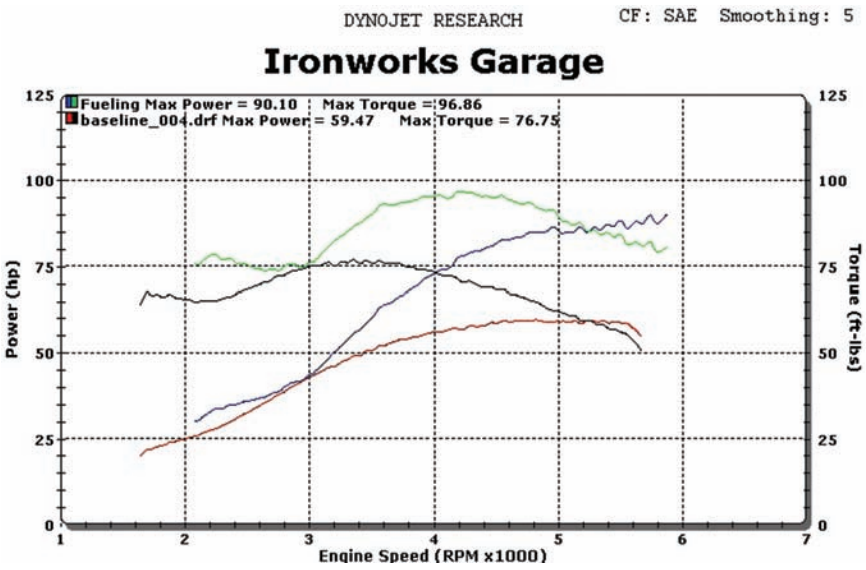
airplane engine! Small beehive springs even found their way into stock Harley-Davidson engines beginning in 2005. Harley-Davidson beehive springs are stock, low rated springs that could never be used in a performance application. Feuling Beehives are made specifically for high performance valve trains. They can replace the factory beehives found in 2005 to present cylinder heads with 7mm valve stems and can also swap places with the more traditional double-wound springs found in 1984-2004 heads with 5/16" valve stems. Feuling Beehive Springs are quite a bit larger and have almost twice the spring pressure of the much smaller and weaker Harley-Davidson springs in 2005-up stock heads, and they're 33 grams lighter than the double-wound springs in earlier stock heads—like the ones in our 2000 FLHT. Another advantage to the Feuling spring is found during engine assembly. Because the top of the spring is much smaller than even a stock spring, the lower rocker boxes do not have to be ground out as they would if a more traditional double- or triple-wound high rate spring was used.

While there are many benefits to beehive springs, this is not a "plug and play" modification: things rarely are when you venture away from stock. I found only a few assembly concerns when installing Feuling's Beehives. First, because we used Feuling's High Load springs, they have a larger diameter lower spring retainer than the stock rate springs. They don't quite fit in the factory valve spring pocket. Fortunately, Feuling also sells a valve spring seat cutter to make quick work of the issue; just chuck it in a drill and machine away. To save some machining steps, Feuling's Endurance line of springs fit with no modifications, they just have a lower spring pressure than the High Loads. An additional clearance issue—the top spring collar to valve guide clearance—occurs with stock heads almost anytime a non-bolt-in cam is used. A valve guide cutter, similar to the valve spring seat cutter, easily cuts down the valve guide.

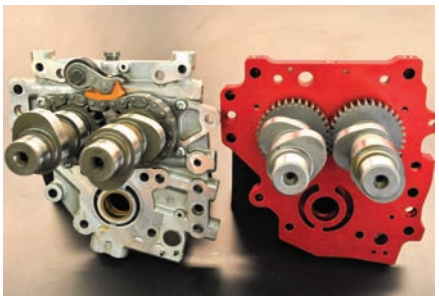
Another new product from Feuling is their Reaper line of camshafts. The Reaper is available in three different versions: 525, 574, and 630. These numbers conveniently correspond to the cam max valve lifts. The 525 is considered a bolt-in cam that can use stock valve springs and pushrods. The 574 and 630 cams require Feuling HP+ adjustable pushrods. HP+ pushrods are chrome moly, tapered pushrods that offer "increased stiffness and column rigidity maximizing valve-train stability," according to Feuling. Another benefit of the HP+ pushrods is they are completely compatible with the stock pushrod tubes. While the 525 is a hearty torque cam, great for a heavier bike, and the 630 makes an excellent mid and top end cam for a lighter bike; we've got the lightest heavy bike that Harley-Davidson builds so we needed to split the difference. We went with the 574 as a "best of both worlds" cam choice; great peak power without sacrificing all the bottom end grunt needed to get our Glide out of the intersection. We made a conscious decision to use the stock heads and carburetor to maintain a lot of that great port velocity and bottom end power that stock-sized intake components provide. This choice definitely hurt our peak power, but an ElectraGlide spends a lot more time between 2500 rpm and 3500 rpm than it ever will at 6000 rpm. It's a fair trade off as far as I'm concerned.

Even though we're using stock heads, I couldn't help but do a little valve seat and port blending along with a radius valve job. Sure, it's no custom CNC ported head, but it improves airflow over a set of purely stock heads and provides performance for a fraction of the cost of a new set of heads.

Reaper cams aren't just about stump-pulling torque and scything top end power, they also have a practical side.




Two clearance issues were found when installing the Beehive Springs. The valve guide was cut down for spring top collar-to-guide clearance, and the head had to be cut allowing the lower valve spring retainer to sit flush in the spring pocket.



Feuling Reaper Cams are gear driven. Just look at all the moving parts to fail in the stock chain driven cams at left. Gear drive offers simplicity, power, and durability. Also note the enlarged oil journals for the Feuling pump (the "parenthesis" shaped holes around the pinion shaft bore below the cams) in the Feuling Cam Support Plate, at right.

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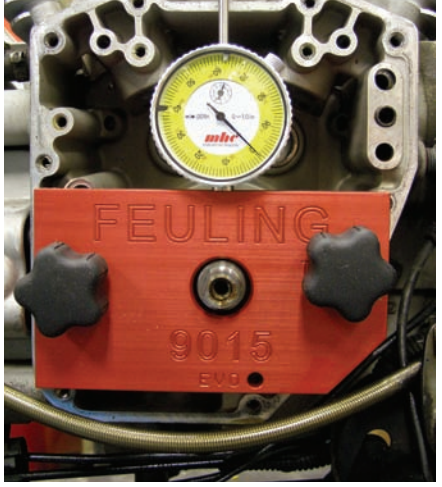
Reaper Camshafts are gear driven and require a four-gear install kit. The inner gears press onto the camshafts and are timed with a key. No big-time press is required, a 10-ton press is plenty good.

They're gear driven cams, and anybody with a 5-speed Twin Cam engine has to make a decision about those temperamental factory chain driven cams. While there has never been a "factory recommended service interval" for the factory chain tensioners, after years of Twin Cam experience, I've learned that a peek every 40,000 miles or maybe a little sooner is the best "non-official" interval for catching tensioner problems before they grow into big dollar repairs. The maintenance of replacing just the tensioners is several hundred dollars in parts and labor, while waiting too long can easily run up to a grand in damages. Herein lies the question; if you want to keep your factory chain driven cams, are you prepared to inspect and/or replace your tensioners every 40K or so? Well, we weren't! If you're going keep your bike for any length of time and you're a true believer in the unwritten Murphy's Law that failures only happen when you're 2000 miles from home, gear driven cams like the Reaper offer a return to reliability and simplicity. Less moving parts, less to go wrong.

And finally, we come to the components that have made Feuling a household (or should I say garage-hold?) name. The Feuling Oiling System: oil pump, cam support plate, and lifters. Let's start with the pump. Feuling states that their pump creates 40% more pressure (feed) volume and 60% more scavenging (return) vol-




As you might expect, Feuling's Run-out Measuring Tool (MSRP $112.95) accurately measures flywheel run-out. Flywheel run out equates to a flywheel that has shifted or is running out of true. The Feuling Cam Plate and Oil Pump require a flywheel assembly that is not damaged to work properly. Duh! Maximum allowable run out is .0025".

The Beehive Springs utilize a tiny titanium top spring collar. These Beehives are state-of-the-art in valve spring technology.

ume than stock. Just visually comparing the Feuling pump and stock oil pump side by side, it's obvious the Feuling pump moves more oil in both directions. The gerotors that make up the feed and return sides of the pump are just plain massive in relation to the stock equipment. The Feuling Cam Support Plate is a beefed-up version of the stocker. Made out of 7075 billet aluminum, it's more rigid than stock and incorporates an improved pressure relief valve calibrated especially for Feuling's oil pump. The Cam Support Plate has enlarged oil passages to get the most flow out of that oil pump; in fact, it can only be used in conjunction with the oil pump. They go together like a PB&J sandwich.

So what's the big deal with all this talk about better oiling? Well, increased oiling efficiency has both power and rideability benefits. First and most basic is that with more oil pressure the oil gets where it needs to go in bigger volumes. A critical first stop for oil is the hydraulic lifters. Sufficient oil pressure keeps the lifters pumped up and valve train noise down. What's not talked about much is that returning engine oil back to the oil tank and away from the engine also has big benefits. Harley-Davidson engines are dry-sump, just like NASCAR Cup engines. Dry-sump means that engine oil is not stored in the engine itself, but remotely in an oil tank. Even though our V-Twins are billed as air-cooled, in reality they are also oil cooled. To cool, the oil has to make it back to the oil tank. And we all know an air-cooled twin is hot enough already. All the more reason to like the 60% more scavenging ability that the Feuling pump offers. Get the oil out of the engine, get the heat out too.

Feuling Race Lifters cap off the Oiling System. Made from 8620 steel, CNC-machined, and precision ground to aerospace tolerances, the Race Lifters perfectly match the performance of both the Feuling Oiling System and Reaper Camshafts.

So if you're looking to build a reliable, powerful Twin Cam engine that will outlast those chain-driven big bore counterparts, these components from Feuling can make it happen. Even though we used these components on a 2000 FLHT, Feuling offers many of the same parts to fit a multitude of Harley-Davidson models from 1984 to present. Re-capping our build, we used Feuling Reaper Camshafts (MSRP $349) for durability and performance, Feuling Beehive Valve Springs (MSRP $329) for increased spring pressure and less valve train weight, and HP+ adjustable pushrods (MSRP $199) for strength and adjustability. We also used the Feuling Oil Pump (MSRP $425), Cam Support Plate (MSRP $389), and Race Lifters (MSRP $279) to optimize engine oiling and help control engine heat.

## *RESOURCE

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