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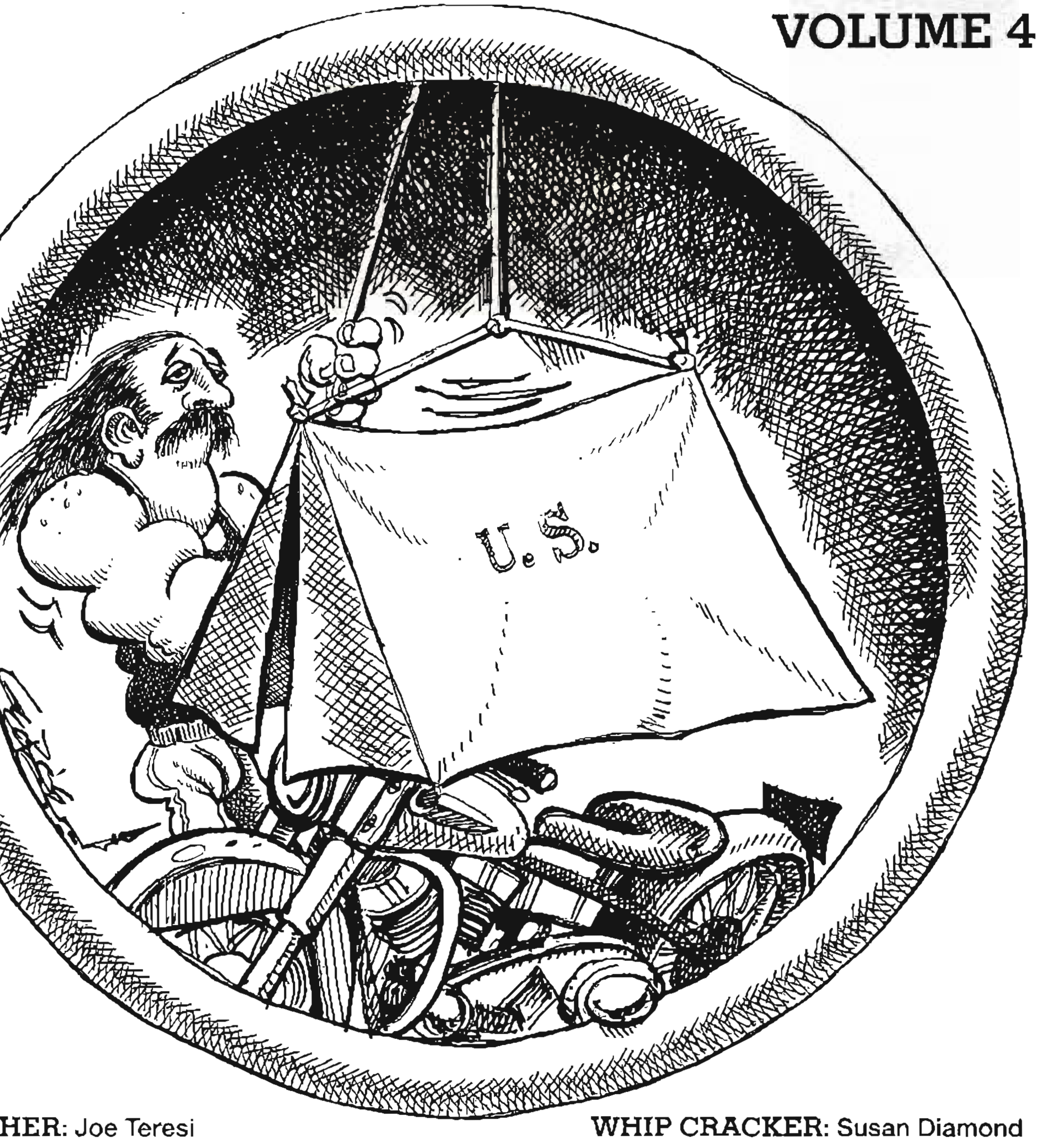

STAFF:

PUBLISHER: Joe Teresi
EDITORIAL DIRECTOR: Keith R. Ball
EDITOR: Mike Osborn
WHIP CRACKER: Susan Diamond
ART DIRECTOR: Deborah Razo
ILLUSTRATIONS: George DiLucca

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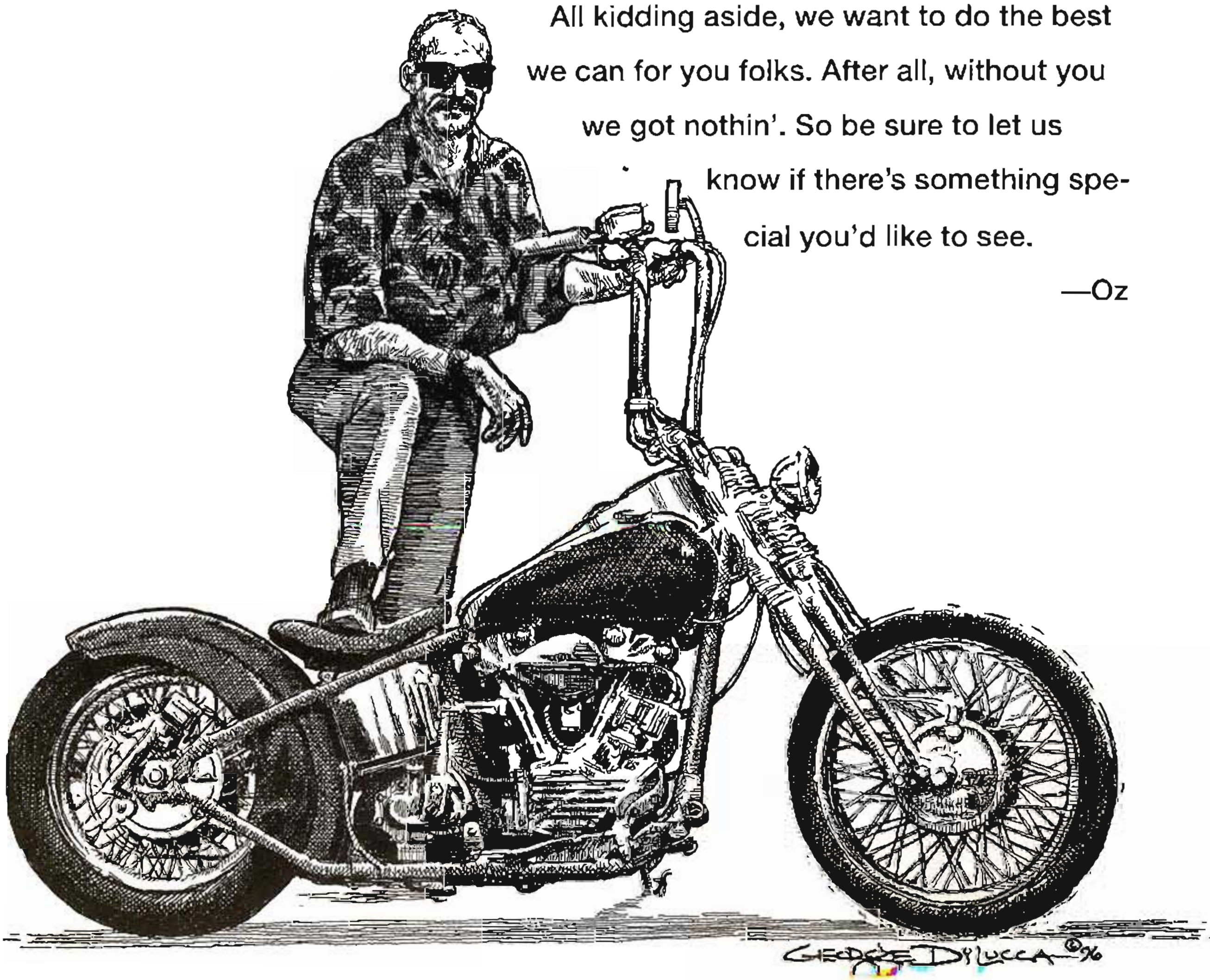
Well, Bandit kicked my feet off the desk, and told me to get my ass to work, so I guess it's time to do another Tech Tip Book. This is our fourth book (maybe we'll get it right), and we're putting in a bunch of stuff, so there should be something for everybody.

We've set it up with four sections; Engine, Trannys, Chassis and Tools. For you guys who read like I do, just look for the great George Dilucca illustrations. Each of these tips are from the pages of *Easyriders* and *Quick Throttle*, so if there's something you've seen in the mags but can't find the issue, it just might be in here. If you can't find it, you might check out Tech Tips #1, #2 or #3, or call our ever friendly staff for some direction.

You're going to find some new performance ideas in here, fuel injection, strokers and the like, mixed in with some old standbys, Knuckle lower ends and 39mm fork tune ups. So whattaya doing readin' this crap, open 'er up and get to work!

All kidding aside, we want to do the best we can for you folks. After all, without you we got nothin'. So be sure to let us know if there's something special you'd like to see.

—Oz



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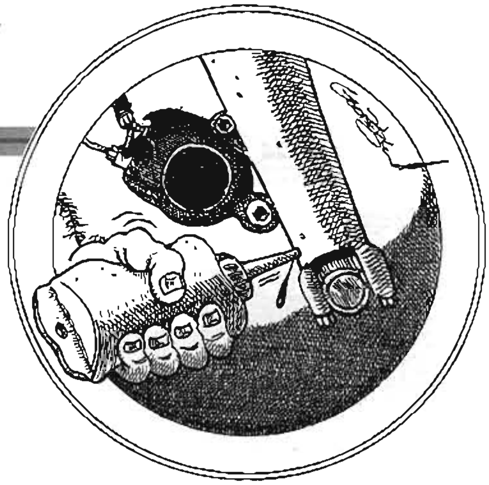

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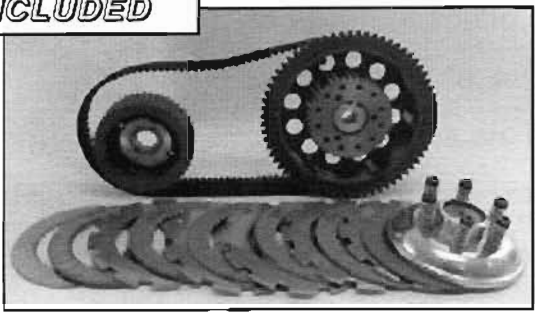

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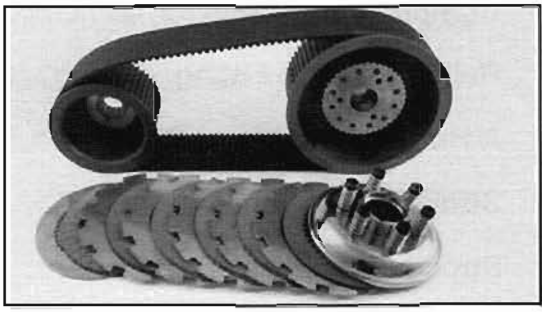

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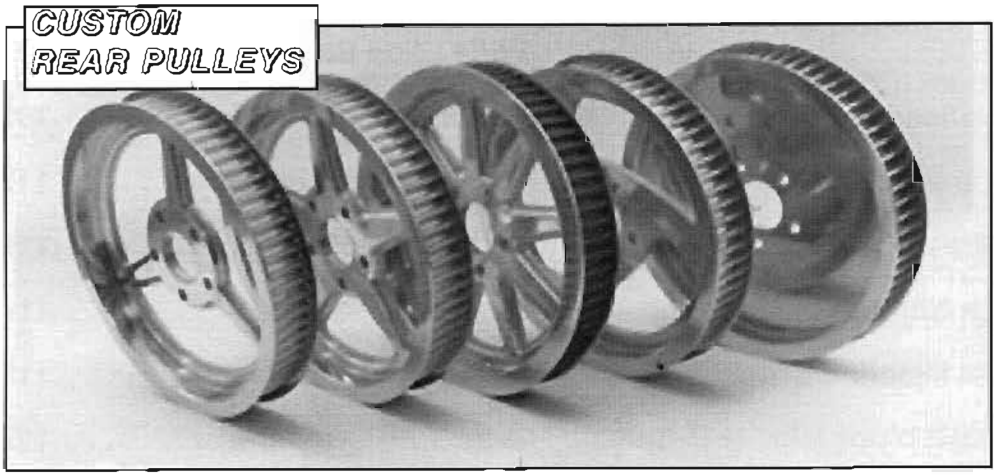

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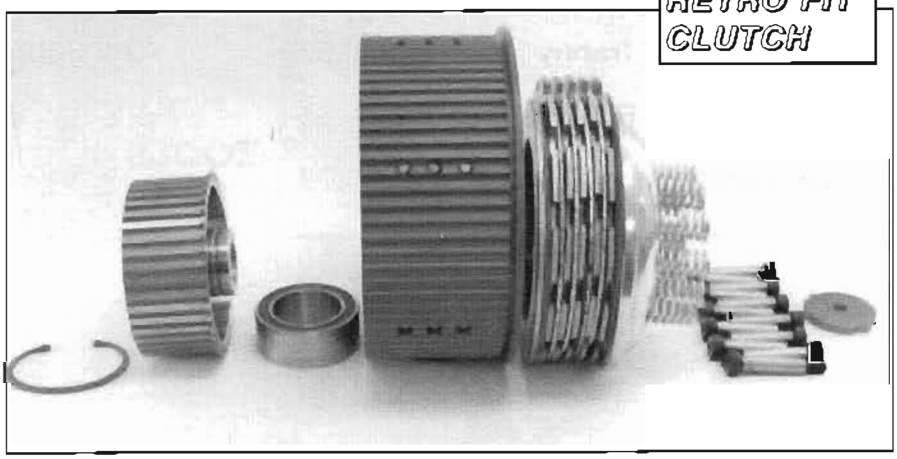

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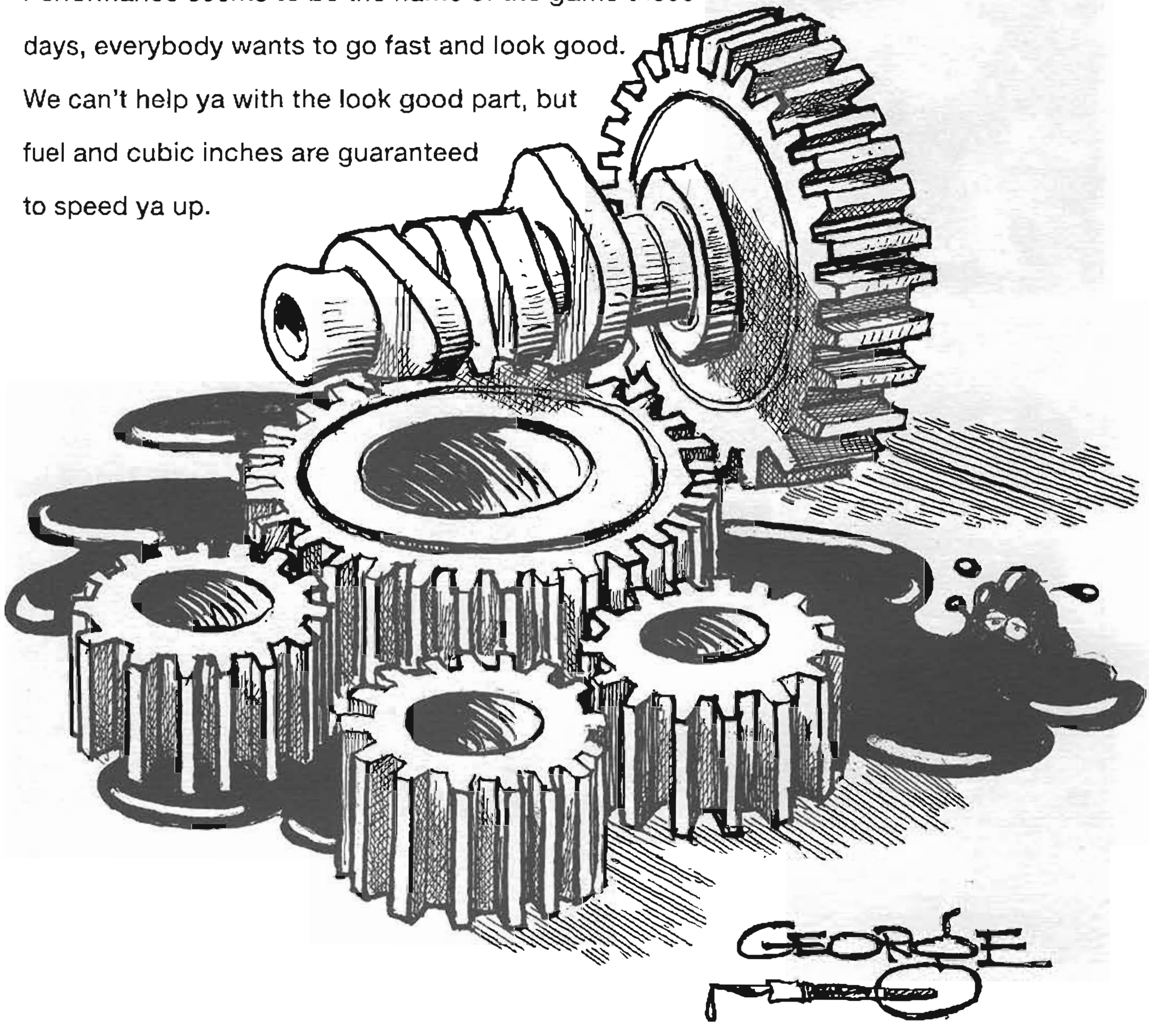
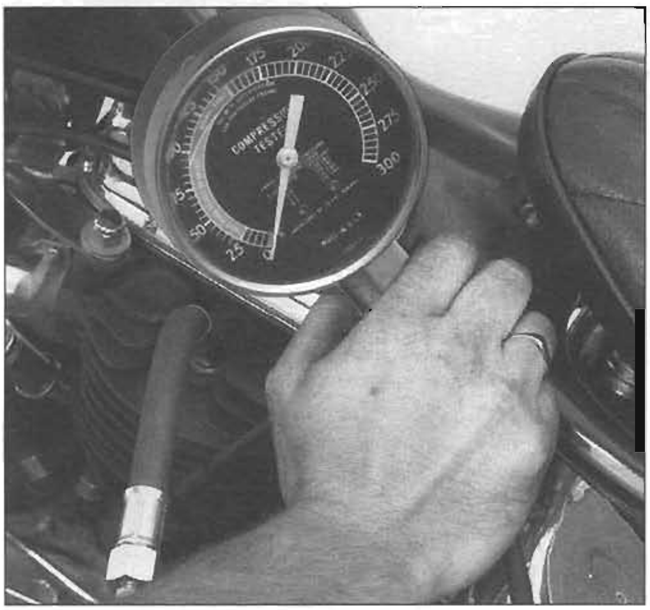
ENGINE

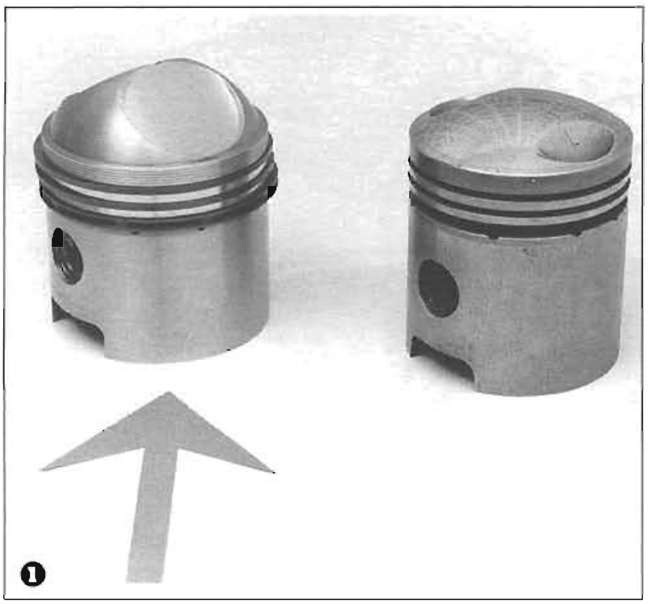
Performance seems to be the name of the game these days, everybody wants to go fast and look good. We can't help ya with the look good part, but fuel and cubic inches are guaranteed to speed ya up.

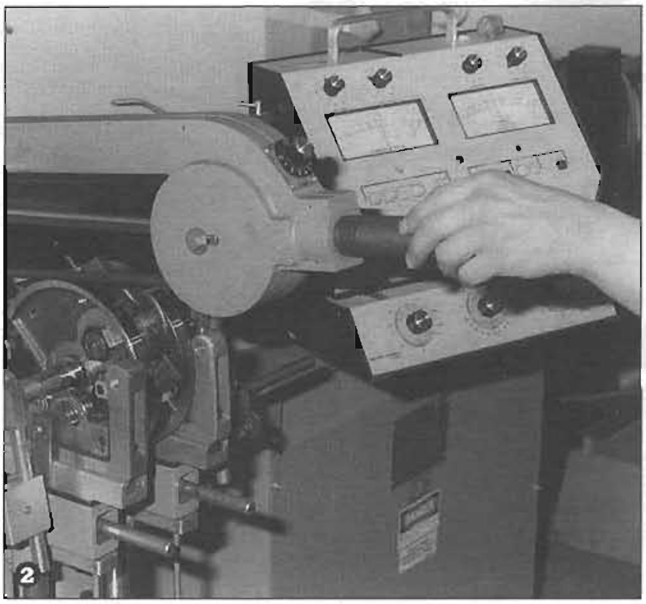


COMPRESSION



PRESSURE TACTICS: MORE SQUEEZE, MORE POWER



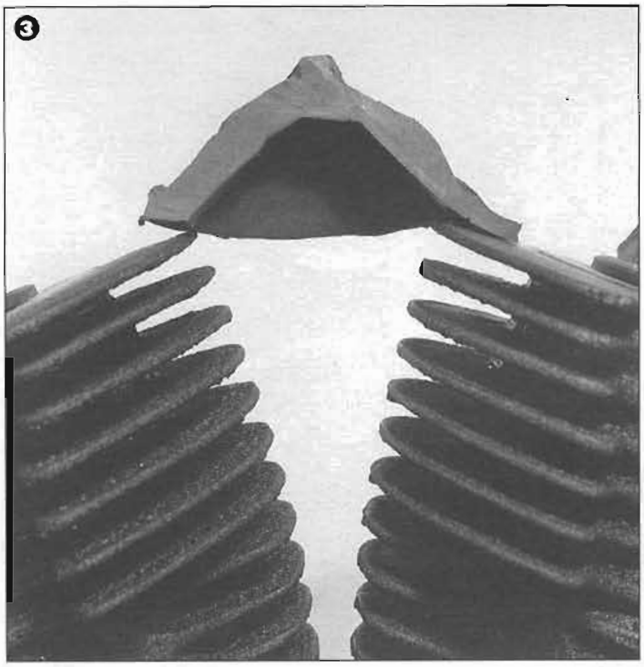


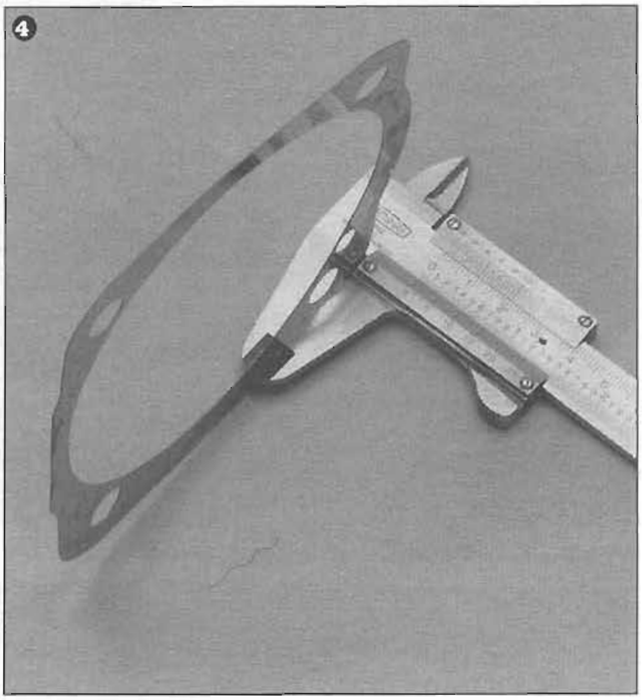
Does more muscle for that Milwaukee mill sound like music to your ears? Well, read on—after all, *Quick Throttle* is dedicated to the art of making Harleys move faster.

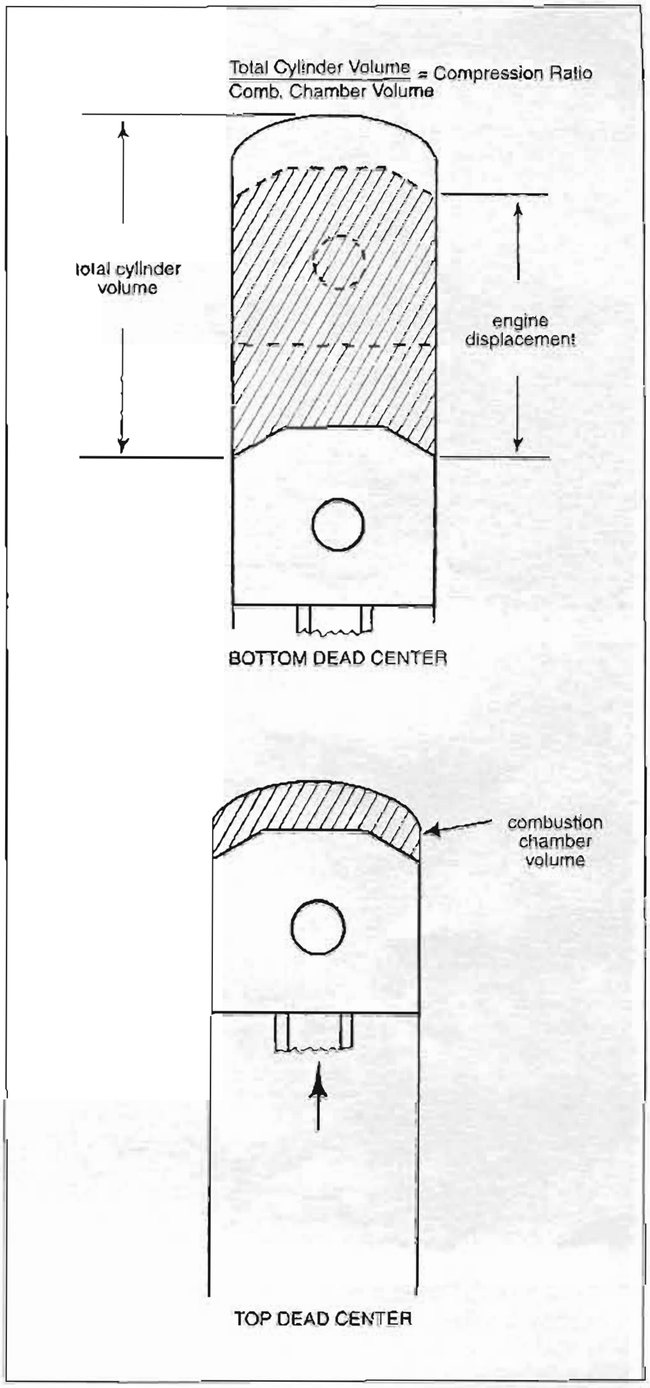
A prime avenue to higher engine output is increased compression ratio. "Internal combustion" burns a mixture of compressed fuel and air (see schematic, page 78). The more squeeze, the more results—to a point. You need fuel with increasing octane so it will burn under pressure without exploding or knocking, otherwise engine damage results.

During the energy crisis of the '70s, octane ratings plummeted at the pump. So did compression ratios. Today's performance engines and parts, increasingly designed and even run by computers, have lower octane requirements. Refineries now produce respectable premium grades, lead free. The payoff? Modest compression increases are back. Here are some ways to go.

First, are high compression pistons. Their higher tops (photo 1) push the same displacement into a smaller



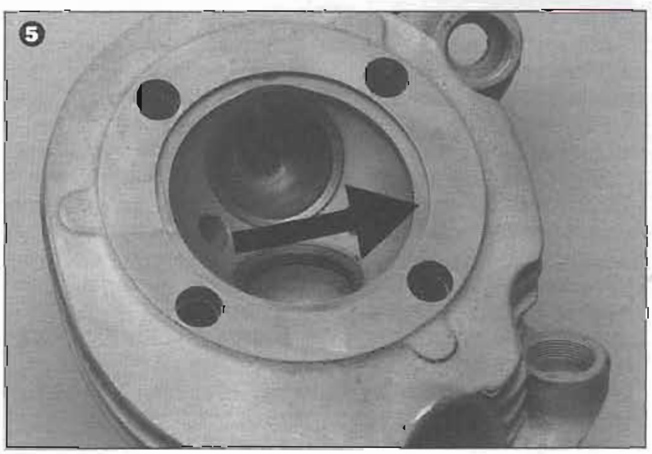


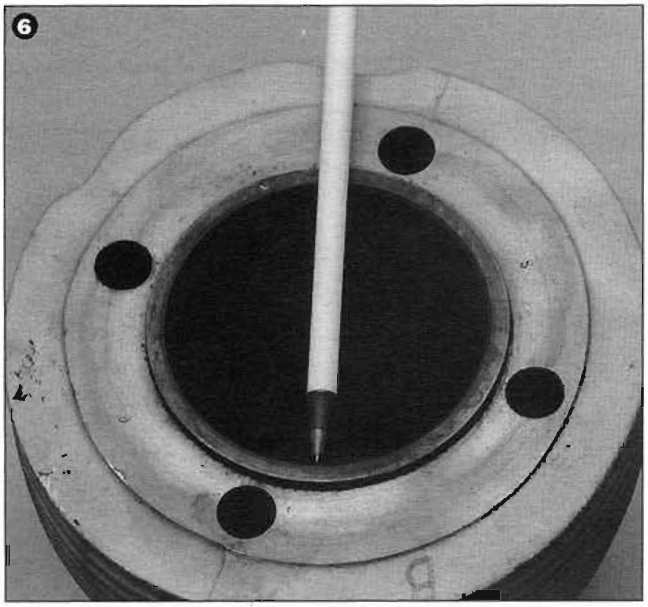


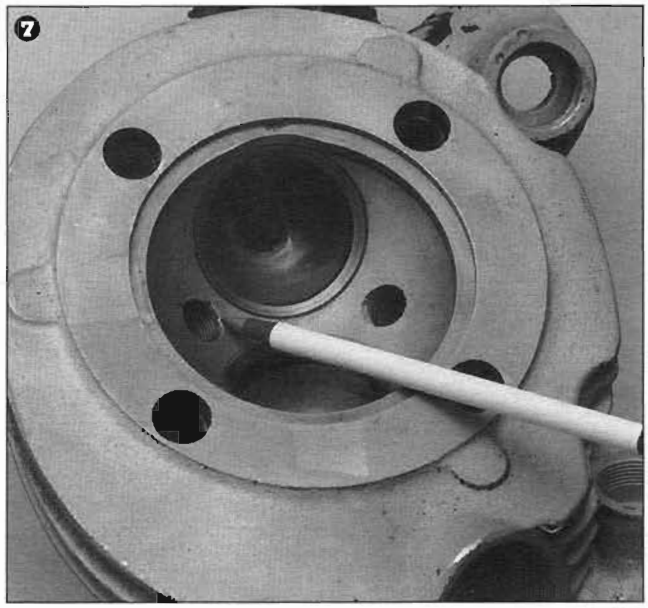
space for often-dramatic compression increases. Piston manufacturers generally specify how much. For today's "premium unleaded" fuel (R+M/2 94 octane) the maximum limit is about 10:1 compression. Beyond that, you'll need octane boosters. Installing hi-comp pistons means a top-end tear down. If they weigh the same as the old, you can avoid rebalancing (photo 2). (Most vendors use stronger-than-stock material, so no problem.) Since the new tops come closer to valves consider a clay clearance check (photo 3). (Temporarily reassemble the top end with a wad, turn it through, and then tear down to measure the thickness; a good tolerance is .090 inches.)

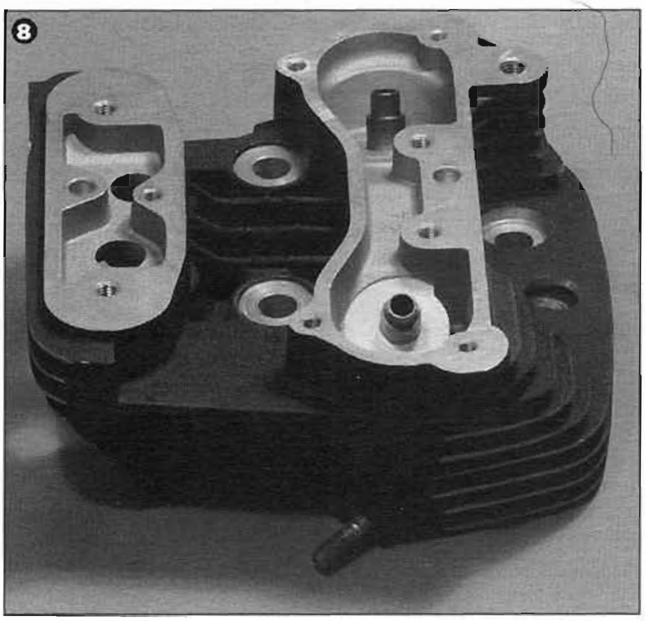
Thinner than stock, copper head gaskets (photo 4) also increase compression but only slightly. However, you get the improved seal strength and heat transfer of copper metal).

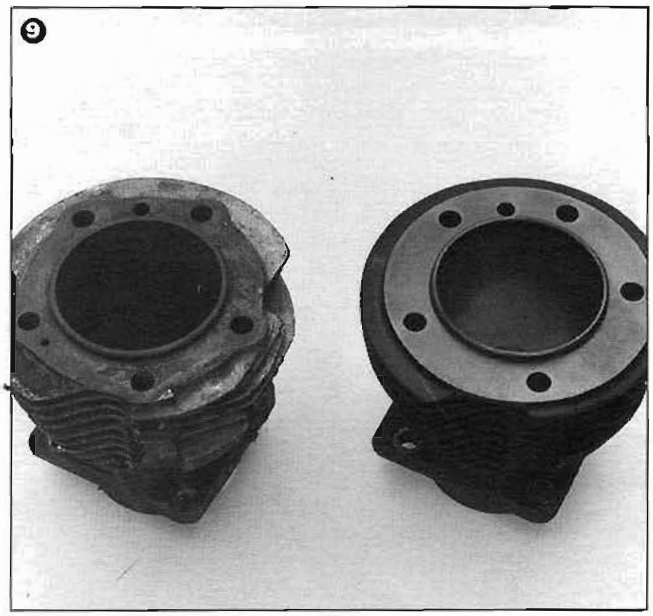
Milling of head or cylinder surface achieves slightly more







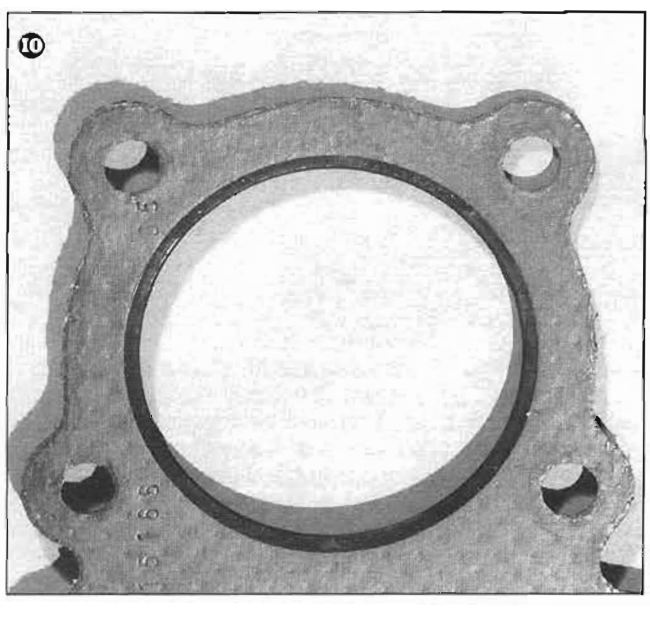




squeeze than thin gaskets. It removes metal, requires careful machining, and may disturb squish bands (see arrow, photo 5), O-ring lands, and step seals (photo 6). It can also alter overhead valve timing. Tappet clearances never change while valve timing may require a change to keep pistons and valves separated. Another good idea if you have the heads off: eliminate sharp, exposed edges in the combustion chamber (photo 7). These encourage pre-ignition and increase octane requirements.

Another alternative? Some aftermarket heads (photo 8) including those from Custom Chrome and Chrome Specialties, among others, offer increased compression. Check with the particular vendor. Pricier than mere machining or pistons, these add the advantage of being engineered from scratch for high-performance.

Once you've bumped compression ratio, what to expect? Not surprisingly, more power throughout the entire range and better gas mileage. Emissions should not be affected with potent modern ignitions; but make sure your planned mod is street legal before you start. You'll probably be pumping 91 or 93 octane instead of 87. Trial-and-error test rides will tell you how high to avoid knock. In-



MORE SQUEEZE, MORE POWER

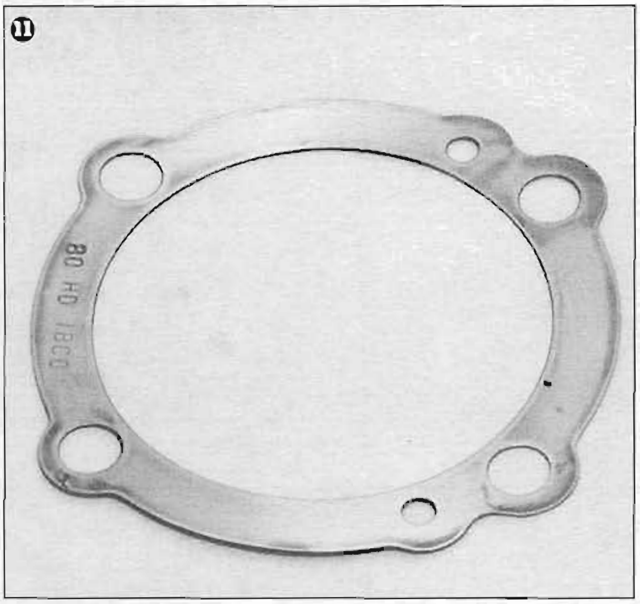
Modest compression increases up to 10:1 can be made on Big Twin Evo engines without too much concern about detonation as long as premium fuel is used and spark timing and carb jetting are correct. Earlier engines (Knuck, Pan, Shovel) can start having detonation problems well below 10:1 compression because of the lack of a quench pad in their combustion chamber.

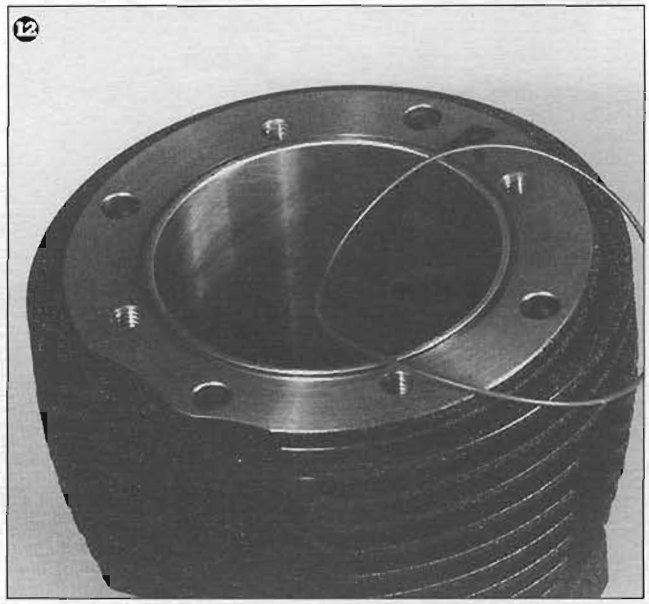
The quench pad or pads do a couple of things that help promote a good clean burn in the cylinder. The first thing is the turbulence that is generated when the piston comes to the top of the cylinder on the compression stroke, and pinches the fuel mixture against the quench pad. The pressure rise in this pinched area causes the fuel mix to squirt out into the main chamber and create a high speed spin, which when sparked to life, causes a quick even burn. The second thing the quench pad does is snuff any compression ignition (pre-ignition) before it can get far enough to cause a problem.

The next interesting point seems to be that if the quench pad space is narrowed down, compression ratios of over 12:1 can be used with no adverse effects, as long as the spark timing and jetting are correct. Cam timing and the amount of valve overlap can unload some pressure at low speed to make starting easier and at the same time boost power at higher rpms.

The exact example I am using is my 1990 FXRS-SP. It has the stock CV carb, stock ignition, stock valves and ports, and the latest style cylinder studs with the shoulder at the bottom to stop base gasket leaks. The heads were milled .090, the cylinders were shortened .010-inch with a .005-inch sealing step left where the fire ring is, on the head gasket. The piston to cylinder head clearance must be carefully set at .040. With a Crane H-296-2 cam I now have 200 pounds of cranking compression and the engine produces well over 80 horsepower and not less than 85 foot pounds of torque from 2200 rpm to the factory redline of 5200 rpm. At Phoenix Firebird Raceway, I ran 1/4 mile at 12.55 ET and 107.9 mph, street legal with mufflers (Python II). All this and a total expense of about $800 (plus labor if you can't do the wrenching).

— *Keith Ruxton*

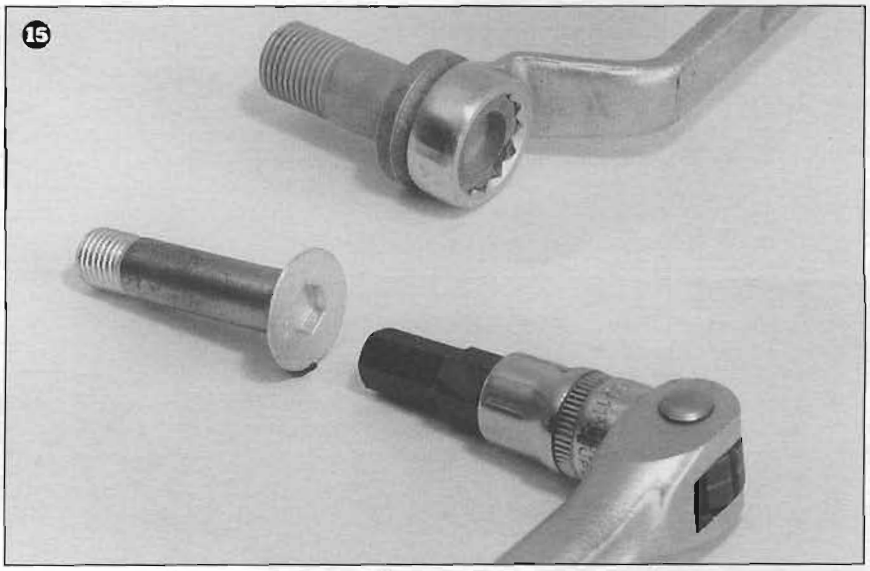


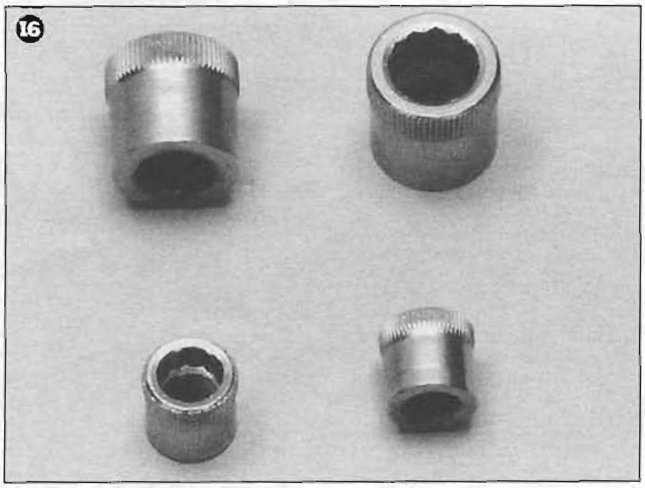


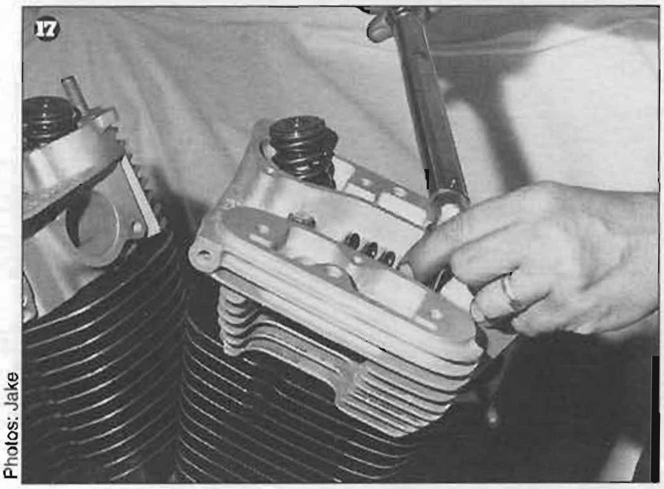
creased-compression engines may ping more under load, so avoid lugging. Not so apparent are greater loads on head gasket joints. Here are ways to minimize problems.

First, parts with increased gasket area (photo 9) aid sealing, especially aftermarket high performance components. Use premium gasketing materials such as metal rimmed (photo 10), teflon, or solid copper (photo 11). Machining cylinders or heads with lands for O-ring seals (photo 12) is ideal. Otherwise, supplement with high temp engine sealants (photo 13) not only at head joint, but also at cylinder base (photo 14).

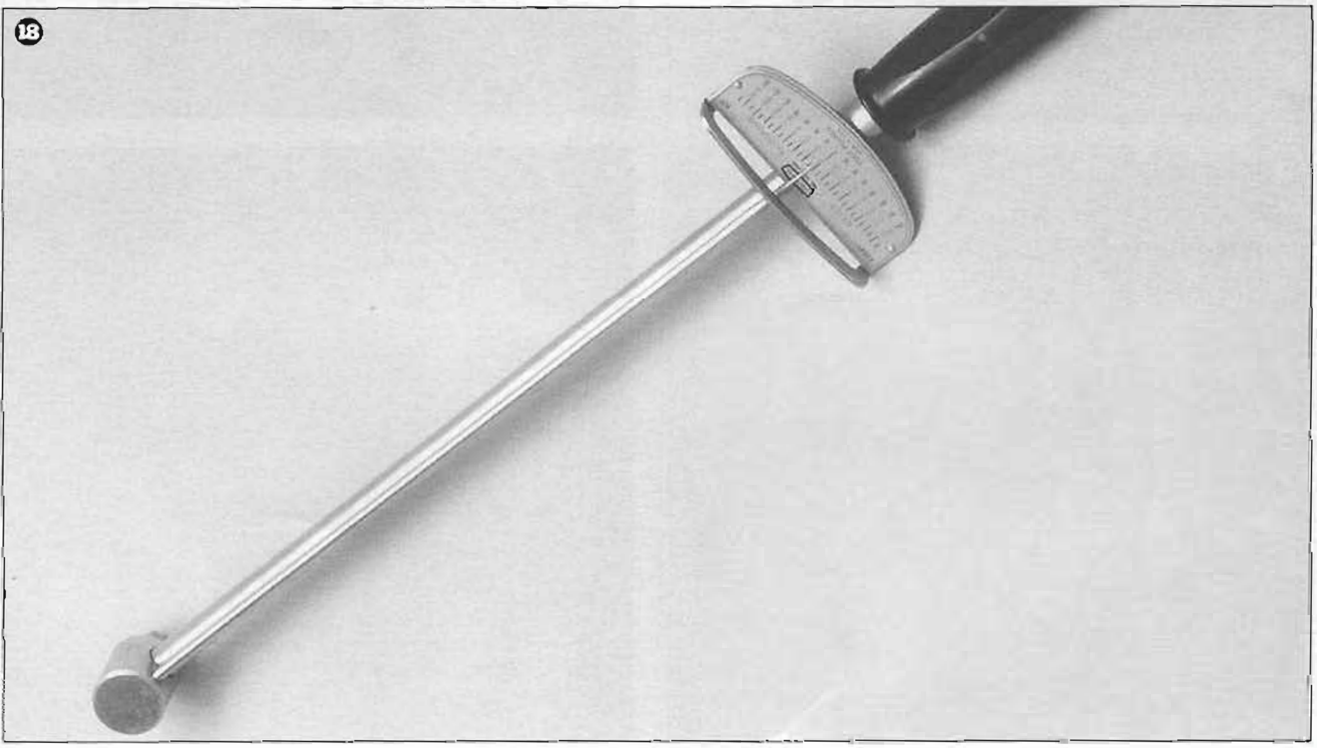
Clamp gaskets with good fasteners. 12-pointed bolts (photo 15) and nuts (photo 16) beat 6-pointed hard-







Photos: Jake



Photos: Jake

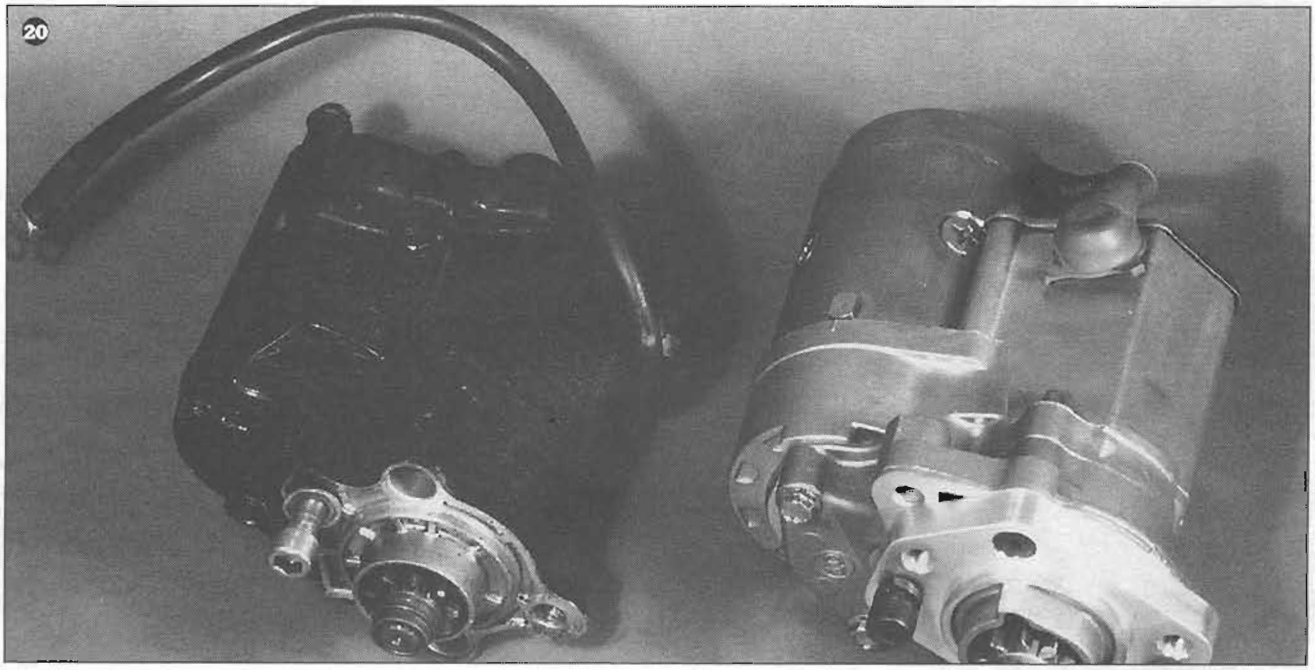
Increased CR Advantages	Challenges	Strategy To Overcome Challenge
more power	more engine heat prod.	oil cooler, alloy oil tank
better gas mileage	more detonation/ping potential	premium fuel, additive, altered ignition timing/advance
more torque	harder starting	late opening inlet cam; high torque starter; compression release
	preignition prone	careful combust, chamber design, careful piston design
	valve shrouding	stock weight hi-comp. pistons
relatively inexpensive	possible engine rebalance	

ware. Tighten with a torque wrench (photo 17). Beam-type torquers (photo 18) are cheap insurance against blown gaskets.

High-compression Evolution engines require extra care. Four cylinder head fasteners (photo 19) replace the five of earlier years. Stock aluminum barrels mean a reliance on heat expansion to achieve head gasket sealing. Warm thoroughly before riding hard!

Finally, that tad extra squeeze may make kick starting a taste tougher on the tendons. But hey, no pain, no gain. Or how about a heavy-duty high-torque starter (right, compared to stock on left, photo 20)! 'Nuff said.

—Jake



PARTS, SERVICE, & SOURCES

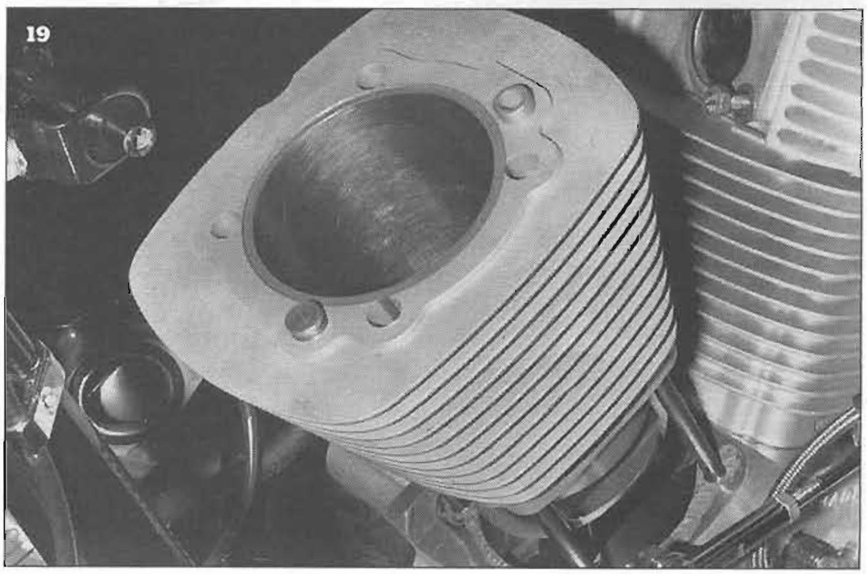
Engine part machining (cylinder heads O-ring, lands, etc.):
Thompson Engine Service
186 River St.,Dedham, MA (617) 326-8380

High compression pistons:
Wiseco Piston, Inc.
7201 Industrial Park Blvd., Mentor, OH 44060
(800) 321-1364

Arias/RevTech- Custom Chrome, Inc.
16100 Jaqueline Ct., Morgan Hill, CA 95037
(800) 729-3332

Thin, copper head gaskets:
U. S. Strokers
1404 N. State Rd., #163, Margate, FL 33063
(305) 537-3657

High torque electric starter:
Thompson Engine Service
186 River St., Dedham, MA (617) 326-8380



There I was again, taking in another scooter with a terrible sound coming from within the big V-Twin. The confused customer said it only had 700 miles on the rebuilt top end and asked what the noise could be. My answer was, as always, "Hard to say till we get a closer look." Of course this didn't ease his pain as dollar signs flashed in his eyes. I told him to go home, take two, and I'd call him in the morning.

After he left, my trusty assistant "Apache" and I went to work to find the problem. We already knew it sounded bad but we started with the easy, inexpensive stuff first; proper pushrod adjustment, bad lifters, bad rocker arm shafts, the list goes on. Finally, with no choice left, off came the heads and cylinders. There it was as big as day, the chewed up cylinders and scored pistons. Seven hundred miles, it looked more like 70,000. I called the bro with the news and reassured him that we'd go easy on his wallet, hell, I've been there.

I grabbed the cylinders and a new set of pistons and headed to Micah McCloskey's shop in Canoga Park, Calif., where he keeps a boring and honing machine for just these occasions.

Piston and piston ring fit are very critical. If attention is not paid in this area, you can bet you'll be back to the shop. The first step in doing the job right is to bore the cylinder (photo 1). When it comes to boring an Evo there is more to it than just drilling a hole. First, you

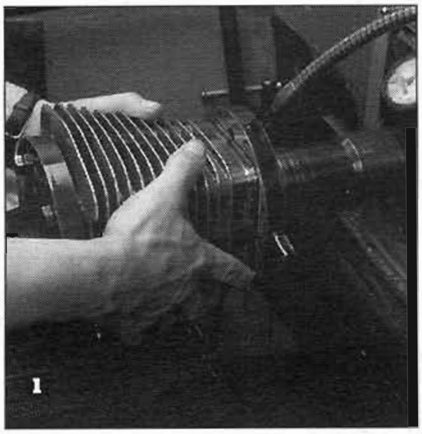
RELIABLE PISTON FITTING

must set the cylinder up for boring by using torque plates which are used to simulate the cylinder stress that will occur when the heads are torqued down and the motor is running. When setting up the torque plates for this simulation, you must consider exactly how the heads will be torqued in your case during assembly. For the factory Harley-Davidson, a three-step process is used. Complying with the recommended torque sequence, you torque the heads down evenly in two steps, reaching 14 foot pounds. Then in the same sequence you tighten an additional 1/4 turn. This usually equals 30 foot pounds of torque but the factory procedure allows for various conditions such as head bolts fitting tighter or looser than others. Also, you should always remember to lubricate those head bolts. You should be able to run them down by hand.

If you're going to mill the heads for more compression while you have the top end apart, or decide to use other than stock head and base gaskets, then make sure you figure in the stress factors when setting up your torque plates.

After you have your boring machine set up, you can start cleaning up the cylinders by boring them out until they are free from all traces of scoring (photo 2).

Once this is done, you can measure for the proper piston size needed. The only way to do this right is to measure the cylinder bore (photo 5). Because there is no way to measure the factory pistons, you must go by the size stamped on the piston. Measuring the cylinder size will give you the correct size piston needed to fill the hole, whether it's a factory style piston or one you choose for the purpose of a little boost.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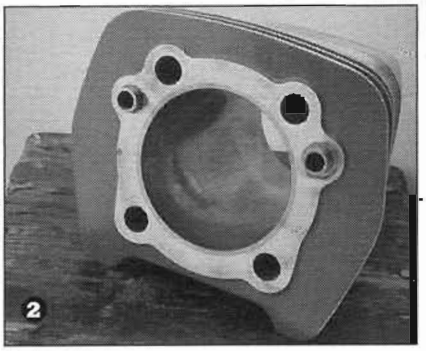
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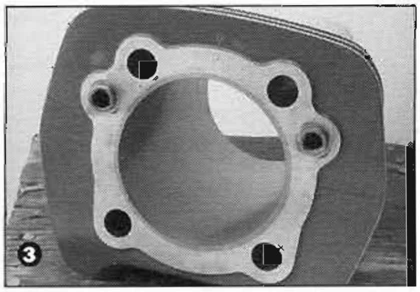
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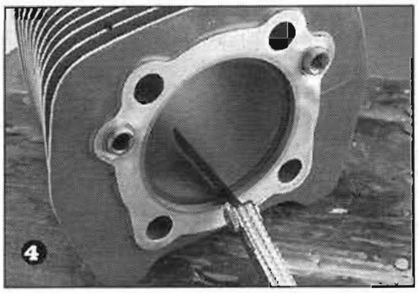
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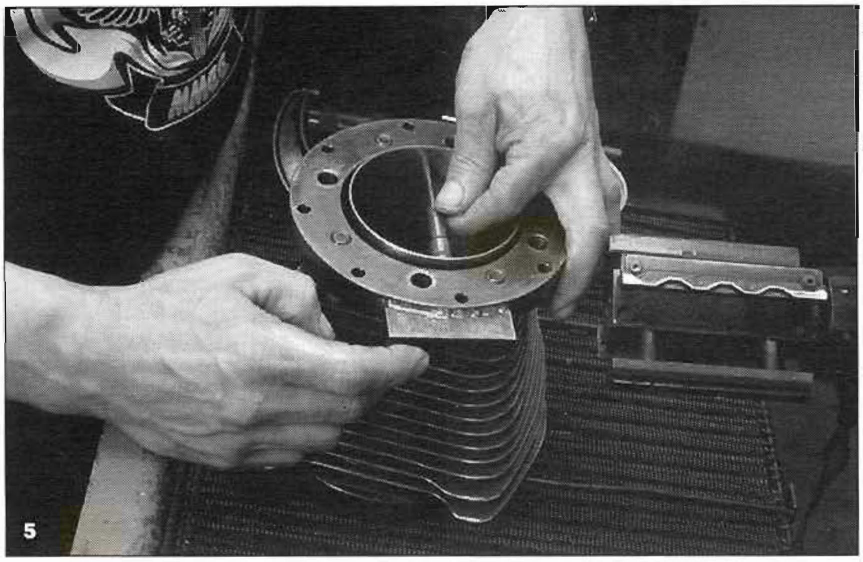
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Photos: Markus Cuff

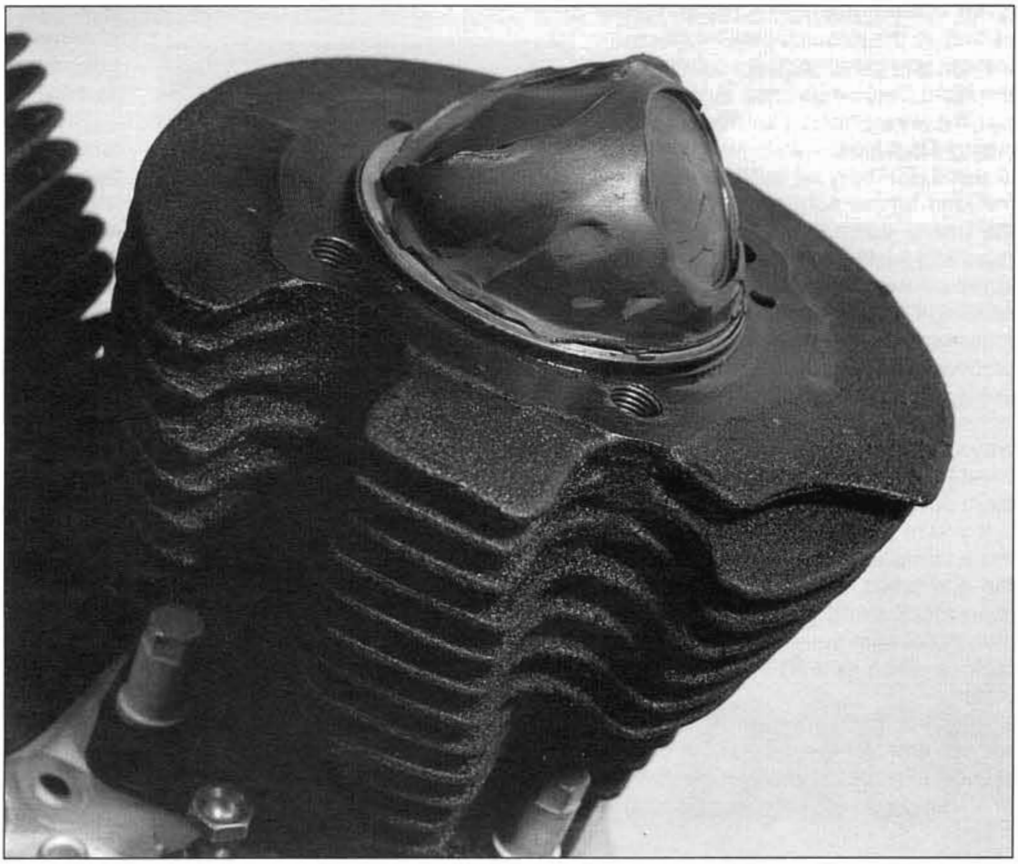
After the right piston is chosen, the next step would be to hone the cylinder. Honing is done to create the finished surface, against which the piston and rings travel (photo 3). The rough bore would act as a file on the new rings, quickly causing excessive wear. As the rings wear, the ring cap expands, and guess what? You're burning oil. Of course, if the cylinder walls are too smooth, then the rings never really seat well. The proper honing will leave a nice cross hatch, enabling the rings to seat as they should with the proper break-in. Ring suppliers usually recommend the proper grit for your honing bar to create the finish best suited for their rings.

The proper honing will leave a nice cross hatch, enabling the rings to seat as they should with the proper break-in.

Speaking of rings, you're not out of the water yet. The next step is to measure for piston ring gap (photo 4). You do this by taking the compression rings one at a time, putting them down inside the top of the cylinder, using the piston to ensure that they're in the cylinder perpendicular and at the same depth all the way around. Next, take a filler gauge and measure the amount of gap. The rule of thumb is .004 multiplied by the inch of bore of the cylinder. That would be about .014 to .020 for your stock 80-incher. The piston ring package has all the necessary information so always read it before you do anything.

The last thing to remember in this process is proper break-in. Ultimately, no matter how well you measure fit or assemble the parts, the one thing that will destroy all your hard work is forgetting to give it time to settle in from the major surgery you just performed. Breaking in your scooter the right way will give you many trouble-free miles, but if you throw caution to the wind, just open your wallet and try again.

—Big Daddy Drew



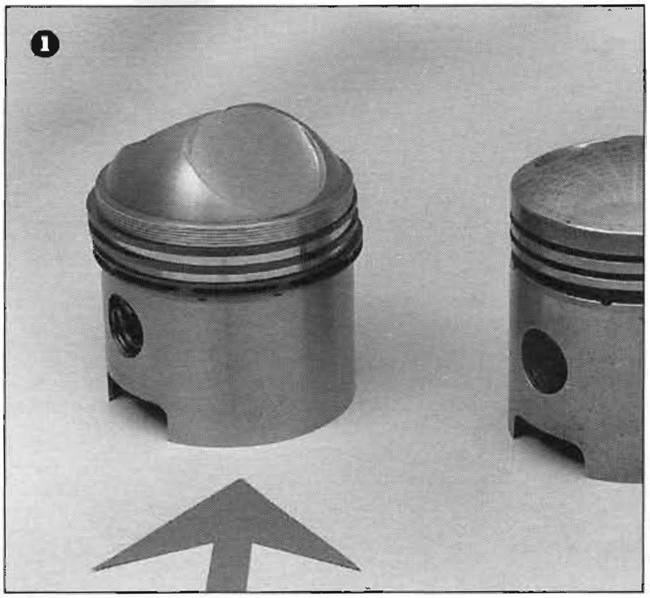
YOU TAKE A HUNDRED GRAMS OF CLAY

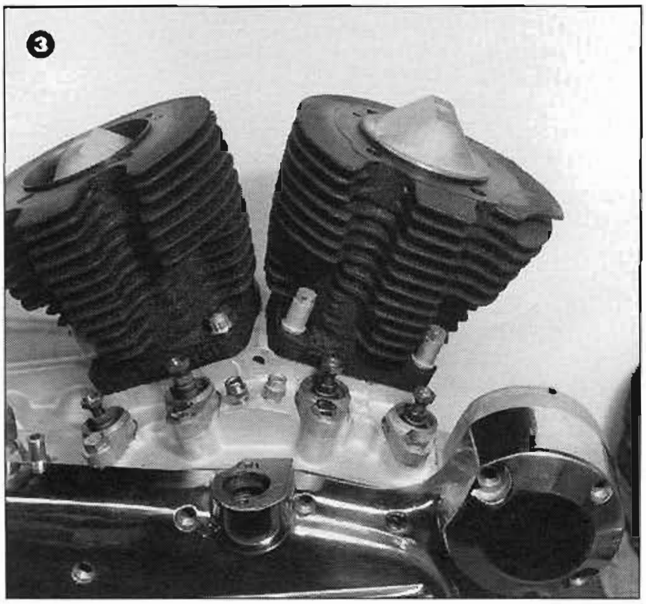
CLEARANCE CHECKING THE EASY WAY

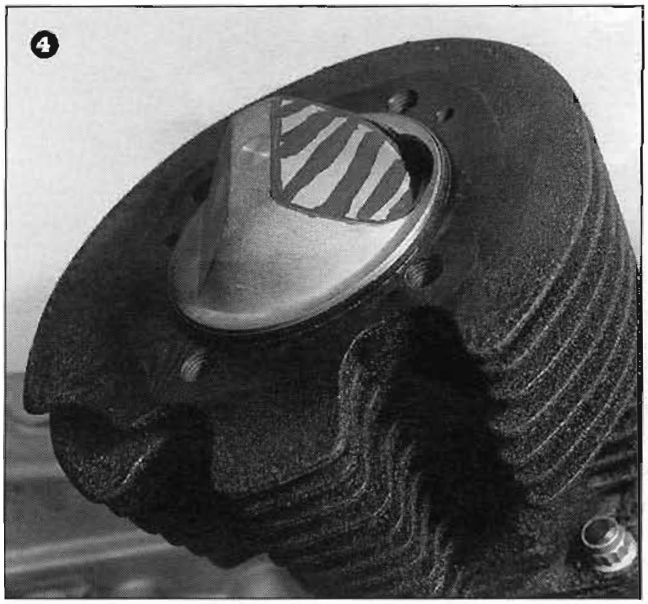
Building a high-power Harley? Chances are, you'll be making changes to your top end. A high-lift, long duration cam will raise valves off their seats higher and hold them open longer—for better cylinder filling and evacuation. Bigger ports and valves also let more fuel flow in and out of the combustion chamber. High-compression pistons squeeze that fuel mixture tighter, giving you more bang once it's burned. And, dual or projected-nose plugs can fire the mixture faster and more completely.

There is at least one common result—and potential pitfall—to many of these routes toward more power. They can affect all-important clearances inside your top end. You've got pistons going rapidly up and down while valves are opening and closing at blinding speed. Plus, spark plug tips firing in the center of the action. And, unless all the moving elements are timed and located correctly, big trouble can happen. Common catastrophes are valves hitting pistons, or piston domes themselves kissing cylinder head squish bands.

Here's a way to avoid the pitfalls. It's plastic modeling clay, the Harley engine builder's best friend. It gives you a simple and easy way to double check clearances inside your engine—before trouble occurs. The primary use is measuring all-important valve-to-piston clearances—and that's what our photo sequence details. But, you can also apply the same techniques to other close-quarter areas. In stroker motors, for example, clay checking can help you



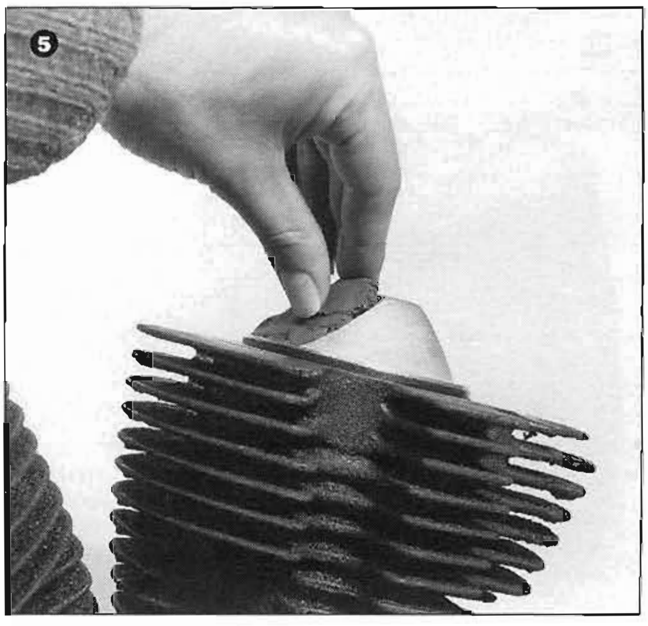


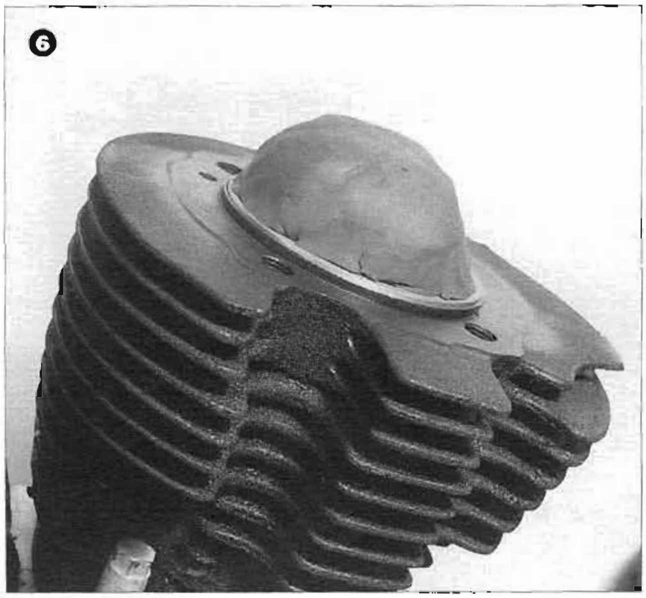


confirm that rods aren't fouling themselves or the crankcase, or that piston skirts are clearing flywheels. Clay can also help you ascertain—and avoid—valve spring coil bind with things like replacement valve seats, high lift cams, alloy bronze valve guides, or aftermarket spring retainers.

So here's the lowdown. We used clay to check the valve-to-piston face distances after the installation of forged hotrod pistons that had a raised dome for increased compression ratio (photo 1). What you should obtain for the clay is non-hardening plasticine (photo 2). It's a common item at most art, craft, hobby, and model supply shops.

To start with, you want to assemble your engine's lower end—including cam, lifters, and timing cover. Also, temporarily put together pistons and jugs on the crankcase (photo 3). Unless you're truly confident that your clearances are in the clear, you skip piston ring and wrist pin locks. That's because you may have to dismount pistons to adjust tolerances later, if necessary. Specifically, we used clay to see how close the opening valves came to the faces machined into the piston dome (photo 4). You open up the clay package and knead a taste. It's a little bit stiff when cold and applies better once slightly warm. Press the clay firmly into the piston face (photo 5), making sure you have no voids or bubbles. Continue until you leave a generous

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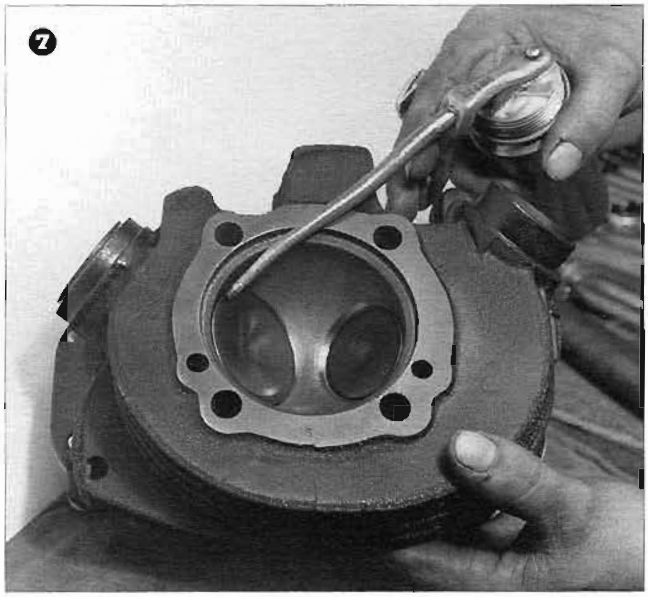
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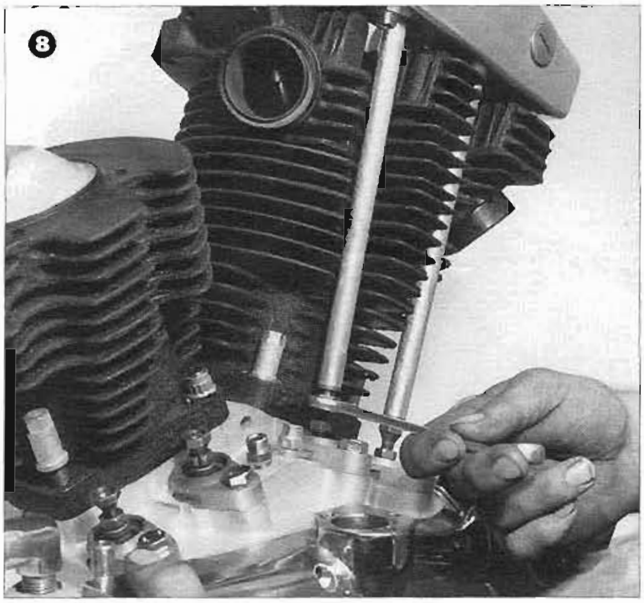
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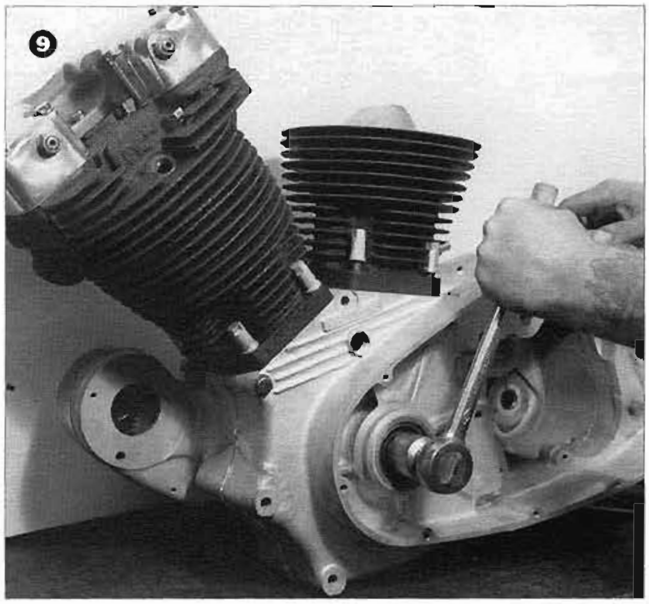
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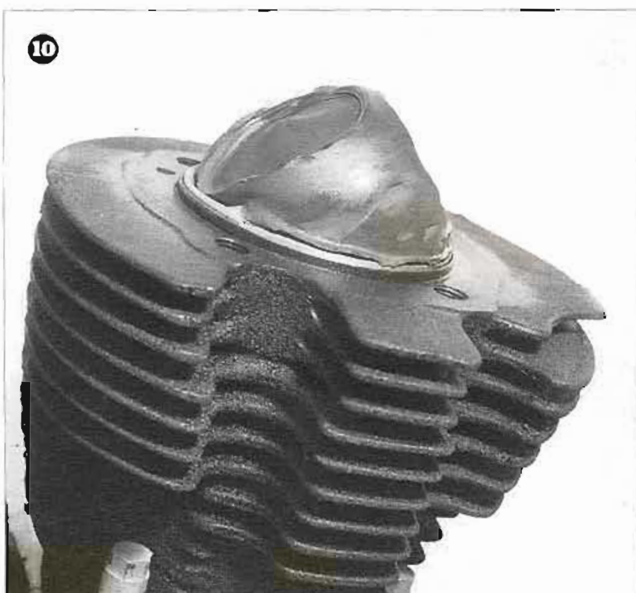
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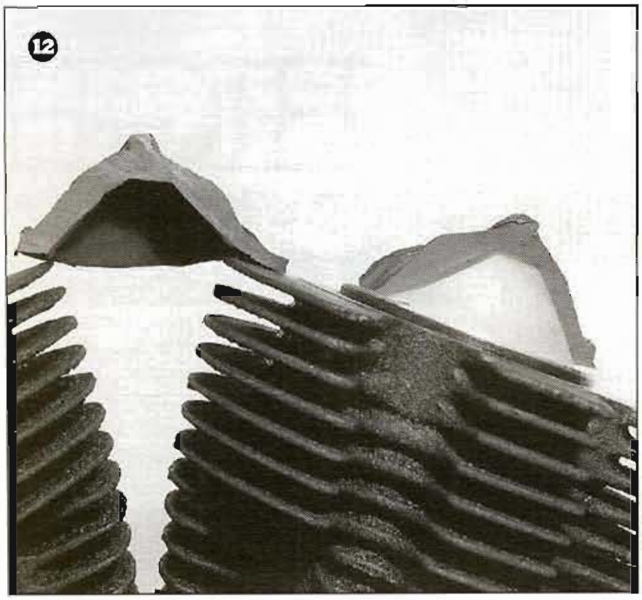

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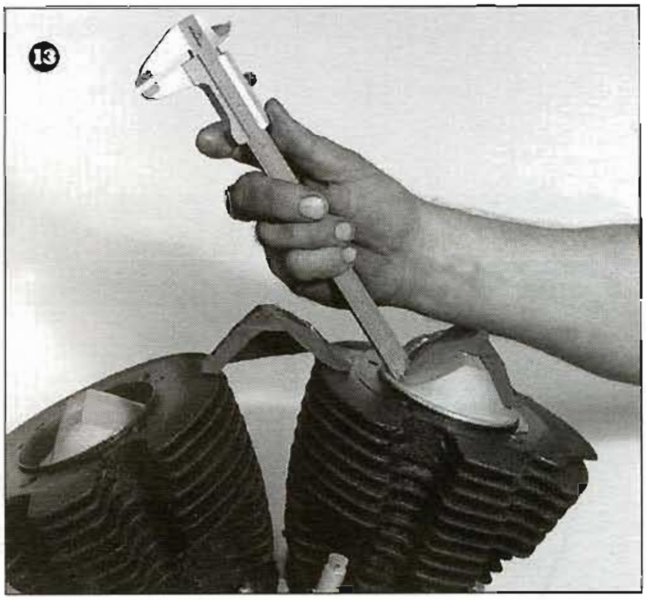

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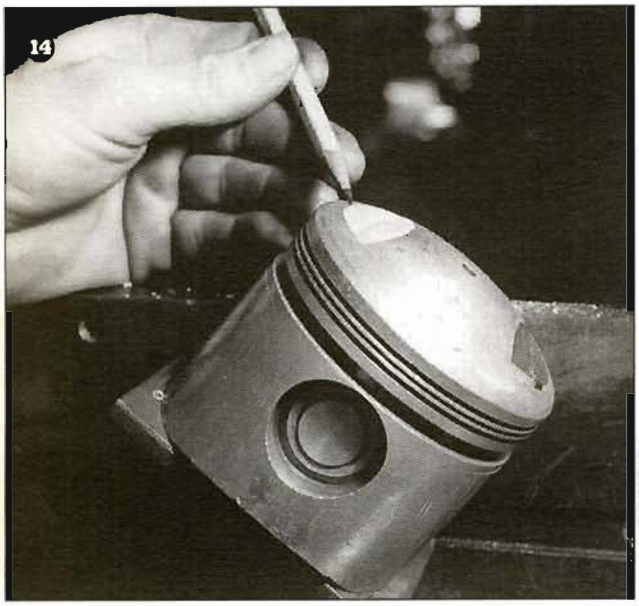
Photos: Jake



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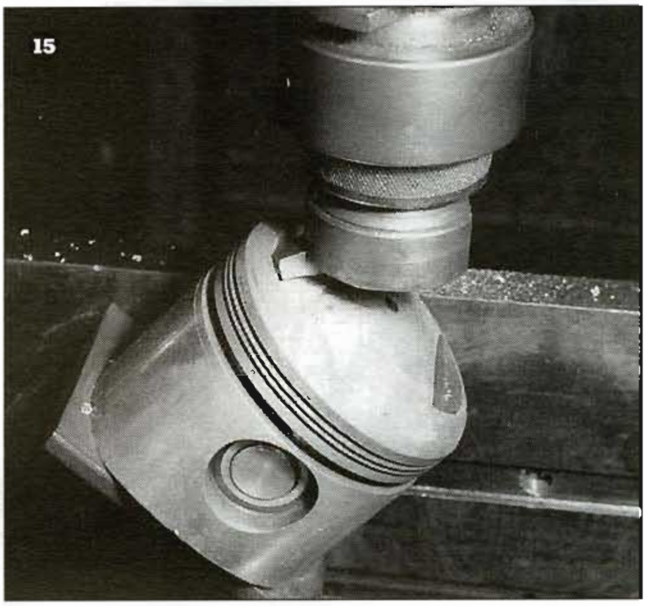

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thickness on the overall piston dome—about 3/8-inch (photo 6).

Now you are ready to bolt things up for a dry run. Cylinder heads should be fully assembled with rocker assemblies (shafts, arms, covers, etc.) and valves, springs and retainers all in place. Apply or spray a little thin oil to the combustion chamber and valve face surfaces (photo 7) and spread thinly. That will help the clay release later. Next, assemble the heads onto the rest of the engine. Make sure you include the pushrods and adjust to take up all tappet clearance (photo 8). This step is especially important with hydraulic lifters, which should be assembled dry. For a little added insurance you can set lifter clearances slightly negative (tight) to make sure the valves are thoroughly lifted off their seats.

At this point, turn the assembled engine over by hand through several complete revolutions. Proceed slowly. A wrench on the engine sprocket nut should do the trick (photo 9). Do not use electric starter, since even that slow an engine speed could result in a bent pushrod if you have a clearance conflict on top.

Proceed to remove the cylinder heads. Eureka! You now see a precise impression, where the valve has left its mark on the clay you piled on the piston dome (photo 10). With a sharp thin knife (X-acto blade, jack knife, etc.) carefully cut through the clay at midsection of the dome, front to back (photo 11). Do not use too blunt an instrument, or you'll disturb the clay thickness. Gingerly remove half the clay impression. What you'll see is a cross-section of the clearance left between valve and piston (photo 12). Now you can measure that distance. If you've got sharp eyes, then a machinist's ruler might get by, but best is a caliper or micrometer depth gauge. Make sure you put your caliper, depth gauge, or equivalent where the clay is the thinnest (photo 13).

Minimum safe valve-to-piston clearances are a matter of opinion; consult the supplier of your engine, pistons, and/or valves for their standard. We'd generally recommend a minimum distance, as measured, of .090-inch. Any less may require that the face in the piston dome (photo 14) relieved an appropriate amount. Be careful you make sure you note in a safe place the amount needed for removal. This step should not be overdone since ample piston crown thickness is needed to absorb heat generated in the combustion process. The piston is generally flycut on a vertical mill (photo 15). The machining is not rocket science but it is a nuisance since pistons must be dismounted. Now you know why we skipped the piston rings and wrist pin locks before. It does take the pain out of the process.

All of which, mind you, is truly featherweight compared to the alternative: bent pushrods, broken valves, and battered pistons—all dredged out of a blown engine. 'Nuff said.

—Jake

ACES HIGH
STROKER'S WILD

THE INSIDE STRAIGHT ON STRONG-ARMED BIG TWINS

It's an old hot rodder's adage: "There ain't no substitute for cubic inches." And for decades, Harley-Davidson's aptly-named Big Twin has delivered amply—61, then 74, now 80-plus. Still not enough? Then consider a stroker for even more of the muscle that makes Milwaukee famous. Cut the cards and deal!

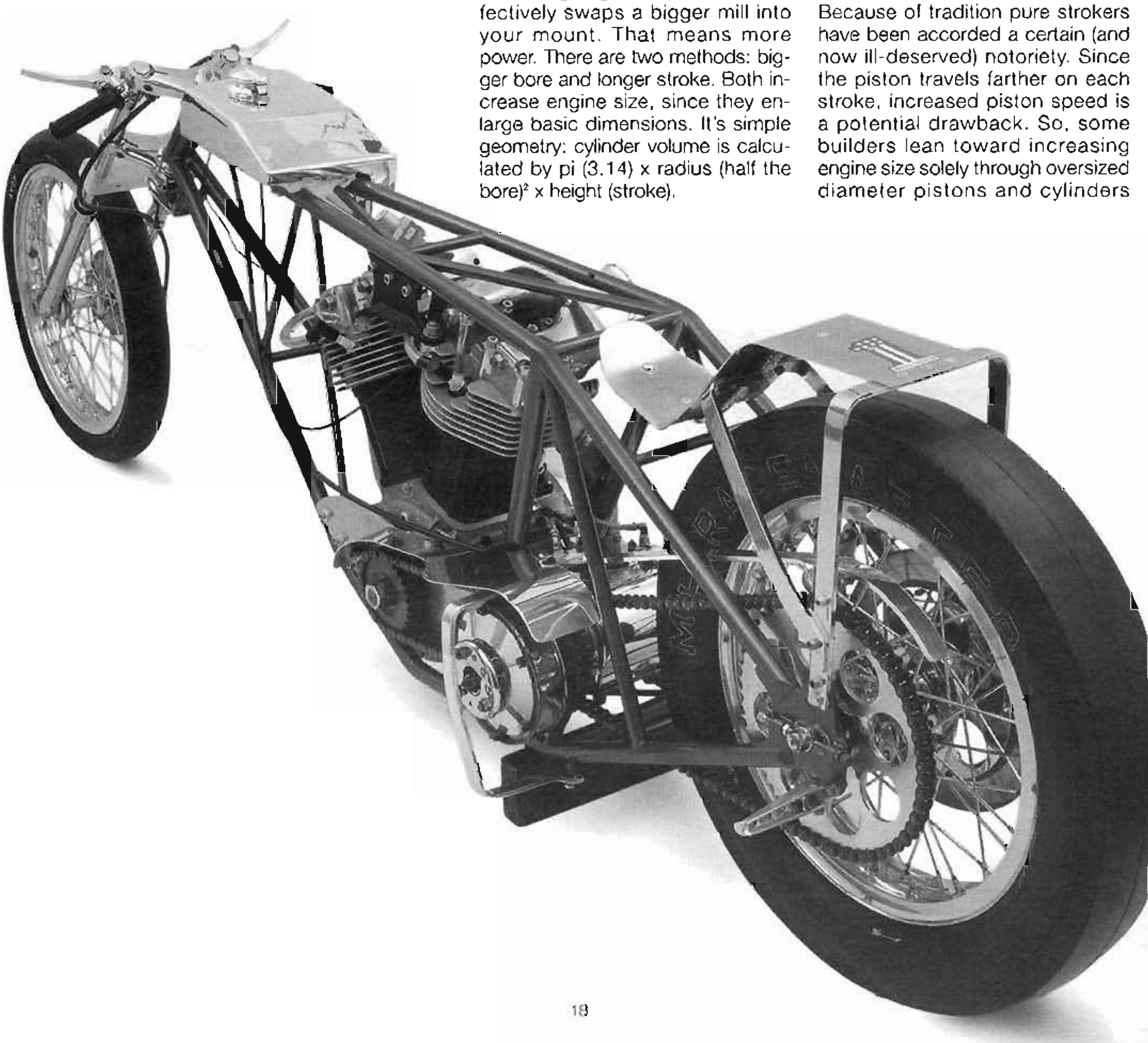
THE BASICS: MORE STROKE MEANS MORE MOTOR

Increasing engine displacement effectively swaps a bigger mill into your mount. That means more power. There are two methods: bigger bore and longer stroke. Both increase engine size, since they enlarge basic dimensions. It's simple geometry: cylinder volume is calculated by pi (3.14) x radius (half the bore)^2 x height (stroke).

Stroke is twice the distance (photo 1) between the centerline of the crankshaft and crankpin (see illustration, page 28). Lengthen it, the piston moves up and down further on each rev, and you've got yourself a pair of taller, bigger cylinders—and a stroker. More cylinder means more gas burned per rev, more energy liberated, more acceleration, and more speed

STROKERS VS. BIG BORES

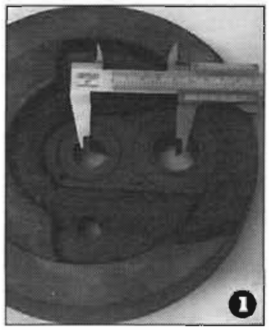
Because of tradition pure strokers have been accorded a certain (and now ill-deserved) notoriety. Since the piston travels farther on each stroke, increased piston speed is a potential drawback. So, some builders lean toward increasing engine size solely through oversized diameter pistons and cylinders



(photo 2). Big increases are possible (photo 3). Often stroking and boring combine for really monstrous results (see displacement chart). Both entail major surgery—engine disassembly and splitting of crankcases. So why not go the whole hog (pun intended)? For big-bores, crankcase mouths must normally be remachined (photo 4) to accept larger-diameter cylinder spigots—best done to aftermarket cases with the requisite extra meat (photo 5). So costs mount. Modern strokers usually require less rework of cases and other parts (see mod chart) as we'll see shortly. Each method can create growing challenges at bigger sizes, which are best handled by professional engine builders. Both in theory and on the street, strokers deliver the most improvement per buck in the best Harley tradition: gobs of added torque at low revs—piston speed is hardly a worry.

A HISTORIC HARLEY HOP-UP

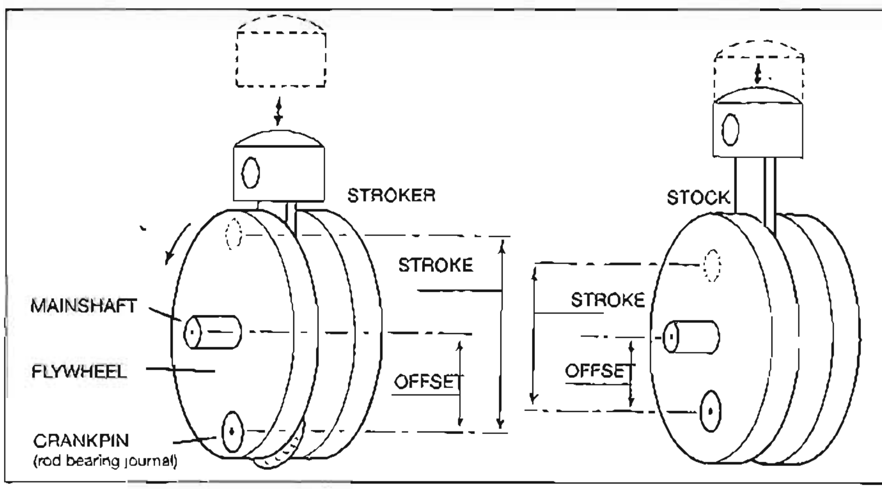
Strokers are rooted in history. Long ago, Harley-Davidson's built-up crankshaft design let backyard pioneers swap long-stroke cast-iron UL flywheels (photo 6) into 74-cubic-inch Big Twins. The result? The first strokers: 80 cubic inches. (A similar strategy put KHK wheels into early Sportsters.) It was no easy road, for strokers cause widespread and subtle alterations to internal engine geometry (see cylinder changes chart). To compensate, home brewed stroker plates (photo 7) raised cylinders so their tops matched the new home territory of stroked pistons. These, in turn, put heads further out on the end of the Vee. That necessitated relocated oil drains, wider intake manifolds (photo 8), longer pushrods (photo 9), and frequent head-to-frame conflicts. And, the different diameter of UL wheels themselves required crankcase machining (photo 10) to maintain oil scraper tolerances. The bigger circle made by rods in a stroked lower end also could require widespread and judicious whittling of piston skirts (photo 11—see cross hatch), case mouths (photo 12), cylinder spigots (photo 13), and rod-to-rod clearances (photo 14). For example, putting that new and bigger displacement between the same pistons and cylinder head leads to a compression ratio increase, greater ignition demands, and altered induction needs. Ordinary, low-tensile and often-aged cast-metal flywheels and pistons made stroker engine failure an unfriendly but all-too-frequent garage guest.



EFFECT OF BORE AND STROKE INCREASES ON THE BIG TWIN ENGINE DISPLACEMENT

Displacement	Bore	Stroke
60.3 cu. in. (FLE)	3.31 in.	3.5 in.
73.6 cu. in. (74)	3.438 in.	3.968 in.
73.8 cu. in. (UL)	3.31 in.	4.28 in.
79.4 cu. in. (ULH)	3.437 in.	4.28 in.
81.8 cu. in. (EVO)	3.5 in.	4.25 in.
89 cu. in.; stroked	3.5 in.	4.625 in.
91.4 cu. in.; stroked**	3.5 in.	4.75 in.
96.2 cu. in.; stroked	3.5 in.	5.00 in.
101 cu. in.; stroked	3.5 in.	5.25 in.
87.7 cu. in.; bored	3.625 in.	4.25 in.
95.4 cu. in.; bored	3.78 in.	4.25 in.
96.9 cu. in.; bored**	3.81 in.	4.25 in.
106.8 cu. in.; bored	4.00 in.	4.25 in.
95.5 cu. in.; stroked & bored	3.625 in.	4.625 in.
98 cu. in.; stroked & bored	3.625 in.	4.750 in.
103.2 cu. in.; stroked & bored	3.625 in.	5.00 in.
103.8 cu. in.; stroked & bored	3.78 in.	4.625 in.
105.4 cu. in.; stroked & bored	3.81 in.	4.625 in.
106.6 cu. in.; stroked & bored	3.78 in.	4.750 in.
108.3 cu. in.; stroked & bored**	3.81 in.	4.750 in.
112.2 cu. in.; stroked & bored	3.78 in.	5.00 in.
125.1 cu. in.; stroked & bored	4.00 in.	5.00 in.

**suggested maximum for long mileage street engine



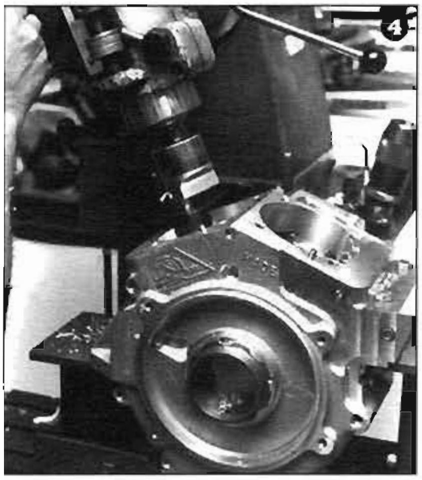
SUMMARY OF MODIFICATIONS IN STROKER ENGINES

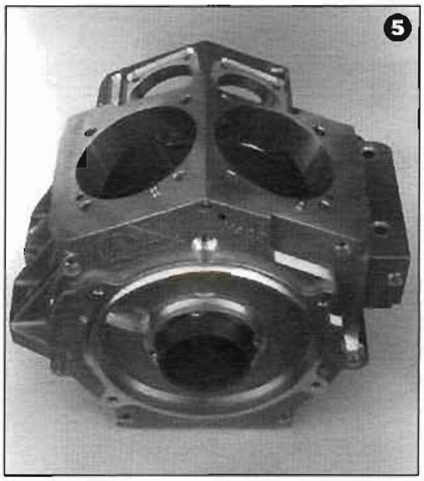
Parts	Modification needed	Reason	Solution
Flywheels	reduced diameter to clear pistons	lower piston travel	aftermarket wheels
Connecting rods	grind increased clearance in neck of forked rods	wider crank swing	aftermarket, pre-clearance rods
Cylinder barrels	increased height, relocated oil drains, notched spigots	higher piston rise, wider rod swings	stroker pistons, cylinders*
Pistons (bottom)	shortened, clearanced skirts	to clear flywheels	aftermarket pistons
Pistons (top)	raised wrist pin location, lowered dome	higher piston rise	aftermarket pistons
Crankcases	notched cylinder mouths, relieved wall	to clear rods	machining, aftermarket cases
Manifolds, pushrods	increased length	taller engine*	aftermarket parts
Frame, engine mount	relocated holes, relieved tubes	taller engine*	aftermarket

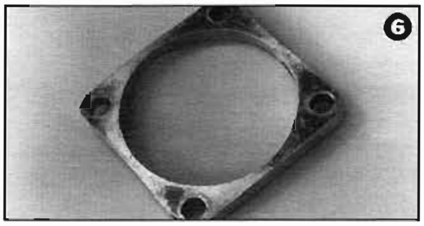
*Note: use of stroker pistons with higher wrist pin locations can eliminate the need for stroker cylinders (and consequently altered engine height) in strokers up to 4.750 inches.

SPECIAL STROKER RIDING AND WRENCHING SUGGESTIONS

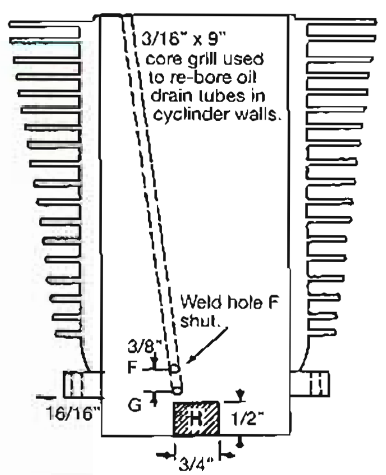
1. Avoid high engine speeds; use an ignition with a rev limiter, tach, and longer overall gearing.
2. Frequently attend to tightness of cylinder head and base nuts/bolts.
3. Avoid electric start operation if the engine has been cold soaked below 20 degrees for 24 hours
4. Maintain driveline components (belts, chains, clutches, axle adjusters) regularly.
5. Due to increased piston thrust, warm all year engines thoroughly before riding.
6. Evo: all aluminum engines rely partially on heat expansion for gasket seal; especially avoid heavy loads while cold; consider o-ringed heads.
7. Change oil frequently.







CYLINDER CHANGES



MAKING MOTORS MIGHTY— THE MODERN WAY

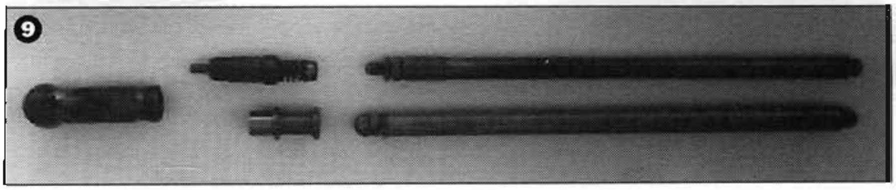
In comparison, today we've got it easy. Complete stroker component kits (photo 15) from an experienced and sophisticated aftermarket are engineered to minimize field alterations. For example, stroker pistons (photo 16) feature extra-short skirts, raised wrist pin location, and appropriate compression that long ago eliminated stroker plate headaches in many moderate length strokers. Special, taller cylinders (photo 17) now accommodate longer strokes. Aftermarket rods from S&S and Carillo are pre-clearance. Niceties like oversized mainshafts (photo 18) are available. Dual plug and dual electrode (photo 19) ignitions cope well with stroker sparking demands. Wider intake manifolds are supplied if necessary. Superior materials make failures a rarity. For example, low-expansion, forged aluminum alloy pistons with extreme pressure coatings (photo 20) easily contend with the increased piston speed and lateral thrust of strokers (see schematic). Thus, with a few precautions (see care chart), strokers can be ridden regularly like any Big Twin. Savvy riders and builders know their old bad reputation has gone the way of the mousetrap and suicide clutch.

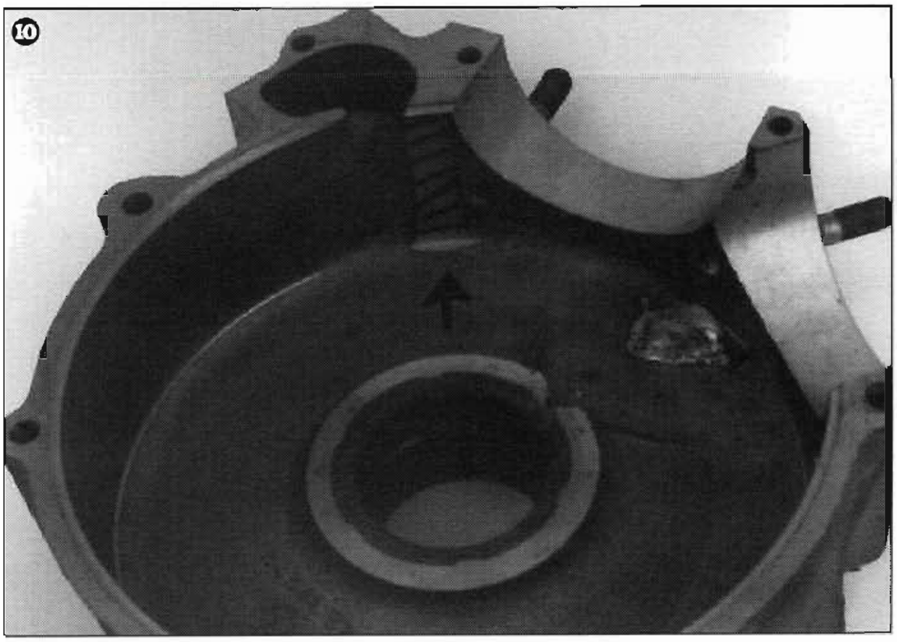
STROKER SPECIALISTS STRONGLY SUGGESTED

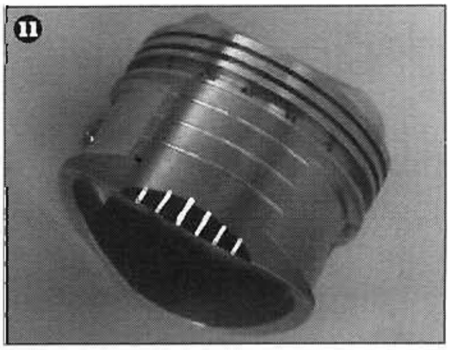
We cannot stress this point enough. The ability to build a stroker right in your own garage remains only for the *very* experienced. Besides their dimensional changes, strokers induce a host of other engine effects (see changes chart). Spark, cam, or exhaust a stroker just a taste off and you may end up with even less power than stock—and a big waste of money. Remember that you are creating a much bigger engine. That has ramifications throughout the entire driveline and chassis. So, locate a professional Big Twin engine builder to do the job, one who has plenty of experience in making a stroker run as strong as intended. Look for good stuff like machine tools, premium gaskets (photo 21), O-ringed heads (photo 22), and manifold clamps (photo 23). Talk to satisfied customers—those with more than one season on their 100 incher.

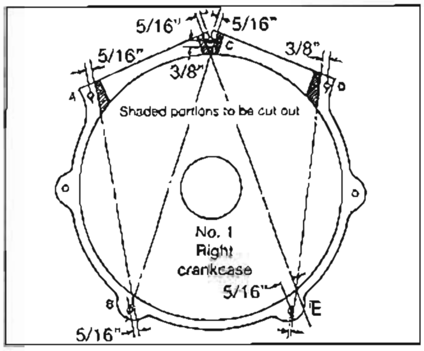
Bike shows are a good place to check out many big inch engines in one place. Take notes on who built what. Get the deal in writing. Don't push too hard for a bargain—you generally get what you pay for. And don't be put off by backlog—the good guys are in demand. A little homework and patience now will assure you a full-house motor later!

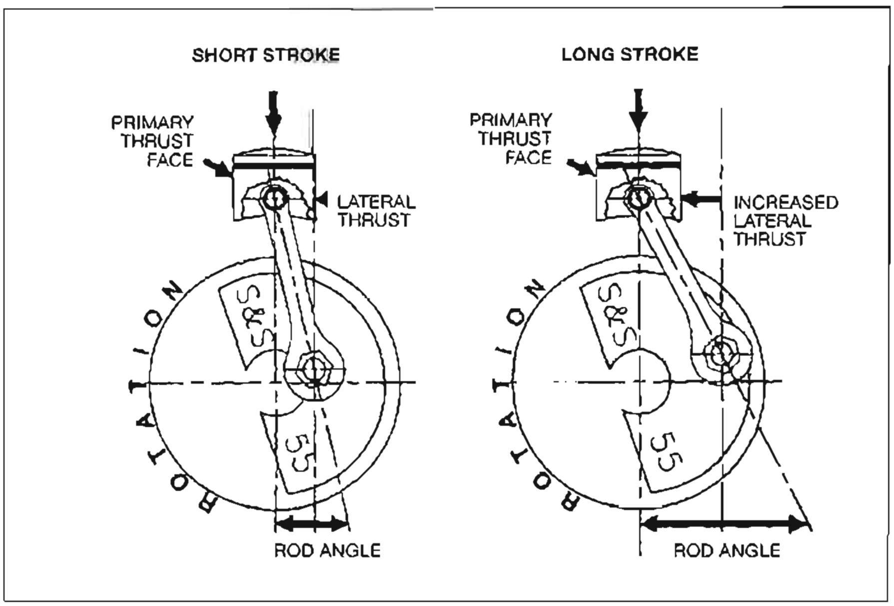
—*Jake*











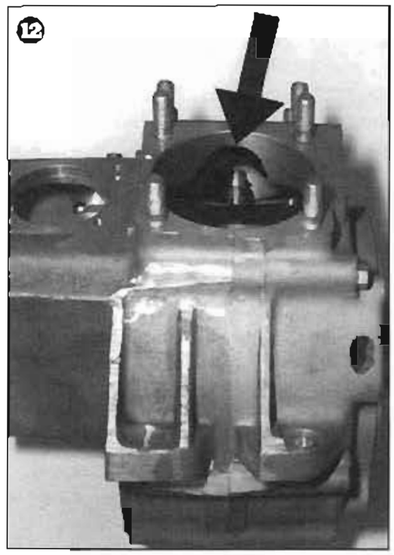
CHANGES IN ENGINE CHARACTERISTICS BY STROKERS AND COMPENSATIONS EVIDENCES AND FIXES

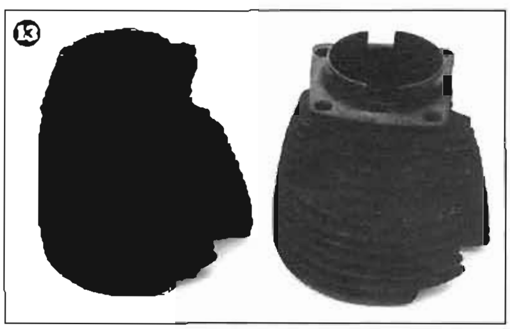
Operational stroker effect	Evidence	Strategy/solution
Higher rod and piston speed	rod bearing wear, ring land fractures, accelerated ring wear	limit engine rpm's; install tach, forged pistons, premium bearings
Increased lateral piston thrust	piston slap, wear, failure	forged lo-ex pistons, tighter fit, longer rods
Lowered rod/stroke ratio	less combustion time	better (faster) induction, ignition (dual plug heads, dual electrode plugs), longer rods
Less piston wear surface	skirt wear	skirt coatings and/or buttons, synthetic lubricants
Harder starting	electric starter wear, burnout	late closing inlet cams (S&S 563) high-torque starter, compression release
More displacement/gasket area	head gasket leaks	hi-perf. copper, Teflon, o-ring gasket, premiumsealants*
Larger effective engine size	increased driveline	heavier duty stress, wear components, especially drive side mainshaft
More power, torque	female attention, male envy	enjoy!

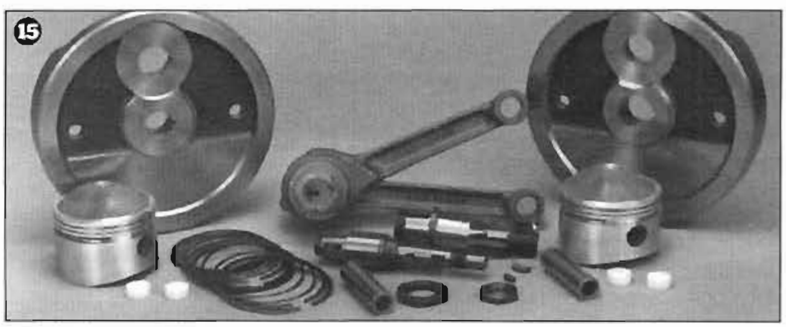
*especially Evo engines—only four head huts, rely on alloy barrel heat-growth for gasket seal.

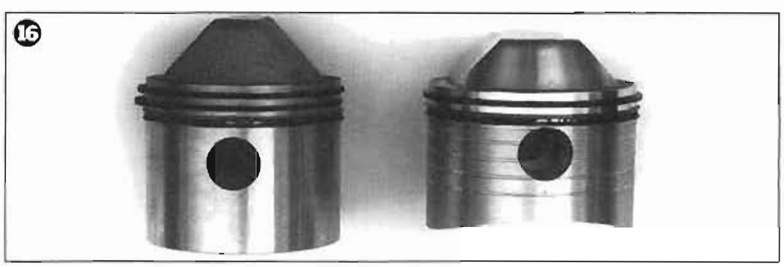
CHANGES TO ENGINE DIMENSIONS BY STROKERS—AND COMPENSATIONS

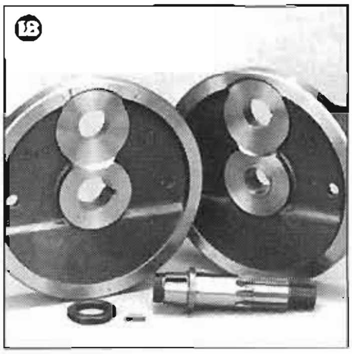
Dimensional stroker changes	Original (backyard) strategy	Today
Greater piston lift	stroker plates, relocate cylinder oil drains	taller cylinders, high-pins stroker pins
Deeper piston drop	shortened/relieved piston, shaved diameter flywheels	short slipper-skirt pistons, new smaller O.D. fly-wheels
Wider rod swing	notched cases, relieved rods,notched cylinder spigots	pre-clearanced rods, big bore cylinders, aftermarket cases
Increased compression ratio	milled pistons, thick head gasket	compensating pistons
Altered top geometry	longer pushrods, mani-fold; relieved frame	stroker pistons to maintain stock engine height (reduced compression distance)
Altered engine balance	engine rebalancing	engine rebalance or stock weight components







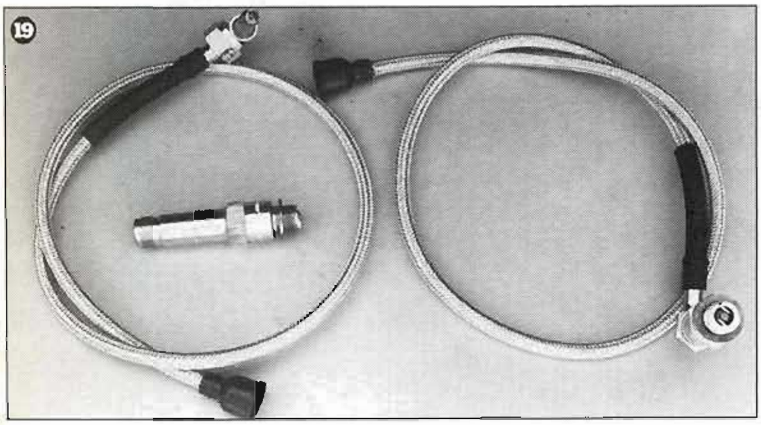


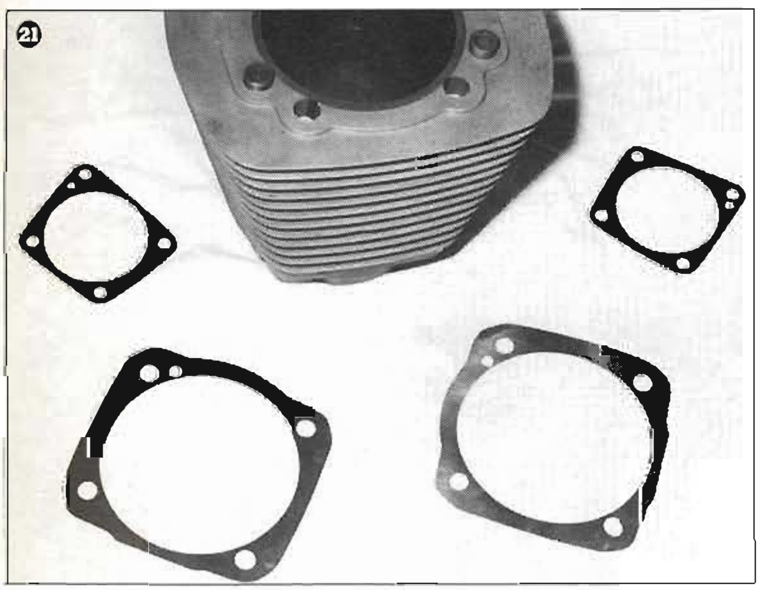


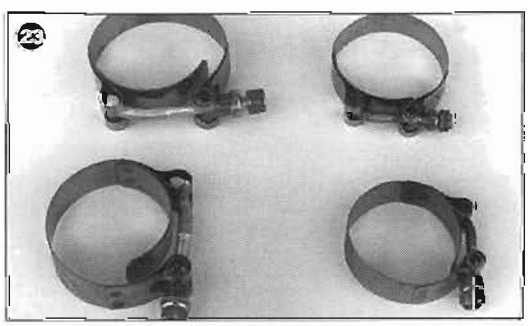
AFTERMARKET PARTS AND SOURCES

Component	Source
Stroker flywheels	Truett & Osborne 3345 E. 31 St. South Wichita, KS 671216
	S&S Cycle, Inc. Box 215 Rt. 2 County G Viola, WI 54664
Stroker rods	Carillo (through dealers) S&S Cycle, Inc.
Stroker kits	S&S Cycle, Inc.
Stroker/big bore pistons, cylinders	Axtell Sales, Inc. 1424 S. E. Maury Des Moines, IA 50317
	Sputhe Engineering, Inc. 1185 Lime Kiln Rd. Grass Valley, CA 95945
	Hyperformance 5152A N.E. 12th Ave. Pleasant Hill, IA 50317
Crankcases	STD Development P.O. Box 3583 Chatsworth, CA 91313
	Delkron 2430 Manning St. Sacramento, CA 95815
	Sputhe Engineering, Inc.
	S&S Cycle, Inc.
High torque electric starter	Tech Products 511 West Mahoney Mesa, AZ 85202
Compression release/head rework	Thompson Engine Service 186 River St. Dedham, MA 02026
Bronze crankpin thrust faces	Thompson Engine Service
Premium head gaskets	U.S. Strokers 1404 N. State Rd. 7, #163 Margate, FL 33063
	Sputhe Engineering, Inc.

Photos: Jake Thanks to Thompson Engine Service (Dedham, Mass.) for assistance in parts photography







STROKERS

The Straight Story

In motorcycle lore, there's nothing like a stroker for rocky romance and cantankerous cachet. Chet Herbert's Beast, an early '50s dragster, first publicized the power potential in long-armed, stroked engines. A hand-crafted, dual carbed, 80-inch Knucklehead, it amazed onlookers and ruptured records regularly. Soon, backyarders built a spate of similar big-inch street mills—with varying success. From that, the stroker's rowdy, roguish reputation was born.

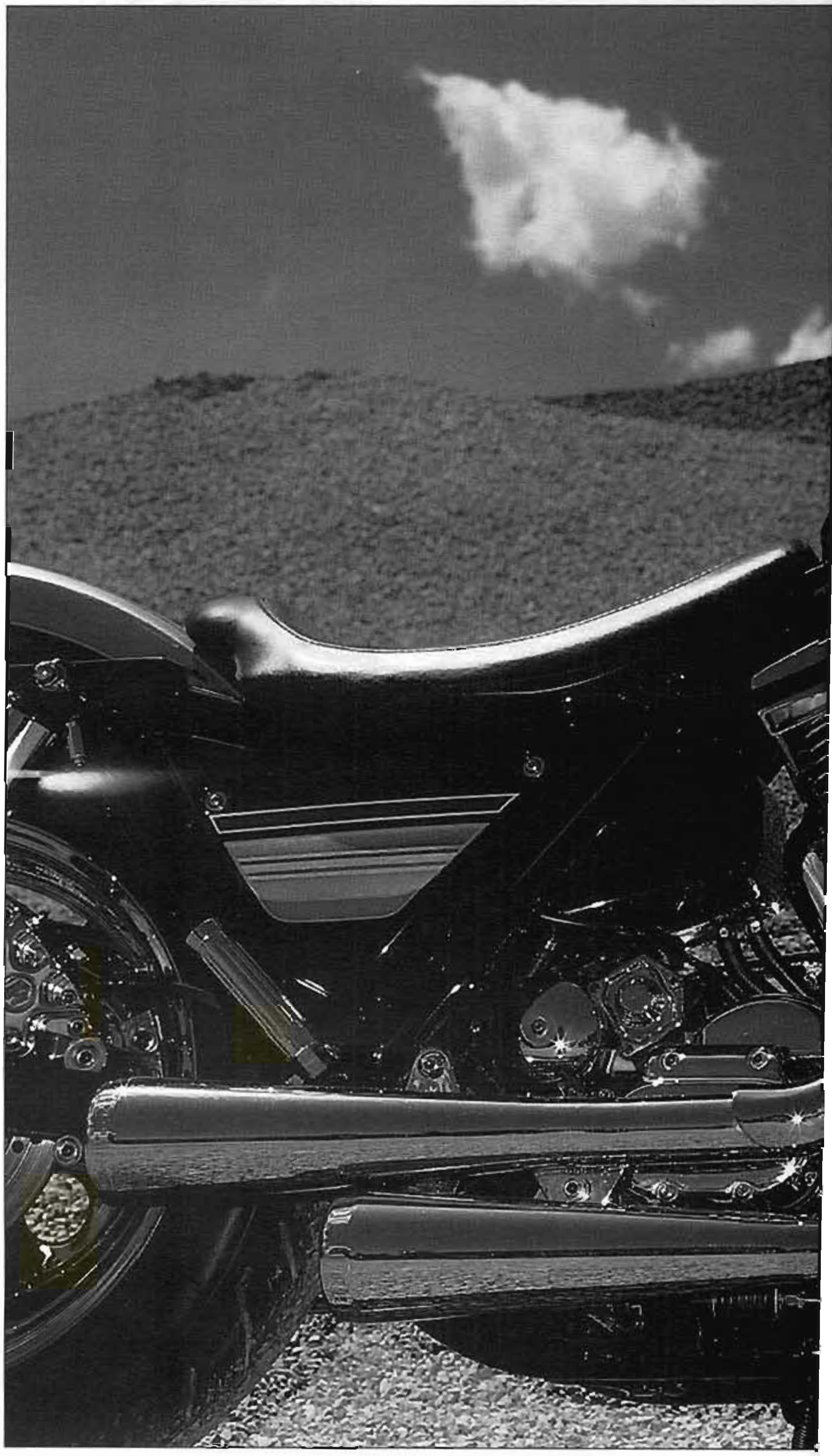
Today, strokers have ceased trading off treachery for tons of torque. Credit decades of development, modern metals and astute aftermarketers. Reliable electric-start strokers are ridden daily and cruised cross-country. Even the factory sometimes goes the stroker route to enlarge its product.

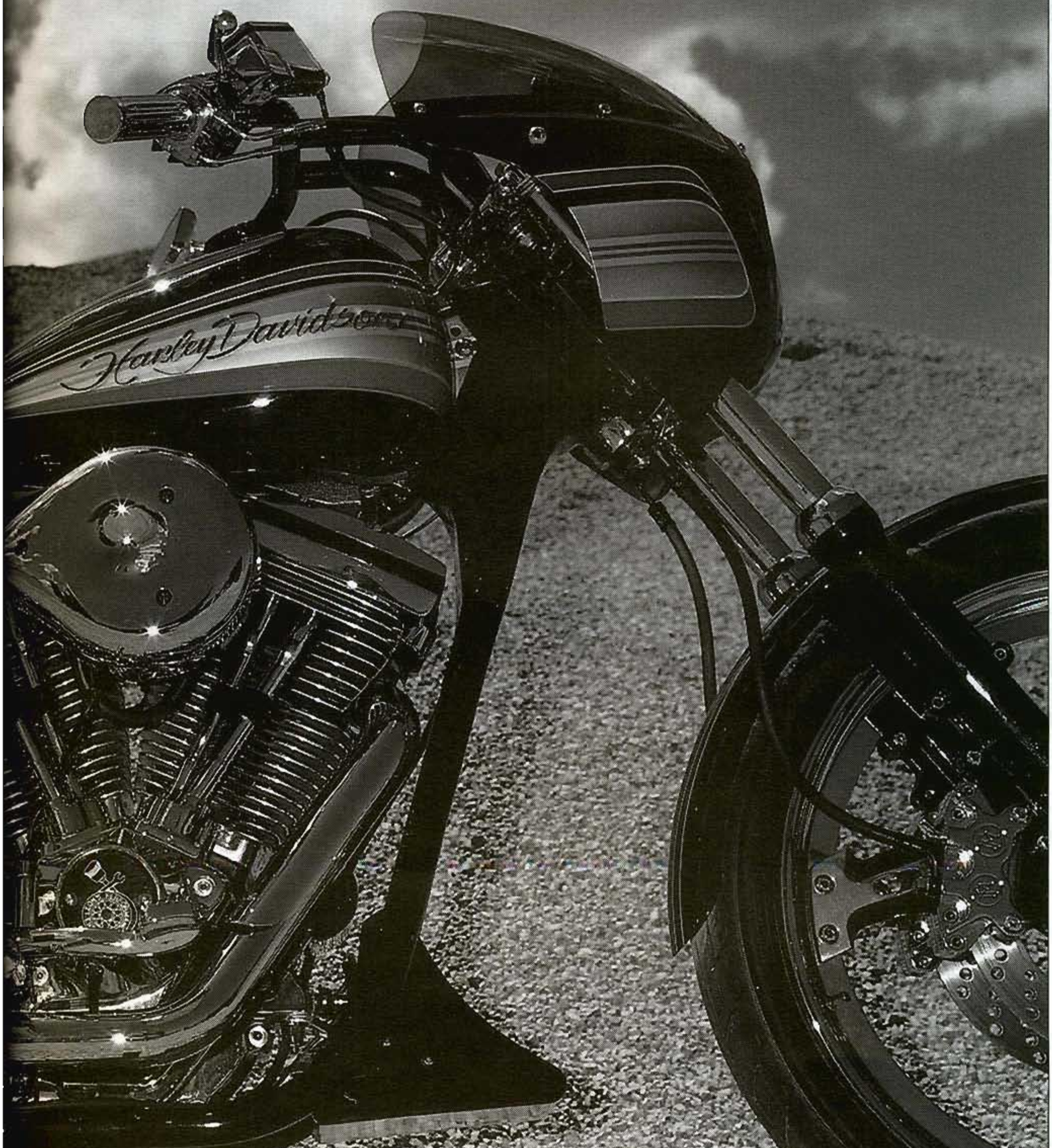
Lengthening an engine's stroke is a soup-up axiom. You get more displacement, more motor, more power. Thanks to stroker crank's greater leverage (like a breaker-bar wrench), riders also enjoy increased low-end torque.

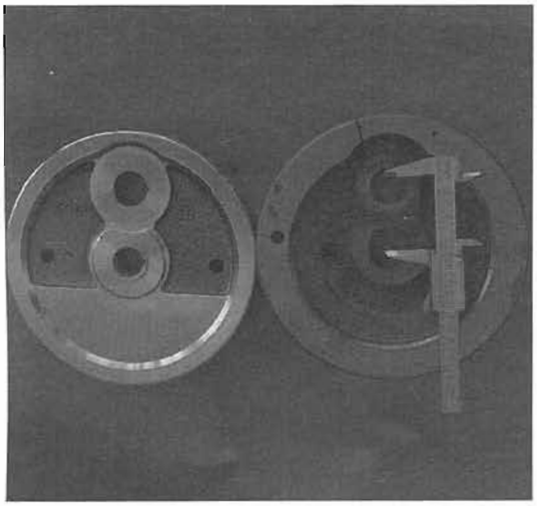
Altering a Big Twin's stroke is conceptually (and deceptively) simple, due to a single-throw, built-up crankshaft design. Cases are parted, the lower-end disassembled and two new stroker flywheels replace the originals. These relocate the crankpin (which is offset from centerline to create stroke) outward from the stock position. Consequently, pistons (and rods) reciprocate greater distances in the cylinder, increasing stroke.

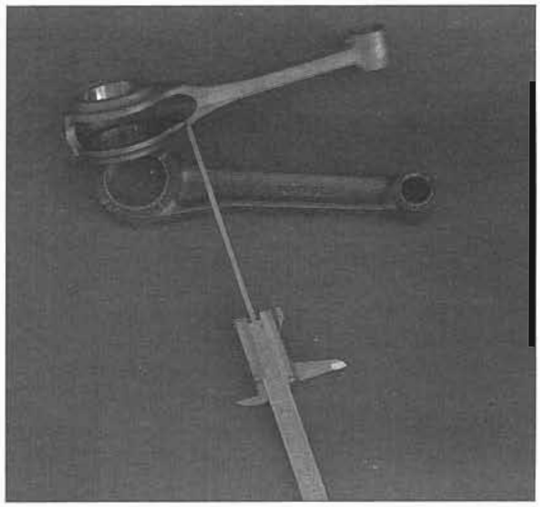
However, the devil deals out details. Strokers create—and demand—widespread engine changes. Some are obvious, dimensional and easily managed. (For example: much shorter and stronger forged stroker pistons can compensate for greater cylinder travel and thrust forces; aftermarket rods and cases have critical stroker clearances built in). But others aren't. To wit, some strokers create externally taller engines, necessitating added alterations. What's more, if you tune a stroker incorrectly, you'll easily end up with less power than stock. And Ben Franklins wasted.

For these reasons, an executive approach to strokers may work best



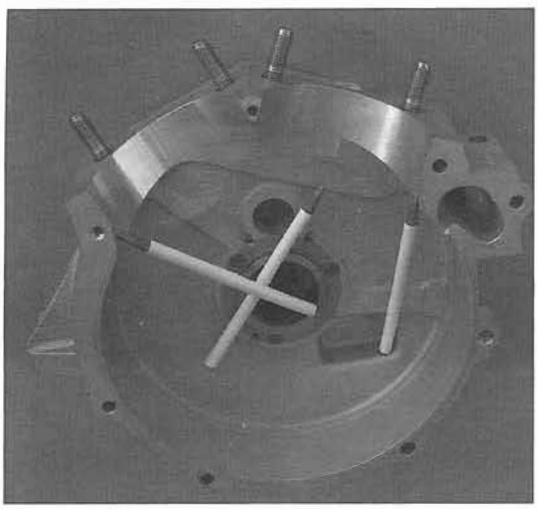

Harley Davidson

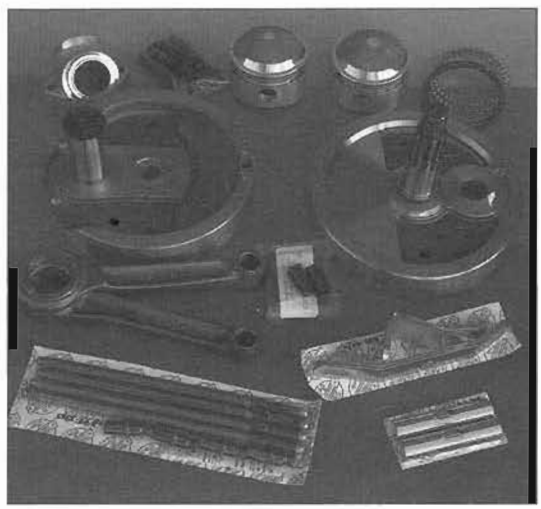




Far left: Crux of the matter: crankpin offset determines stroke. Lengthen it and you've got yourself a stroker. Stroked flywheel (left) has smaller O.D., but longer stroke. Caliper reveals all.

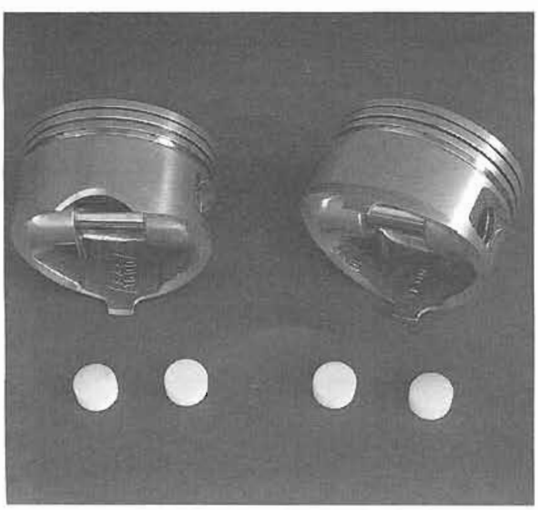
Left: Aftermarket advantages: rods from Carillo and S&S are pre-clearanced for strokers, eliminate grinding in the critical notch area.

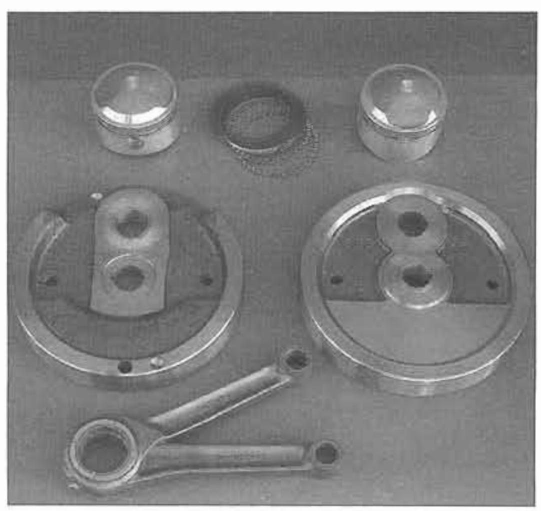




Far left: Case clearances: aftermarket castings come already milled to clear wider excursions of rods and crankpin nuts in a stroker lower end.

Left: Comprehensive kits: stroker packages range from basic (rods, rings, pistons and wheels) to total—replete with heavy duty fasteners, ancillary hardware, and even large mainshaft.





Far left: Critical compensation: since stroker cranks swing further, special pistons avoid costly collisions with head and flywheels. Key are shorter skirts and raised wristpin (effectively lowering the dome).

Left: Budget bug inches: a medium-sized, basic stroker requires minimum in parts, machining and jigger pokery. Payoff? Big bang for the buck.

We suggest:

Seeking a pro: Experienced engine experts have already solved the subtleties of Big Twin stroker surgery. Why reinvent the (fly)wheel on your own time and nickel? Research and network for a good builder, like any major purchase. Bike shows are a fertile field for leads. Nobody nearby? Forwarders can crate and freight quickly. Study literature; get deals in writing; avoid lowball bids. Talk to satisfied customers with over 20,000 miles on their stroker.

Limited extent: Consensus holds that strokers up to about 4.75-inches can live long and prosper. Push that envelope and technicalities, like piston speed and altered engine height, loom larger. And costs mount. Want more? Combine stroker with big bore—see following.

Boring your boar: With a big-bore conversion *and* a stroker, displacement soars to 105-plus inches without very long stroke concerns. Cases must be machined for oversized cylinders, but you eliminate some duplicate parts and operations. Your builder will expound on the happy details.

Planning ahead: Go stroker when your engine's already apart for obvious parts and labor savings. Remember, winter equals overload for shops. Avoid then. You'll get better, faster service—maybe even off-peak pricing.

Ride, wrench reasonably: Protect that stroker investment with thorough warm-ups, frequent oil changes, and careful driveline maintenance. Torque head nuts often. Avoid excessive engine speed via longer gearing, rev limiter or tach. Follow your builder's advice. Ask him about high-torque starters, "late closing inlet" cams and compression releases to make fire-up easier.

Once it's rolled out and ready for the road, you'll discover that riding a raffish, rakehell, raucous stroker can be regular, refined, even routine. Until you rotate the throttle, that is! It's like religion!

(For further stroker reading, see Paisano Publications' *Quick Throttle* Number 3)

—*Jake*

(Thanks to Thompson Engine Service, Dedham, Mass., for their assistance in parts photography)

Typical stroker engine modifications

Mod:	When
longer-stroker replacement flywheels	required
short skirt, raised pin pistons	required
retuning, timing, jetting, exhausting	required; extent varies
aftermarket (or clearance stock) rods	required
aftermarket crankcases	optional; advisable for 1990-up engines over 90-inches
taller cylinders	depends on stroke length
wider intake manifold	depends on stroke length
shorter, aftermarket rods	depends on stroke length
reworked upper engine, frame mounts	depends on stroke length
longer pushrods	depends on stroke length
premium head gasket (copper, Teflon, o-ring)	optional, recommended
longer final gearing, tach, rev limiter	optional, recommended
bronze crankpin thrust faces	optional, recommended
larger diameter drive-side mainshaft	optional, recommended
high-torque electric starter	recommended for 100-plus-inches
compression release	optional
relocated oil drains	pre-EVO and very big bores
overall engine re-balance	usually; component dependent

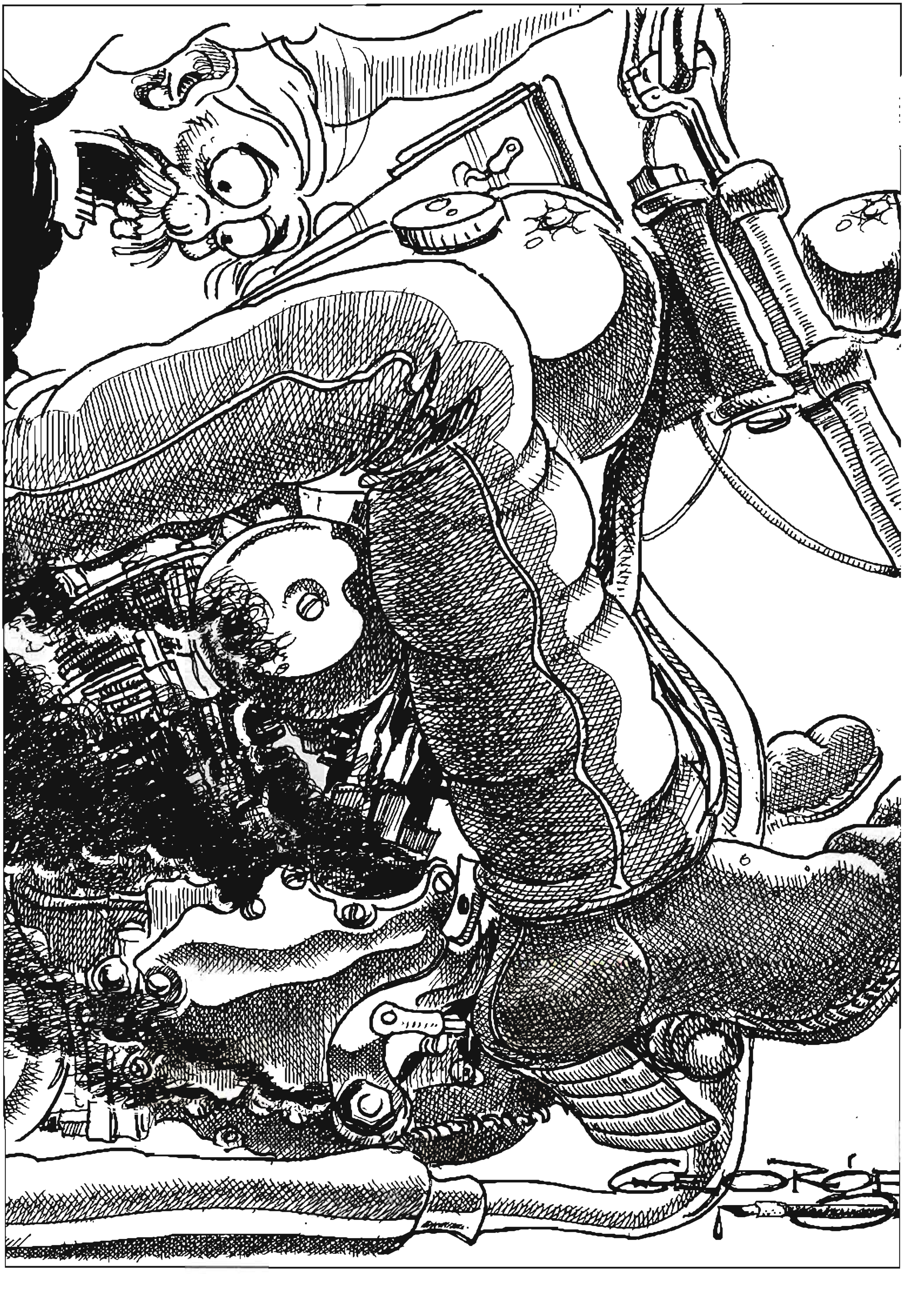
Effect of selected stroke and bore increases on total EVO engine displacement.

Displacement	Bore	Stroke
81.8 cubic inches; stock	3.5-inches	4.25-inches
89 cubic inches; stroked	3.5-inches	4.625-inches
91.4 cubic inches; stroked **	3.5-inches	4.75-inches
96.2 cubic inches; stroked	3.5-inches	5.00-inches
101 cubic inches; stroked	3.5-inches	5.25-inches
87.7 cubic inches bored	3.625-inches	4.25-inches
95.4 cubic inches bored	3.78-inches	4.25-inches
96.9 cubic inches bored **	3.81-inches	4.25-inches
106.8 cubic inches bored	4.00-inches	4.25-inches
95.5 cubic inches; stroked & bored	3.625-inches	4.625-inches
98 cubic inches; stroked & bored	3.625-inches	4.750-inches
103.2 cubic inches; stroked & bored	3.625-inches	5.00-inches
103.8 cubic inches; stroked & bored	3.78-inches	4.625-inches
105.4 cubic inches; stroked & bored	3.81-inches	4.625-inches
106.6 cubic inches; stroked & bored	3.78-inches	4.750-inches
108.3 cubic inches; stroked & bored **	3.81-inches	4.750-inches
112.2 cubic inches; stroked & bored	3.78-inches	5.00-inches
125.1 cubic inches; stroked & bored	4.00-inches	5.00-inches

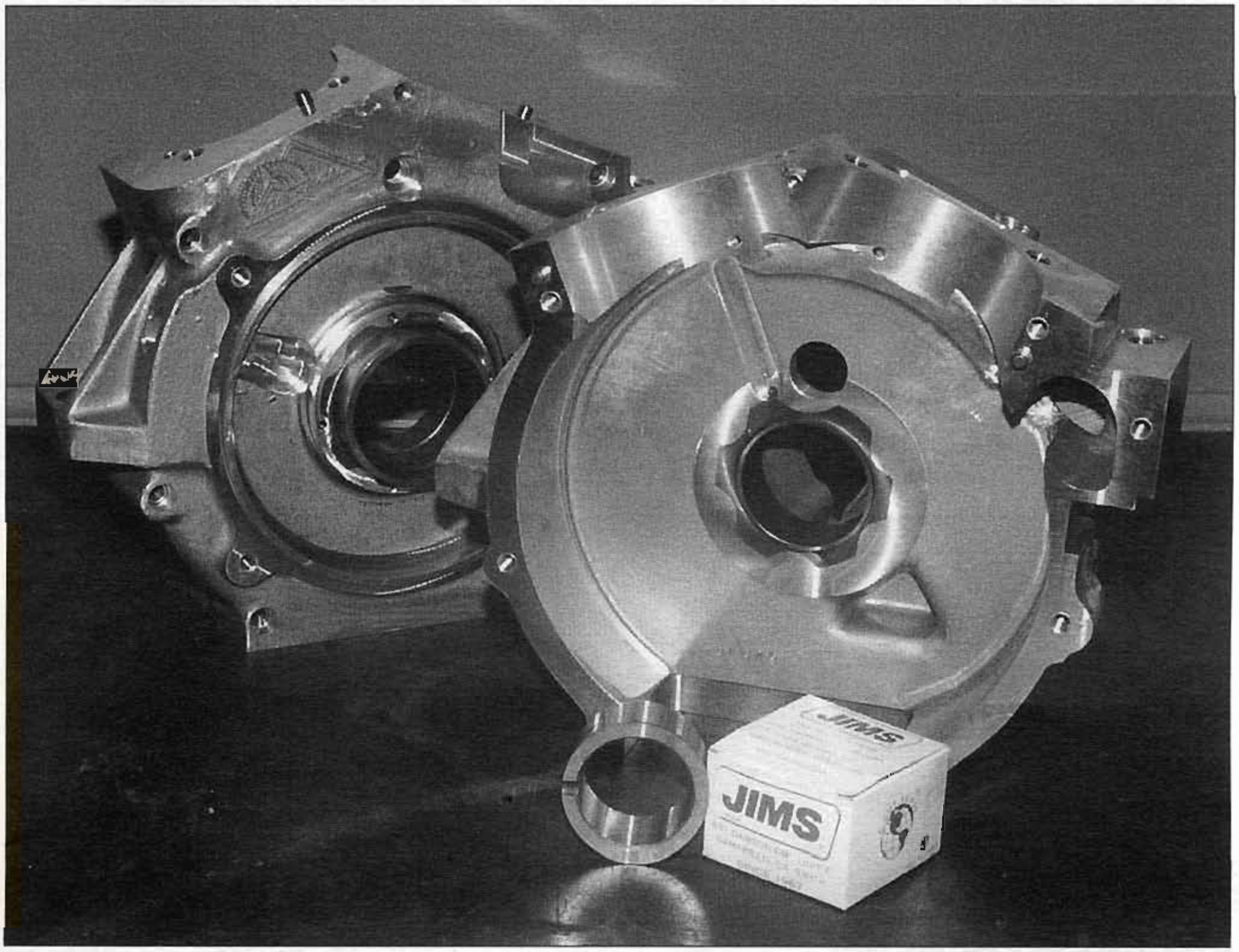
** suggested maximum for long mileage street engine

Sources of aftermarket stroker components.

Component	Source
Stroker flywheels	**Truett & Osborn:** 3345 E. 31 St., South Wichita, Kan. 67121 **S&S Cycle, Inc.:** Box 25 Rt. 2 County G, Viola, Wis. 54664
Stroker rods	**Carillo (through dealers)** **S&S Cycle, Inc.:** Box 25 Rt. 2 County G,Viola, Wis. 54664
Stroker kits	**S&S Cycle, Inc.**
Stroker/big-bore pistons, cylinders	**Axtell Sales, Inc.:** 1424 S.E. Maury, Des Moines, Iowa 50317 **Sputhe Engineering, Inc.:** 1185 Lime Kiln Rd., Grass Valley, Calif. 95945 **Hyperformance:** 5152A N.E. 12th Ave., Pleasant Hill, Iowa 50317
Crankcases	**STD Development:** P.O. Box 3583, Chatsworth, Calif. 91313 **Delkron:** 2430 Manning St., Sacramento, Calif. 95815 **Sputhe Engineering, Inc.:** 1185 Lime Kiln Rd., Grass Valley, Calif. 95945 **S&S Cycle, Inc.**
High-torque electric starter	**Tech Products:** 511 West Mahoney, Mesa, Ariz. 85202
Compression release/head rework	**Thompson Engine Service:** 186 River Street, Dedham, Mass. 02026
Bronze crankpin thrust faces	**Thompson Engine Service**
Premium head gaskets	**U.S. Strokers:** 1404 N. State Road 7, #163, Margate, Fla. 33063 **Sputhe Engineering, Inc.**



LAP OF LUXURY



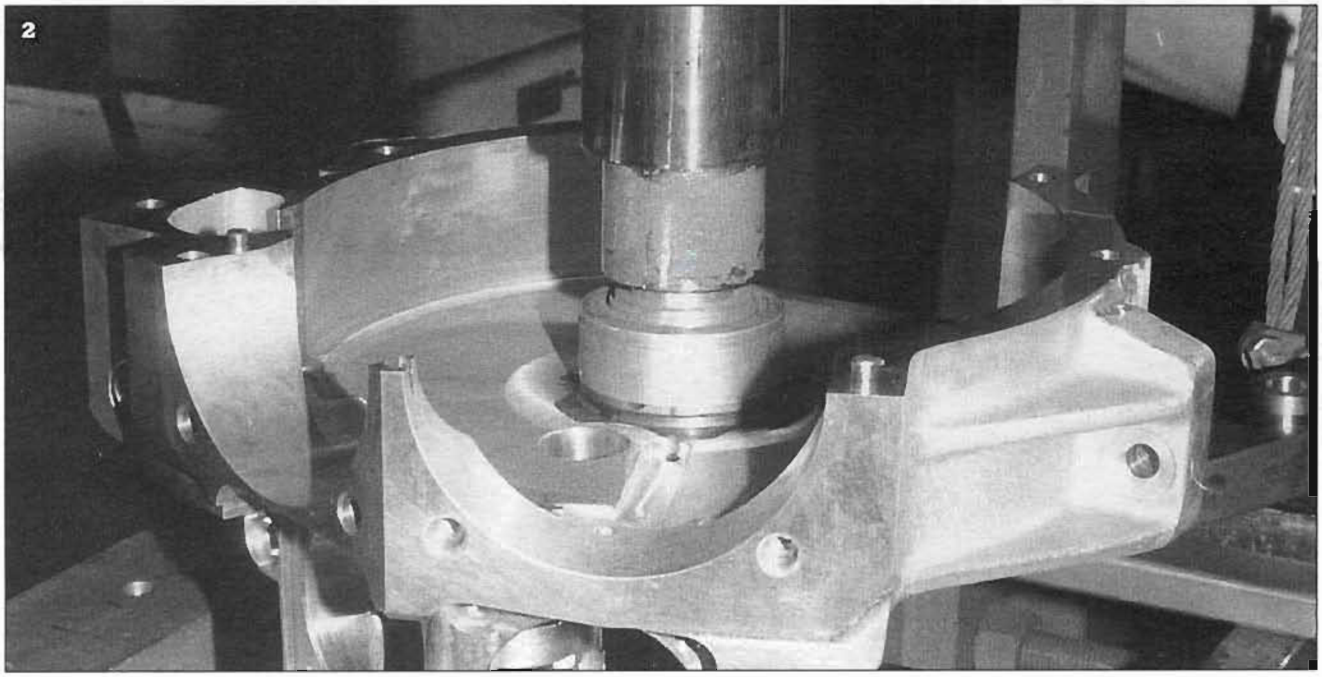
BIG TWIN CASE LAPPING

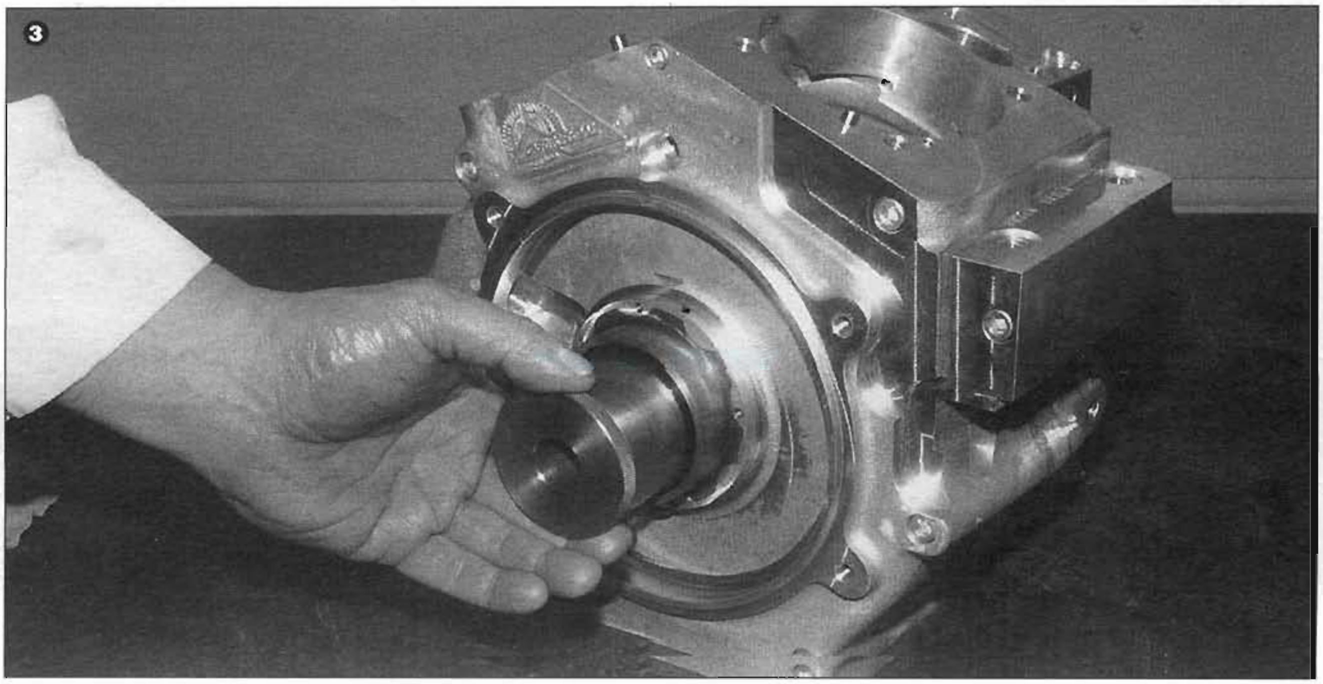
MADE EASY BY JIM'S MACHINE

When it comes time to rebuild your Big Twin, or if you're building a brand-new one, there are several key steps that can't be ignored. The one we are going to focus on here is properly sizing the pinion bearing race. After all, the dimensions here are critical, and if it's a couple thousandths of an inch too loose or too tight, you've got problems.

Now, for a lot of you out there, the easiest thing to do is to take the case and new pinion bearing race down to your local bike shop where they'll size it to the proper specs for your engine. However, many of us enjoy doing things ourselves, and thanks to companies such as Jim's Machine (531 Dawson Dr., Unit F, Camarillo, CA 93012; 805-482-6913), pinion race sizing is now something that we can do at home, in the garage. With their new Big Twin case lapping tool (p/n #96710-TL), any case from 1958 to present can be accommodated. This makes it a more worthwhile investment for the engine builder who's working on a variety of different engine configurations.

To get started, you will need certain tools, especially a dial bore gauge, or at least a set of snap gauges and a one- to two-inch outside micrometer for properly measuring the bearing race. In our case (no pun intended), we started from scratch with a brand new set of Delkron big-bore Evo cases and a pinion bearing race from Jim's Machine (photo 1). It is important to note that the cam and sprocket shaft bearings should not be installed at this point, since the grit in the lapping compound could get in and damage them, and also that the lapping tool centers on the sprocket shaft bearing bore. The cases should be washed clean and assembled with at least three of the crankcase studs, although Jim's recommends that they all be used and torqued in sequence to the appropriate factory specs. Since we started from scratch, the bearing race had to be installed before the case halves could be secured together. Using a light oil on the bearing race, it is pressed into the case with attention paid to lining up the oil feed hole in the case to the one





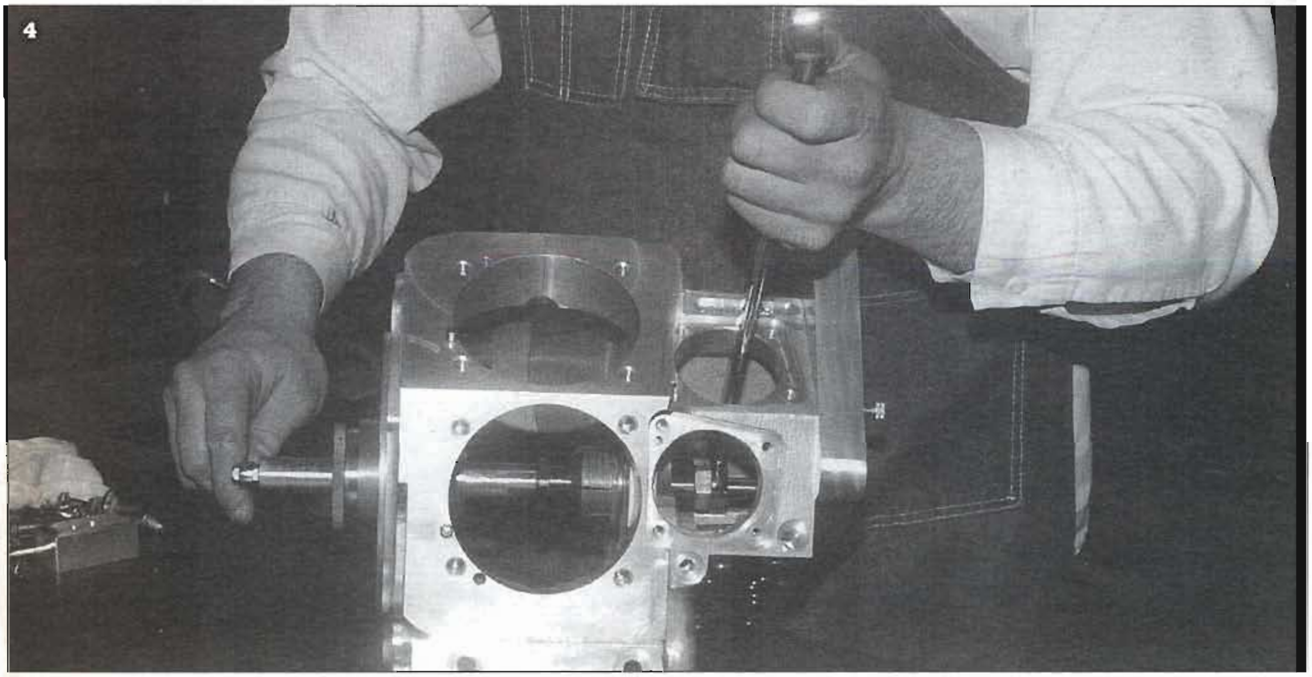
in the bearing race (photo 2).

The large steel bearing sleeve should be lightly oiled, and inserted into the sprocket shaft bearing bore (photo 3). The lapping tool is assembled into the case and adjusted to provide a small amount of drag in the race. If the arbor is adjusted too snugly, it could size the race too large at both ends. Once the tool is assembled into the case (photo 4), the race is ready for lapping (photo 5). Jim's recommends a low-speed drill for the lapping procedure, approximately 200 rpm, stroking the arbor from stop to stop. Either an oil or a grease-based lapping compound can be used (220-grit will produce a micron finish of 33.0). For finer finishes, the race can be sized within a few tenths and then finish lapped with 320-grit compound, which will yield a 16.0 micron finish.

Maintaining the low speed, the arbor should be stroked about 80 times per minute (photo 6). It takes about 30 seconds to remove .0002 (two tenths), but it is recommended to check the I.D. size in several locations before lapping over one minute. With a little patience, we arrived at the proper bearing race size for our engine which was 1.7510-inches I.D. (photo 7). Throughout the procedure, it is very important that no lapping compound get on the arbor shaft in order to ensure maximum tool life. Once this operation has been completed, the case must be washed thoroughly. Special attention must be paid to all oil passages to make sure lapping compound has been washed free of the case. Lapping compound is very fine and even a little bit will bring immediate disaster to a new engine if the case is not thoroughly cleaned.

The Big Twin case lap is just one of the latest additions to Jim's extensive line of tools for do-it-yourself engine builders and professional shops alike. Check out their latest catalog for all the details.

—Wordman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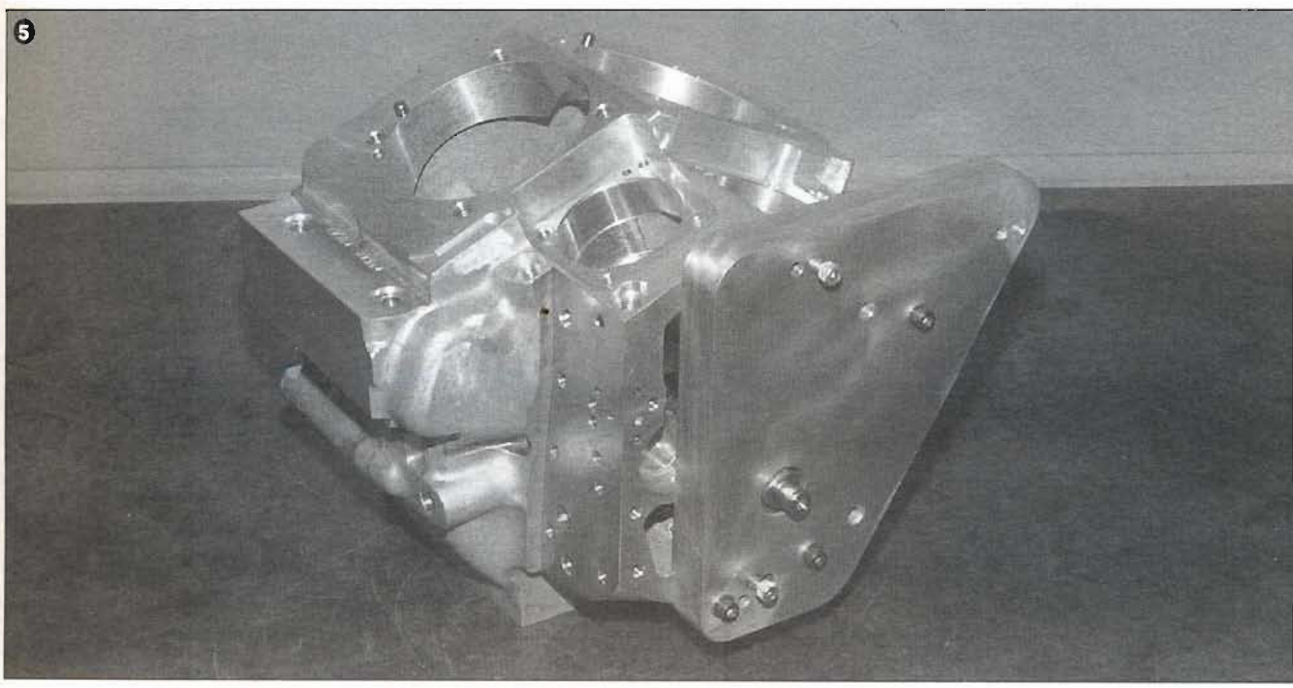
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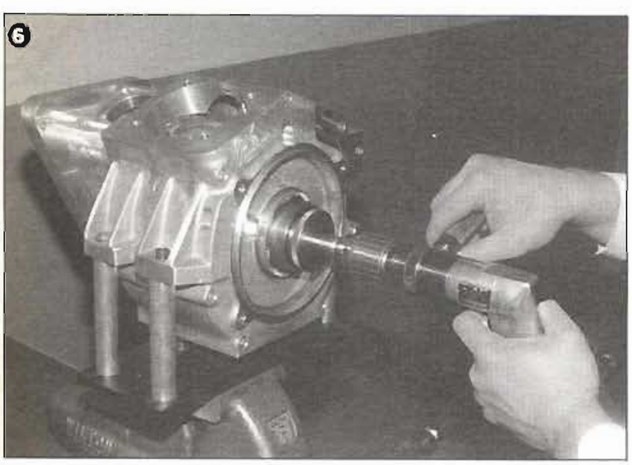
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Photos: Erik Falconer


FUKD
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SPORTSTER CASE REPAIR

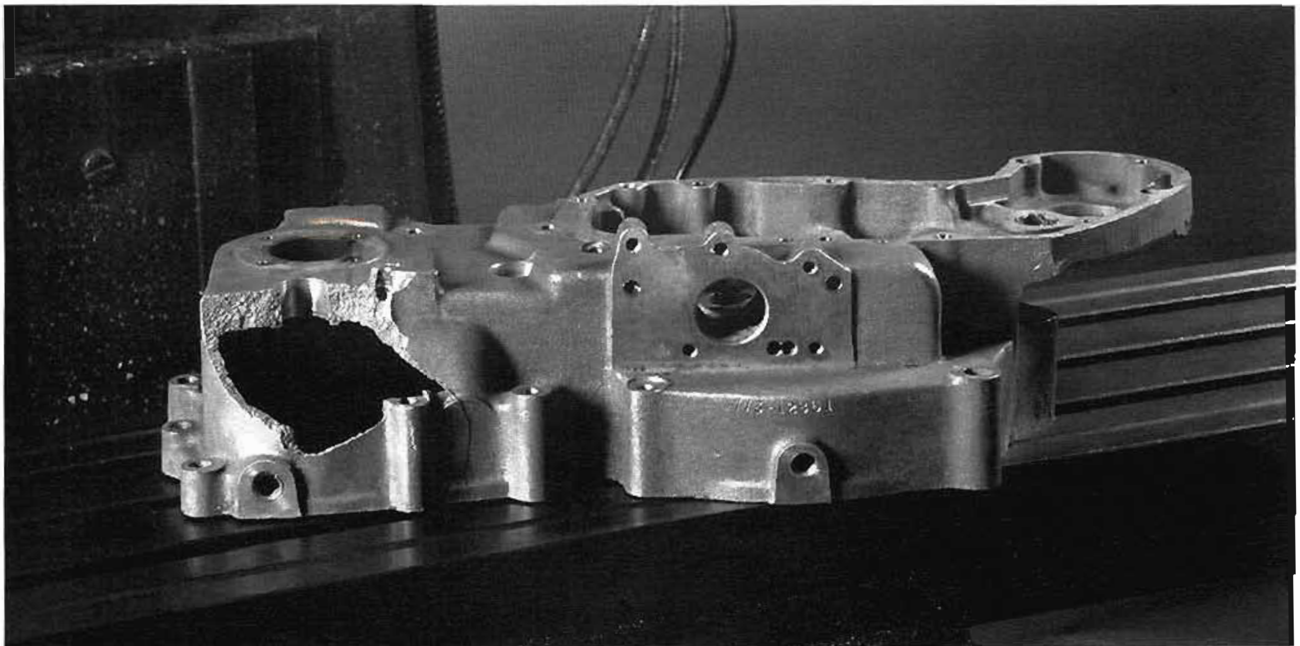


Photo 1

As we all know, there's nothing better than puttin' the scenic route on a nice sunny day—taking in the sights, the action, and taking on the occasional hot-dogger who thinks his bike is better built than yours. The light turns green,

The case is clamped to the mill table and machined in the broken area

and as the smoke clears, you can see him disappearing in your mirrors—adding to the adrenaline rush and to the smirk on your face.

As many Sportster riders can attest, this small victory can be shattered in an instant from a problem that will end your plans for the day—all in the time it takes to shift from second to third. In that one

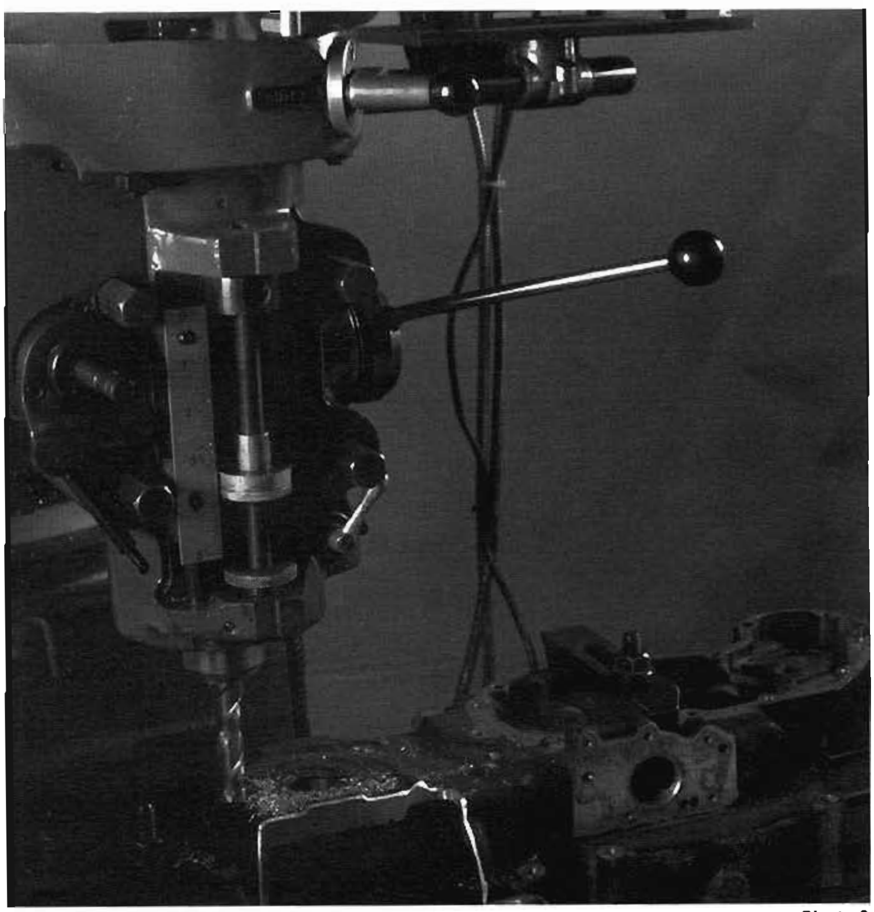


Photo 2

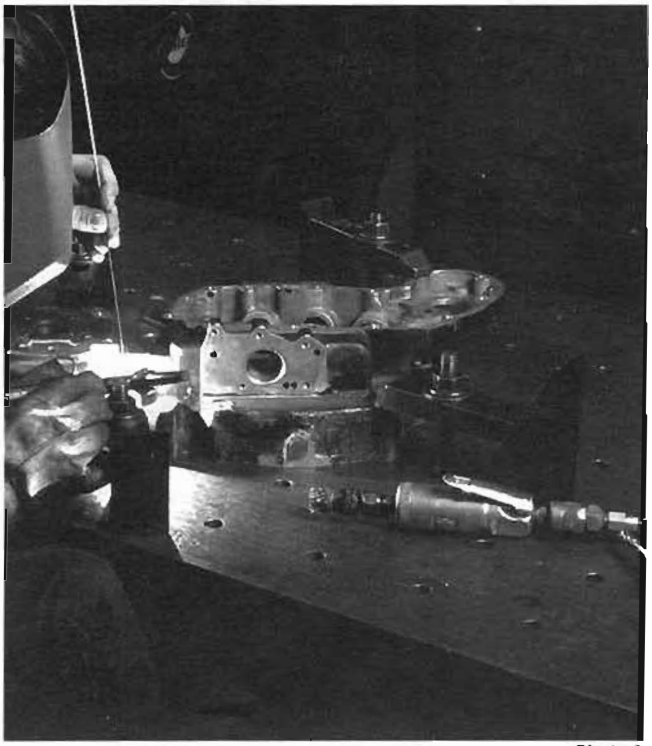


Photo 3

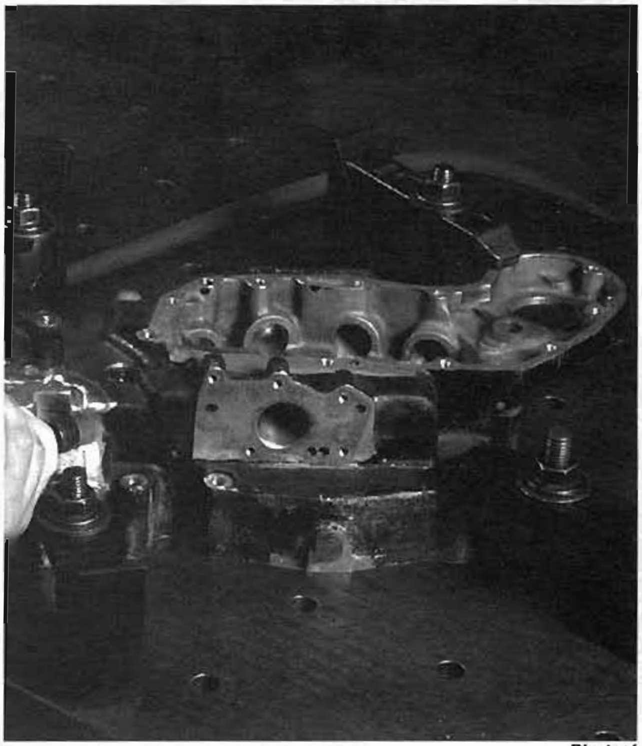


Photo 4

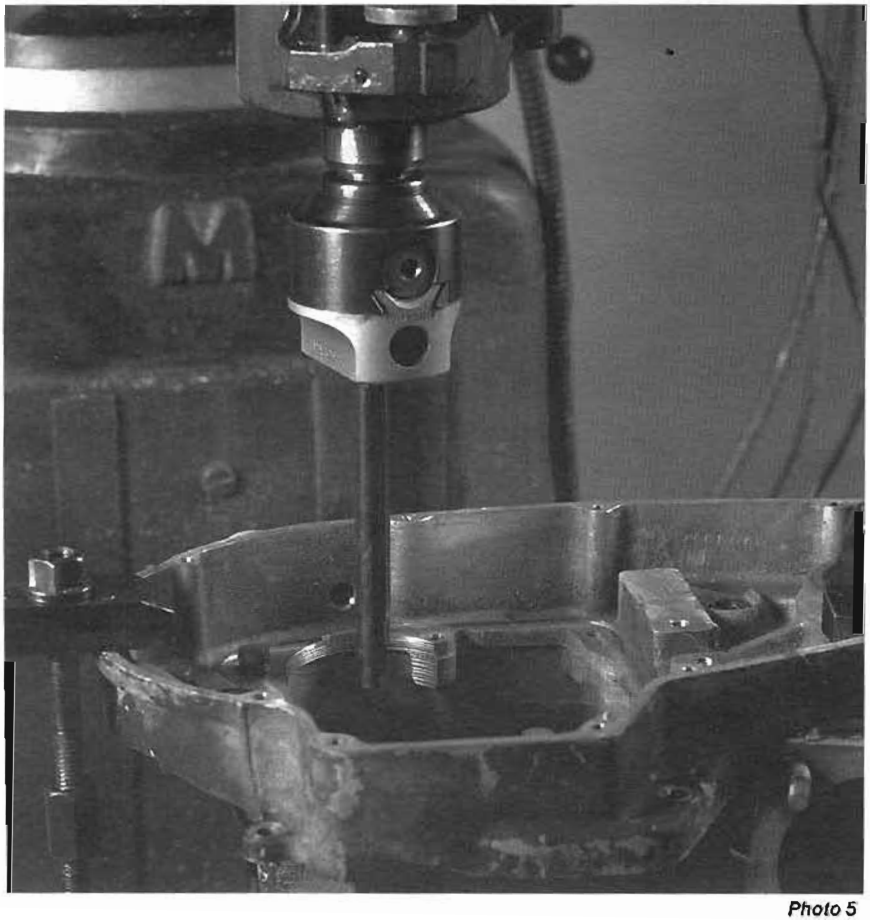
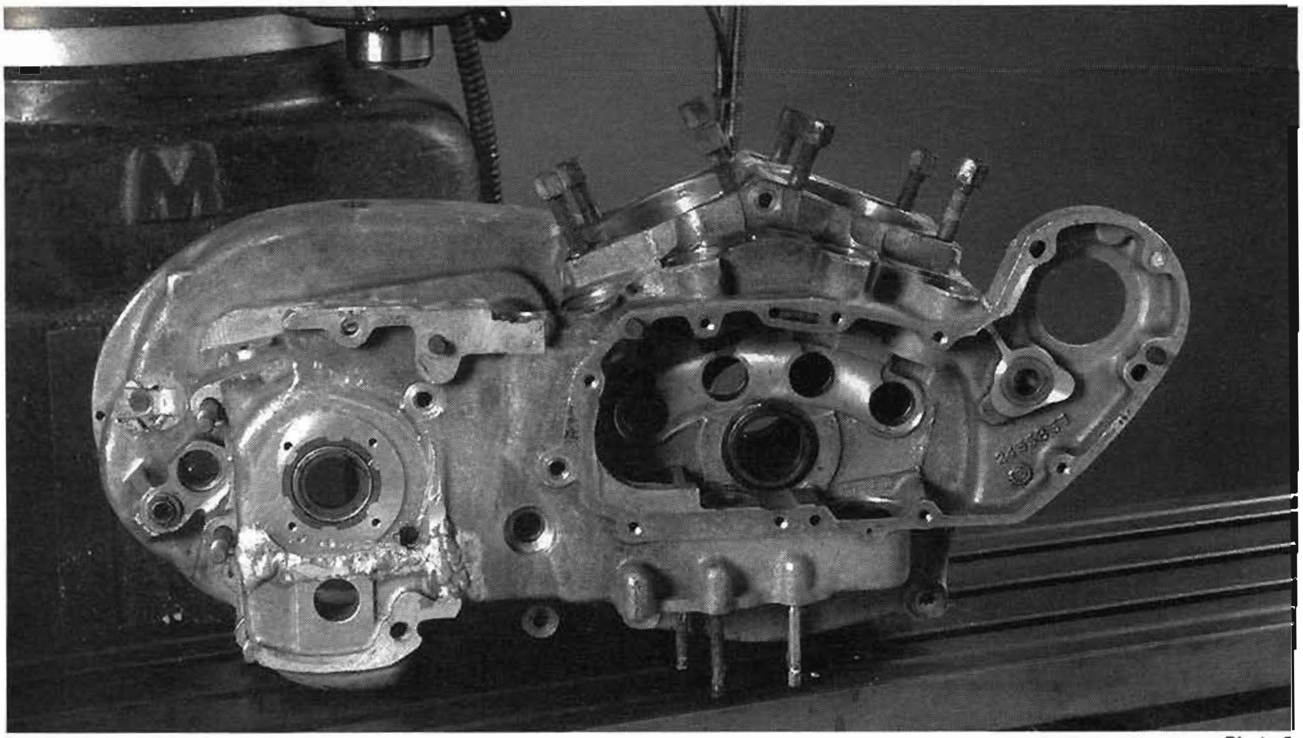


Photo 5

fateful instant, you grabbed second gear, hit the throttle, grabbed third, and then boom! The long years of abuse, hard-running, or a poorly set up clutch and tranny have resulted in the destruction of your right engine case. The phrase "Oh shit!" will soon replace your cocky grin as you realize that the right case has blown out, right at the tranny's countershaft area. The questions then begin, namely: "How the hell am I gonna get this fixed?"

After securing a ride home, and later stripping down the engine and transmission, things start looking hopeless, and you start to ponder the troubles of finding a new right case or another complete set of cases.

Any of you who have had this unfortunate incident bite you in the ass will recognize the blown-up case (photo 1), which has been cleaned up and is ready for repair. The case is clamped to the mill table and machined in the broken area so that a cast aluminum insert can be welded in to repair the right case. As



Photos: David Jones

Photo 6

Gary recommends new shift forks upon reassembly, as a matter of precaution

shown here by machinist Gary Woodford (photo 2), the aftermarket insert (which is available through Milwaukee Iron in Lynchburg, Virginia) has also been machined to fit the case, exactly.

From there, the case is removed from the milling machine and is clamped to a jig table so that the welder can tack-weld the insert to the case in several places (photo 3). The tack welds are cleaned up with the help of a wire wheel and die grinder (photo 4) to get rid of any imperfections in the case metal that have risen to the surface during welding. The welder then finishes the job with a slow, steady bead that (along with the case being clamped to the jig table) virtually eliminates case warpage. Afterward, the case is checked for flatness and milled flat again (if necessary).

The final step in the repair work is handled back on the milling machine where both halves of the case have been bolted together, complete with the transmission door. From there, the location of the countershaft bore is indicated, and the left half of the case is removed so that the right case can be milled and bored out to the correct dimension (photo 5). When everything is finished (photo 6), the engine and tranny can be reassembled into the cases.

Gary recommends new shift forks upon reassembly, even without this major problem, as a matter of precaution, as they will bend under abusively hard shifting. He says that, occasionally, some of the busted Sporty cases that have come his way needed the shifting rod redrilled, and sometimes the damage has included the mainshaft bearing area as well. Therefore, proper reassembly, following the specs in your factory manual, and a well set up clutch will be good insurance against this recurring. In the end, though, it will depend on how hard you ride and how closely you maintain your bike.

Gary told us that this repair procedure wasn't always popular, due to the full day of labor and the $400-$500 price tag. But, he says that with the diminishing number of cases now available, this is a more practical alternative, and it allows you to retain your original numbers.

Then with you and your bike back on the road, you can blow off that hot-dogger when the next sunny day comes around.

—Erik Falconer

Tech Tip courtesy of Milwaukee Iron:

CAMSHAFT INSTALLATION 101

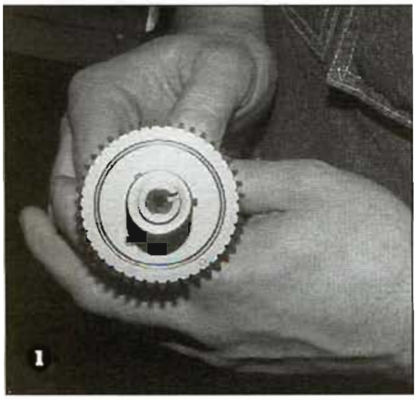
THE BASIC INS AND OUTS OF CAMSHAFT OPTIONS AND INSTALLATION

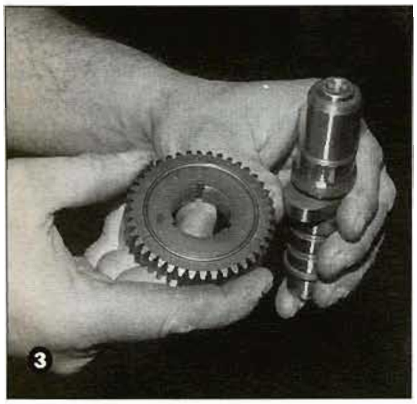
Doing a cam swap is one of the most routine power upgrades you can do. The procedure is simple and doesn't require much in the area of special parts, and, usually, it is something that can be done in an afternoon. Thanks to the performance aftermarket, there are plenty of good choices for cams, lifters, pinion and breather gears and just about everything else to do the job.

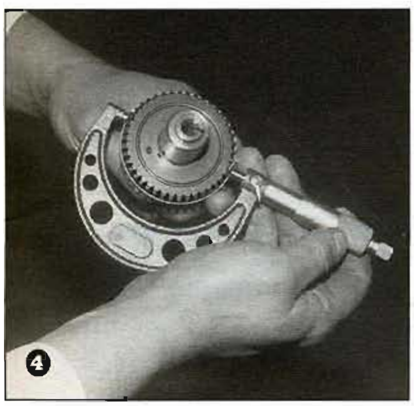
In this case, our parts list included Crane's #1-1003 Hi-Roller camshaft, cam thrust plates and shims (also from Crane), an S&S pinion shaft gear and breather gear, Jim's Machine Power Glide hydraulic lifters, and Jim's billet aluminum lifter blocks. With the exception of this particular camshaft, all of these parts are available for Shovels as well as Evos.

The neat thing about Crane's Hi-Roller cams is that they allow you three choices for your cam timing: zero, four-degrees advanced, or four-degrees retarded. As a general rule, advancing the cam timing will give the engine better bottom-end performance, while retarding will give it better top-end power. This basically allows you to custom-tailor the engine's power curve to your liking and riding style. Looking at the cam gear (photo 1) there are three notches that indicate the zero, advance, and retard settings. By pressing off the gear (photo 2) you can re-align the gear for whichever setting you choose. The cam itself is keyed for proper alignment (photo 3) which makes it easy to re-adjust cam timing as you wish.

Before installing the cam, it is necessary to verify the pitch diameter of the cam gear in order to properly match it to the pinion gear. If the gears are mismatched, you'll end up with gear whine or a lifter-like noise, and further problems may result. Using a rubber band to hold





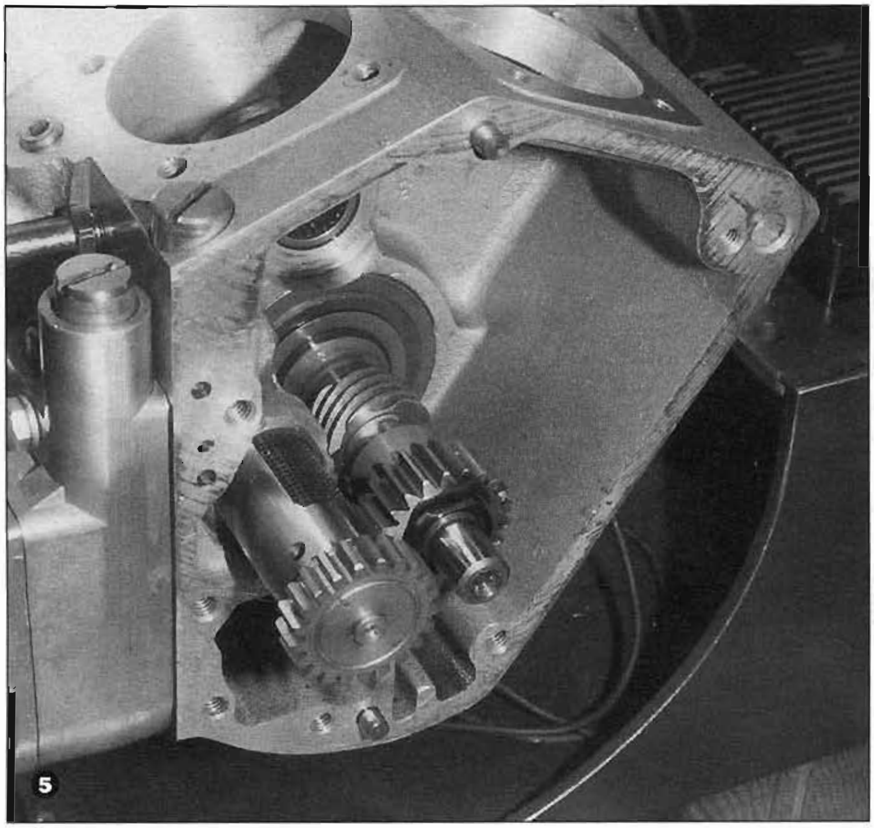


the two gauge pins (.105-inch for 1989 and earlier engines, .108-inch pins for 1990 and newer) in place, the pitch diameter is measured with a micrometer (photo 4). Since our engine is being built to 1990 specs, we used the .108-inch pins and came up with a measurement of 2.748 inches. A quick look in the factory manual told us that the color-code for the proper pinion gear was white, so we opted for a white S&S pinion gear and added an S&S breather gear as well (photo 5).

After getting a fresh thrust plate and cam shim, we installed the camshaft (photo 6). With the appropriate notches on the cam, pinion, and breather gear lined up, the cam cover was bolted back up to the engine to check cam end play. The 1990 manual calls out end play at .001 to .050, but we ended up with a more reasonable .018-inch (photo 7) thanks to the assortment of cam shims from Crane. Another way to check cam end play that is more accurate is by using a dial indicator (photo 8). Magnetic base dial indicators are necessary for checking cam timing as well, and since they are pretty inexpensive, it's a good idea to have one for this job.

Once the new lifters and lifter blocks have been installed, the cam's lift and timing numbers can be verified against its supplied spec sheet. Not all cams come with data sheets, so this extra step will help you determine the actual characteristics and timing of your specific cam. A small steel plate is bolted in place, using one of the lifter block's bolt holes to allow a mounting location for the dial indicator (photo 9). This plate can be moved as you check each lobe of the camshaft at the tappet. Crane and Delkron also manufacture camshaft degreeing kits which come with all of the necessary hardware for this step. They are available through the manufacturers or through aftermarket suppliers such as Custom Chrome. For this story though, we used basic tools that many mechanics and weekend wrenches alike usually have on hand.

A degree wheel is necessary for checking the cam timing, and depending whether or not the engine is in the frame, on a dyno or on a workbench it can be attached to the pinion or sprocket shaft. First, though, the wheel must be set to TDC (top dead center). Using the timing marks on the flywheel, set the engine on the proper mark for TDC depending on model. Now a pointer can be attached to the engine, in our case we used some soft welding rod held in place by one of the case nuts (photo 10). This TDC bumper (photo 11) was made using an old spark plug, with a socket head allen bolt welded inside it. An air bleed hole is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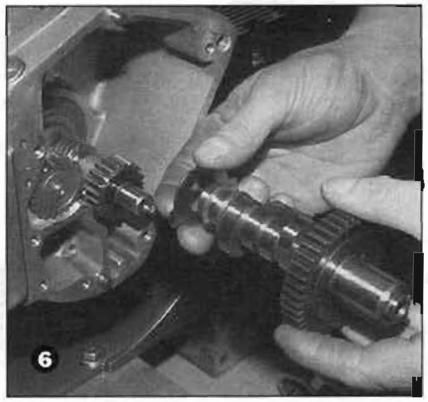
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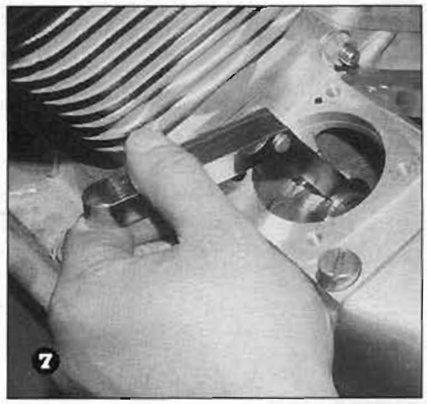
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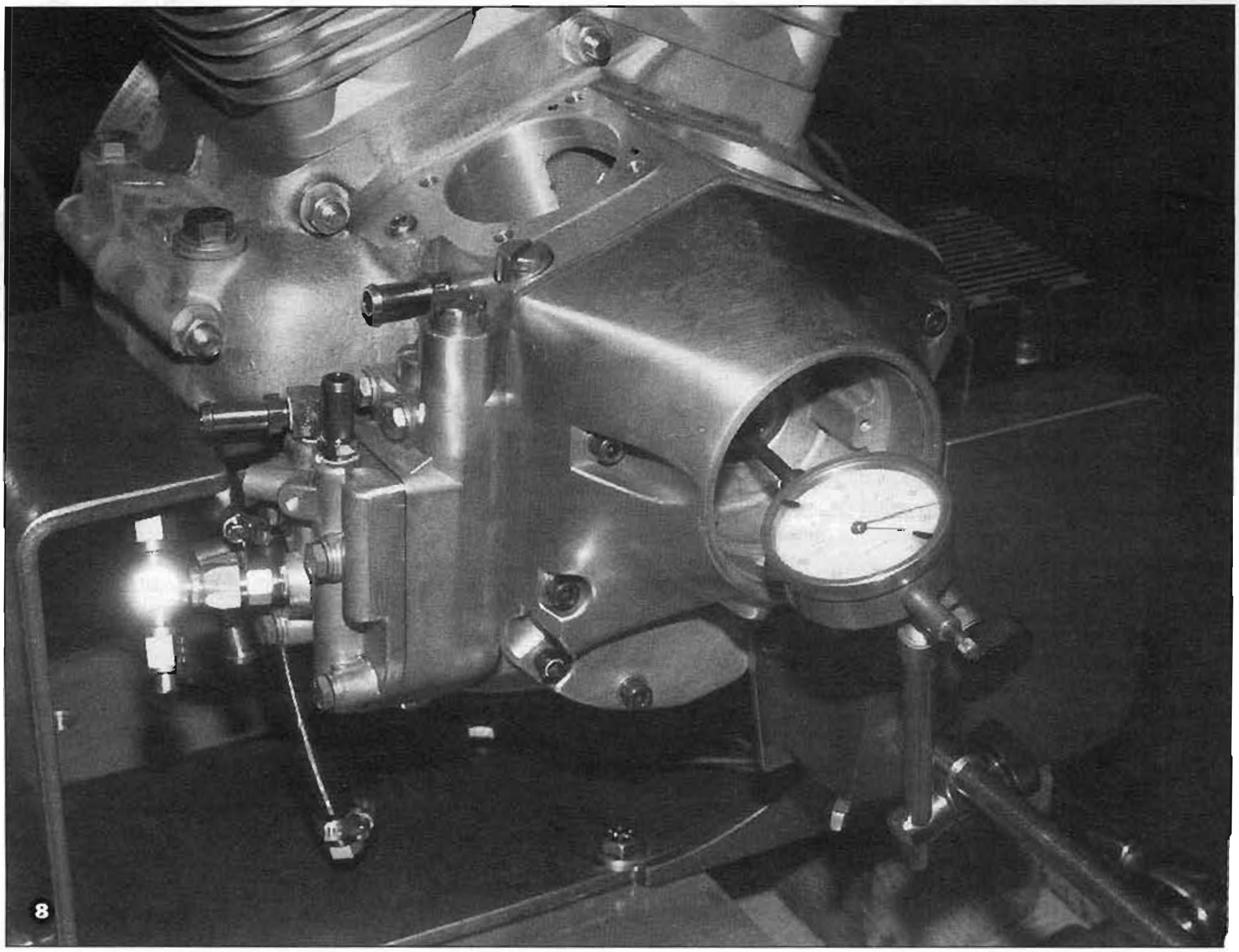
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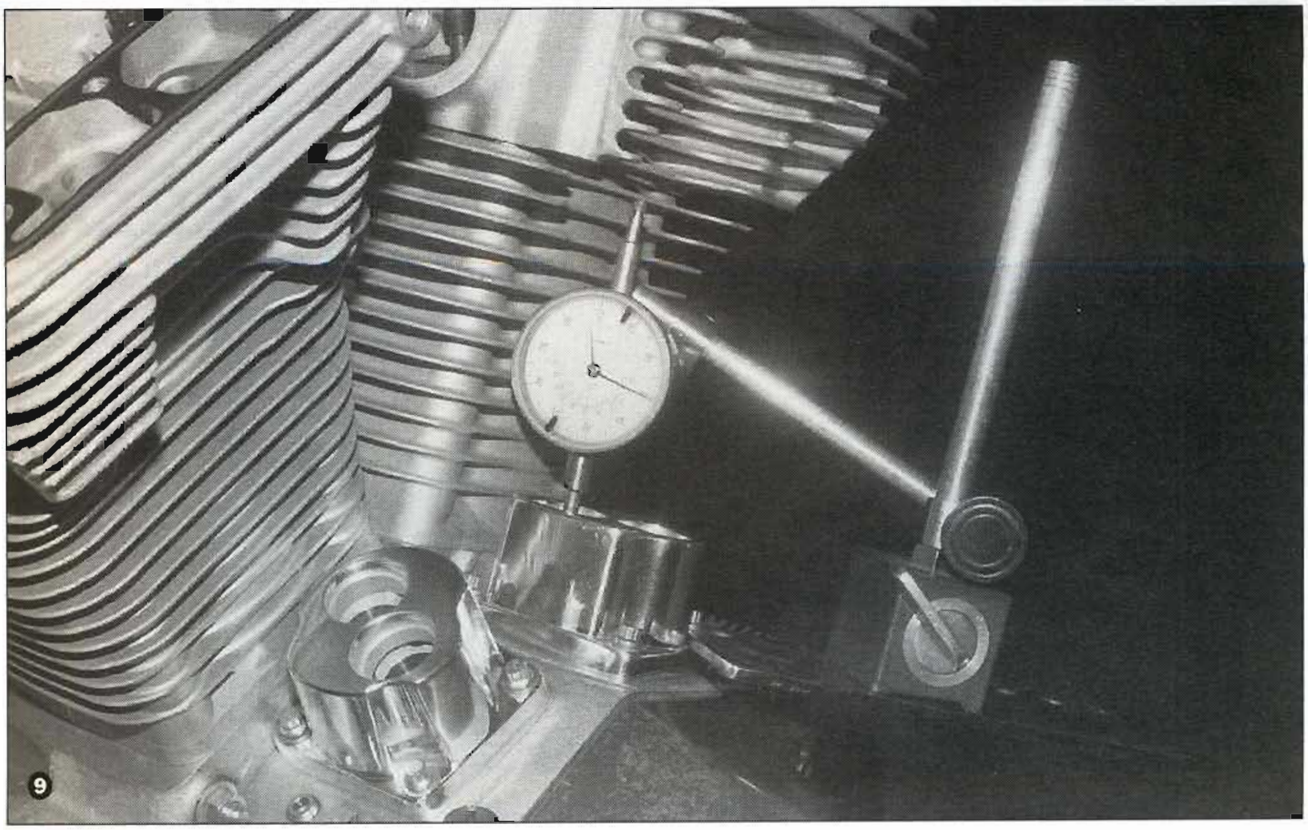

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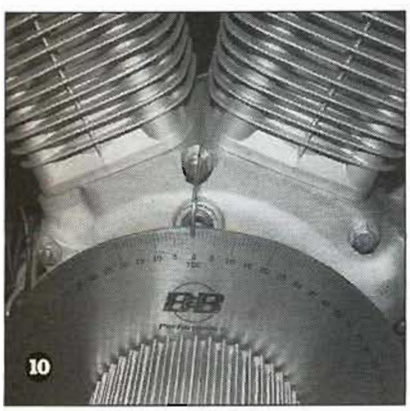

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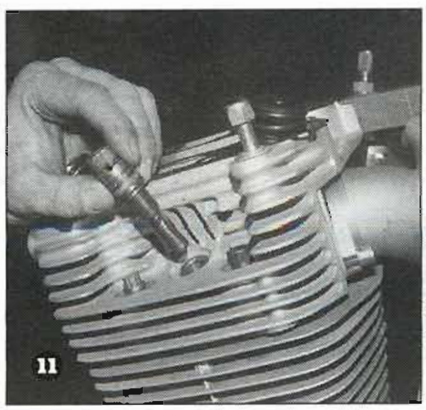
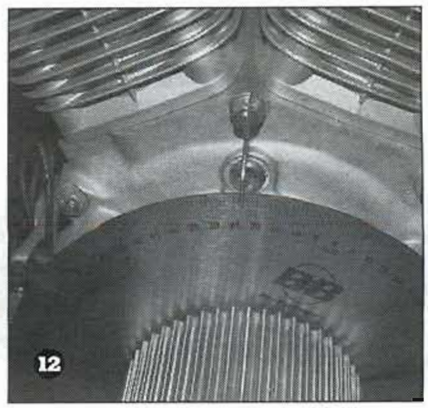


11

Photos: Erik Falconer



12

drilled in it to let you know when the cylinder is reaching TDC. By hand, the engine is turned until the piston makes contact with the bumper, and the reading on the degree wheel is taken. Then the engine is rotated backward until the piston touches it again and another reading is taken. Splitting the difference between the two readings will give you the correct TDC setting for the degree wheel.

Now we can get at the cam timing. The info card from Crane stated that the 1-1003 grind has .344 lift at the cam (where we checked it) or .550 at the valve due to the Evo's1.6 rocker arm ratio. Checking this is simple, because all you have to do is count the revolutions of the dial indicator as the lifter travels up the cam. Actual timing and duration are checked from .053 lift until .053 before closing. The use of .053-inch is a standard that allows accurate results when timing a cam, instead of watching the indicator for the first signs of lift, which is often hard to judge.

Starting with the front cylinder intake lobe, the spec sheet said that our cam, at .053 lift, should begin opening the valve at 23 degrees before TDC. As you can see (photo 12), it actually opened at 27 degrees before BDC (bottom dead center). By checking these numbers, you can decide whether or not to advance or retard the camshaft. This step also spots any errors that may have occurred while grinding the cam, and will let you know for sure if it is the actual cam you ordered. The intake lobe's closing at 63 degrees after TDC matched the specs on the card perfectly. Checking the exhaust timing verified the factory numbers, opening at 68 degrees before BDC and closing at 28 degrees after TDC. Duration can be determined a number of ways, such as counting the total on the degree wheel from .053 lift at open to .053 lift at closing, or you can take the opening and closing numbers you get and add them together, plus an additional 180 degrees. For example, the exhaust lobe on our cam opens at 68 degrees before BDC, and closes at 28 degrees after TDC, so adding 68+28+180, we got 276 degrees, as per the cam sheet.

While all of this may seem like a lot of work to some people, these steps to properly install and degree a camshaft provide you with the knowledge that the cam timing is exactly where you want it for maximum performance from the engine, and that the cam is doing what it's supposed to. Also, it's the difference between doing a quick overhaul and blueprinting the engine, by taking the time and doing it right. After all, that's why they say "take pride in what you ride," right?

—*Wordman*

84-INCH KNUCKLEHEAD

POWER AND RELIABILITY THROUGH S&S

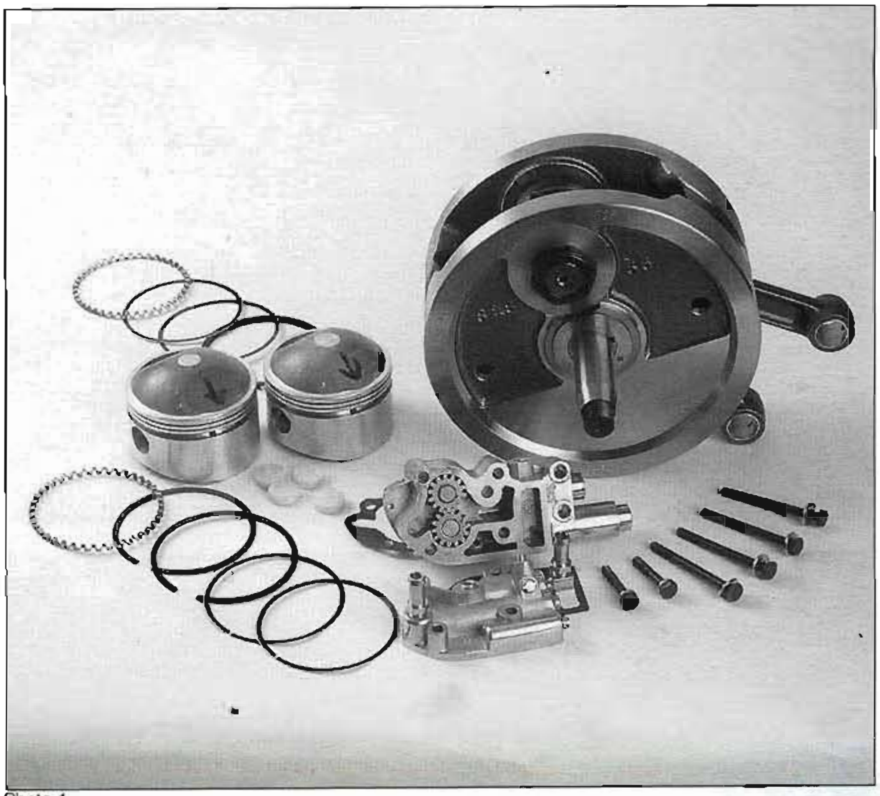


Photo 1

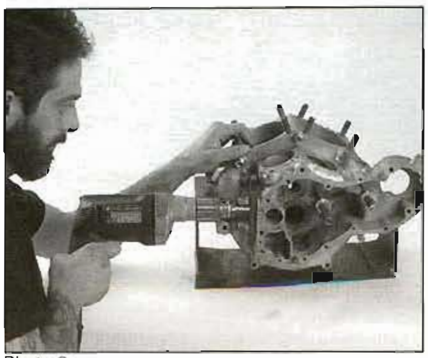


Photo 2

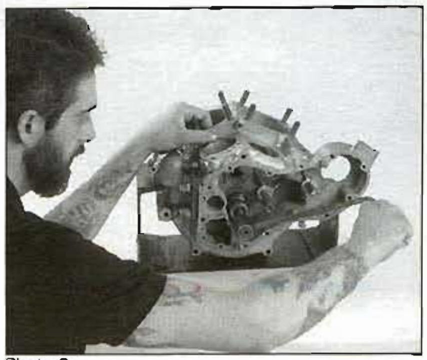


Photo 3

This is basically a bottom end rebuild using S&S components. We'll cover the heads later. The cases were carefully checked stock Knuckleheads with new races pressed in place. The remainder of the critical components were an 84-inch, 4.5-inch stroke, 7.4:1 compression, forged pistons S&S Stroker kit with heavy duty connecting rods, pinion shaft, and sprocket shaft. The oil supply will come from an S&S oil pump kit (photo 1). Randy Simpson and Gary Woodford at Milwaukee Iron selected this configuration to afford my sorry ass a responsive but streetable and dependable motor. Oh, by the way, I'm not talking about gambling or Amber this issue. She ran off with another winning streak, and I'm sweeping the shop to make a couple of bucks.

If you decide to use an S&S Stroker lower end, don't lose the instructions. They are helpful and detailed. S&S has an entire line of stroker kits from reasonable to full race. Their lower ends come assembled, trued, and balanced or as separate components. Each has its advantages and disadvantages, as you will see. But even if you order a pre-assembled kit, make sure that you true the wheels. Shipping can jar an elephant's teeth, and you never know what they'll do to your precious wheels.

Randy started by reading the S&S instructions. Then, he carefully drilled the inlet and feed passage in the case by using a depth gauge so he did not over-drill the passage. This is the crank shaft supply passage which has been relocated in the later model pumps. Drilling allows the oil pump to align properly (photo 2).

After the cases were bead-blasted and inspected for cracks, the new races were pressed into place. Then, the two cases were bolted solidly together so they could be line-bored for bearing fit. Randy performed this function with an original work-your-arm-off Harley lapping tool (most machine shops use an electrical hone). This lapping tool is available at dealerships, through CCI, Drag Specialties or Ted's Cycle Supply (photo 3). While wearing his arm out, occasionally he'd slip the shafts into their respective case for fit check. The tolerance needs to be a clean slip fit. If the shafts need to be screwed in or out, they're too tight.

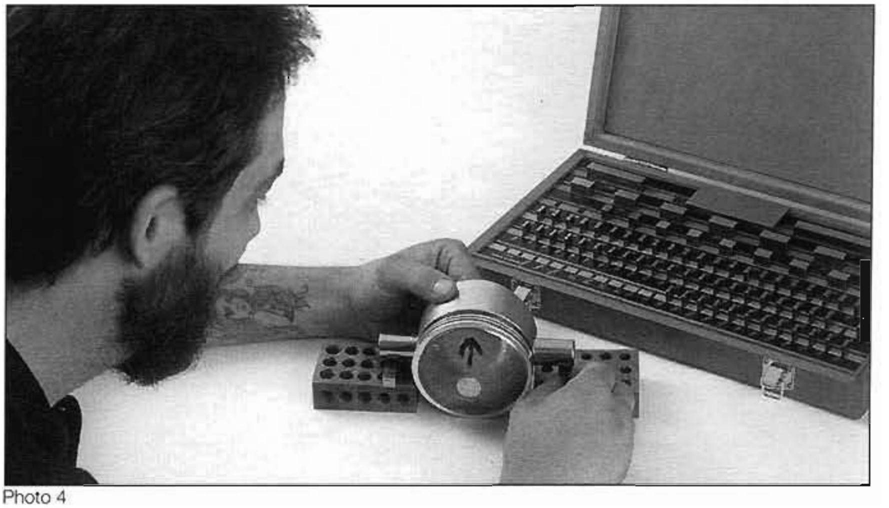


Photo 4

I learned something watching this process. By using pistons with offset wrist pins extra torque or horsepower can be dialed in. Most kits will instruct you how to install the offset to get the best results. The actual effect that offset wrist pins have on the engine is to change the leverage angle that the rod is using against the crank. Offsets to the rear of the engine will increase the torque; offsets to the front will tend to increase horsepower at high rpms. Since the engine is getting a stroker kit, we want more torque.

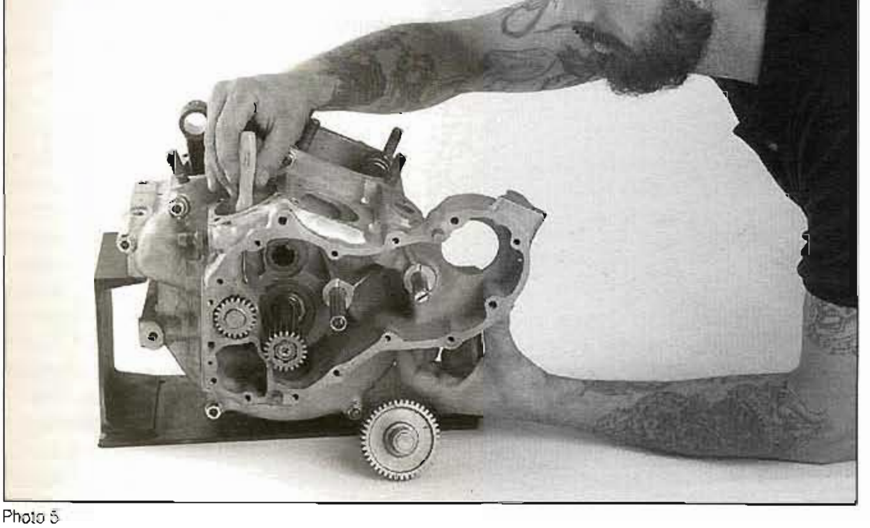
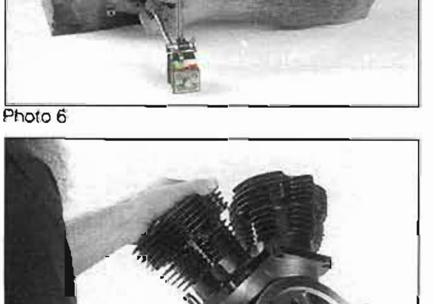


Photo 5



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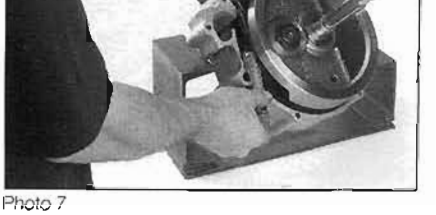


Photo 7

Photo 8

Photo 9

Randy measured the distance from the skirt to the pin on each piston with gauge blocks so that the pistons would be assembled in the motor with the offset to the rear of the engine (photo 4).

Another theory I absorbed and saw remedied is allowing the engine, more specifically, the lower end, to breathe. The larger the displacement the more critical the breathing capacity becomes. As pistons travel down the cylinders the are forcing air out of the crankcase and breather valve. If that air is restricted, th engine's power is reduced. S&S details how to time the breather gear properly by aligning the gear notches, then moving the piston into a particular position and checking the position of the gear in the case opening. It's sorta like porting heads. The first position is 10 degrees after TDC (top dead center). The gear should just be meeting the opening in the case. If not, Randy removed the gear and relieved the area in the case. The second position is 55-75 degrees after BDC for the close (photo 5). He made the modification with a small die grinder.

Randy set up the clearance in the

AN 883 JUMPS TO 85 HORSES

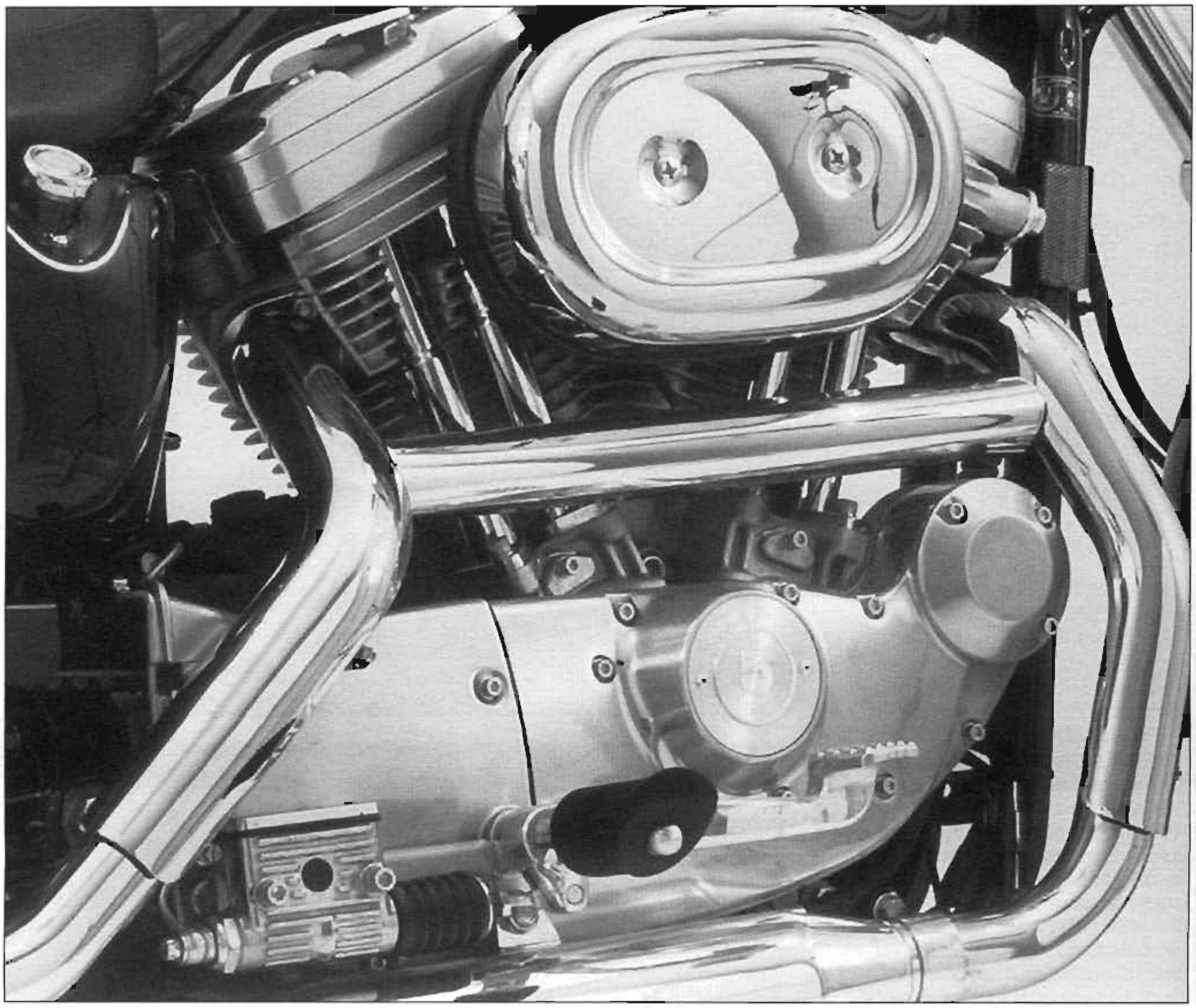


Photo 1

The XRV Formula For Sportster Performance

Hey, this Sport-Sportster is coming together. It's lightened, the front end is tuned, and the brakes are sharpened. Now we're getting to the heart and soul of the matter: the engine (photo 1).

Roger Kallins, of XRV Performance in North Hollywood, (818) 762-5407, is again at the wheel. This is Roger's formula for sprucing the stock 883 to 1200cc, while pushing the horsepower from 41 to 85.

Roger prefers to start the project with an 883 because the heads can be effectively manipulated to any compression ratio with relative ease (photo 2). Stock compression is 8.5:1. If you switch the barrels to 1200 models or bore 883 barrels out to fit 1200 pistons, and slap the stock 883 heads into place, the compression jumps to 11:1.

The factory recommends shaving the pocket in the head to lower the compression. Roger's formula includes using the stock Harley 1200cc piston set, which includes pistons, rings with gaskets, cir-clips, and wrist pins. After he bores the barrels, he installs his prescription Axtell cams (C.R. Axtell company of Sun Valley, Calif.), which bleed off excess cranking pressure so Roger can maintain performance while reducing the pressure needed to crank over the engine (photo 3). Heads are extensively ported and bigger valves installed. The combustion chamber is reworked, creating a tight double-swirl effect, and heavy duty valve springs are fitted.

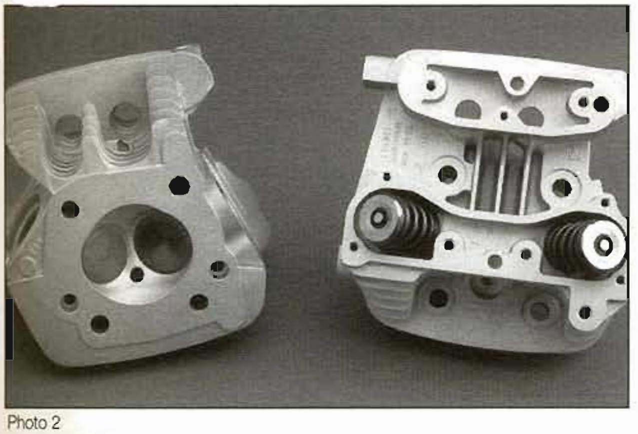


Photo 2

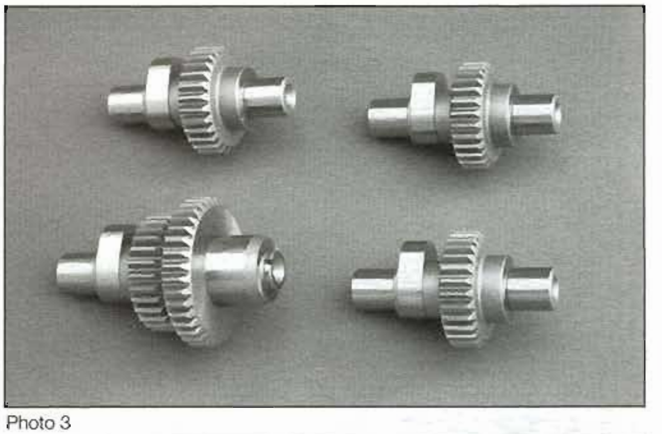
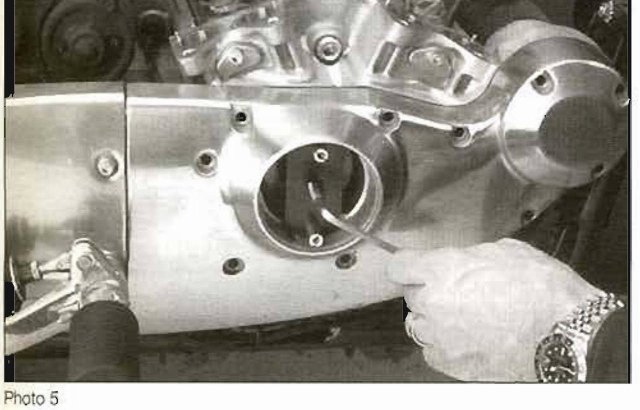


Photo 3


Photo 4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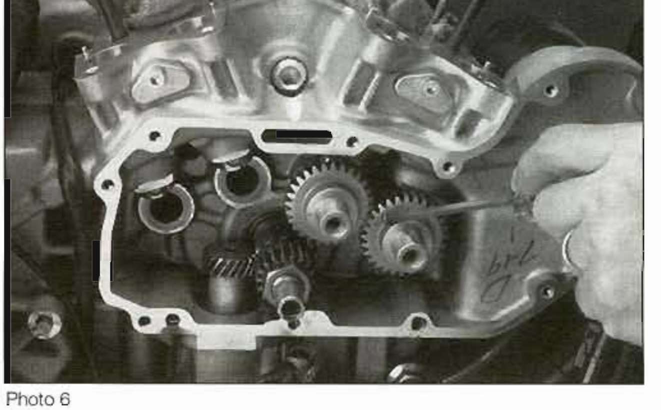
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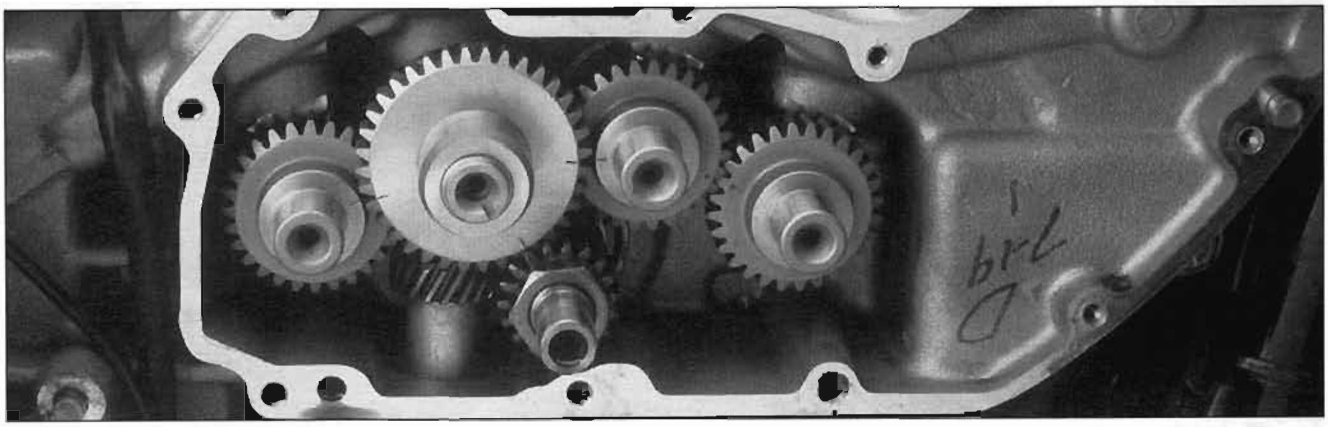

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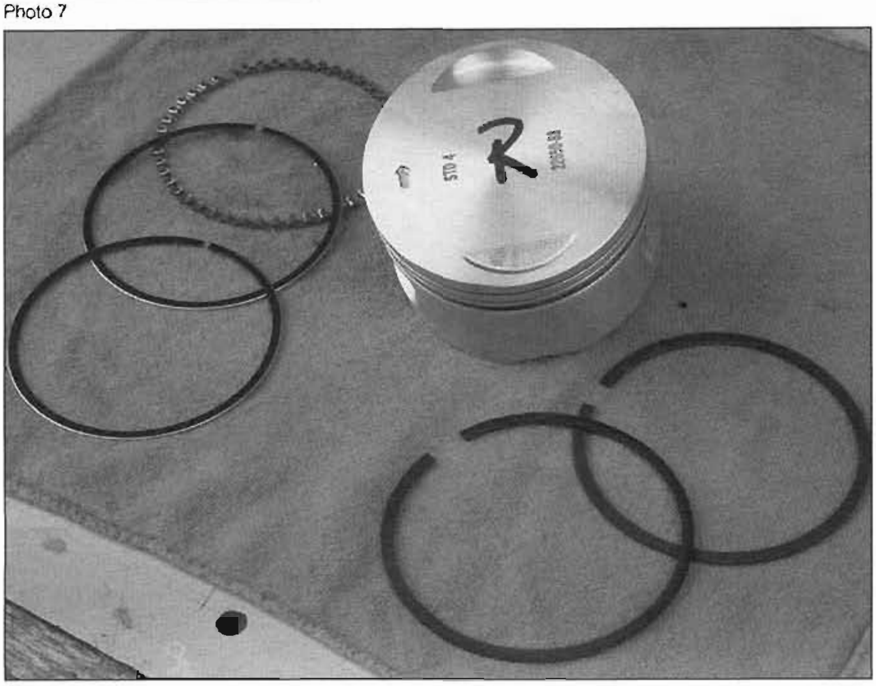

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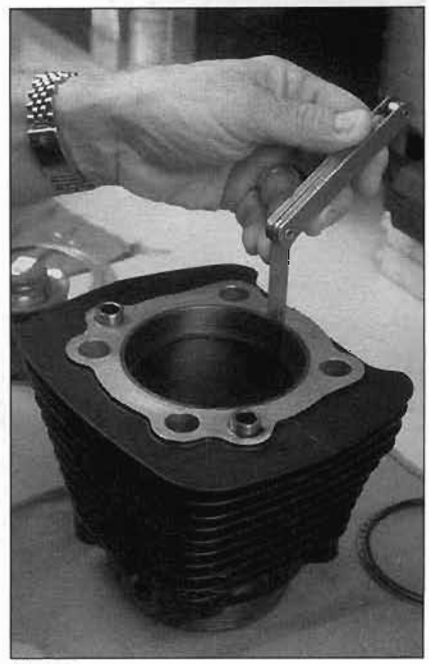

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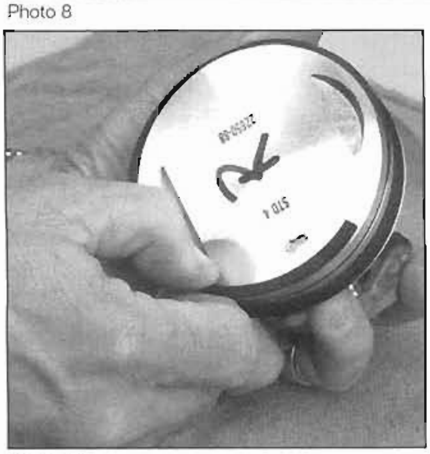


Photo 10

When asked whether he was going to dual plug the bike, he said, "Five-speed heads are better designed → than the four-speed models, but make it more difficult to install the plug between the heads. With the use of single-fire ignitions and super-unleaded fuel, we accomplish the performance we need—without dual plugs."

With the Axtell cams in place, the compression ratio is 9.5:1. These recent Axtell #3 cams (photo 7) have a slightly advanced intake lobe over their previous sets for a broader power band, causing Roger to notch the intake valve cups on the pistons

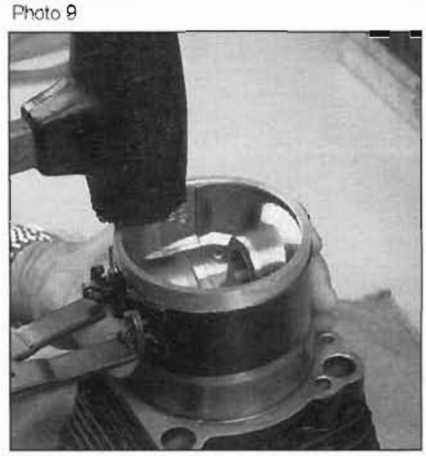
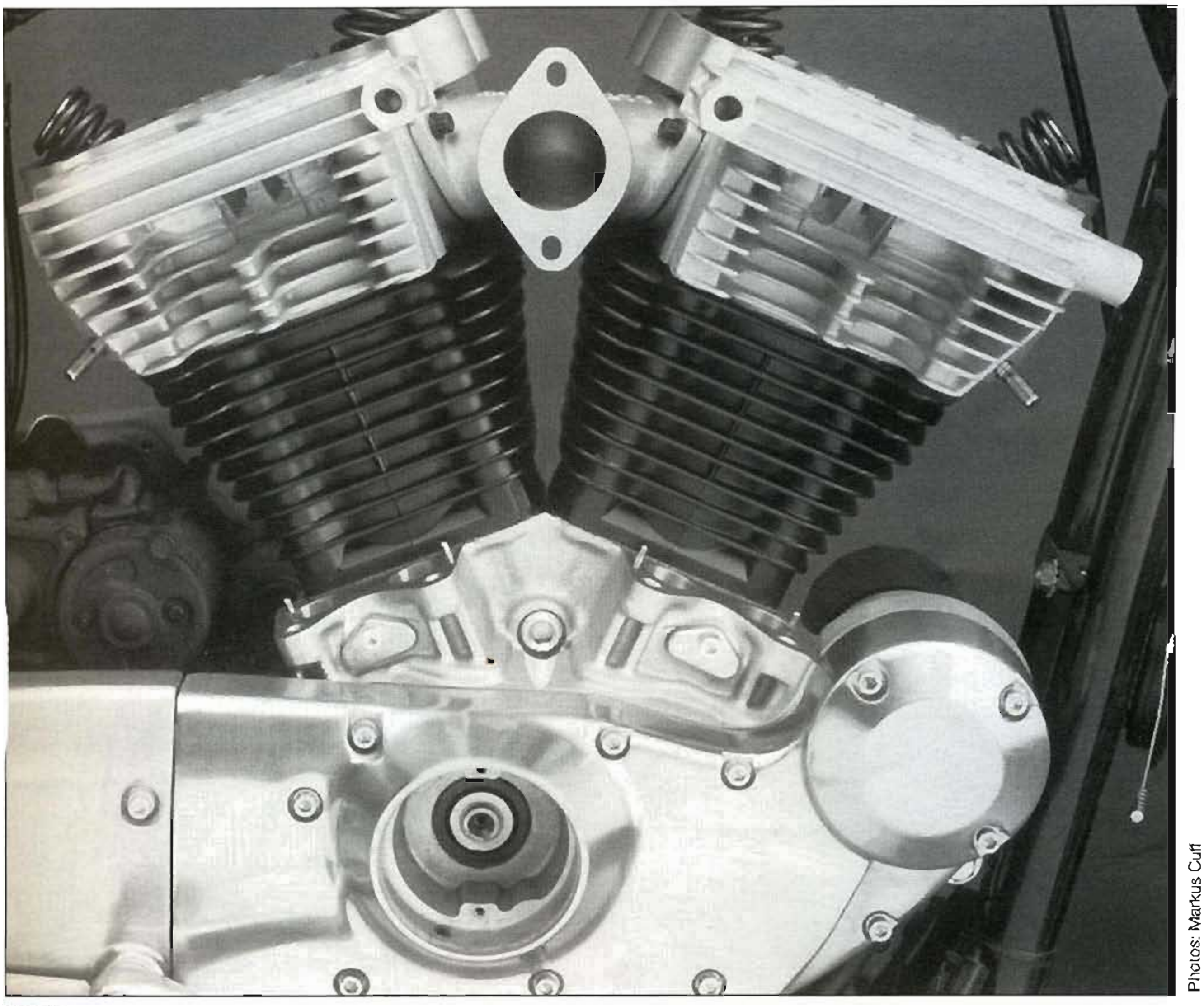


Photo 11



Photos: Markus Cuff

Photo 12

slightly to ensure proper clearance.

For engine reassembly and cam installation (photos 4-11), following the straightforward factory manual instructions and using HES copper head gaskets and aluminum base gaskets torqued to 40 foot-pounds, Roger installed Axtell adjustable pushrods and Sumax pushrod covers. With the front piston at top dead center (TDC) he adjusted the intake and exhaust valves (on the heel of the cam) until there was no free play, then extended them 4.5 turns. Some adjustable pushrods have different thread pitches and need only 3.5 turns.

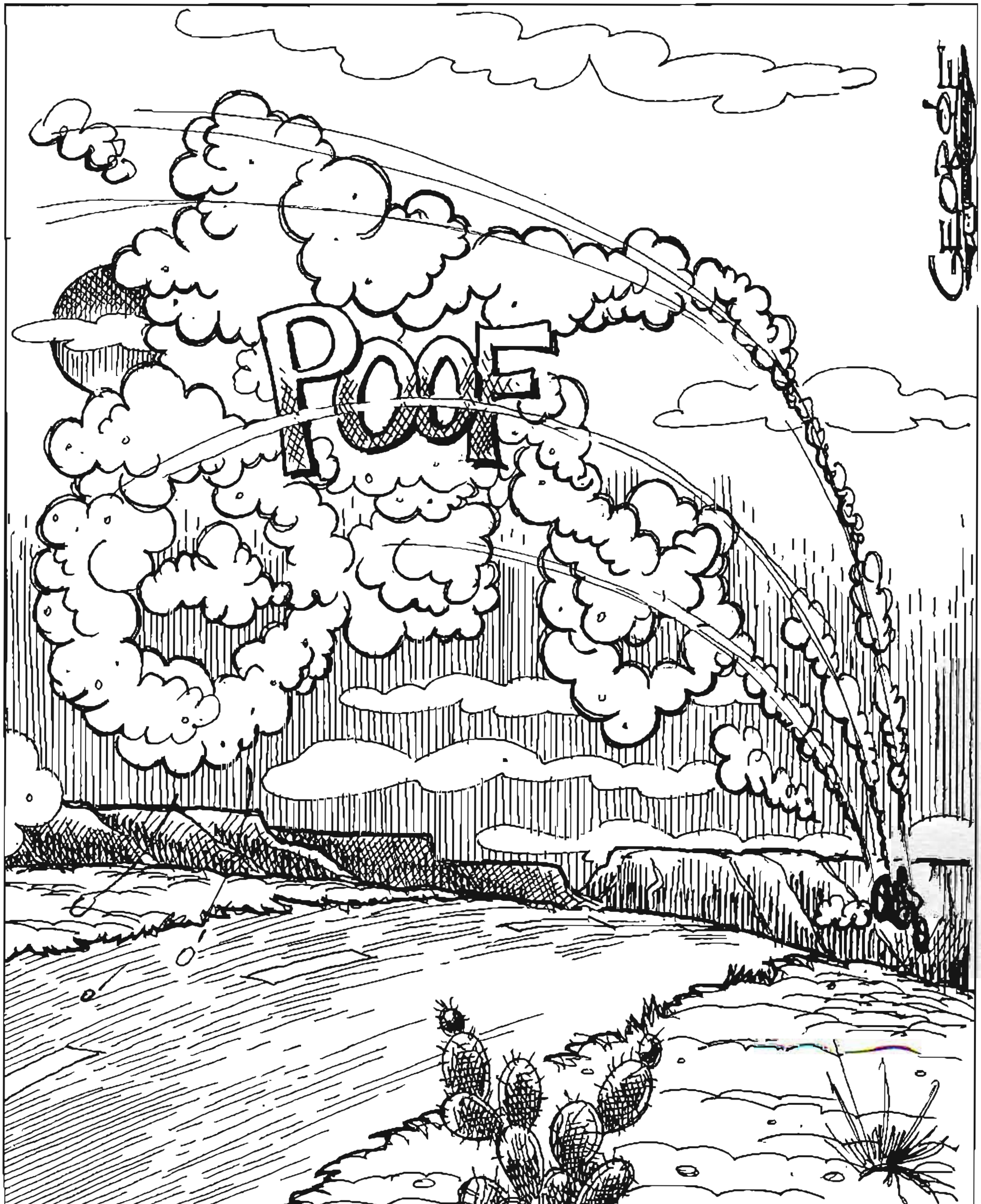
Then the engine is turned until the rear cylinder is at TDC and left for 15 minutes to allow the tappets to bleed before performing the adjustments again.

With the engine reassembled, he will install a QwikSilver 38mm carburetor, which bolts on simply using the easy-to-read instructions (photo 12). Little or no adjustment is generally needed. He also expanded the performance by mating his engine formula with Nempco 2-into-2 SuperTrapp XR-style exhaust pipes. Roger usually must install at least 15 plates to make the engine sing.

It's a simple bolt-on maneuver, but don't forget to use new exhaust manifold gaskets and cinch the units down before and after warm-up.

The last crucial element of the formula is the ignition system, including the coils. Roger often uses the HES (310-397-3195) dual Dyna coil mounting system, but in this case, he will try the nology coils, which are smaller, potent and lightweight. Generally, installing dual heavy coils can cause vibration and space problems. The single-fire ignition will be handled by Compufire in an upcoming issue.

—*Wrench*


POOF

THE REVTECH PRO-STREET KIT

Custom Chrome's Street Horsepower Combination

Photos: Eric Pierce

Experts agree that performance modifications made to an engine must be carefully coordinated in order to produce the biggest gains for the least amount of money. This approach to engine building is the key to the ability of Custom Chrome's RevTech Pro-Street Kit to produce from 88 to 92 honest, dyno-proven rear wheel horsepower from a stock 80-inch California Evo motor. That's more than double the 43.7 hp the California motors put out in stock form (49 state versions average 47 hp stock) at a total parts cost of just $2,700.

According to RevTech and R&D Manager Bob Deiss, the Pro-Street Kit is designed for use on the lighter bikes in Harley-Davidson's lineup including the FXR, Dyna, and Softail families.

The RevTech kit has five basic groups: special-grind cam and adjustable pushrods; free-flowing, 'trapp-style, 2-into-1 exhaust system; single-fire electronic ignition; all-new high-performance heads; and a special replaceable-venturi carb—all manufactured by CCI and bearing the trademarked RevTech logo. All of these parts were developed through extensive testing on the flow bench and dyno to work together as a team, each one complementing the others (photo 2).

The RevTech 40 camshaft has a computer-designed profile which features both a higher lift and a longer duration than the stock H-D design (see chart). Valve timing is also a key factor to minimize the effects of reversion and stand-off at high rpms, and the technicians at Rev- Tech have worked very hard to optimize the efficiency of the combination as well as maximizing the power it produces. The RevTech 40 cam, supplied as part of the kit, was developed to work with the flow characteristics of the RevTech carb, the porting of the RevTech heads and the back pressure inherent in the RevTech by SuperTrapp 2-into-1 exhaust. It's designed to work best between 2800 and 6500 rpm, but still retains strong mid-range power.

Made of 356-T6 aircraft-quality aluminum, RevTech's 4-Plug High Compres- sion heads are the result of many well-documented flow tests as well as countless trips to the dyno room. The combustion chambers have been cast and machined into semi-bathtub shapes that are more turbulent and thermally efficient than stock chambers.

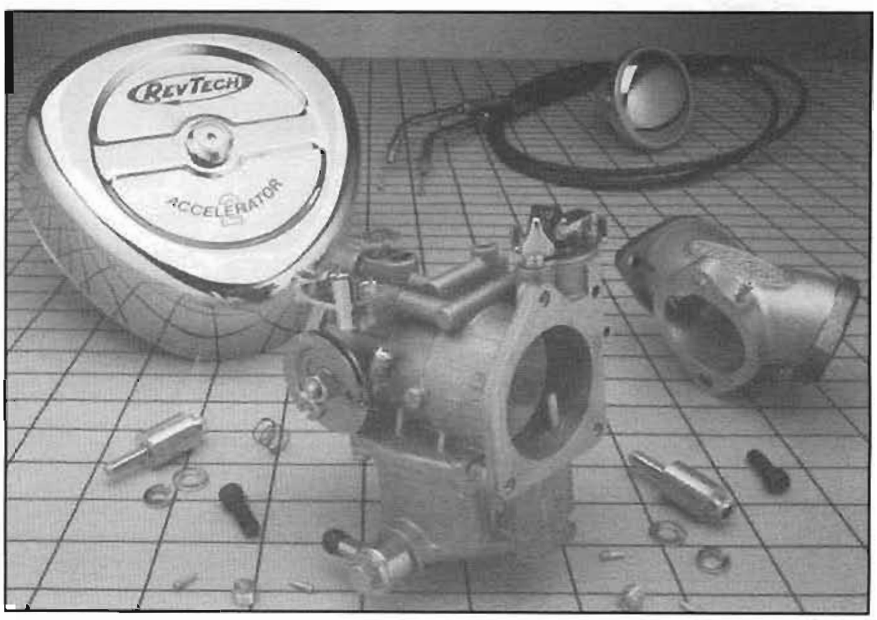


Photo 2

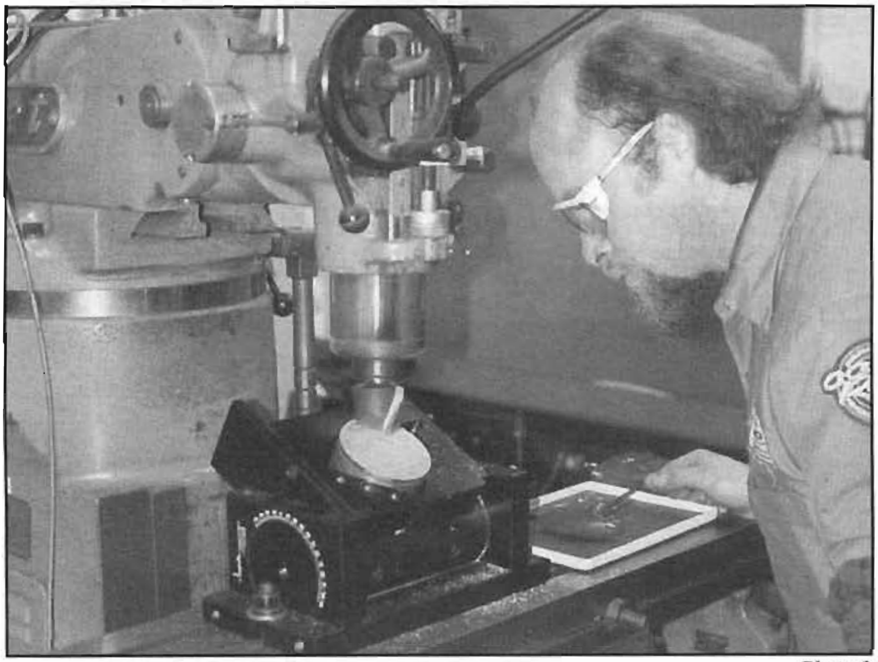
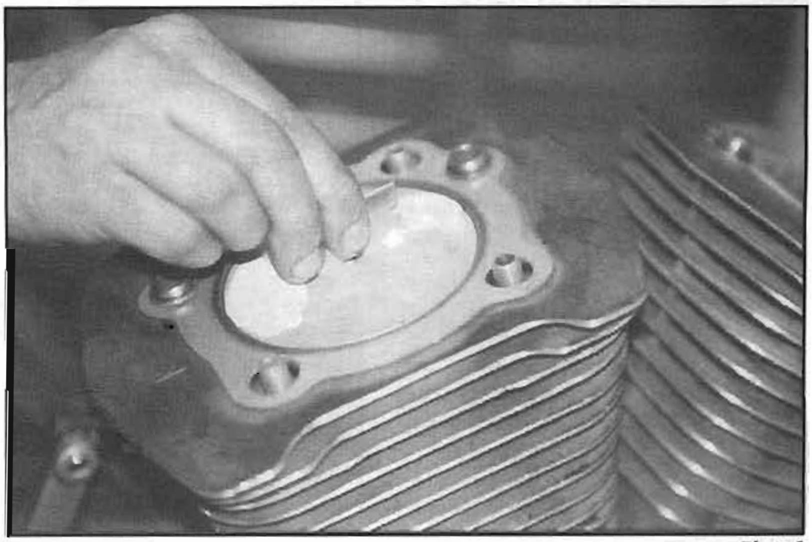


Photo 3

The stainless intake valves are 1.940 inches, .100 larger than stock, while the stainless exhaust valves are 1.610 inches, the same as stock. The heads feature redesigned intake runners with floors raised .100 inches to maximize flow and D-shaped exhaust ports to minimize exhaust pulse reversion. The compression ratio has been raised to a reasonable 10:1, as well and the seats hardened to be compatible with all fuel types.

The RevTech Accelerator 2 high-performance carb follows the same philosophy, featuring a replaceable venturi so that its flow characteristics can be tailored to the engine on which it is in- stalled. The version supplied with the kit has been calibrated specifically for this application and should be installed just as it comes from the box. No adjustments or tuning is required, just a light tweak of the idle speed screw once the setup is up and running. Installing the various kit parts is no problem for bros with mechanical aptitude, a reasonable selection of tools, a little experience with V-twins,

Photo 4



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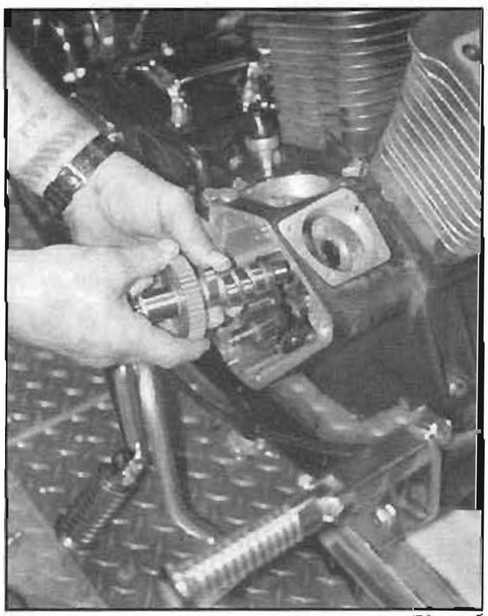

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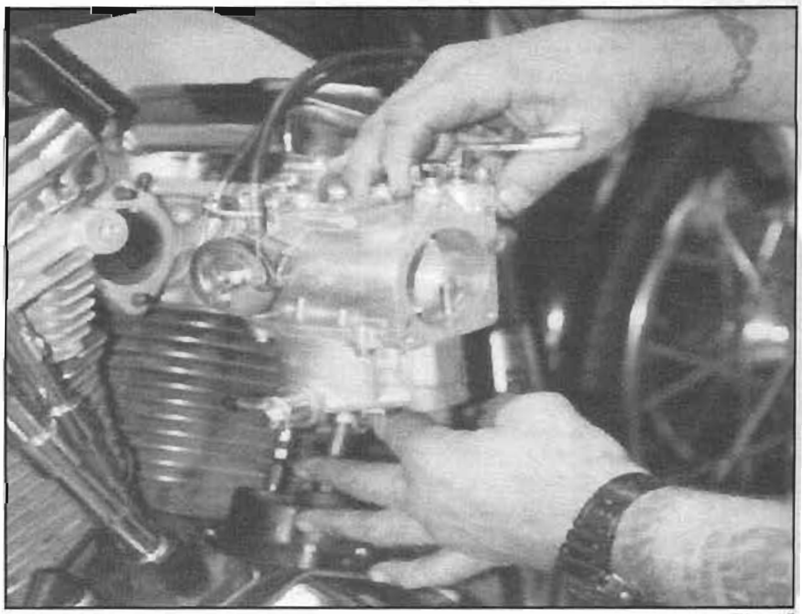


Photo 7

Photo 8

and a good attitude. The pipes, ignition, and carb are straightforward bolt-on items.

Because the RevTech custom heads require the valve pockets in the pistons to be opened up slightly for clearance (photo 3), or replaced with new ones (which CCI sells for this purpose), the barrels and pistons must be removed from the engine. This is a good a time to freshen up the cylinder walls with a ball hone and replace the piston rings with new ones, even if the engine only has a few miles on it—better safe than sorry. Puddy comes with the kit, for checking valve clearance (photo 5).

Installation of the high-performance cam also requires a bit of minor modification in order to work as it should. In addition to carefully checking the end-play and adjusting it properly with the shims provided, it's usually necessary to grind the case slightly to provide extra clearance for the innermost cam lobe (photo 6). This is easily done with a high-speed grinder using a small dome- or ball-shaped burr. RevTech recommends the use of a degree wheel to check the timing of the breather valve to avoid pressure build-up in the lower end that could negate power gains.

To prove that the RevTech Pro-Street Kit is everything they say it is, Bros Club Director Al Gelfand and I rode up to CCI's Morgan Hill, California, headquarters with one of our *Easyriders* test bikes, an '89 "California" FXR with a little over 16,000 miles on it,

CAMSHAFT SPECIFICATION

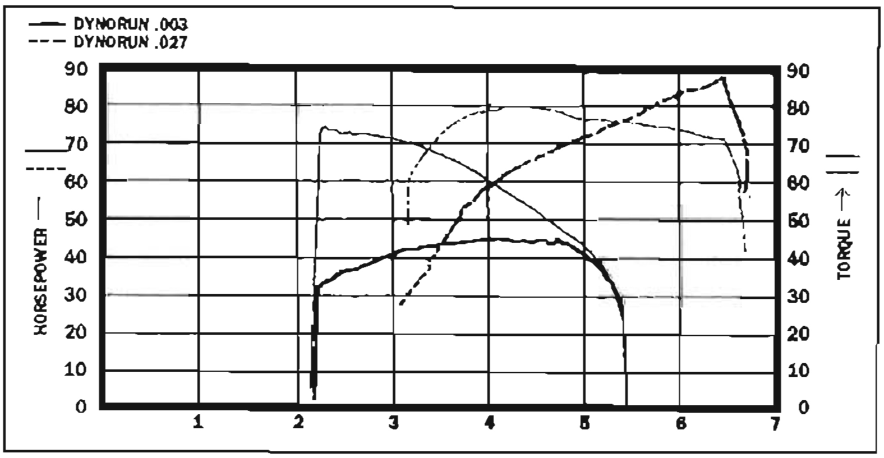
	OPEN	CLOSE	DURATION	VALVE LIFT
Stock Harley-Davidson "C" (California) Camshaft				
INTAKE:	-18°	6°	168°	.416 in.
EXHAUST:	5°	18°	168°	.416 in.
RevTech 40 Camshaft				
INTAKE:	31°	55°	266°	.560 in.
EXHAUST:	59°	27°	266°	.560 in.

owned and ridden by Paisano employee Bob Cain.

After running base-line dyno tests to check the bike's stock output, technicians Bob Deiss and Tom Butler spent the better part of a day installing the Rev-Tech kit on the FXR. At the end of the day, it was back on the dyno. The motor produced more than double the stock horsepower—a healthy 88 at 6,400 rpm (photo 8).

"Horsepower sells parts," Bob Deiss explained between dyno runs, "but smoothness and reliability is what makes a nice ride. The RevTech kit provides a combination of parts that produces power in a very smooth, civilized way."

—Truckdawg



POWER PLAY

Bolt-On Power At The Push Of A Button

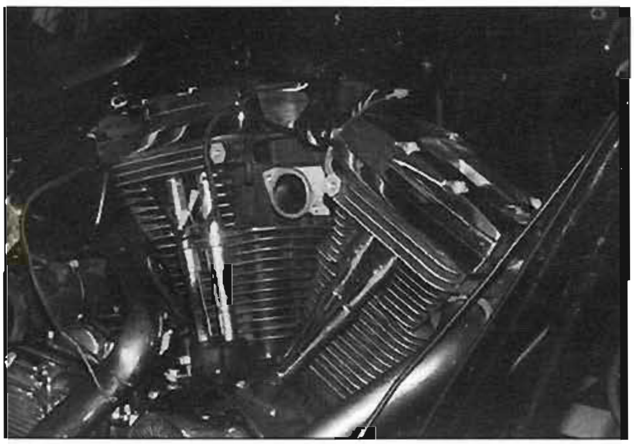
Nitrous oxide. Some love it. Some hate it. But overall, it's the tried and true choice of weekend warriors and hardcore racers alike who are looking for maximum performance from their engines with a cost-effective price tag. The dollar-per-horsepower is one of the lowest when compared to other performance upgrades. When used in conjunction with blowers, big-inch engines, and other performance modifications, your power gains will be even higher. For the average rider who wants a blast of power every so often without having to tear into the engine, nitrous is a perfect option. Even if you're not a world-class machinist, you can install a nitrous system with basic tools and a little patience.

We headed to the source, Nitrous Oxide Systems (NOS) in Cypress, California, to see what it takes to put the squeeze on your Hog. Our test bike was a modified 1991 FXR, owned by Dale Vaznaian, one of the owners of NOS. Although the engine remained at the standard 80 cubes, an S&S Super G carb with S&S intake, SuperTrapp 2-into-1 exhaust, Branch heads, and a special Wink's Custom Cycles camshaft combined to give the bike an honest 80-plus horsepower at the rear wheel. However, if a little is good—a lot is even better. As you'll see, the nitrous oxide system added another 30 horses and almost 40 foot-pounds of torque at the push of a button. This combo has proven fatal for more than one unknowing sport bike rider, and will no doubt defeat more in the future.

Now, although 30 horsepower and 40 foot-pounds of torque is nothing to scoff at, this kit can be tuned to provide even more power. At this point, you'd want to check with your mechanic to see if your engine is capable of handling the extreme power without complications. After all, there's only so much brute power that a stock bottom end will handle—so check it out. And while this is not a complete step-by-step installation, the installation time should take about 4 to 6 hours, barring any special work that may be necessary depending on space limitations, etc. Several kits are available for Harleys, and they price out between $500 and $600, so you'll want to call NOS (714-821-0580) for specifics.

Enjoy. —*Wordman*

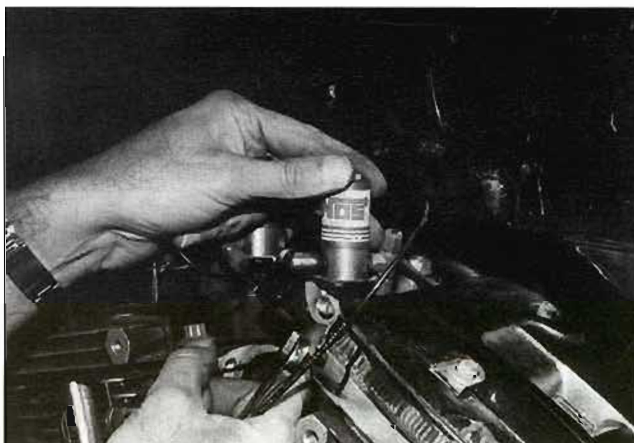
With the exception of the new billet aluminum nitrous bottle clamp, this is the kit that we installed on our test bike. All of the necessary hardware comes with the kit, which installs easily.



Here's where we started: The tank was removed, then the S&S Super G carb and the manifold. The S&S intake manifold will get drilled and tapped for the nitrous oxide and extra fuel nozzles

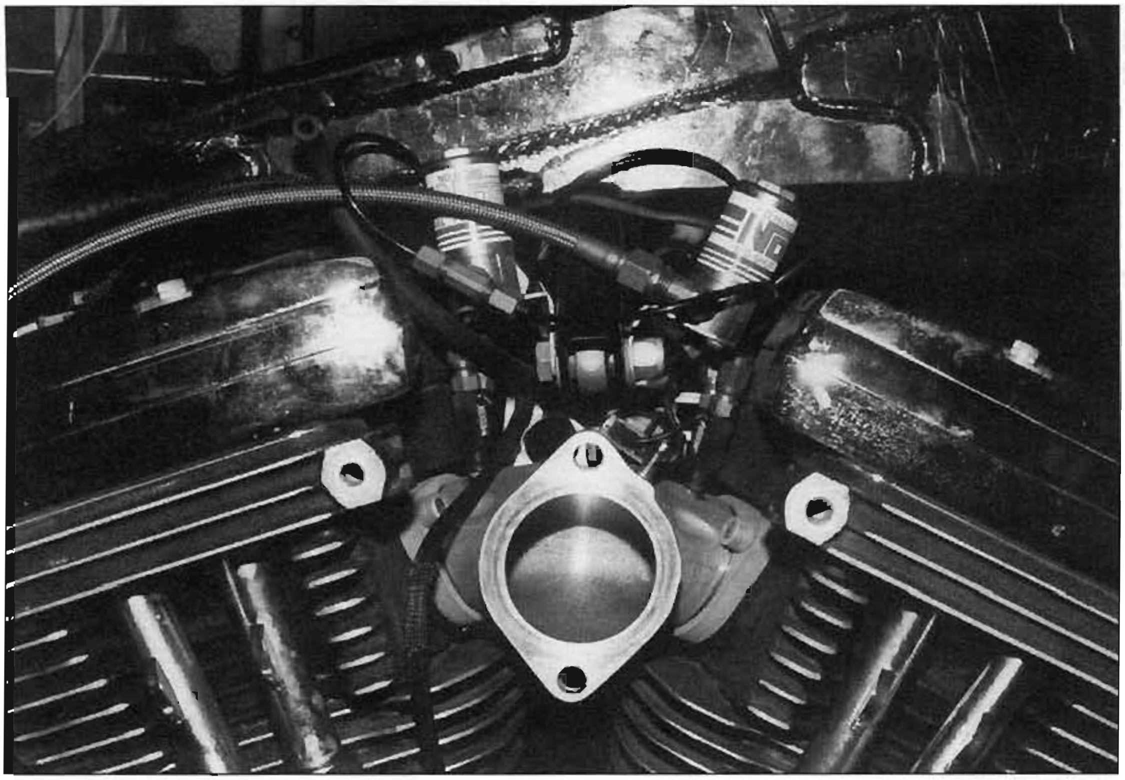
NOS recommends mounting the bottle solidly to the frame at least 6 inches from the exhaust system. This billet aluminum bracket, designed especially for H-D applications, holds the bottle in place. Two allen-head screws hold the clamp together.

Mount fogger nozzles with the discharge ends facing down. This will eliminate fuel seeping down into the nitrous passageway and damaging the solenoid seals. Although this is a rare condition, don't take the chance.

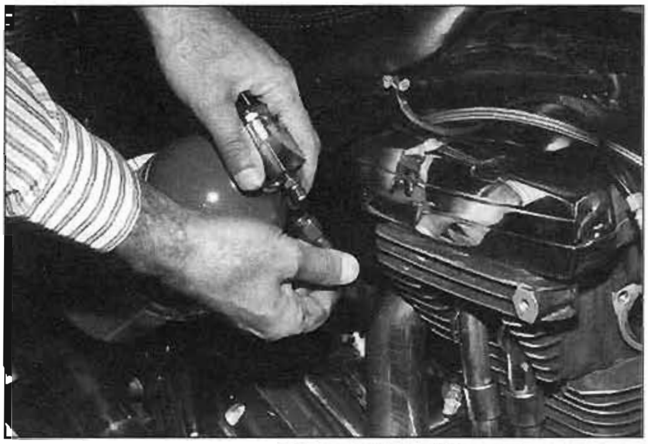


Photos: Eric Falconer

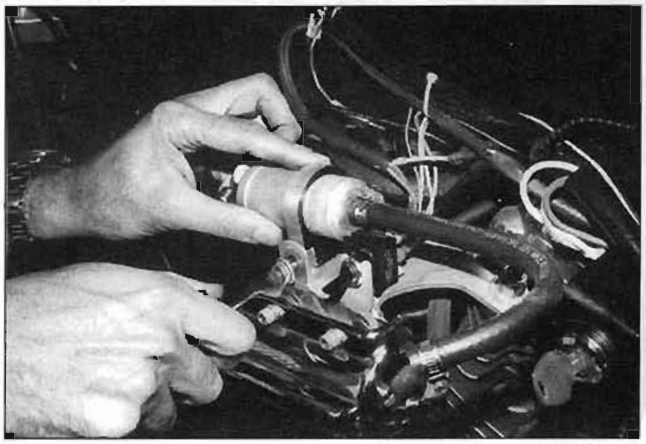
The nitrous and fuel solenoids can be mounted separately (or together) on supplied bracketry. Keep them away from exhaust pipes, and make sure they're mounted above the fogger nozzles, but near enough to keep the lines as short as possible.



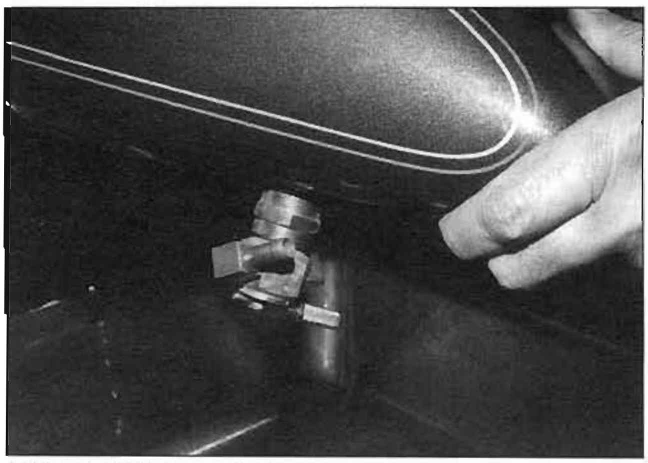
Both solenoids are now in place, mounted to the upper engine mount. The nitrous and fuel lines are installed after we did a trial fit to determine how long the lines needed to be. High-pressure Nylon line is used with brass fittings for the output side of each solenoid. The nitrous feed is a steel-braided high-pressure line, the fuel feed line is routed to the electric fuel pump where it is mounted on the coil side.



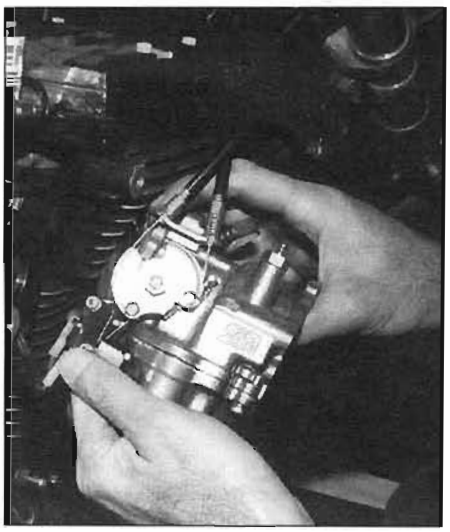
If you route the nitrous feed line under the seat near the battery, avoid contact with the battery's positive (+) terminal. A good idea is to wrap the line in plastic crinkle hose or heat-shrink tubing wherever it may come into contact with the battery.



Here's the electric fuel pump mounted to the ignition coil bracket with NOS' billet aluminum clamp. The arming switch is also located on the coil bracket. Keep the pump as low as possible, in relation to your fuel tank(s), and away from heat.



A high-flow fuel petcock, such as the Pingel dual outlet model shown here, is recommended, since the fuel demands will increase significantly when the nitrous is being used.



Notice the micro-switch (safety feature) mounted to the carb. This ensures that the nitrous is applied only under full-throttle conditions. Once the wiring is complete, the horn button on the handlebar will double as the nitrous button when the arming switch is flipped. Then, once you're at full throttle, hit the horn button and hold on.

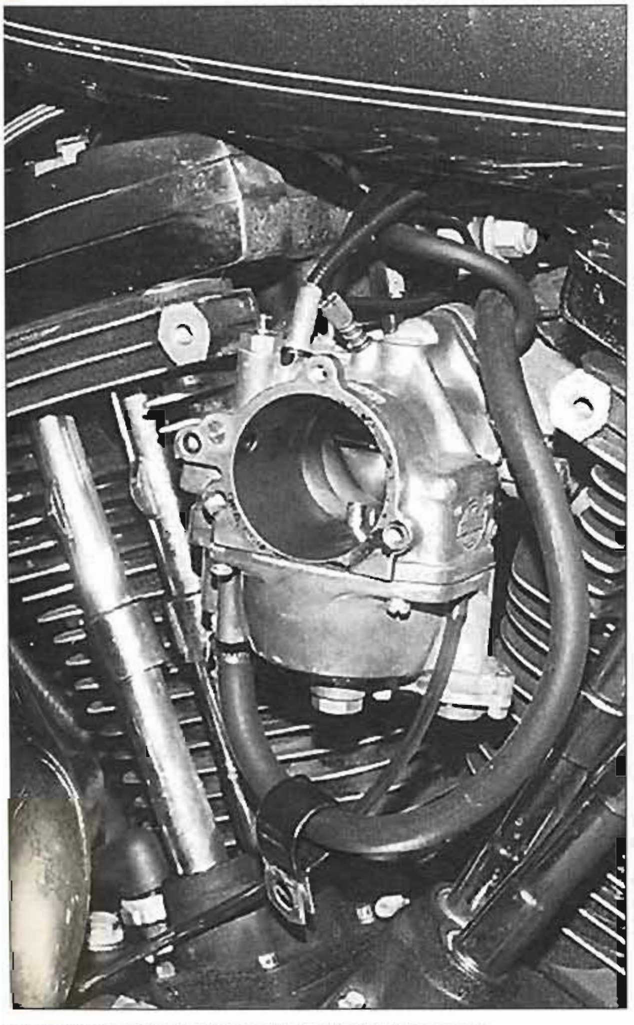
Here, the nylon fuel line, which feeds the fogger nozzle, will be threaded onto the solenoid with brass compression fittings.

POWER TESTING

With the nitrous system installed, it was then time to cruise over to Attack Performance—12929 Telegraph Rd. Unit G, Santa Fe Springs, CA, (310) 903-7757— to get the real numbers. Just how much power was available at the push of a button? As you can see, plenty. Larger jets in the nitrous and fuel fogger nozzles and further tuning can yield even larger increases. All power figures are correct data. Check it out.

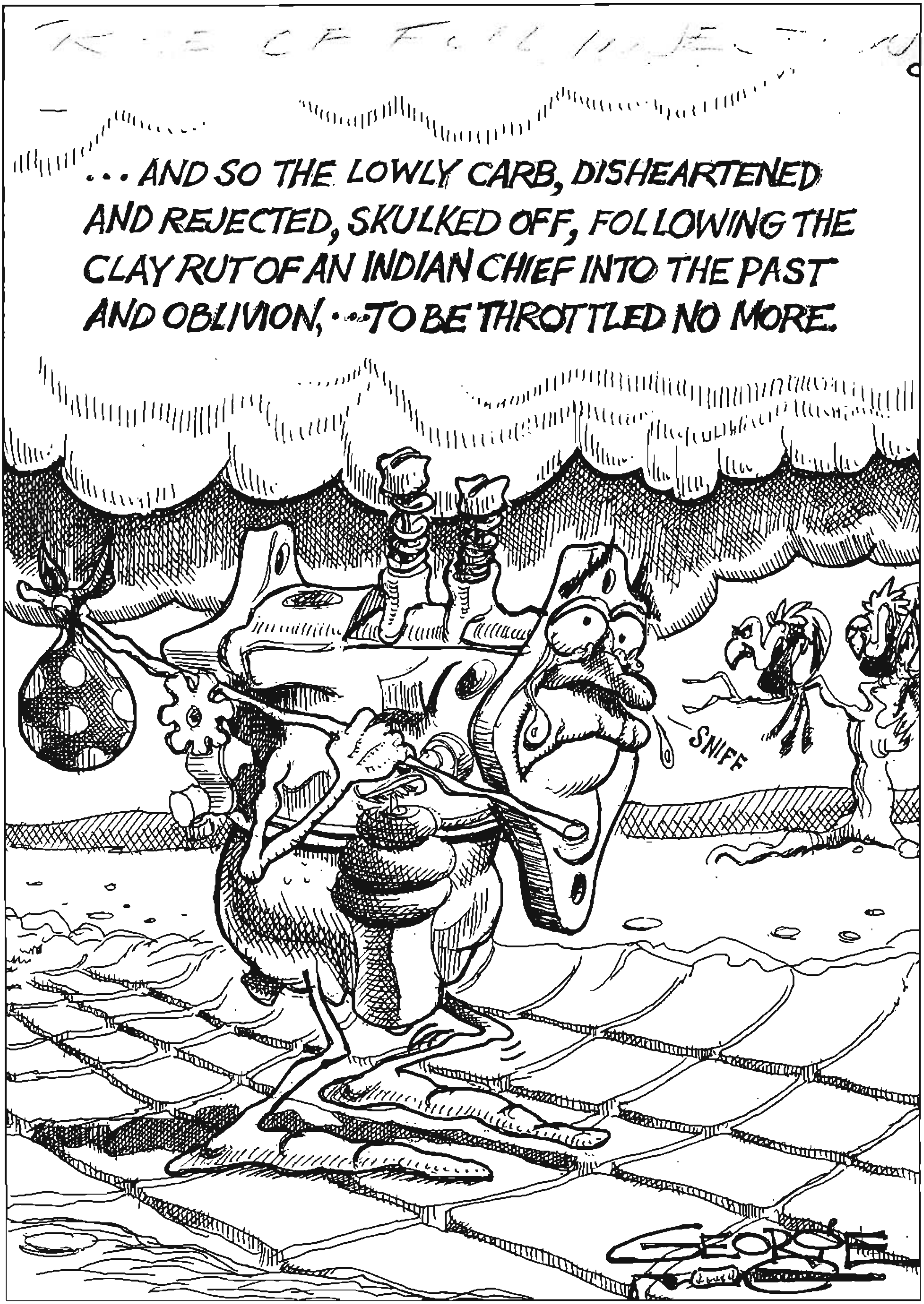
	Without nitrous oxide		With nitrous oxide		Power increase	
RPM	Torque	HP	Torque	HP	Torque	HP
3500	81.7	54.4	121.5	81.0	39.8	26.6
4000	86.1	65.6	124.9	95.2	38.8	29.6
4500	84.1	72.1	119.3	102.2	35.2	30.1
5000	80.0	76.1	115.5	110.0	35.5	33.9
5500	77.3	82.2	99.6	104.3	27.0	22.1
6000	71.2	81.4	91.4	104.5	20.2	23.1

Note: The high-pressure nylon nozzle lines are easily damaged, melted, or over-tightened at the ferrule ends, which will crimp the line size down to less than nozzle size, causing a mismatch in jetting—not good. Extreme care must be used when using these lines. Other things to avoid are bubble traps in the fuel side that will cause momentary lean-outs or backfires. Foam air filters are not recommended because of the fire hazard. K&N filters have a better chance of snuffing a carb backfire, and they flow better anyway.



With the Super G back in place, the installation is nearly finished. The solenoids and fogger nozzles are all plumbed up and will be tucked neatly out of sight, once the fuel tank is reinstalled.

Once installed, all that will tip off any prospective adversaries would be the nitrous bottle, unless of course, you've got someplace good to hide it. The 10-ounce bottles are excellent for that.


. . . AND SO THE LOWLY CARB, DISHEARTENED AND REJECTED, SKULKED OFF, FOLLOWING THE CLAY RUT OF AN INDIAN CHIEF INTO THE PAST AND OBLIVION, . . . TO BE THROTTLED NO MORE.
SNIFF
GEORGE

THE RISE OF FUEL INJECTION

A New Age Is Coming

In the new world of increased fuel economy, velocity, and power, fuel injection is knocking at our garage doors; drag bike racers have been experimenting with it for years. Last year Accel introduced their unit for Harleys and it worked well. This year, the unit to check out is a solid state, all-in-one piece system from Whitek. Next year H-D is scheduled to introduce their first OEM injection system on a touring model.

We installed the complete Whitek system on a 1992 Dyna Glide in less than three hours (photo 1). The system consists of the throttle body, the handlebar control panel, hoses, and a 5-wire loom to connect the electronic module (mounted on the inside of the air cleaner to the existing Dyna electrical system). We chose to use a Ramjet intake manifold and replace the stock petcock with a high-flow pingle. The kit also provides a choice of two venturi sizes: 42mm or 46mm.

The Ramjet intake manifold afforded us the most solid mounted throttle body, which enhanced the stability of the wiring. Each wire was carefully soldered and shrink-wrapped to prevent any possible disconnection or short. The electronics are voltage-sensitive and the slightest interruption in current can disable the system. This particular unit was installed by Marty Ruthman of Hi-Tech Custom Cycles in Van Nuys, California. For technical support, the designer, Bob White at Whitek, was readily available.

We disassembled the stock intake manifold and carburetor. The Whitek unit requires a flange type of intake manifold, so the solid Ramjet unit was installed only after tremendous care went into checking the fit (photo 2).

The new throttle body was then bolted in place and the wires were connected per the instructions (photo 3). Coil(s) can be wired in either the single-fire or dual-fire mode.

A high-flow Pingle petcock was installed, because a fuel pump attached to the right side of the throttle body maintains a high constant pressure. Electronics control the pulses of fuel being time-injected into the intake manifold (photo 4). The remaining fuel is pumped back into the tank to cool. Neither the Accel nor the

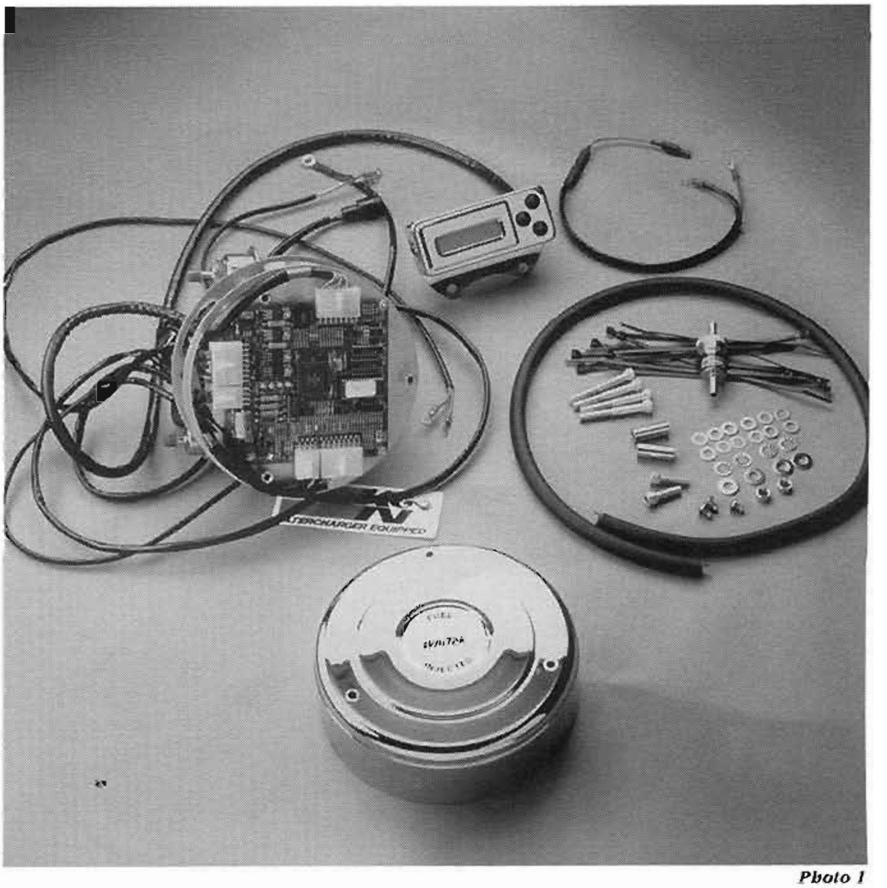


Photo 1

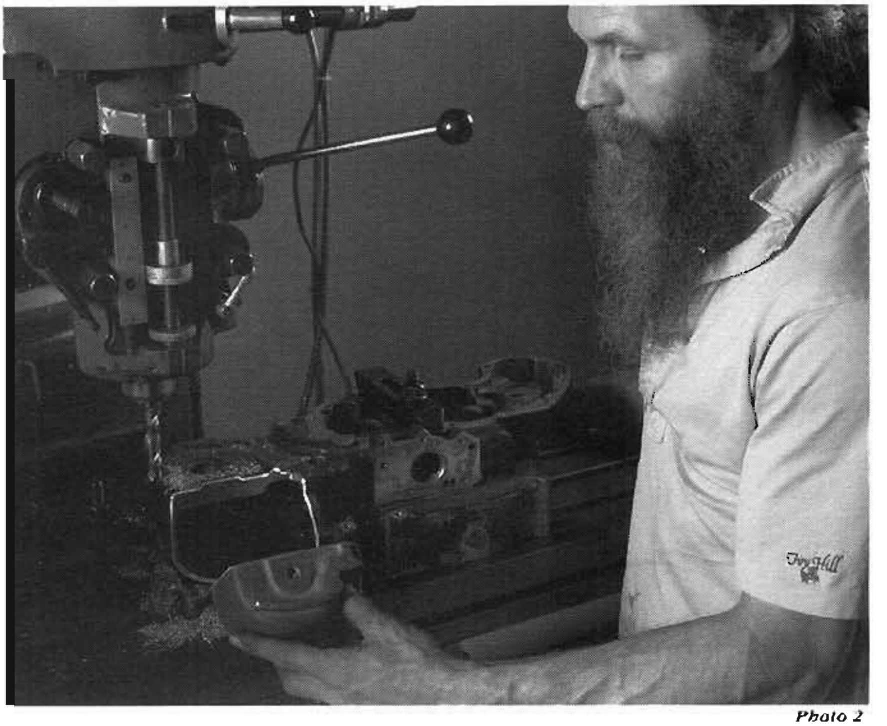
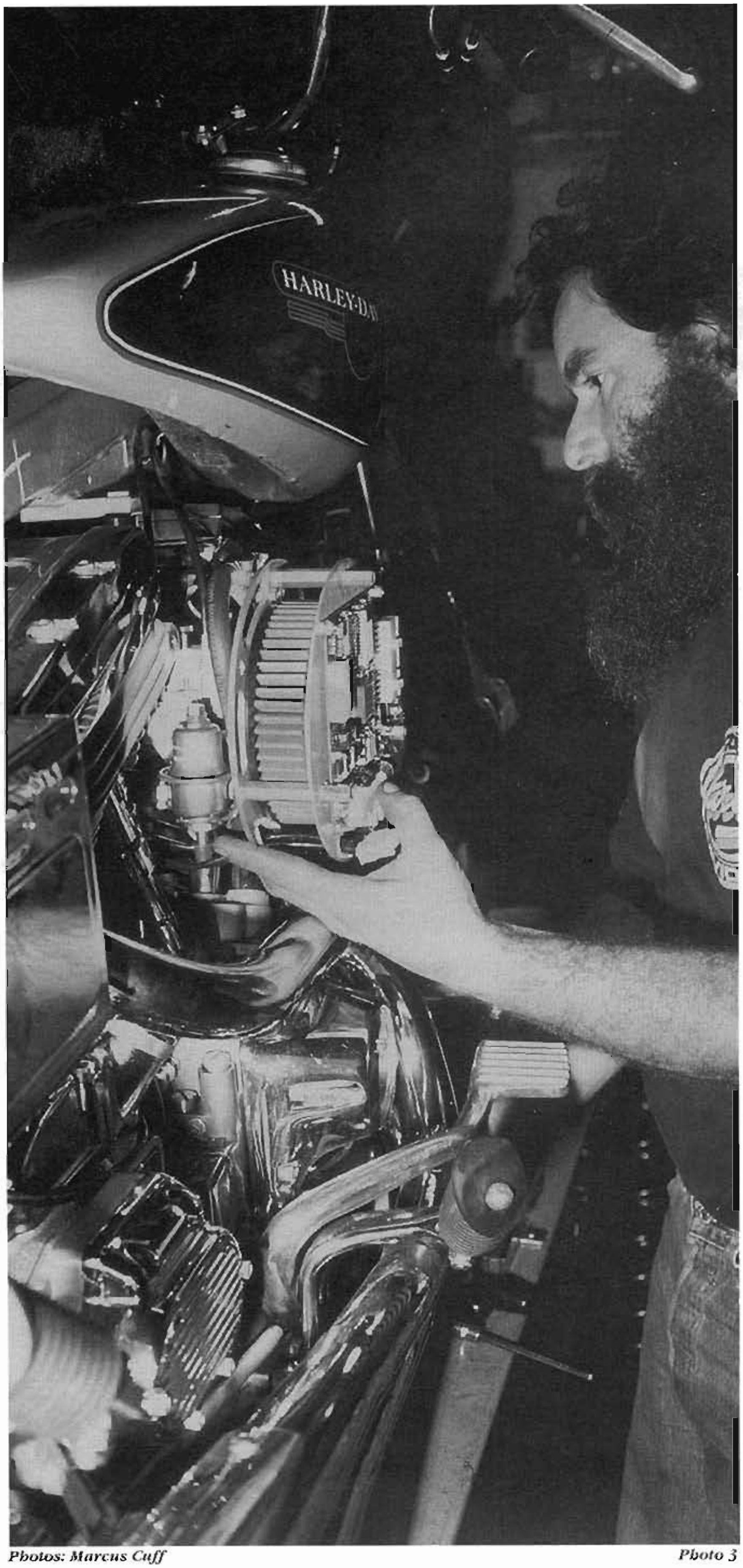


Photo 2



Photos: Marcus Cuff

Photo 3

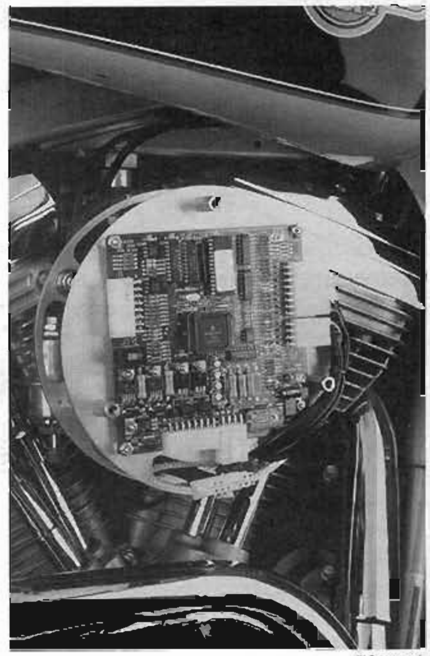


Photo 4

Photo 5

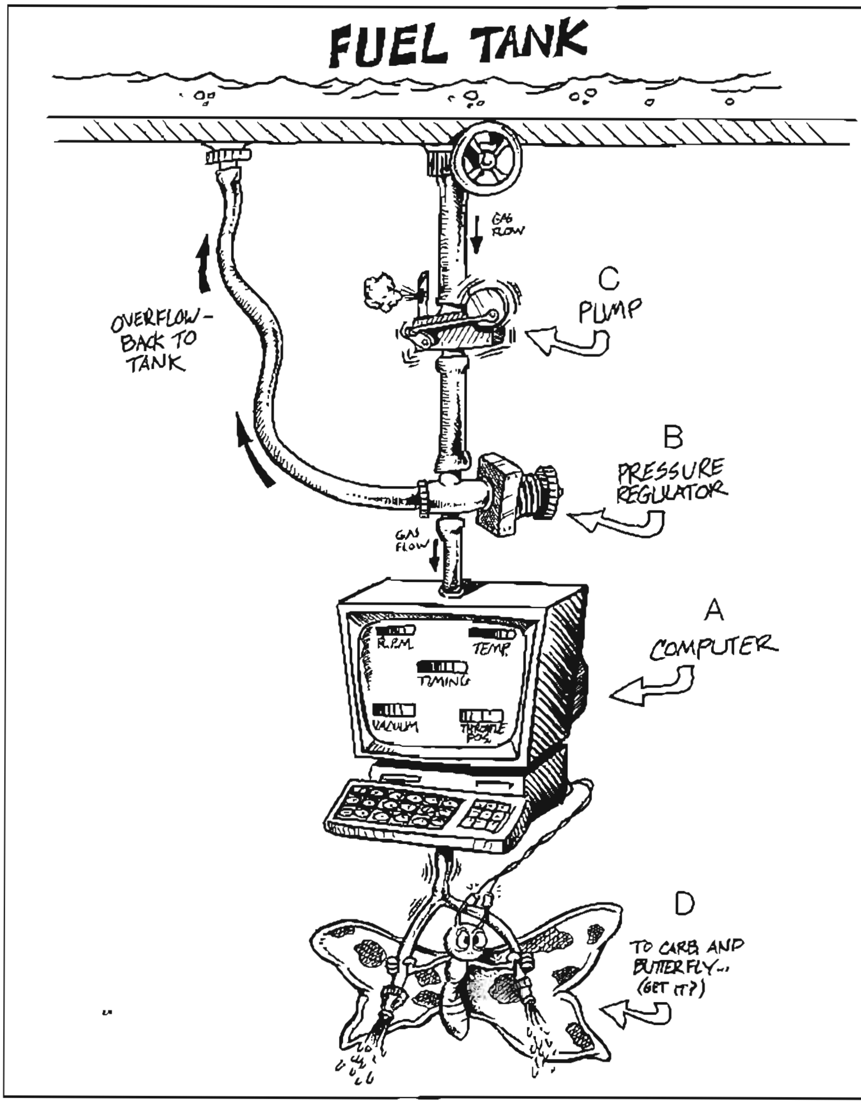
Whitek unit monitors exhaust, but both have thermocouples. The control panel is mounted on the handlebars and can adjust the ignition timing, the fuel system delivery (amount, duration), and the "choke" duration and intensity (photo 5).

The major difference between the Whitek system and the Accel unit is the rider's ability to adjust every aspect of the system while rolling down the road. For the tinkerer who goes beyond the realm of his motorcycle's performance curve, pressing one button erases all the mistakes and pulls the bike back into a preset performance formula.

Some minor items to watch out for: You may need longer throttle cables (any non-CV dual cables should work). Some trimming of the air cleaner and backing plate may be necessary for tank clearance, especially on rubber-mounted motors.

The overall benefit of fuel injection is its efficiency. Blasting the fuel into the manifold on a timed system is economical and enhances the performance tremendously. Note the diagram. Instead of fuel being sucked into the cylinders only when the valve is open and only through venturi velocity, fuel injection squirts the fuel into the manifold (or directly into the port with the Accel model) precisely when it's needed. No *venturi effect is needed to speed delivery.* The throat is wide open to the intake valve and the fuel spray duration, fan design, and amount are controlled for maximum performance. You'd be surprised what a difference injection makes in V-twin performance.

—Wrench



INJECTION THEORY

The ECU (Electronic Control Unit) reads crankshaft position (degrees) from the stock ignition pickup (A). This tells the ECU when to inject fuel. With another reading from the TPS (Throttle Position Sensor), it tells how much fuel to inject, and a reading from the MAP (Manifold Absolute Pressure) sensor blends the first two readings to give smooth throttle response. There are other things occurring at the same time to ensure optimum operation.

The ECU's thermocouple senses temperature, so it knows when to reduce the amount of cold start enrichment (choke). It also reads engine speed and controls it at idle—with the IAC (Idle Air Control))—and holds the idle speed up, while cold, in order to speed the warm up process. (The Whitek system does not use this.) The ECU also controls fuel and spark to help prevent overheating.

In addition, the ECU reads how fast the throttle (TPS) is opened and, depending on engine speed and temp, delivers an appropriate "accelerator pump shot." This "accelerator pump shot" does not deliver quite the same as a carb, but it's tailored to the demand of that instant and can vary with different demands, such as load and engine speed. This is where the injection unit saves fuel that a well-tuned carb can't. The carb has to supply an amount of fuel equal to the largest demand every time, even when a smaller amount would do. This is because it has no way of discerning the engine speed or load. Of course this "accelerator pump" is used on all carbs and injectors, except *true* Constant Velocity carbs. Constant Velocity refers to the air speed in the carb—not road speed.

The fuel pressure regulator would seem to be a simple piece, but it is not (B). It very precisely and instantly controls the fuel pressure from zero flow to maximum flow, and it corrects for altitude changes. It does all this without back loading the fuel pump to the point where it would "stall" and burn up.

The fuel pump (C) will pump over 50 pounds of pressure at "stall." But, if it's left running, it would overheat, cause a large vapor bubble to develop, then quickly weld itself. The pressure regulator by-passes excess fuel back to the tank; this fuel flow keeps the pump cool and alive.

The Idle Air Control air pump is very precise. It moves air around the butterfly to control the idle speed. It is not absolutely required to make the injection function, but it is nice, and it eliminates the need to constantly adjust idle speed manually. (Whitek Fuel Injection does not use one. Instead,it uses ECU to control other things and to allow the rider to fine tune for the best seat-of-the-pants feel.)

The injector nozzles themselves are another reason why electronic fuel injection is here to stay—their spray pattern is makes them uniquely efficient (D).

A carb just delivers a stream of fuel into the air flow and hopefully this air stream is turbulent enough to get the fuel spread sufficiently to provide a good burn in the cylinder. With injection, there are two cone-shaped sprays pushing fuel into the air stream, and they can be timed so that they end up in front of the spark plug when it sparks. This way, even lean burn conditions present no problem. And, with all aspects of the engine's power output under control, the operating smoothness is very deceptive on how much power is actually being produced.

—Dr. Rux

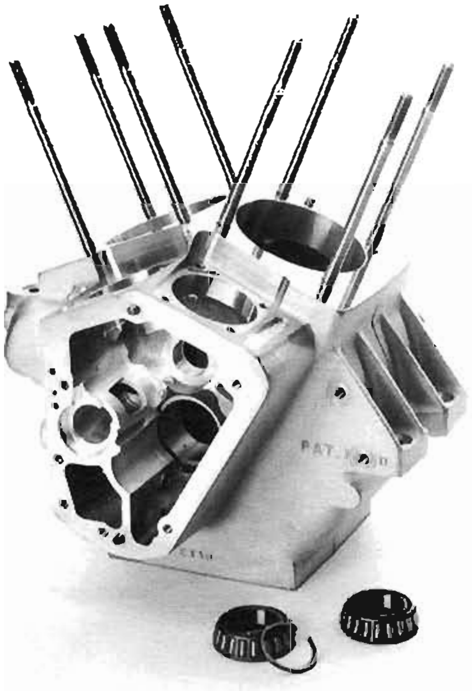
Special thanks to: Roger at X.R.V. Enterprises, Andrews Cams, Dyna Coils, and Bub Enterprises.

THE

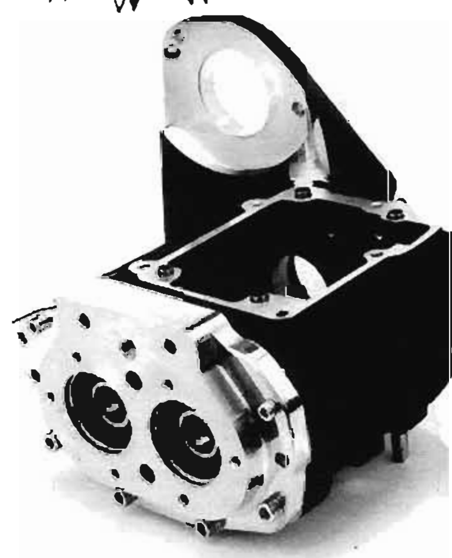
STRONGEST - MOST RELIABLE

CASES AVAILABLE

CASES NOW AVAILABLE WITH: TIMKEN BEARINGS INSTALLED- PINION RACE INSTALLED AND LINE LAPPED- CYLINDER STUDS INSTALLED- READY FOR ASSEMBLY



EV-2U



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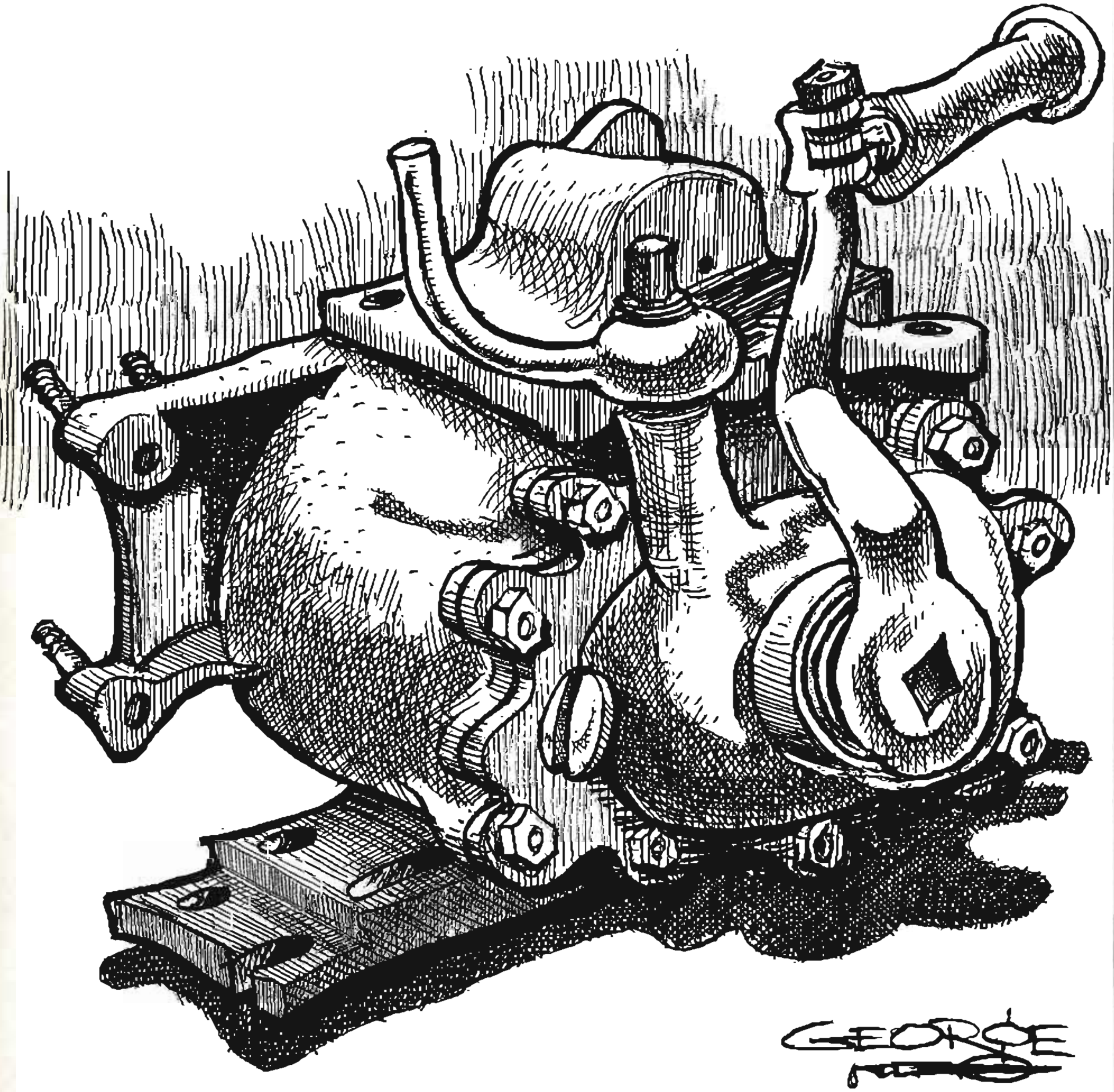
TRANNY

Gettin' the power to the back wheel, the best way. You need your trans shifting faster, easier, smoother and the whole thing needs to last longer. Turn the page for some time honored and bro tested tricks.



UPDATE YOUR TRANNY

Fitting And Honing Gear Bushings To Properly Fit The Mainshaft

Harley-Davidson four-speed transmissions have been around for a long time and are still a favorite with a lot of people. And rightfully so, for they are strong, dependable, and easily repaired or rebuilt. Their only flaw, that I have found, is the bushing used in fourth gear (photo 1). Fitting and honing the bushing to properly fit the mainshaft are critical, and they are something that most people aren't able to do—unless they have access to a shop.

Even when done properly, this is normally the first part to wear. The wear is usually indicated by an oil leak from the fourth gear seal and the fact that the shaft no longer runs true, causing wear throughout the drive train.

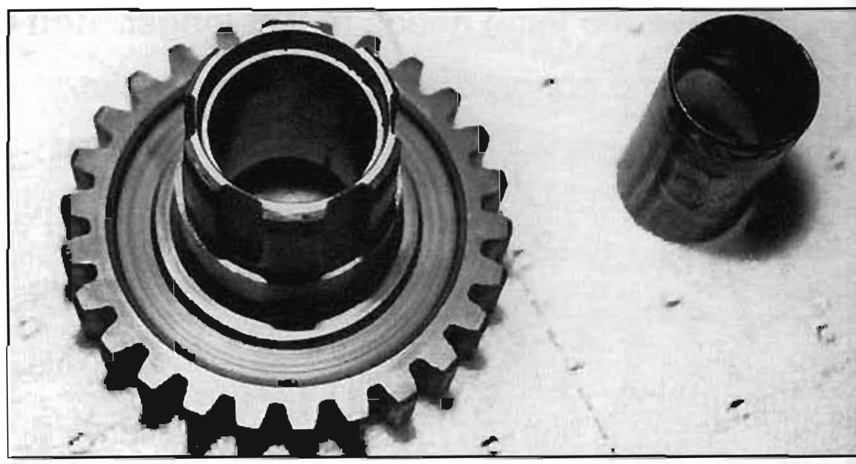


Photo 1

When Harley came out with a 5-speed, they changed the bushings to roller bearings, but the parts were not interchangeable with those on the old models

When Harley came out with a 5-speed, they changed the bushing to roller bearings, but the parts were not interchangeable with those on the old models.

Here's the solution:

After the transmission is disassembled and all parts are cleaned


Photo 2

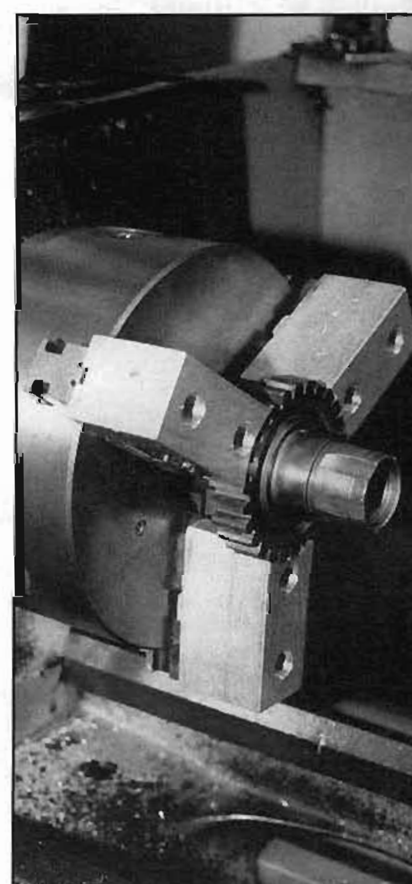
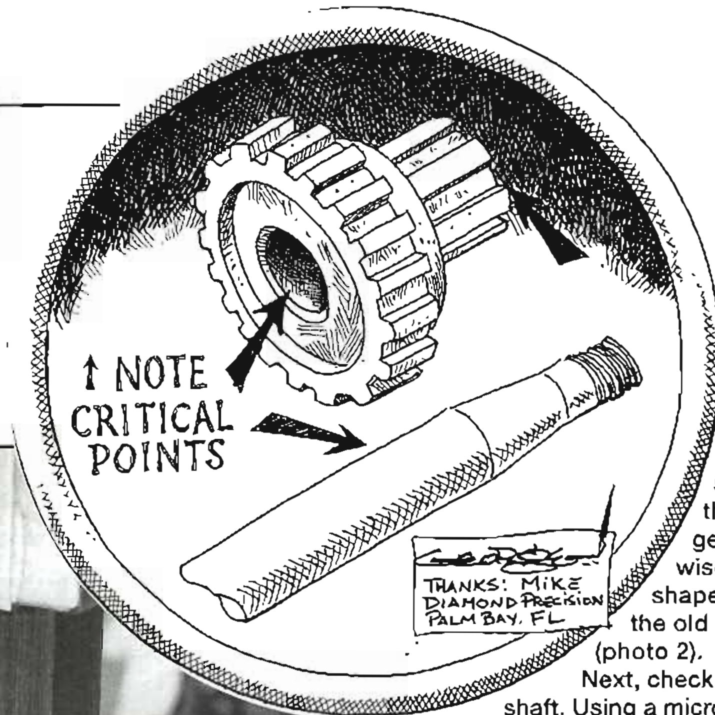
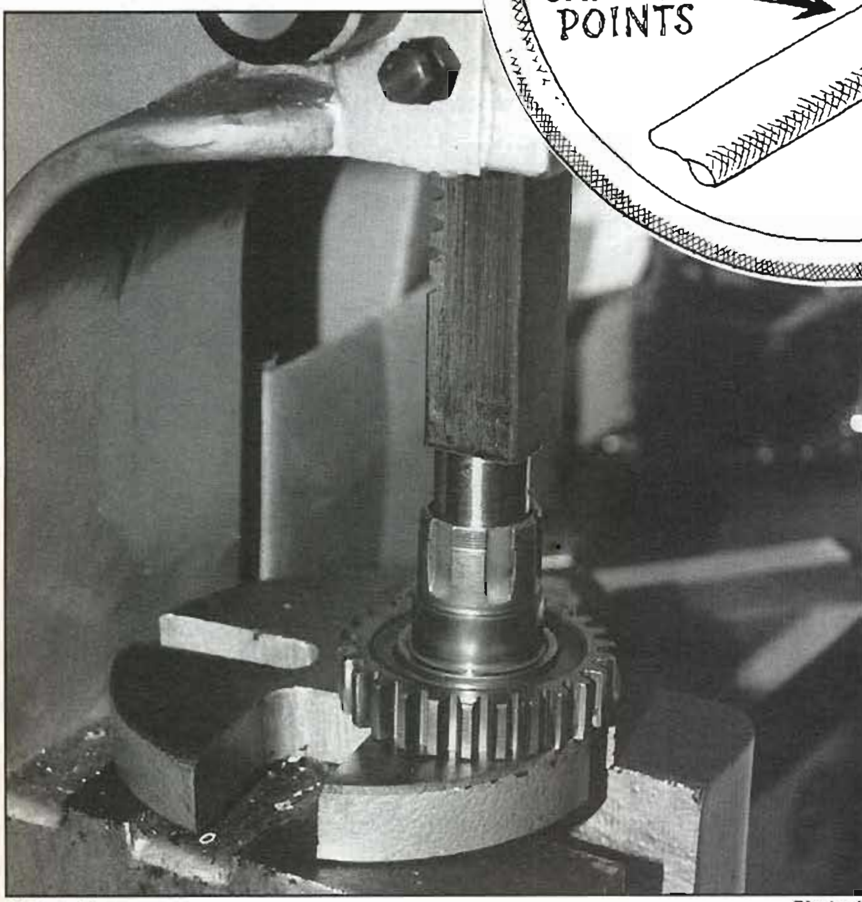


Photo 3



and inspected, if the fourth gear is otherwise in good shape, remove the old bushing (photo 2).



Photos: Rogue

Photo 4

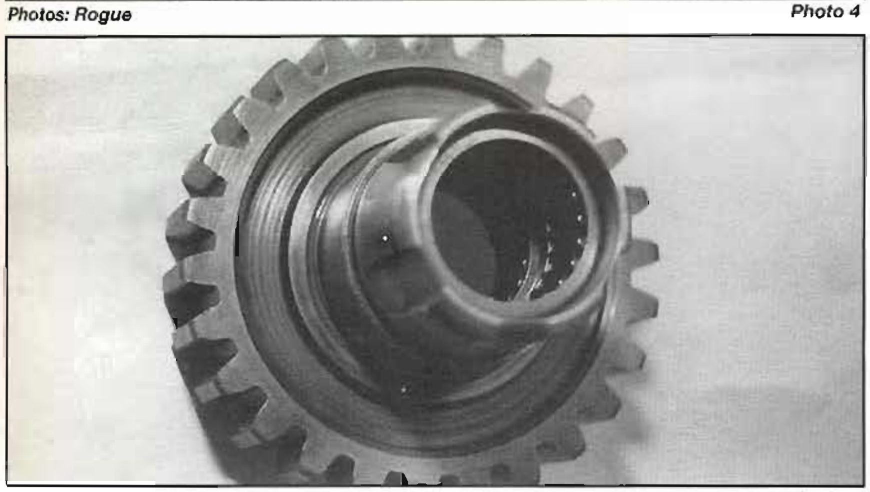


Photo 5

Next, check the mainshaft. Using a micrometer, measure the area where fourth gear goes. It should measure 1.000, but can go as low as .998. If it is smaller than that, get another shaft.

Get two H-D bearings (part #8904). Mic the outside of these. They should be 1.252. Be sure that both mic the same.

Using a good lathe, set up fourth gear, with the gear end in jaws, to 0 runout (photo 3). You will need to use a carbide cutter because the gear is hardened. Harley gears are about 50 Rockwell (with Andrews etc., about 60 Rockwell).

Taking small cuts go 2 inches or 2.000 down bore. Do not go all the way through the gear. This should leave you about .015 at the end of bore. Continue cuts until you have a bore of 1.250 or 1.2505. This will give you a .0005 to .001 press fit for bearing. Press bearing into gear. I strongly suggest you make a tool to do this, and do not hammer it (photo 4).

When the bearing is seated on the lip, insert the mainshaft to check the fit. If it rolls freely, insert the top bearing, pushing it down 1/4-inch or .250 from the end in order to leave room for the seal.

Check the mainshaft fit again. If acceptable, install the seal.

Note: When assembling, I suggest oiling the shaft well and using a slight twisting motion when going through the seal. Assemble as per the manual.

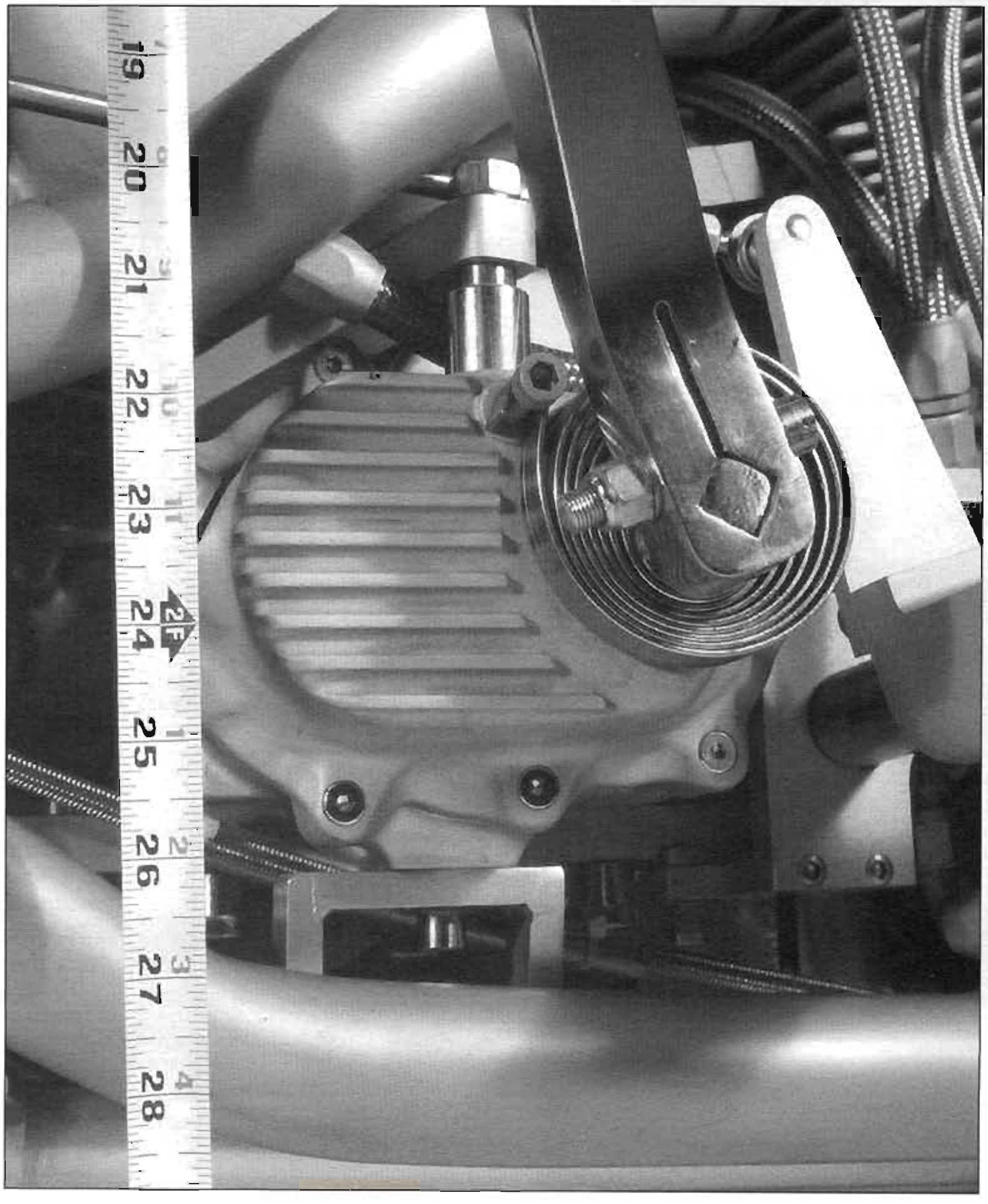
If you aren't equipped to do this job in your garage, you can contact Mike

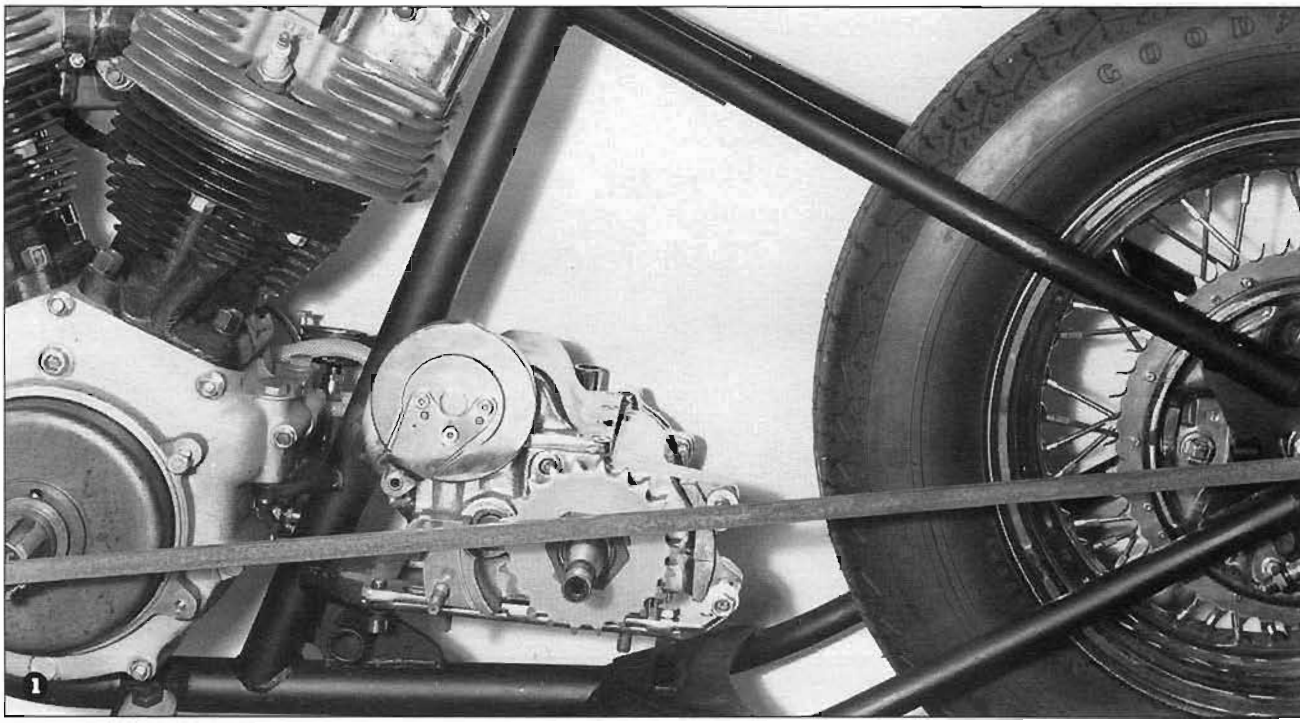
INCHING UP

RAISED TRANNY ADDS RELIABILITY

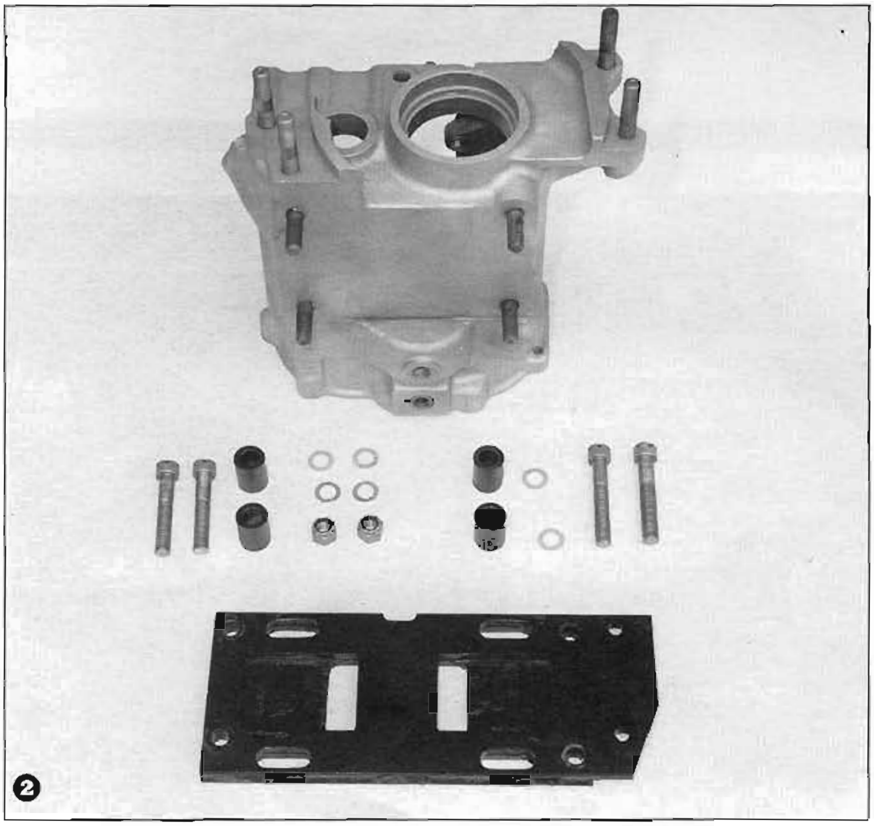
Whether you want to make that big-incher drivetrain live longer or maximize the mileage of a mild mod-job, here's a transmission trick that helps. It applies to Big Twins with solid mounted (non-rubber) engines/trannies. The modification works most simply with kickstart gearboxes.

What's it all about? Big benefits accrue from a transmission located an inch above stock. Normally, the axis of the transmission output shaft sits an inch below the centerline of the engine sprocket and the





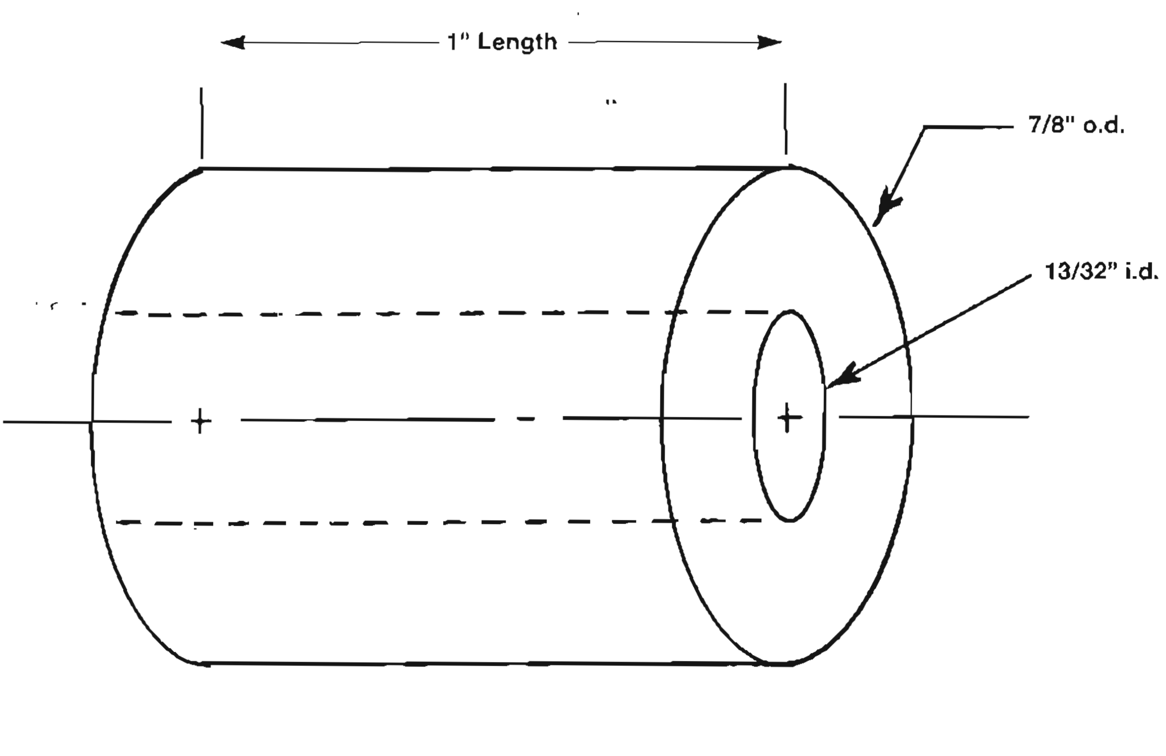
GEORGE
ÖLD ZEKE SAYS:
TRANNY TIP
OLD ZEKE
HMMM
Instructions -
A. Prop transmission.
B. Lower motorcycle.
C. Raise headlight.
A FORMER FACTORY DESIGN ENGINEER, OLD ZEKE IS BEST KNOWN FOR CREATING THE 1928 61 C.I. POLICE MOTOR-KAMAKAZI. HE IS NOW PAISANO'S BASEMENT CUSTODIAN.



2

rear sprocket (1). Spin your mill tight, drop the clutch, and everything wants to yank the transmission up off its mounting plate. Raising it puts all the centers in one plane. Result? The pull of the primary drive opposes the resistance of the final drive. No more "up forces" on the transmission. With all three sprockets aligned horizontally, bearings last longer; stresses on frame and cases diminish.

It doesn't take radical surgery to fly high. At the bare frame stage, you add one-inch long spacers underneath the stock transmission mounting plate, with longer bolts (2). The spacers are easily machined (3). (Since tolerances vary, mock up your driveline—see photo 1—and adjust spacer length to line up centers exactly.) They raise the entire transmission assembly and plate one inch (4). If your frame accommodates it, we'd also recommend using a fifth spacer under the fifth mount, especially for kick-start motorcycles. The spacers surround through-bolts in front and blind cap screws in back, usually 3/8-24 TPI, but some hell-for-stout set-ups carry 7/16-inch bolts. Once you've fabbed the spacers, get extra-long, industrial strength (grade eight or better)



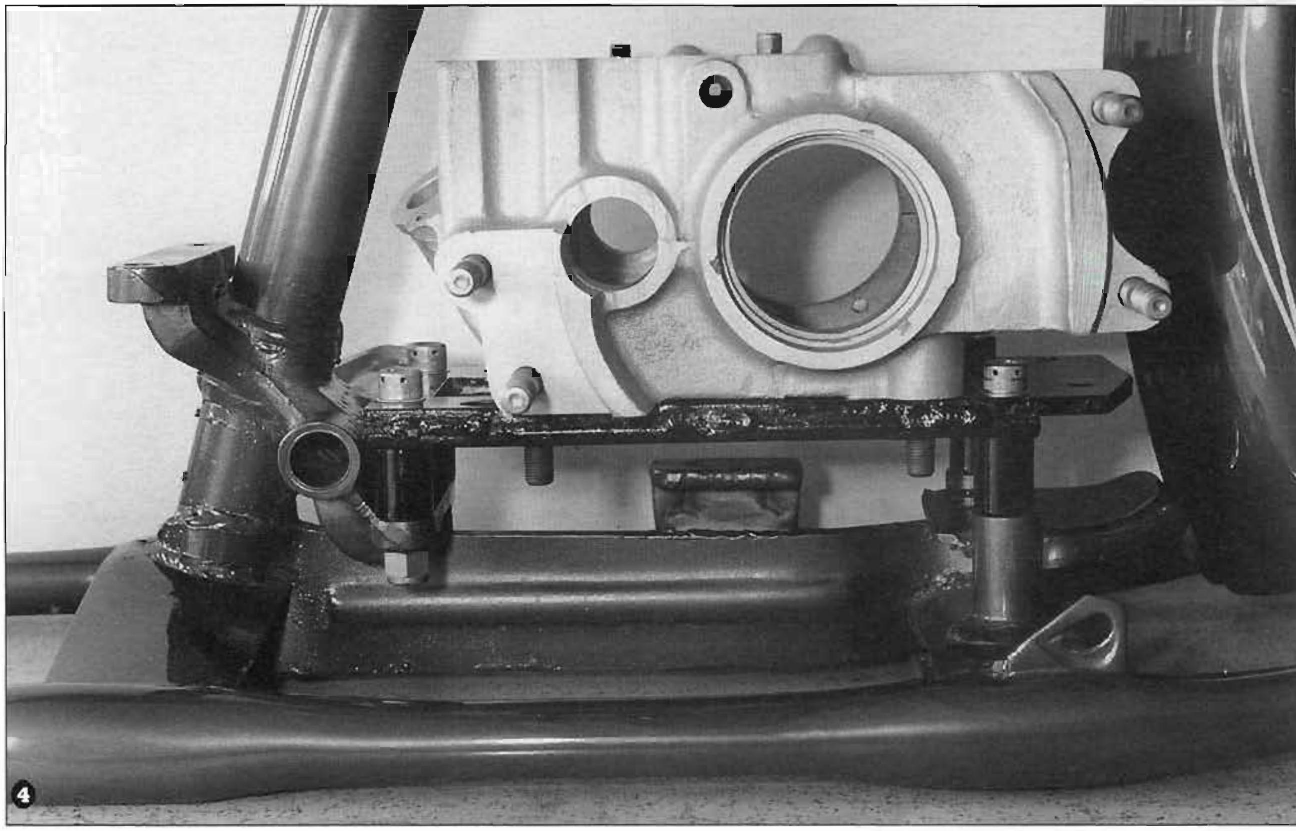
Material: billet/bar stock

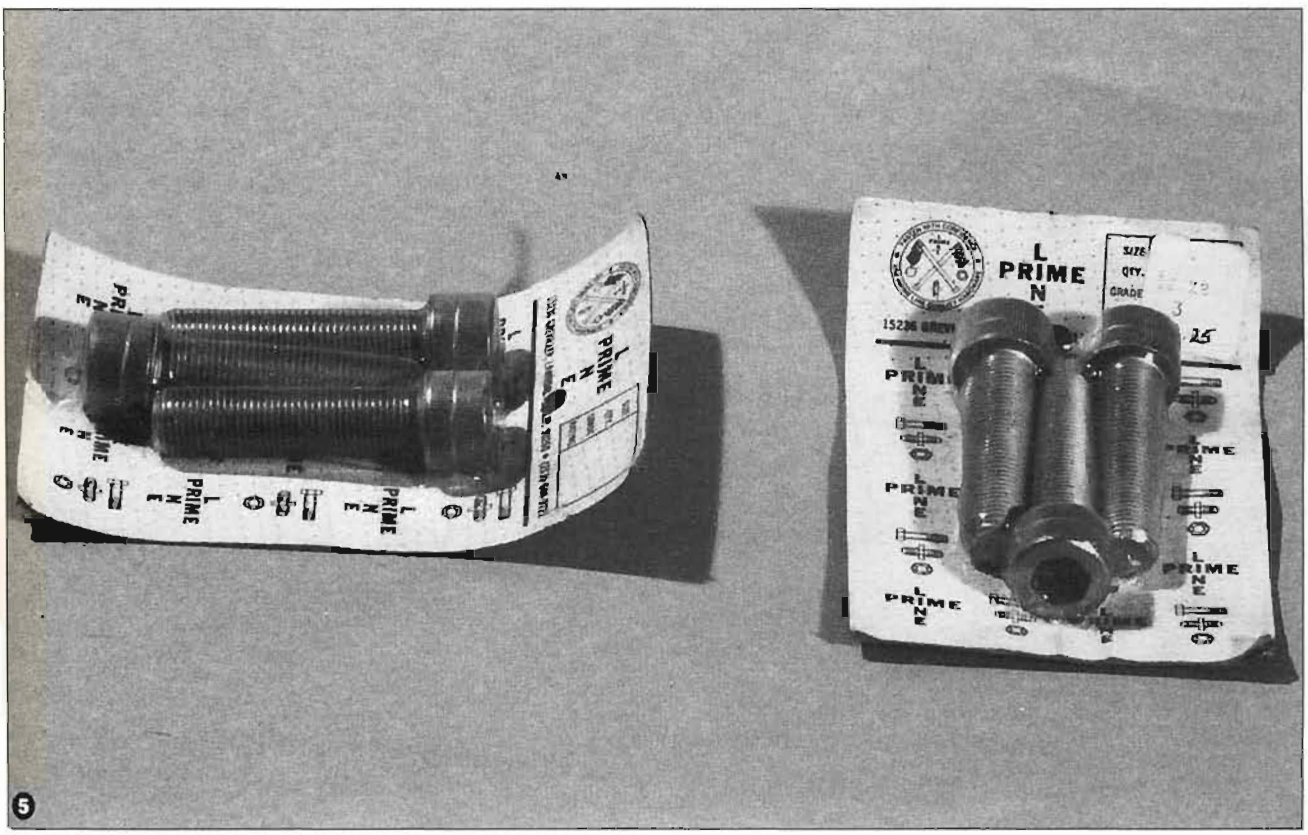
cold rolled steel or,
304 stainless or,
6061, 2024 or equivalent aluminum

Notes: not to scale

break all sharp edges
dimensions +/- 1/64 in.
pieces required 4 or 5

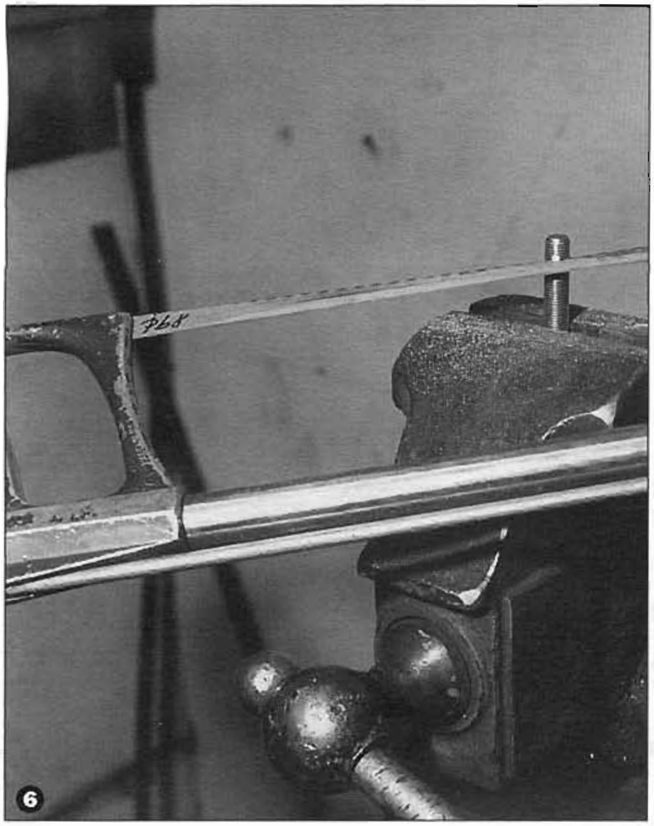
3





bolts (5), cut to length (6), and deburr ends. The front bolts should protrude amply through self-locking nuts; rear bolts should engage at least 5/8-inch of thread length in the tapped frame bosses. Thread lock or safety wire the rear bolts.

Since we are dealing with frames having a seat post tube, the front edge of the transmission top may kiss the clutch release cable bracket and/or front oil tank mount, especially with ratchet-tops (7) and some of the thicker billet aftermarket tops. Shave (or dent!) things judiciously, or relocate the frame boss upwards, since the flex in the cable gives some latitude in position. There are a couple of other solutions if



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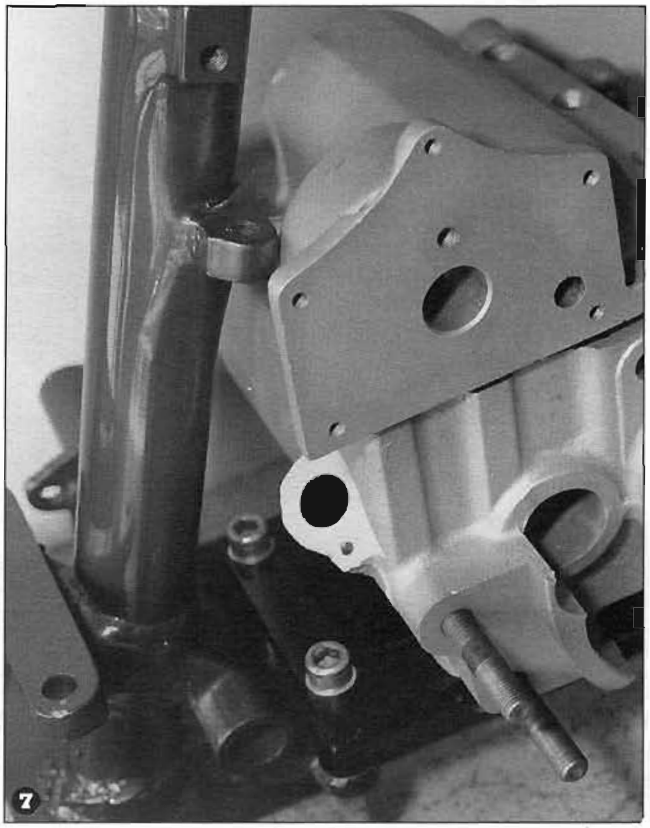

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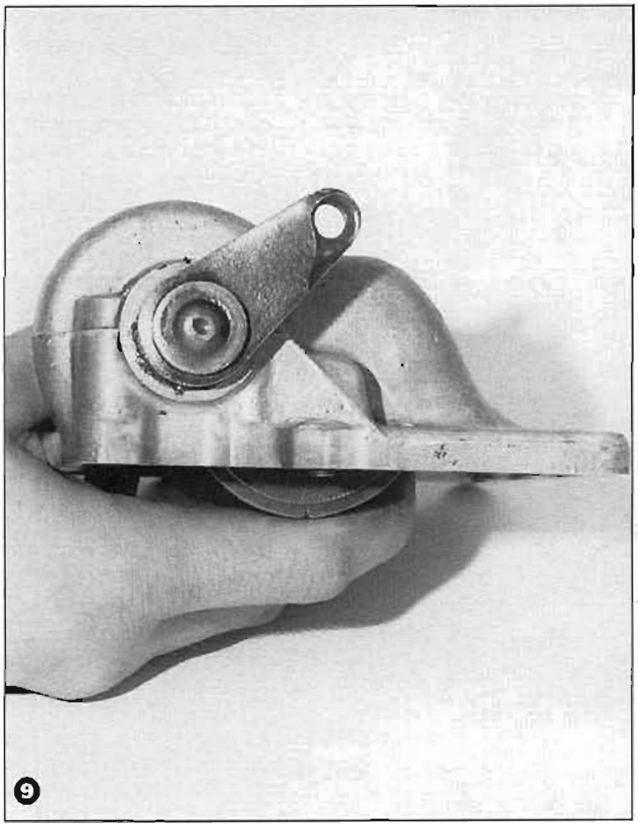
you are building a retro-ride. Run a mousetrap (8)! That completely eliminates the clutch cable and the need for a bracket. (Seriously, though, for a better way, read on.) Or, use a jockey top shifter; it's got a much lower profile top (9).

And, since the entire transmission now flies at a higher altitude, the clutch release arm may near the bottom of some oil tanks (10). (If you have an 1987-up transmission, you're in luck—the clutch is released through the side-cover.) If necessary, use a slightly more squat tank (11), common with electric start engines. But, you can also eliminate the release arm entirely in many pre-1987 trannies via aftermarket transmission covers that let you



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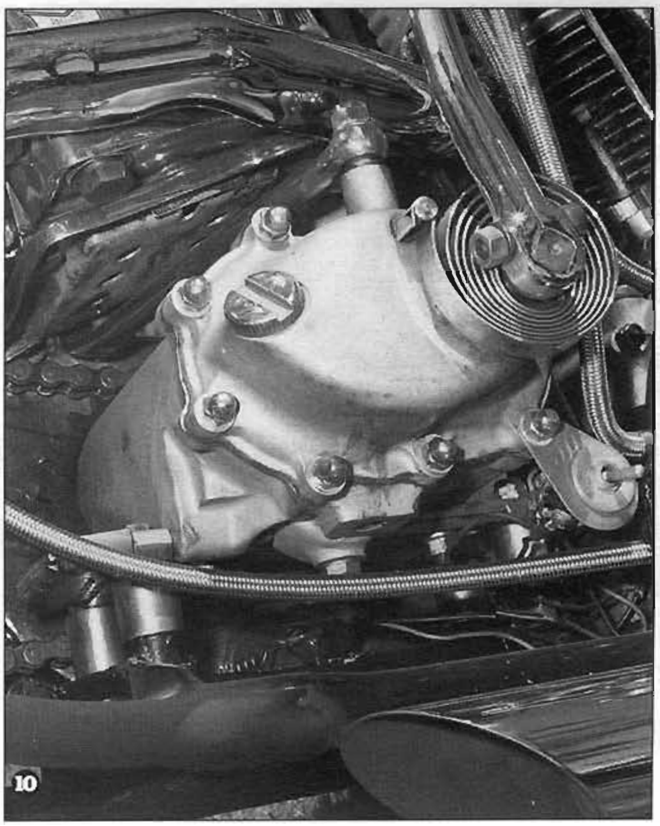

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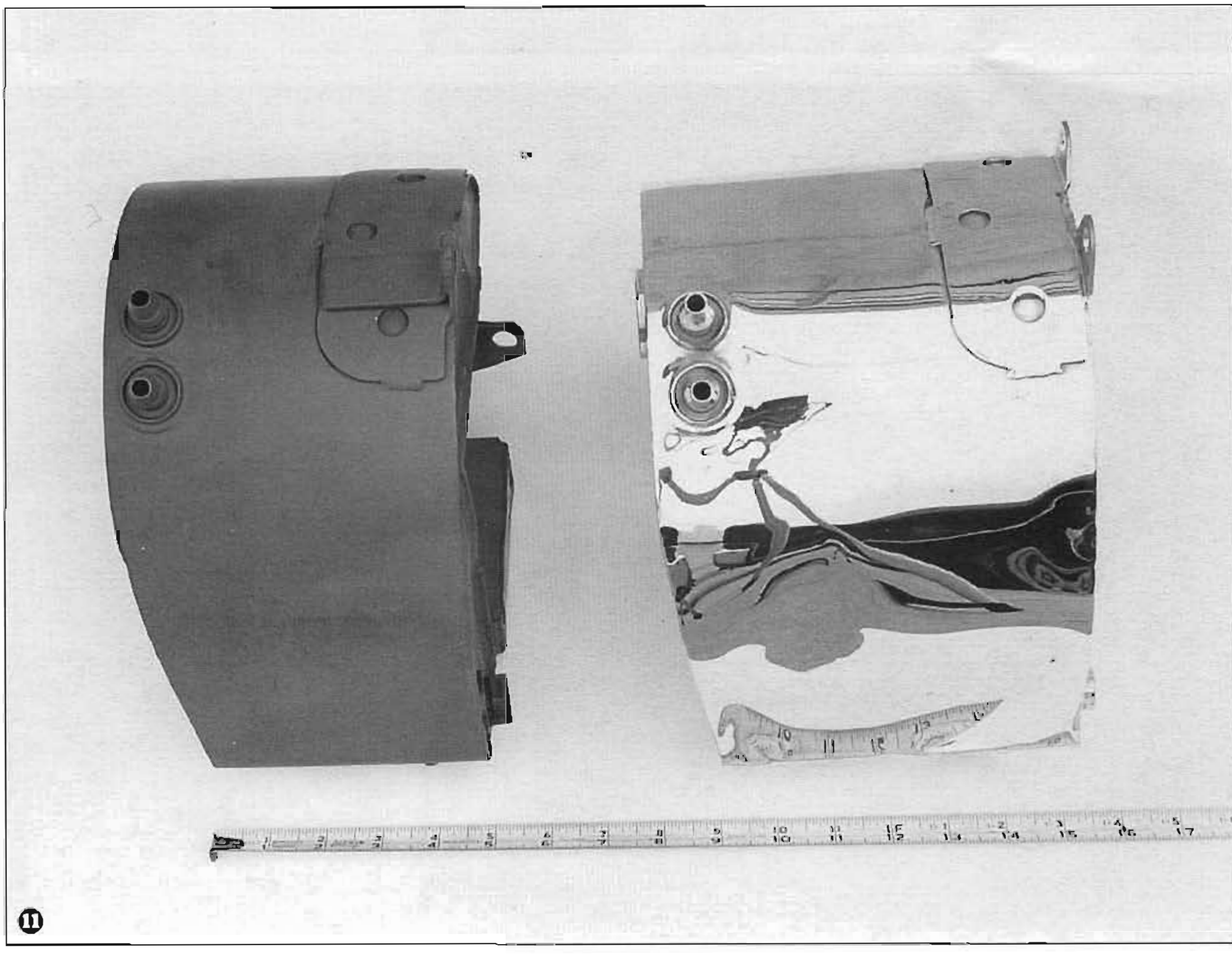
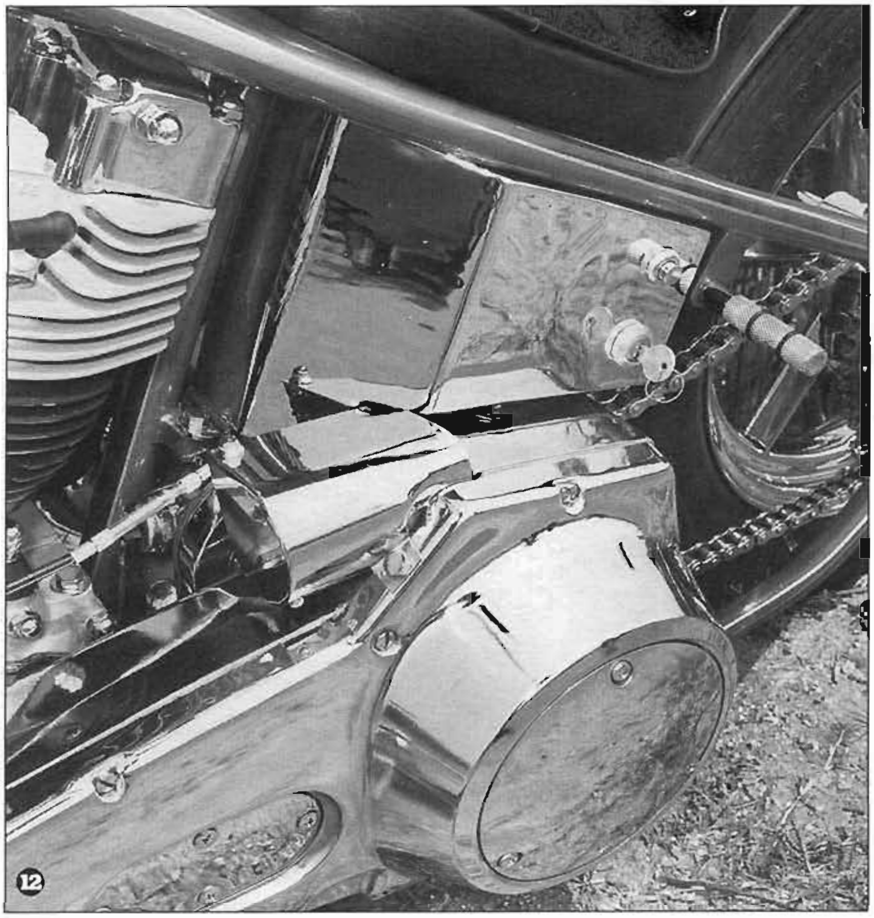


11

Photos: Jake. Thanks to Thompson Engineering



⓬

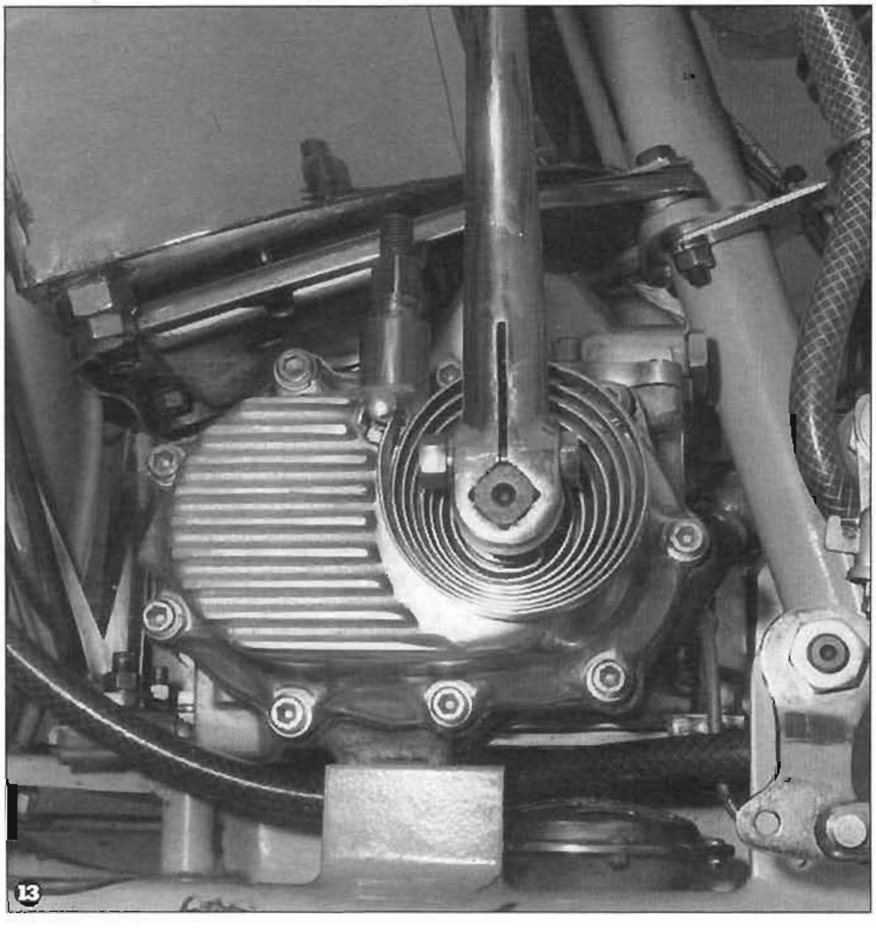
actuate the clutch solely via mechanical cable (e.g., Rodan) or hydraulic line (CCI, ART, etc.).

To retain push-button starting, you'll find that an electric starter gear also gets real friendly with the oil tank (12). Solution? A wide choice of suitably relieved aftermarket tanks, or, going to a kicker (13) eliminates starter issues and also lets you run lightweight tin primaries (14). For five-speed transmissions, select numerous aftermarket kickstarter options from Billet Built, Grannies Trannies, and Vee-Twin Manufacturing, among others.

Finally, since raising the gearbox rotates the entire primary drive around the engine sprocket axis, you'll need to elongate the front mounting holes in the inner primary case (15) to suit and remount the rear as well. Frame-mounted primary tensioners (16) and oiler/breather pipes (17) generally have enough travel or clearance to handle the slight rise and rotation without modification, but check it out to be sure.

So, take an inch in altitude, and you'll get long freeway miles in return from your bearings, shafts, cases, and frame welds.

—Jake



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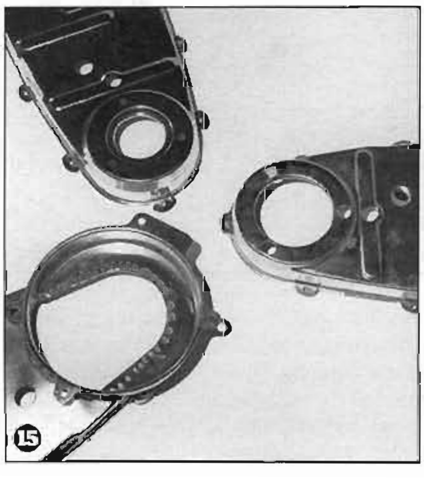

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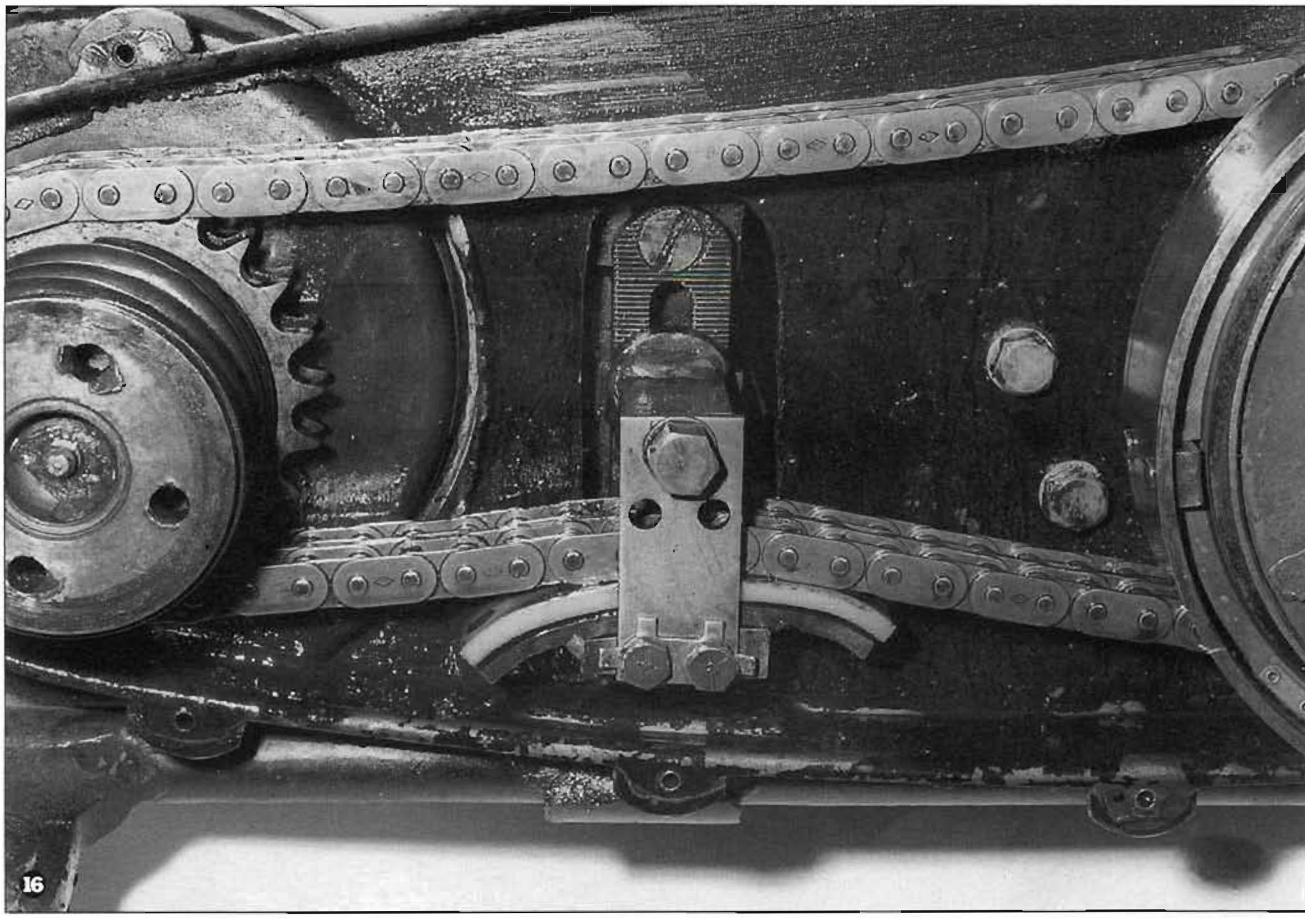
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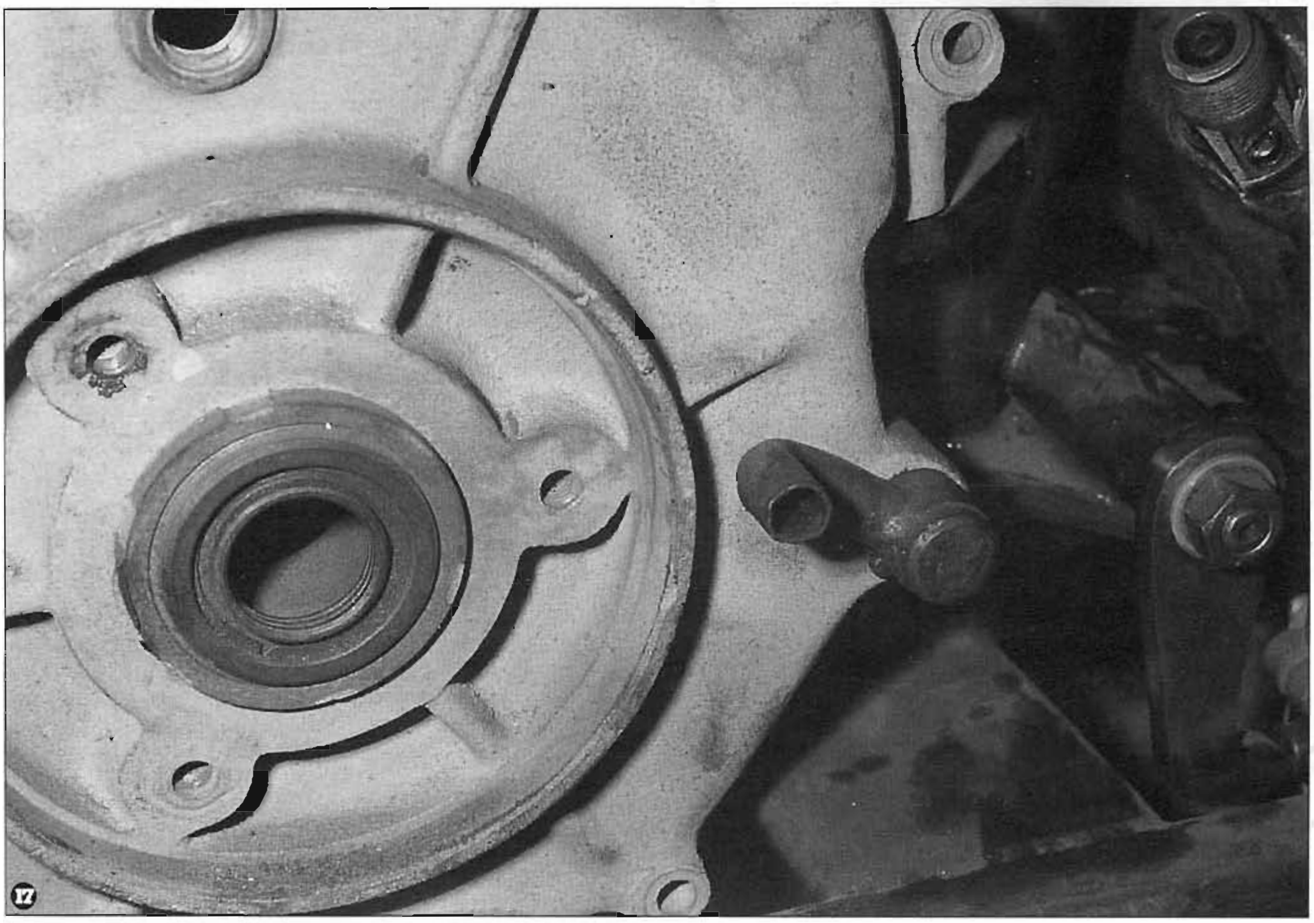
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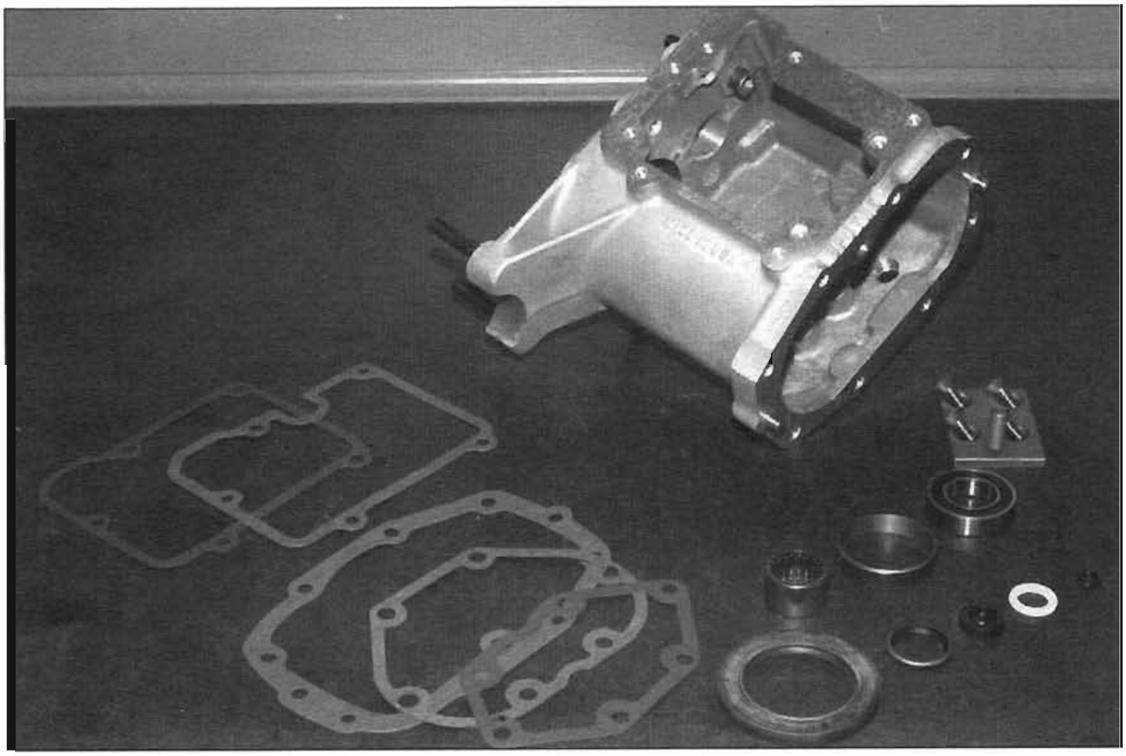
GRABBING



The 5-speed tranny case from Sputhe Engineering comes complete with all gaskets, bearings, seals, and hardware necessary to do the job, including the right-side transmission to frame bracket.

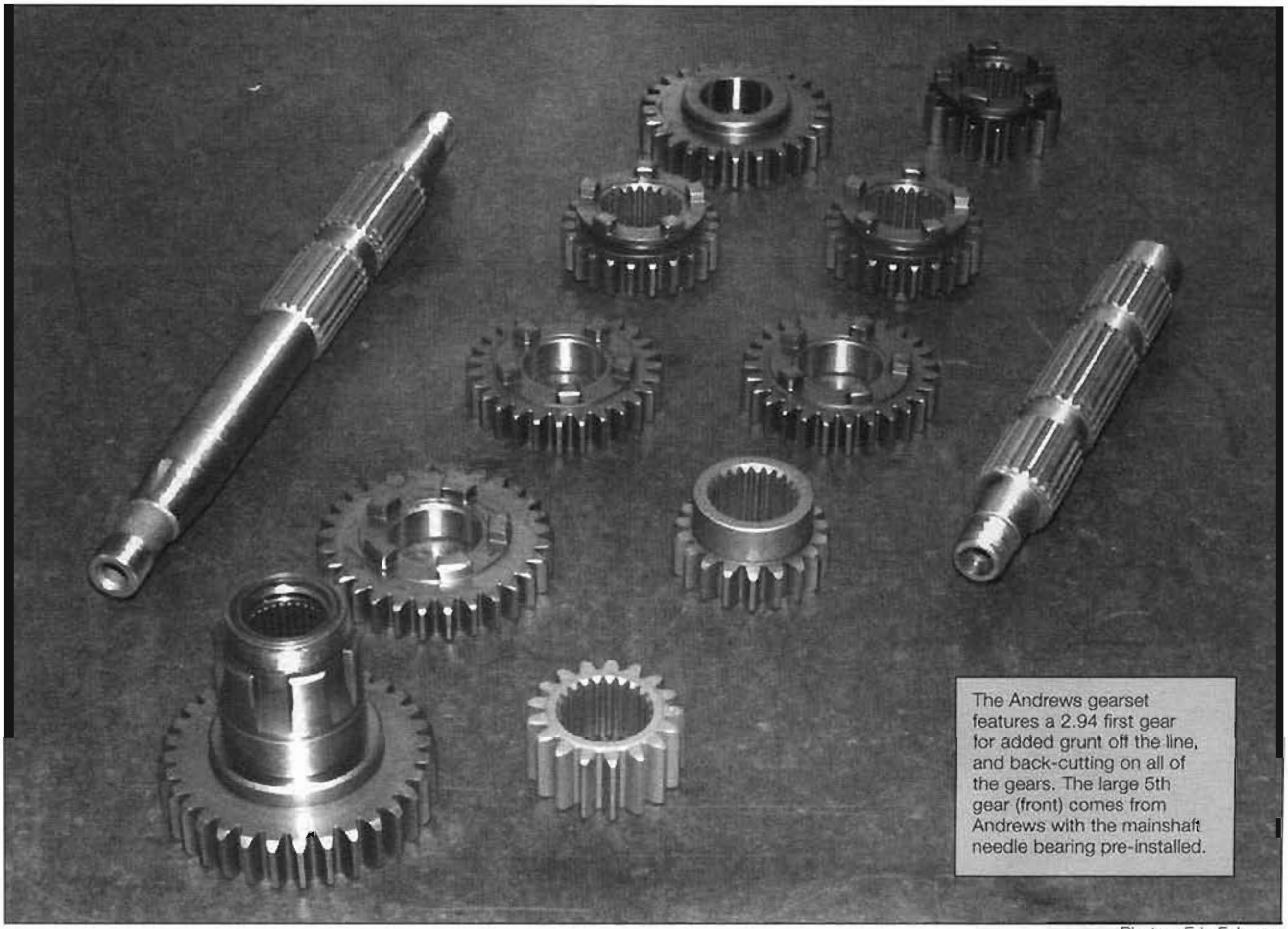
FIFTH

OFF THE LINE GRUNT AND ONE MORE AT THE TOP

If you've ever found yourself grabbing for one more gear, then remembering that you're already in fourth. Or, if you've ever wanted to upgrade your putt to a five-speed gearbox, but just weren't sure how, we've got just what you're looking for. Sputhe Engineering solved this dilemma by designing a five-speed tranny case that would bolt into any four-speed frame.

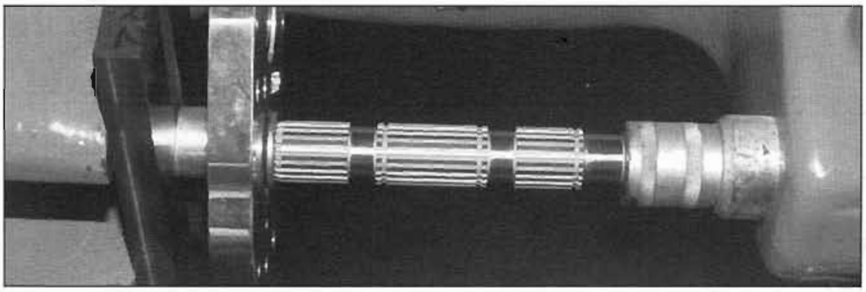
As a result, this has been a popular conversion among four-speed riders. Andrews was called upon to make the gearset which fits 1981-1984 specs, allowing a wide range of applications from late-model FX frames, clear back to early rigids. The Andrews gears come back-cut for smoother shifting and feature a 2.94 first-gear ratio for more off-the-line grunt.

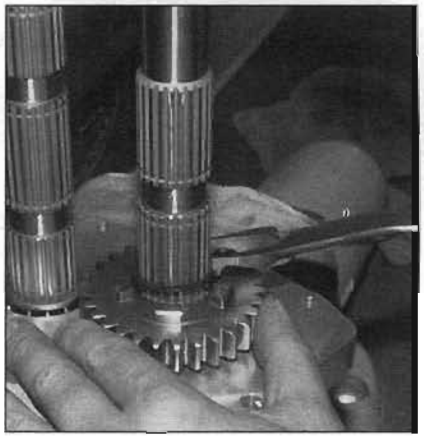
There are several options for you to choose from when you're ready for this new tranny. First off, you can buy them completely assembled with the Andrews gears and shafts, ready to bolt into your frame from Sputhe Engineering, and/or Arlen Ness to name a few. The second option is perfect for those of us who have plenty of spare parts lying around, none of which ever seem to work on what we're building at the time. For instance, the stock five-speed 1981-198



The Andrews gearset features a 2.94 first gear for added grunt off the line, and back-cutting on all of the gears. The large 5th gear (front) comes from Andrews with the mainshaft needle bearing pre-installed.

Photos: Eric Falconer





ABOVE: Before the gearset can be assembled, the main and countershaft must be pressed into the trap door bearings. This isn't a job for a hammer, because the roller bearings could be damaged by the impact. A small arbor or hydraulic press will do the trick. Once they are both pressed in, the lock nut and washer can be threaded on for good.

RIGHT: Using these special pliers, the snap-ring is installed onto the mainshaft where it will hold 4th gear in place. If you don't have a pair, check with your local toolman.

FXR tranny can be completely gutted and all of the internals transferred to the Sputhe case. This option does require shortening the countershaft a bit, but there just happens to be a video from Video Manuals that completely outlines the entire process of swapping the FXR internals into the Sputhe case. If the money's not all there for an off-the-shelf unit, or if you're in a mood to get down and dirty, you can purchase the Andrews gearset, the Sputhe case, and the few odd bits and pieces from your local Harley dealer and build it yourself from all brand-new hardware.

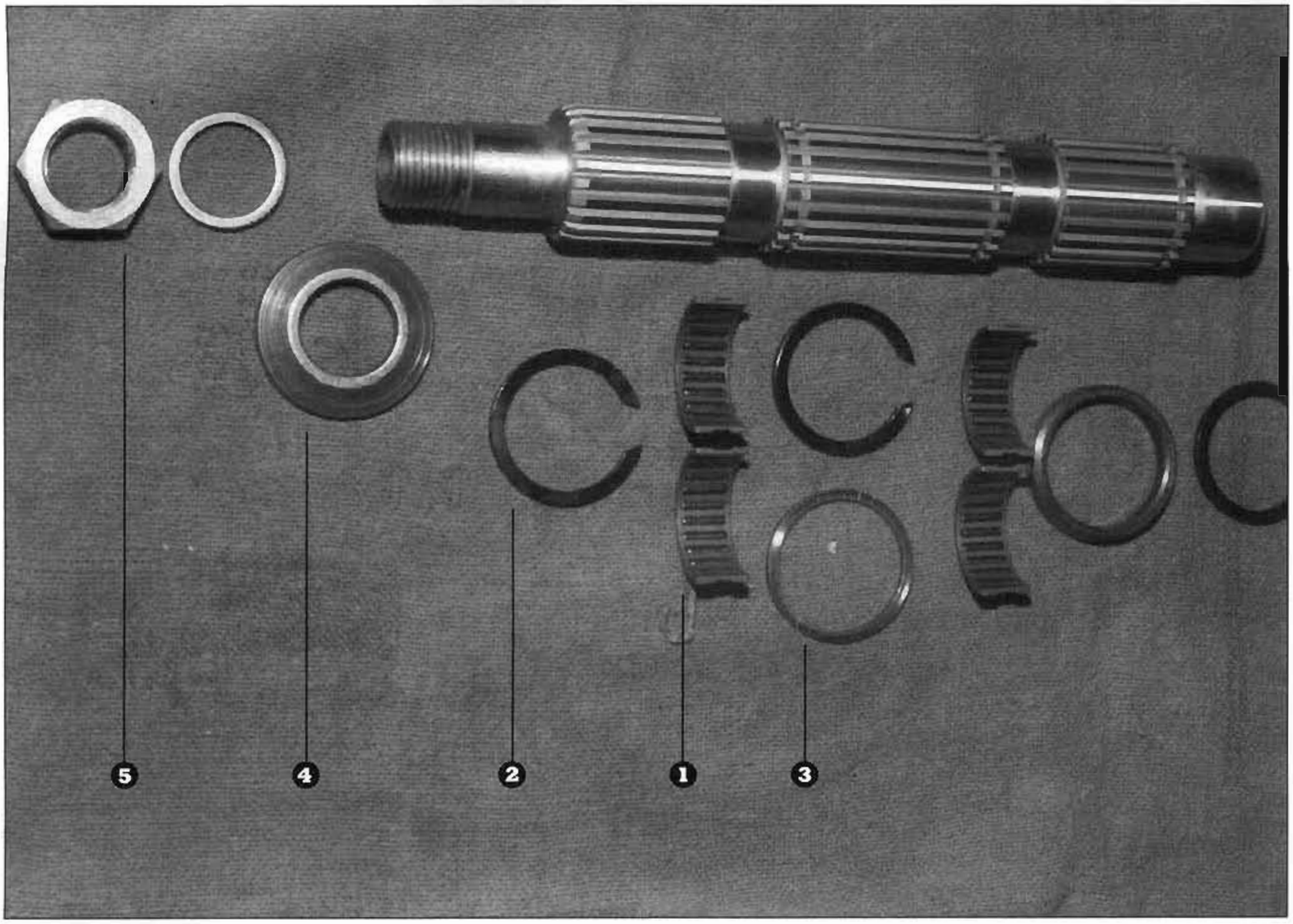
Some of the H-D parts you'll need will be the mainshaft bearings and retaining clips, as well as the entire shifter assembly. And, of course, there are plenty of chrome and billet aluminum top covers, side covers, and trap doors to choose from, should you desire. We used stock covers and a stock trap door so that you could see how easily stock hardware will bolt to the Sputhe case. Once you have all of the parts, the transmission easily goes together in an afternoon. After that, grab your new fifth gear, another handful of throttle, and smile. —*Wordman*

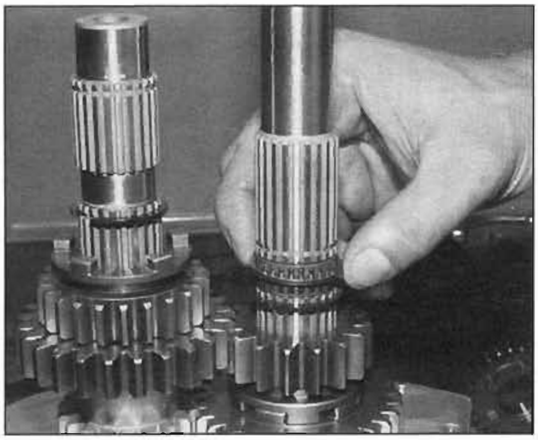
SOURCES:

Sputhe Engineering, Inc.
11185 Lime Kiln Rd.
Grass Valley, CA 95949
(916) 268-0887

Andrews Products
5212 N. Shapland
Rosemont, IL 60018
(312) 992-4014

Jim's Machine
531 Dawson Drive, Unit F
Camarillo, CA 93012
(805) 482-6913

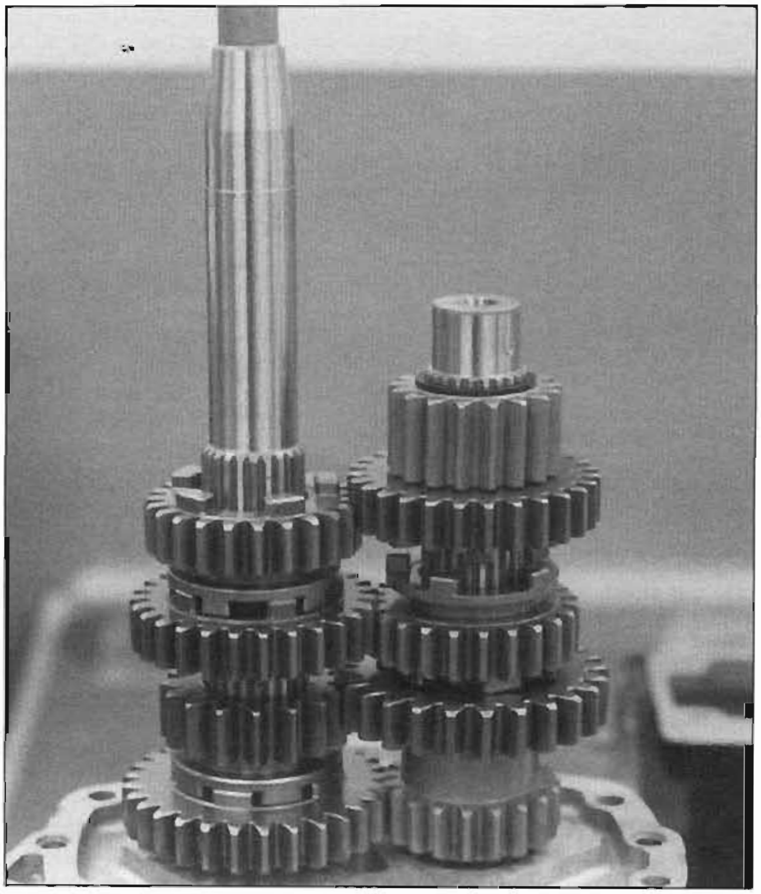


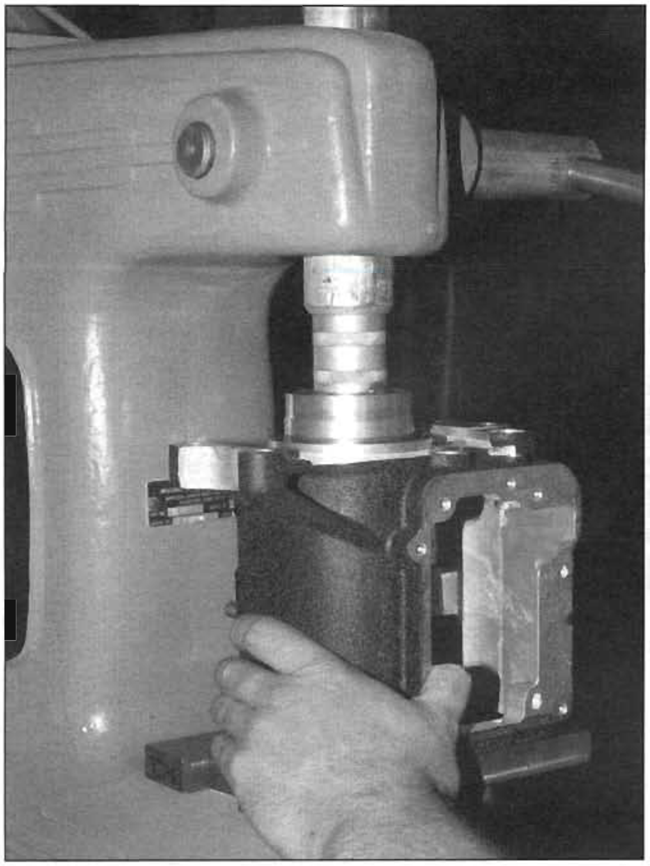


TOP: Here's a close look at some of the parts you'll need to buy from your local dealer The split-cage needle bearings (1), snap rings (2) and spacers (3) are H-D parts only, as are the spacers that ride between the shaft ends and the inside face of the trap door (4), and the washer and lock nuts (5) that hold both main and countershaft to the trap door These parts are necessary to complete the assembly of the gearset, so be sure to order them if your dealer doesn't keep them in stock

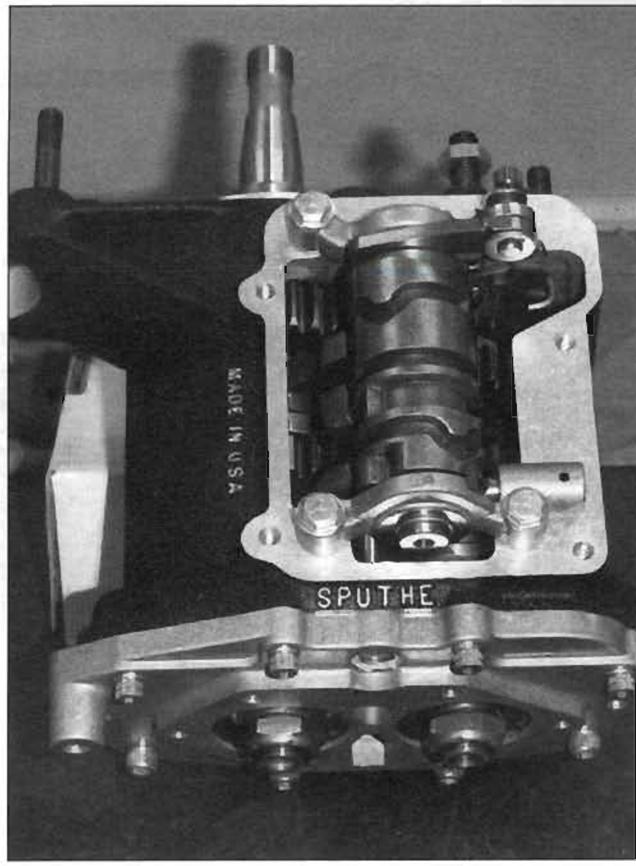
ABOVE: Here you can see the split cage needle bearings placed on the mainshaft and the gear spacer going on next. 3rd gear will slide over the bearings and will be held in place with another retaining ring.

RIGHT: With the gearset complete, it is now ready to slip into the transmission case. Gear order on the mainshaft (long) and countershaft (short) are the same. From the trap door up, the order is 4th, 1st, 3rd, 2nd, and 5th. Although fifth gear is seen here on the countershaft, its mainshaft counterpart is pressed into the case.

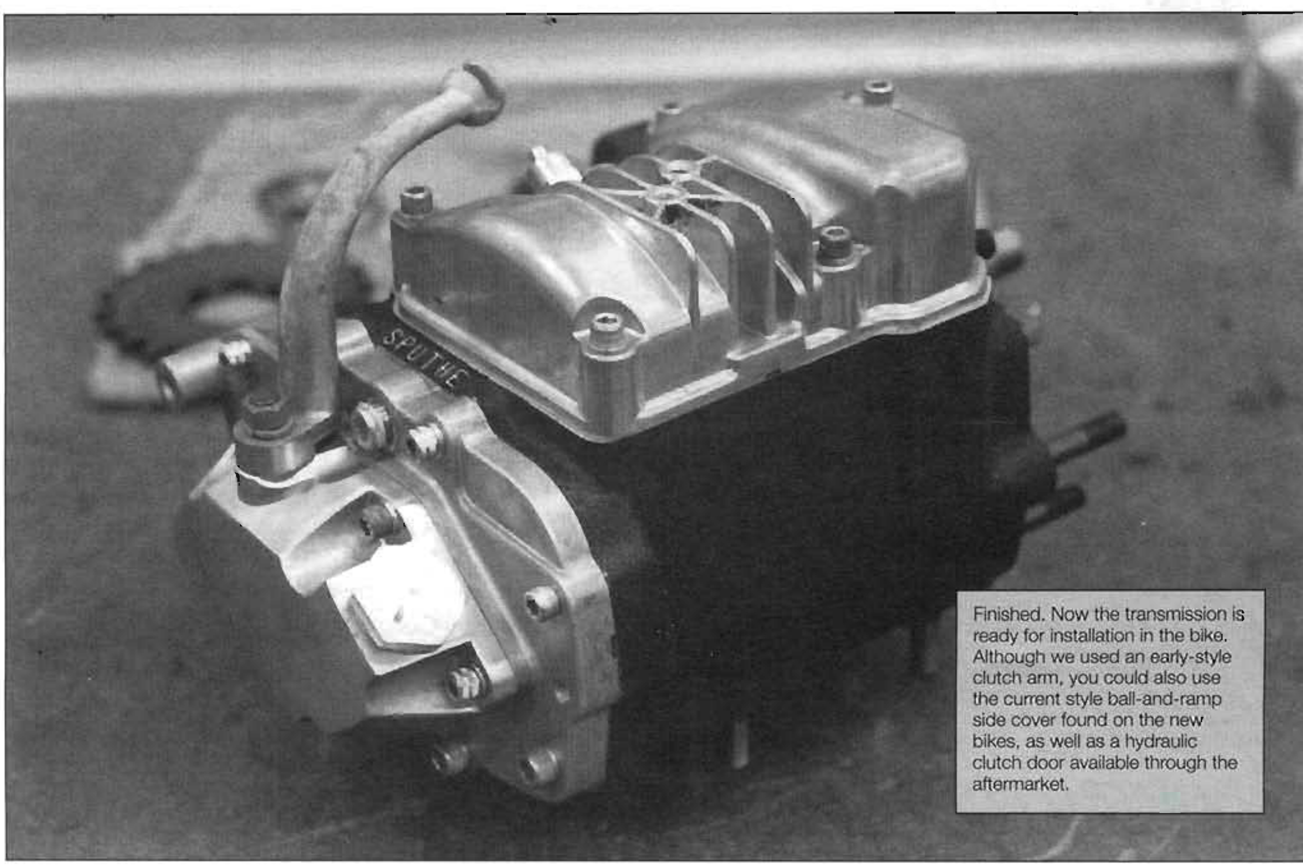




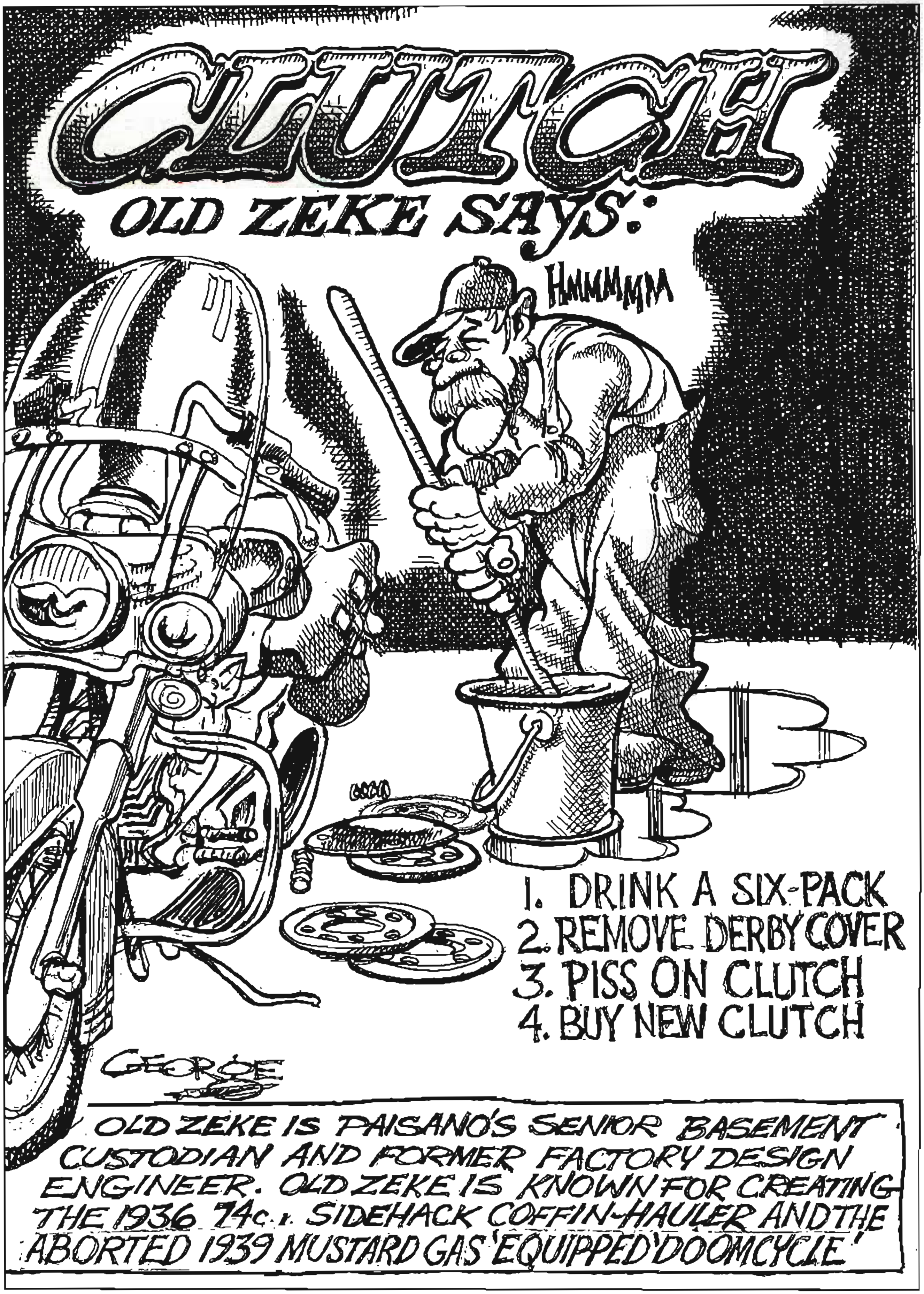
The large mainshaft seal has to be pressed into the case, as does the needle bearing for the countershaft. If you don't have an arbor press, do yourself a favor and find someone who does, usually a local machine shop.



The other few parts you'll need from the dealer will, of course, be the shifter forks and shaft, shifter arm and shifter drum assembly. The shift fork shaft can be purchased from Jim's Machine.



Finished. Now the transmission is ready for installation in the bike. Although we used an early-style clutch arm, you could also use the current style ball-and-ramp side cover found on the new bikes, as well as a hydraulic clutch door available through the aftermarket.



CLUTCH
OLD ZEKE SAYS:
HMMMMM
1. DRINK A SIX-PACK
2. REMOVE DERBY COVER
3. PISS ON CLUTCH
4. BUY NEW CLUTCH
GEORGE
OLD ZEKE IS PAISANO'S SENIOR BASEMENT CUSTODIAN AND FORMER FACTORY DESIGN ENGINEER. OLD ZEKE IS KNOWN FOR CREATING THE 1936 74c.i. SIDEHACK COFFIN-HAULER AND THE ABORTED 1939 MUSTARD GAS 'EQUIPPED' DOOMCYCLE'

1984 AND EARLIER CLUTCH FIX

Here are some of the reasons why you are reading this tech tip in the first place: Your transmission grinds while shifting from neutral to first gear; you can't find neutral while stopped; while in gear and stopped, your bike creeps or bumps forward; your clutch does not engage smoothly when starting off.

I will start with the simplest fixes first. The first thing to check is to see if the plates are stuck together. This can be caused by too much grease on the clutch hub rollers or by a mixture of oil vapors and clutch dust that form a black gum that can be found as streaks on the steel plates. The plates should be cleaned with a non-oily solvent (brake cleaner, contact cleaner, lacquer thinner, etc.) and should not be left to soak, as this may cause the clutch linings to swell. Water should also be avoided because it will cause the plates to rust together. The plates should also be lightly sanded with 120- to 180-grit sandpaper. This keeps the plates from suction-sticking together. This procedure should be done every 5,000 miles or sooner just to check on how things are wearing. Once you do this a couple of times, it is very easy to do and can save you a lot of time and money later on.

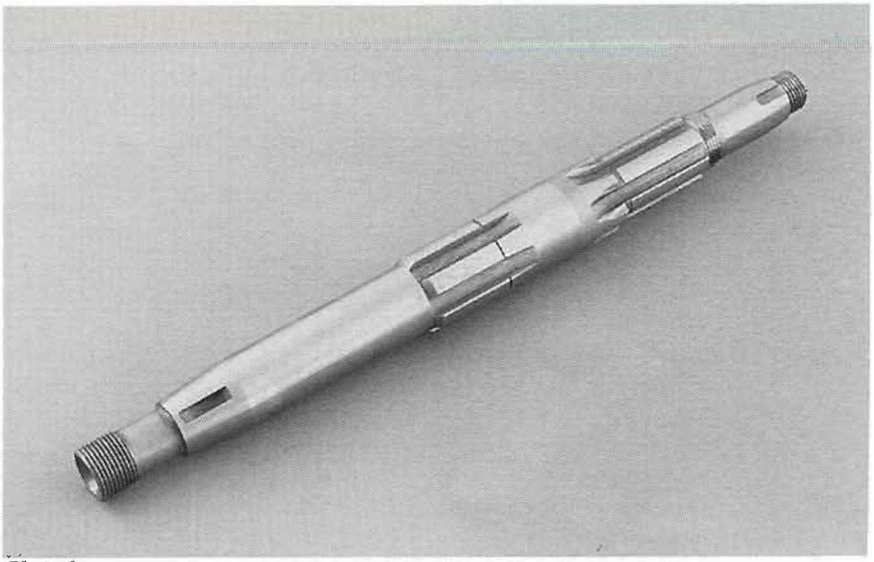


Photo 1

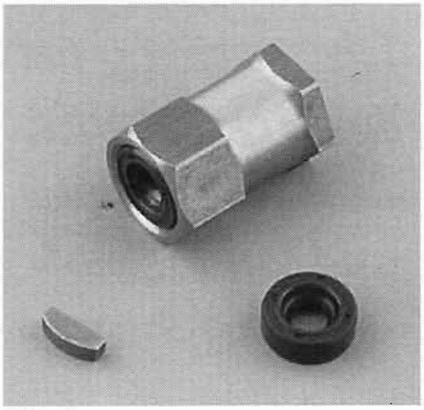


Photo 2

Now, while I am talking about taking out and reinstalling clutch plates, the next problem area is the pressure plate and the springs and retainer. Every service manual starts off with the correct procedure for adjusting the handle free play and spring tension. However, after you measure the springs' installed height (31/32 inches)

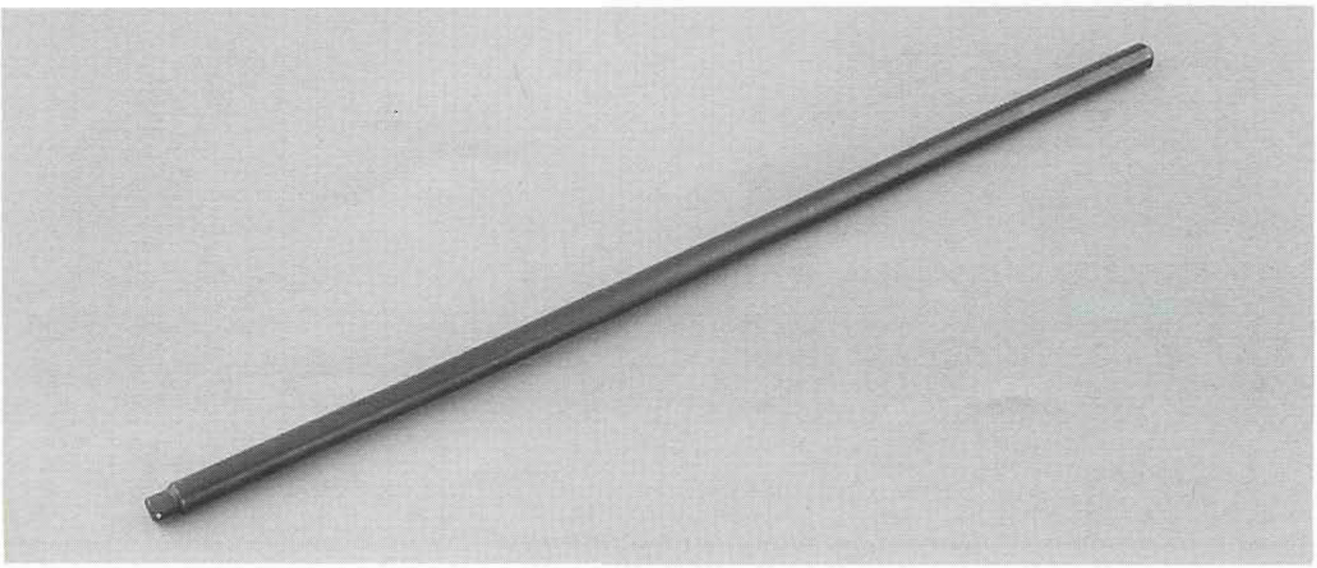


Photo 3

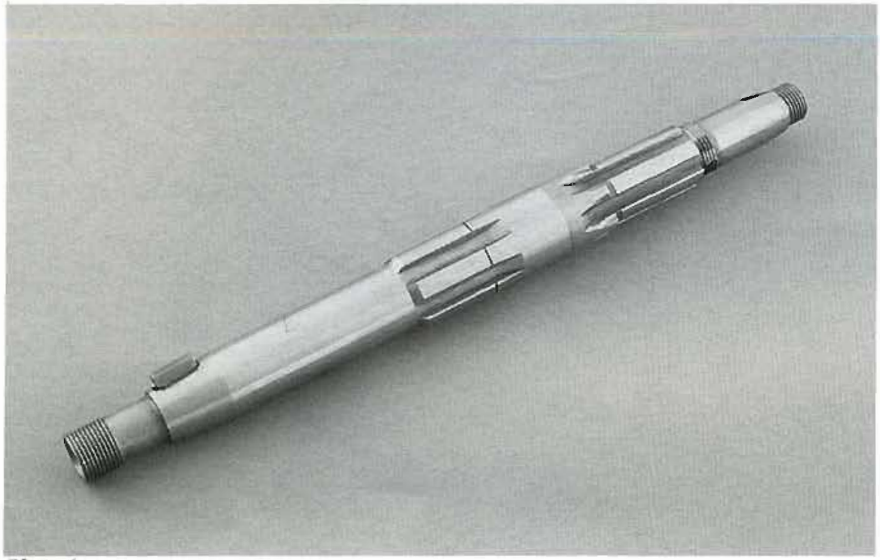


Photo 4

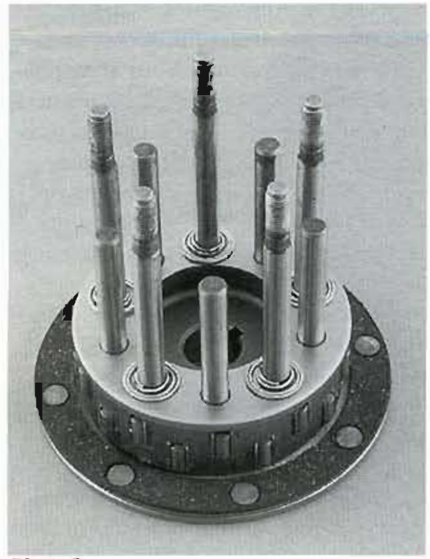


Photo 5

and you have the pushrod and cable adjusted, pull in the handle and see if the pressure plate lifts squarely off the clutch pack. If it tilts over as it lifts, the clutch won't work very well—if at all. Adjust the three (or five) spring retainer nuts in or out until the pressure plate lifts squarely off the clutch pack. A wobbly spring retainer doesn't matter as long as the pressure plate runs straight when released.

If the pushrod is not properly supported it will fall off center and cause an uneven lift of the pressure plate

If none of the above has fixed the problem, then it's time to dig further by checking your clutch components:

1. Check the main shaft (trans). If it is bent from previous damage or if the key slot or the hub mounting taper is damaged the shaft must be changed (photo 1). Max runout is .003 inches.

2. The clutch release pushrod must have support at the clutch end of the trans main shaft. The original design has a steel bushing pressed in at both ends to support the →

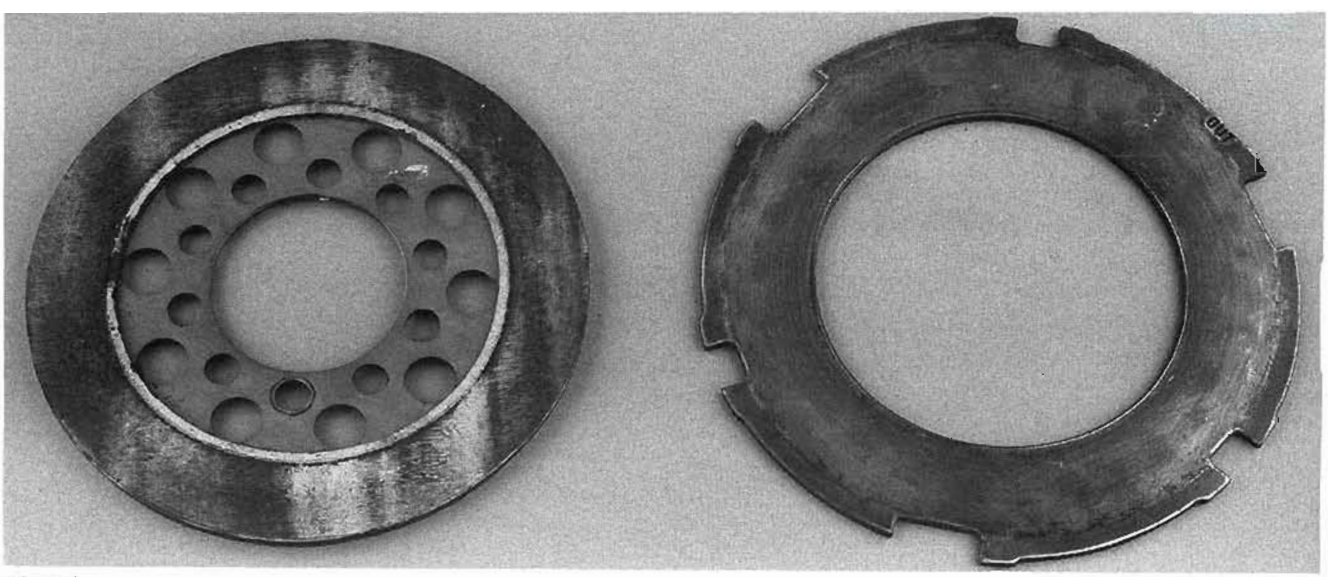


Photo 6

pushrod. Some aftermarket mainshafts are the "gun barrel drilled" type which support the pushrod full length. If the pushrod is not properly supported it will fall off center and cause an uneven lift of the pressure plate which causes the clutch to drag and engage roughly. Check the seal in the end of the clutch hub nut (photo 2).

3. Check the pushrod for grooves worn in it where it rides in the mainshaft bushings. This will cause the same problems as in number 2 above (photo 3).

4. Check the clutch hub for damage or wear. The things to look for are: damaged taper, damage to the key slot, cracked at the key slot, bearing race damage, worn out or bent studs, bent thrust lining plate. Replace or repair (photo 5).

5. Clutch hub key. This key must be the correct size and shape (photos 2 and 4). It must also fit in the mainshaft slot snugly and must be able to freely slide the length of the slot in the hub. This will allow the hub to seat properly on the mainshaft and maintain the .003-inch or less runout.

6. The clutch hub thrust lining must also be checked for lateral runout and bearing clearance on the inside diameter of the lining (photo 5). Lateral runout is usually caused by a bent thrust plate on the back of the hub. This condition causes the clutch basket to tilt on the roller bearings as the clutch is being engaged and causes a jerk instead of a smooth engagement. The thrust plate can be trued by pressing or by a light machine cut. At the same time check the bearings for clearance under the hub lining. Any interference will cause the bearings to jam (lock).

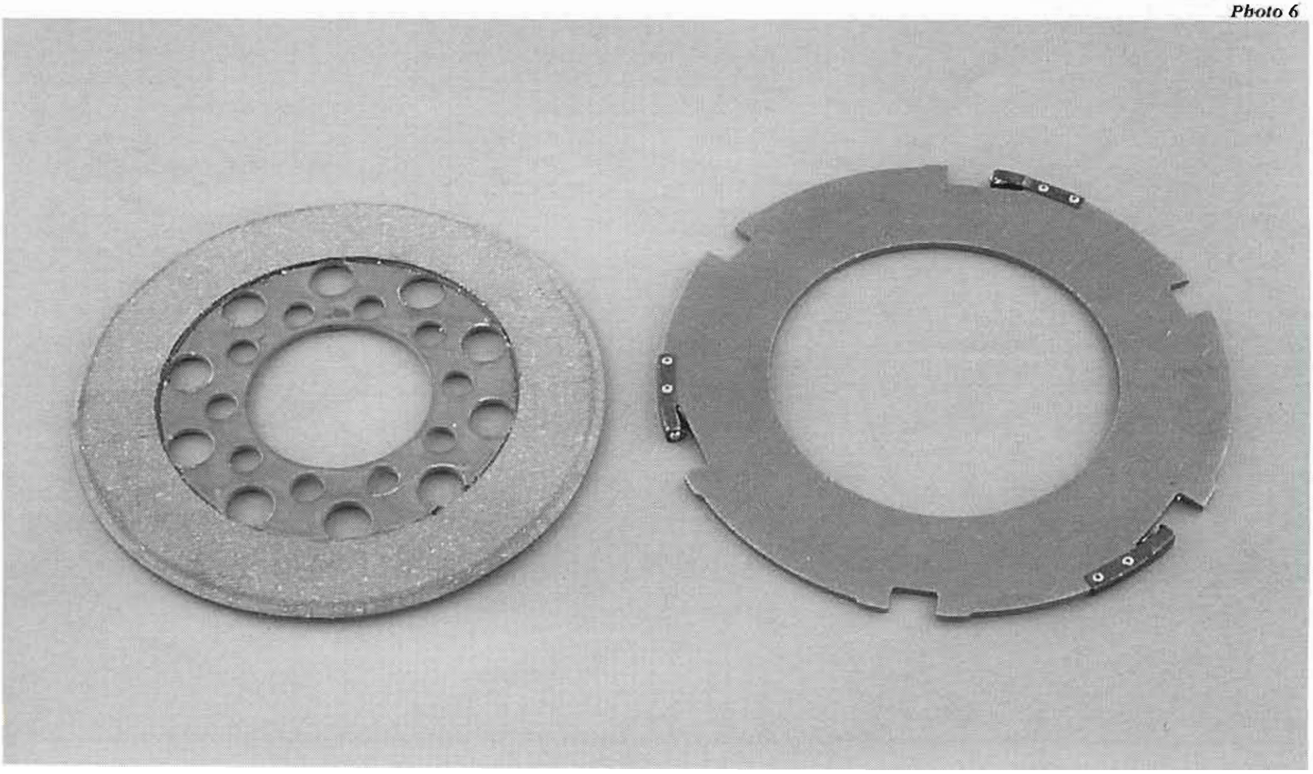
7. Check all of the clutch plates for warps, bends or other obvious damage. The steel plates should have an even wear path all the way around with no dings or creases showing and no dishing (photo 6). The friction plates should have an equal amount of lining material all around (side-to-side, top-to-bottom, front-and-back). Stud holes should not be excessively loose but should not have any tight spots fitting over the studs. The friction plates can be run in either direction, the steel drive plates that have "OUT" stamped on their edge must be installed with the "OUT" facing out. This is so all six dog notches are carrying the load while accelerating.

8. Chain or belt alignment is very important and has been the main subject of many articles. Different models and years have different methods of aligning the drive. Check your alignment by following the instructions in the correct year service manual for the bike you're working on.

That's it for basic maintenance. Watch for more clutch tricks in an upcoming issue.

—Rick Diaz

Photo 6



Photos: Marcus Cuff, courtesy of Hi-Tech Custom Cycles, Van Nuys, California.

So, you've got your baby pumped up to make a zillion horses, and while doing one of your baddest burnouts you hear some parts thrashing around inside the primary covers. It's a sick sound. Believe me. I've been there.

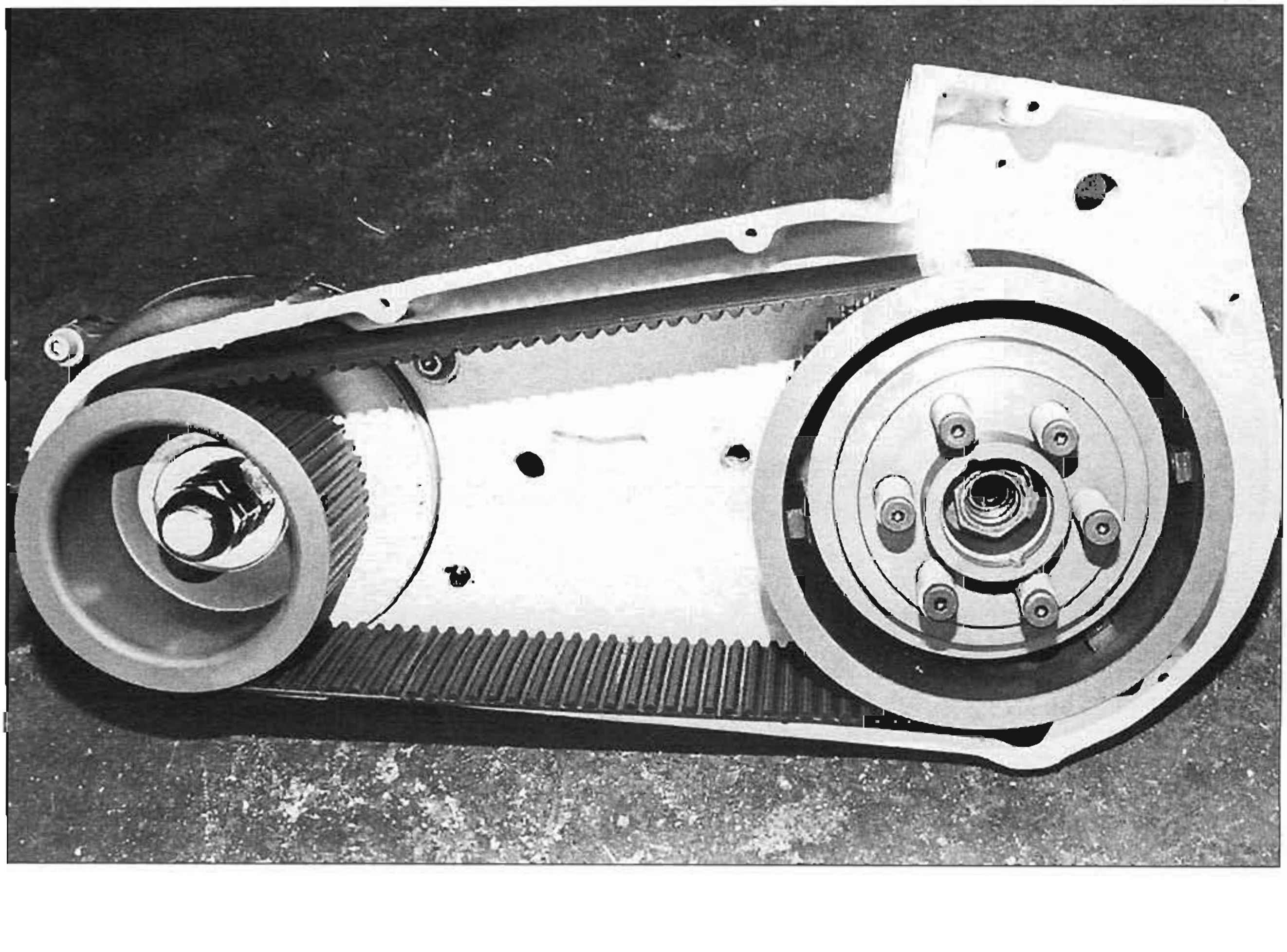
You could prevent or soften the blow to the wallet by taking a few preventative measures. The clutch systems I'm referring to are the early 5-speed diaphragm type (1984 ½ to '89 wet clutch models).

If you don't do anything else, make sure that the rear of the clutch hub basket gets a tight fitting ring or collar pressed around the area where the woodruff key slot goes. If you examine this area (photo 1) you will see that there ain't much meat left over after the groove was machined into it. Too much power can (and has) split this soft material. Once it's cracked it can't be successfully repaired. You may spend countless hours trying to weld and machine the damaged area. It would be stronger and cheaper in the long run to get another clutch hub. Then send that clutch hub to Zippers in Jessup, Maryland. Zippers will machine and install the reinforcing kit for the clutch hub that the catalog claims will make it virtually unbreakable. The evolution clutch hub cure number in the catalog is part # ZM-9502. The collar that Zippers presses in is tapered so it doesn't interfere with anything around it (photo 2). Check with your local dealer; they may have the Zipper's reinforcing kit unit on their shelf.

If you have an extra clutch hub basket lying around, make sure you don't send the wrong clutch. They may all look the same, but some have a greater distance from the starter ring gear to the clutch hub sprocket (photo 3).

I can't forget to mention the Barnett clutch kits. The friction plates or fibers

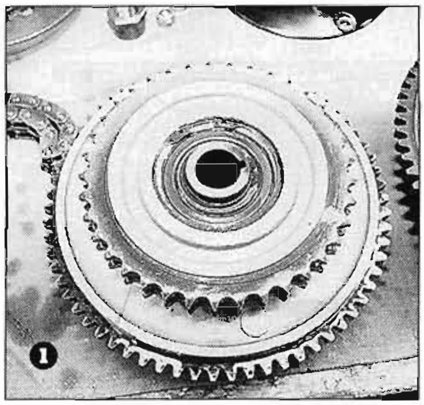
CLUTCH FIX

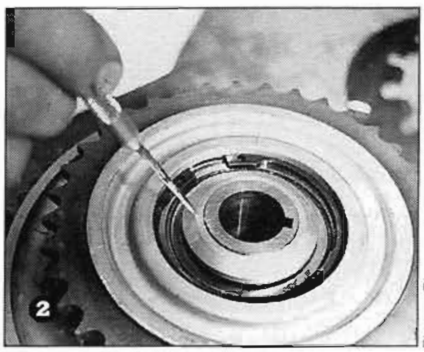


are bonded with Kevlar (photo 4). They are wider and provide 25 percent greater surface contact area (photo 5). If your steel drive plates are warped or dished, this is the time to replace them. Barnett also makes a heavier clutch spring than the Screamin' Eagle brand found at the dealership. I'd recommend the Barnett clutch spring for the drag strip. It's a little heavy for everyday use. The Screamin' Eagle may be all a street rider needs.

If that extra pressure is a problem, then try the AMP Research power assist E-Z pull clutch unit. It's small, but it bolts to the handlebars easily (photo 6). It's like a mini-mousetrap with two gears and a strong small spring that cuts the grip exertion in half. Combined with the thicker diaphragm, the clutchgrabs immediately—no slippage.

There is also the White Brothers E-Z Boy lite clutch unit for both Big Twins and Sportsters. It uses leverage to reduce the effort required to pull the clutch lever by 40 percent. It's great for women riders or performance riders with heavier-than-stock diaphragm springs. When installing this unit in the transmission cover care must be taken





Photos: Rip

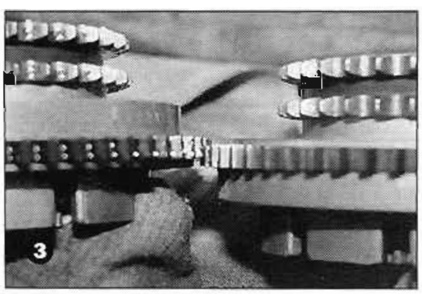
to insure that the cable end doesn't rub against the dip stick.

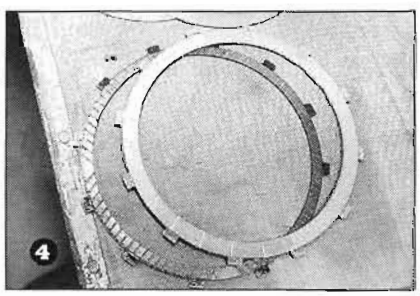
Seen around the drag strip lately are drive lines produced by Belt Drives Limited. As the name implies, Belt Drives Limited also sells all kinds of belt drives for the industry. The company is the oldest (and largest) manufacturer of belt drives, and the first manufacturer to come out with a primary unit that'll fit an Evolution five-speed, both street and strip proven.

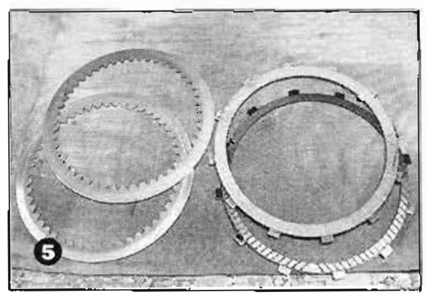
Recently, using a Belt Drives Limited clutch and belt, Larry Lee Veque captured a national 1/8-mile AMRA record in M/FL class at Beech Bend Raceway in Bowling Green, Kentucky, doing an E.T. of 6.35. Larry also did a 108.25 mph, another 1/8-mile record, at Gateway International 1/8-mile strip. Belt Drives Limited has been making belt drives for Elmer Trett for years.

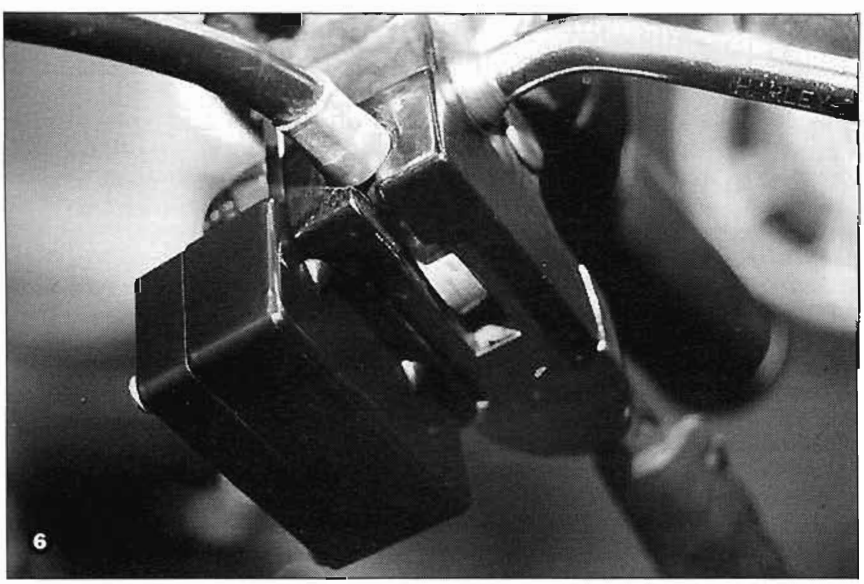
That's it. I hope this helps you. It helped me, and saved me some dollars and grief, too. Good luck, whether it be on the strip, canyons, or streets. But watch out for those black and white alligators cruising the hood.

—*Rip*









PARTS CHECK

Zippers Performance Products
8040 Washington Blvd., Jessup, MD 20794
(410) 799-8989/Fax (410)799-9450

Barnett Tool & Engineering
9920 Freeman Ave., P.O. Box 2826
Santa Fe Springs, CA 90670
(310) 941-1284/Fax (310)946-5887

AMP Research
1855 Laguna Cyn. Rd., Laguna Beach, CA 92651
(714) 497-7525/Fax (714)497-0284

Belt Drives Limited
3080 E. La Jolla St., Anaheim, CA 92806
(714) 630-1433/Fax (714) 630-1433

High Performance Clutch Spring
Screamin' Eagle Diaphragm
part # for '84½ - '90 Sportster XL 36783-89
part # for '84½ - '89 Big Twin 37875-86A

Primary Belt Secrets
How To Run A Primary Belt Forever

Remember pulling your clutch in at a light only to have every head within a mile turn because the plates clanged so loud that it sounded like a Catholic church at noon? Then, when your face quit glowing red, and you let out the clutch, the primary would slap the inside of the primary so hard that the old lady in the Volkswagen alongside you would stomp on the gas 'cause it sounded like you were torturing little animals in that tin thing.

Of course, I remember pulling off the side of the freeway on my way to a run, pulling out my squirt can, and oiling the front chain through my rotating inspection cover—all to keep those spinning bearings from turning red and welding themselves together.

So, the reasons we shoved a Custom Chrome, Inc. (CCI) Karata 14mm belt drive system, the CCI standard replacement 4-speed clutch, and the CCI clutch tamer inside the classic twin inner primary, included: quieter operation, one-time adjustment, no mess, smoother operation, and the damn thing will last longer than the engine.

It also won't jump or slap when banging gears, and affords a minimal amount of flex to cushion harsh shifts. In fact, we're so sold on belts, we ran a rear one on the Knuckle (we'll cover that installation in another issue). Imagine never being forced to clean chain oil off your rear wheel again, or having to oil, or constantly adjust. The only reason the factory doesn't run primary belts as a stock item is the heat factor. The heat generated by the engine in the enclosed primary is too severe for a primary belt. Since this one is tin, and modified in the back to accept the rear belt, affording the primary operation more ventilation, we have no problem with the heat build-up.

The main mechanic behind this operation was Gary Woodford of Milwaukee Iron in Lynchburg, Virginia, (804) 845-7688. Gary stresses that in order for belts to operate completely maintenance-free, the frame must be entirely straight—or the teeth aren't running true to the sprockets and will be constantly wearing.

Here's how the M. . crew installed the Karata system and rerouted the original primary oiling system:

First, Gary cut off the elbow on the oil vent fitting on the case that dumps oil on the stock chain and ran a hose underneath the transmission. With the primary oil adjuster screw turned down until it stops, the line is strictly a vent. If the vent was previously rerouted, the first step includes removing the outer primary, primary-chain adjuster, pressure plate clutch plates, engine sprocket and clutch shell (don't remove the clutch hub).

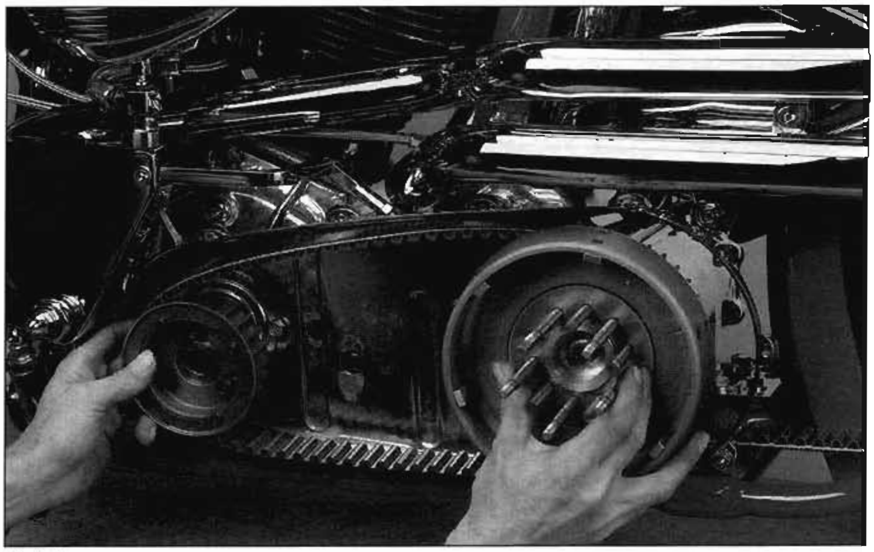


Photo 1

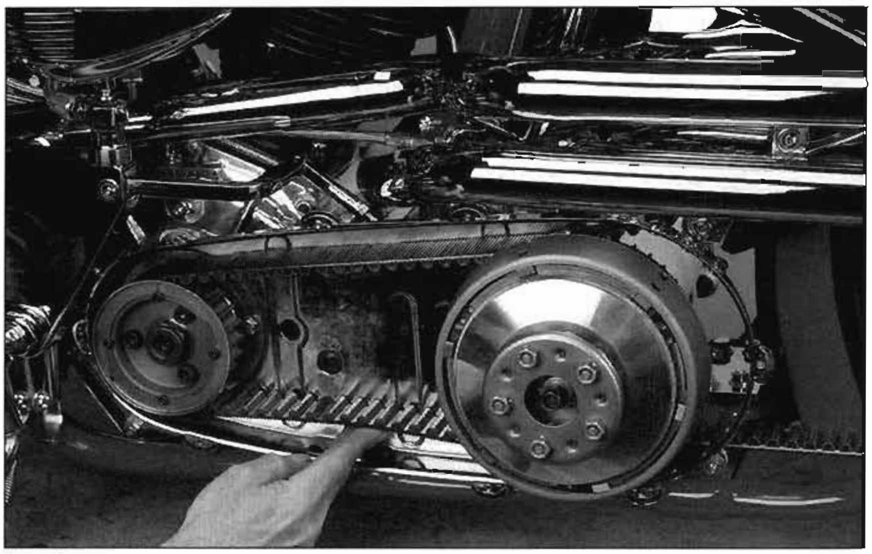


Photo 2

If you have a steel primary, loosen the four 3/8-inch nuts on the base of the transmission and turn the adjusting screw so the tranny is as forward as possible.

Shaft-to-shaft distance on 1 ½-inch drives must be 12.812 or $12\frac{13}{16}$ inches (on 3-inch models shaft to shaft distance must be 12.910 or $12\frac{29}{32}$ inches). Re-tighten the transmission. You may have to elongate the four slots on the transmission mounting plate.

Important: For 14mm drives, lower bolt bosses of the inner primary must be clearanced for the belt (on four-speed aluminum primaries). (It is not necessary on five-speed primaries.)

Alignment: First, go to your local hardware store and purchase two pieces of single thickness windowpane glass measuring 18 inches long by 1-inch wide. We say two just in case one breaks. This is your straightedge. Install the front pulley and tighten the engine nut with an air electric impact wrench to 150 ft./lbs. Place the piece of glass vertically on the engine shaft between the front pulley and the engine. Place the rear part of the glass on the transmis-

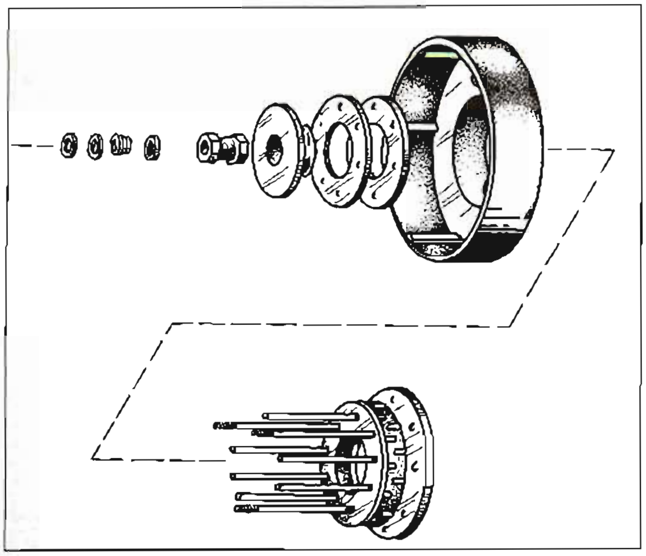


Figure A

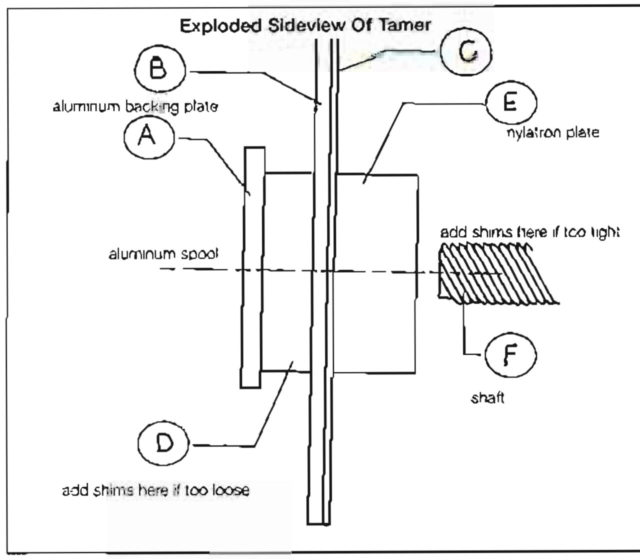


Figure B

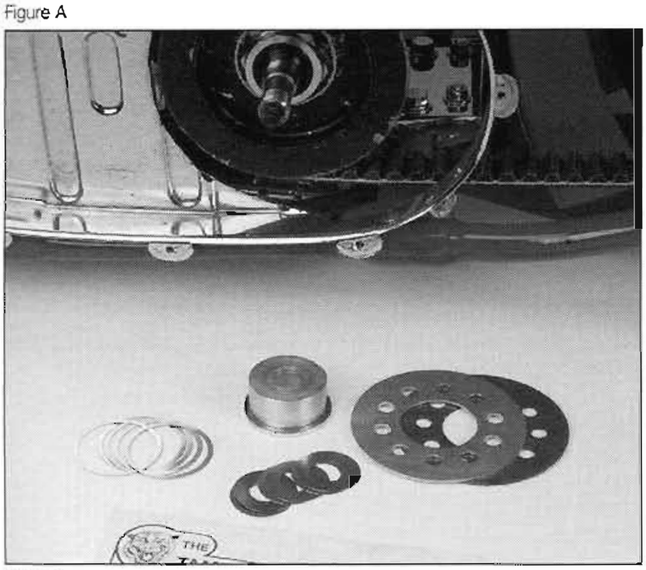


Photo 3

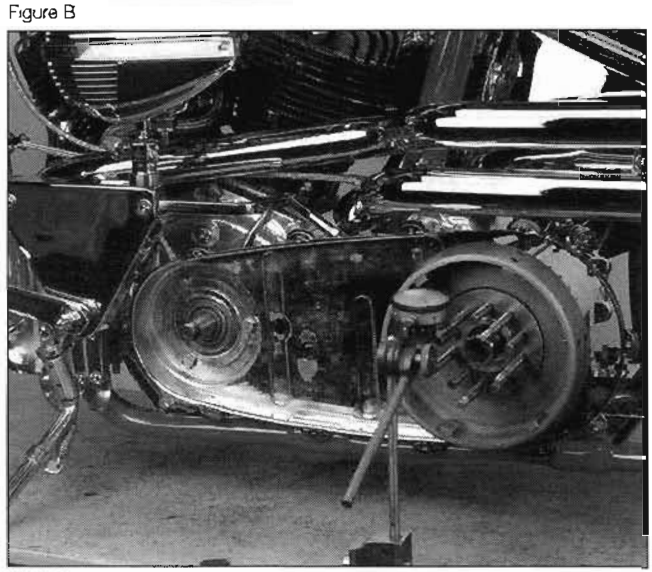


Photo 4

sion shaft between the transmission and the clutch hub.

If you can't place the glass between the front pulley and engine, you must install a spacer temporarily (late model spline shafts), and measure the thickness with a micrometer. Write the thickness on a piece of paper. You will have to deduct the thickness from your straightedge measurement.

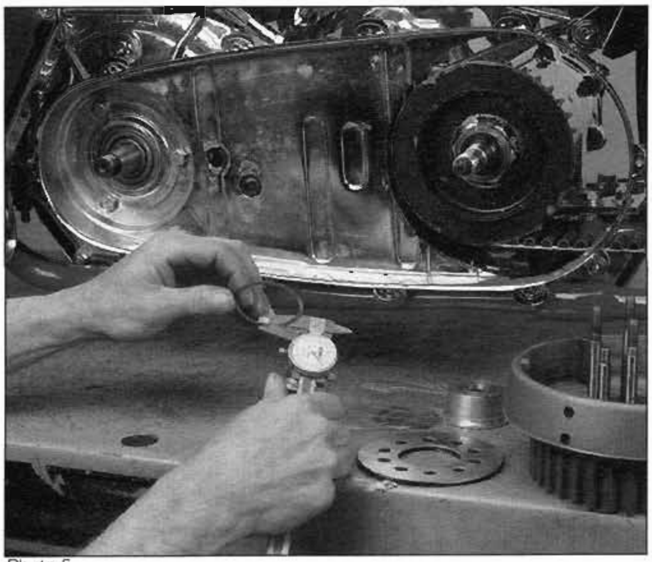
Install the rear pulley with the clutch plates (steel and friction), pressure plate, springs, and retainer. This will hold the rear pulley in the correct position: flat face of front pulley (flat surface of pulley closest to the engine), and flat face of rear pulley (flat surface of pulley closest to the transmission).

With your index fingers, press the glass on both sides of the flat face of the rear pulley. This makes a straight parallel line between the rear and front pulley. Now, you'll need a feeler gauge to measure the distance between the flat face of the front pulley and the glass. Measure the right and left sides; both sides must be the same measurement. If they are not, your transmission is angled to the left or right, and you must correct this—now.

After the transmission is straight, recheck your measurement with the feeler gauge. If it measures .030, you must remove material from the steel spacer on pre-1970 engines. On engines dating from 1970, you must remove the factory spacer, and possibly the machine alternator nose. But do not machine the steel insert on the front pulley.

Now that your pulleys are parallel, install the belt as follows: Remove rear pulley. If your unit is an electric start, use blue or red Loctite on the six Allen bolts that fasten the ring gear to the rear pulley. Now, do the following:

- Check the Allen bolts holding the clutch dogs and make sure they're tight.
- Lubricate the roller bearings on the clutch hub with axle grease.
- Remove the four-bolt retaining flange from the engine pulley. Important: Do not use a screwdriver, etc., to force the belt on. With your left hand, place →



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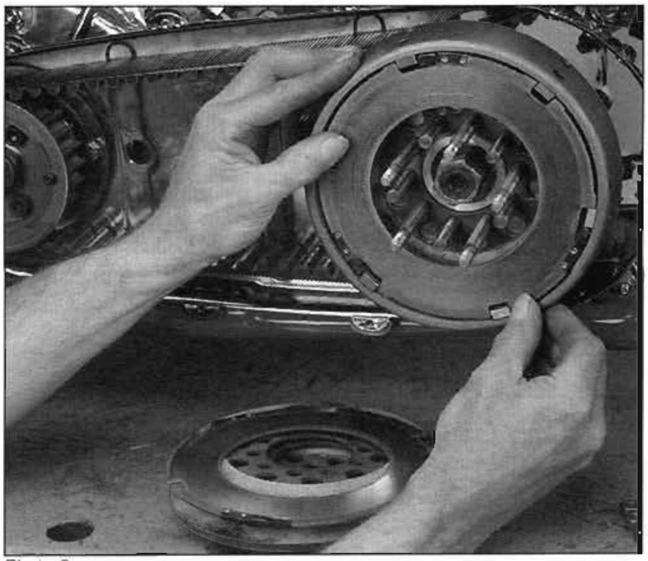

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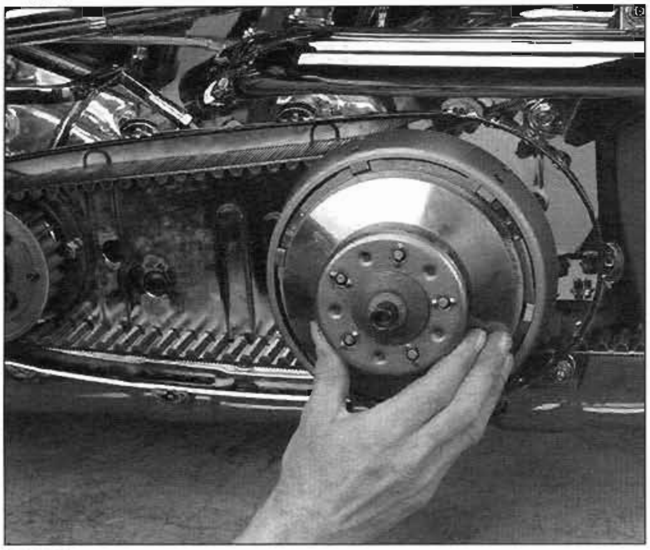


Photo 7

Photo 8

the belt on the rear pulley. Place 1/4-inch of the belt on the front pulley.
With your right hand, install the rear pulley on the clutch hub. As you push the rear pulley in, push the belt in on the front pulley with the palm of your left hand (photo 1).

Installation will be easier if you remove the spark plugs and turn the rear pulley clockwise. This will make the belt run in toward the engine and trans. Adjust the belt to the following measurements:

- 9mm belt deflection should be 1/8-inch to 1/4-inch (photo 2).
- 14mm belt deflection should be 1/2-inch to 5/8-inch.

To prevent the clutch shell from walking out on the hub when the clutch is disengaged, Milwaukee Iron installed the Custom Chrome Tamer (photo 3). It eliminates clutch-jerking, all clutch drag, and lunging.

Study figures A and B to determine sequence and proper method for adding shims to gain the clearance necessary for proper functioning.

Install the Tamer in clutch shell over 10 pins and without shims. Clearance must be between .010-inch and .015-inch (photo 4). Add or subtract shims (photo 5) from back or front to achieve proper clearance (see figure B). Measure from lip of aluminum spool to flat of aluminum plate.

If the Tamer is to be installed in a Karata belt drive, *do not* use steel plate before installing clutch plate. (Note: Caution regarding steel plate usage applies to Karata *only*; all others require the use of a steel plate.)

Reinstall clutch plates and drivers into clutch shell (photo 6).

Adjust pressure plate spring length to 1 1/16 inches to 1 1/8 inches. Measure from lip of top plate to flat of bottom plate. Adjust pushrod screw to remove play from throw-out bearing, and remove slack from cable with cable adjusting screw. Allow for approximately 1/4-1/8-inch of free play at the clutch lever.

That's it. Now, run with the wind.

—Wrench

SOURCES:

Randy Simpson
Milwaukee Iron
3000 Lennox St.
Lynchburg, VA 24501
(804) 845-7688

Karata Belt Drives
Tamer
Both from Custom Chrome, Inc.
(800) 729-3332

Reproduction Clutch
Custom Chrome, Inc.
(800) 729-3332


ELECTRICS
GEORGE

EASY EVO IGNITION BACKUP

Low Tech, But You Can Limp Home

When it comes to scootin' from point A to point B, it's always a good idea to carry some insurance—both figuratively and literally. The Space Shuttle does it by packing double, triple, even quadruple backup systems. In other words, it's got built-in spare parts. If something drops off in the dust or otherwise fails, there's another high-dollar doohickey ready to dance in its place. In olden times, multi-engined warplanes like the Boeing B-17 bomber or the Lockheed P-38 Lightning fighter could still fly home with one of their mills shot to smithereens. More recently, some door slammers, like Cadillac's Northstar-engined Eldo, come factory- equipped with "limp-home" modes that will keep the cage rolling (however slowly), even if engine coolant is lost or the on-board computer fails.

But what about us bros stuck on the side of the road when our bikes' brains fail? Well, thanks to rocket scientists, propeller brains, and the Evo eggheads here at *Easyriders*, we've got some fail-safe ideas comin' at ya.

The first is just a general suggestion on what to carry to aid the roadside blues: 1. Tire inflation in a can may or may not cure a leak permanently, but the added pressure will at least let you ride—instead of walk—to a friendly repair shop. 2. A stubby screwdriver or two (slotted and Phillips head) and medium-size pliers or vise grips are good for general wrenching. And to attach things in jeopardy of falling off, try packing some duct tape, five-minute epoxy, hose clamps, and metal plumber's tape.

Now, let's move on to some more specific stuff. This cures sudden ignition woes, and it's compact, low buck, and easily installed in a roadside pinch. So much for the sales pitch. Actually, credit Dave Perewitz and the crew at Cycle Fabrications (909 N. Main St., Brockton, MA 02401, (508) 586-2511).

Like most modern power plants, Evo engines are sparked by either a stock or aftermarket electronic, pointless ignition system. But when a rare failure in the ignition module occurs, it's likely to be sudden—they just go out in the blink of an eye.

What's more, the module that controls ignition is a solid block of potted material that generally prevents disassembly and trouble shooting.

Photo 1


Photo 2


Photo 3


Photo 4

Thanks to legendary Harley parts and their interchangeability, there's a mechanical backup that bolts in—even to late-model Evolution engines. The secret is to carry some old-time parts—available either from H-D or Accel—including a breaker plate with mechanical points (photo 1). Thanks to Harley, the mechanical advance unit (if needed), the ignition cam, and older plate will all go in with a minimum of fuss.

So, here are the details on this low-tech magic. Let's start with the basic tool list:

One Buck knife or jackknife to cut the wires.

One roll of black electrician's tape or plastic screw-on connectors.

One shorty screwdriver to remove and install the plate.

One adjustable wrench for removing/replacing both the ignition timing screw and spark plug.

One set of small sockethead (Allen key) wrenches.

One sockethead wrench (9/16-inch, or to fit your scoot) for removing the timing mark plug.

One cigarette pack for use as an emergency feeler gauge

Next, you'll want to have available the parts themselves. What you will bring along will depend on the specifics of your bike's ignition. See the following list for details. Note that the Accel kit has a breaker plate with mechanical points, but a chip instead of a condenser.

Replacement parts for a stock, late-model (1989-up) ignition:

Accel #8503—entire swap-in kit with breaker plate, points, ignition cam, advance mechanism, longer retaining screw, coil wire.

The parts to replace most aftermarket electronic ignitions:

1. H-D #32577-70—breaker plate

assembly with mechanical points, condenser.

2. H-D #2542-70A—ignition points cam.

3. H-D #70456-73—coil wire.

First, eliminate the obvious causes:

1. Out of gas
2. Master switch (or any hidden kill switch) inadvertently turned off
3. Broken wires, loose terminal lugs

If none of these check out, then it's time to suspect the ignition module. On 1989 and later stock models, it's located under the seat. The circuitry is a computerized brain, providing ignition

Photo 5

advance electronically, but it can—and does sometimes—get the equivalent of Alzheimer's disease. On most aftermarket ignitions the module is situated under the point cover itself.

Next, remove the small cover on the cam case by unscrewing the two Allen cap screws. (The original late-model stock cover is riveted on—for which you will need a cold chisel and hammer.) Then, pull the inner cover—two head screws here (photo 2). You'll see a rubber gasket that comes off next. The timing plate with the electronic pickup now sees the light of day. Unscrew the two remaining studs and then pull the plate. You'll have to cut the coil wire at this point (photo 3). What you are left with is either a circular polymer electronic trigger (aftermarket) that's sitting on a mechanical advance unit, or a bucket-shaped metal trigger with slot (H-D electronic) that's sitting directly on the engine shaft.

In either case, undo the inner screw

"Thanks to legendary Harley parts and their interchangeability, there's a mechanical backup that bolts in"

Photo 6 *Photos: Jake*

and remove the trigger. If you are fixing late-model stock electronics, install the mechanical advance unit from the Accel kit on the engine shaft. Make sure the unit fits onto the keyway. Then, on both stock and aftermarket ignitions install the breaker point cam (photo 4).

Here's a very important detail. Make sure the flat part milled onto the inner shaft of the point cam slides down by—*not on top of*—the small roll pin on the advance unit. If you can put the cam in 180 degrees out, it will hit the roll pin. You can check by looking at the face of the hollow point camshaft and the end face of the advance unit that comes up in its bore; the two faces should be flush. If the cam face stands higher, you've got it in 180 degrees out, and it's hitting the roll pin. Remove it, turn 180 degrees, and then reinstall the bugger.

Now you can start to button things up. Sock down the timer screw. On formerly stock ignitions be sure to use the longer screw from the Accel kit. It's needed because you have added the mechanical advance unit. Install the replacement wire on the breaker points. Place the point plate in the cam cover (photo 5). Feed the wire through the cam cover and attach it to the coil, as you remove the prior coil connection. This step eliminates using the existing primary ignition harness in case the failure has happened there.

Since your engine is now gonna be sparked by good old-time mechanical stuff, you can time it the same way. Pull the front spark plug and kick the engine over slowly. You are looking for the front piston to start coming up on the compression stroke. Put your thumb on the plug hole, and it will be very easy to tell by the pressure. Once you have ballparked it, you'll want to rotate the engine to precisely 35 degrees BTDC (before top dead center). For that, use the timing mark on the crank. Unscrew the timing plug and kick the engine over a bit more until the mark appears in the inspection hole. Now you are dialed in to 35 degrees BTDC. Once you are there, turn the mechanical ignition advance unit counterclockwise with your fingertips until it is fully advanced (photo 6). You can retain its fully advanced position with a screwdriver tip, if need be. Now, with full advance, rotate the breaker plate until the points just break. This is where the cigarette wrapper is handy; place it between the points and exert a steady pressure. It will release just as the points separate. Having some extra hands sure helps. Sock down the point plate mounting studs and you're on the home stretch. Reinstall the gaskets and covers, and it's time to set sail for home.

This low-tech cure almost makes you want to build an entire retro scoot with a WICO mag, brass-bodied Linkert, mousetrap, rear chain, and a total loss JD oil system. Well, let's not go overboard.

—Jake


DYNA
GEORGE

DYNA 2000 INSTALLATION

This gang of throttle-twisters has torn through most types of Evo-designed ignition systems available on the market today (photo 1). As fuel injection creeps into our lives, so do more sophisticated electronics. The guinea pig for this operation was a 1987, 98-inch FXR. The reason for the exchange was a flat spot in throttle response that plunged into a stop-spot breakdown alongside the road in a twisting canyon. Unlike points ignition systems, a problem with an electronic system is usually fatal. Even a faulty spark plug wire or a low-voltage battery can shut down an electronic system. On the other hand, electronic ignitions draw less maintenance than standard points systems and are ultimately more efficient, reliable, and trouble-free.

Okay, so let's review the benefits of the Dyna 2000, install the bastard, and go for a ride. This unit uses a high-speed microprocessor; it's capable of making more than one million decisions per second, which allows it to synthesize electronic dwell control and spark advance accurate to better than one tenth of a degree of crank rotation across the entire programmed advance profile It's also user programmable. The functions of the Dyna 2000 can be tailored to match the requirements of specific engine configurations. With this unit, we can choose from four electronic advance curves that the factory optimized for your application. Selection between the four available curves is accomplished by setting a two- position DIP switch on the control module. This allows the ignition advance curve to be matched to the level of modification of a particular engine. The installation manual describes various engine configurations and recommends advance curves. The switches are *easily* altered to test various curves.

A built-in programmable rpm limiter allows you to set the appropriate limit for your engine. This is also controlled through the DIP switches and affords a choice of four limits, from 6000 to 7500, in 500 rpm increments (photo 2).

Digital dwell control optimizes spark energy across the entire rpm range. Like most electronic ignition systems, it uses a constant dwell period to optimize spark. But it also measures the charging

Photos: Markus Cuff *Photo 1*

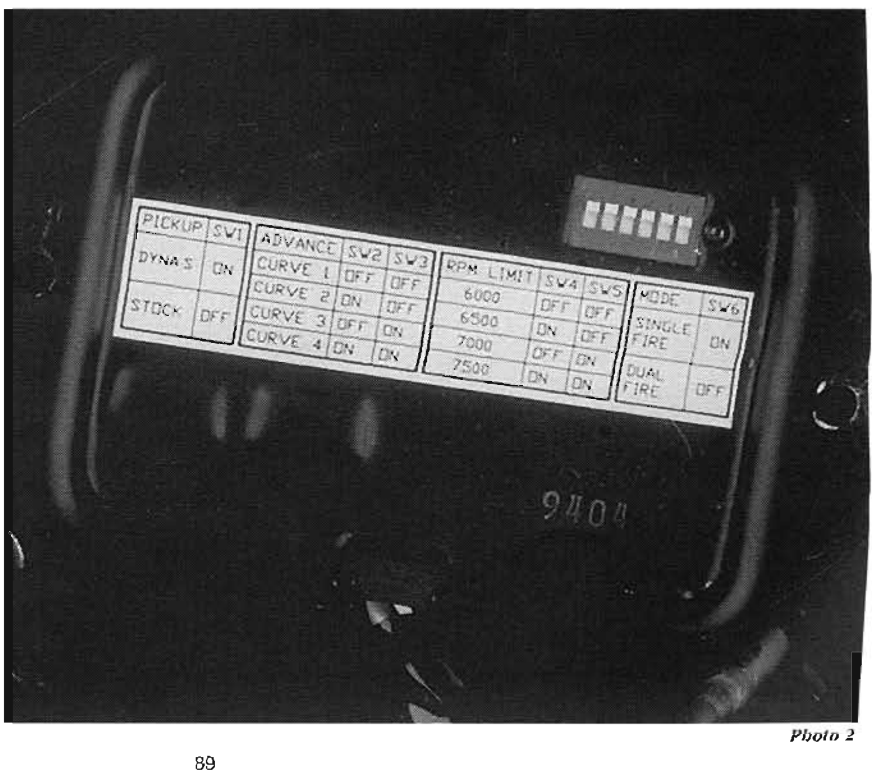


Photo 2

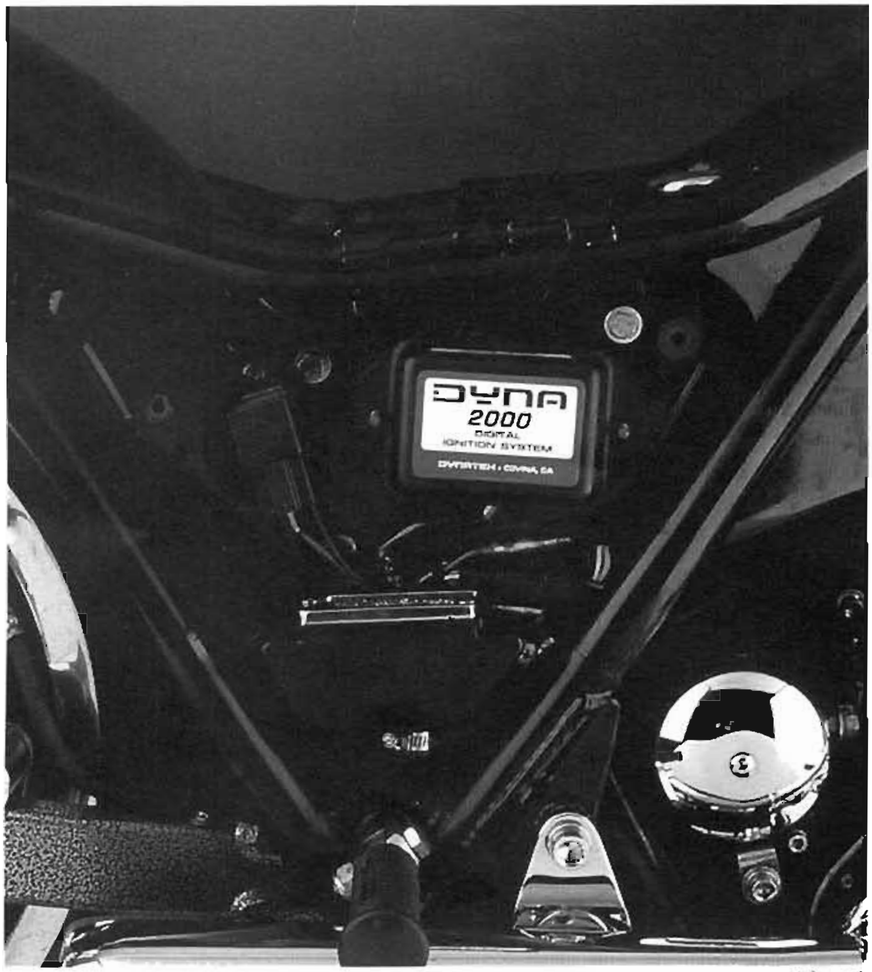


Photo 3

characteristic of the coil attached to it and adjusts the dwell period to match the needs of that particular coil. This allows the user to employ a wide variety of street and racing coils.

This unit can also be set up for single-fire or dual-fire capabilities. In this case we chose the single-fire mode.

The following procedures for installation are from Marty Ruthman of Hi-Tech Custom Cycles, Van Nuys, California, (818) 901-7037:

1. Disconnect the negative cable from the battery.

2. Remove the stock module on '91 and later bikes, unplug the module and plug in the Dyna 2000 (photo 3).

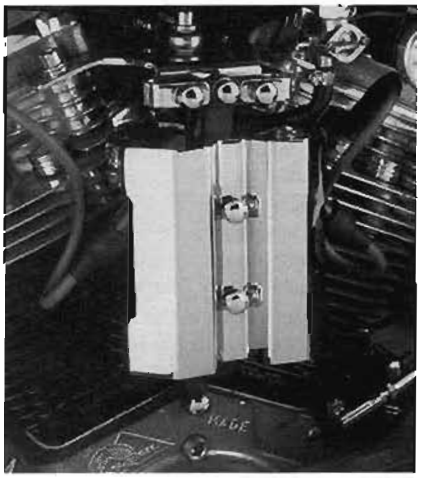


Photo 4

On '88 and later Softails the module is under the seat; for '87 and earlier models, the module is located under the oil tank or on the front of the frame; on FXR models, the module is under the right side cover; on Sportsters the module is under the left side cover; on dressers, the module is on the side of the fork neck, and on Dynas, the module is in the toaster on the left side.

On 1990 and earlier Evo models you will need to remove the module and the wiring harness and replace the wiring harness with Dyna part #1009001.

If you are going to use a single-fire ignition module, remove the coil cover and coil and install new coils and brackets. We used the 30,000-volt single-fire Dyna units and a Custom Cycle Engineering bracket (photos 4 & 5).

3. Connect the blue wire (supplied in the Dyna 2000 kit) to the front cylinder coil and the pink wire (that went to the original coil) to the new rear cylinder coil. Connect the white power lead to both coils.

4. Connect the white wire of the original coil to the new coils to supply power. Do not connect a tach lead to the coils if your motorcycle has one. Instead con- →

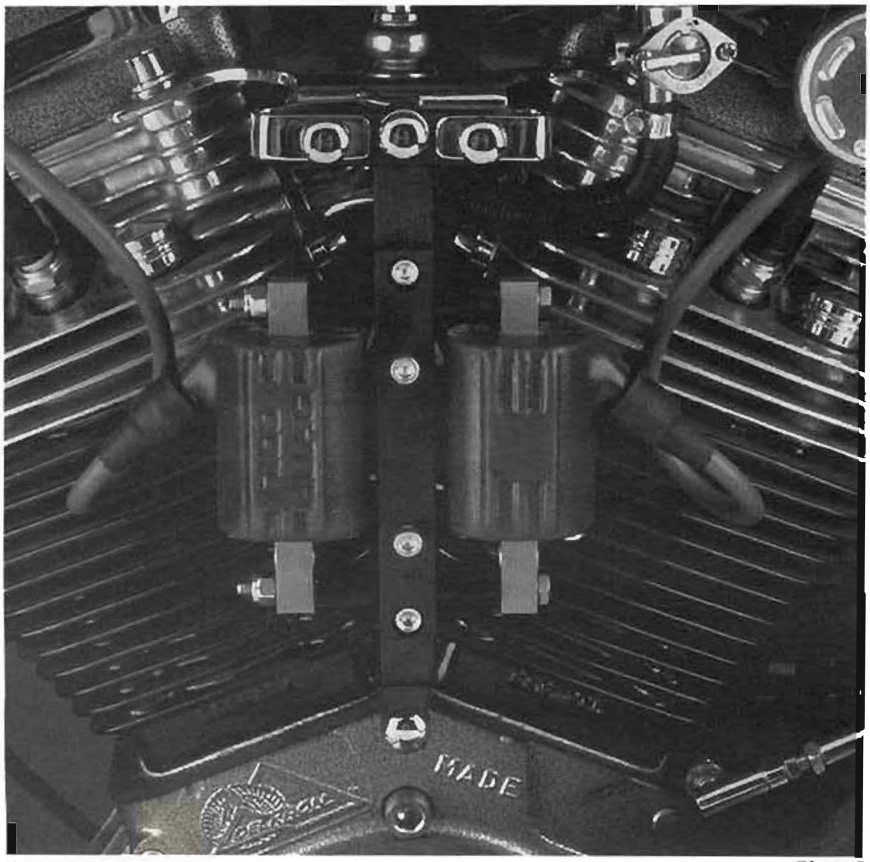


Photo 5

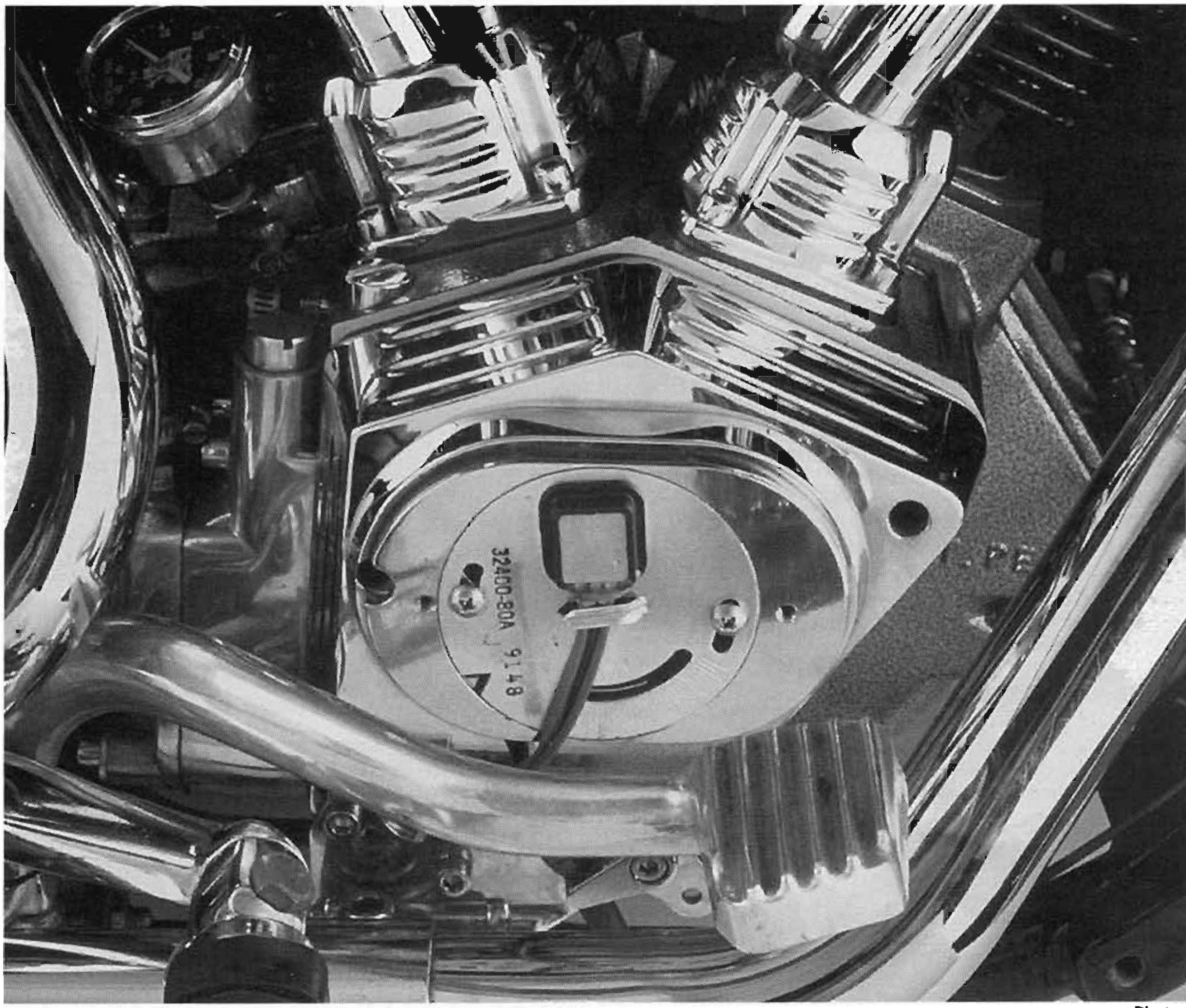


Photo 6

nect it directly to the Dyna 2000 module using the green wire supplied in the kit.

5. Connect the plug wires, set advanced curve, rev limit and timing, using switches and LED light on the rear of the module.

If you are going to run a dual-fire (one coil system) install the module, set the timing curve/rev limit, put the switch in the dual-fire position, and set the timing, using the LED light in the rear of the module.

Do not connect the tach directly to the coils. Use the green wire to connect the tach to the module.

Both of the above installations use the original electronic ignition pick-up units. If you have points it will be necessary to install a Dyna DS6-1 pick-up or an original equipment pick-up.

If you already have a Dyna DS6-1 or a Dyna DS6-2 ignition system, you will need to remove the advanced weights and replace them with Dyna pole piece =1404001, using the wiring connector supplied in this kit (photo 6).

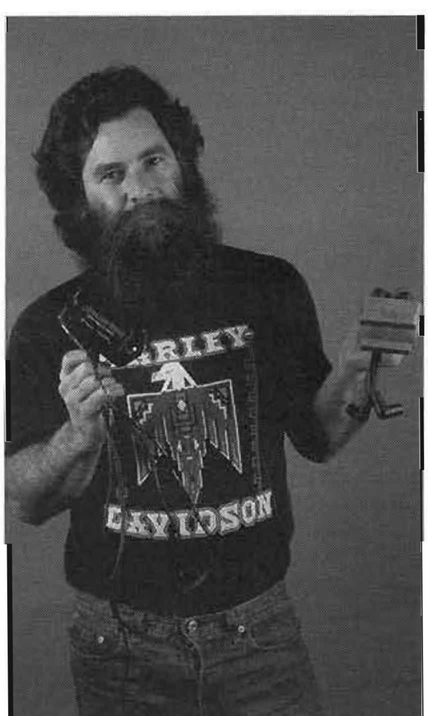


Photo 7

If you wish to use H-D's VOES (vacuum operated electric spark control system), the Dyna 2000 HD1 unit will function as designed by H-D. If you do not have a VOES (or don't want to use it), the Dyna unit will function without it.

It is also possible to connect the VOES switch to retard the ignition timing on command using a momentary switch. This would be useful in starting big inch motors and for the control of pre-ignition and also would be useful on bikes running nitrous oxide.

But the bottom line is ignition flexibility at a nominal cost. Since Hi-Tech installed this particular unit, they've installed a half dozen more, and ordered another dozen. Marty finds that they've eliminated the need to go from stock, to modified, and then to single-fire. This unit affords the flexibility to change ignition configuration or engine size and stay with the same ignition. Marty testifies that Dyna is a company that stands behind its products (photo 7).

—Wrench

Clever Coil Mount

Simplifies, Shortens, Sanitizes

Whether you tour the country on an FLT or just barhop on a Fat Boy, you know that electrical wiring can be a necessary but nasty looking evil. Appearances aside, long and complicated multi-wire electrical harnesses also have functional drawbacks. They can develop frays, breaks, and other glitches over time, in an often-hostile scooter environment of vibration, rain, spilled fuel, and oil. A particularly vulnerable spot is wiring that must traverse the steering head, where the constant turning of the forks can lead to trouble. One common problem is wires that get loose and end up being mashed on fork stops or pinched on the edges of gas tank mounts.

Here's one of the best solutions for simplifying, shortening, and otherwise sanitizing electrical wiring. Relocating components closest to their intended use dramatically cuts the length of leads. That means better looks and improved reliability. Less wire means fewer potential places where it can rub through insulation, separate from connectors, or otherwise go south.

On late-model Big Twins a lot of electrical activity centers on the engine room: battery, starter motor, ignition timing, charging. And, there's a particularly good place to locate a streamlined, relocated electrical control center, closer to the action. Adjacent to the cylinder heads, on the primary drive side, is the handy top motor mount. It's easily accessible to the rider. By putting an FXR-style coil there, you minimize the length of spark plug leads. Then, by adding an ignition key switch and a starter switch, you eliminate a world of wiring. A plate of sheet or billet aluminum that bolts to the top motor mount can hold these components. For those of you hankering for the latter, you don't need to own a machine shop to do it. Cycle Fab of Brockton, Massachusetts, has an alloy billet coil mount engineered to let you bolt up the necessary good stuff. Related parts are available directly from Cycle Fab, aftermarket sources, or even H-D itself (see Parts and Sources).

The complete setup looks sano and gives you all the modern conveniences. It is threaded to accept either stock H-D or popular aftermarket master electrical key switches; ditto goes for the starter button switch, available from component

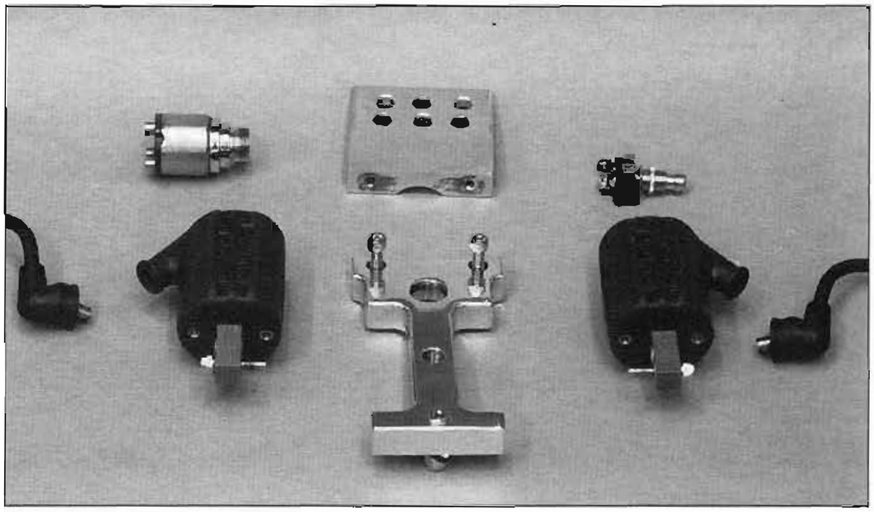


Photo 1

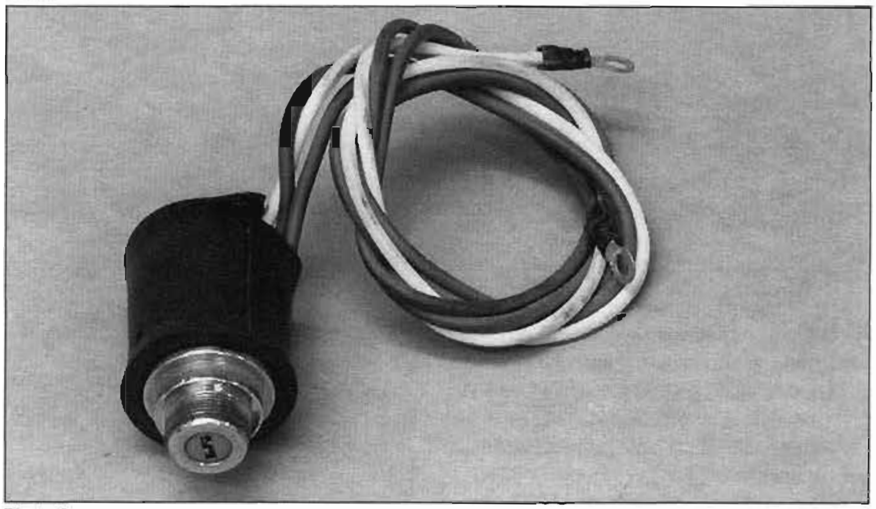


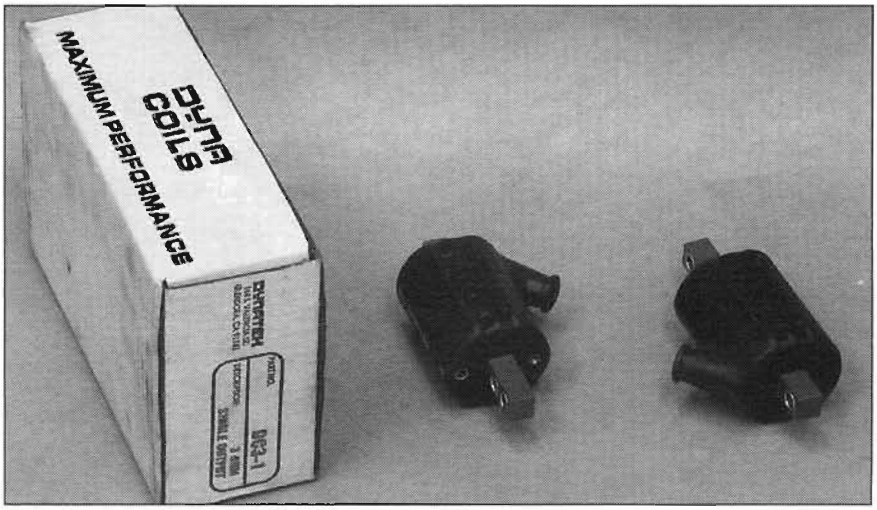
Photo 2

Photo 3

suppliers or Cycle Fab. Once the switches are screwed in, there's a set screw to keep them in place. Another plus is the use of dual Dyna coils for improved ignition. These feed two standard short FXR spark plug leads and are covered with two sheet metal shrouds from Nempco, which can be plated or painted. The billet mount also has a bottom hole that can be utilized for either a manual carb choke control or wire router. It's machined to accept a variety of motor mounts and bolts up to any FXR or (with an adapter) '93-up Dyna Glide mount. Industry standard 5/16-18 thread socket head fasteners are used throughout.

The result? This billet beauty deep-sixes a small wheelbarrow full of standard switches, wiring, looms, connectors, etc.

—Jake



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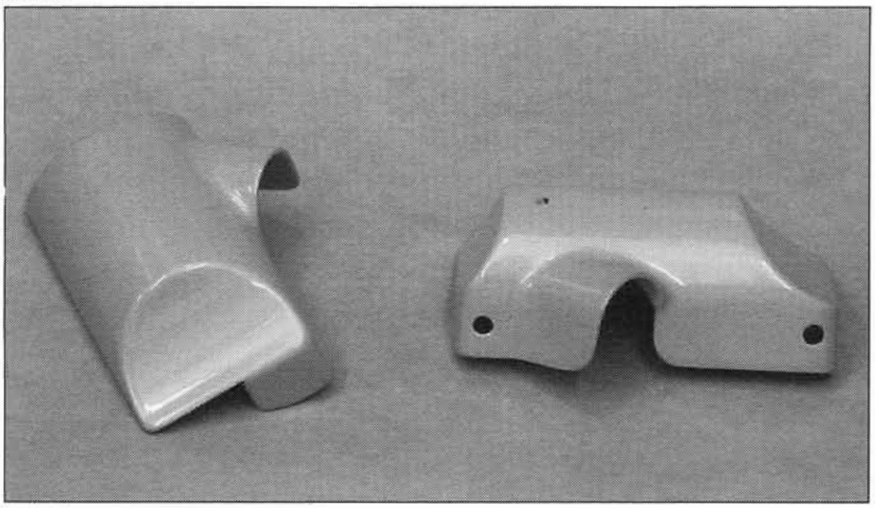
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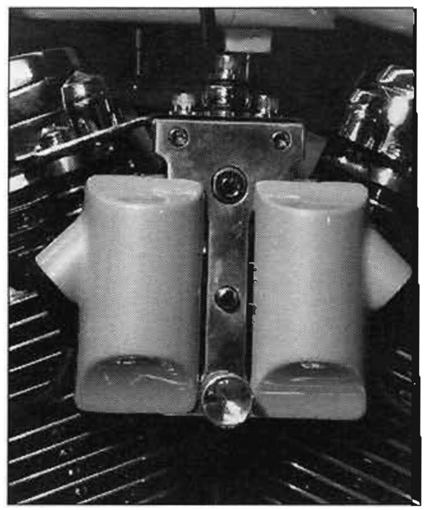
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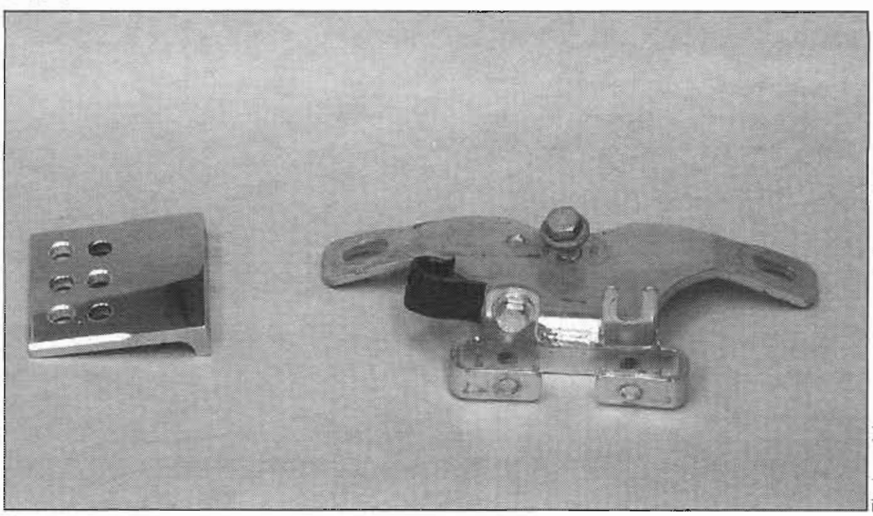
Photo 7

Photos: Jake

Parts & Sources

Billet coil mounting plate fasteners:
Cycle Fab: (508) 586-2511

Master key switch:
H-D (#71425-77) or aftermarket

Starter button/switch:
Cycle Fab or GC (#35-3497)

Dual, single output coils (3 or 5 ohm):
Dyna (#DC3-1 or DC6-1, depending on application)

Coil covers:
aftermarket/Nempco distributes: (518) 861-6949

5½-inch FXR spark plug wires:
H-D (#31980-65B)


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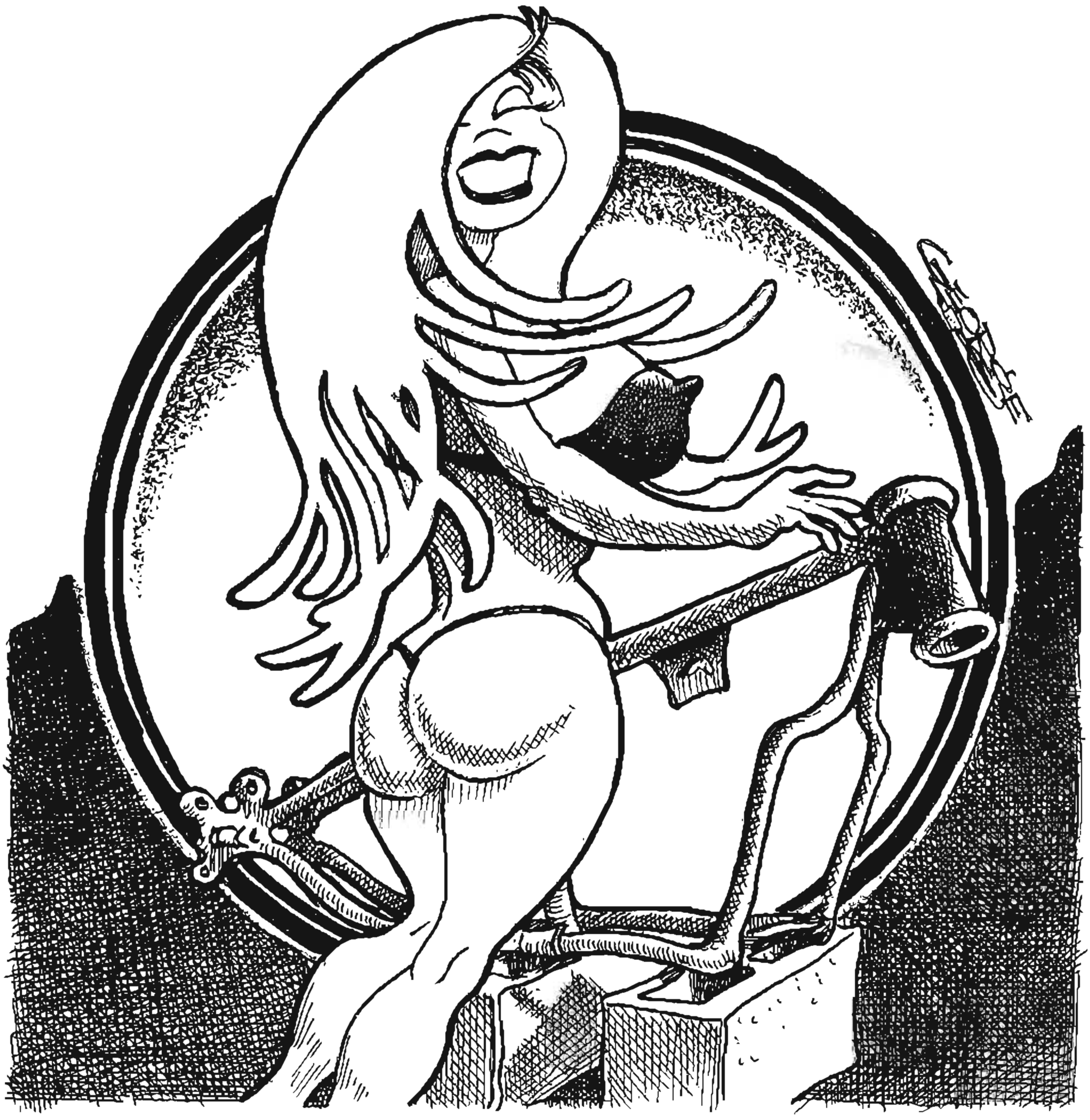
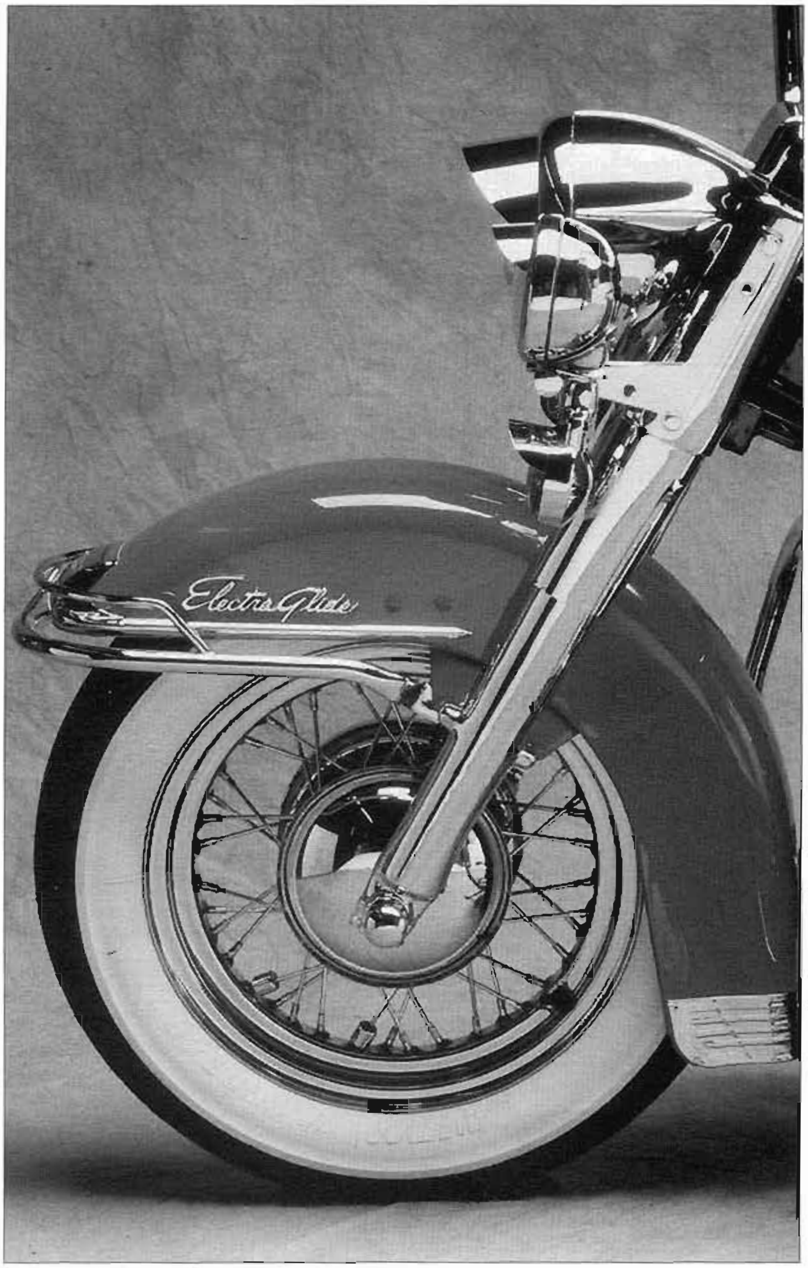
CHASSIS

It doesn't matter if you stretch it, lower it, rake it, or rigid it. If it's stock, chances are you want to do something to it. This is the section that will make the miles easier on you and your parts. And show you some handling mods that just might get you there a little quicker.

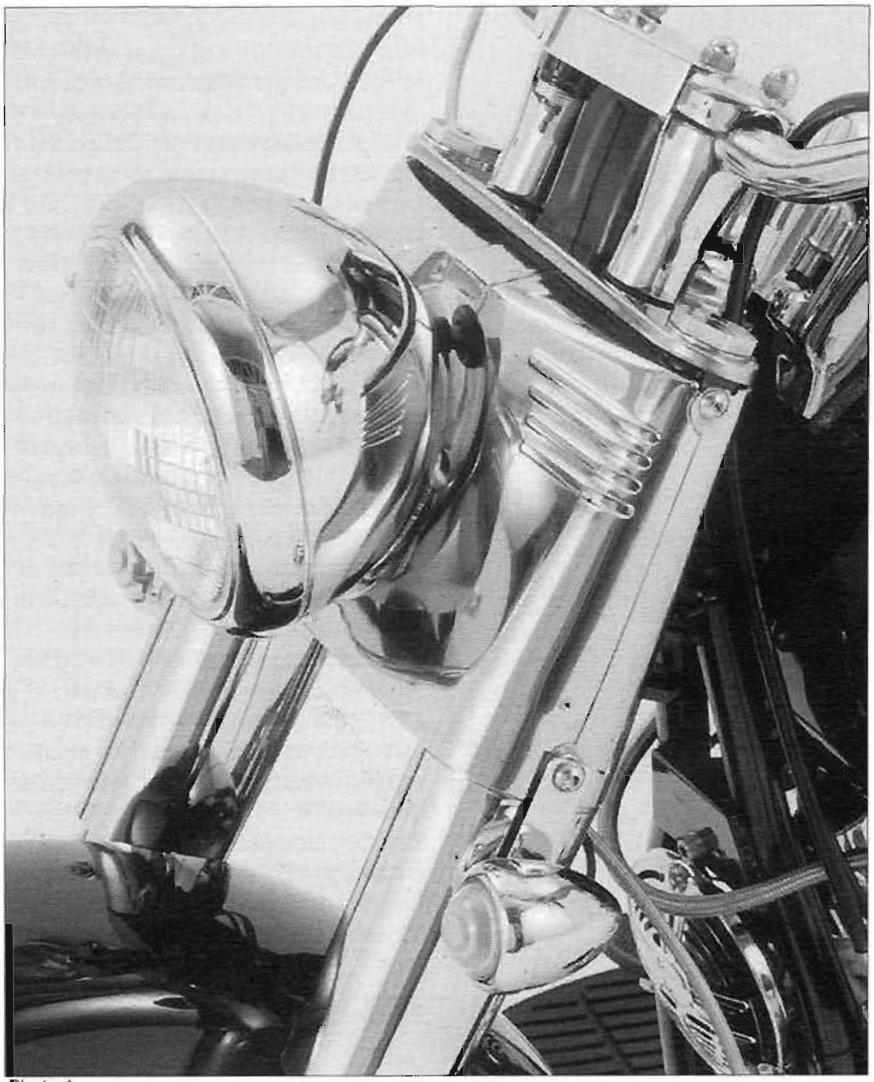


WIDE GLIDE HISTORY

THE LEGEND OF THE HARLEY-DAVIDSON TELESCOPIC FRONT END



The first few Harley-Davidsons were equipped with a bicycle-type rigid front fork. This was replaced in 1907 by a springer fork which featured a rigid rear fork attached to a movable front fork. This basic design continued to be used on all Harleys until 1948. The 1949 Big Twins were introduced with a telescopic fork called a Hydra-Glide. Harley's interest in a telescopic fork dates back at least to 1943 when a Harley XA military shaft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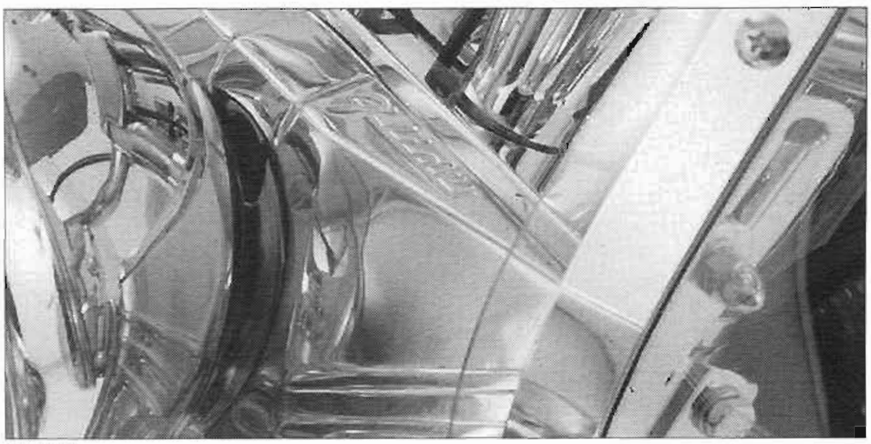


Photo 2

drive motorcycle was equipped with a telescopic front end. Apparently a telescopic front end was on the minds of Harley's engineers as soon as the war ended in 1945. Jerry Hatfield's informative book, Inside Harley-Davidson, closes with a photo that was processed November 28, 1945, showing a knucklehead with a mock-up telescopic front fork.

The first year glide front end (photo 1) differed from the 1950 and later models in that it had small fork tube caps that contained grease fittings, sheet metal covers over the fork tube caps , black lower legs, and an upper fork cover with four horizontal ribs. In 1950 the larger domed fork tube caps appeared, the lower legs were polished, and the word Hydra-Glide was added to the top portion of the upper fork tube cover.

Harley also produced an adjustable version of the glide front end for sidecar use. The rear position of this front end gives the same rake

> **Harley-Davidson's sidecar manual warns that riding solo, i.e., without a sidecar, with the front end in the forward aposition is dangerous.**

as the non-adjustable unit and is intended for use on the bike without the sidecar. The forward position gives the increased rake necessary for sidecar use. This increased rake makes a sidecar rig more stable and easier to steer. Harley-Davidson's sidecar manual warns that riding solo, i.e., without a sidecar, with the front end in the forward position is dangerous. I ride my panhead with the fork in the forward position without the sidecar. While the bike is a little less stable at low speeds, the increased rake gives more stability at high speeds, like on my 95 mph run at Bonneville. I am not saying that the Harley manual is wrong and should be ignored. I feel that an individual with an adjustable front end should weight the facts and make his own choice of which way to run

Photo 3

the front end.
From 1955 to 1959 the glide front end remained unchanged except that the upper fork cover had three ribs angled at 45 degrees (photo 2). Looking straight at the front of the bike, with the headlight in the middle, gives the appearance of a sergeant's chevron. This fork was reintroduced on the Heritage Softail in 1986, without the word Hydra-Glide across the top. The 1958 and 1959 Duo-Glides used the headlight and upper fork cover of the earlier models which still had the Hydra-Glide logo. I get asked about this occasionally because the '49 to '57 panheads were called Hydra-Glide, and people think that the name Hydra-Glide doesn't belong on a Duo-Glide. This fork cover does belong on the '58 and '59 Duo-Glides. and the best answer that I can come up with is that the front end was a Hydra-Glide, whether it was on a Hydra-Glide or a Duo-Glide model bike. However, that name doesn't appear again after the introduction of the aluminum headlight cowling in 1960 (photo 3). With the introduction of the aluminum cowling the handlebar riser mounting holes on the upper triple tree were moved closer together.
Servi-Cars continued to use a springer front end through 1957. In 1958 a modified Hydra-Glide was developed for the Servi-Car. It was non-adjustable, but permanently set at the

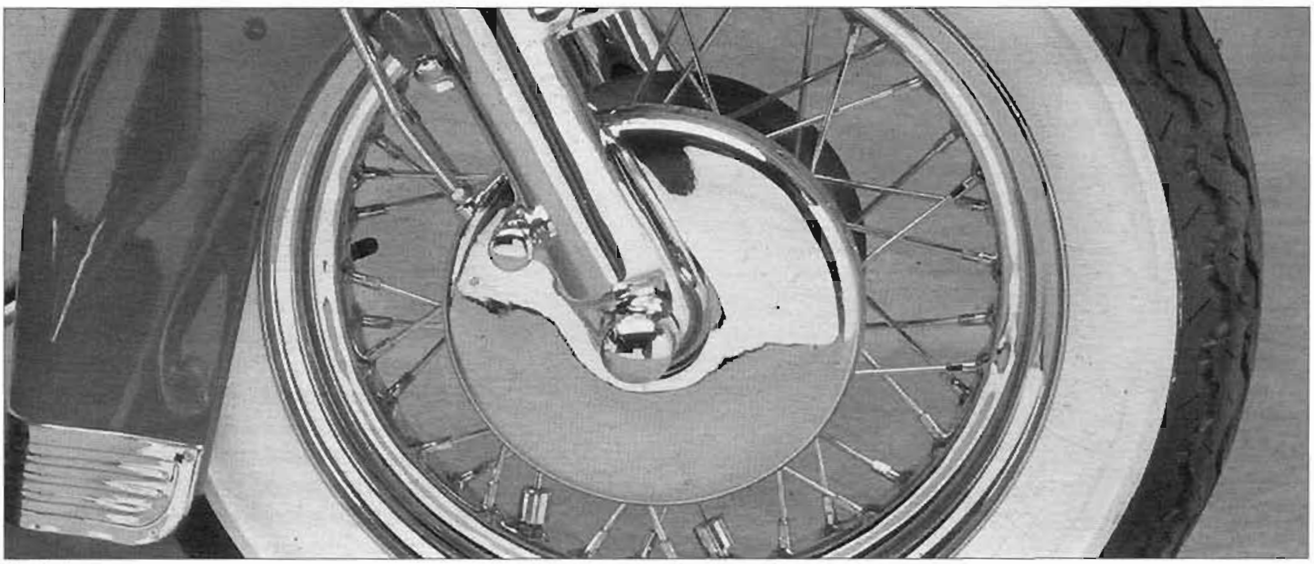


Photo 4

forward rake angle of the adjustable sidecar front end.

The glide front end used the star hub wheel introduced with the first knucklehead in 1936. In 1967, a permanently lubricated sealed-type hub was introduced.

The big Harleys had both front and rear brakes located on the left side of the wheel hub from the introduction of front brakes in 1928 until 1969 (photo 5). This could cause the bike to pull to the left in an emergency stop. So, after 40 years of sideways emergency stops, Harley moved the front brake to the right side of the wheel hub. Officially, this was a 1969 change (photo 4). I have seen one very original 1968 Electra Glide with a right side brake. This bike had a serial number in excess of 10,000 which means it was a very late 1968 production.

I have heard of one enterprising Texas biker who built a dual drum brake front end using a '68 and earlier left drum and fork leg coupled with a '69 to '71 right drum and fork leg. The guy who told me about this set-up didn't know how the brake drums were attached to the wheel hub. Texas bikers are a bunch of innovative geniuses so I'm sure it was an interesting set-up. The lug wrench must be inserted through the opposite side of the wheel to loosen the lug nuts.

In 1972 Harley-Davidson introduced a disc brake on the front wheel only (photo 6). They moved it back to the left which meant both front and rear brakes were on the left side again. This apparently was in anticipation of putting a disc brake on the right side of the right wheel in 1973.

The Hydra-Glide or FL front end remained unchanged internally from 1949 until mid-1977, when Harley went to the Japanese-made Showa front end. Although this front end functions the same and is similar in appearance to the Harley front end, parts are not interchangeable between the leg portions of the two front ends. The triple trees are interchangeable, however.

And that's the history to date of the famous Wide Glide front end. We will rebuild an FL-type glide front end in a future issue

—David Royal

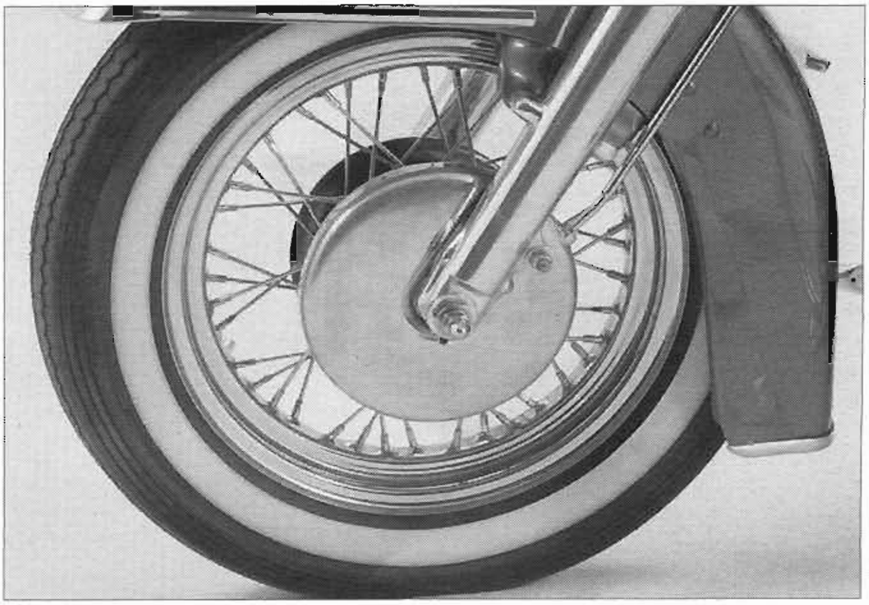
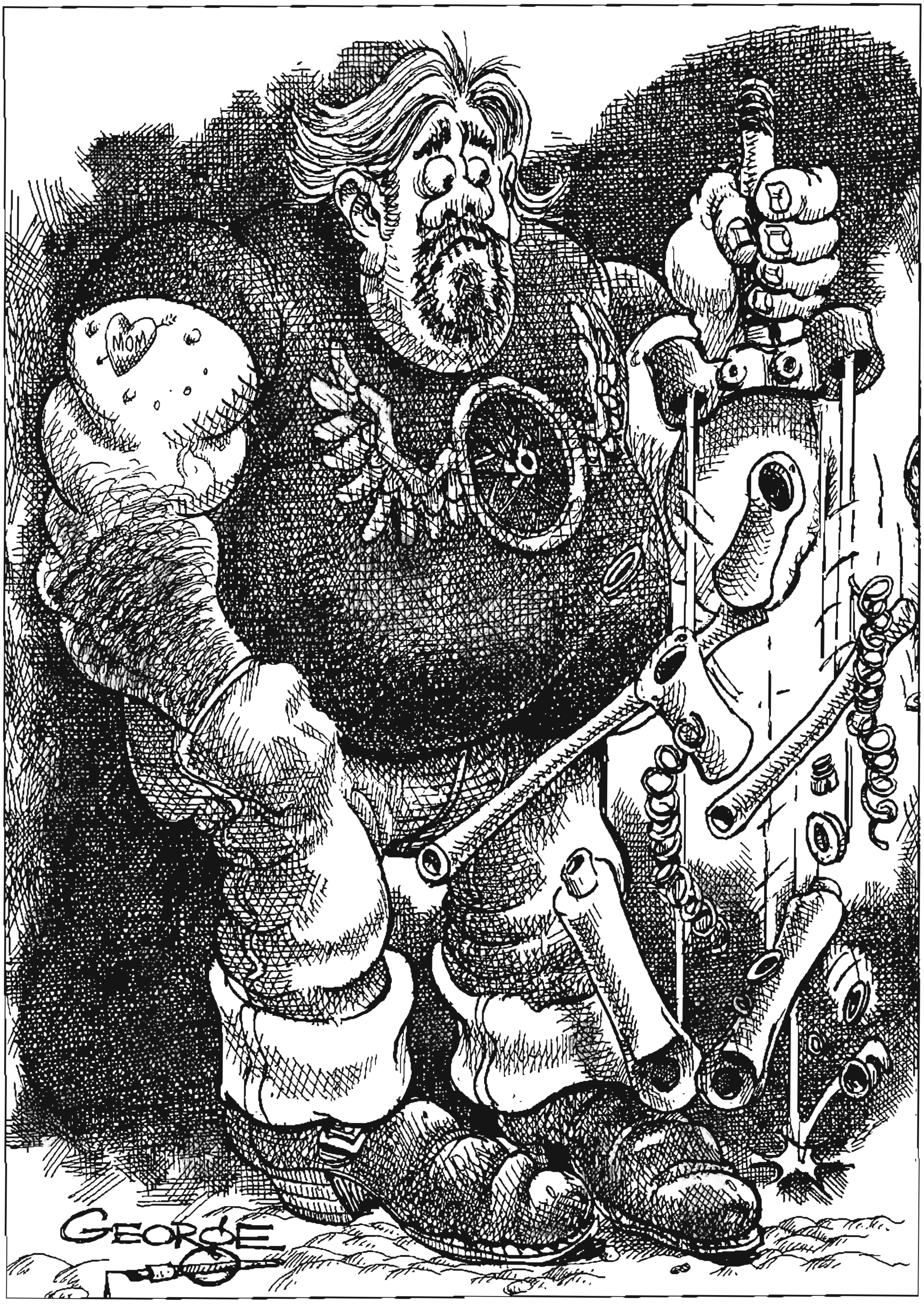


Photo 5

Photo 6


MOM
GEORGE

REBUILDING THE HARLEY GLIDE

Seal And Bushings And It's New Again

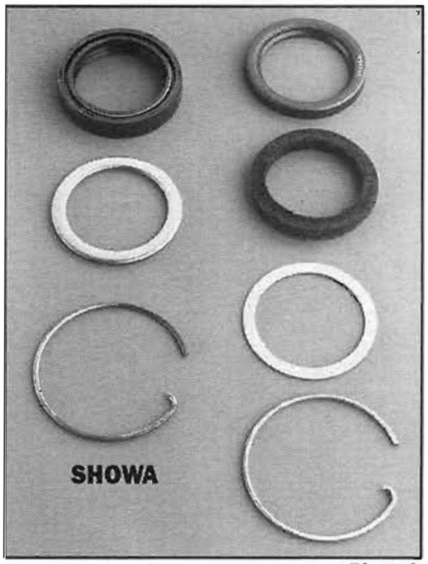


Photo 1

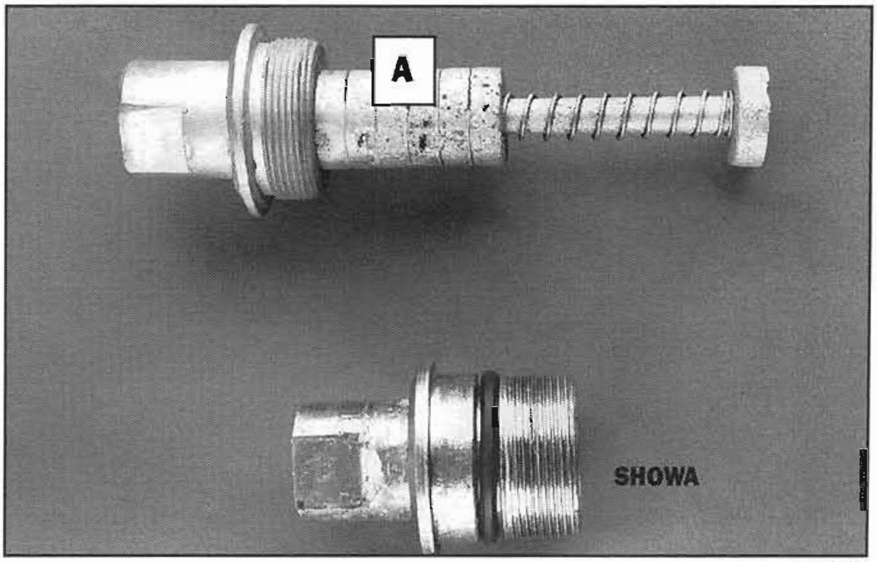


Photo 2

Recently we covered the variations of the Harley hydra-glide front end used from 1949 to 1984. This article will cover rebuilding the glide front end.

There were no changes made in the functioning mechanism of the glide forks during the period 1949 to 1977. Harley's original design worked so well there was no need for change.

The Japanese Showa front end, introduced mid-year 1977, was a virtual copy of the original Harley-Davidson front end. Harley probably changed to this front end as a cost-saving measure. See photos 1, 2, and 3 comparing the internals of the two front ends.

Usually, the only repair a glide requires is changing the seals. On the '49-'77 front end, the upper seal consists of a lock ring, steel washer, felt washer, and the upper oil seal, which has a single lip. The Showa front end's upper seal consists of only a lock ring, a thicker seal with two lips, and a steel washer. It is best to replace the earlier setup with the Showa-type seal, which is less likely to leak (photo 1). The lower slider seals are made of paper. The small one goes between the damper tube valve and damper tube lower bushing. The large washer goes between the damper tube lower bush-

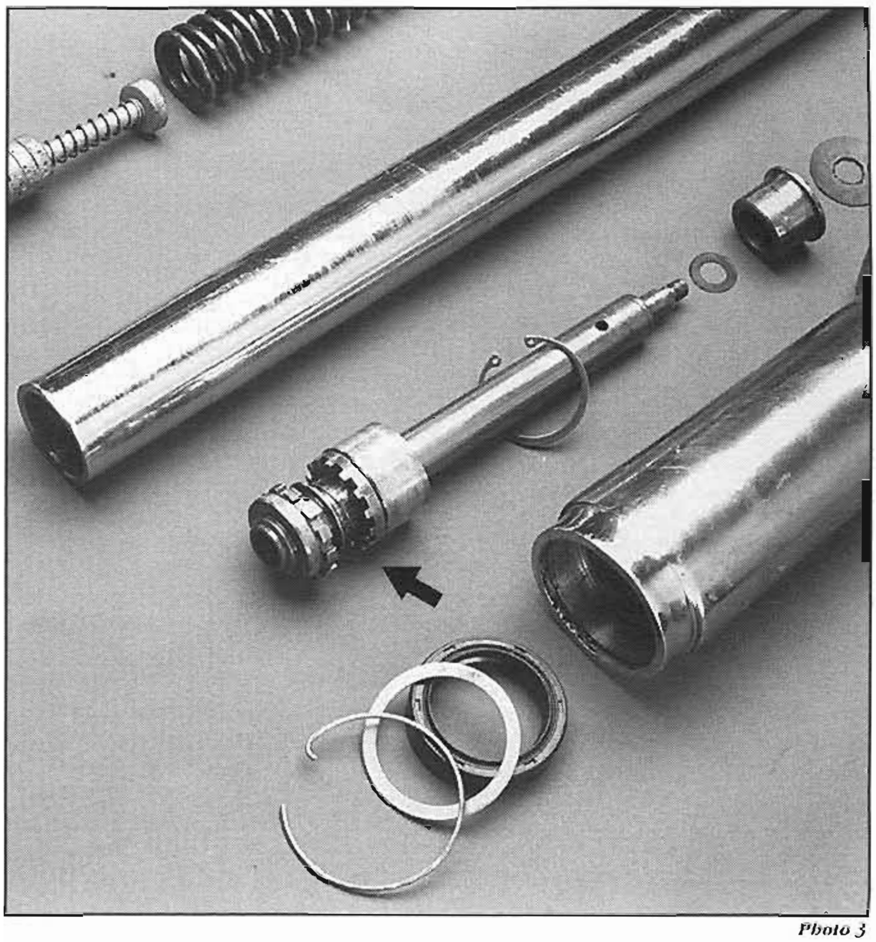
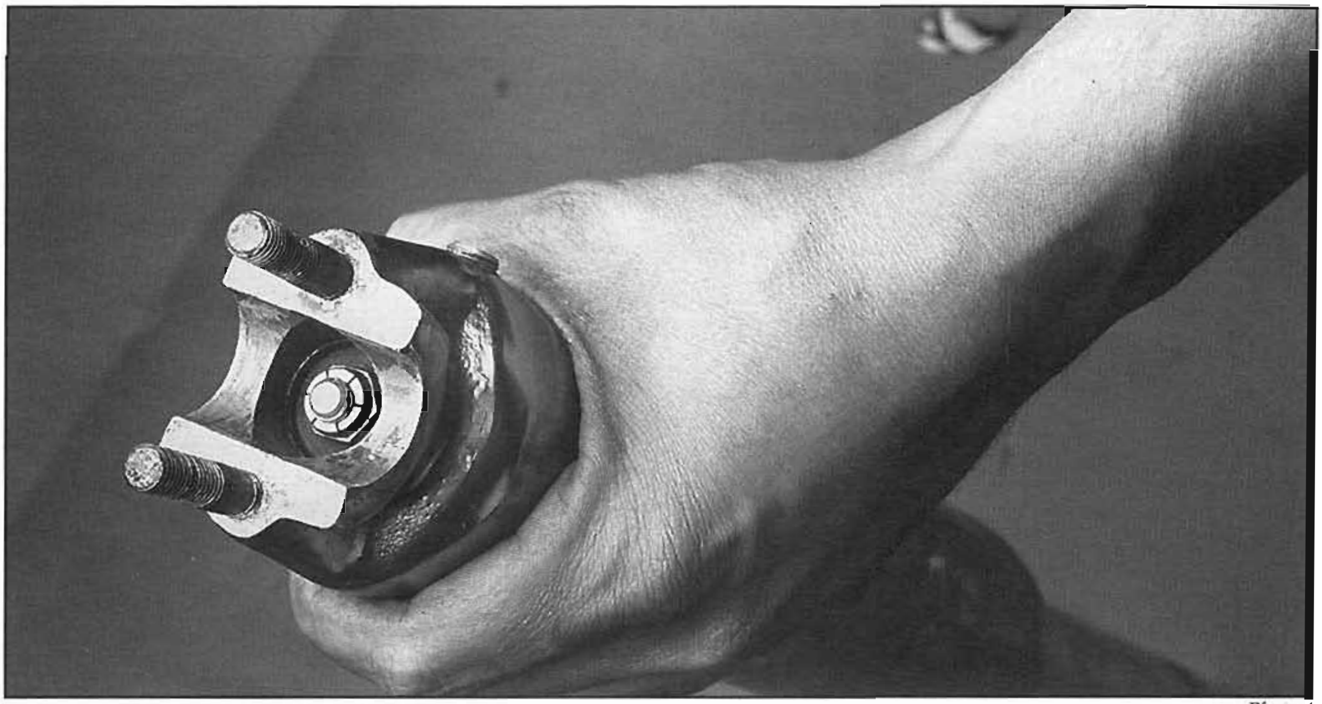


Photo 3



Photos: Markus Cuff

Photo 4

Photo 5

ing and the slider.

Upper seal failure is usually caused by letting the bike sit too long. The upper fork tubes are bare steel and will start to rust if the bike sits long enough for the fine film of oil on the tubes to evaporate. This rust will damage the fork seal lip the next time the bike is ridden and the fork will seep oil over the top of the sliders. The best way to prevent fork seal failure is to ride your bike regularly. If you live where the snow is eyeball deep for six months out of the year, work the front end up and down once a month. Other damage to the fork tube surface that comes in contact with the seals can also cause fork seal failure.

Other possible problems:

Broken fork springs—that's the big mutha. They have to be replaced. Replace any rusty or broken damper tube parts. The slider tube plug baffle cups can become loose or displaced. You can solder them back in place (photo 2a). Replace any that are broken. The baffle plates must be arranged with the slots for air passage on opposite sides (staggered). Otherwise, oil will leak at the upper tree bolt. If the slider tube plug spring is broken, it has to be replaced (photo 3).

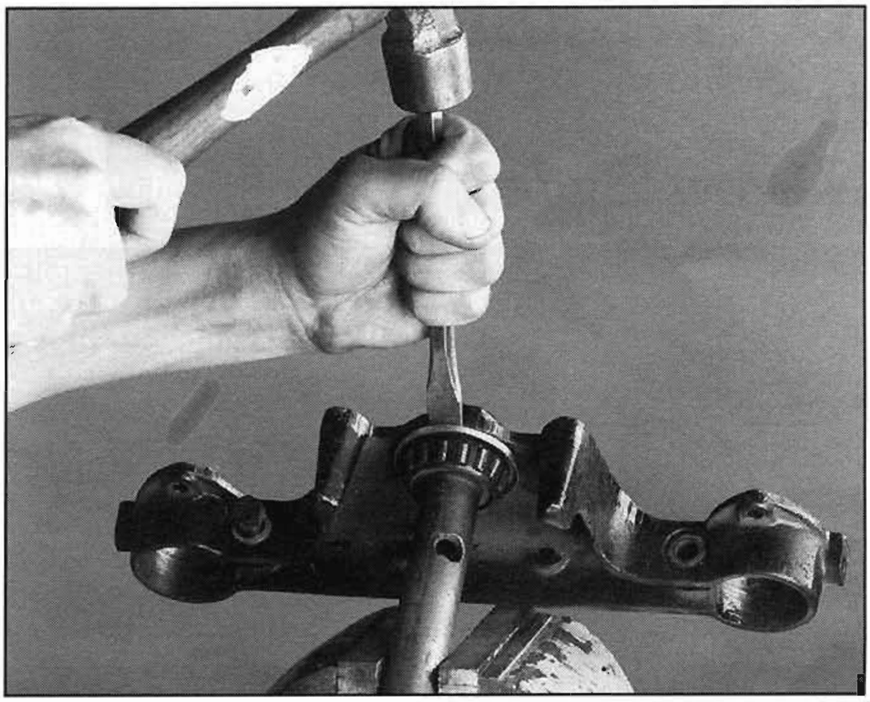


Photo 6

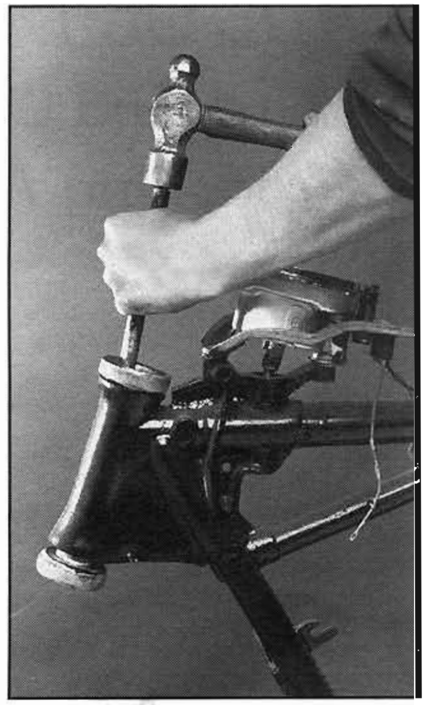


Photo 7

Now, for the tough one. If the fork legs flop around in the sliders you've got bad bushings in the sliders. This is fairly unusual and since there are a lot of good used sliders around, it's probably cheaper to buy another set and use the old ones for ashtrays. Never throw Harley parts away. Someday they'll be valuable enough to repair.

There are three special tools required for replacement of the bushings and a lot of labor involved. If your local shop can do it (a lot of them don't have the tools) it's going to be expensive. If you do it, buying the tools will be expensive, and you'll probably never need them again.

If you insist on restoring the bushings in those fine old original sliders from your 1949 panhead, the Harley service manual covers the job in detail.

Reassembly: Wash the slider assembly and the fork legs with solvent and check for burrs or other damage which would interfere with the operation of the fork.

Early front end: Replace the upper oil seal by driving it carefully into the lower leg until it just seats. Use a large socket or piece of pipe that just fits into the slider to the drive seal. Then install the felt washer, steel washer, and lock ring. You can leave out the felt washer and replace it with a second early-type washer, or you can use the later setup.

Later front end: Install the steel washer first. Next, drive the later-type seal in following the directions for the early front end. Then, install the lock ring. The gap in the lock ring has to be directly over the water drain hole in the top of the slider so that moisture doesn't collect in the fork (photos 1 and 3).

Follow the instructions in the H-D manual to reassemble the cushion assembly. Make sure the flattened part of the threaded end of the damper tube aligns with the slotted hole in the bottom of the slider (photo 4). It's possible to install the nut with this out of alignment; it will eventually work itself into alignment. This will cause a leak since the nut will no longer be tight. It's a nylock, so it probably won't back off. Once the lock nut is tightened on the bottom of the cushion assembly, put a bead of silicone seal around the lock nut to help prevent leaks (photo 5).

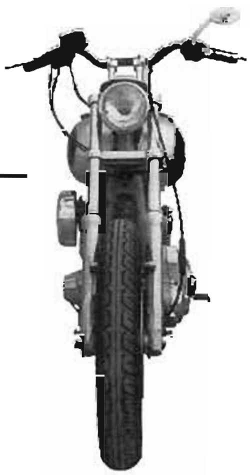
If it is necessary to replace the steering head bearings, pry the lower bearing off the stem with a chisel or large screwdriver as shown in the photo (photo 6). It is a tight fit, only for about 3/4-inch, then it will drop off. Replace the bearing bottom dust shield. Then drop the new bearing on the stem and drive it into place with a hammer and a piece of pipe that just fits over the stem. The piece of pipe can only contact the center of the bearing. Be careful not to drive the bearing.

If the races in the steering neck cups need replacing, remove the cups as shown (photo 7). Once the cups are out, drill two small holes opposite each other in the bottom lip of the cup and drive the race out with a small drift (or replace the cup assemblies). Drive the new race in with a hammer and a piece of pipe that just fits the top of the race. Be careful not to damage the bearing surfaces in the races. The bearings and races are slightly different between the 1949 to 1959 front end and the 1960 and later . The later races and bearings can be used in the earlier bearing cups by matching the bearing cup slightly deeper. The earlier races and bearings won't work in the later cups.

Reassemble the front end per the Harley manual, and ride free.

—Dave Royal

Tech Tip courtesy of the restoration expert at Panhead Fever (805)343-2932.



WIDE GLIDE CONVERSION

The Ins And Outs Of Widening A Narrow Glide

You notice a wide glide that you like on another bike, and when you go back to your own, all of a sudden the front end looks skinny. Rest easy. You don't have to mortgage your home to buy a new front end. You can just convert your narrow glide to a wide glide.

To make the conversion project go smoothly, do a little homework. There are several styles available, from custom billet (like Bay Area Custom Cycles' Lightning Bolt units, 510-537-3338) to original cast style (from Custom Cycle Engineering, listed at the end of the article). However, aside from immediate eye appeal, there are many questions to consider. For instance, if the trees have fork stops, are they designed to work on your model? Or if stops aren't provided, are you capable of doing some fabrication? If no stops are provided on the new trees, it's important to pre-fit them on the bike with the gas tank in place. It's a good idea to put a towel over the tank when doing this. Carefully turn the new forks from right to left and check clearance. When the new trees are approximately 1/4- to 1/2-inch from the gas tank, mark the bottom tree where it meets the fork stop on the frame. Disassemble and install the stops where necessary. What about the fork lock? Dyna Glides have a neck lock, but is the stem from the chosen kit notched for this? Most bikes are set up to use a padlock. Is the new lower tree on your bike set up for a padlock?

Other things to consider: the hydraulic brake lines are set up for a narrow glide, so you may have to purchase some hydraulic hoses and miscellaneous parts to make it correct for a wide glide. We used Russell Lines distributed by Drag Specialties. If the bike is already custom painted, fender spacers are available to run the narrow brace fende, or you can purchase a new fender with a wider brace. If you're running a dual disc front end, an extra brake rotor spacer will be needed. I recommend having a shop manual at hand.

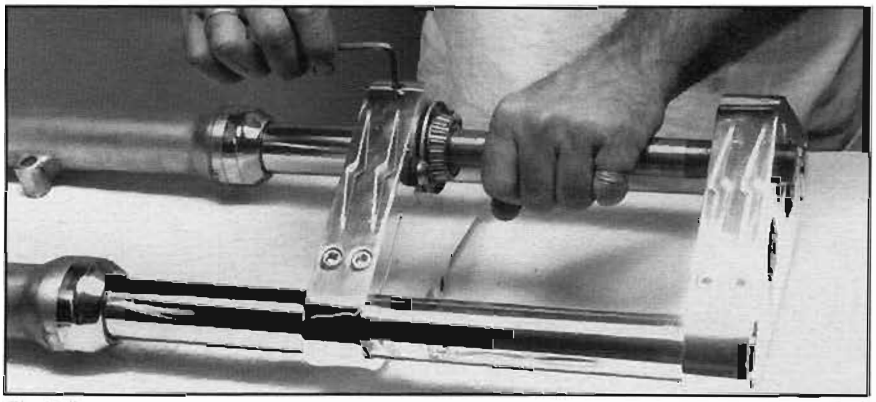


Photo 1

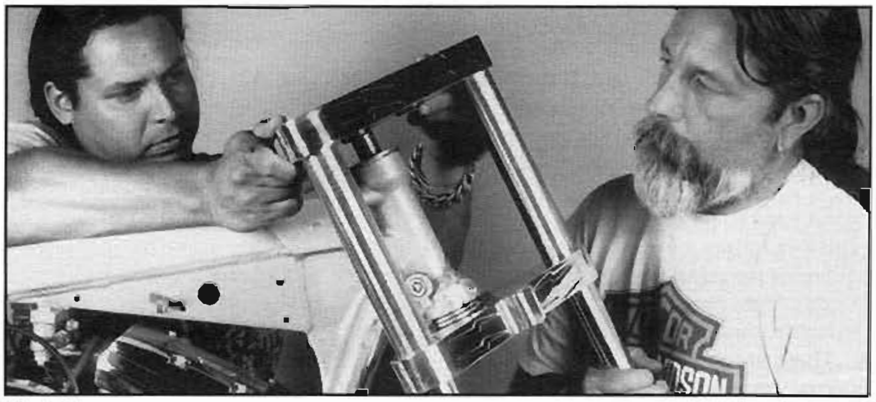


Photo 2

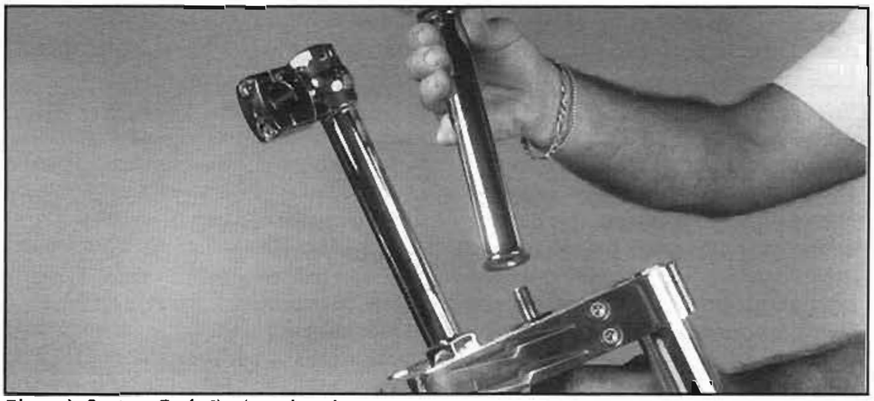


Photo 3: Custom Cycle Engineering risers

Renegade decided his Dyna Glide's narrow front end had to go. Since his bike was already getting a lot of other work done at Jim Waggaman's Air Stream Studio in Carlsbad, California (619-931-5931), he decided to have Jim and his partner Mike Maldonado give it the wide glide treatment.

Installation:

It's real easy to screw up the paint on

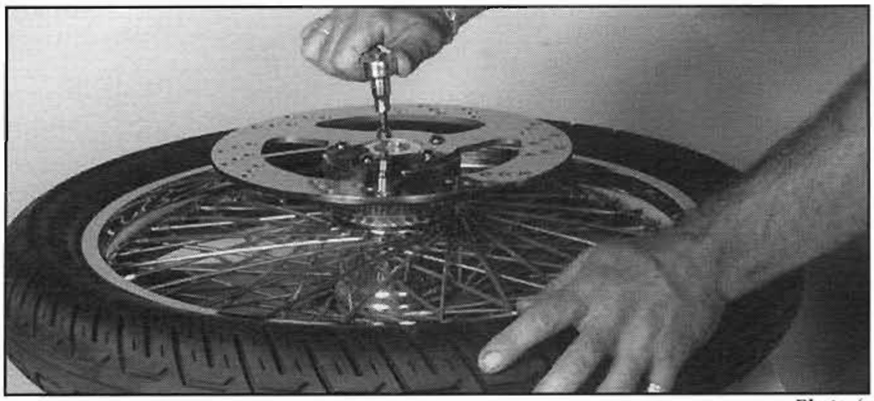


Photo 4

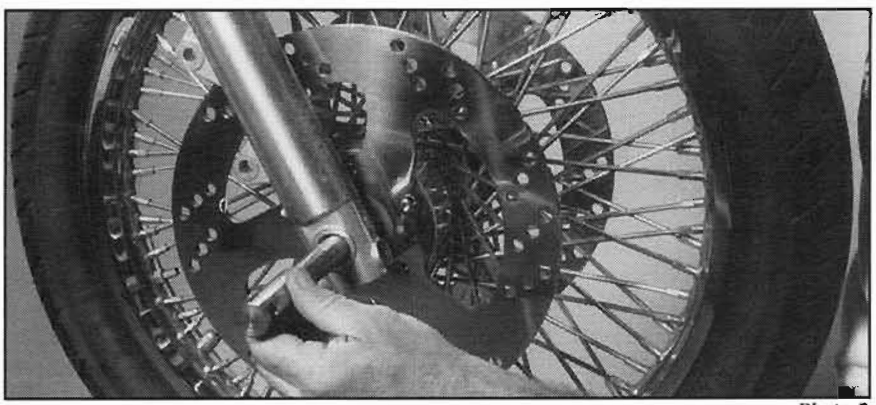


Photo 5

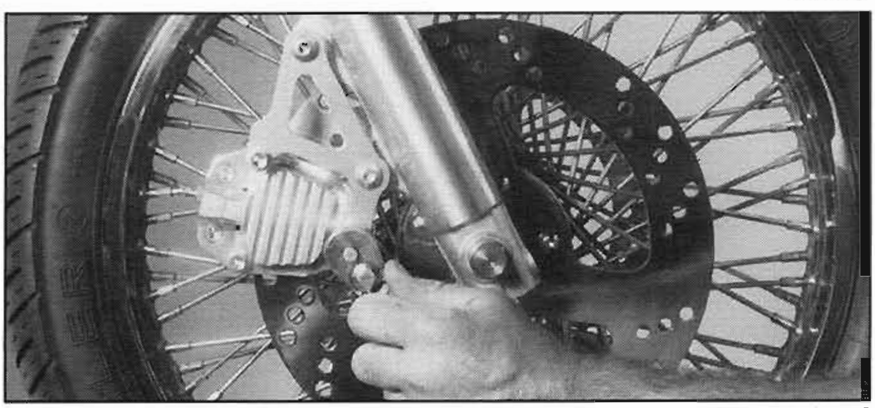


Photo 6

the gas tank when changing the front end, so remove it and set it aside before you even start. Be careful what type of stand is used to get the front end in the air. Make sure the bike won't slide off or fall over (check our Duo-Lift). Since the calipers get in the way of removing the wheel, start by removing them first. Next, remove the wheel and fender. The Dyna has a 39mm front end, so all Jim had to do was loosen the pinch bolts and slide out the lower leg assemblies. With a 35mm front end, you have to remove the fork tube caps (careful, they're spring-loaded).

Remove the hydraulic junction under the lower triple tree. Remove the headlight and handlebars from the upper triple tree. Put a rag on the frame (the gas tank has been removed, right?) and set the bars behind the triple trees. Be careful not to pinch or kink the cables and wires. You can leave the controls and cables in place this way. Loosen the pinch bolt and remove the stem nut, but be careful because when the stem nut is loose the lower tree may drop below the fork stops, turn, and bang into the frame. Slide out the lower tree and remove the bearings and dust shields. Check the upper and lower bearing races in the steering head. If they are either pitted or grooved, then replace the bearing sets.

We're now ready to assemble the new wide glide parts. If the stem and fork stops aren't installed in the lower tree, then install them. Also, now is the time to drill the top tree for wiring. Pack the bearings with bearing grease, install a new lower dust shield and bearing on the fork stem (photo 1), and slide the bottom tree into the steering head. Install the upper bearing, dust shield, and top tree. Hold the lower tree up into the steering head so it does not flop from side to side, damaging the frame. Then put on the stem nut (photo 2). Tighten it until you feel no shaking in the trees and they turn freely. Be careful not to bind the front end.

Install the lower legs and tubes, then tighten the pinch bolts. Grab the lower legs again and check for shake in the trees. If there's no shake—and they still turn free—tighten the pinch bolt on the stem nut. Install the handlebars and the headlight. Install the front fender, using spacers or wider fender braces. This will keep the lower legs lined up to install the axle easier. Remove the brake rotors from the wheel. You may have to use heat to loosen the Loctite on the bolts. Reinstall rotors (we used polished RC Engineering components) with the new spacers behind them and Loctite the rotor bolts so they don't come loose (photo 4)

With the new axle and spacers, install the front wheel (photo 5), and don't forget the speedometer drive. After you torque the axle nut and leg caps, make sure to check the end play in the wheel. Check the manual because it varies with different models. This end play is important. If it's too loose, it could cause handling problems. If it's too tight, it could cause bearing seizure. Install the brake calipers and lines (Renegade worked with Bill Gardner of GMA Engineering-photo 6). Spin the wheel and make sure the brakes are positioned properly and not binding. (We had problems here, and Rick Whitehead of Custom Cycle Engineering helped with his rotor spacers and expertise.) Fill with DOT 5 and bleed the brakes (photo 7).

If you made any changes in the handlebars, make sure the cables don't hit the tank. Throttle cables can ruin paint jobs.

Double-check all bolts to make sure everything's tight, then take it out for a ride. This conversion will give your bike a new attitude (photo 8). Enjoy it.

—Gene Koch

Wide Glide Conversion Kit Manufacturers:

ACCUTRONIX, 17650 N. 25th Ave., Phoenix, AZ 85023, 602-993-2606, FAX: 602-993-1909

Arlen Ness, 16520 E. 14th St., San Leandro, CA 94578, 510-276-3303, 800-223-6377, FAX: 510-276-3534

Custom Chrome, Inc., 6100 Jacqueline Ct., Morgan Hill, CA 95037, 408-778-0500, 800-359-5700, FAX: 408-778-2042

Custom Cycle Engineering, 629 S. Rancho Santa Fe Rd., #309, San Marcos CA 92069, 800-472-9253, FAX: 619-941-6489

Drag Specialties, 9839 W. 69th St., Eden Prairie, MN 55344, 612-942-7890, 800-222-3400, FAX: 612-942-7891

GMA Engineering, 2808 Q St., Omaha, NE 68107, 402-734-6141, FAX: 402-734-1574

Milwaukee Iron, 3000 Lennox St., Lynchburg, VA 24501, 804-845-7688, FAX: 804-845-7687

Pat Kennedys Custom Motorcycles, 905 E. Fremont St., Box 670, Tombstone, AZ 85638, 602-457-2237, FAX: 602-457-2239

Photo 7

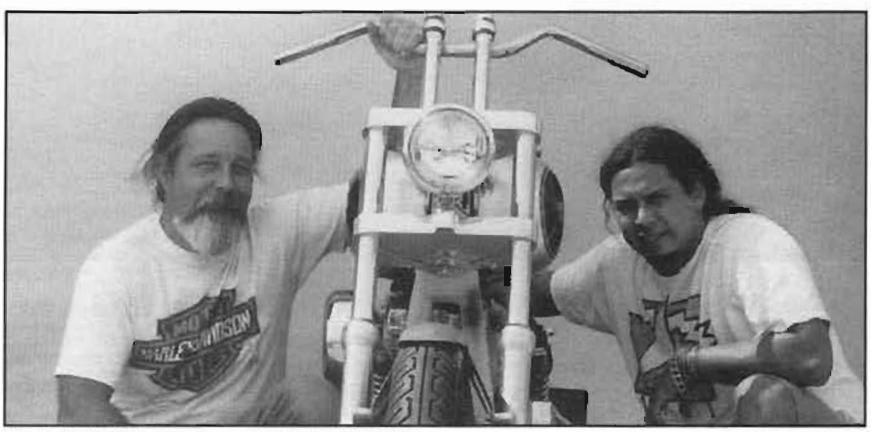
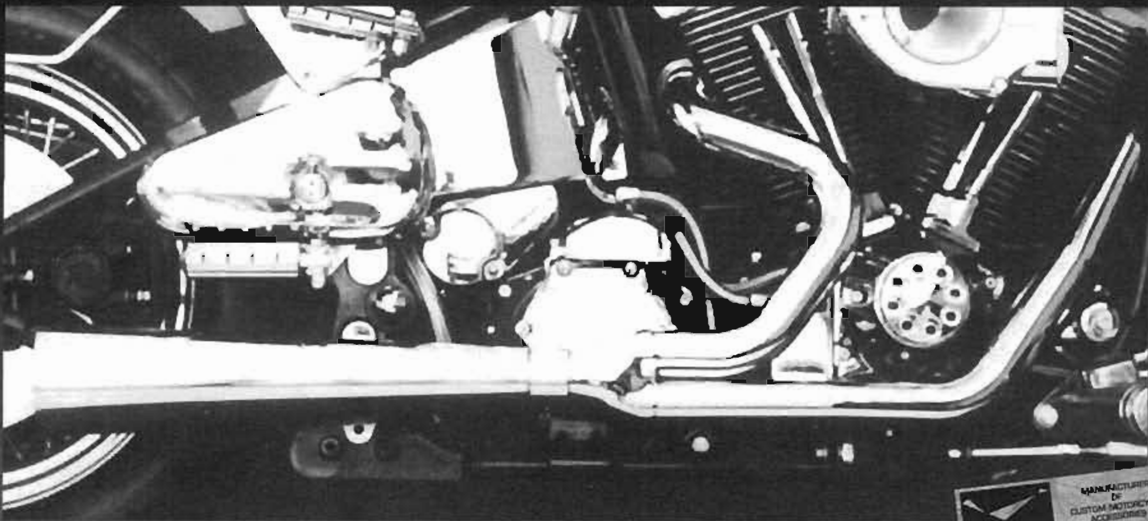


Photo 8: Jim Waggaman and Mike Maldonado

Mongoose Performance Headers



- The latest design from Run Roader Inc., these Mongoose Performance Headers on the Dyno, made more horsepower and Torque than any other pipes on the market on a bone stock bike.
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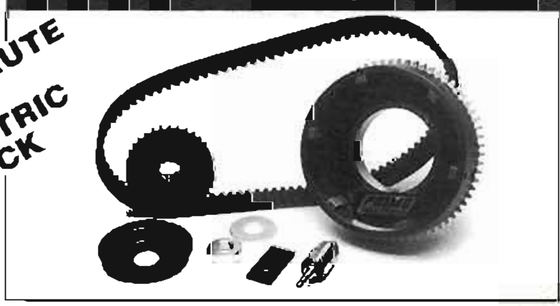
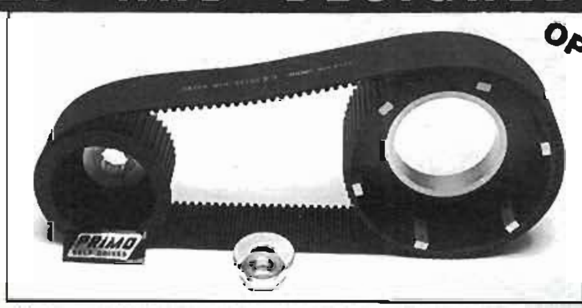


OPEN UNIT 2" & 3"



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SERVICE DEPARTMENT

Photos: Doug Mazel

Performance Handling

Taking A 39mm Front End From Stock To Pure Silk

FXR and Sportster front ends have damn fine reputations, but that wasn't enough for this new hop-up tech. We wanted to take the stock Sportster glide and add some finesse to it. The man for the job in this end of the woods is the Sportster guru himself: Roger Kallins of XRV Performance in Burbank, California.

In this tech tip, Roger explains his special formula for modifying a Sportster front end in order to achieve better, more positive handling. As he accurately demonstrates, it's the little things that count. In addition to his personal touches, he will install Gold Valve Cartridge Emulators from Race Tech.

The owner, Paul Thede, supplied the directions to this simple installation that transforms the damper rod system into a more precise and flexible variable-rate dampening system. Dampening is controlled by a series of holes in the damper tube. Large holes control the oil flow during compression and a smaller series of holes control the surge of fluid during the rebound motion.

The holes are constant; consequently, they perform perfectly under one series of conditions and not as ideally under others. The cartridge allows more flexible dampening over a broader range of conditions.

So, let's hit the garage for the master's recommendations: First, remove the forks, twist off the fork cap, remove the main fork spring, and drain the fork oil. Remove the dust cap and the seal with a small drift and light hammer (photo 1). Be careful not to mar the lower leg—your chromer will never forgive you.

From the bottom of the lower leg, remove the 7mm bolt with an 8mm Allen, drop off the dust cap seal and dust ring. Then, yank on the fork tube and the complete unit will slide out of the lower leg. With the fork tube upside down, shake out the anti-topping springs, followed by the damper tube mechanism. Don't forget, while you're in the disassembly stage, remove the cup way down in the bottom of the lower leg, and don't forget to return it when you assemble the front end.

Here's the first tip: With a small screwdriver, spread the bushing on the bottom of the fork tube and carefully remove it. Purchase a 1/2-inch wide strip of .015 steel 4.5 inches long (photo 2). Also pick up another chunk .020 inch thick. Wrap the strap around the lower leg where the bushing fits (don't overlap) (photo 3). A 1/4-inch gap is fine. Then replace the bushing (photo 4). Slip the assembly into the appropriate leg. It should be snug and drag slightly, but not bind. If it's too tight, use the .015 thickness.

Remove the top bushing from the lower leg, slip it over the fork tube and, with a small pointed punch, dimple the entire surface of the bushing (photo 5). While you're at it, take a hacksaw and cut along the split seam in the bushing to give it additional clearance (photo 6).

With the bushing compressed around the tube, use a fine file to take the points off the dimple edges (photo 7), then attempt to slip the fork tube with the bushing on it into the lower leg. This takes patience and experience, but you're after the perfect, not binding, snug fit. Don't attempt to shove the bushing all the way in until you are sure of the fit. Replace the bushings.

There are four 1/4-inch compression holes in the damper tube (photo 8). Drill them out and add two more 5/16-inch holes (2 sets of 3 holes). Space them axially (lengthwise) at 7/16-inch increments (photo 9). After drilling, chamfer and deburr the compression holes inside and out. Be careful not to weaken the rod. Don't add to or enlarge the rebound holes and make sure to leave their edges sharp.

Install the Gold Valve Emulator (photo 10) to the top of the damping rod (photo 11). The step on the Emulator must sit into the top of the damping rod, and must completely cover the end of the rod. Reassemble the forks according to your manual. Remember to install the top-out spring and bottom-out cone.

To adjust the Emulator, simply remove it from the fork (you don't have to remove the forks from the bike in most cases). Twist out the springs to

SERVICE DEPARTMENT


Photo 1


Photo 2


Photo 3

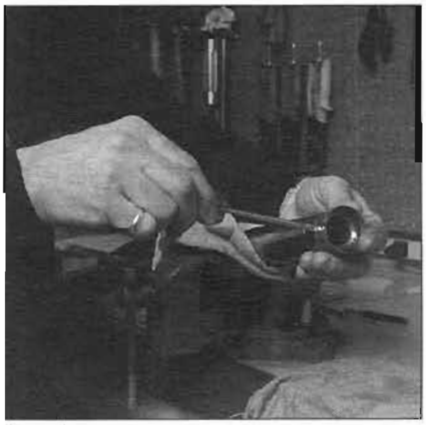


Photo 4

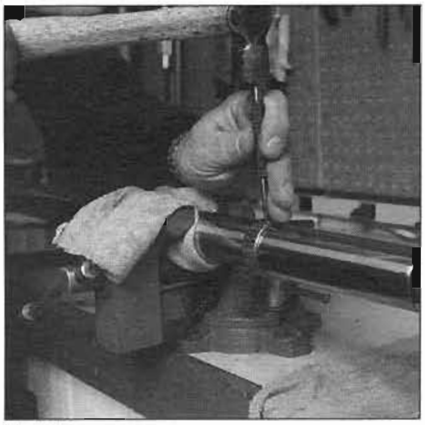


Photo 5


Photo 6

Photos: Marcus Cuff

avoid dripping oil, use a 1/16-inch welding rod with the bottom 1/4-inch bent at 90 degrees to hook into the rebound check valve slot capturing the Emulator.

Before installation, be sure the jam nut on the Emulator is tight, using a 3/16-inch socket. Use Loctite 242 (blue) on the threads. Race Tech recommends four to seven turns with 20-weight fork oil. Roger recommends using Progressive Suspension 1130 fork springs.

Add fork oil 5½ inches from top with fork collapsed and springs removed! Spring preload should generally be in the 1/2- to 1-inch range. Remember that the fork cap may supply some of this preload. Use only one piece of PVC pipe as a spacer. Do not stack slices. Any changes in preload should be done in 1/4-inch increments.

With the front end replaced and checked, take it for a ride. It may

Photos: Marcus Cuff


Photo 7


Photo 8

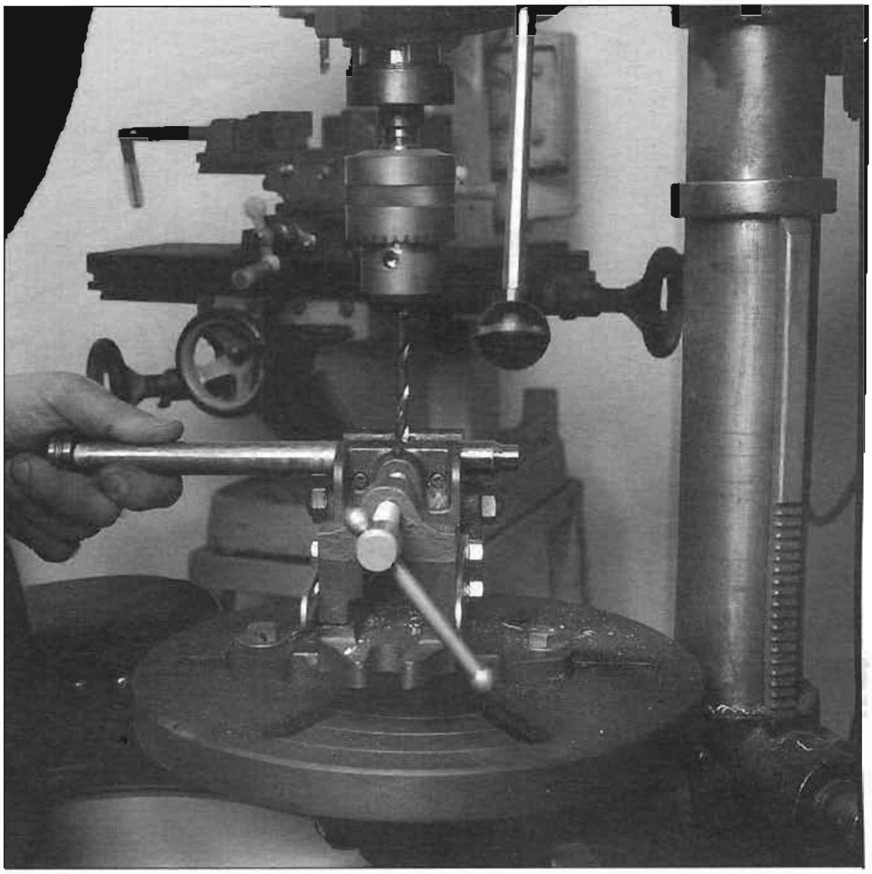


Photo 9

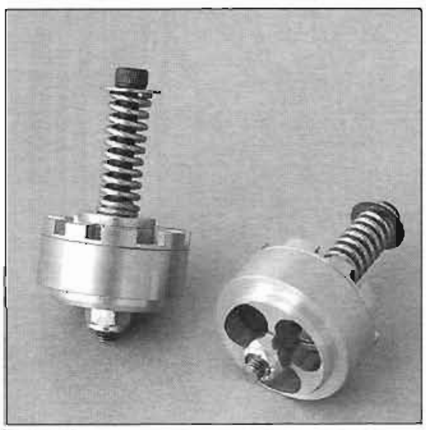


Photo 10

take three to five miles for the Emulator to seat in before a considerable difference is noticed. In a future issue, we'll cover lightening the wheel and beefing up the stopping power on your Sportster. You won't want to miss it

—Wrench


Photo 11


Photo 12

Shop List

XRV Performance • 10428 Burbank Blvd.
North Hollywood, CA 91601 • (818) 762-5407

Race Tech • 3227 Producer Way #127
Pomona, CA 91768 • (909) 594-7755

Progressive Suspension • 11129 G Ave.
Hesperia, CA 92345 • (619) 948-4012


...THE WAY IT WAS.

NOT JUST ANOTHER SOFTAIL

It hits you all at once. Even after you've bolted on every chrome doodad imaginable and blown your life savings on paint, your Softail still looks like every other one parked at the weekend watering hole. You stare at the squatty factory front end and yawn at the rest of the chassis. Every little chicken turd of an assembly line weld screams out its crudeness. It's time to get down to business and cut up the bike.

The first step is to get your bike off the ground and pull off your front end. If you plan to make the frame a color other than black, take the whole bike apart. If step one is too scary or hard for you, find a customizer you trust (like Mike Kelly and Len Lockmiller at *Easyriders* of San Diego), and take this article,

A "V" is cut directly behind the neck and into the top frame tube casting

your ride, and your checkbook down to visit him.

Let's start with the neck. A "V" is cut directly behind the neck and into the top frame tube casting with a power hacksaw (photo 1). The "V" should extend 3/4 of the way through the top frame tube's diameter and be equal in angle to the degrees of rake chosen to add to the front end.

A second cut is made from the bottom of the casting, following the shape of the neck and ending just below the top frame tube. To create the open neck style, the triangle between the neck and the front down tube castings must be cut out entirely with a second hacksaw cut along the line of the down tubes, meeting the other cut (photo 2).

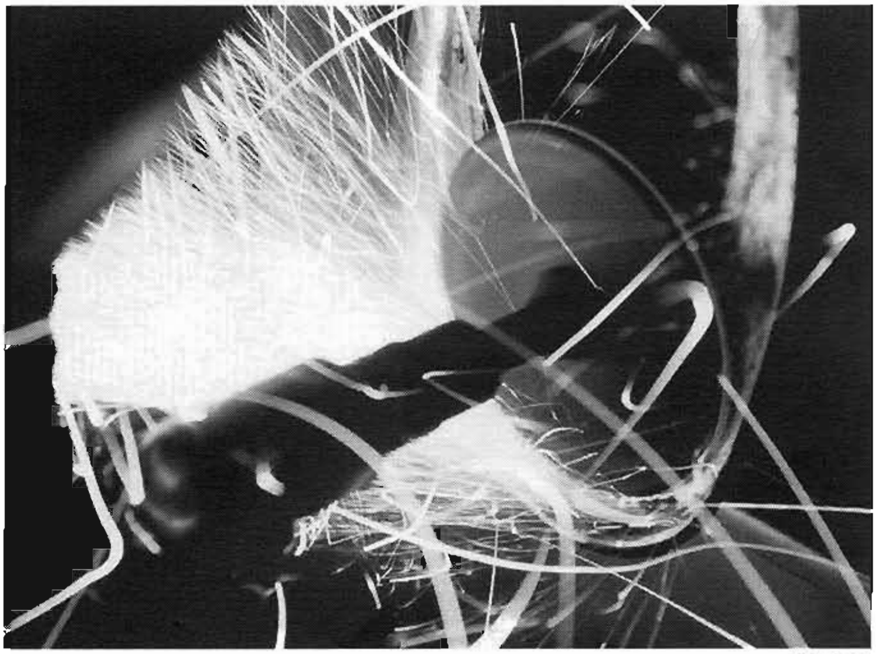
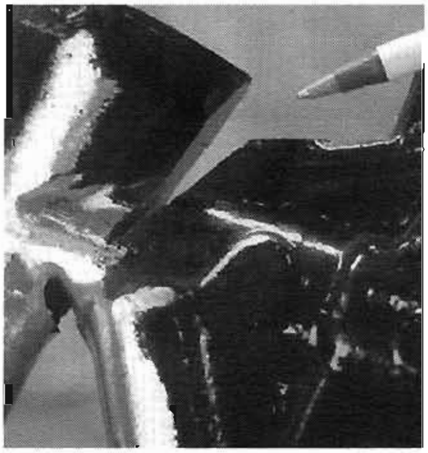


Photo 1



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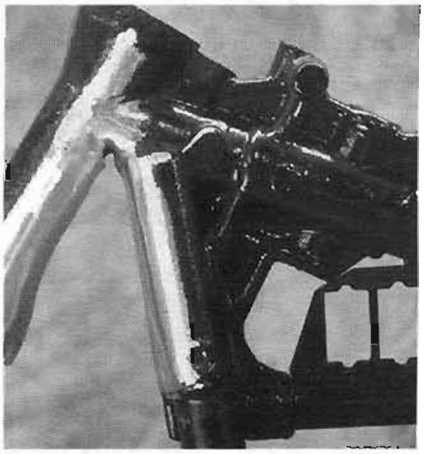

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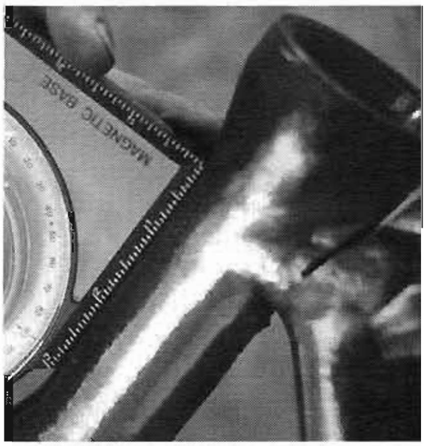
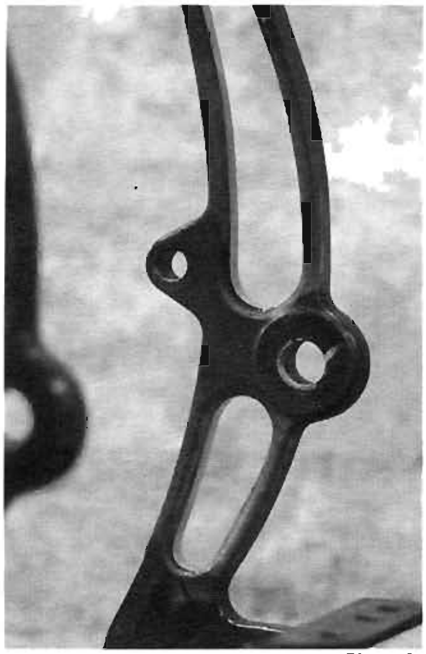


Photo 4

Photo 5

Secrets of Frame Modifications



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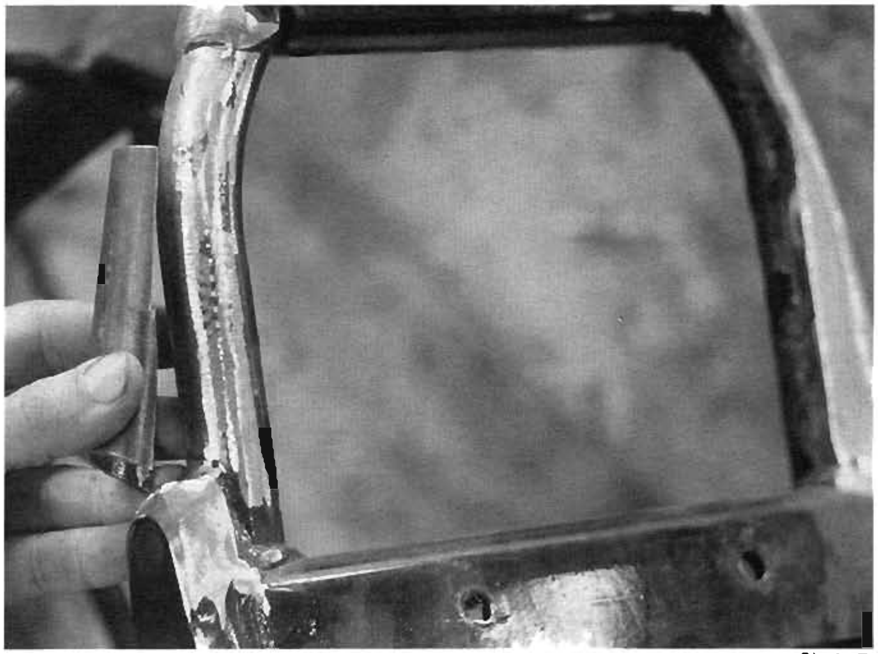


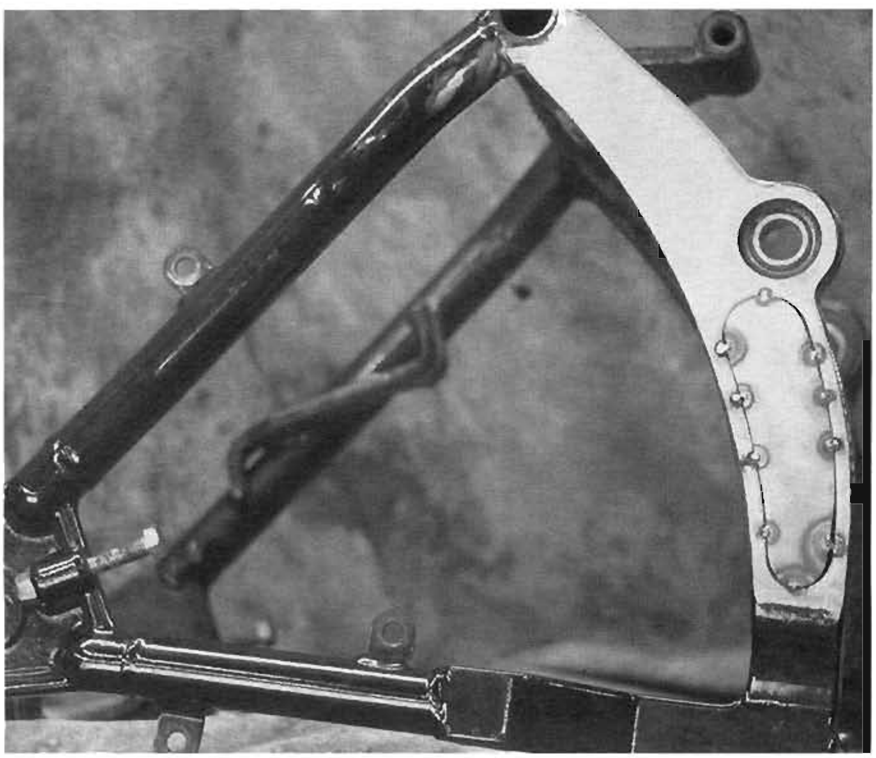
Photo 7

A 30-inch long, 1¼-inch diameter tube is stuck into the neck as a lever and pulled straight out. The "V" in the top frame tube will close up (photo 3). The angle should be checked with a magnetic angle finder to make sure the desired rake has been reached. Measure from the end of the lever tube to each of the foot control mounts on the lower frame down tubes to make sure the neck is straight. The distance should be the same.

A new bottom neck brace is made out of 1/4- inch steel bar. Using cardboard, a template is made first so the section of bar can be cut and shaped to fit perfectly. The bike pictured here is being fitted with Milwaukee Iron's billet triple trees and new internal fork stops for 1989 and earlier Softail frames, but if you plan to keep your front end stock, make sure the new bottom neck brace sits low enough for the fork stops on the bottom tree to hit. Spot welded in place, the brace is checked for level and then TIG (Tungsten Inert Gas) welded into place (photo 4).

A little die grinding with a carbide rotary file and the neck is complete (photo 5). With a smear of Bondo body filler here and there to fill in the rough spots, spray on some paint and you can slap together the front end as soon as it's dry.

One option is to clean up the front down tubes. The crash bar mount can be cut off as well as the lower



Photos: Jim Kaiser

Photo 8

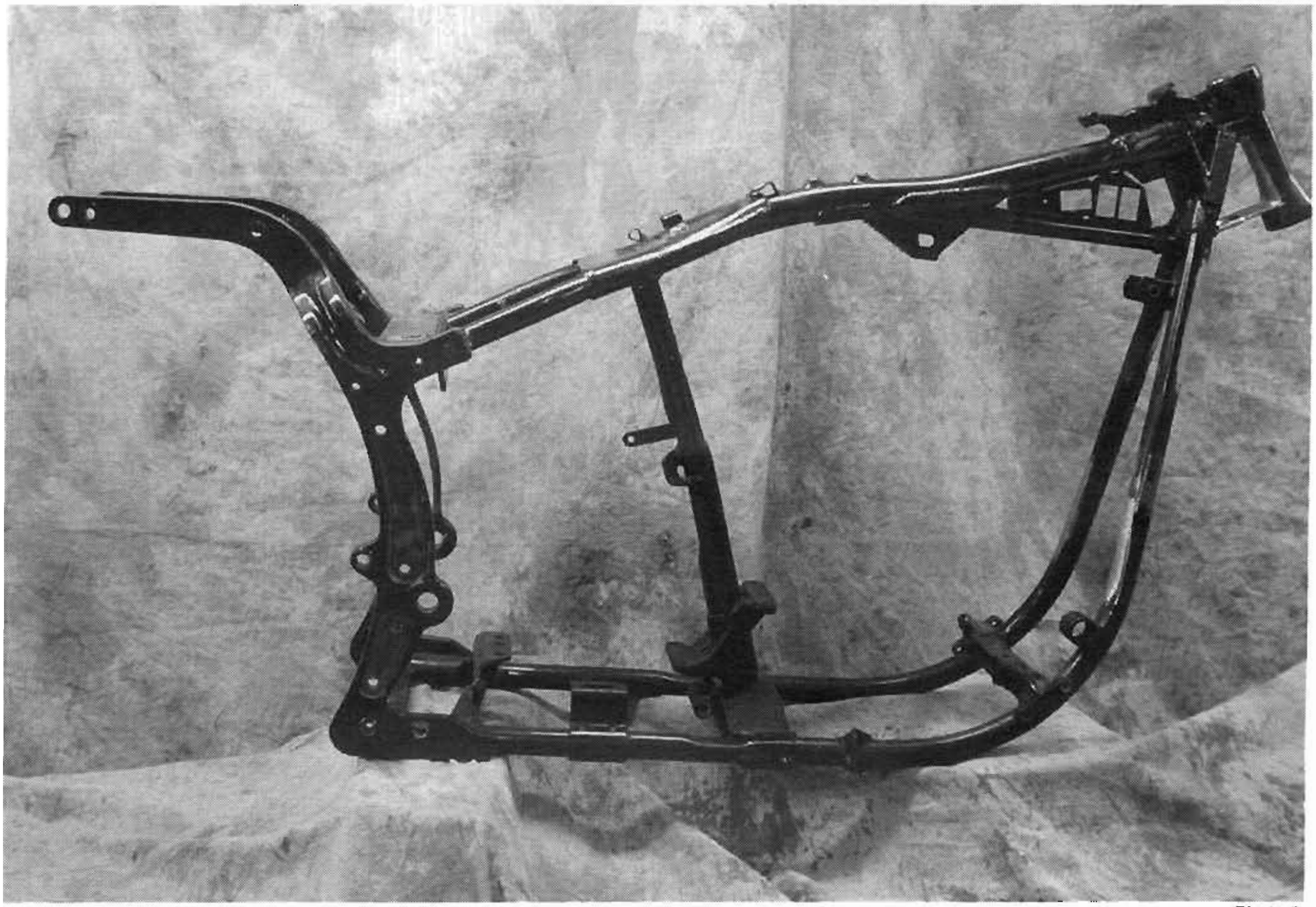


Photo 9

rectifier/brake fluid reservoir mount. If this mount is eliminated, a custom foot control set must be used that incorporates the reservoir in the rear brake master cylinder assembly.

We opted for the clean look of the Accutronix forward controls though it means making a bracket for the reservoir. The bike pictured here will be using a Dyna-S single-fire ignition system from Dynatek, with coils attached to the motor mount, so the stock coil mount has been cut off the main frame support tube to clean it up and create space (photo 6).

If you're going to smooth out all those factory splatter welds and do the killer molding job on the joints of the frame, one section that requires extra attention is around the seat pan/fender strut horn area. A ton of Bondo would be needed to make this area smooth. Since body and paint men agree that Bondo shouldn't be applied more than 1/8-inch thick, an easy way to make the frame tube flow into the strut horn casting is by cutting a piece of 1 ½-inch diameter by 3 ½-inch long piece of tube diagonally (photo 7). This can be TIG- welded in place and ground to shape (photo 8). Then only a skim coat of body filler is needed to smooth out surface imperfections.

For the frame shown here, the builders at *Easyriders* of San Diego decided it would be trick to cut out the indents in the rear uprights of the frame. This is done with a Plasma cutter and should be done only by a professional who knows how to keep the metal from overheating.

Cutting out the rear of the frame will limit the bike's ability to jump 18 buses

Now the swingarm will show through the uprights. It can be cut out to match the frame, but if the bike's being lowered, the cutouts won't line up, and that looks hokey. Since Progressive Suspension Softail shocks will be used to lower the bike, the indents in the swingarm have been welded smooth. Using a cardboard template, pieces the shape of the indents are made out of 18-gauge steel sheet. These are tacked in place with spot welds first to keep the metal from warping as a weld is run all the way around (photo 9). After grinding the weld and sanding with 80-grit sandpaper, the side of the swingarm is smooth. The uprights of the swingarm will be chromed to show a contrast through the frame cutouts.

For the skeptics in the crowd, cutting out the rear of the frame *will* limit the bike's ability to jump 18 buses or the fountains at Caesar's Palace, but for going from bar to bar it will be just fine and look dynamite.

At this point your frame's been raked and molded, with some neat tricks thrown in for good measure. Now, simply put the bike back together (or just the front end if you gave up after the rake job). You won't be disappointed, and you'll dig the crowd that forms when you pull up

Wide Tire Softail

Widening Your Softail Fender


Photo 1

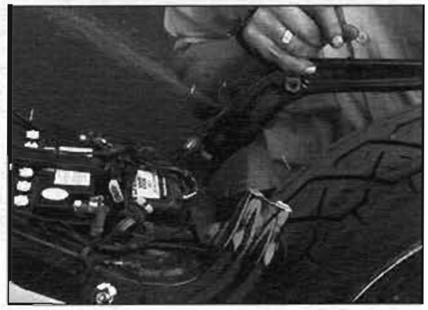


Photo 2


Photo 3


Photo 4

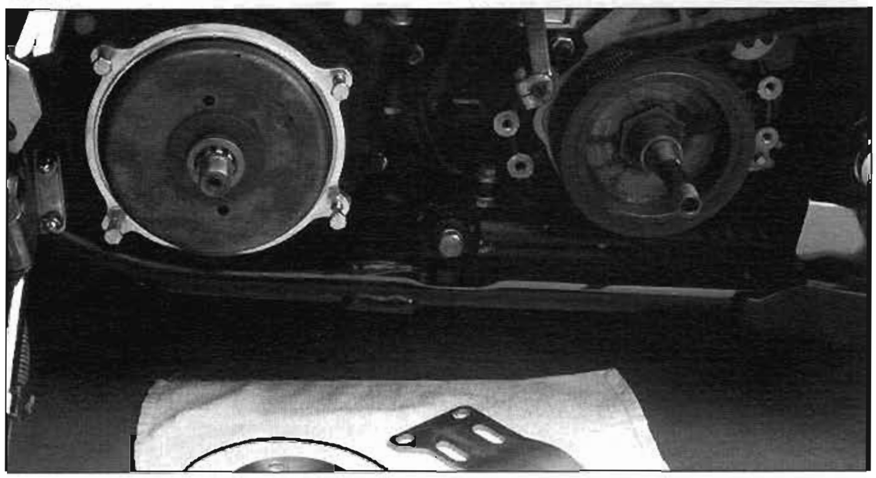


Photo 5

You've been looking real hard at your Softail and toying with the idea of throwing on a beefier rear tire. Whether it's a passing whim or an all-out, gut-wrenching obsession, the only way you're gonna find out is by widening your Softail fender and making room for that meat-packin', pavement mauler 150-series rear skin. Before you get started, though, you might find it helpful to review the following step-by-step Softail fender-widening process used by Marty Ruthman at Hi-Tech Custom, Van Nuys, California.

Marty begins by disassembling the rear fender assembly and removing the fender. Next, he measures from the center of the lower strut mounting bolt (below seat, closest to swingarm) up the rail 5¼ inches, and marks the middle of the bend that brings the two rails inward. Marty's always careful about double checking his marks and measurements in order to avoid turning his frame into an expensive boat anchor. He uses a cloth tape measure because it bends with metal. He then cuts horizontally—level with the top of the rail (*not* the ground)—in order to keep both sides even (photos 1 and 2).

Next, Marty uses a special set of fixtures (photo 3) which he installs to facilitate rewelding (photo 4) the cast iron strut support back to the frame—moving each side out 3/8 of an inch to achieve the desired 3/4-inch total width gain (just enough to accommodate any 150-series tire).

If you don't have a special set of jigs like Marty's, you can use your original chrome outer struts to align the inner struts to the frame to be welded. This is done by using a 3/8-inch spacer between the chrome outer strut and the frame. You'll then want to use a threaded rod at the front and very rear holes of the inner strut in order to secure it to the outer strut. Be sure to check alignment from side to side and adjust (as necessary) by moving the nuts on the threaded rod. Whether you use this procedure or a pair of special fixtures like Marty's, it is critical to make sure that both the right and left strut supports are aligned properly before welding.

Since you're dealing with cast iron, welding should be done with a MIG or TIG—*not* gas! MIG or TIG-welding is much quicker than conventional flame-welding, which means you don't have to worry about your metal's strength or structural integrity being distorted or compromised by excessive heat build-up. And if you have any second thoughts about doing the actual welding yourself, Marty recommends having a professional lend an experienced hand for this procedure.

The next step after welding is to grind the welds, particularly on the inside—by the supports—to prevent scratching the fender when reinstalled. Also, while you're still in the grinding mode, be sure to grind down the two small tabs on the inside of each support (that had the original seat strap bolted to them); grind off approximately 1/4-inch on each tab (on the inside) for fender clearance.

Next, Marty installs the Ness Big Wheel kit (photo 5)—available through any major distributor—per Arlen Ness' instructions. The purpose of the kit is to move your transmission and inner primary over to the left so that your belt will align with the rear wheel without any interference.

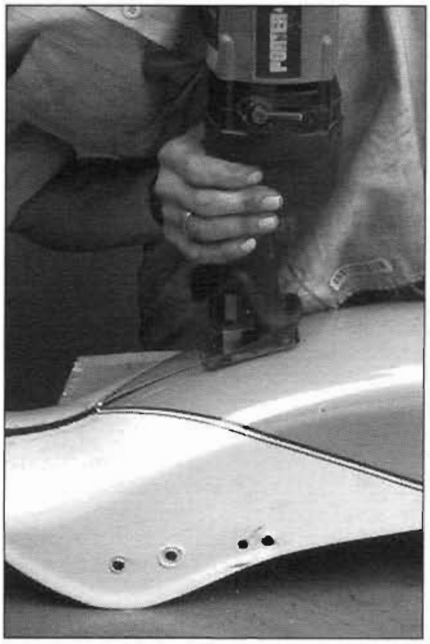


Photo 6

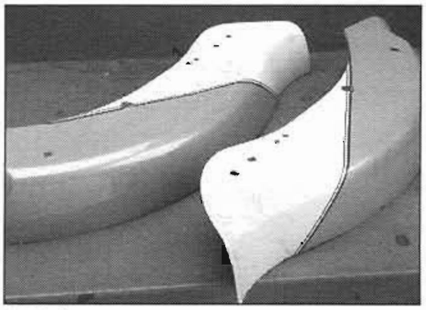


Photo 7

Photo 8

Photos Markus Cuff

Photo 9

Okay, it's time to throw on some rubber. Marty recommends Avon's Super-Venon 150 by 16; he feels they're the widest of the 150s. When you're done drooling over the way all that added beef looks on the rear of your ride, you're finally ready for the actual fender widening. First, you'll want to saw the fender down the middle—from front to back—(photo 6). Although Marty uses the speedy ban saw, your Sawzall or skill saw will get the same job done (photo 7). Next, install a 3/4-inch wide by 1/8-inch thick cold roll strap of steel—or any metal of your choice—form it to the contour of the fender (butting it to the fender, not overlapping), and clamp it in place.

Then, once you've carefully checked fender alignment from side to side and front to back, tack-weld the metal in place (photo 8), turn the fender over and finish welding the inside—metal rod, gas, or MIG are all okay to use here. If you're welding a Heritage-style fender with a taillight mount in the center, the mount will need to be reworked; otherwise, it will be too wide for the taillight. The simplest solution is to remove the mount from the fender prior to cutting, then re-mount it after the fender is widened.

By now, you're in one of two categories: A) You've re-worked your fender, you're happy with it and ready to proceed. B) You've created an interesting conversation piece for your fireplace mantle. If you're in category B, or if you never intended to re-work your own fender in the first place, then there's no harm in going out and picking up one of those aftermarket fiberglass jobs; either way, it's time to install that bad boy.

When installing your new, custom widened (or aftermarket fiberglass) rear fender, Marty points out that it's important to use the shortest bolts and thinnest nuts possible in order to retain optimum tire clearance (photo 9). During the actual installation of the fender, it will be necessary to space the fender struts (under the seat) 3/8 of an inch away from the frame. This can be done with either regular spacers or with Hi-Tech's Custom Frame and Fender Strut Spacers ($98.90 per set in chrome, Hi-Tech Custom, 5931 Van Nuys Blvd., Van Nuys, CA 91401; or, call 818-901-7037). Next, check belt alignment as well as the clearance between the belt and tire. In the event that you're still slightly shy of your desired clearance, then a small amount of the tire's sidewall can be ground down or sanded off. It's *extremely* important, however, to shave no more than 1/8-inch where the tread meets the sidewall.

On the fatbob custom Softail fender, you will need to fabricate your own taillight/license plate support or purchase Hi-Tech's custom billet unit ($145 polished, $185 chromed). Marty recommends you make your own, if possible, due to the irregularities of fenders after being widened and welded; or, send him a template and he can fabricate one for you for the same price (one week turn-around on polish and 10 days on chrome). That wraps her up. Assuming you've crossed the threshold of merely fantasizing about transforming your once-tame Softail into a full-tilt, down-and-dirty digger, this is where some real rubber finally meets the road.

—Clay Dog

THE ANSWER TO A HARD-RIDIN' SOFTAIL

It was the weekend once again and I had my Softail slammed to the max. I was ready for some serious miles of stylin' and profilin'. That was Friday and by Sunday night I was pure tired from the pounding I took. Southern California may be the place for beautiful weather but it's lacking in the smooth road department. The term Softail can sometimes be misleading. It is a long way from the traditional hardtail but, if you're like most, you spend a lot of time trying to make it look like one. Since the Softail showed up in 1984, people have been doing innovative flips in an effort to get them closer to the ground.

Suppliers came to the rescue with lowering kits for our stock shocks, then came replacement shocks that were adjustable—you name it, you can get it with or without air.

The only problem has been that these upgrades leave us with a less than desirable ride. Well, just when you thought you had seen all your choices, here comes another, and, man, is it different.

First of all, the name will leave some baffled; it is a "Torsion Bar Suspension." The first thing that came to my mind was foreign cars. Well, Ken at KT Components set me straight, and it's actually very simple.

To clue you in, the stock system, or any system that would bolt in as a replacement, works with the wheel travel. For every one inch of wheel travel your suspension only travels 3/8 of an inch. If you're like me and your bike is slammed to the ground, then you are probably limited in the wheel travel department to start with.

Now this Torsion Bar changes all that. Instead of the limited suspension travel, you now get one for one or for every one inch of wheel travel, you get one inch of suspension travel and it eliminates all the drag associated with stock components (i.e. shock spring drag in the shock canister, seal drag due to the pressurized stock shocks which tend to lock until you bounce on them). The fun doesn't stop there. Not only do you get more suspension for your slammed softail but with two small wrenches you can also adjust your ride height in a matter of 15 seconds. I'm talking from pavement dragger to dirt bike. For you folks who pack a little extra from time to time, it makes it easy for you to compensate for your load.

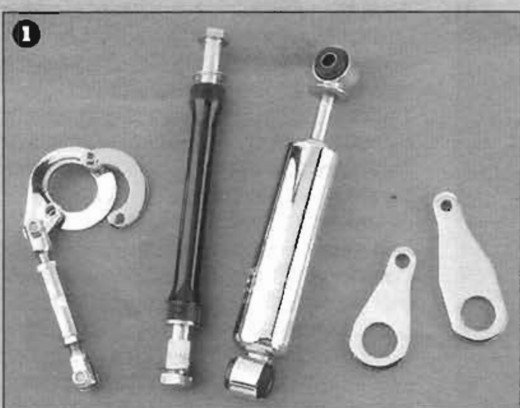
The Torsion Bar comes in three different ranges to suit your needs: soft, medium, and hard. The kit takes about an hour to an hour and a half, depending on how many accessories need to be removed. The kits all come with detailed instructions. I'll walk you through the basics and you can decide if it is for home repair or off to the shop.

The first step is to remove the tire and wheel. You will need a jack for this, of course. Next, remove the stock shocks. Now move to the stock pivot axle. You may need to move the exhaust pipes or tool boxes to get to the pivot axle bolts. Once you're there, loosen the bolts but don't pull them all the way out, just far enough for the pivot axle to come out.

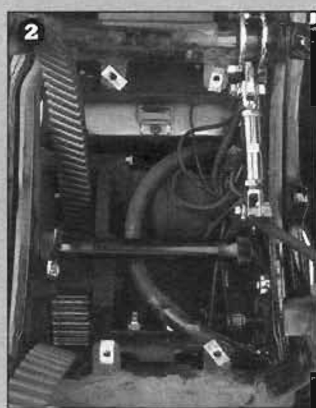
After the stock pivot axle is removed you can replace the pivot axle bolts one at a time with the stainless ones provided in the kit. Now grab the torsion bar and prepare it for installation by sliding the mounting arms on the appropriate ends. Once this is done, slide the torsion bar into the spot the stock pivot axle once was. Leaving the swingarm hanging, install the adjuster link hanger on the swingarm cross member and attach it to the arm on the torsion bar. Now go to the other side and anchor the remaining arm to the frame. Once this is done, install the dampener, which is supplied, and put it all back together.

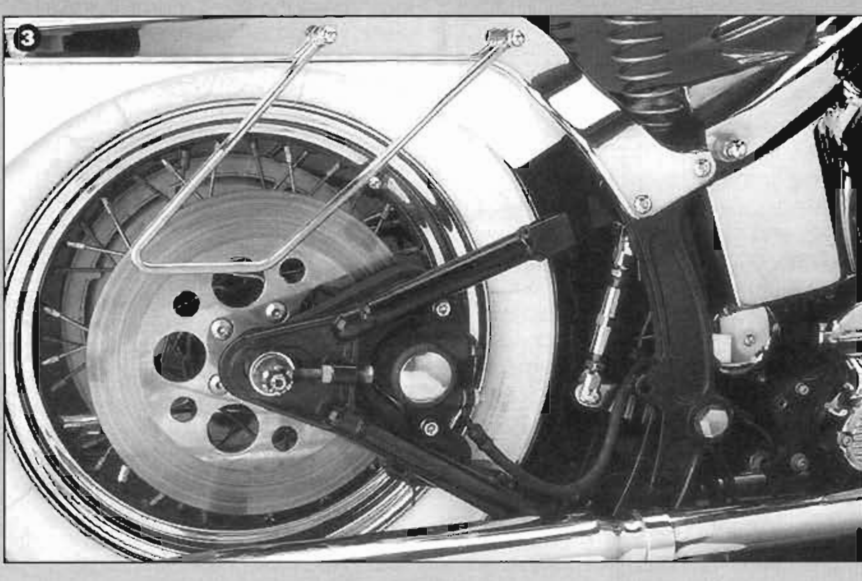
After you finish, just take a 5/8-inch wrench and raise or lower it to your liking. I choose way down and have been riding comfortably ever since. If you think this piece is calling your name then give a call to Ken at KT Components at (800) 847-8618. He'll get one right out to you along with all the assistance you can stand.

—Big Daddy Drew



Photos: Markus Cuff





LOWER YOUR DRESSER

With Minimal Effort And Expense

Most Harley dresser owners figure, because of the air-adjustable suspension with which these models are equipped, that they cannot be lowered without considerable modification. There's also the fear that, once changed, the bike will no longer handle well, support as much weight, or be able to return to original should the need arise. After all, the idea is to improve the look of these freight trains, not ruin their ridability or resale value.

It's true that radical drops cannot be accomplished without tearing the bike completely apart, but thanks to Roger Reiman at Kewanee Harley-Davidson in Kewanee, Illinois, (309) 854-6661, a conservative 1 1/2 inches can be trimmed from her rear with only minimal effort and expense (photo 1). For a little under a hundred dollars, and in an hour or so, you can drop the rear down so that the bottom of the muffler is just about even with the bottom of the rear brake caliper. It doesn't sound like much, but it sure makes a difference visually. Late-model dressers, especially the popular nostalgia-style FLHS, will look more like the older Electra-Glide and Duo-Glide models—without sacrificing the good ride of the modern suspension.

The Roger Reiman brackets simply relocate the bottom air-shock bolts downward, allowing the swingarm to move upward a like amount, thus lowering the bike without altering any other components. Not a complicated or high-tech change, but simple and very effective.

Late-model dressers will look more like the older Electra-Glide and Duo Glide models

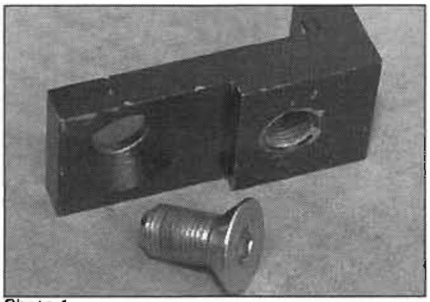


Photo 1

Photo 2

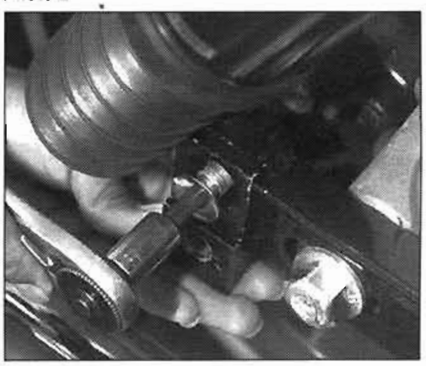
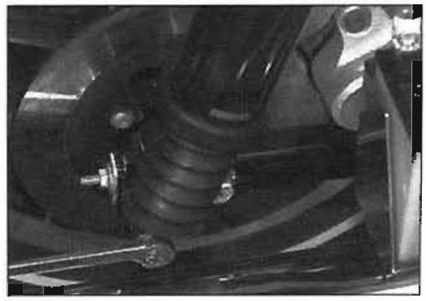


Photo 3

It's best to use a drop or two of blue Loc-Tite on all the fasteners when reassembling the suspension (photo 2), and by all means check the belt tension against the factory specs for your model when you're done (photo 3). And, depending on the specifics of your bike, it may be necessary to space the upper rear bag mounts outward slightly by installing a couple of washers between them and the fender brace (photo 4). The kit moves the shocks outward slightly, and this modification allows clearance between them and the inside of the bags (photo 5).

As a real-world bonus, the use of these lowering blocks also allows short-legged riders, like me, to more securely plant their feet at stops and while maneuvering in and out of parking spots (photo 6). When riding solo, we run about five pounds of air pressure in the rear, and from five to 10 in the front, which provides an excellent ride, allows the bike to ride quite low and the suspension seldom bottoms. We found that this modification also improved the directional stability of our FLHS, especially in fast, sweeping turns.

They come off just as easily as they went on so you can take 'em with you when you trade bikes! What more can ya ask for?



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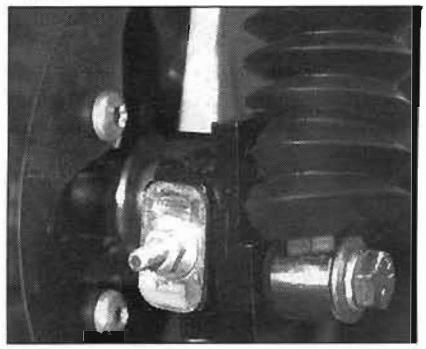

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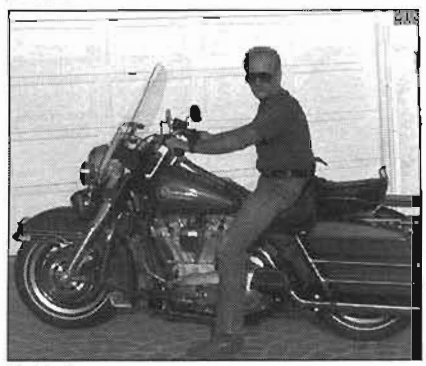


Photo 6

Photos: Eric Pierce

—*Eric Pierce*

DROP YOUR DRESSER

In The Flip Of A Swingarm

There are at least three good reasons to lower a full dresser. First, it helps anyone shorter than 6 feet to place both feet firmly on the ground while waiting for a stoplight. Second, by lowering an FL series Harley the center of gravity is lowered too, so a big Hog starts to feel like a Sportster at slow speeds. The last reason may be the best and has nothing to do with how tall you are or how big your rig feels in the parking lot—simply because they look damned good.

The front end of a Harley-Davidson garbage barge can be lowered much the same way you would an FXR or Sportster—by installing new springs from any of the aftermarket companies (such as White Bros of Drag Specialties) or by cutting the tubes. Dropping the rear the same distance is harder, especially if you want to keep the air-adjustable shock absorbers.

The man with the answer to this problem is Minnesota's Donnie Smith, well-known builder of killer custom Harleys. During a recent visit to his shop, Donnie showed exactly how it's possible to have your cake and eat it, too. He showed us how you can drop the rear of a full-dress Harley by over 2 inches and still retain the stock air-adjustable, factory shock absorbers.

The explanation seems almost too simple, because what Donnie does is flip the swingarm. Before you run out in the garage to flip-flop the arm on your FLH, read on, because like everything else, this isn't quite as simple as it sounds.

Donnie started the project by disassembling the rear of the bike. He and Rob Roehl locked the front of the bike down, then picked up the rear. First he removed the bags, then the mufflers, and finally the rear wheel. The swingarm removal began by disconnecting the shocks on both sides. Next, the transmission was supported because the swingarm pivot bolt supports the transmission as well (the bike used was a '93, so the jack was placed under the

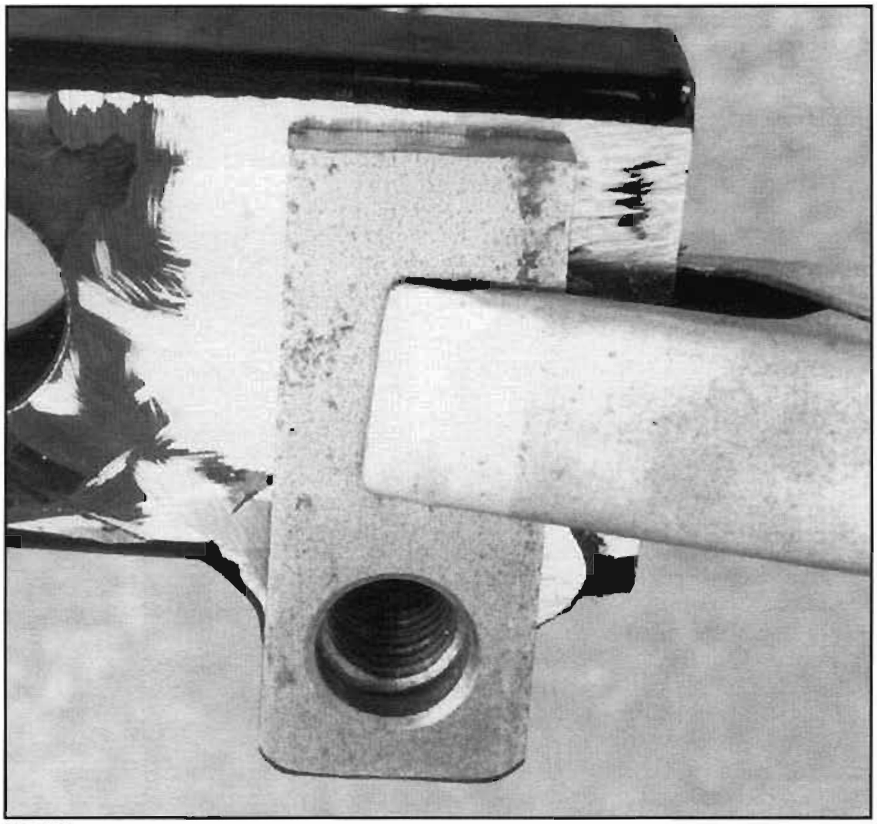
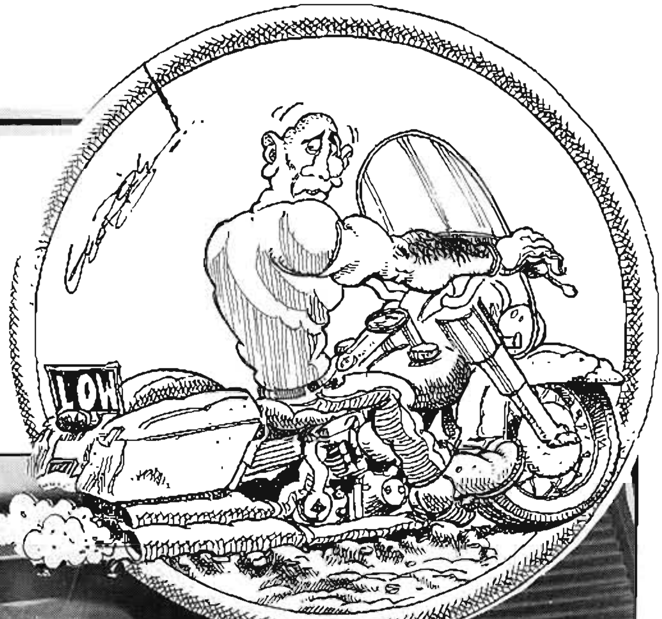


Photo 1

Photo 2



oil pan). Next, Donnie removed the swingarm end cap for the left side. And, finally, the pivot shaft itself can be pulled out the left side.

Donnie doesn't like to just flip and reinstall the swingarm. With the swingarm in the inverted position, the shock absorber pulls on the welded mounting point instead of pushing the mount against the swingarm. In a worst-case scenario, this pulling could rip the shock mounts from the swingarm.

To insure that the shock mounts can't be torn from the swingarm, Donnie cuts a reinforcing plate from one-quarter inch steel plate and uses that to reinforce the connection between the shock mounts and the swingarm (photo 1).

After carefully Heli-arc welding the plate in place (check the photos to clear up any confusion) and touching up the factory paint, Donnie and Rob start the reassembly (photo 2). This is pretty straightforward, except for just a couple of details. Like the fact that the shock absorber's lower mounting point needs to be spaced out from the swingarm about three-eighths of an inch so that the rubber boot on the lower part of the shock won't be smashed against the swingarm (photo 3). The other detail of note is the fact that the reinforcing plate and extra spacers create the need for longer mounting bolts, preferably grade eight quality.

When you're all done, that big sled will sit over two inches closer to the pavement (photo 4). And all it took was an afternoon's work, some quality welding and a longer pair of shock mounting bolts. The ride is unaffected and there is only one real trade-off. If the new setup is heavily loaded, the swingarm itself can come into contact with the upper shock. So don't load on everything including the proverbial kitchen sink and then take the Ultra out across the moto-cross track.

—Frank "Lowboy" Lanz

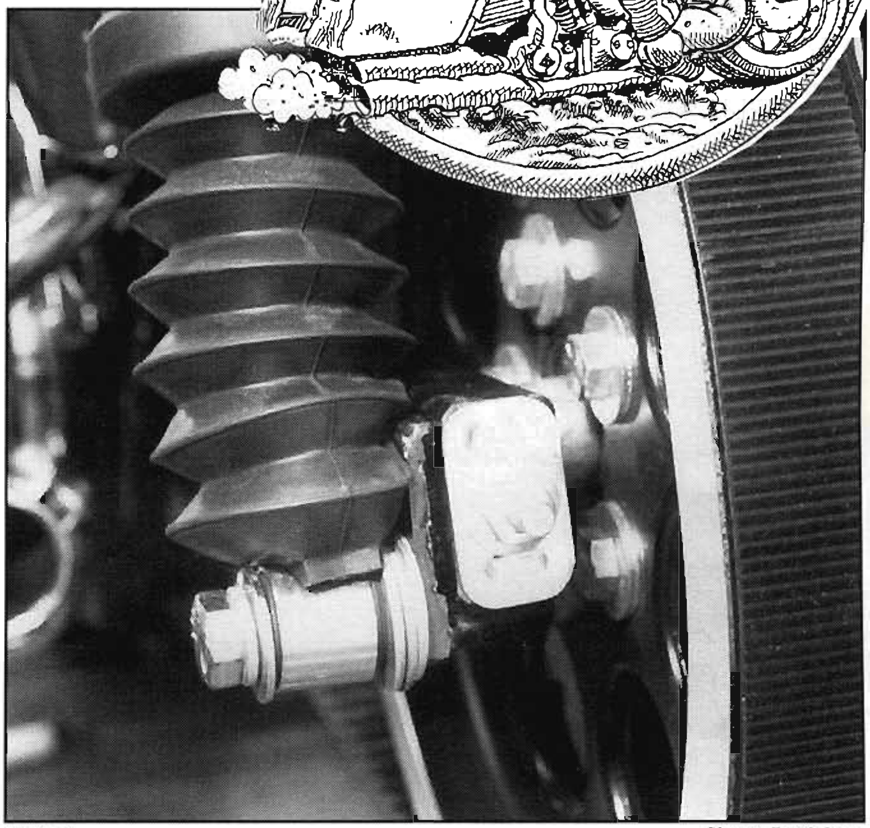


Photo 3 *Photos: Frank Lanz*

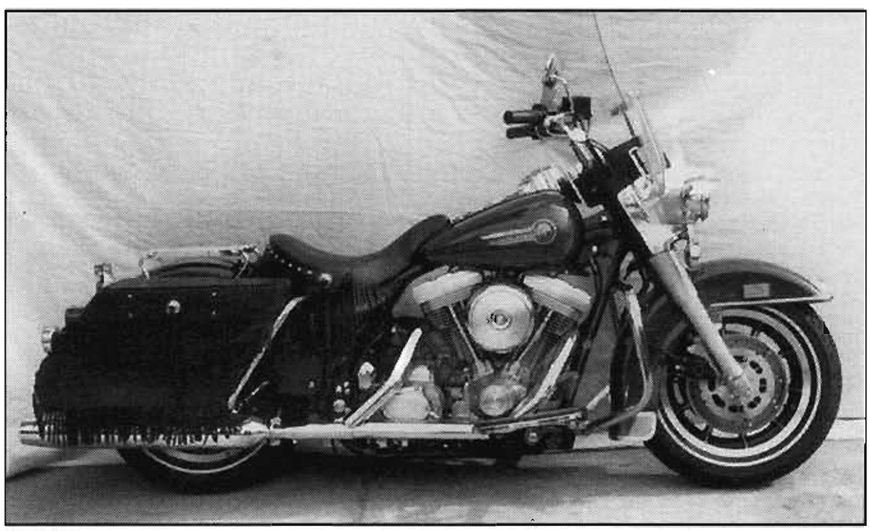


Photo 4

STAYIN' UPTIGHT

Keep It All Together With Fastener Fixes

High performance Harleys spend mucho time running hard, revving high and rolling fast. All that action means they need extra help keeping nuts and bolts tight. Fasteners loosened from vibration and temperature cycling (pun intended) can spell disaster—from dropped-off parts to oil floods to mechanical damage. So, here's a complete, compact cookbook on ways to keep everything connected on your Kawasaki-killer.

It's so fine. First, nuts 'n' bolts with fine threads stay tight better, better than those with coarse threads. The higher numerical pitch permits more even clamping and better leverage against loosening. See Table 1 (page 130) for a guide on common sizes to select. A word of caution, however: because fine threads have less effective depth, they can strip more easily in soft substrates like aluminum castings and brass. Start such bolts by hand, use lubricant and do not over-tighten.

Righteous wrenching. Properly-torqued fasteners are less likely to strip (too tight) or back off (too loose). Use a torque wrench, even on places like side covers. The heads of Phillips and slot-type screws are easily stripped; replace them with head types more easily torqued, especially Allen or socket heads (photo 1): kits are widely available for side covers, even entire chassis. In tight confines and heavy-duties, the use of specialty 12-pointed hardware with extra-wide bearing faces helps; you can get both bolts (photo 2-center) and nuts. See Table (page 130) for a guide to torque settings.

Liquor's quicker. Anaerobic thread locking compounds (photo 3) range in grades from easily-removed (for tool box covers, oil drain plugs, etc.) to semi-permanent (e.g., cylinder base studs). You

Liquid lockers get our vote as generally the best way to keep things together

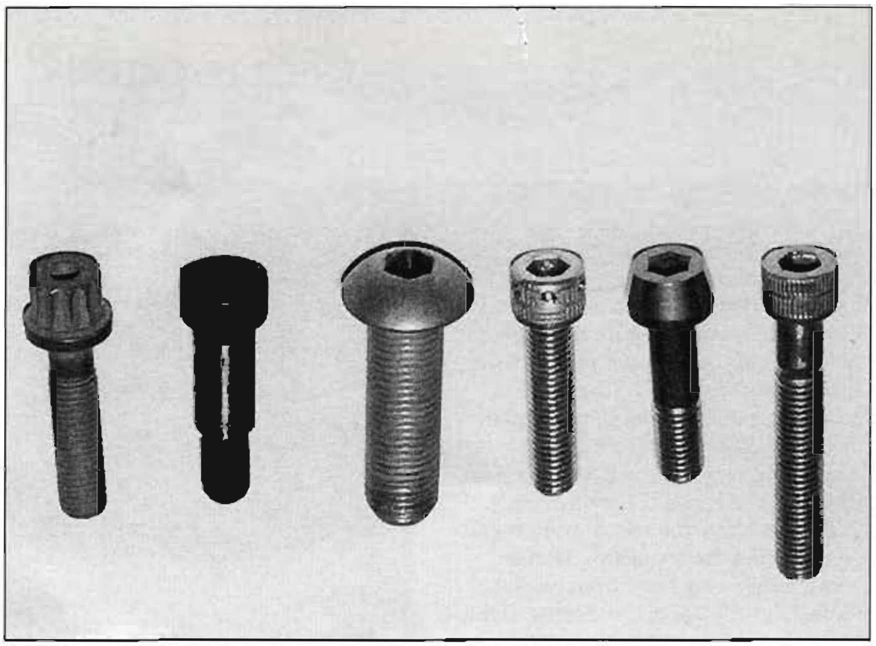


Photo 1

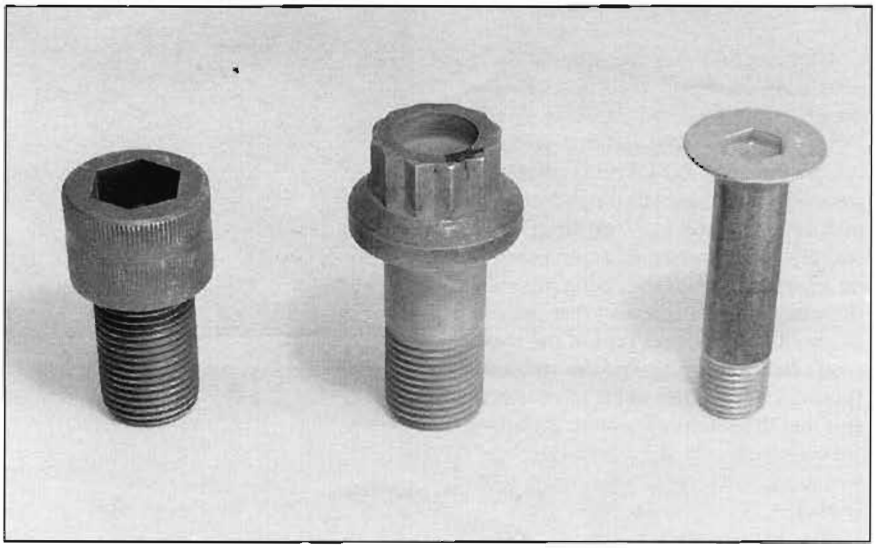


Photo 2

apply these to exposed threads wet, everything gets assembled, and then they set up in the absence of oxygen. Liquid lockers get our vote as generally the best way to keep things together. In some cases threaded lubricants (photo 4) will inhibit the process. Alternatives then include liquid nylon-type lockers that dry fully on the threads before insertion—or the following mechanical alternatives.

Be industrious. A variety of off-the-shelf fasteners from industrial/bearing supply houses (photo 5) have built-in thread lockers; special washers easily add locking. For blind bolt holes, cap screws come with nylon pellet inserts or have pre-drilling for safety wire(photo 6). (More on that later.) Cotter-pinned fasteners are ideal when you need to maintain a fixed end play at less-than-full tightness—axles, cranks, linkages. Nuts feature locking inserts or castellated tops. Locking washer types range from flat spring, to split ring to star (photo 5). Caution: the →

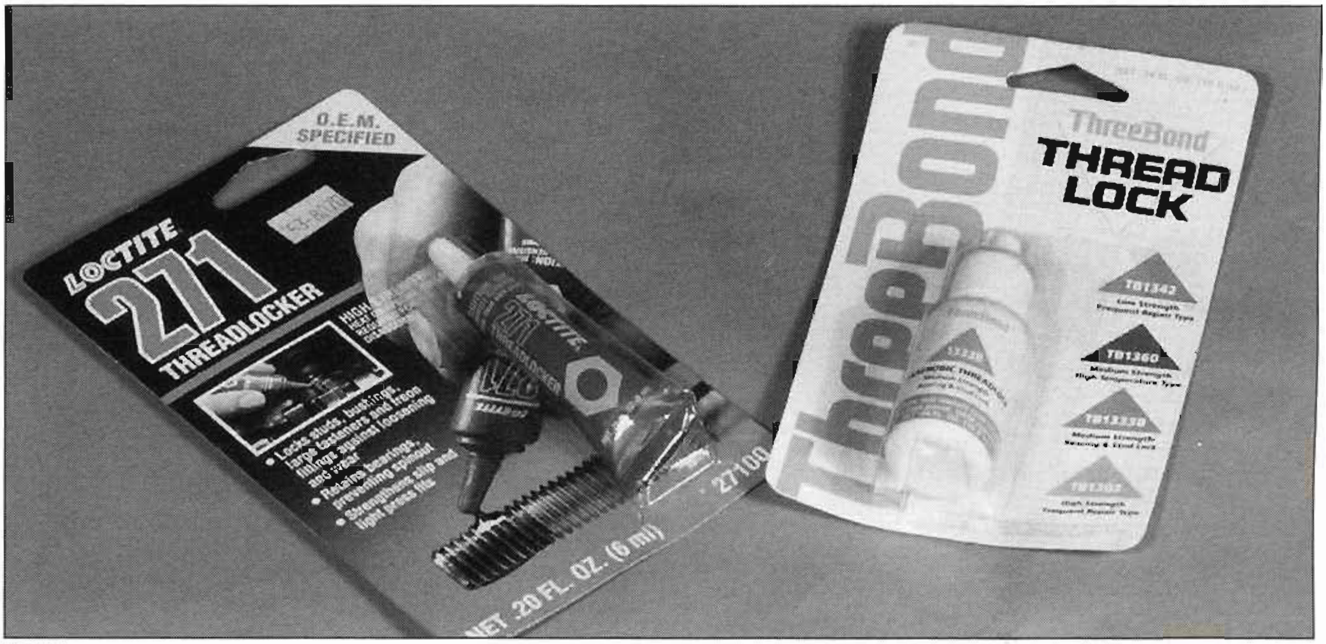


Photo 3

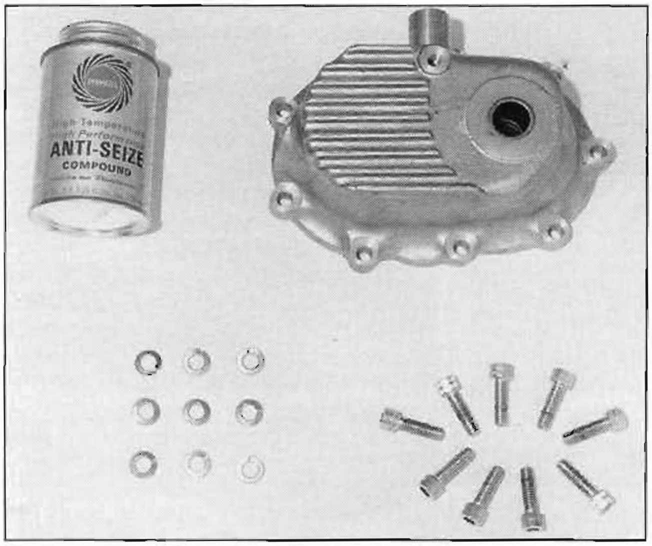


Photo 4

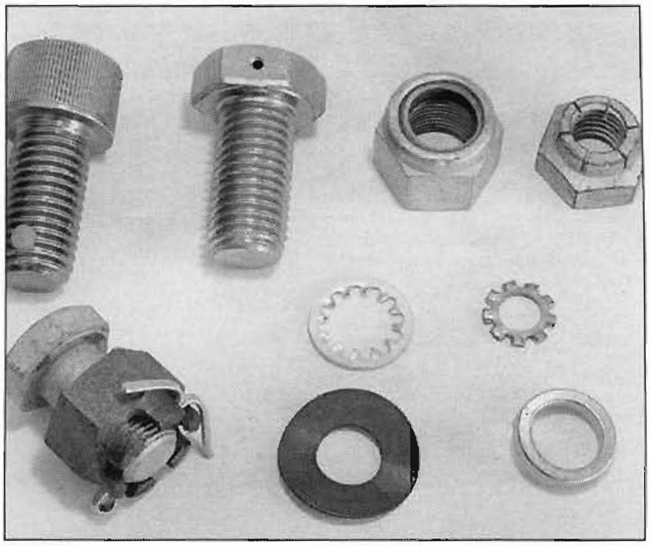


Photo 5

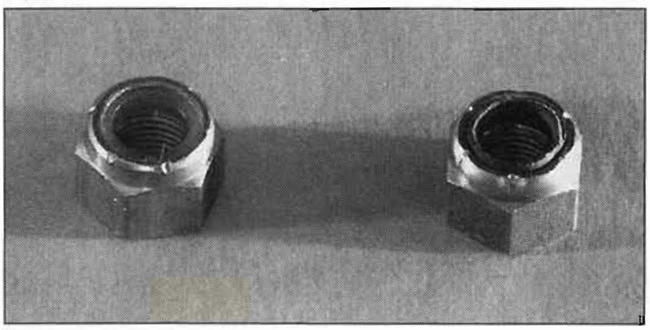


Photo 6

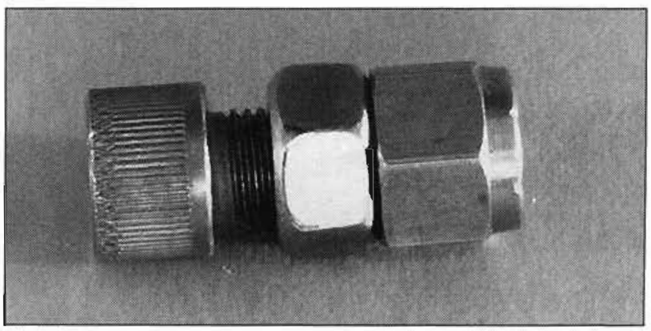


Photo 7

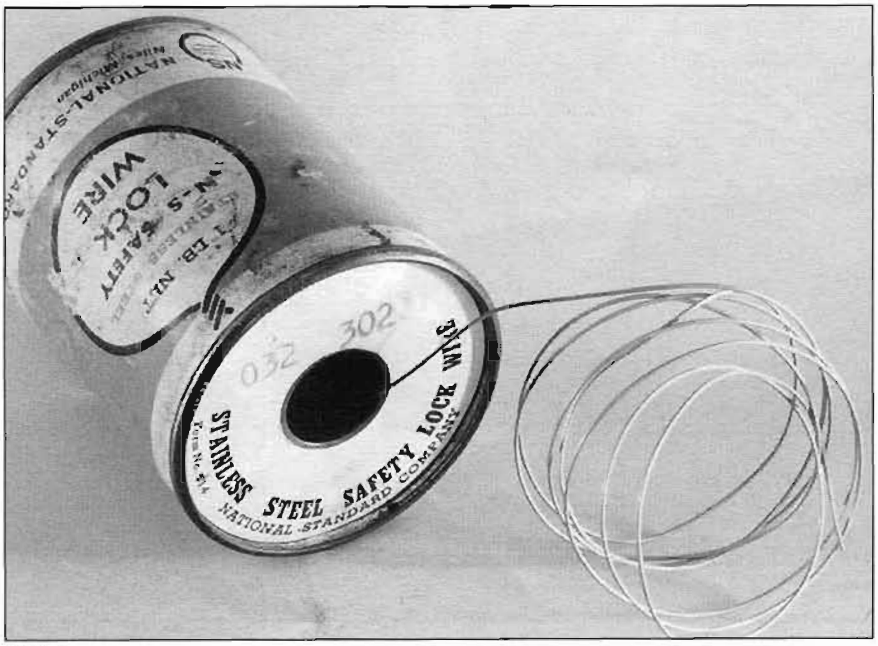
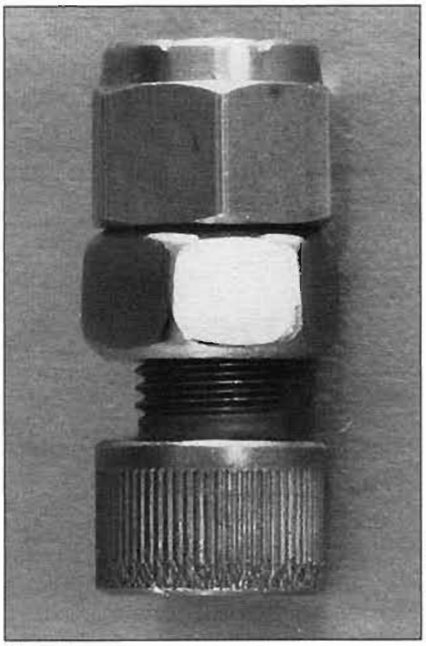


Photo 8



Photos: Jake

Photo 9

Table 1. Selected Fine Versus Coarse Thread Pitches (Threads Per Inch)

Nominal diameter	Coarse pitch	Fine pitch
3/4-inch	10	16
5/8-inch	11	18
9/16-inch	12	18
1/2-inch	13	20
7/16-inch	14	20
3/8-inch	16	24
5/16-inch	18	24
1/4-inch	20	28*
#10 (3/16-inch)	24	32

*early Big Twins used 1/4-24

Table 2. Recommended Approximate Torque By Fastener Size

Nominal diameter	grade 2 (no head marks)	grade 5 (3 head marks)	grade 8 (6 head marks)
#10 (3/16)	2-3 Ft. lbs.	--	--
1/4-inch	5-6.5 ft. lbs.	7-8 ft. lbs.	10-12.5 ft. lbs.
5/16-inch	9-12 ft. lbs.	14-20 ft lbs.	22.5-25 ft. lbs.
3/8-inch	18-20 ft. lbs.	25-35 ft. lbs.	40-45 ft. lbs.
7/16-inch	24 ft. lbs.	40-55 ft. lbs.	65-70 ft. lbs.
1/2-inch	37 ft. lbs.	60-85 ft. lbs.	100-110 ft. lbs.
9/16-inch	53 ft. lbs.	88-115 ft. lbs.	135-150 ft. lbs.
5/8-inch	--	150-160 ft. lbs.	195-210 ft. lbs.

- assumes clean, dry threads
- for lubricated threads, deduct about 10 percent
- use high values for fine threads
- superseded by any specific manufacturer's instructions

teeth of star washers can put deep marks in polished or machined faces. Generally you must buy in lots of 100 per size or type, so pool your needs with bros, then take the plunge.

Hot, still tight. Heat tends to degrade some thread lockers: nylon inserts may loosen or even melt; liquids may age prematurely. For those cases, consider strategies like all-metal castellated nuts on places like exhaust pipe clamps, top motor mounts, and rocker box studs—or heat-proof fiber instead of nylon inserts.

On the cheap. A good emergency locking route is double nutting (photo 7). A second nut is simply tightened against the first. You need extra exposed thread, of course. Don't depend on this permanently.

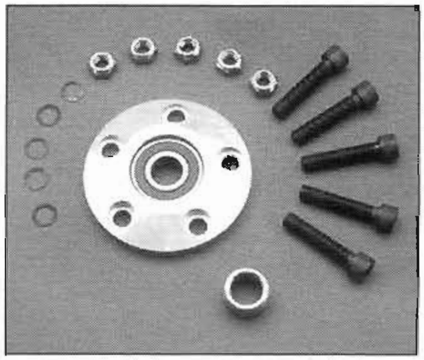
Safety last. A final secure fastening method for serious hardware freaks is safety wire (photo 8). It's time-consuming, since bolt heads must be cross-drilled and the wire then carefully attached and spun in such a way that it holds the fastener tight. Aircraft supply houses offer a "Millbar wire twister" that speeds the process. It's basically a pliers that holds the wire ends—with a spiral cam to rotate the jaws. And the results certainly look bulletproof (photo 9)—sorta like putting your scooter in bondage! Oh yeah, I forgot—this is a family mag...

—Jake

AXLE SUPPORT BEARING
FOR 1973 AND NEWER BIG TWINS

You just had the cam changed and the exhaust system changed and now the bike really flies. Your next step is the heads, ignition, and carb. But before you do anything else, you'd better check the rear belt or chain for excess slack. Belt drives will develop excess slack before chain drives when the horsepower is turned up. The reason for this is as simple as a bent rear axle. How to check the axle for a bend is also simple. Just loosen the axle nut slightly, and, while pushing down on the belt or chain, turn the axle a half-turn. If the drive tightens up, then the axle is bent.

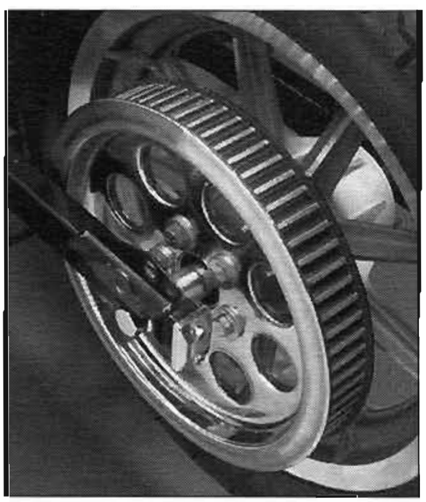
The reason that belt final drives bend axles so easily involves the distance from the wheel bearing to the swingarm. This varies from model to model—from 1½ inches on chain drives to 1⅞ inches on rear belt drives. With the support bearing in place, the distance is reduced to about 1/4-inch on chain drives and about 5/8-inch on rear belt drives. What this means is that the wheel doesn't have the leverage to bend the axle anymore because the support bearing is so close to the swingarm.

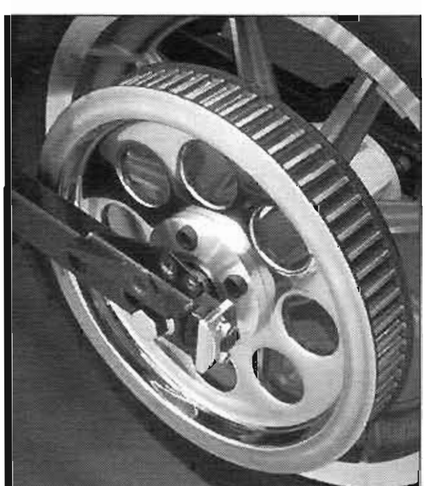


Installation is simple: 1) the axle is removed, 2) the pulley or sprocket bolts are removed, 3) the support bearing (by Rivera Engineering) is loosely installed with the new bolts. Next, the new shorter axle spacer is installed, and the axle nut is retorqued to factory specs. Finally, the support bearing bolts are torqued to factory specs, and you're done. By tightening the axle before the pulley or sprocket bolts, the axle can be used to align the bearings.

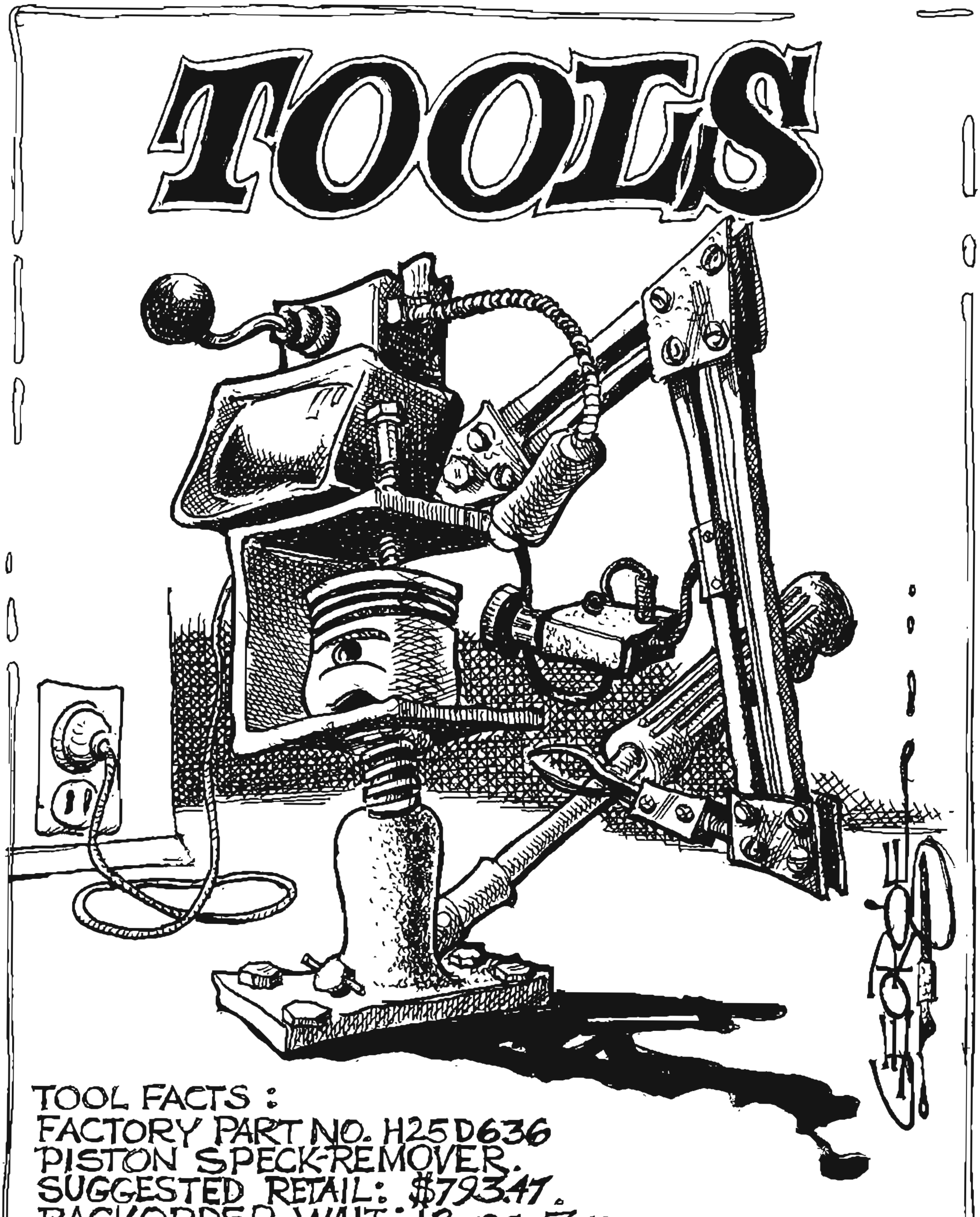
While everything is apart, it would be wise to check and repack the wheel bearings as well as checking the axle for straightness.

—*Keith Ruxton*





Photos: Doug Mezell


TOOLS
TOOL FACTS :
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PISTON SPECK-REMOVER.
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THE FIGHTIN' FOUR:

SPECIAL TOOLS TO GET THE JOB DONE

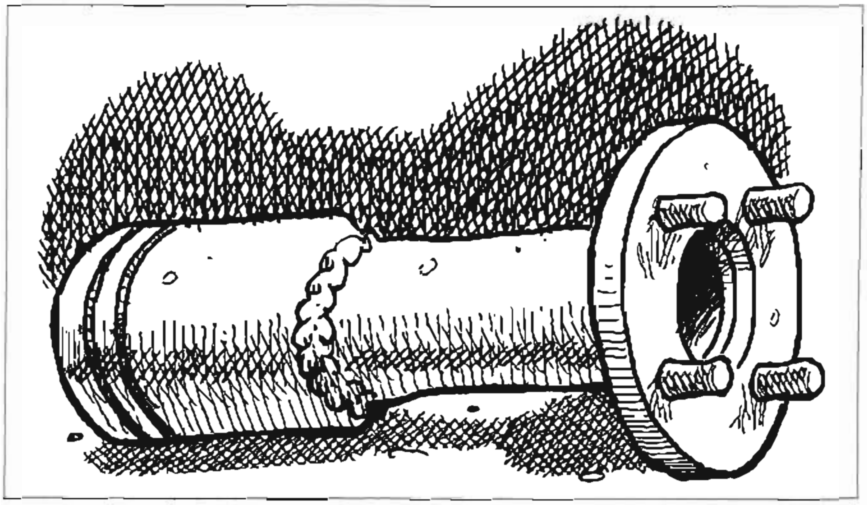
Rogue is a scruffy veteran mechanic at HMW in Melbourne, Florida, who's sending us photographs and tech tips from up and down the East Coast for about 20 years. HMW, which was once known as Harley Motor Works before the boys in Milwaukee took their name away, specializes in four-valve head installations and performance motor work.

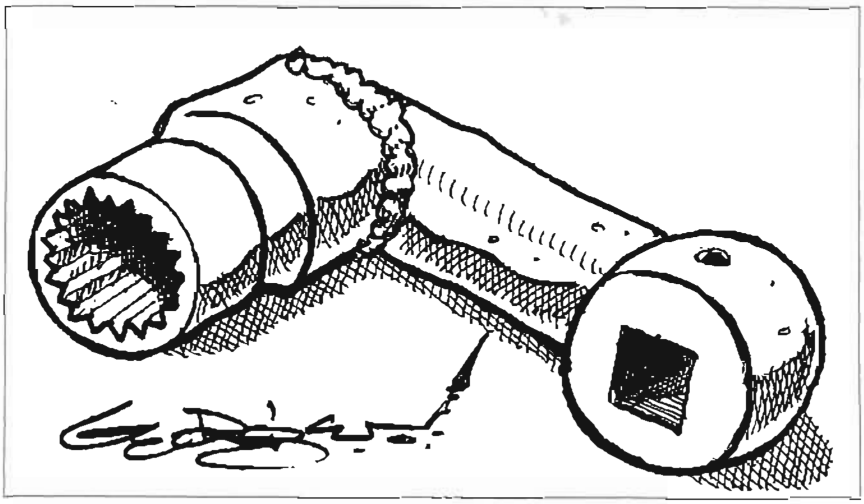
For well over a decade, Rogue has been hammering pissed-off performance into V-twins, including the installation of turbo chargers on shovelheads. He thought it would be an admirable idea to share some of his special tools with the rest of us wrenching fools.

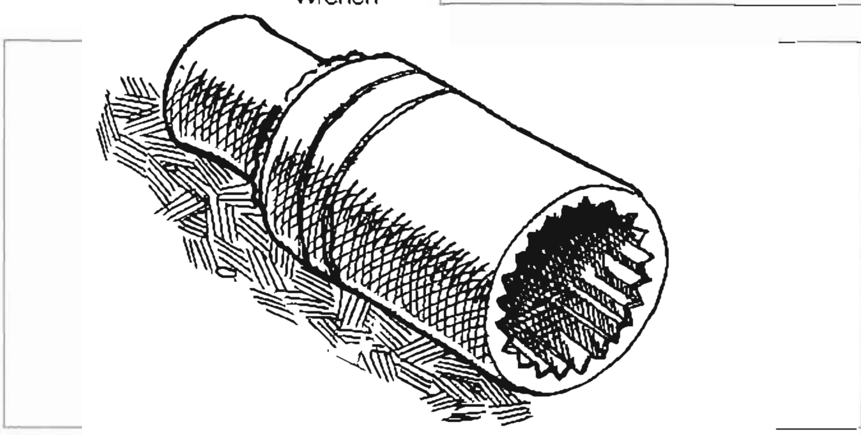
The only problem was that Rogue had a problem focusing his lens, and his shots of these tools looked like the junkyard dog had pissed on 'em. So we asked our main penman, George, to illustrate the devices that have assisted Rogue in his wrenching duties for years. If you have questions about these tools, or about other special tools, give Rogue a call at HMW, (407) 723-0026. And if you're thinking about four-valve heads, they are experienced at installation.

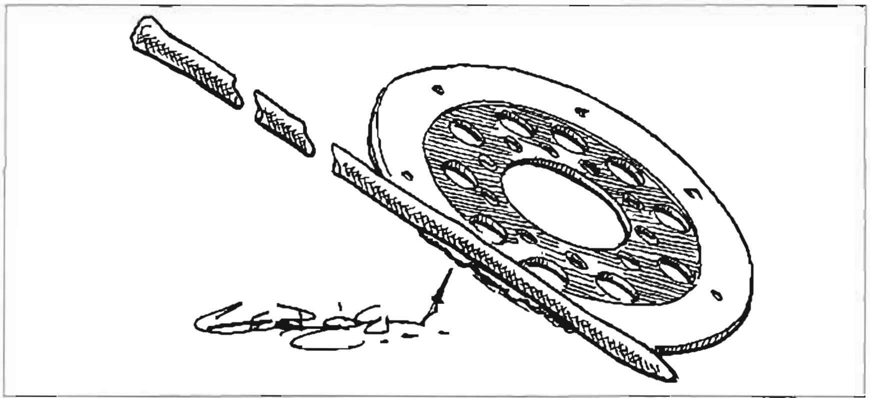
Enjoy.

—Wrench









1. Compensator Tool: This tool is used on early Big Twins and most Sportsters to remove or install the compensating sprocket on the engine. It's made by taking an old compensating spring retainer and installing 4 5/16-inch diameter hardened pins into the existing holes, measuring the length to make sure the pins are long enough. Weld an old socket to the shaft end of the retainer, and it's done.

2. Sportster Head Bolt Tool: Because of clearance problems, this tool is a must for tightening the 12-point head bolts on Sportster. Use a 7-16-inch, shallow, thin wall 12-point socket and weld a 3-8-inch drive torque adapter to it.

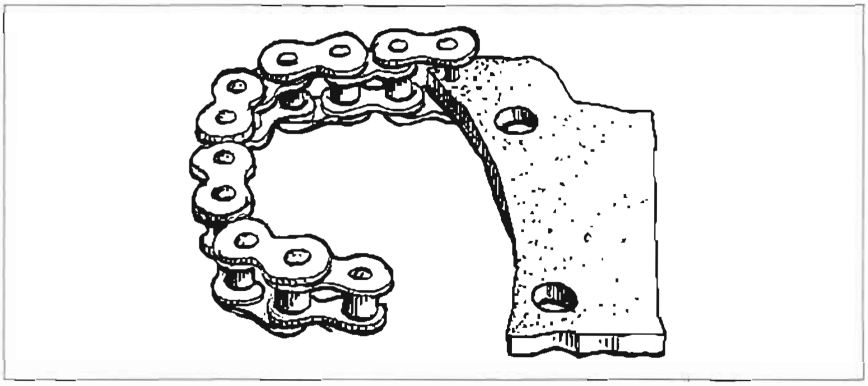
3. Clutch Hub Socket: This is a simple one used to remove the clutch shell. Too often the sockets available are too short, and it's easy to damage the fingers protruding from the hub. This is the correct socket welded to another socket for length. The threads on the nut are left-handed.

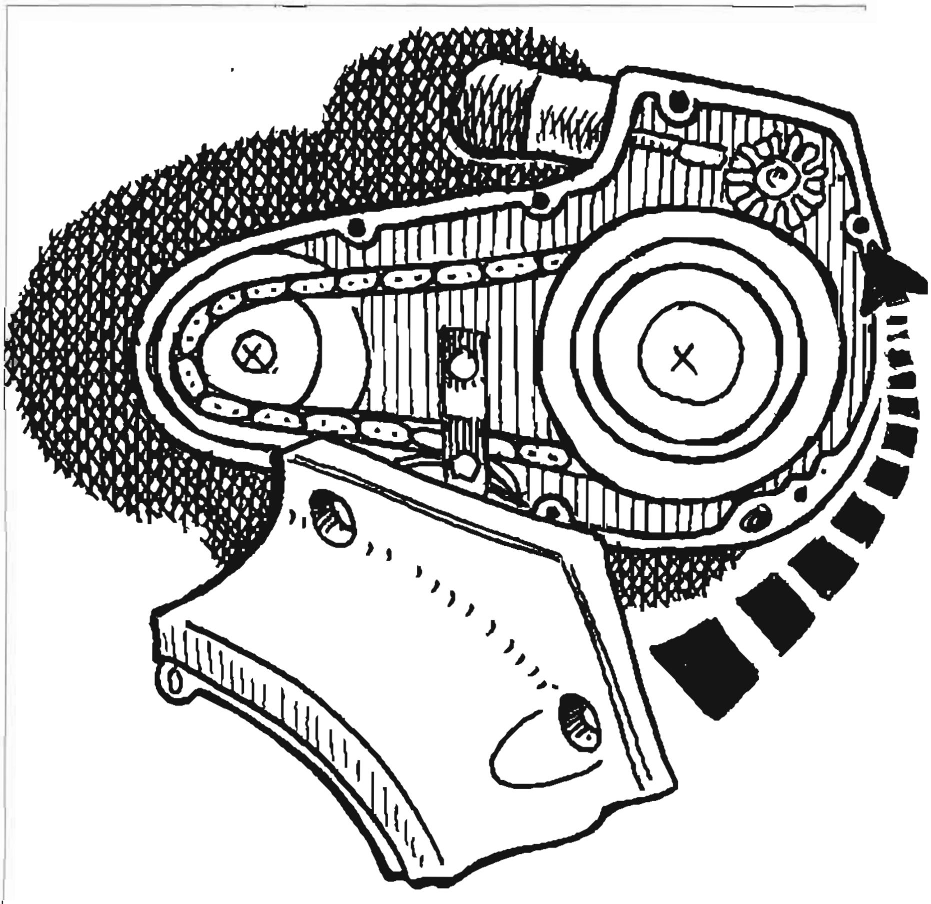
4. Clutch Hub Retainer: This one is an oldie but a goodie. It is used to hold the clutch hub while loosening or tightening the hub nut. Take an old clutch plate, remove the friction pad, and then weld a handle to it. If you make the handle long enough, it will smack the ground.

5. Tranny Sprocket Tool: The chunk of flat mild steel and length of chain (approximately 6 inches) is used to hold the transmission sprocket in place while tightening the left-handed nut on the main drive gear. This part will only work on chain drive trannies with aluminum primaries.

6. Starter Tester: Don't throw away that broken outer primary cover—at least not before you cut off the corner holding the starter drive bearing. Now you have a tool that will let you check starter operation. Watch those fingers though.

—Rogue



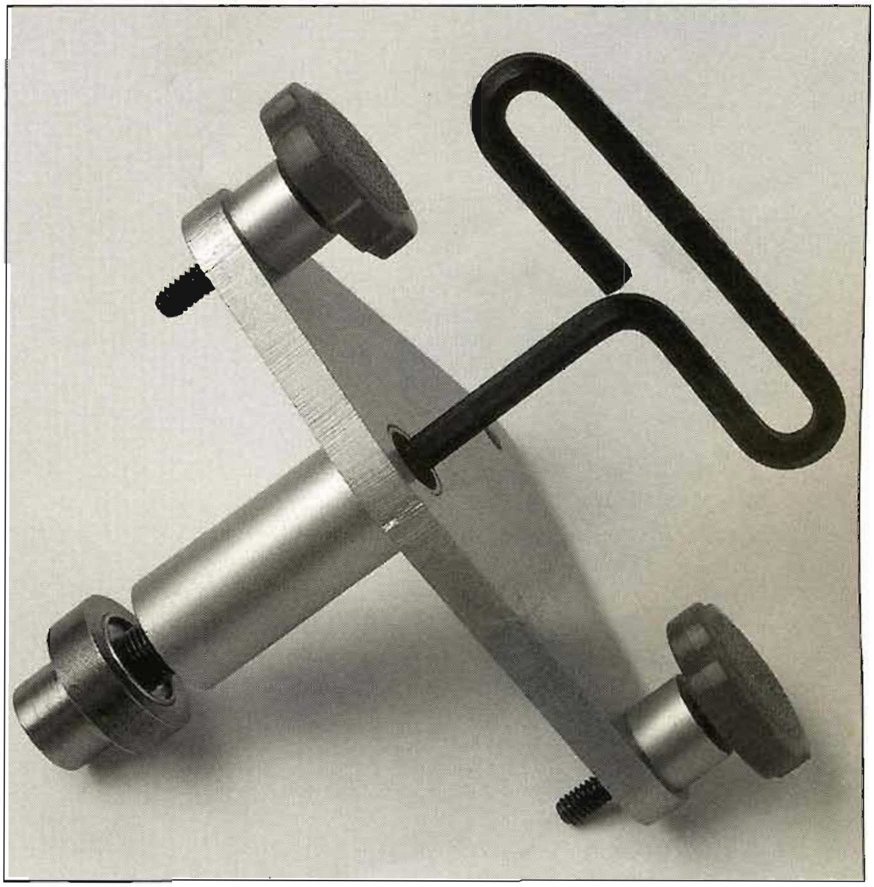


A Hot Topic

Big Twin Cam Bearing Installation

Since mid-1992, Big Twin cam bearings have been a hot topic around here. At that time, the factory started installing the same bearing that had caused so many failures in the late '70s. The bearing in question is the INA SCE-138 needle bearing. It can be identified by the name and number etched in the heavy-walled end or by the amount of rollers (19). The 19 rollers are separated by a cage in this design, and when the cage wears slightly, the rollers tend to wander around in the bearing shell until they run over a piece of cage. At this point they quit rolling and the engine has only a few moments left before major damage occurs.

> Even this heavy-duty bearing can have its life shortened if it is not installed correctly



The INA bearing will usually last about 25,000-30,000 miles, but after that a *big* magnet should be placed on the outside end of the cam while removing the cam to prevent the loose needle rollers from falling into the flywheel cavity of the crank case, where they are not retrievable without a complete tear-down.

The old bearing can be pulled out with a variety of bearing pullers, including the original Part No. 95760-69, or Jim's Machining Cam Bearing Puller 95760-TB, or Trock's Cam Bearing Puller TR-11. The Trock tool is the easiest to use and will pull the outer bearing shell out even after the needle rollers have fallen out.

Now that the old bearing is out, let's make sure that the new Torrington B-138 (this is the good bearing with 29 needle rollers) is *pressed in straight* so that the bearing case is not damaged. Even this heavy-duty bearing can have its life shortened if it is not installed correctly. The old service manuals said to *press* the bearing in from the branded end of the bearing shell because of the heavy wall on that end, and then showed the mechanic hammering the bearing into the hole. Not good!

The current service manuals show the bearing being pressed in during engine assembly using a shop press. This is fine if your engine is completely apart for repair (did the bearing blow up?). If the bearing is being replaced without a complete overhaul, then the best way to install (press) in the new bearing is with the Trock Cam Bearing Press Tool. This keeps the bearing straight and presses it in to the correct depth without any guesswork and keeps the bearing shell from being distorted, which could trap the rollers. It also can be used to protect the bearing from cutter chips when relieving the main bearing boss for very high lift cams.

The Trock tool shown here is a prototype and is undergoing some modifications to allow it to be used on earlier generator-style engines; also, it can be easily modified for earlier engines.

—*Rux*

Sources:

Trock Cycle Specialties
13 No.417 French Rd.
Hampshire, IL 60140
(708) 683-4010

Jim's Machining
531 Dawson Dr.
Camarillo, CA 93012
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Please Note: Cam Bearing Installer Must Be Used With Handle Assembly No.33416-80

97272-60

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