Total weight is 2280 lbs. due to acid-dipped doors, plexiglass windows and fiberglass components from Anderson Industries. The hood and fenders, which are completely removable in about 30 seconds, are held on by Dzus buttons. Evidentally there is enough weight over the rear wheels because the large hatchback is also glass. When we visited Bruce, he was in the process of installing a new pair of doors for the '76 season because the acid dipper got a little carried away and the old ones were held on the car with racer tape!

The rear end is also strictly Pro Stock equipment. It is a nine-inch Ford unit with Strange Engineering 33-spline axles and spool. The carrier has been beefed up with Lenco bearing caps and a Gapp and Roush load bolt which keeps the ring gear from deflecting away from the pinion gear. Schiefer 5.14 or 5.43 Pro Series gears are used, depending upon the track situation. This stubby rear end mounts 15x12-inch Motor Wheel Fly style wheels with 14x31.5-inch Firestone number nine compound slicks.

With so many Pro Stock titles to its credit, there is no denying that the Boss 351C is one of the best power producers around. Sizemore undertook the task of building essentially a six-cylinder version of a Boss 351C using a basic Ford '65-'76 300-cubic-inch six-cylinder engine. As can be imagined, much of the engine is hand-fabricated, but with the exception of the hybrid cylinder head, the engine is



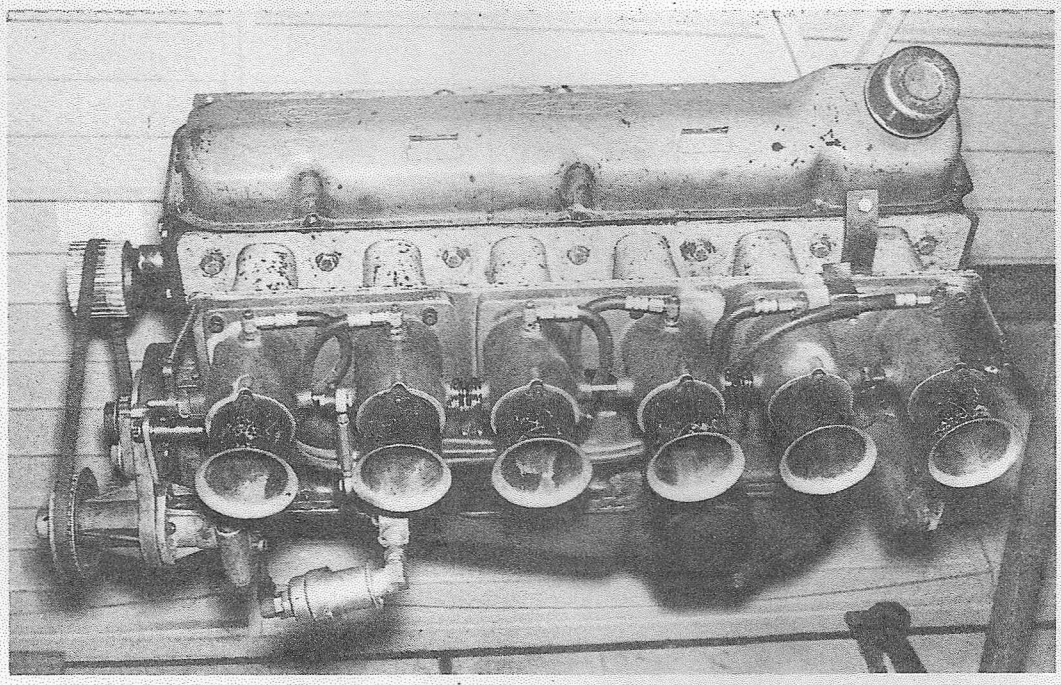
Internally Sizemore's six is really a 351C engine due to the Brooks 351C pistons he uses. Finished piston on right has recontoured dome, plunged valve reliefs and .043-inch gas ports. Piston on left is what you get from BRC.

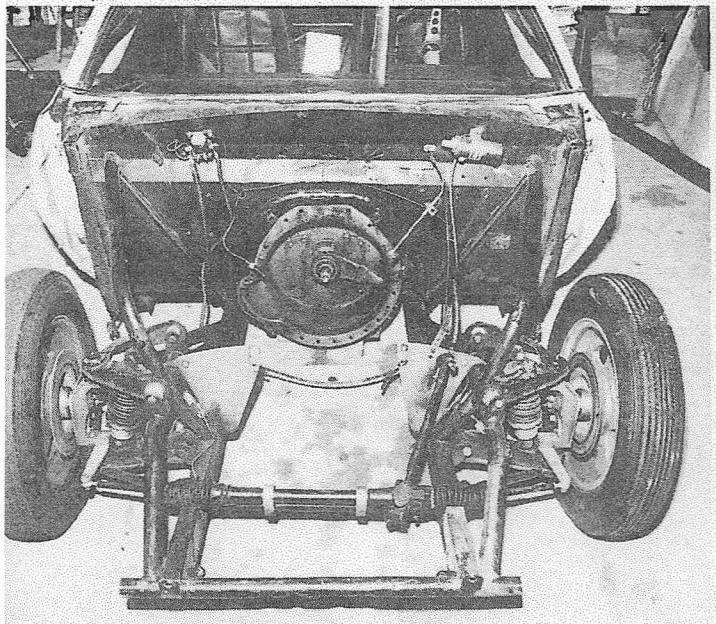


Brooks makes two different skirt designs for the 351C Pro Stock piston. Sizemore has experienced cylinder wall failure with the narrow design (left). Cylinder wall life is good with the wider skirt piston (right).

Bruce Sizemore's six-cylinder I/G '74 Pinto is hard to tell from a Pro Stocker. It has run consistently in the high-nines with a best of 9.71. The powerplant is basically a 300-cubic-inch Ford six.

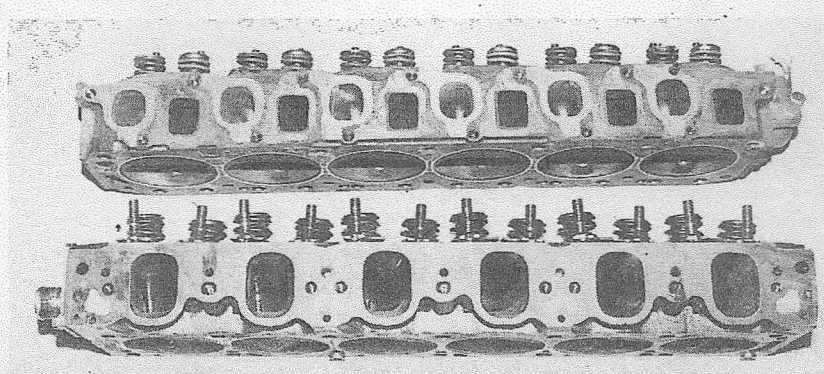
Bruce had to hand-fabricate much of the speed equipment for his six-cylinder, including the Hilborn fuel injection system. The intake manifold is made out of steel; the injectors are from a Ford SOHC or Tunnel Port engine. They feature 2-7/16-inch butterflies and homemade linkage. Valve cover is made out of sections from 351C valve covers.



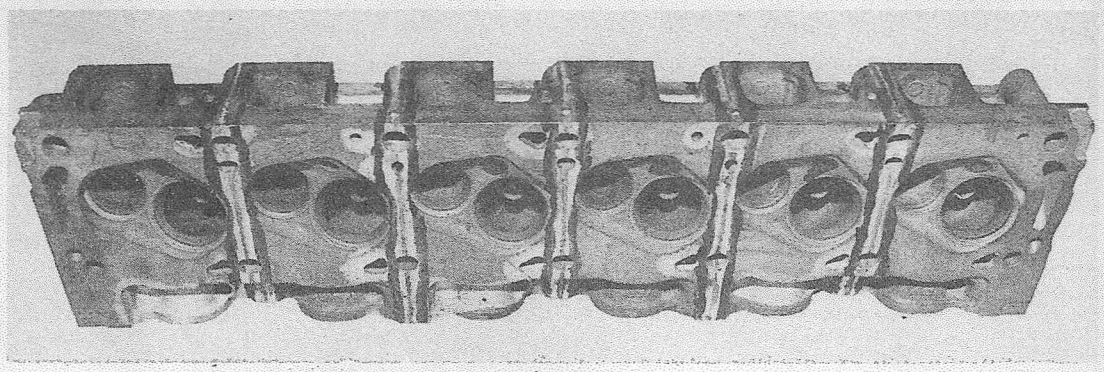


The Anderson Industries fiberglass front end removes in seconds, making engine maintenance easier. Pinto is a duplicate of a Don Hardy Pro Stocker.

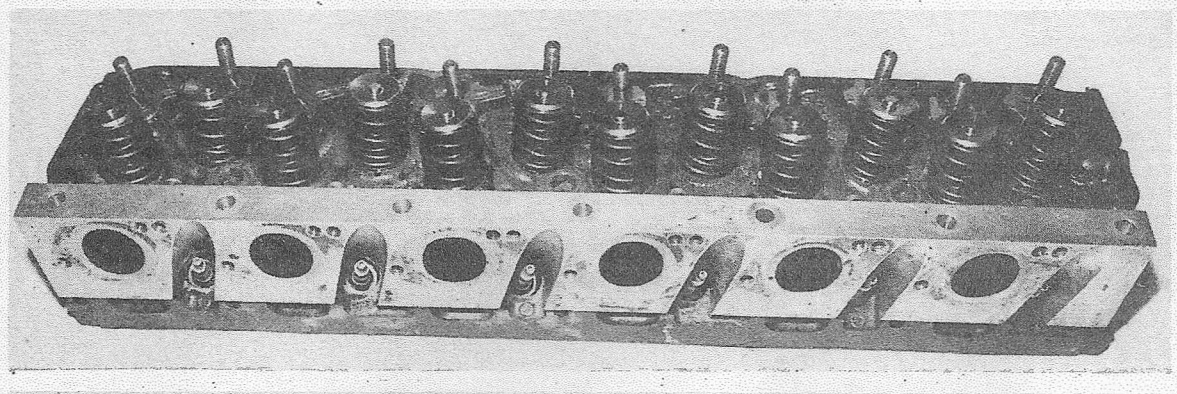
Sizemore had an unfortunate experience **when the Pinto was just finished. He** had a brake failure at **the '74 POP ROD Championships** and ended up rolling **over in the sand pit and catching on fire.** Car was taken back **to Don Hardy's for repair and was ready** for the rest of the **season.**



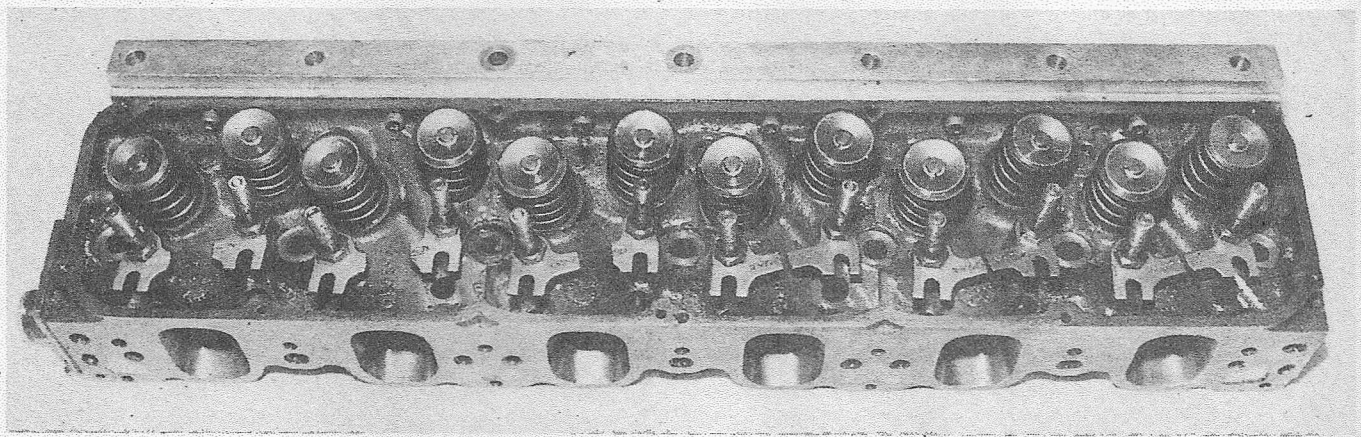
Here is the reason that your six-cylinder won't run in the nines and Bruce's does. Stock Ford 300 cylinder head is on top with both intake and exhaust ports on the same side. The head on the bottom, referred to by NHRA as a "hybrid head," is made up of 351C head sections. Head is constructed and ported by C.J. Batten of Romulus, Michigan.



Trick cylinder head is made up of six pieces of 351C cylinder head cut out of three V-8 heads. They are furnace-brazed together as shown here. New head has the same head bolt pattern and cooling passages as the original six-cylinder.



Typical of all Ford Pro Stock heads, C.J. Batten has modified Sizemore's cylinder head for raised exhaust ports with an aluminum section added to the exhaust side of the head.

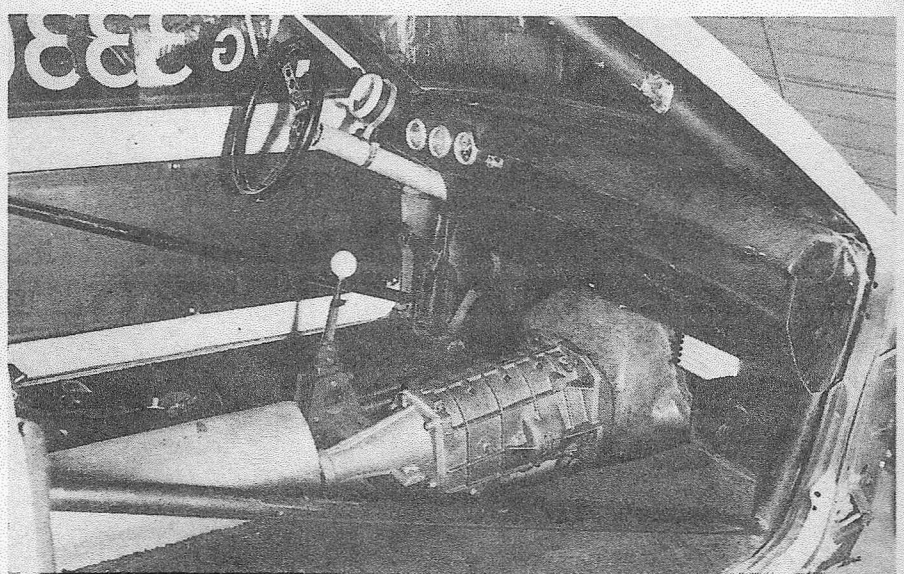


Guideplates are 351C units split in half so that they can be used to align the push rod and rocker arm with the valve tip. Once aligned, the rocker arm stud can be tightened down.

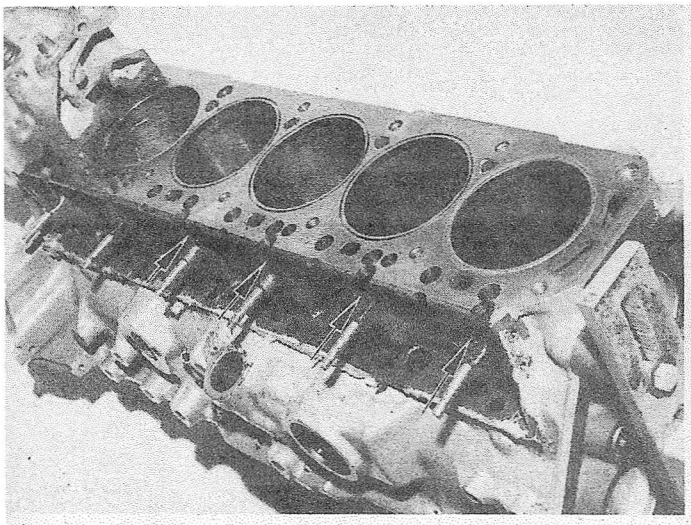
very much a basic Ford six.

The cylinder head is the handiwork of C.J. Batten of Romulus, Michigan. It is furnace-brazed together out of six sections cut out of three 351C cylinder heads. The finished head miraculously ends up with the six-cylinder head bolt pattern and cooling passages. C.J. then mills off the exhaust side of the head and installs the aluminum high exhaust port plate made by LOC Performance in Taylor, Michigan. The raised exhaust port greatly improves the 351C style head.

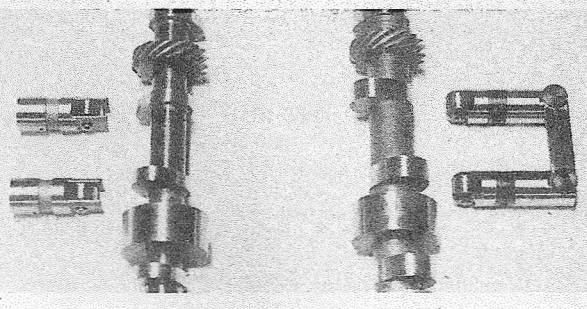
Batten gives the head a full porting job and installs 2.19-inch Ford titanium intake valves and Ford 1.71 hollow stem exhausts, along with Gapp and Roush triple valve springs and Trick Titanium retainers. Then the cylinder head is ready to be bolted to the engine and



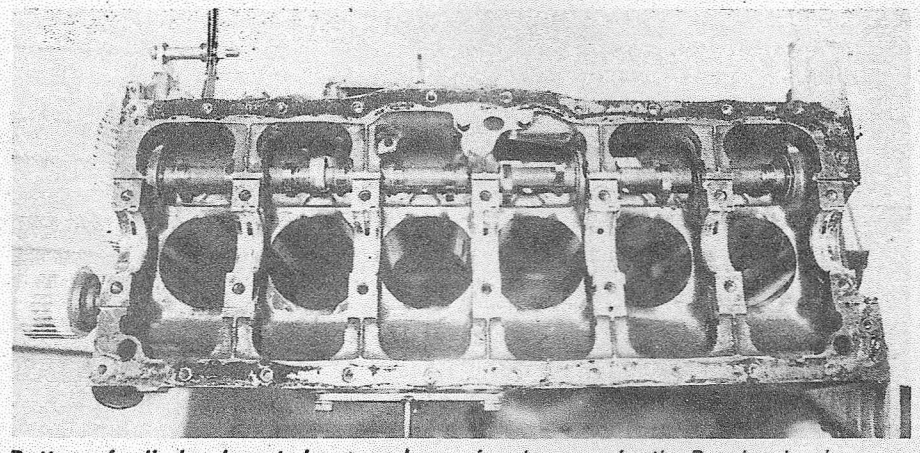
As with most Modified Eliminator cars, Sizemore's Pinto is now equipped with a Doug Nash five-speed (3.05 first gear) and Hurst Super/Shifter. Barely visible under the dash is ACCEL BEI yellow box. Dash is fitted with Auto Meter gauges and tach.



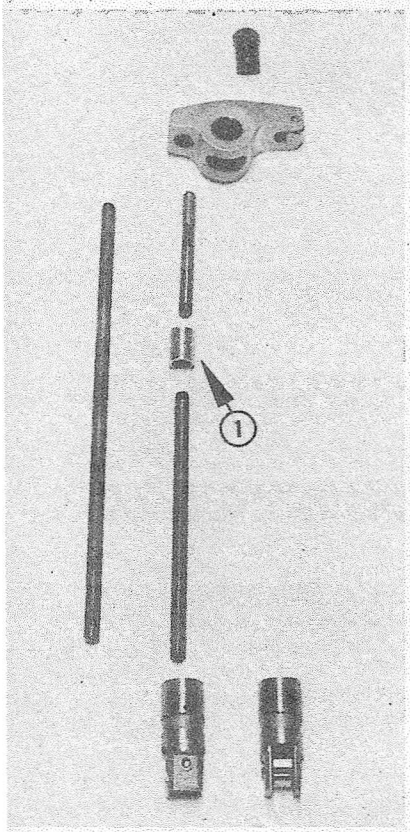
Because of the design of the Ford six engine block, Sizemore hasn't been able to use the link-type roller lifters (right) and thicker camshaft. Instead he has been using the Racer Brown straddle-type lifter which requires a skinny undercut cam for lifter clearance. With the long six-cylinder cam, there is a possibility of twist and erratic cam timing.

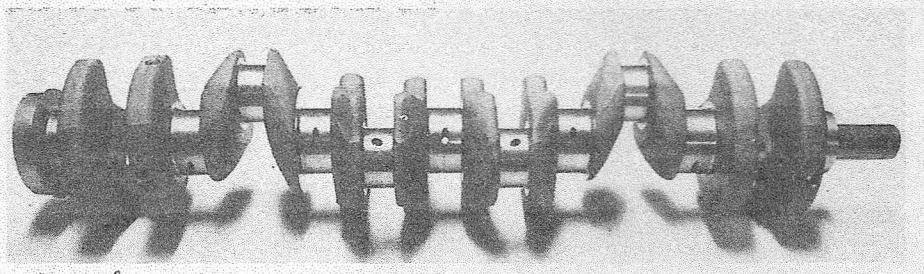


is dummy cylinder block is junk cause of gapping hole in cylinder all. It illustrates the .062-inch O-ring ooves and push rod holes that are cut t into notches for the wider Boss ad (arrows).



Bottom of cylinders have to be ground away for clearance for the Brooks aluminum rods. Stock bottom end is good for the 500 hp and 9000 rpm.

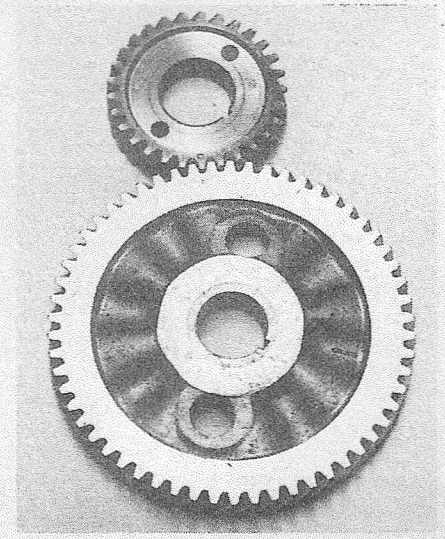




Race-ready crankshaft has been prepped by Moldex Tool, Dearborn, Michigan. It has been destroked by offset-grinding to a smaller crankpin diameter. Crank has also been cross-drilled and oil holes chamfered in the direction of crank rotation.

sing the 351-style head on the x-cylinder required a two-piece push d assembly instead of a single push d. Small aluminum sleeve (arrow) les up and down in the push rod hole the cylinder head and has sockets on ch end for the push rods. The rest of e valvetrain is made up of Crane 1.73 ller rocker arms and Racer Brown raddle-type roller lifters.

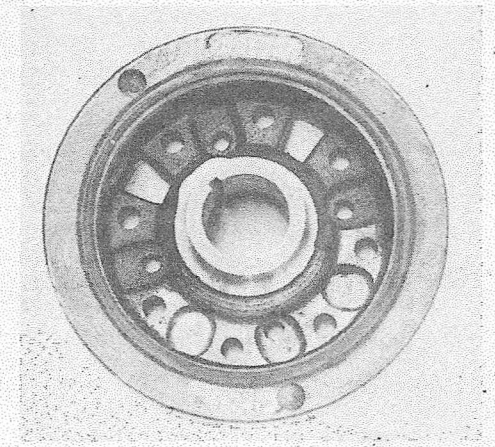
One of the real weak links in the Ford six-cylinder engine is the stock timing gears. They are replaced with these Cloyes gears that have much stronger teeth.



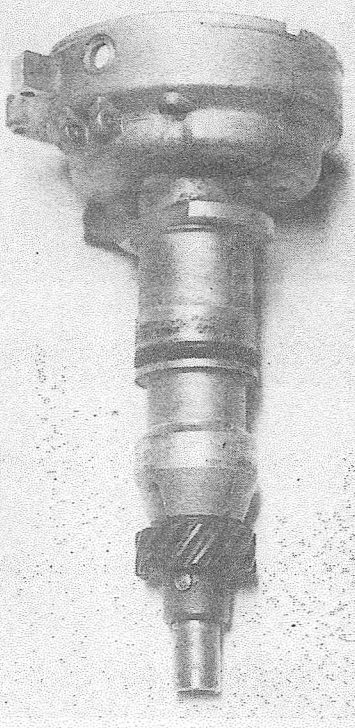
essure-tested for leaks where it is rnace-brazed together, and there ually are plenty. The leaks are sealed th epoxy because it would be disaster get a torch anywhere near the intri-tely sectioned head. If you wonder why

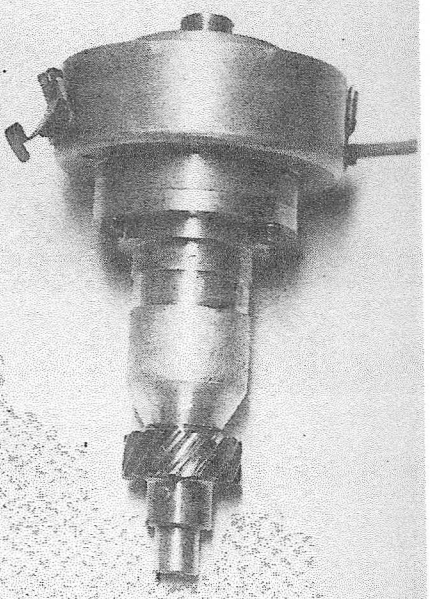
Bruce grits his teeth everytime he starts the engine, it's because the "brother-in-law" price for this piece is over $2000 and you need a spare!

Bruce locates a 240 or 300-cubic-inch block (they are the same) which will clean up with a .030-inch overbore. The difference between the 240 and 300-inch engines is that the 240 has a 3.12-inch stroke cast crank and the 300 has a 3.98-inch stroke with both cast and forged cranks. Incidentally, the rumors that you

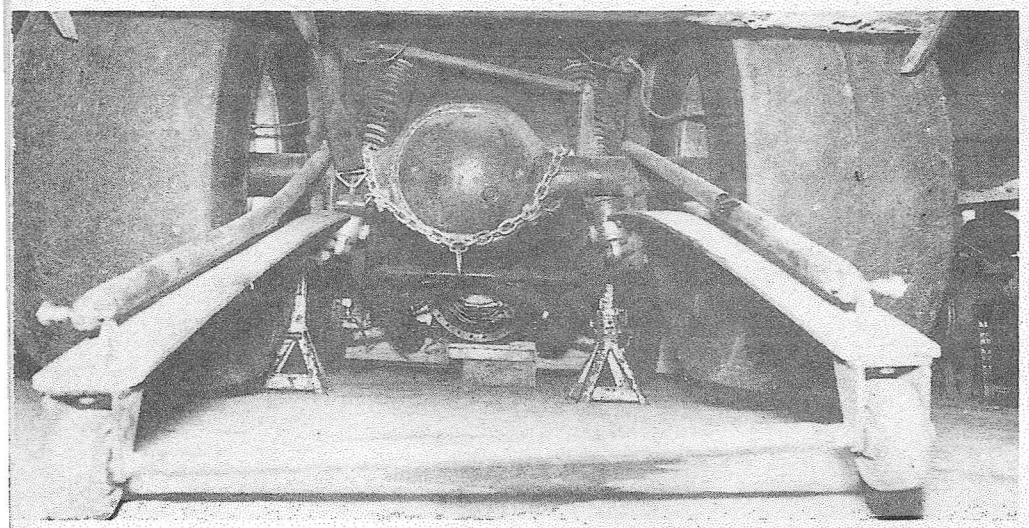


With crankshaft longevity being at a minimum, Bruce adapts the large 351C harmonic balancer by shortening the hub and machining the seal surface further into the balancer. Also, the balancer is used to externally balance the 351C, so it must be neutral-balanced for the six-cylinder.

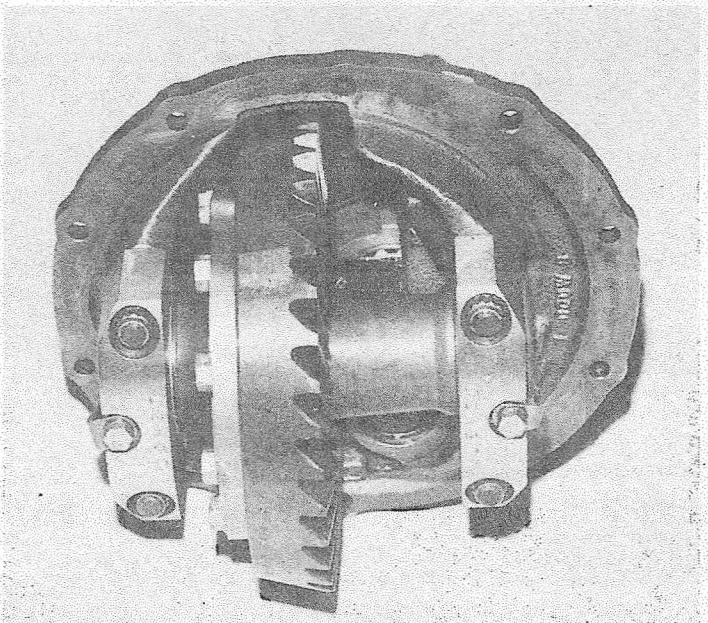




Sizemore hand-built the ACCEL BEI distributor shown on the right in comparison with the stock six-cylinder distributor. Housing was machined out of aluminum billet by LOC Performance and uses 351 BEI components with a six-cylinder shutter.



Sizemore's Pinto is equipped with simple ladder bar rear suspension and adjustable Koni coil-over shocks. Car launches so hard that wheelie bars are a must.



Nine-inch Ford rear end is beefed up with Strange Engineering spool, Schiefer Pro Series 5.14 gears, Lenco caps and Gapp and Roush load bolt. When coupled with the Strange 31-spline axles, unit has been indestructible.

have heard that sixes are hard on crankshafts are all true. Sizemore was fortunate enough to locate a couple of 3.98-inch stroke, raw crank forgings a few years back; they are no longer available. The advantage to having a raw forging is that Bruce can give it to Moldex Tool in Dearborn, Michigan, and they can precision-grind it with .100-inch radii in the fillets, which resists cracking. However, the production forged crank, C6TE-G, has been used quite successfully. With Bruce running the engine over 9000 rpm, the crank has a life span of 10-50 runs before it cracks at the rear bearing journal fillet. A telltale sign that the crank has given up is that it will vibrate all of the bolts loose on the outside of the engine.

Even the production cranks are sent to Moldex for a number of modifications. The rod journal size is offset-ground down from 2.123-inch to 2.100 which reduces the stroke from 3.98 to 3.97; with the .030-inch overbore, this gives

303 cubic inches. At the same time Moldex cross-drills the crank and Tufftrides it. They have a unique way of chamfering the leading edge of the oil holes which provides better oiling and bearing life. Brooks aluminum rods are actually early 392 Hemi models with the small-block Chevy size 2.100 bearing bore; the pin hole is drilled 6.615 inches away. The stock Ford rod is 6.800 inches long. Because of the mass of these rods, the bottom of the cylinder block must be ground considerably for clearance.

The pistons are Brooks Pro Stock 351 forgings with the pin moved up to accommodate the longer stroke. Brooks makes two different skirt designs for this piston, with a narrow or wide skirt. After some trouble with breaking cylinder walls, Bruce sticks with the wider skirt that distributes the load better. The domes are contoured after the valve notches have been established, and the top ring is gas-ported with 10 holes, .043-inch in diameter. The pistons are surrounded with Speed-Pro rings, starting at the top with a .043-inch moly with .012-inch end gap and a 1/16 cast iron second ring with .010 end gap. The oil ring is a three-piece low tension 1/8-inch-wide model which provides room for the higher piston pin location.

Very little is done to the engine block except truing the deck surface with the crankshaft centerline. The deck height is set at .025-inch, which gives a total deck of .059-inch with the .034-inch compresed thickness Mc Cord head gasket. Bruce selects a used block that doesn't require align boring, so that step is eliminated. Because the Boss cylinder head is wider than stock, the original push rod holes in the block must be cut out into notches (see photos). Finally the block is O-ringed for .062-inch diameter wire.

The assembly is quite straightforward, with .003-inch clearance on both the main and rod bearings, which are TRW CL-77s. The stock two-bolt main bearing caps keep the crank firmly in place with no girdle or four-bolt conversions (which says a lot for the stock bottom end). The stock timing gears are really a weak point and are replaced with Cloyes gears. The oil system is beefed up by adding a spacer to the stock pump and installing the 351 rotors, which increases the capacity by 20 percent. Bruce sets the pump relief spring for 75 psi with a warm engine. The oil pan is well baffled around the pickup screen to keep oil available on acceleration and deceleration.

Much of the hassle of using the 351 head on the six-cylinder was in connecting the camshaft to the valve. With the wider head the push rods had to angle out away from the block, then angle in toward the head. Naturally this is impossible with a one-piece straight push rod. A very important member of Sizemore's part-time crew is his father-in-law, Johnny "Pops" Parmentier from Palm Harbor, Florida. "Pops" fabricated a two-piece push rod arrangement which is joined by an aluminum sleeve that rides up and down in the push rod hole in the cylinder head. This sleeve has sockets on both ends for the long (bottom) push rod and short (top) push rod. It solves the angularity problem and makes for quite a stiff valve train. Ford 351 guideplates are cut to make individual guideplates. This way the push rod and rocker can be aligned before the rocker stud is tightened down.

Another valve train problem with this hybrid six is that there isn't room for roller lifters that are linked together, such as the Crane style. Bruce is presently using the Racer Brown straddle type roller lifter which keeps itself from rotating on the cam. With the net .700-inch lift cam (270/280 degrees duration at .050-inch lift), it makes for a mighty skinny cam with the straddle-type lifters. Bruce feels that he is losing something due to cam twist with the long six-cylinder cam. He will adapt the link-type lifters to the block in the near future so that he can use a thicker camshaft. Sizemore uses Crane 1.73 roller rocker arms.

As with the cylinder head, the induction system had to be handmade. A set of Hilborn 2-7/16-inch diameter injectors from a Ford SOHC or Ford Tunnel Port engine were cut into pairs, then Bruce fabricated a steel intake manifold for them. The headers were made by Hooker and feature 2¼x34-inch primary pipes and 3½x9-inch collectors. Sizemore hand-built an ACCEL BEI ignition system out of a 351C BEI. It is equipped with a six-cylinder shutter and a new housing machined out of aluminum billet by LOC Performance.

When the little I/Gas Pinto leaves the starting line, it almost looks like it is going to break in half. Sizemore uses Schiefer clutch components consisting of an 11-inch Long-style pressure plate and 11-inch sprung hub disc. The flywheel is either a 30-lb. steel or 12-lb. aluminum wheel, depending again upon track conditions. Bruce has just switched from a Doug Nash-equipped Ford Toploader 3.05 four-speed to a Nash 3.05 five-speed. He feels that there is more to be gained with the five-speed as soon as he can dial some more horsepower into a narrower rpm band.

That's what it takes to produce those unbelievable 9.71-second runs with a six-cylinder engine. It has taken Bruce and his crew of Willie Baker, "Pops" Parmentier and Bruce's wife Joann a lot of work to make it go. Even though NHRA has heavily factored the car for '76, watch for Bruce to be at the top once again when the smoke clears. This six doesn't know when to quit!