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the A-148 NASCAR Hemi Motor

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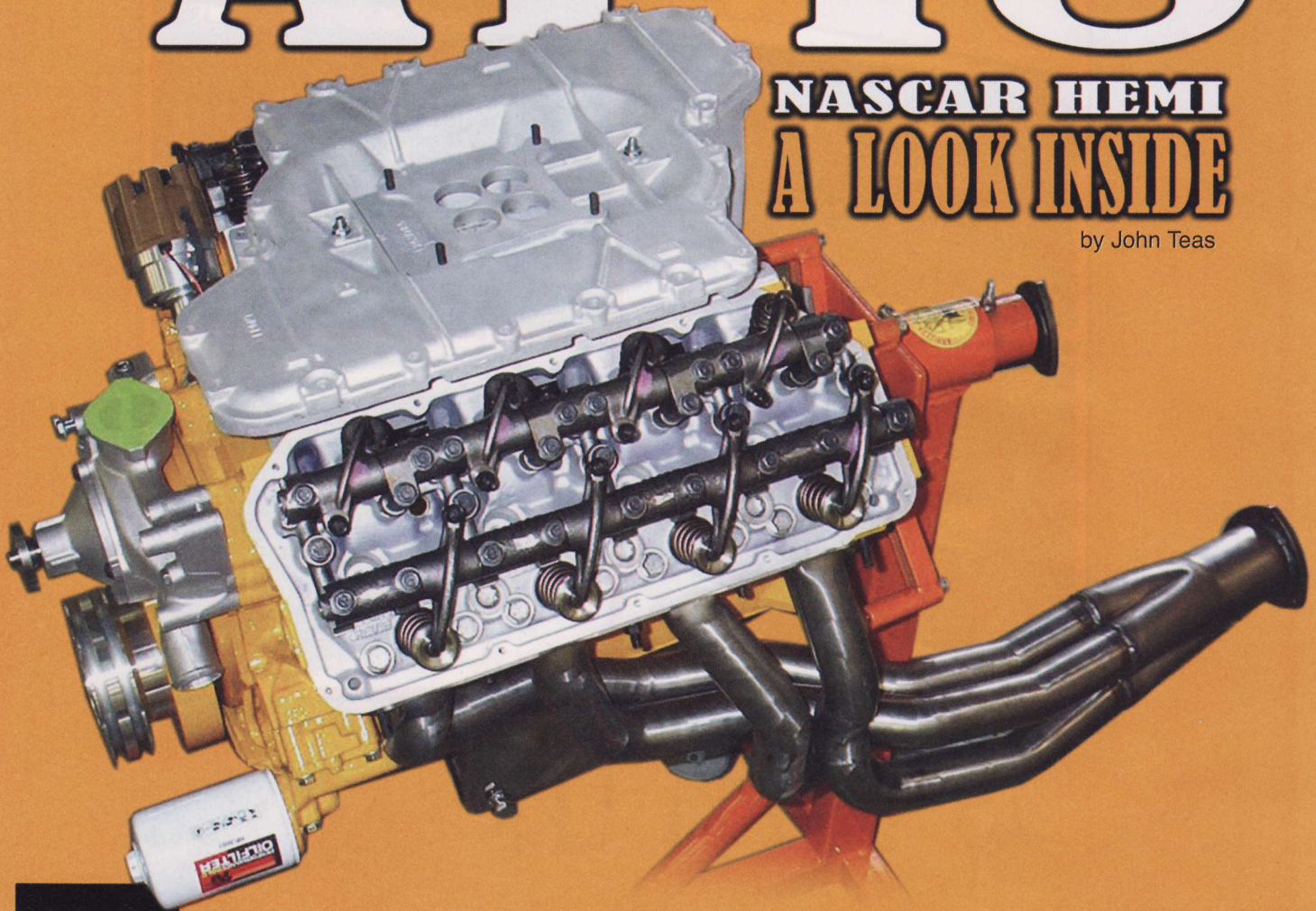
August 2009

PART 2

A148

NASCAR HEMI A LOOK INSIDE

by John Teas



This has to be one of the coolest jobs a car guy can have! The phone rings; an e-mail shows up, and what follows is cool stuff to learn and write about. In the April issue my colleague, Randy Holden, did a piece on John Arruzza's totally trick A148 Hemi that he had dropped into a 1966 Plymouth. What followed was everyone wanted to know more about this mystery motor, so this month we'll delve deep inside the power plant to show what made it so unique.

As with any good story, there's always a shroud of mystery. The story of this almost "phantom muscle" is no exception. So, with the help of John Arruzza, from Arruzza Performance, let's unravel the mystery of the A148

NASCAR Hemi engine.

It all started back in 1963. While Chrysler was a dominant player in drag racing with their awesome Max Wedge engines, they were having a lot of trouble going around in circles in NASCAR racing. Chrysler was by far the smallest of the big three, and they wanted to slay the big NASCAR dragon - Ford. If Ford wasn't winning, Pontiac was.

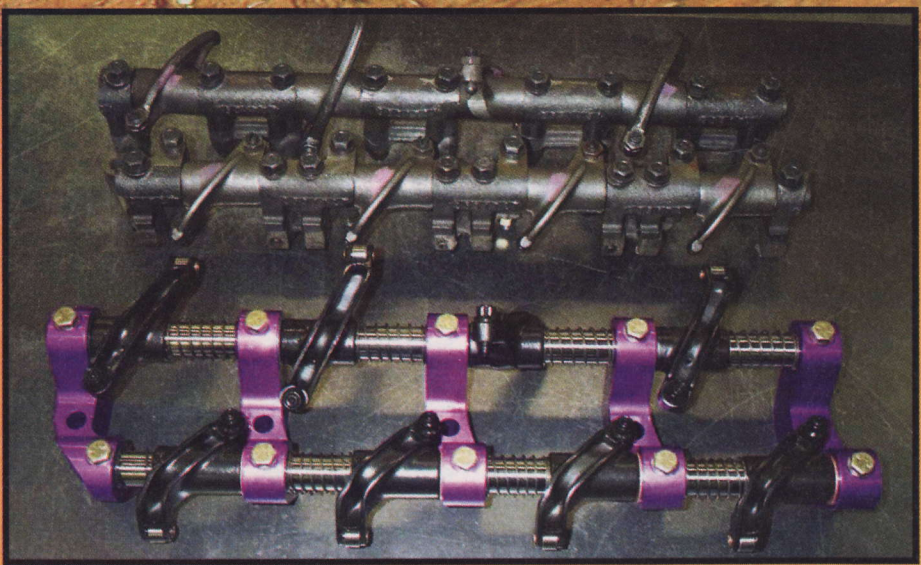
Tom Hoover and an incredibly talented group of engineers were given the task of winning races. The engine they designed and built to do just that is still revered as the "king" of muscle car engines; the 426 Hemi. The Dodge boys took it to Daytona in 1964 and changed the relationship of Chrysler and NASCAR forever.

Ford whined and cried "foul" as

NASCAR's Bill France held Ford's hand and said, "Don't worry, it will be okay." Needless to say, the squeaky wheel got greased, and Chrysler dropped out of NASCAR for the 1965 season in protest. The ruling committee deemed the 426 Hemi was a purpose-built engine, not a "stock production" engine. And so began Chrysler's stormy relationship with NASCAR.

Richard Petty went drag racing for the 1965 season to show his displeasure with NASCAR's November 1964 decision that banned the A864 Hemi engine from racing. Petty's 1965 Barracuda wore the name "Outlawed" down both sides in defiance.

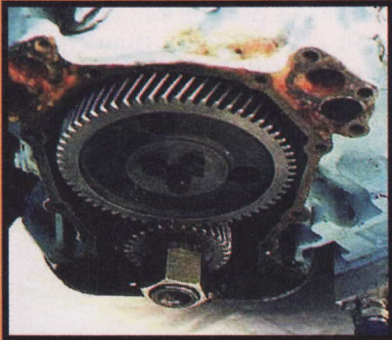
Chrysler had had enough. Chrysler was going to slay the dragon once and for all. The 426 was going nationwide. Any "average Joe" with a



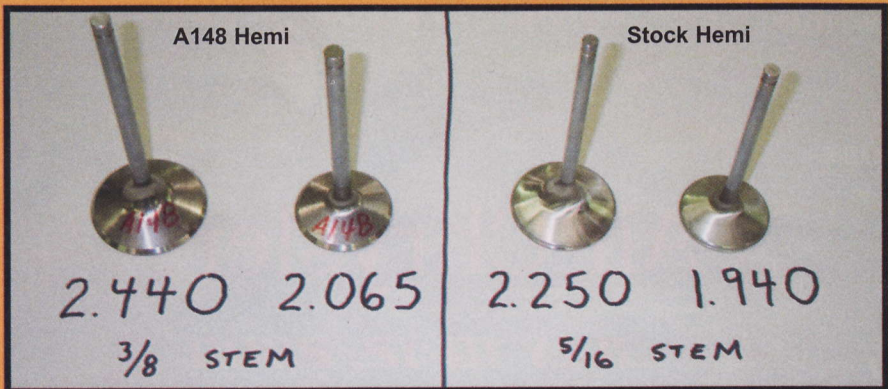
The 426 has ten bolts per head to retain the rocker shafts, while the A148 (top) has twenty-one bolts! Now you see why this stuff was so hard to find. The purpose of this multi-piece rocker stand arrangement makes it possible to remove all, or just one rocker shaft, and/or rocker arm, without touching the head bolts.



The piston dome configuration on the A148 is a beautiful design; no sharp edges, and a perfect complete radius dome with tulip valve reliefs. For a lighter and stronger rotating assembly, Ross Custom forged pistons with 10.5:1 compression and taper-wall steel piston pins sit atop Manley 7.100 I-beam connecting rods. This is all swung by a Callies 4.5" stroker crank, giving this A148 Hemi a total 517 cubic inches.



Rotate a camshaft backward? Chrysler actually tested double gear drives which did just that!

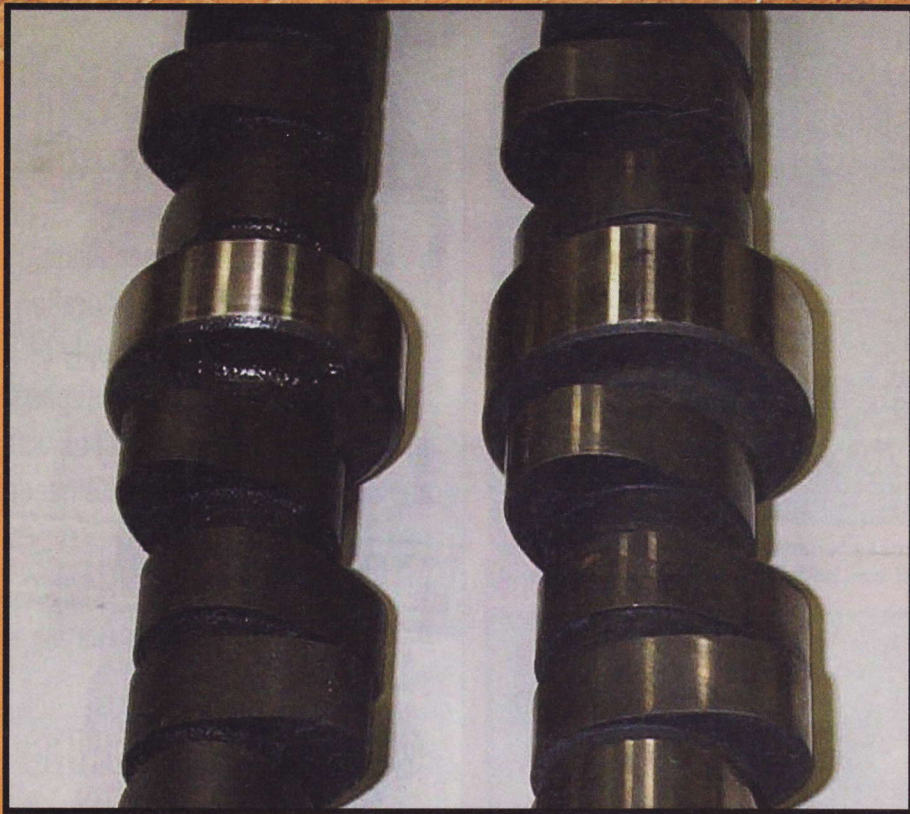


The A148 valves are a massive 3/8" diameter, and a full inch longer in length. They were sodium-filled hollow valves, and very lightweight considering their size.

current pay stub could go down to their local dealership and buy his own 1966 Street Hemi production car. Ford had a lot more crying to come.

The Hemi was allowed to race again, with engine size rulings of 396 and 405 cubic inches (Petty won

four races with the 404" A117 Hemi). Now the 426 Hemi complied within the "Ford 429" cubic inch rules, and became a merciless killer. Think of the movie "First Blood" and the 426 Hemi was the "Rambo" of engines. It took



Note the drastic cam lobes Racer Brown used (right), and the massive cam bearing journals! Now that you know how to spot this rare part, see if you can find one.

on all comers and summarily put them in their place.

Ford couldn't build a conventional push rod engine that would run down the mighty 426 Hemi. Then, Ford's own whining bit them when they tried to get a single overhead cam hemispherical engine passed by NASCAR, but it wasn't available in a street car, so it wasn't allowed. The "Cammer" that Ford developed was an awesome engine to say the least, and worthy of respect.

Rumors were everywhere; some of them more than rumors. Oldsmobile built a 455" rocket "Hemi," very similar to the 426, but they were too slow in development work. By the time the 455 was ready, Uncle Sam and the Insurance Companies wrecked everything. Pontiac had even built a three-valve, single overhead cam head, with one massive intake valve and twin exhaust valves per cylinder, to be used on their 421 Super Duty motor. Chrysler built an overhead cam head too, and would have raced it if everyone else was going to. Bill France wouldn't

allow any of it.

Ford knew they needed a push rod-style Hemi of their own (sounds like you needed a Hemi to beat a Hemi). The Shotgun Boss 429 Ford was rumored and whispered about since late 1965. Chrysler wanted to remain dominant in stock car racing. They wanted the competition to eat their words of "Race on Sunday, sell on Monday."

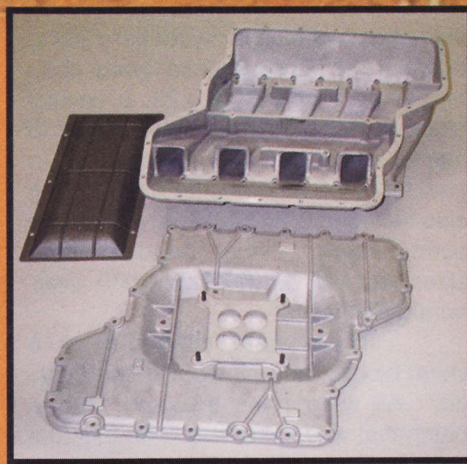
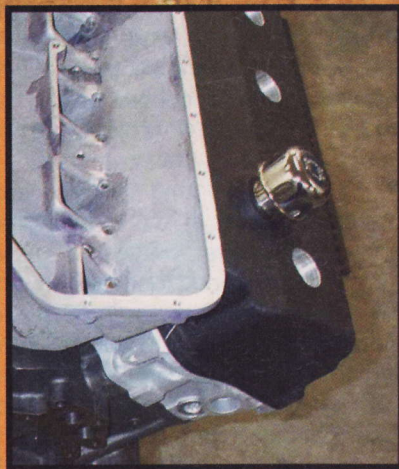
Chrysler prepared a secret engine development plan in December 1965. The main purpose for the A148 Hemi development was as a backup plan should Ford build a push rod Hemi and get it legal by building cars powered by it. Ford finally did it in 1969, with the advent of the Boss 429 Mustang.

According to John Arruzza, "The short block I obtained twenty years ago (from an ad in Hemmings around 1987) was 464 cubic inches and 13.5:1 compression. The piston dome configuration on the A148 is a beautiful design; no sharp edges, and a

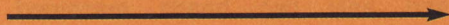
perfect complete radius dome with tulip valve reliefs. It's very much like today's most current and technical Hemi dome designs, except these are from 1966."

Initial testing on the A148 was for a short stroke, big bore combination so rpms could be utilized. A de-stroked

crankshaft, 3.558 inches, was used first in combination with overbores of .110 inch, then .120 inch; 4.360 and 4.370 bore sizes. The problem with the A148 Hemi was that it was making so much horsepower and turning some serious revs that the Hemi blocks from 1966



The A148 NASCAR-style Rambox bathtub intake is radically different than the typical version. A special heat shield was required under the intake to keep the incoming fuel mixture cool. The A148 Rambox Intake had to come off before the valve covers could be removed, since the intake is wider than a conventional NASCAR Hemi bathtub.



did not have the capacity for bore sizing that big. If Chrysler had been challenged by Ford's Boss 429, a special block casting would've been required to handle all of the A148's horsepower. To gain more information, the A148 testing also included 3.75 stroke and 4" stroke combinations, using standard bore sizes, as well as .060 and .070 over-bore dimensions.

There were only four A148 Hemi blocks, and all were dated 3-21-66. All were hand selected from a batch that was sonic tested for the best cylinder bores. The cylinder walls were coming apart from the punishment inflicted by the A148 combination, John's block was never fully assembled at Chrysler, and therefore, it survived to live again. The Hemi was once again outlawed by NASCAR before the A148 was to be summoned for duty.

Quite a few unique cylinder head designs were drawn up and some were even cast. One was a very conventional Hemi head, but with oval intake ports. Only six heads were cast and only two heads machined.

Through the spring and summer of 1966, the only variant still being developed was the A148, dubbed as the "Tall Port Hemi." The A148 project was getting results in more than one area.

The A148 had many unique features; many far ahead of their time. Chrysler's famous "battleship" valve spring was developed for the A148, and later became a staple among Chrysler Hemi racers for years to come. In an effort to gain more usable rpms, the A148 cylinder heads have a much thicker bulkhead across the top of the head to make the platform for the rocker gear stiffer and stable. The iron 64/5 K heads and A99O aluminum heads could, and would, crack across the top because of the twisting forces exerted by how the rocker gear assemblies were held in place.

Conventional 426 Hemi heads have five head bolts and five dowel pins to retain the rocker assemblies. The A148 has twice as many dowel pins. The 426 has ten bolts per head to retain the rocker shafts, while the A148 has twenty-one bolts per head. An impor-

tant feature is that the rocker shaft hold down bolts (all forty-two of them) don't just merely go into the stands, they go all the way through the stands and into the heads, making the rocker gear part of the head and increasing the heads' strength. The rocker stands on the A148 are beautifully engineered and amazingly cost effective to manufacture. While the rocker arms themselves are the same as on the parent 426, the stands consist of machined steel platforms - five per head.

The shaft enclosures are castings, one intake shaft casting and one exhaust shaft casting; again, one part produced for each task with the end pieces trimmed. So, you basically have three rocker gear stand parts. The shafts are completely contained inside the stands which make for an incredibly stable and durable rocker arrangement, designed for five hundred miles of 9,500 to 10,000 rpms. The purpose of this multi-piece rocker stand arrangement makes it possible to remove all, or just one, rocker shaft and/or rocker arm, without touching the head bolts.

So, changing a single valve spring, or rocker arm, or rocker shaft, is quick and easy, and you wouldn't even have to readjust the valves.

The A148 valves are massive 3/8" stem diameter, and a full inch longer in length. They were sodium filled hollow valves and very lightweight considering their size; 2.440" intakes and 2.060" exhausts. To gain the much-needed valve-to-valve clearance, the valves have been stood up, the intake valve by three degrees and the exhaust valves by five degrees. The result is a combustion chamber with a relief contour for the exhaust valve seat like a Stage Five Engineering Millennium head. The heads were cast in iron and in aluminum. John purchased his aluminum heads from the estate of drag racer John Hagan, who had these heads, but couldn't obtain the rocker gear.

The camshaft configuration was light years ahead of its 1966 counterparts. It weighs four pounds more than a normal 426 Hemi cam. Cam flex was understood by Tom Hoover thirty-five years before anyone else even knew what it was. The cams tested in the A148 program were all billet Enderall material. The camshafts were made in two styles; rotating clockwise and counterclockwise. Chrysler did test double gear drives, which would rotate the cam backwards. The A148 cam rode on much larger journals and huge cam bearings; only the #5 bearing was stock (this is another way to identify an A148 block). The billet Enderall cam in the A148 is from Chrysler's original cam guru, Racer Brown. Enderall is a special cam material hard enough to do roller cams, but are also compatible to make flat tappet cams. The beauty of this material is it's hard all the way through, not just the skin, so the cam grinder can put any profile he wants on the core.

The port sizes of the A148 are staggering. The intake ports are 4.28 square inches; up from 3.51 inches. The exhaust ports are 3.825 square inches, up from 2.68 square inches. The ports are nicely contoured, turning up higher inside the head castings, making the forty-five degree seats further away from the turns. This is a very big advantage in port design (see flow numbers). The exhaust side of the heads has a unique bolt pattern,



requiring custom headers. Bob McCarthy made the custom header flanges on a water jet laser. Bob also made the aluminum 1/2" risers for the valve covers. The spacers were necessary because there are no valve covers available that will clear the A148 rocker gear.

Interestingly, before the valve covers could be removed, the A148 Rambox intake had to come off first. The intake is wider than a conventional NASCAR Hemi bathtub. Two-piece cast valve covers were in the works so valves could be adjusted and rocker gear replaced by only removing the outer half of the valve cover - they were never produced. The A148 Rambox bathtub intake is radically different than the typical 426 version. The runners are so much larger in volume, the runners actually run down into the valley of the engine block and then back up. A special heat shield was required under the intake to keep the incoming fuel mixture cool. The front and rear rails of the block prevent the runners for cylinders one and eight to go down then back up, so those two runners of the intake manifold are different than the other six.

The A148 Tall Port Hemi has remained a mystery. "It took me twenty years to round up all the parts and the correct history to put the one and only surviving A148s back on the road," says John. "It has the distinction of being the best of Chrysler's push rod style conventional Hemi engine variants. Only the four valve-per-cylinder dual overhead cam Hemi had more



The port sizes of the A148 are staggering! (shown on lower head) The intake ports are 4.28 square inches, up from 3.51 inches.

capability, and that engine never ran under its own power. But, if I had it here in my shop, it would be certain to get built and find its way into a car. I think maybe a fine 1964 Plymouth Sport Fury hardtop with a four-speed, yeah... that sounds about right."

The 426 was still a superior NASCAR engine, with durability and torque coming out of the turns being the biggest advantage over the Fords. The Boss 429, once sorted out, was a very good NASCAR engine. But, physics mastermind, Tom Hoover, and his masterful engineering staff at Chrysler, planned and executed the 426 Hemi so well that the implementation of the A148 was never needed. Thanks to John Arruzza, the A148 phantom Hemi remains a reality today. The A148 Tall Port Hemi shows that a lot of thinking was going on at Chrysler. ❖