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MiscRes: Magazine Articles

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"Fire Power", A Dual Plug Conversion Will Make Your Ironhead Run Cooler

TECH & HOW-TO

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HOW TO

FIRE POWER

A Dual Plug Conversion Will Make That Ironhead Run Cooler

Text and photos by Tom Hurd

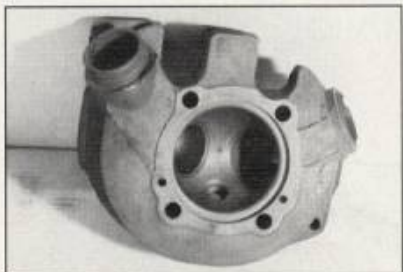
When someone who's been around high performance machines for a long time hears the term "hemi-head," what usually comes to mind is a tire-smoking, nitro-burning, Chrysler-powered dragster. Well, if you have an Ironhead Sportster you've got a hemi-headed machine, too.

What the term "hemi" refers to is the shape of the cylinder head's combustion chamber. Hemi simply means that the shape of the combustion chamber is hemispherical, or half of a sphere. Generally speaking, the hemi-head is a pretty good horsepower producer. However, one problem with the Harley-Davidson version is the location of the spark plug. The Chrysler heads have the spark plug at the top and almost center of the combustion chamber. Harleys have the plug low and off to the side. You see, there's a frame and fuel tank directly over the head which makes top and center placement of the spark plug impossible. But from a performance standpoint, this is a problem. To understand why, let's talk about what happens in the combustion chamber, omitting valve overlaps and other things not needed for this discussion.

On the intake stroke, with the intake valve open and the exhaust valve closed, the piston moves down in its cylinder creating a vacuum. This draws in a fuel/air charge from the carburetor through the intake manifold and intake valve, and into the cylinder. At about the bottom of the stroke, the intake valve closes. As the piston comes up, the dome of the piston compresses the fuel/air charge into the combustion chamber. When the piston approaches the top of its stroke, the spark plug fires and



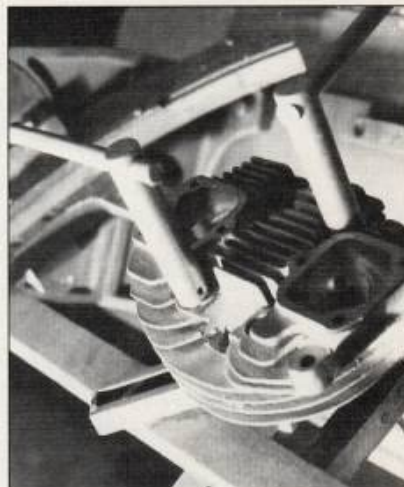
1 This is a stock iron head from an older Sportster with a stock, single spark plug. The arrow is pointing to where we will bore the new spark plug hole into the center rocker box bolt boss.



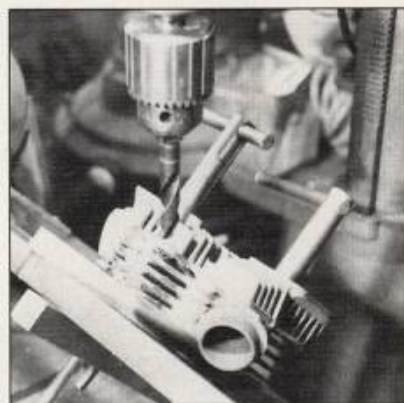
2 Here we are looking at the piston's side of the same head. You can see the hemispherical shape of the combustion chamber. One problem with a Harley-Davidson "hemi" head is that the dome of the piston gets in the way of flame travel during combustion. This is because the spark plug is low and off to the side instead of top and center in the chamber.



3 To dual plug the head, the first step is to set the table of the machine at a 47-degree angle to the head's head-to-cylinder gasket surface.



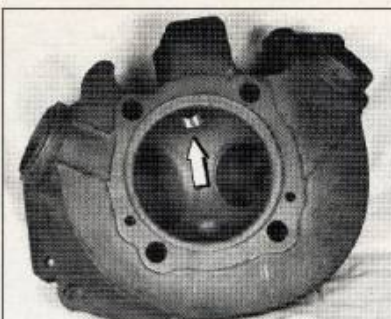
4 The stock Sportster head bolt holes go all the way through the head so they can be used to hold the head to the table of the machine.



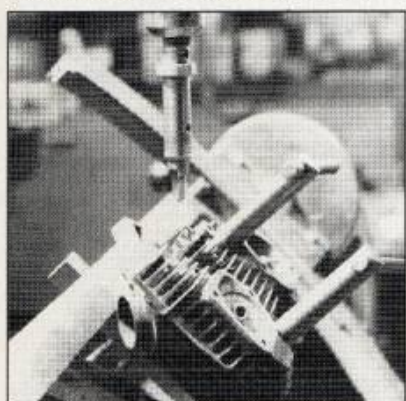
5 Once the head has been properly positioned on the table, the first pilot hole bored should be with a 1/4-inch bit. The hole must be drilled all the way through to the combustion chamber. The next step is to increase the size of the pilot hole to 7/16-inch. Again this hole is bored all the way through.



6 A 7/8-inch milling tool is then used to bore the clearance hole that will accommodate the spark plug socket. This hole must be bored until a flat surface is obtained at the bottom of the hole in the solid, non-finned part of the head.



9 This is the final product, an old Sportster head improved with the installation of a second spark plug hole (see arrow). There's no need to taper the new hole in the combustion chamber like the stock one.



7 The pilot hole is finally bored out to a 1/2-inch to accommodate the 14mm tap used to cut the spark plug threads. Shown here is a special tool that bores the 1/2-inch pilot hole and cuts the 45-degree chamfer in the plug hole. If this tool is not available, you can use a 1/2-inch drill bit and then a 45-degree chamfering tool.

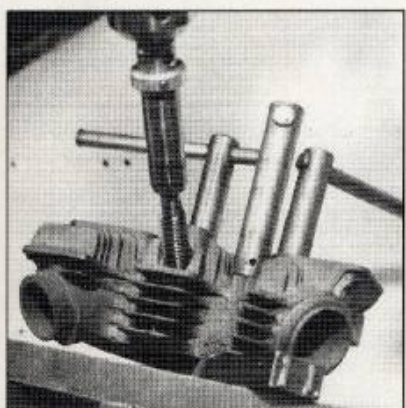


10 Here's how it should look from the outside. You can see that though we have bored through the center rocker box bolt boss, there's still plenty of boss left for support. This is because we will use a 5/8-inch spark plug instead of a 13/16-inch one. A bigger spark plug would require removing too much material from the boss.

ignites the fuel/air charge. However, because the spark plug is to one side and low in the chamber's dome, the combustion flame can't reach the entire fuel/air charge quickly because it is blocked by the dome of the piston. Basically, the spark plug has to try to ignite the fuel/air charge over and around the piston dome. The result is an inefficient ignition and poor flame travel.

The factory fix was to overly advance the spark's timing to compensate for the poor position of the plug.

This often resulted in pinging, hard warm-engine starting and a hotter-running engine. The real fix is to have another spark plug on the other side of the combustion chamber so a flame starts from both sides and ignites the fuel/air charge all around the piston dome for a uniform and efficient burn.



8 The final step is threading the new spark plug hole. Use a 14mm by 1.25-inch tap in the machine. Go slowly and use plenty of tapping oil.

With two spark plugs, you can run the engine with less ignition timing advance which gives you a cooler engine, more efficient combustion, and extends the life of your starter and starter drive. Another benefit is that you can run a higher compression piston without detonation problems. (If you are unfamiliar

GLOSSARY OF TERMS

TDC: Top Dead Center is when the piston is at its very highest point in the cylinder and the rod is at the top of its stroke.

BDC: Bottom Dead Center is when the piston is at its very lowest point in the cylinder and the rod is at the very bottom of its stroke.

Advance and Retard: The timed interval between ignition and when the piston reaches TDC is expressed in degrees of flywheel (crankshaft) rotation. The greater the number of degrees before TDC, the more advanced the timing. Reducing the number of degrees is referred to as retarding the timing.

Fuel/air charge: This is the carburetor's, or fuel injection system's, mixture of gasoline and air that the engine needs to burn in the combustion chamber to produce power. An inefficient burn will result in reduced power output and higher exhaust emissions.

Detonation: Normal combustion is not an explosion. Rather, combustion is the quick burning of the fuel/air charge. As the charge is burned, the expanding gases push the piston down and produce the mechanical power needed to turn the rear wheel of the motorcycle. Detonation is when the fuel/air charge explodes rather than burns. This puts severe stress on the piston and its connecting components. Detonation will quickly turn your engine into a collection of worthless parts.

Pre-Ignition: This is frequently confused with detonation. While detonation occurs after the spark plug fires, pre-ignition occurs before the spark plug fires. Hence its name. Hot spots, such as a burning piece of carbon, are responsible for igniting the fuel/air charge prematurely.

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with the term "detonation," refer to the Glossary of Terms.) Of course, part of the modification is that you will have to purchase an aftermarket ignition system that will accommodate the dual spark plug conversion. There are several excellent systems presently on the market.

Interested? Well, before you grab for your electric drill, understand that dual plugging your heads is a machine shop procedure and the heads must be removed from the engine. The actual procedure of boring the new spark plug holes can be performed with a head machining shop (we used Winona), a Bridgeport-type milling machine, or even a heavy-duty drill press.

We at *Hot XL* recommend you consider this modification if you are already pulling the heads for a rebuild. Or, if the valve and guides are in good shape, the heads can be pulled from the engine and remain assembled during the machine work. Having said that, we'll show you what needs to be done so you can have your local, competent machine shop do the job.

DOING THE JOB

The second spark plug hole should be installed at a 47-degree angle to the head's head-to-cylinder gasket surface. To do this, set the table of your machine to 47 degrees (see photo #3). Using the stock head bolt holes to locate and fasten the head, position the head on the table with the existing plug hole facing up towards the tool holder of the machine. Then center the tool holder in the existing spark plug hole and lock the table to hold that position. Now remove the head from the table and turn the head around so that the side without the spark plug hole faces toward the tool holder just like the plug hole did. Now the head is set up and ready for machining.

Begin the machine work by using a pilot drill to establish a starter hole. Then, using a 1/4-inch drill bit, bore a pilot hole through the head into the combustion chamber (photo # 5). Now step up to a 7/16-inch bit to increase the size of the pilot hole. Next, install

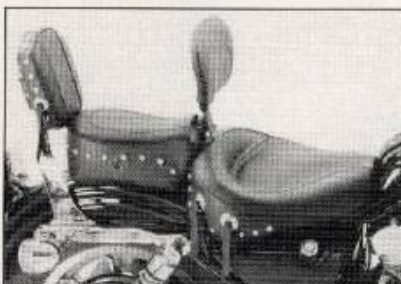
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LEPERA

LePera Enterprises' high-quality seats have earned it a reputation for craftsmanship since 1972. The Bare Bones Solo is for those who would ride the bare frame if they could. The seat is thin and narrow, and demonstrates a simplicity which allows it to flow into a variety of paint and styling schemes. It fits a low-slung profile the best. While, for some people, it may not be the perfect seat, for many it will be the ultimate.

LePera's Maverick seat provides a combination of touring comfort and finely-tailored styling. It is a very comfortable, full-size seat that retains a reasonably low and sporty profile. Both of these LePera models are available with Biker Gel. LePera offers a complete Sportster seat line as well as other Harley-Davidson makes. Info: LePera Enterprises, Inc., 8207 Lankership Blvd., Dept. HXL, N. Hollywood, Calif. 91605, 818/767-5110.



MUSTANG

Mustang emphasizes long distance comfort and old-style looks. Their latest seat for XLs accepts Mustang's matching fender bib for solo riding, and its passenger pad and backpad. Mustang's rustproofed, 16-gauge steel baseplate allows the backrest receptacle to be welded, not bolted, in place. There are no ridges or bumps from under the seat. The backrest adjusts to up and down positions, as well as forward, while you're traveling. The pad pivots to match the angle of your back. Mustang's Solo seat features a wide molded foam bucket

and is trimmed with chrome studs and leather tied conchos. The Sportster Solo with Built-in Driver Backrest sells for \$349. The matching passenger pad is \$99. A thin pad sells for \$95. Passenger backrest is \$59, and Studded Fender Bib is \$30. All Mustang seats and accessories are hand-crafted in the USA and sold through dealers and accessory shops. Info: Mustang Motorcycle Seats, Box 29, Dept. HXL, Terryville, Conn. 06786, 800/243-1392.

ARLEN NESS/ DANNY GRAY

Arlen Ness first began using Danny's seats in the 1970s. Many top name builders have followed this lead. Each seat is produced using fine materials, including Connolly leather and high-density, closed-cell foam, and is sculpted onto an ABS plastic base. Danny stitches the cover for each of his seats personally. He also inspects every seat before shipment to ensure quality. Several different styles and designs are available. The newest seat is the Bar Hopper Solo seat that features a classic look with a low profile design and a Connolly leather seat panel. Suggested retail price for Danny Gray seats range from \$349 to \$399 depending on the style and design selected. Info: Arlen Ness/Danny Gray Seats, 16520 East 14th Street, Dept. HXL, San Leandro, Calif. 94577, 510/556-9447.



TRAVELCADE/SADDELMEN

If you spend a lot of time on your dresser, then you'll be interested in a Travelcade/Saddlemen seat. This California-based manufacturer makes seats for all models of touring bikes. The Classic Explorer has an adjustable driver backrest and detachable fringe. Suggested retail price for the Classic Explorer seat is \$345.95 without backrest, or \$506.99 with backrest. For winter riding, Travelcade offers the Saddleheat Motorcycle Seat Warmer which runs off your bike's electric system. Info: Travelcade/Saddlemen, 6325 Alondra Blvd., Dept. HXL, Paramount, Calif. 90723-3750, 800/397-7709. ■

FIRE POWER

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a 7/8-inch end mill in the tool holder and use it to slowly plunge cut through the fins of the head until a flat surface is obtained at the bottom of the hole in the solid, non-finned part of the head (photo #6 and 10). You can now remove the end mill and install a 1/2-inch drill bit in the tool holder and bore out the pilot hole (photo #7). This will be the pilot hole for the 14mm spark plug thread.

Install an extended 14mm by 1.25-inch tap into the tool holder of your machine. On a *slow* speed, use the machine to tap the spark plug hole (photo #8). Be sure to use plenty of tapping oil. The last step is to use a 45-degree chamfering tool to make a seat for the spark plug to seal against. Once this is done, you can clean and reinstall the heads on your engine.

You may have noticed that the plug hole we install is suited to use a "peanut" or 5/8-inch plug. We did this because the smaller diameter spark plug uses a 5/8-inch

With this dual plug conversion, you will see improved performance and efficiency with less ignition advance.

socket, whereas the bigger plug uses a 13/16-inch socket. Because we use the area around the center rocker box bolt boss for the new spark plug hole, to bore the bigger hole would mean the loss of all or most of this bolt's boss. We don't believe the rocker box can afford to lose the support of this bolt. The smaller plug will work just fine without losing needed rocker box support. Use a Champion RV12YC, Split-Fire SF2E, or equivalent spark plug in the new plug hole.

With this dual plug conversion, you will see improved performance and efficiency with less ignition advance, be able to run a higher compression piston without risking detonation, and have a cooler running engine. There will also be less wear and tear on your electric starter, or knee joints if you have a kick start model, in hot start situations. In closing, a word of caution: though this is not a complicated modification, be sure your machine shop fully understands this procedure before turning over your heads to it. ■

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article submitted by ferretface of the XLFORUM

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