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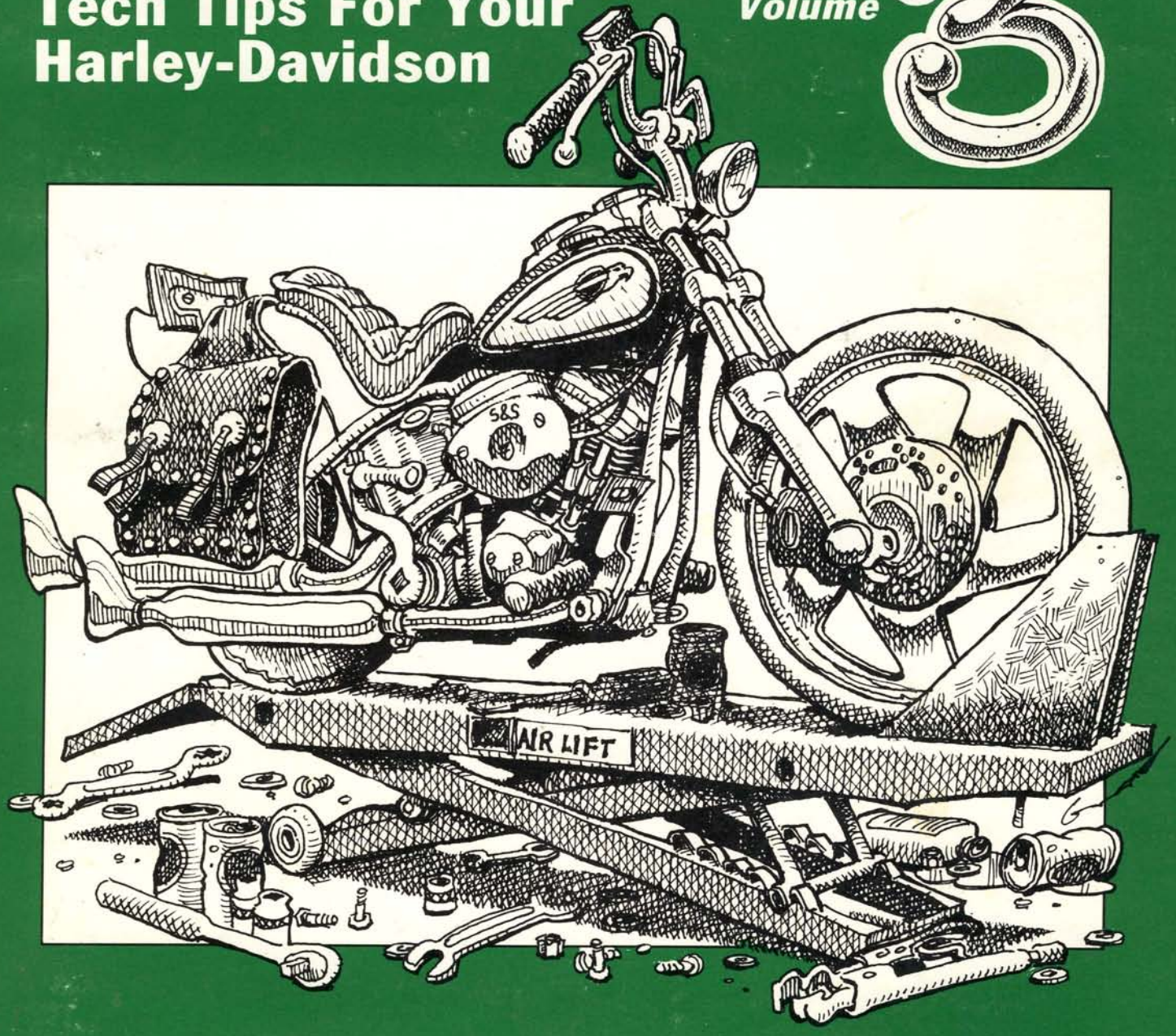
TECH TIPS & TRICKS

The Best Tech Tips For Your Harley-Davidson

Volume 3



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Easyriders

TECH TIPS AND TRICKS, Volume III

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Hey,

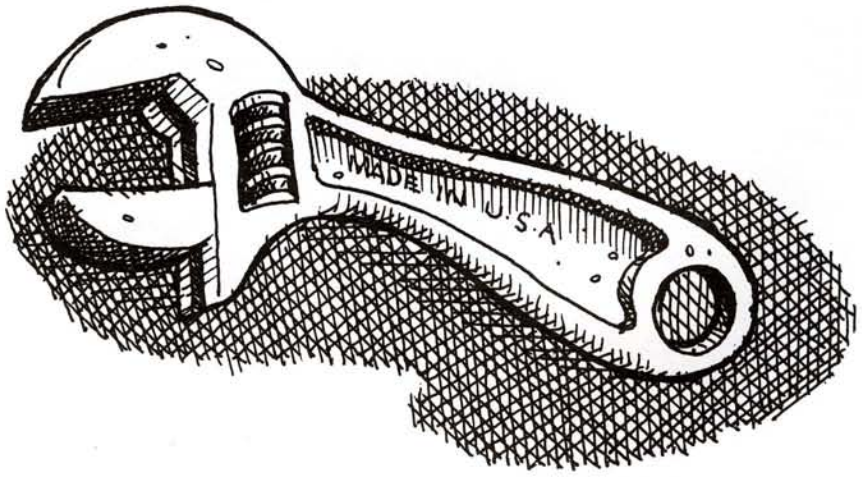
This third issue of Tech Tips and Tricks primarily consists of Tech Tips gathered from the last two years of *Easyriders*. Since this is the '90s and Harleys have changed over the years, this particular book includes a lot of performance modifications, go-fast tips, and tech tips for Evolutions.

But it looks back, too. You'll find a number of restoration articles and the latest information on antique models. We revised ('cause we blew the last one big-time) the Harley-Davidson model history chart, and we've added an Indian model history chart. For you trivia fans, we compiled a complete list of American motorcycle manufacturers, including the years they thrived and died.

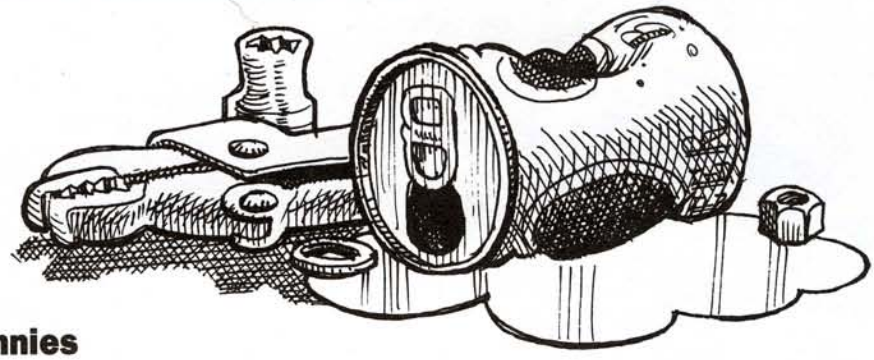
Other models are also covered as well as basic wheel truing, oil pump problems, and disc brake trouble-shooting. If you have an older model putt and want additional info, we still have *Volume #2* (with lots of shovelhead stuff) and *Volume #1* (the all-around madman's maintenance manual). And finally, for you tech heads who need everything spelled out for ya, we're working on a *Basic Maintenance Manual*. We even had to give up beer drinking at lunch to pull this one off. It will cover bikes from stem to stern. Keep an eye out. We may be done with it before I retire.

That's it. I'd like to thank all you wrenches who helped with ideas and articles, all our astute contributors, and George DiLucca for his entertaining art. Enjoy.

—Bandit



Greased Contents



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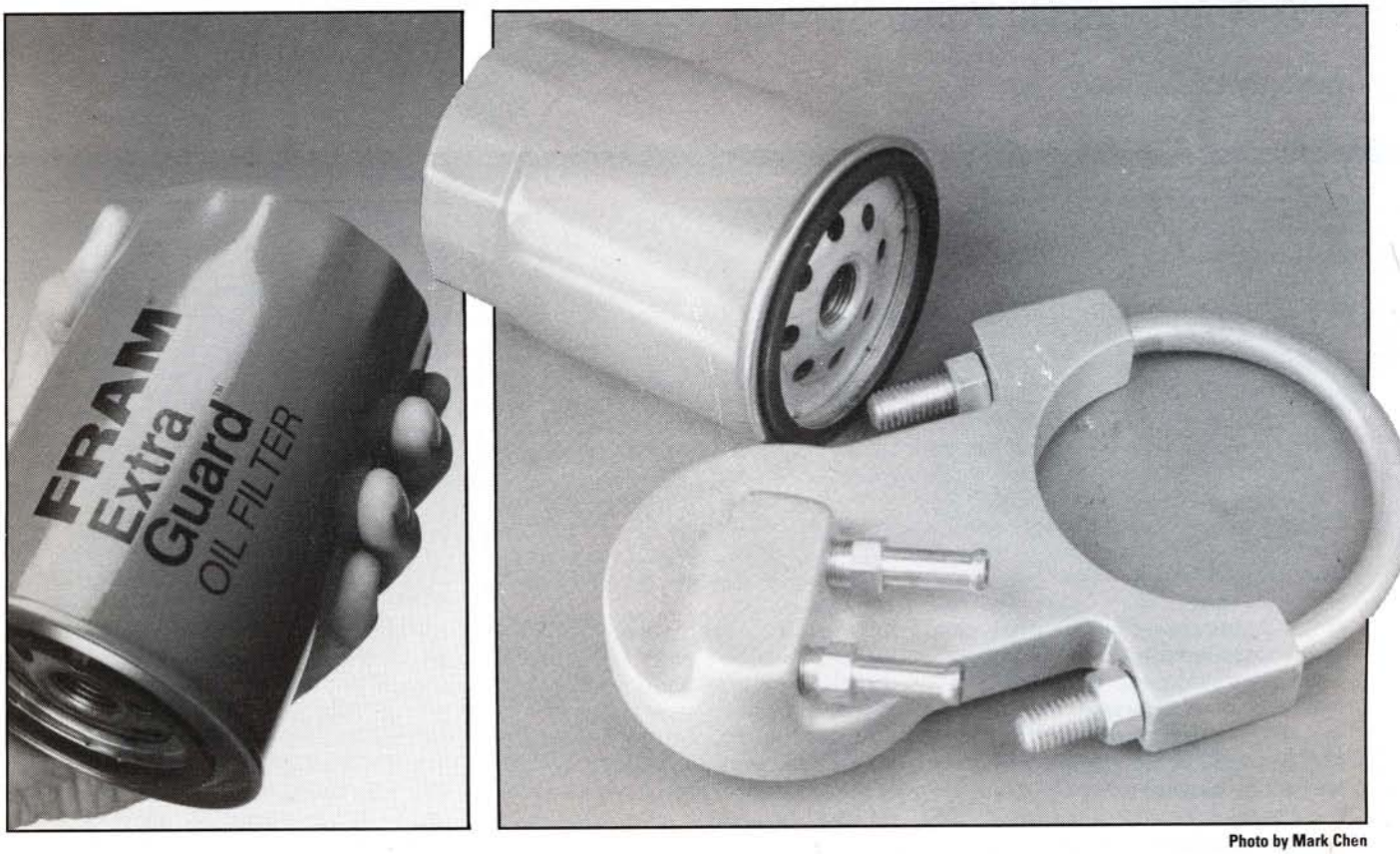
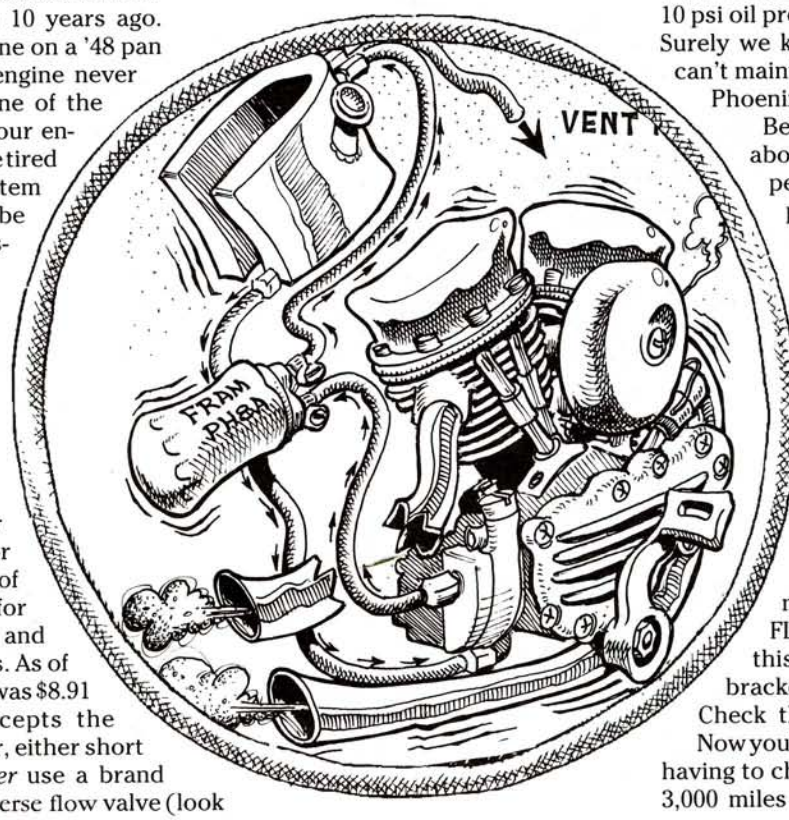


Photo by Mark Chen

We did a bit on this standard oil filter mounting bracket about 10 years ago. But it still works (I ran one on a '48 pan for over a decade, the engine never gave out), and is still one of the simplest ways to keep your engine alive. You also may be tired of the ol' in-the-tank-system of poor filtration. Or maybe you just purchased a custom tank without an oil filter. Whatever the reason or need, here's the way to ease your pain for less green than you'd spend on a box of .44 magnum rounds.

A remote oil filter adapter (Trans-Dapt P/N 1028) is available at your local auto parts store or speed shop. It's made of cast aluminum, tapped for standard brass fittings, and has three mounting holes. As of this writing, the list price was $8.91 plus tax, if any. It accepts the Chrysler V-8 spin on filter, either short or long. **CAUTION**: *Never* use a brand which has a pressure reverse flow valve (look inside)! This little monster will give you a V-twin charcoal surprise, as it requires 10 psi oil pressure to open the flow gate. Surely we know that the Big Twin just can't maintain that figure at idle—or in Phoenix.



Besides the easy access, it adds about 3/4 quart to capacity (depending on the filter you use), provides a bit of extra cooling, and looks trick. For those of you who are employed, you might like to go for a Moroso chrome filter and Russell anodized fittings and stainless lines. I prefer a Fram brand, paint it black and run 3/8-inch hoses off the return side of the pump (through a cooler if ya got one) and home again.

Pictured is a "no frills" model, installed on Carl's '75 FLH. If ya don't happen to like this mounting, the rubber horn bracket works, or invent your own. Check the clearance.

Now you'll have to quit snivelin' about having to change the oil and filter every 3,000 miles . . . 'cause ya got no more excuses.

—Troll

Oil Pump Blues

EPA-Approved Oil Pump Service

Tech by Thompson

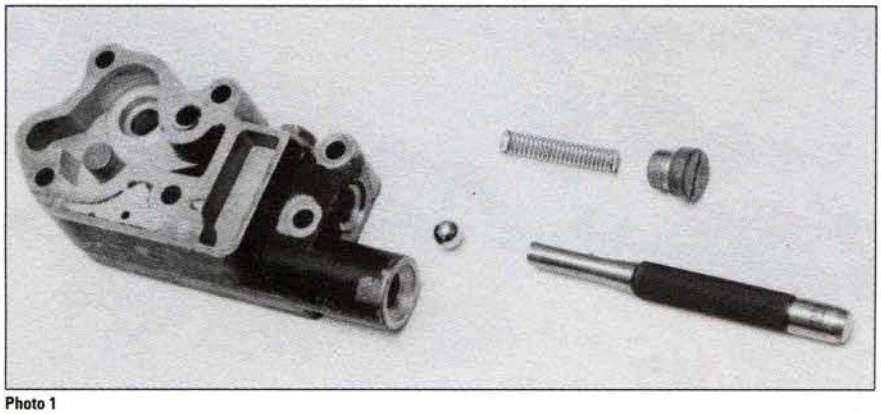
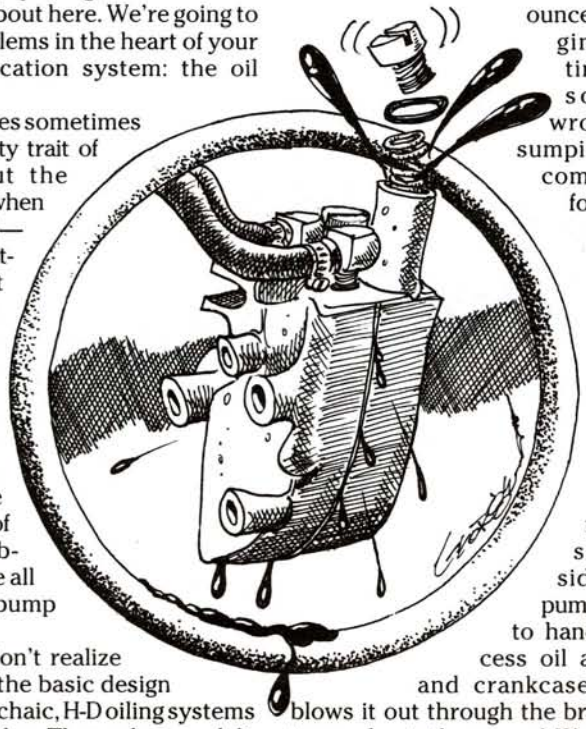


Photo 1

Photo 3

Does your garage look like the Exxon Valdez berths there? Is your ol' lady threatening to amputate certain body parts if you don't stop tracking oily bootprints 'cross the floor? Maybe payin' some attention to your Hog's oiling system would eliminate these hassles. Repairing leaks isn't what we're talking about here. We're going to be curing problems in the heart of your engine's lubrication system: the oil pump.

Harley engines sometimes exhibit the nasty trait of puking oil out the breather pipe when they're started—quite unacceptable behavior at best. Even the sleekest Hog is a sorry sight parked over a mound of Speedi-Dry. In almost all cases, this can be traced to one of several problems, which are all within the oil pump itself.



Most folks don't realize that, although the basic design is somewhat archaic, H-D oiling systems are quite complex. They rely on a delicate balance of pressure and scavenge pumps, crankcase pressure and breather timing to supply oil to the engine (and primary drive on some models) and to scavenge (return) it back to the oil tank.

When an engine loses oil at the breather, it means there's too much oil in the crankcase. This may be caused by one of several potential defects in the oil pump, or, simply overfilling with oil. You must understand that there's no appreciable amount of oil actually stored in the crankcase. The oil belongs in the oil tank—if there's more than a few ounces in the engine at any time there's something wrong. "Wet-sumping" is the common term for what happens when oil drains out of the oil tank and into the crankcase when the engine isn't running. The scavenge side of the pump is unable to handle the excess oil at start-up, and crankcase pressure blows it out through the breather system and onto the ground. We're going to talk about how to keep that oil in the tank.

Overfilling, which is more common than you'd think, happens quite easily. For example: You decide you want to go for a Sunday morning putt: You go out to the garage, roll the bike out, and check the oil. What's this? Down 2 quarts! Oh, well, I guess the engine's just showing it's age. You top off the oil tank and away you go. Only now there are 6 quarts in there instead of the 4 that belong there: The missing 2 quarts weren't burned off like you thought, they were actually hiding in the crankcase, where they'd slowly drained down to while your scoot was sitting in the garage.

Correcting this used to be easy; almost all older models had drain plugs which could be removed to drain excess oil. On current models, though, only the XL has a drain plug. If you think you have an over-filling situation, drain 1 quart from the oil tank and operate the vehicle for a few miles. The oil pump, which enjoys a substantial scavenge/feed volume ratio bias, will gradually bring the oil back up into the tank where it belongs. If the tank fills right up to the top again, you may need to repeat the procedure until the oil level stabilizes and you can then fill to the proper level.

The defects in the oil pump, which can cause wet-sumping are: poor sealing at the feed side check ball (dirt present or damaged ball/seat), a loose idler gear shaft in the pump body, and a leaking oil seal at the pump drive shaft. Any one (or a combination) of these will allow the oil held in the tank and feed side of the pump to slowly drain down into the crankcase.

Note: Although these procedures are shown being performed on a '68-'80-style Big Twin oil pump, they are directly applicable to both later Big Twin pumps and 1976 and earlier XL pumps.

Now let's get to the heart of the matter: checking and correcting the possible defects we've mentioned.

Servicing the oil feed check ball can be done simply, and usually without removing the pump. A high percentage of problems can be cured here without going into the pump (refer to photo #1). The first step is to obtain two H-D #8873 check balls (these replace the previous steel ball, H-D #8866). Drain the oil from the tank or pinch off the feed hose close to the pump. Remove the plug and spring above the check ball. Remove the oil check ball by fishing it out with a mechanic's pocket magnet. Clean out the oil and debris from the check ball cavity. Drop in one of your new check balls and, using a steel drift punch and *small* hammer, give the ball a sharp rap to "seat" it into the pump body. Not too hard! If you give it the gorilla treatment, you'll end up buyin' a new pump. Remove this ball and *throw it away.* Install the other new ball and reassemble. If problems persist you'll have to take the pump off to lap in the check ball seat and/or check for other problems.

Lapping in the check ball seat is a fairly easy procedure, but it requires the fabrication of a simple, special tool (see photo 2). Weld a new check ball and a piece of steel welding rod together as shown. A piece of rubber hose slipped over the end makes the tool much easier to use. Coat the ball end with very fine lapping compound and lap the pump body's valve seat (just like lapping a valve seat in a cylinder head) until an unbroken lapped band appears all the way around the seat. Clean the pump thoroughly. Remove *all* traces of lapping compound. Repeat the seating procedure performed previously with two *new* check balls.

Your next step is to check the pump's idler gear shaft for fit in the body. This part has a press (interference) fit in the body. You should *not be able to move it at all* using hand pressure or even with a *light* tap on the end with a *small* hammer.

See photo 3. Repairing a loose idler gear shaft can be done easily by using this procedure: Clean the pump body and shaft thoroughly (remove *all* oil from mating surfaces of shaft and body). Using high-strength Loctite, assemble the shaft to the body. Be sure the ends of the shaft are *perfectly flush or below* the body's gasket surfaces or it may bottom against the crankcase or pump cover surfaces when you assemble your pump.

See photo 4. Use the idler gears as aligning tools: Slip 'em on the shaft just enough to make sure that it's straight and square in the body while it's curing. Allow it to cure for several hours. Be *certain* there is no Loctite between the gears and the shaft or you will end up with everything glued together—*not good.* This is a reliable (and cheap) fix when done properly. I've used it many times and have had excellent results.

Replacing the pump's drive shaft oil seal is fairly simple, but the pump body should always be removed to do it. Be sure the sealing lip of the seal faces *toward the feed gears* (see photo 5, which shows the sealing lip side of the seal). Check the pump's driveshaft for wear and/or scoring. Use a machinist's fine India stone to remove burrs around the shaft's retaining ring grooves and keyways to prevent damaging the new seal when installing the pump body over the driveshaft.

Oil pump gaskets aren't a good place to choose to save cash. High-quality gaskets are necessary to do a high-quality repair. My choice for oil pump gaskets are James gaskets from the Gasket Co. Their gaskets are made from OEM-quality (or better) materials and, most importantly, they're the exact thicknesses required to maintain the proper internal clearances necessary for optimum pump efficiency. Use H-D's torque specs of 50-60 inch-pounds for Mylar (plastic) gaskets and 90-120 inch-pounds for paper ones. If you choose to use gasket sealants, use 'em sparingly, they may squeeze out and block oil passages if applied too heavily.

Photo 5

Caution: If you remove and replace your oil pump without removing the gear case cover, be sure the pump driven gear key doesn't fall out inside the gear case while you're working. If it does, the pump won't function. Verify that the drive keys for the feed and scavenge gears are in place. Make sure the pump turns with the engine before putting the outer cover back on.

Photo 2

Do a careful, workman-like job here; you're risking catastrophic engine damage should you fumble this one! This info won't do you any good if your pump's not healthy to start with. If it has a scored body, chipped or worn gears, etc., these fixes probably won't help much. If your pump's gone South on ya, call Jim—he'll be happy to help you out.

If you've followed these instructions carefully, your oil pump problems should be cured.

This article was furnished by Jim Thompson of Thompson's Cylinder Head Service Co., 186 River St., Dedham, MA 02026. (617) 326-8380 or FAX: (617) 320-9351.

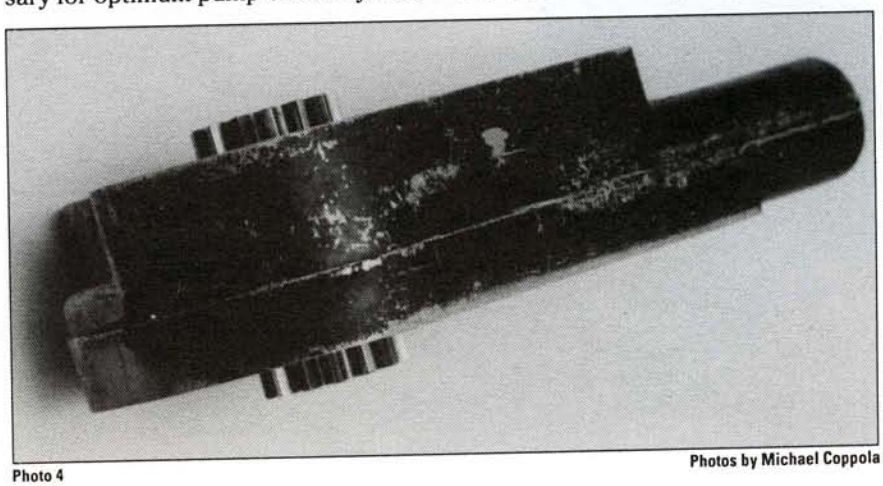


Photo 4

Photos by Michael Coppola

Exhaust Pipe Tuning

Picking The Right System For Your Scoot

Editor's Note: We've been hammering away at an exhaust systems article for months. Mike Stevenson, of Mike's Exotic Bikes, located in California's San Fernando Valley, (818) 780-0738, originated the piece below, and then Keith Ruxton, our esteemed Streamliner Crew Chief and engine builder, refined it some. Hard and fast rules are difficult to come by, though. The more we test these systems, the more we find that an exhaust system that works a particular way on a stock bike, will work a completely different way on a stroker. The key is to match the right exhaust system to the engine you've built and to your riding style.

The factory exerts a lot of time and effort into getting the stock exhaust system to be *quiet* and still run fairly well. At the same time, they are matching up cam specs and the carb size and jetting. But all their work to make things quiet is more often than not at the expense of performance.

Since about 1975, a crossover tube has been used on factory pipes. This was done to allow each cylinder to breathe through the system, because the mufflers substantially restricted flow. As noise levels have been clamped down, the mufflers have become even more restrictive.

The decibel level has gone down, but so has the power

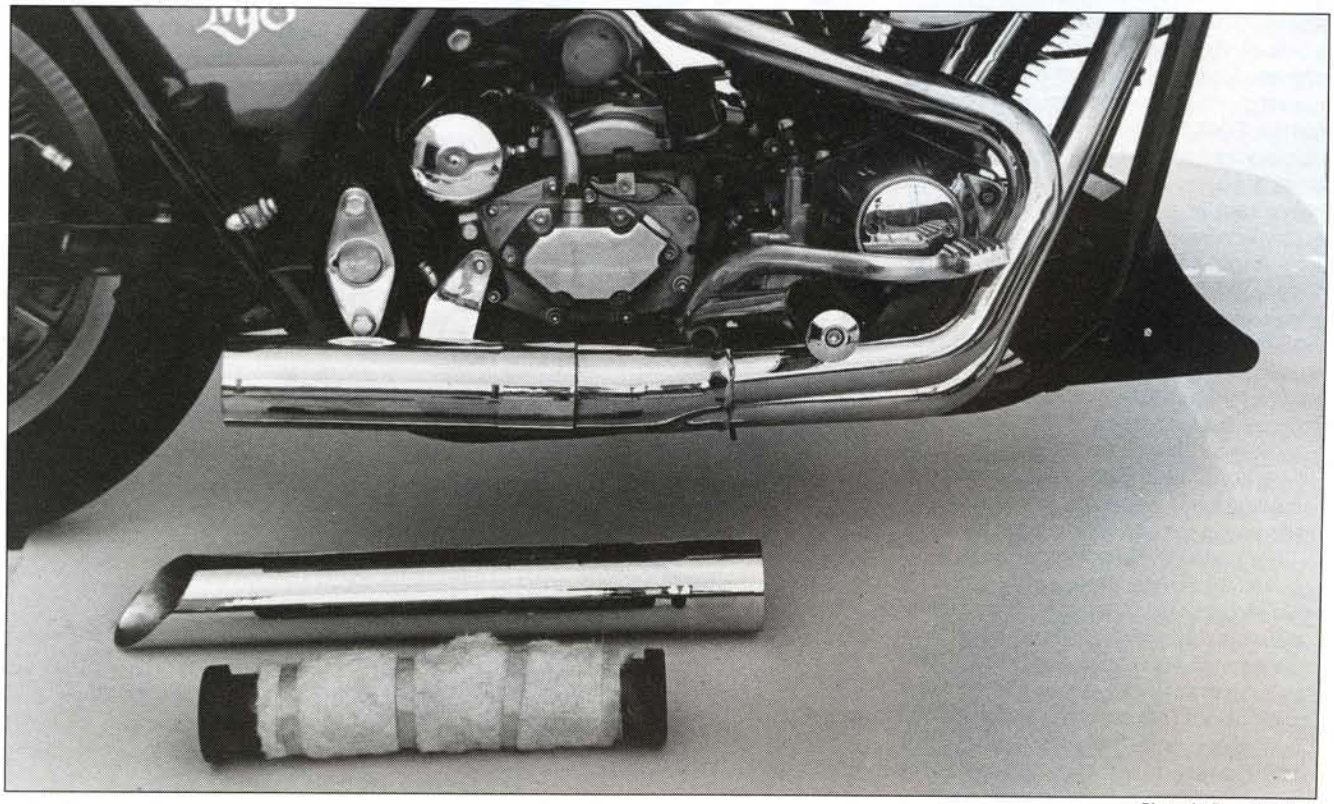
Okay, so let's try some 2-inch drag pipes. They are 40 inches long, have shiny new chrome, and the price is right. But, to make them *work right,* you need a 100-cubic-inch, cammed-up monster. They sound pretty good after you've gotten your carb jetted for them, but noise isn't horsepower.

What about 1 3/4-inch drag pipes? They *will* work better than 2-inch pipes, but your stock-size motor doesn't come alive until it's approaching valve float. Now you stick some baffles in them because the neighbor's kids won't come out of their house until you quit making the windows rattle. The decibel level has gone down, but so has the power.

What do we look for now? The whole package—cam, carb, displacement, and exhaust system—needs to be matched up to how and where you ride. Everything's sophisticated, even mufflers. Some mufflers are loud, some are quiet, some work all right, some work great. But remember, your exhaust system is what makes the other parts of your engine package work.

The operating principle of the exhaust system is to get rid of the burned fuel and air at the end of the

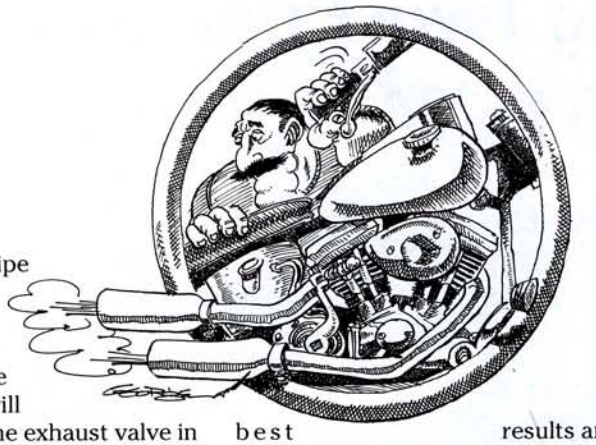
Photo A



Photos by Doug Kamicar

exhaust stroke, when the piston reaches the top of the cylinder and the intake valve has started opening (valve overlap). You should use the velocity of that exhaust gas down the pipe to start pulling air through the carburetor, before the piston has even started the intake stroke. With too much back pressure, or too much valve overlap (too much cam timing for your engine), large amounts of fuel can be sprayed back out the throat of the carb. A freer-flowing exhaust system can prevent this from happening. But if the pipes are too large, then there's not enough exhaust velocity at the time of valve overlap to start the air moving in the carburetor—a tuning balance must be reached.

There is one more thing going on inside the exhaust system that you need to understand and be aware of. It is called the reversion pulse. The reversion pulse is caused when the exhaust valve closes and the velocity of the escaping exhaust gas is brought to a stop. At this point, the exhaust left in the pipe wants to bounce back and forth up and down the pipe. If this bounce can be timed correctly, it will leave a vacuum at the exhaust valve in time for the exhaust valve to open (which helps get the exhaust flow started again). Back pressure increases the intensity of the pulse and decreases its ability to create the vacuum. The more the back pressure, the less the pulse or bounce.



There are several ways to achieve this reversion tuning. One way is to use the correct pipe diameter, muffler flow rate, and system length for your engine combination. Another method is the use of a "reversion dam" at some point in your exhaust system. What's a reversion dam? It's a "step" in the exhaust system that allows a smooth flow by it on the way out, but interferes with a reverse flow. A reversion dam can be placed almost anywhere in your exhaust system, but best results are usually obtained when it's situated near the head. Drag Specialties distributes Python Pipes with a dam built in.

Another way to boost your exhaust flow is with a 2-into-1system. But, again, the system you use must match up to your whole engine package. The 2-into-1 system uses the exhaust flow of one pipe to create a vacuum in the other. However, timing this vacuum pulse to happen when it's needed is "designed in" by the manufacturer. Some use equal length pipes, some use unequal length pipes. Supertrapp, RB, and Arlen Ness build this type of system. Some are adjustable, some aren't.

What works? They all will—if, as we've been emphasizing, the other components of the engine match up with each other.

Photo B

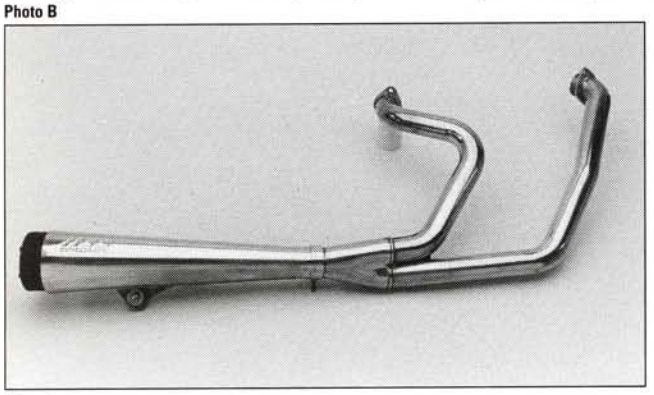


Photo C

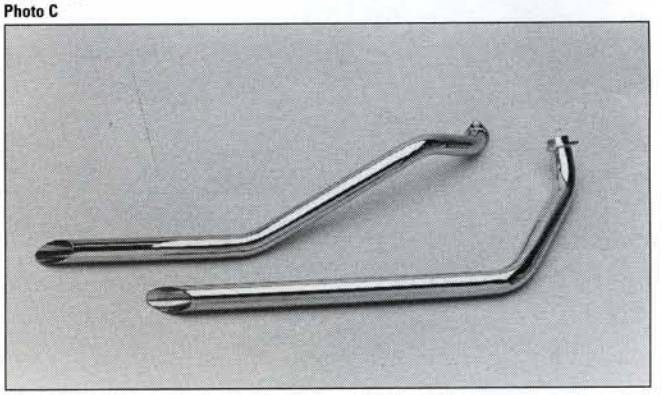


Photo D

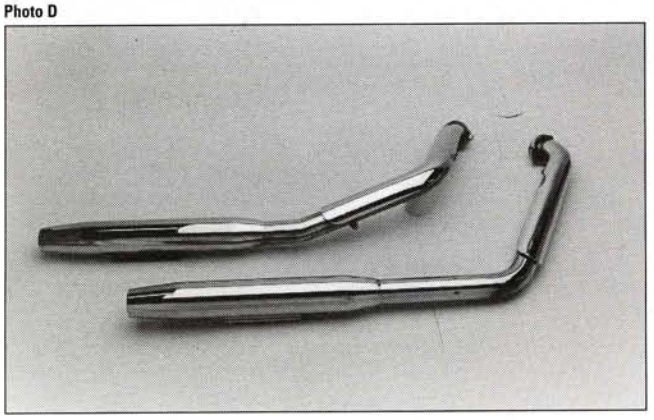


Photo A: R.B. Racing's' collector-style exhaust system uses unequal primary tube lengths to help compensate for the unequal firing pattern of the Harley engine. These systems are also available with different types and lengths of collectors, and different size primary tubes up to a 2 -1/8 -inch diameter, for various engine sizes and cams.

Photo B: Supertrapp uses equal length primary tubes, with a venturi-type collector with interchangeable collector end caps and varying amounts of discs to control the amount of back pressure and noise level. They are also available in staggered dual systems.

Photo C: Here is an example of a basic drag racing exhaust system. They can be found in many diameters and lengths, although the most common sizes available are 1 3/4 inches and 2 -inch diameter and anywhere from 36 inches to 44 inches long.

Photo D: The staggered dual exhaust system from Carl Morrow looks like many other brands, but incorporates removable baffles which can be modified to better match almost any engine tuning requirements. Carl's 114-cubic- inch FXR ran 155.9 mph at Bonneville (at a 4300-foot elevation) with these pipes.

Big Twin Primary Oiling System '65 to '84

By Keith Ruxton

Anyone who's had a 1965-1984 Big Twin model is probably aware of the fact that these bikes had a primary oiling system that used motor oil in the primary case to lube the chain—and anything else in there. This was better than the total loss method used on '64 and earlier models, but it introduced a new problem.

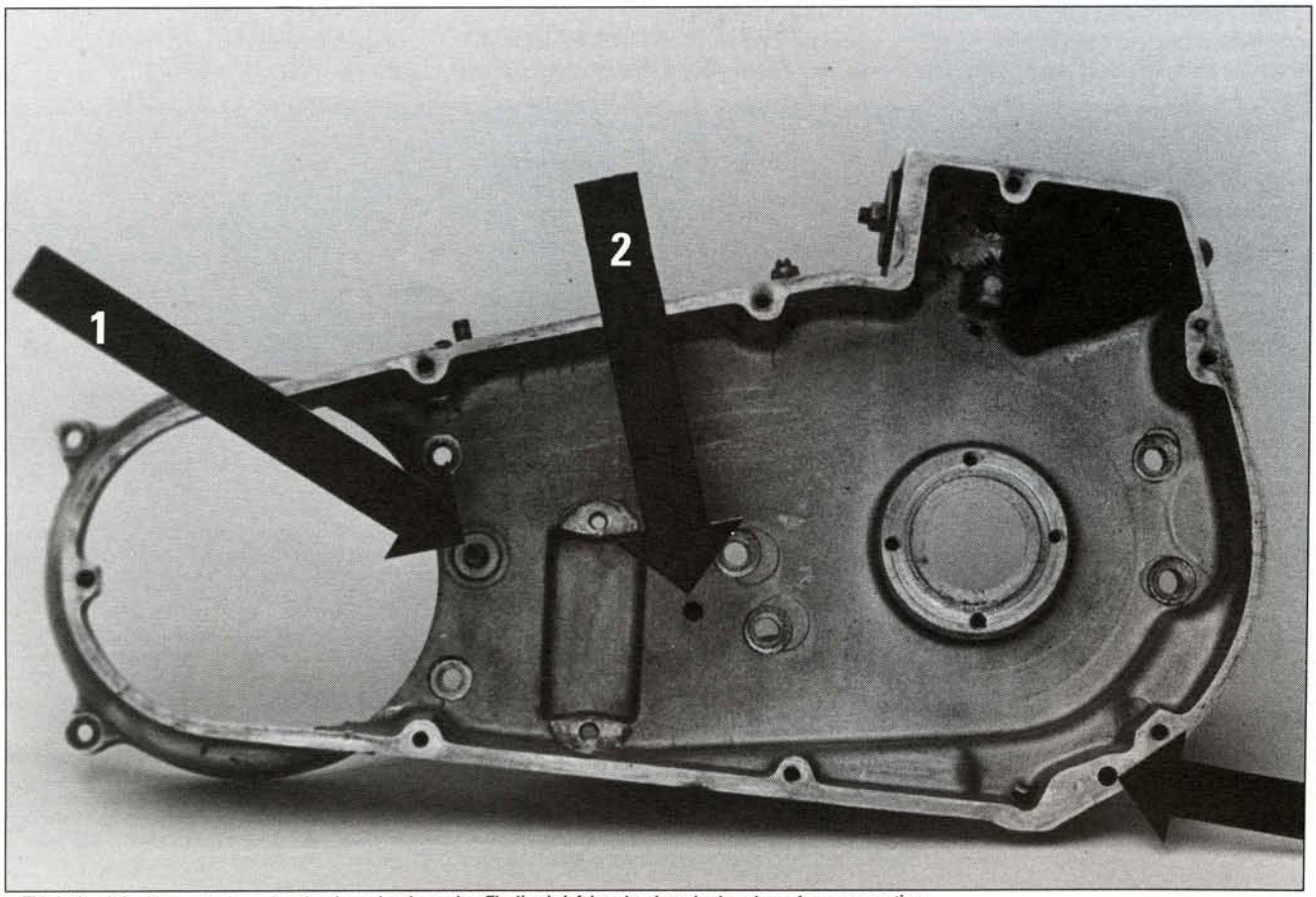
Motor oil in the sealed, aluminum primary wasn't a bad idea—the fact that it was run back through the engine, however, was. Chain and sprocket wear particles and dust from the clutch plates are washed out of the case and fed back to the engine with no filtering of the oil. This usually results in reduced engine life at best, or if you weren't so lucky, you had an engine weld itself together when a starter ring gear tooth broke off (because the engine was getting harder and harder to start) and found its way to the oil pump.

The problem was solved on later models when the factory sealed up the primary

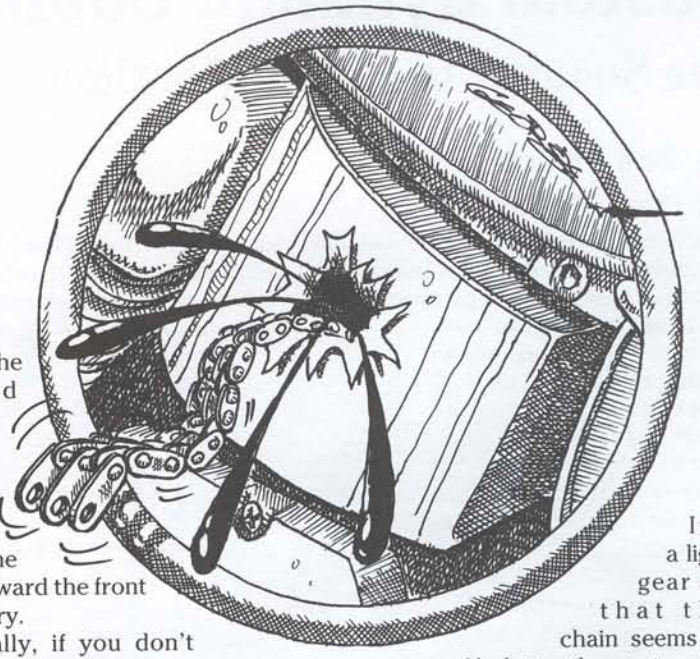
This problem was solved on later models when the factory sealed up the primary and gave it its own oil supply. This can be done to the earlier models also, but because of the clutch being a "dry" clutch the oil level must be kept at a lower level. The level is determined with the bike on its side stand and should have oil just touching the outer edge of the clutch basket for dry clutch models.

The operation to seal your primary is reasonably simple. You need to plug the oil feed hose. The simple procedure is to slice the small line at the oil pump and plug it. Take the remainder of the small line and leave it open hanging down out of the way behind the primary. This line then becomes the primary vent, hanging lets it vent without catching water or dirt, or allowing it access to the clutch and chain.

The primary vent, which is attached



1. This is the oil feed hose which needs to be plugged at the engine. The line is left hanging down by the primary for proper venting.
2. This was the vent line from the engine. It can be removed and plugged at the primary and eliminated at the oil bag T.



to the center of the primary, is T'd into an oil vent line at the oil bag. Take the T out and splice the line from the engine to the oil bag. Plug the line into the primary by removing the fitting and using a pipe plug.

The last puppy is the return line at the lower rear of the inner primary. This line needs to be plugged at both ends. Use an 1/8-inch pipe plug in the primary and cut the hose off, or take the fitting off the engine by the oil pump and braze it closed. Or, you can leave a small length of line on the fitting, run a 3/8-inch bolt into it and clamp it with a hose clamp.

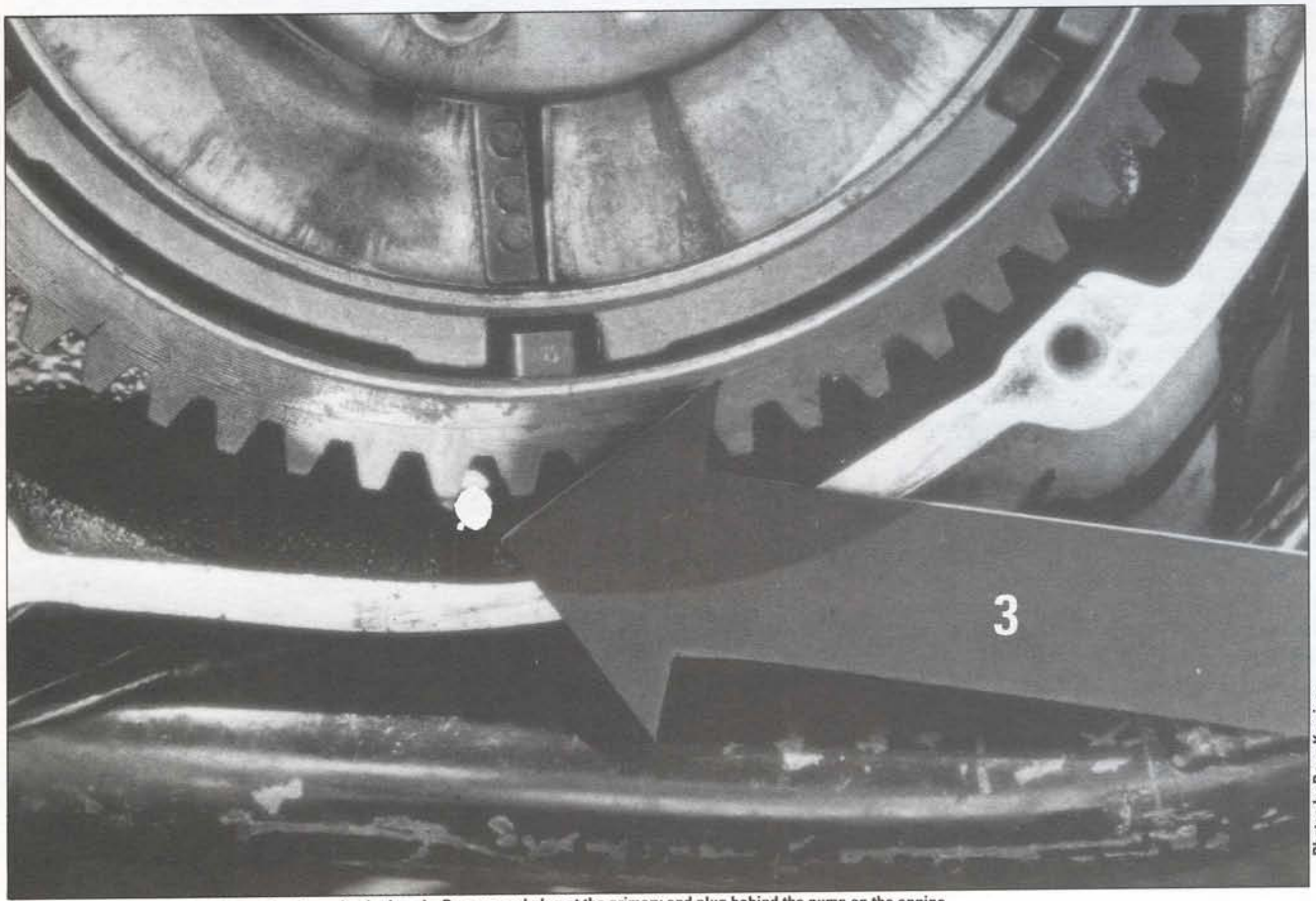
If I stumbled through any portion of the above, just remember that all the lines to the engine must be plugged, along with the center and lower rear holes to the inner primary. The only hole left open is the small one toward the front of the primary.

Incidentally, if you don't have an electric starter ring gear on your clutch basket, you might as well stop reading. The ring gear is what throws oil on the chain.

I've tried many different types of oil, from 10w30 to 70-weight, and have found that the best oil to go with is the same type that the factory is currently using. It's a light gear oil that the chain seems to like better than motor oil.

Next, you'll find that with more oil in your primary, your "dry" clutch will begin to slip under power and drag (or not release as well after a while). The cure is to use a Barnett "Wet or Dry" plate set.

Nothing to it.



Photos by Doug Kamicar

3. This is the last return line. It must be plugged at both ends. Remove and plug at the primary and plug behind the pump on the engine.

Custom Dynamic Balancing

The Solution To Engine Vibration

By Bob Pickett

The benefits of having your flywheel assembly dynamically balanced are:

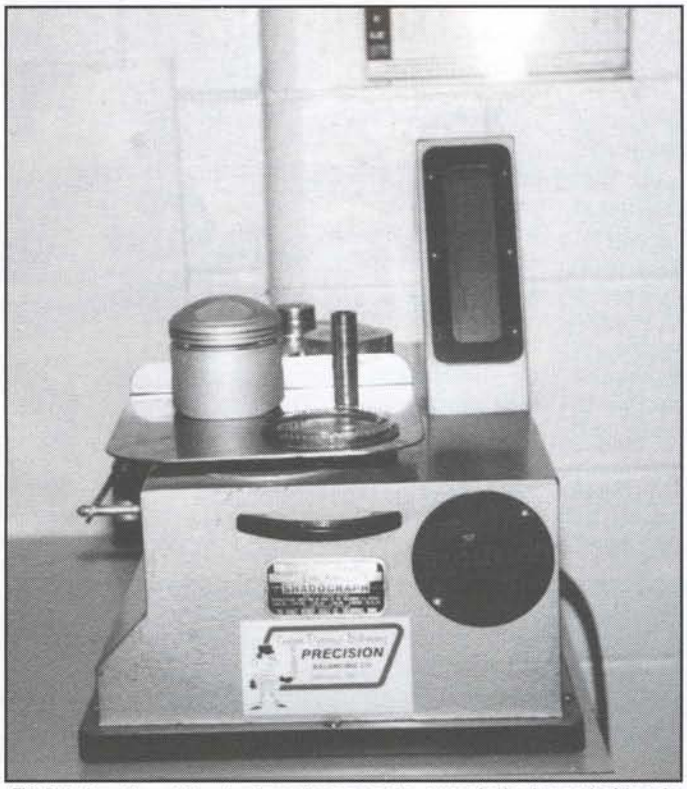
1) smoother operation (less vibration)
2) longer bearing life
3) more usable horsepower
4) higher rpm (usually more important in racing applications)

Although vibration can come from tires, wheels, brake discs, etc., the majority of vibration in a V-twin comes from the engine. This occurs in two areas: torque vibration and vibration from the rotating mass unbalance.

Torque vibration is caused by the engine firing on the power stroke. The amount of vibration varies with the engine load; the greater the load, the more severe the power impulse, the greater the vibration. As the cylinder fires, the piston is forced down and at the same time the cylinder head is forced up. (Newton's Law: for every action there is an equal and opposite reaction.) Since the cylinder head is fastened to the crankcase, and the crankcase is fastened to the motorcycle frame, the result is vibration. For example: 6,000 rpm is 100 power cycles per second = torque vibration.

The second source of vibration is the rotating mass of the flywheels. The rotating mass is the total weight of the rods, pistons, rings, and complete flywheel assembly.

A rotating unit that is in perfect balance rotates concentrically around the center line of the axis of rotation. A rotating unit that is not in perfect balance tends to rotate in an elliptical (egg shaped) manner, around the center line of the axis of rotation, with the elongated portion of the ellipse at the point of unbalance. The more unbalanced, the more exaggerated the ellipse. Of course, the elliptical movement caused by the unbalance is restrained by the bearings. It follows that the greater the elliptical motion of the flywheels, the greater wear on the bearings. For example, as the speed of the engine doubles, the amount of force, per revolution, created by unbalance tends to increase by an approximate factor of four.



This flick shows the weighing of reciprocating components—except for the piston ends of the rods.

Example: 1 ounce inch of unbalance at 2,000 rpm creates approximately 7 pounds of force per rpm

One ounce inch of unbalance at 4,000 rpm creates approximately 30 pounds of force per rpm.

One ounce inch of unbalance at 8,000 rpm creates approximately 120 pounds of force per rpm.

Unbalance is typically expressed in ounce inches (oz. in.). This means 1 ounce inch is equal to 1 ounce (28.35 grams) of unbalance at a 1-inch radius.

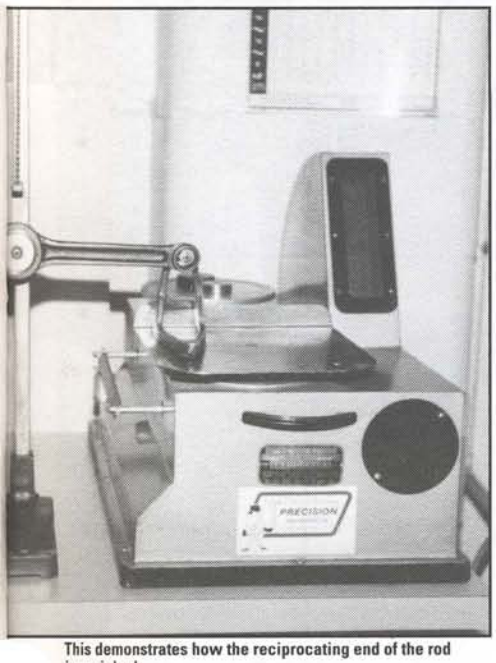
If it takes "X" amount of rpm to generate "X" amount of horsepower for an engine with unbalance; it follows that it will take less horsepower to generate the same rpm with a balanced engine, because you are not losing horsepower overcoming the effects of the unbalance. Reasons three and four for having the flywheel assembly custom balanced—more horsepower and higher rpm.

So what does this really mean? Typically, the closer your flywheel assembly is to perfect balance, the less vibration you'll have. By balancing correctly and accurately, the vibration produced from the rotating mass can, in most cases, be greatly reduced.

I really don't know what the balancing tolerance (to what accuracy) the stock Harley-Davidson flywheel assembly is balanced at the factory. Rumor has it that they balance by an average weight of components, then apply that formula to all engines. Some shops try to balance to .5 ounce inches. However, our shop balances the Harley flywheel assemblies to less than .5 ounce inches. To put it another way, .5 ounce inches of balancing tolerance is 3.336 grams placed on the outside diameter of the flywheels (note: a $1 bill weighs 1 gram).

The closer your flywheel assembly is to perfect balance, the less vibration you will have

It is especially important to have the flywheel assembly custom balanced if



This demonstrates how the reciprocating end of the rod is weighed.

you have cut down or lightened the flywheels, lightened the crank pin, changed pistons, put in different rods, or stroked or destroked the crank. For example: Let's say that the engine is in good balance but you want to go with a bigger piston. The new pistons, rings, pins, etc. weigh 100 grams more, each, than the pistons you took out. This would mean that the flywheels would be out of balance by 62 grams (8.2 oz. in.) at the outside diameter of the flywheel assembly.

Why custom balance your modified Harley-Davidson flywheel assembly? The obvious advantage is that the flywheels are balanced for the exact components you are using in your engine. You'll also have the smoothest running scoot on the block.

Procedure for balancing the Harley flywheel assembly:

1. Flywheels should be "trued" to within .001 inch. (be sure the crankpin nut locks and screws are installed if they are used).

2. Weigh the following on a gram scale: rotating ends of the rods (crank pin ends) and bearings, reciprocating end of the rods, pistons, pins, rings, and locks (reciprocating weight).

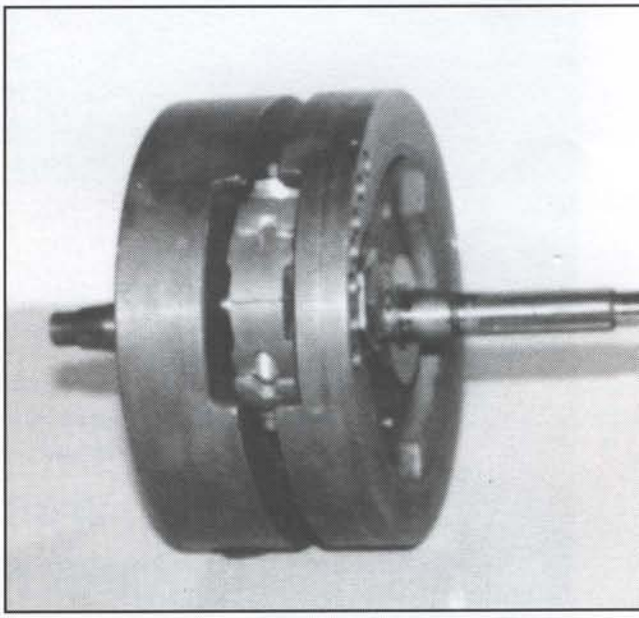
3. Assemble the "bobweight" properly on the flywheel assembly.

4. Set up the balancing machine for the flywheels.

5. Balance the flywheels to .5 ounce inches or less.

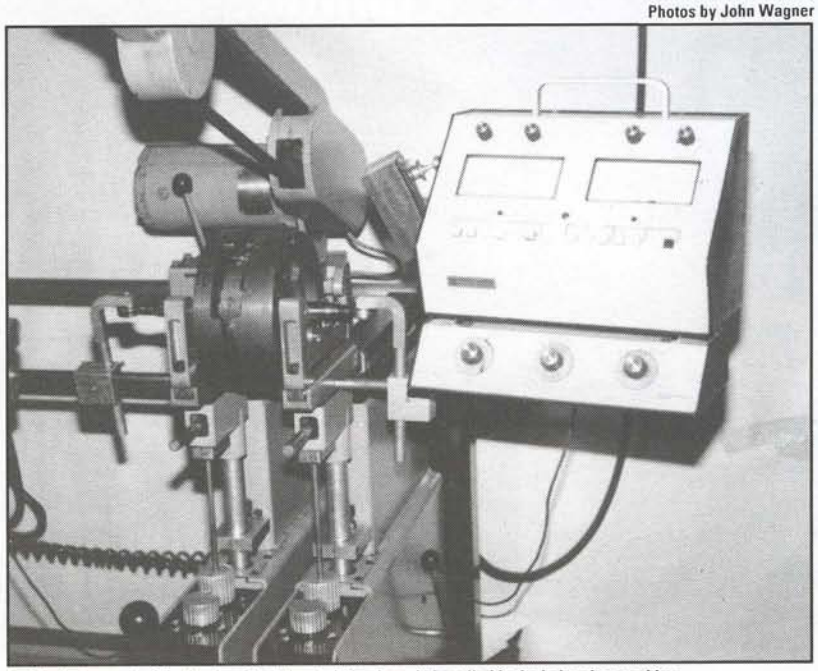
There is one more item that needs to be discussed, one that makes balancing an unexact science. Reciprocating mass is the weight of the elements that move up and down—the top end of the rods, the pistons, wrist pins, and rings. The rotating mass is made up of the wheels, pins, and lower end of the rods.

Balancing the up-and-down weight against the rotating weight is tough. If the pistons and rods were always extended (or at 100 percent) it would be no problem. The counter-balance at the opposite end of the flywheels could always compensate for inbalance. Unfortunately, as a V-twin rolls through its cycle, it is constantly changing. Think about it. When the piston is halfway up the cylinder the counter-balance is at 90 degrees. Unfortunately, you can't vary the balance factor while the engine is running. Consequently, engines are balanced at varying percentages from 52 to 56 depending on the application or the rpm range the bike will be run at. Street bikes and drag bikes vary. We balance street bikes at 52 percent. Engines designed for top-end running are balanced at 56 percent.



Here the bobweight is assembled on the crankpin.

Photos by John Wagner

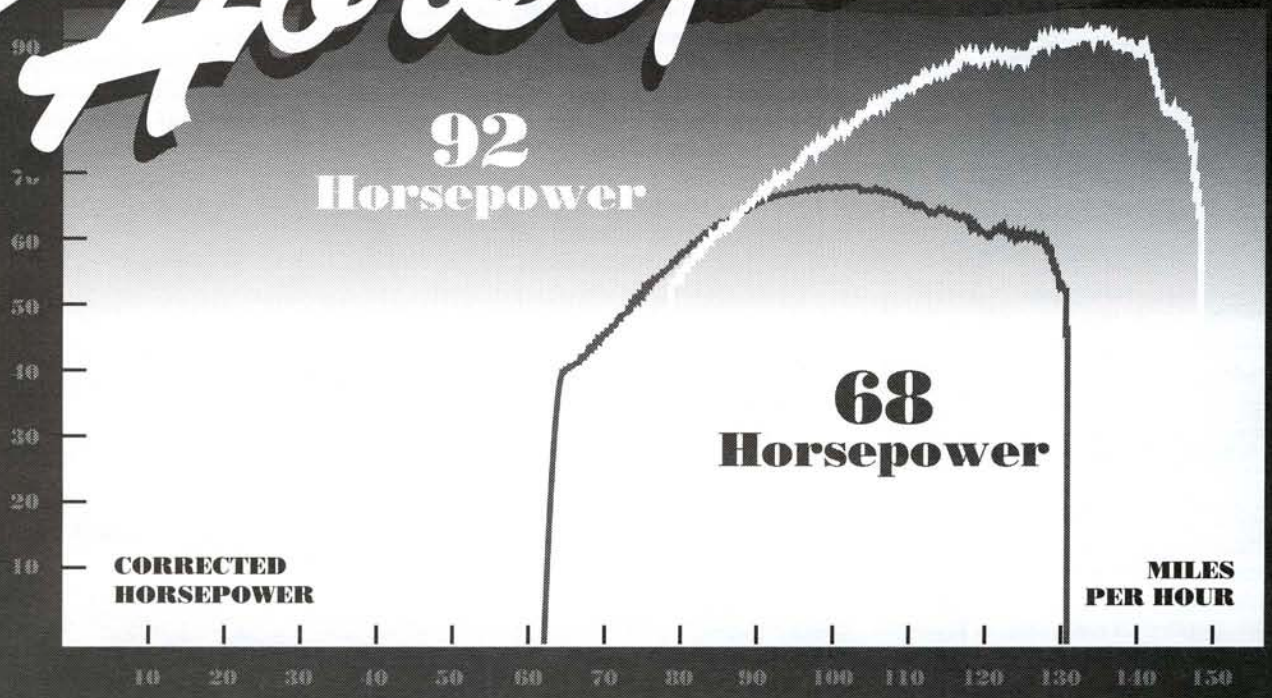


In this photo, a set of flywheels, with bobweight in place, is installed in the balancing machine.

*It should be noted that we are assuming the balancing work will be done on electronic balancing equipment, by a shop experienced in precision balancing.

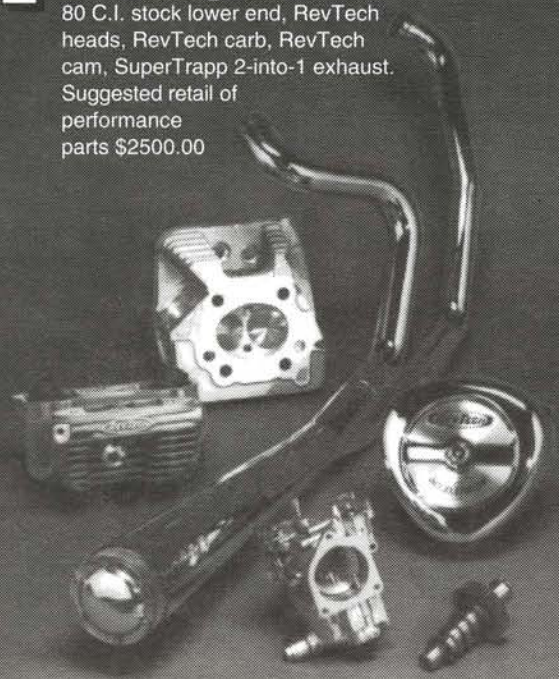
For more information, contact: Bob Pickett, Precision Balancing Co., 448 N. Holmes Ave. Indianapolis, IN 46222, (317) 639-2712.

Horsepower



68 Horsepower
88 C.I. big bore kit, Branch 'Stage 4' heads, Mikuni 'Smoothbore' carb, Screamin' Eagle cam and ignition module, drag pipes. Estimate of motor rebuild $4700.00

92 Horsepower
80 C.I. stock lower end, RevTech heads, RevTech carb, RevTech cam, SuperTrapp 2-into-1 exhaust. Suggested retail of performance parts $2500.00



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All measurements taken on the DYNOJET Model 100 Dynamometer in public demonstrations on Main Street during Daytona Bike Week 1992. Cost of rebuilds and engine modifications listed provided by each bike's owner.

Get Some Head

Feuling-Rivera, 4-Valve, Per Cylinder, Heads That Is . . .

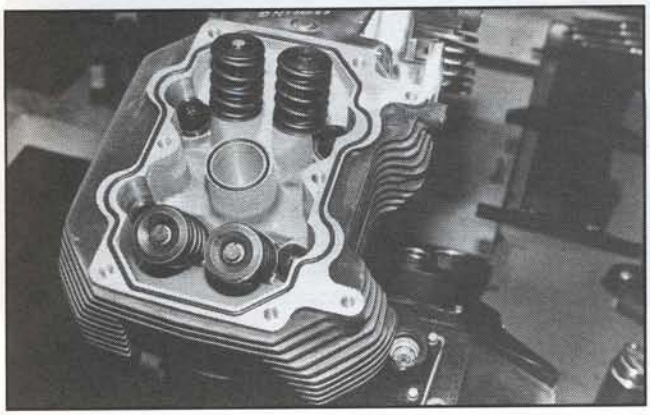


Photo 1

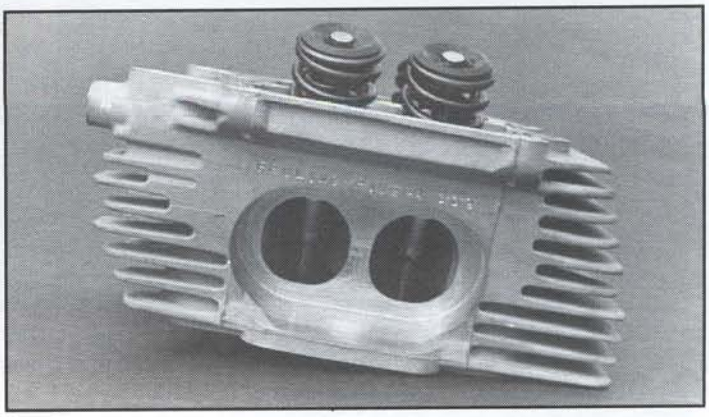


Photo 2

So, you want to go fast. Well, these heads will make it happen. Stock engines with 4-valve heads are outrunning strokers.

It's common knowledge that making a Harley breathe is the first step to making horsepower. In 1986 and 1987, Jim Feuling designed a 4-valve, per cylinder, head for an automotive engine. The car ran 280 mph at Bonneville that year.

Ultimately, Feuling developed a marketing relationship with Rivera Engineering which has grown around this project over the last three years.

It's common knowledge that making a Harley breathe is the first step to making horsepower

Feuling developed his design from aircraft A-356 aluminum to fit the Big-Twin Harley-Davidson Evolution Engine. They're all American. But performance is what we're after. A set of these heads will take a stock, 60-horsepower engine and bump it to 95 horsepower. With optional parts, the dyno pushes the needle higher.

The heads have a more efficient combustion chamber. The spark plug is mounted in the center of the head. This burns the fuel more efficiently and also pushes the piston straight down. The intake ports (photo 2) feature a fairing that streamlines the fuel to the cylinders. By increasing the valve area by 26 percent they have increased the intake flow by 25 percent. Logically, the more fuel the more power.

But exhaust must escape rapidly to complete the formula (exhaust ports (photo 3) are high speed and volume) up to 450 feet per minute at optimum rpm.

The results are: better performance, improved response and efficiency, and reduced heat transfer at the heads.

American-manufactured parts include: stainless valves, nickle chrome-moly valve seats, silicon aluminum bronze valve guides, and special rocker arms and pushrods.

The rocker arms (photo 4) use a neat item called a swivel foot adjuster. Basically, it looks like a ball bearing with a flat spot on it. When you adjust the valves, the flat spot makes contact with the valve stem. When the rocker arm moves to push the valve down, the flat spot stays in contact with the valve stem throughout its travel. When we received this initial set in our shop, HMW, the crew went nuts inspecting every facet of Feuling's workmanship and design.

The heads were being installed on a new engine, not in the frame. Installing them in the frame should be no problem, though.

Because these heads produce horsepower and increased compression, it is important that the rest of the engine is in good condition.

Prior to ordering a set of these heads you need to give some consideration to several things:

1. They do not come with an exhaust system.

2. Due to the design of the exhaust port, stock exhaust cannot *be used.*

3. Depending on year and model, most exhaust systems are available from Rivera. In my case I ordered a set of pipes and flanges—unassembled. I made some minor modifications, welded them, and had 'em chromed. They work fine.

4. The engine performs best with a system called Anti-Reversionary. It should also be noted in some instances the rear exhaust may not want to go in or out without slight modification to flange and one fin. Rivera has said they are modifying the fin on future production heads.

5. A special cam is also offered as an extra cost option. These heads will work with a stock, 49-state cam and hydraulic lifters, but it is recommended not to run the engine over 5000 rpm.

6. If the engine is revving over 5000 rpm, a set of semi-solid adapters must be installed in the hydraulic lifters.

7. If you plan to exceed 5500 rpm, the stock ignition will need to be replaced. Though there are many good ignition systems available that will remove the rev limitation, I recommend the Dyna S Single Fire—although special advance weights and timing must be used.

8. Asking questions and making sure you have all the correct parts at the time of your order will make the job go quicker and smoother.

9. Almost any carb will work. I'm running a 45 DCOE Dual Throat Weber and am very happy with it. The other two bikes we've installed the 4-valve heads on are running S & S carbs, including a 92-incher.

10. A dual carb 40mm Dell 'Orto single throat system is soon to be available. I

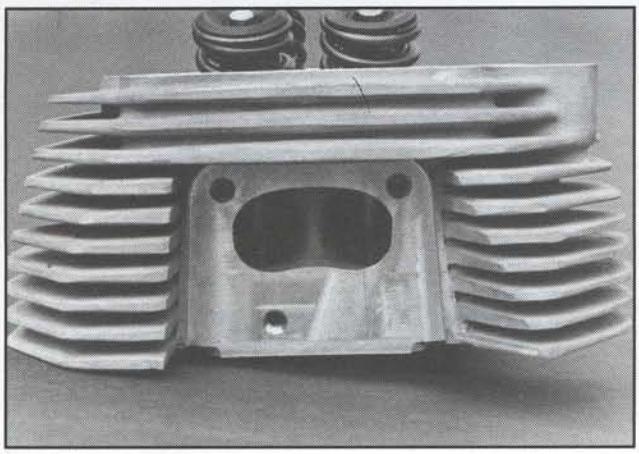


Photo 3

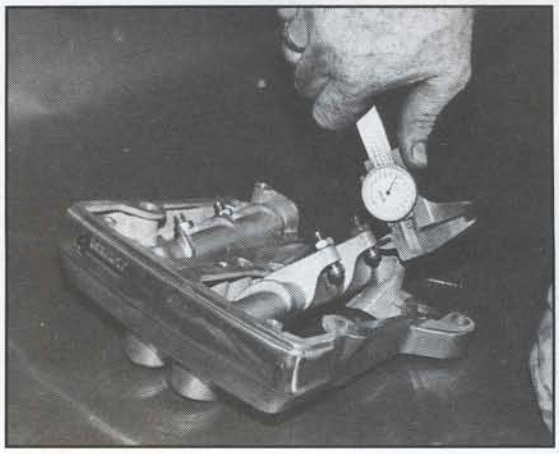


Photo 4

Photo 5

tested this setup and it performed well. There was a minor problem with the carbs returning to idle, but the problem was corrected.

11. Naturally, this is a new innovation and destined to be tested with every cam/carburetor/ignition formula available to Big Twins.

12. If you decide to get a set of these heads, here's some advice: They come with a video and a set of written instructions. Read the instructions, watch the video, watch the video again and use the instruction sheet while assembling.

13. Though assembly is not difficult, a lot will depend on your experience. If you have ever changed a Evo head it is about the same. But it's not just bolting parts together. You may want to have a qualified shop or mechanic do the job. Of course, a clean place and proper tools are a must.

Assembly:

1. Following the procedure in the Harley Manual, remove the stock heads, being careful not to disturb the cylinder base gaskets (unless you're gong to replace the pistons or rings). Retain cylinders to cases using flat washers and old head bolts.

2. Very carefully, and following instructions, use a dial indicator to find top dead center of the front piston (photo 5). Rotate the engine backwards and carefully stamp new timing marks in the flywheel as instructed (photo 6). Rotate engine forward until rear cylinder is on top dead center on compression stroke. Install timing marks.

3. Important: At this time, you must check to see if the rear exhaust header pipe can be installed with the head firmly in place. If any modifications are needed, now is the time to make them.

4. Note: The head comes with two head bolts and washers installed. When installing the other two head bolts and washers, pay attention. Washers are not flat and must be installed correctly—flat side down, raised side up. Use never-seize on threads and a few drops of oil between head bolt and washer. These steps are critical to get proper torque

Though assembly is not difficult, a lot will depend on your experience

5. Use a good torque wrench and tighten head bolts in proper sequence. Go slowly and equally. Do not torque over 35 ft./lbs. Prior to installing rocker boxes, swivel the foot adjusters on right side of the motor. They need to be set to .100 on all rocker shafts (photo 4). Left side adjusters need to be backed off at this time.

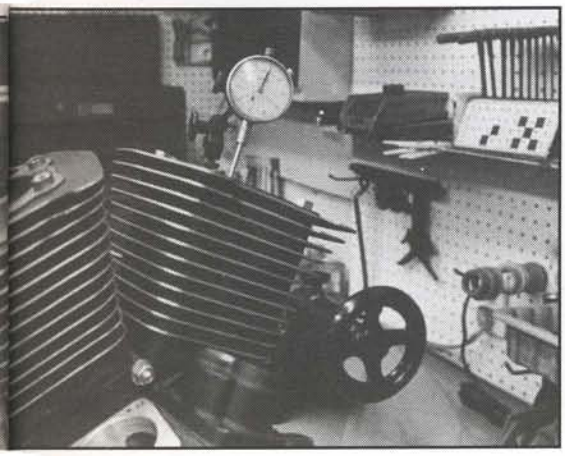
6. Install O-ring in rocker box , being sure the ring is seated and not rolled. Use a good O-ring lubricant and coat liberally. Install pushrods and follow instructions for installing rocker boxes. Care must be taken that the flats of adjusters are in contact with top of the valve stems. Double check and torque rocker boxers to 20 ft. lbs. If you're using stock lifters, they should bleed down in a few minutes. Do not turn the engine over until they have and turn freely using two fingers. If you've used the semi-solid adapters they may take longer to bleed down or may not bleed down enough. (On this installation we had to readjust the right side adjusters to .095 before the pushrods would turn freely.) It is not unusual—pay attention.

7. Once pushrod turns freely, adjust left side adjuster as instructed. Go slow—a good feel for contact is important. Squirt some oil on both adjusters and valve stem and adjust other valves in the same manner. Use same procedure on front cylinder prior to installing rocker covers. It is suggested you wet sand the gasket surface on rocker top cover, using a piece of glass or other known flat surface. All three engines we worked on showed signs of minor seepage prior to doing this. Cement the gasket to the rocker cover only at this time. Rivera had originally suggested only cementing it to the cover but has since suggested cementing both sides. The reason I suggest this is that you'll be able to remove the cover without destroying the gasket (if you need to go back and make minor adjustments).

8. If no seepage shows after you have some miles on the engine, leave it alone. If it does, it's no big thing to remove the covers and reseal. Once you seal both sides of the gasket, order another set to have handy should you need them in the future.

9. Prior to installing the intake manifold runners, inspect carefully for any defects. Install O-rings and, using a good O-ring lubricant, carefully install into the head making sure they are fully seated.

10.Prior to installing intake plenum, inspect runner surface, lubricate O-rings, and very carefully slide them onto manifold runners. If O-ring starts to come out of the groove or restriction is felt stop and inspect. If O-ring comes out of groove, a very small amount of Super Glue may be used to hold it in place. Care must be taken that the glue does not get on outer surface where it mates to plenum. If plenum goes all the way in, inspect inside and outside surfaces to be sure O-ring is properly in place and did not get cut. An intake leak will cause one or both cylinders to run lean and possibly burn a hole in a piston. If you have a problem, you may have to lap the plenum. We had to do this on two out of three jobs.



Photos by Rogue

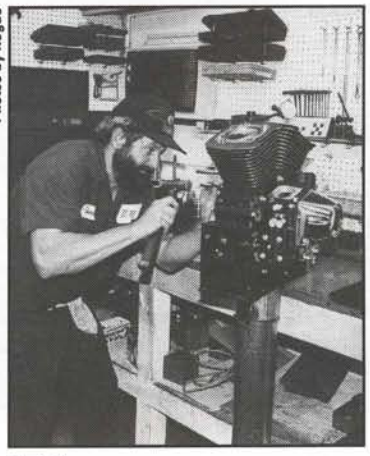


Photo 6

11. Remove runners from head and remove O-rings. O-rings on runners to plenum will be destroyed when you do this. Make sure all of the old O-ring is out of the groove. Use standard valve lapping compound and coat surfaces. Work the plenum back and forth until your surfaces mate. It is a good idea to mark mated surfaces. Clean thoroughly, removing all lapping compound. Now is the part of the job we did not think ahead about. We needed another set of O-rings. Regular delivery UPS, from California to Florida, was one week. Overnight delivery costs $25, plus the price of the O-ring, of course. Though the service from Rivera is great, I wasn't happy with their O-ring and gasket prices.

12. After lapping and installing new O-rings, plenum should slide in smoothly. The plenum is held to runners with retaining rings. Prior to installing on carb side, you either need to install a bottom carb bolt or put a stud in the carb. With your ring in place, you can't get a bolt in the bottom hole.

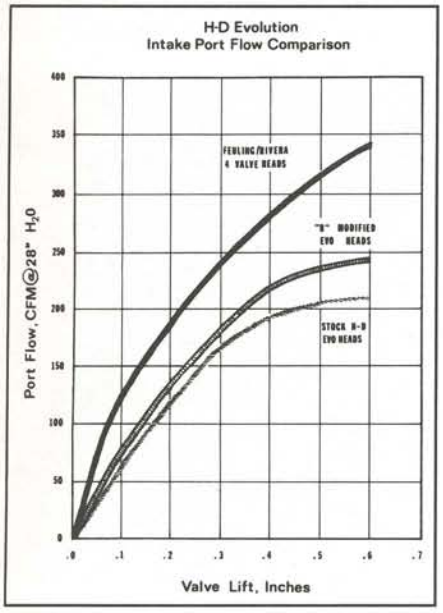
After double checking everything, we fired the engine. Double check the timing and make your final adjustments to the carb. You may also want to check your brakes at this time—you're going to need them. The engine came on strong and smooth. The biggest problem I had was dealing with the slow break-in miles on the engine before I could really lean on the throttle to see what it would do.

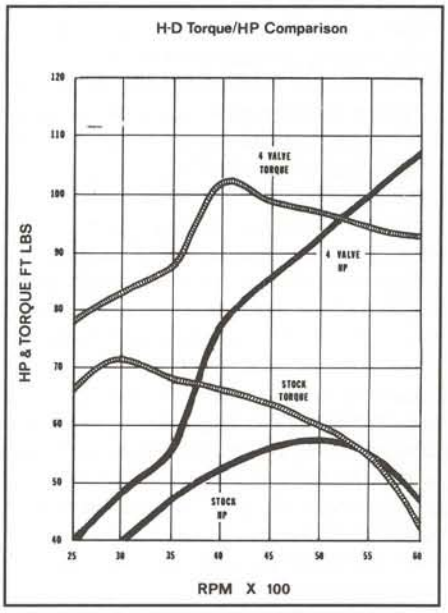
After the novelty of torque and horsepower wore off, I also noticed that the engine ran very smoothly at all rpm and at speed. Looking in clear mirrors at 90 mph is a compliment to this system.

Thanks to Dennis Mitchell—HMW, West Melbourne, Florida, for the use of the shop and help with installation. Also thanks to Jim Feuling and Rivera Engineering for technical assistance.

—Rogue

For further information or assistance you can contact: Rivera Engineering, 6416 S. Western Ave., Whittier, CA 90606, (213) 692-8944, or Rogue, HMW, 2330 W. New Haven Ave., West Melbourne, FL, 32904, (407) 723-0026.

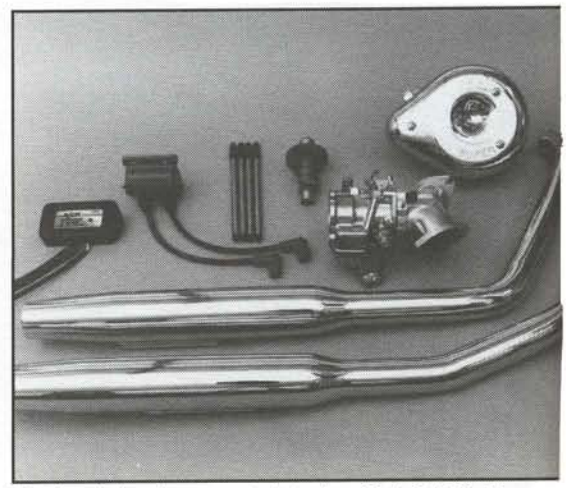




FXRS Hop-Up

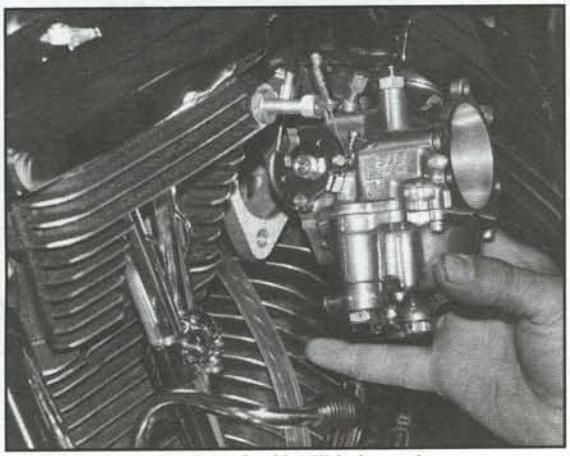
Theories And Philosophies On Performance From Carl Morrow

By Wrench



This photo displays the components that make up Carl's Get-Kit for Evos.

This is the last—except for some detail work—major stage of the development of this 1990 FXRS. The goal: street performance without risking reliability. Riding habits include a tremendous amount of time on freeways. However, it doesn't mean constant top- end running. Due to growing congestion in this area, the average freeway speed is less than 50 mph. The performance was then designed to smack the pavement at mid-range (30 mph), and pull strong to 80 mph. Yet the bike needed to handle low speeds, splitting lanes, and dodging cars in parking lots without stalling.



The new S&S shorty, E-series carb, with 1-7/8-inch venturi.

The hop-up location was Carl's Speed Shop in Santa Fe Springs. Carl's shop is organized and pristine. He's been 17 years in the same town. Carl's also an avid, successful drag racer (his 20-year-old son, Doug, regularly punches an 89-inch Sportster through the quarter-mile in the 10s). Carl also holds a couple of Bonneville (Salt Flats) records and is building a bike for The Salt this season.

The $850, quick street kit includes: S&S adjustable pushrods, S&S Shorty Carb (E-Series, 1 7/8 inches), Accel Mega-Fire ignition, Andrews EV-3 cam, Andrews High Output coil and wires, and Carl's adjustable-baffled exhaust system. Installed, the operation costs $1350.

This is a proven system, one of many on the market today. I hope to explain the reasoning behind every modification, so this system can be applied to any bike—all the way back to pans. Then, we'll get to some specifics regarding the installation of this particular system. Adding the right elements to your motor, without taking the heads off, can increase performance by as much as 33 percent and take an FXR through the quarter at 12.50—doing over 106 mph—with only the baffles removed (which is part of the benefit of this exhaust system). The baffles can be adjusted or completely removed easily.

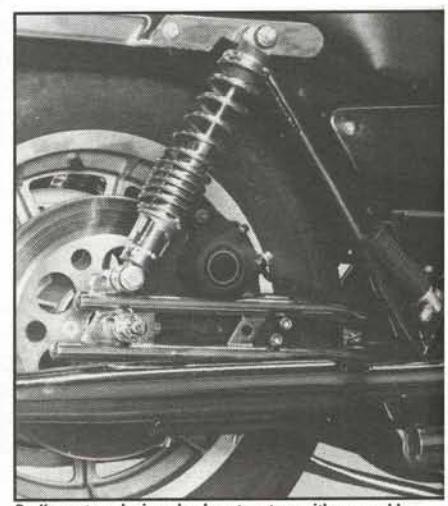
Let's start with the 1 7/8-inch, S&S Series E carb. This carb was developed over the last five years through S&S, Smith Brothers research—they've done a fine job. The choke mechanism is very efficient and easy to adjust while going down the road. In addition, the accelerator pump is highly adjustable and works well. This unit is much more efficient and compact than many carbs. But several carbs will enhance the performance of a stock bike, these include: SU, Dell 'Orto, or Screamin' Eagle, you name it. But each one has its idiosyncrasies or performance variations. This carb was installed with a 29.5 intermediate jet and a 68 main jet.

The exhaust system was designed by Carl to be equal in length, and afford the engine enough back pressure to enhance horsepower (by assisting with the fuel velocity), while moving the exhaust out of the engine quickly, at the right time. "Drag pipes are out," says Carl Morrow, the owner and master machinist. "They don't function well except on drag bikes. They make engines hard to tune and don't give riders any mid-range. Like a light switch, they're either off or on."

The ignition came from Accel. This Mega Fire module is adjustable in several aspects: amount of advance, rpm level for advance to take place and rev limiting capabilities. It seems technical, but it's not. The advance rolls on before 2000 rpms and the rev limiter is an engine saver, unless you're only after top-end on a 1/4-mile strip of asphalt. The stock rev limiter shuts the engine down at 5250. Open it up, and the engine will spin to 7000 plus, but it's dangerous to the engine's internals. An Evo can easily rev to 6200, and that's where I had it set (after removing the limiter altogether for a short while, which is possible with this module). One of the problems with removing the limiter is over-revving during a missed shift, which can cause the valve collars to smack the seals and cause the bike to smoke. Secondly, I was running my revs way too high (going too fast). Anything in the area of 6800 is beginning to wear the engine disproportionately Some modification is fine. With this adjustable module, altering the curve for the drags is just a flip or two of a switch.

Generally, adjustable pushrods simplify one function—replacing the cam. By pinching off the stock solid rods with massive dykes and replacing them with the adjustables the rocker boxes do not have to be removed.

The cam is up to you. Last issue, we described the process of selecting the proper cam, based on riding habits, engine size, and performance expectations. We installed the EV-3 because it comes



Carl's custom designed exhaust system with removable, adjustable baffles.

on like an animal from 2500 to 6500 without headwork. If I had modified the heads, then I could have pushed more in the cam area. A larger cam would be wasted on this engine and performance would have started to slip.

The high-output coil only reinforces the ignition module and enhances the spark for a cleaner more efficient burn over the piston.

Installation

The installation aspects of this tech tip are straightforward. No modifications or special tools are needed. The carburetor comes with very complete assembly and adjustment directions.

We also installed the S&S intake manifold to remove the compliance fitting problem with the improved O-ring design.

The ignition module basically replaces the stock module. Timing is critical, though. A timing light is a must.

The cam installation requires the elimination of the stock pushrods, removal of the cam cover and tappet blocks. Don't forget to buy new gaskets. If you have verniers, check the difference in lengths of the cam. But since end-play is not critical in these models, it shouldn't be a problem (although there should be at least .015 end-play). And when you replace the pushrods, the rule of thumb is four turns down after the end-play is taken up. Be careful with this maneuver. It's all in the touch.

Photo by Michael Lichter

Photo by Mike Lichter

The FXR project complete: lowered, springer front end, and hopped-up.

Finally, the exhaust pipes need only to be installed like the stock ones were. Replace the gaskets with new ones, let the pipes center in the ports for the best fit, and then rock 'n' roll. Carl will custom modify each set of baffles for the owner and his engine before he ships them out.

Carl feels strongly that there will be a surge in Harley-Davidson performance this year and next with the release of Rivera's 4-valve heads, Accel's fuel injection system, the new S&S carb, and new developments to heads.

But, as riders, we need to keep in mind our own rides and riding styles. Combinations of stroker kits, cams, headwork, and ignitions must be matched for maximum performance, just as the needles in a carb. To over-cam a stock motor won't accomplish anything, just like running a stock cam in a 98-incher. Take your time and talk to people who are building successful speedsters before pumping a lot of time, effort, and money into your project bike. Guys like Carl should produce monthly newsletters, explaining new breakthroughs in performance and where they best apply. Bath-tubbing heads and filling in the chambers to heighten compression is hot for some motors. Research tells the performance-minded that this operation fans the flame by causing turbulence in the heads. Polishing intakes is gone—to be replaced with fins in intake ports to streamline fuel direction. Bumps in exhaust ports create exhaust velocity by preventing turbulence at the manifold, because of the turn the exhaust makes.

Carl is a firm believer that stroke is the answer for Harleys, due to the torque design of the engine. Bore is more effective for engines that spin faster. Since V-twins have an inherent rpm life/loss factor, it doesn't make much sense to push the revs for performance, when you know the damage it is doing to the engine.

These are just a couple of interesting performance developments the riders on the cutting edge of the industry are messing with. Carl works closely with S&S on many of their prototype components. His race sponsors include: S&S, Kosman, Feuling, Mike Corbin, and Fullerton Harley-Davidson.

Carl's shop number is (213) 941-9385. The shop is located at 9339 Santa Fe Springs Rd., Santa Fe Springs, CA 90670.

Now I've got a stock FXRS that will keep up with strokers through 4th gear.

I can't bitch.

Photos by Doug Kamicar

The adjustable, Accel ignition, Mega Fire module installed in the same location as the stock unit.

BLOWN HEAD GASKET BLUES

Tech by Thompson

So, your pan's got another blown head gasket, huh? What's this, the third one now in the last year? Well, instead of blaming the poor slob at the bike shop for the "junk gaskets" he's been selling you, did you ever think something else may be wrong?

After reading this article, you'll understand that a gasket isn't such a simple thing after all. It's a complex, sophisticated device that must handle several duties, some of which are at odds with each other.

Pans and shovels are engines of bimetallic design: the components are made of different materials. Okay, heads are aluminium and cylinders are iron. So what? Well, these materials have drastically different coefficients of expansion (rate and amount at which they expand when heated). Therefore, the head gasket must seal against engine compression pressure and oil leakage but *also* must allow movement between the head and cylinder! Yes, Alice, the head, even though it is tightly fastened to the cylinder, actually slips back and forth on top of it as it expands and contracts.

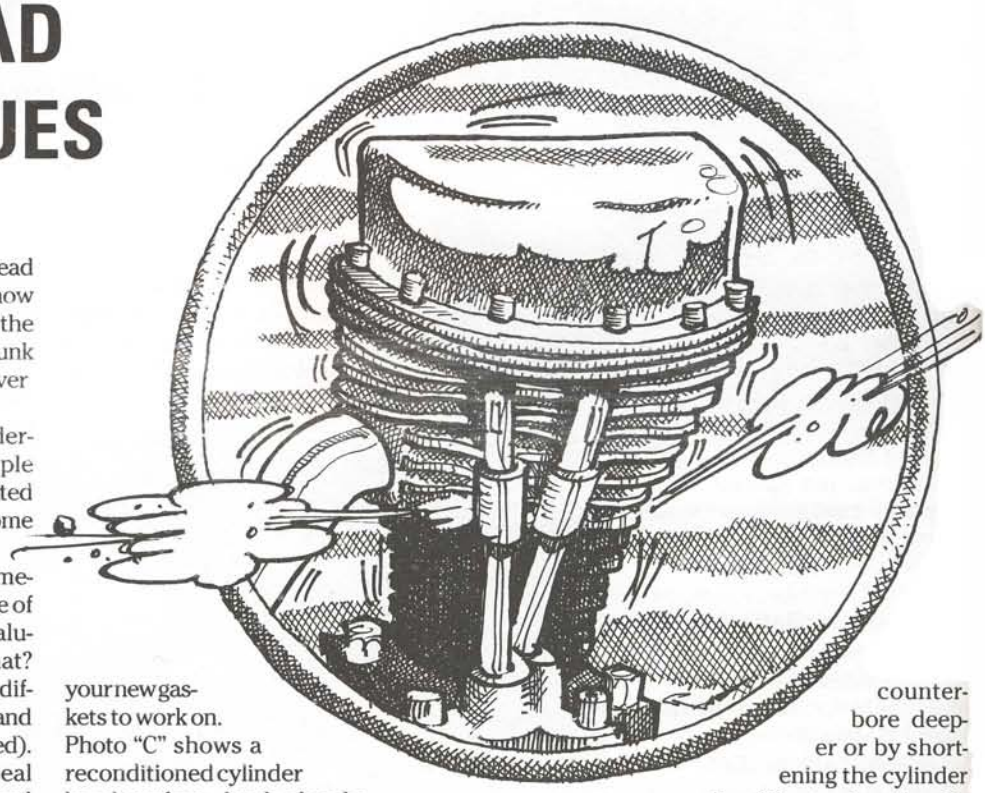
This causes a couple of things to happen, none of which is good. If your engine has older, asbestos-based gaskets, the aggressive, abrasive nature of this material actually *wears away* the gasket surface on the cylinder head.

Photo "A" shows a head that has started to deteriorate from gasket wear. The "pit" marks on the gasket surface are from the woven wire core of an asbestos gasket. The asbestos seal surfaces have "scrubbed" away to where the wire is exposed and can cut into the head. This "scrubbing" action is the reason your head bolts *seem* to loosen up. Actually, the bolts aren't loosening, the gasket and head are wearing.

Many mechanics and machinists will tell you the steel inserts "pull out" of these heads and cause sealing problems. Not true. These inserts are quite large and stable with the head material cast solidly around them. What *really* happens is that the softer aluminum wears away from around them and leaves them standing like small islands in the gasket surface. Photo "B" shows a head where .007 inches of material has worn away.

If your parts look like these, you'll have to visit your local machinist before you're ever gonna keep a head gasket in one piece.

It's necessary to resurface cylinder heads like these to create a fresh, flat surface for your new gaskets to work on. Photo "C" shows a reconditioned cylinder head surface. Look closely, the steel inserts are counterbored slightly to be *lower* than the sealing surface. This helps to keep the surface in a reasonable degree of flatness much longer. It was necessary to remove .012 inches from this head. (See stamped # at top of head).



Yes, Alice, the head, even though it is tightly fastened to the cylinder, actually slips back and forth on top of it as it expands and contracts

Don't forget to check out the gasket surface on the cylinder; although problems here are rare, it won't hurt to look.

Any older engine, or one that has had the heads resurfaced, should have the head counterbore depth and cylinder lip height clearance checked. See Photo "D." If the head counterbore is too shallow, due to resurfacing (or just loose production tolerances), the head bolts will tighten up but won't crush the gasket properly because the cylinder lip bottoms in the head counterbore. This may also be caused by failure to clean out carbon buildup in this area. Problems here can be remedied by either machining the counterbore deeper or by shortening the cylinder lip. (Shortening the lip should be done on a lathe, but, may be done with a file if you're *very* careful and maintain the same height all the way around the cylinder.) Deburr well—leave no sharp edge inside the cylinder. Most heads, when placed on the cylinder (or vice-versa as in Photo "D") without gaskets, will touch the cylinder at the head gasket surface. If clearance exists here, as in Photo "D," you must verify that it is not so much that it will interfere with gasket "crush." A new, James, Teflon-coated gasket is .038 inches thick. When tightened to the proper tension of 55-75 ft. lbs., it compresses to .032 inches thick. (These dimensions and thickness reduction at compression vary drastically between types of material and brands of gaskets—be careful). Photo "D" shows a clearance of .025 inches—a little on the tight side, but it should be okay.

No, that's not all. There are still the matters of gasket choice and assembly to con-

tend with. My recommendation for gaskets are those from the James Gasket Co. Although available in a bewildering array of types and materials, the blue, Teflon-coated, Kevlar-based James gaskets provide a good balance of quality and price. The Teflon coating helps to both seal minor surface imperfections and allow relative motion between the head and cylinder without excessive gasket wear.

Some head gasket materials, like copper, hold compression pressure well but aren't good at containing oil. If you're using these, apply a *very small* amount of sealant around the oil holes in the gasket (both sides) to prevent oil from seeping. Be careful: applying too much sealant can impede oil drainage from the head.

Torque tightening of the head bolts can be a real hassle, mostly due to the lack of wrench clearance. This is especially true when the engine is in the chassis. Some really neat adapters, which simplify the job, are available from Snap-On tools (for 7/16-inch, 12-point bolts use part #FRDH141, for 9/16-inch bolts use part #FRDH181.

Remember, when using an adapter on a torque wrench you must adjust the torque setting on the wrench to compensate for the length of the adapter. Use the following formula and example to figure the correct setting for *your* wrench.

$$\frac{T \times L}{(L + C)} = \text{wrench setting}$$

T = Torque required for fastener
L = Torque wrench length (c/line of head to c/line of handle)
C = Extension length (c/c).

Example :

$$\frac{T \times L}{(L + C)} = \frac{75 \times 18}{18 + 2} = \frac{1350}{20} = 67.5$$

Set your wrench to 67.5 lbs. and fastener will have 75 lbs. applied to it.

Lubricate the head bolt threads with light oil before installation. Tighten the head bolts evenly and uniformly, working up in small increments of tension and working around the head. Don't forget to shift the heads as necessary to allow for proper manifold alignment.

That's it, your problems should be over.

This article was provided by Jim Thompson at Thompson's Cylinder Head Service Co., 186 River St., Dedham, MA 02026, (617) 326-8380/ FAX:(617)320-9351. Jim's been providing fine machine work for over 25 years.

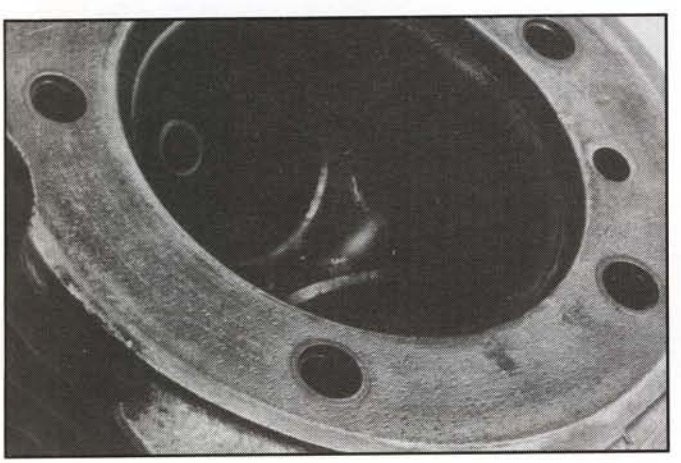


Photo A

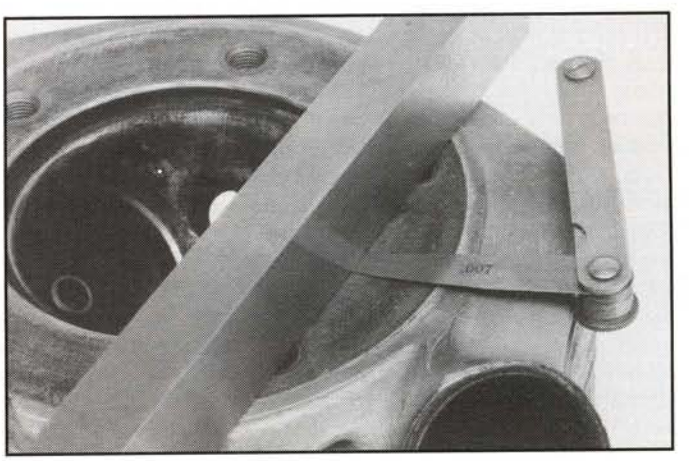


Photo B

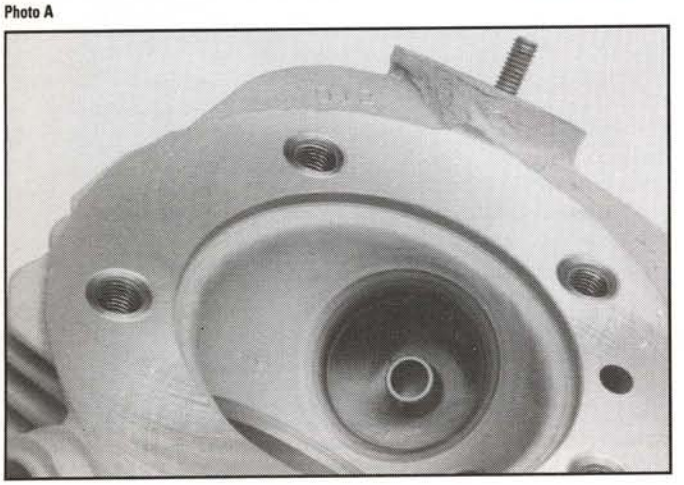


Photo C

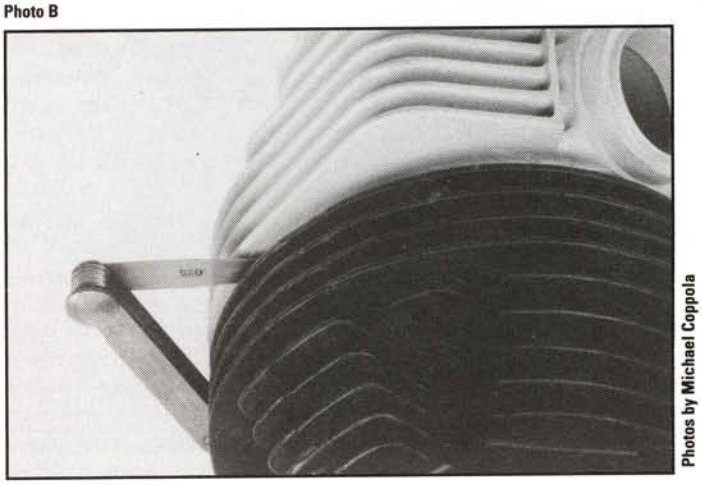


Photo D

Photos by Michael Coppola

Spray Lubricants

Extend Engine Life As Much As 40% And Reduce Friction For The Racer's Edge

For 16 years the people at Kal-Gard have been developing spray and baked-on lubricants. One of their first major challenges was to design a coating for the U.S. Navy's underwater demolition equipment. The Seals needed high corrosion-inhibiting, heat-dissipating coatings, with some lubricating properties, for weapons that would be transported underwater. Ultimately, that research evolved into a commercial product called Gun Kote.

At the time, Joe Ardigo and the late Ken Taylor owned the business. Joe's brother-in-law brought their products to the motorcycle industry. He was an off-road racer, working in the movie industry, which gave him a lot of spare time. So he hung around the shop boiling his chains in oil for dirt bike riding. Joe caught him experimenting and worked with him on a solid-lube coating that was permanently bonded on with a resin binder.

From their initial research they were able to create their current chain lube product using a wet base material that sticks, but is not solid or bonded on. Currently, their business caters to: the motorcycle industry (35%), the automotive industry (35%), and the aerospace industry (30%). Companies such as Crane Cams are utilizing their process to extend the life of their cams by lowering friction.

The difference between their Chain Kote lubricant and the solid or dry film lubes, is in the binders. Both are made with molybdenum disulfide, but the chain type lube is held in place with wet lubricants that can be washed off with contact cleaner. Molybdenum disulfide (Moly) is considered a lubricative pigment. The same Moly stuff is bonded with a resin binder to create the iron grip in the dry, solid form.

Kal-Gard uses Teflon for lining molds. The problem is that Teflon can't handle the abrasion or pressure that solid film lubes can. Another example of a similar substance is the graphite you use to spray in locks—but Moly is then milled with the resin base and solvents for spraying.

And to dispell the old rumor that this stuff actually impregnates the metal surface—it does not. It does, however, fill the asperities, or the highs and lows, and the striations in the metal surface.

It ruins ovens, stinks up the house, and destroys domestic relations

But let's get to the drive train saving system. For about $400, an entire drive train can be sprayed with this coating, then baked. This procedure will increase engine life by about 40%. First, the parts are degreased, sandblasted, and then degreased again (being handled with white gloves). Next they're painted with one coat. This process can be handled at home, but it ruins ovens, stinks up the house, and destroys domestic relations.

The coating builds to 3 tenths of a thousand (or .0003) and burnishes right back down. Kal-Gard is currently setting up service centers nationwide. If you give them a call, they'll assist you with finding the right facility for your work.

The project bike was a 1990 Sportster. As you can see by the photos, they coated the barrels, pistons (anything steel to steel or aluminum to aluminum), gears, valves, and valve guides. The insides of crank cases can also be coated. Then each item is baked for an hour at 300 degrees. If the part sprayed is of sizeable mass, it will need more time in the oven.

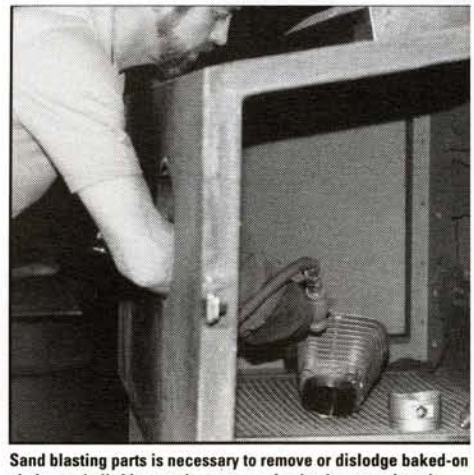
There it is. But my question to Rich Williamson, director of slipperiness at Kal-Gard, was if this system is so good why isn't everyone doing this? He told me that although they have been messing with dry lubes for 16 years, they haven't pushed it. Their consumer products make the money—this process has been used almost exclusively with private contracts and by performance people (such as drag bike racing champs Jim McClure and Bill Furr) on a custom basis.

In fact, the way they stumbled into the automotive industry was an accident. They were coating hardware for an accessory manufacturer for four-wheel-drive vehicles—roll bars, tubular bumpers, etc. A factory representative from General Motors was inspecting a truck and discovered that the underside of the vehicle was corroding evenly—except there was no corrosion on the hardware holding the bumpers and roll bars. They were in business.

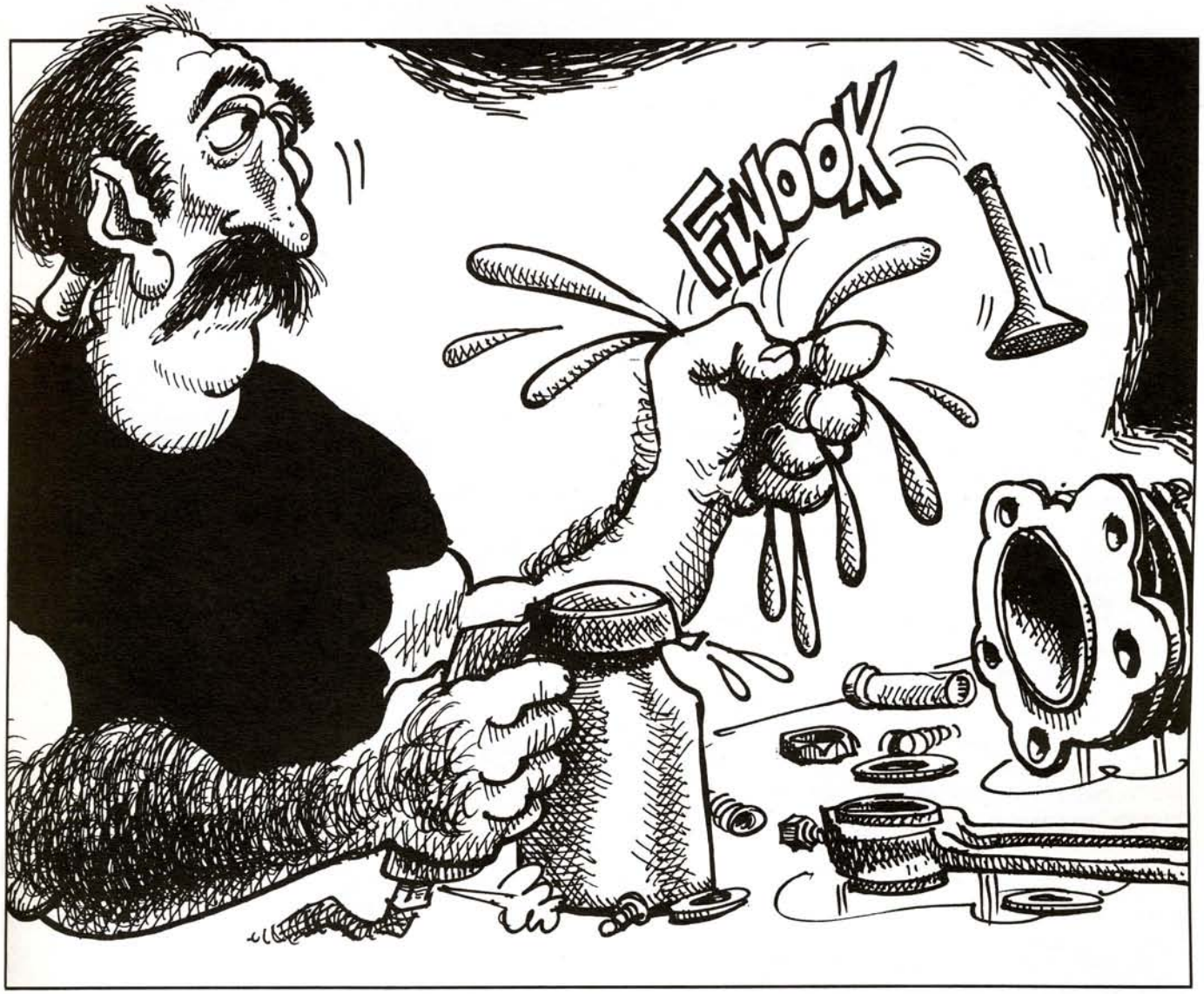
So let's see what the future brings to drag bike racing, performance bikes, and rebuilt street machines as they test the bonded film lubricant process.

—Wrench

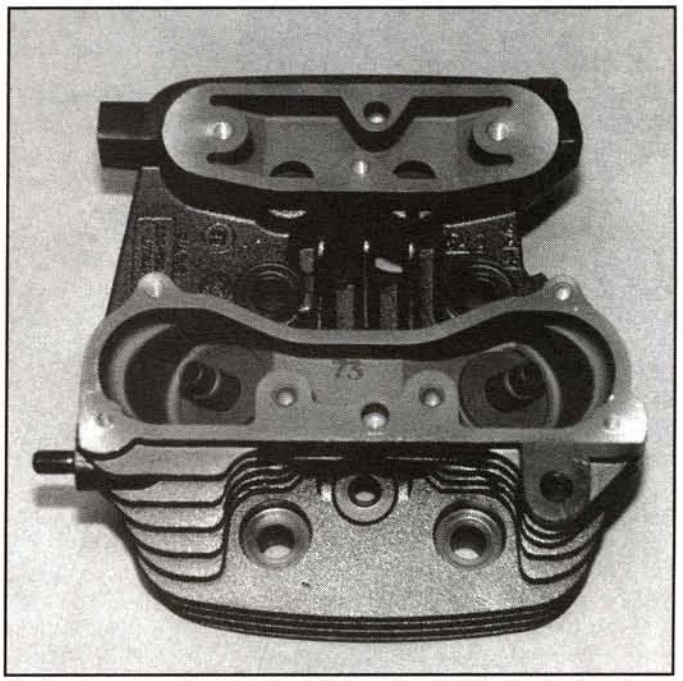
The most important procedure for proper bonding of solid lubrication is degreasing. Parts must be sprayed with clean solvents and scrubbed.



Sand blasting parts is necessary to remove or dislodge baked-on sludge and oil. Afterwards, parts need to be degreased again.



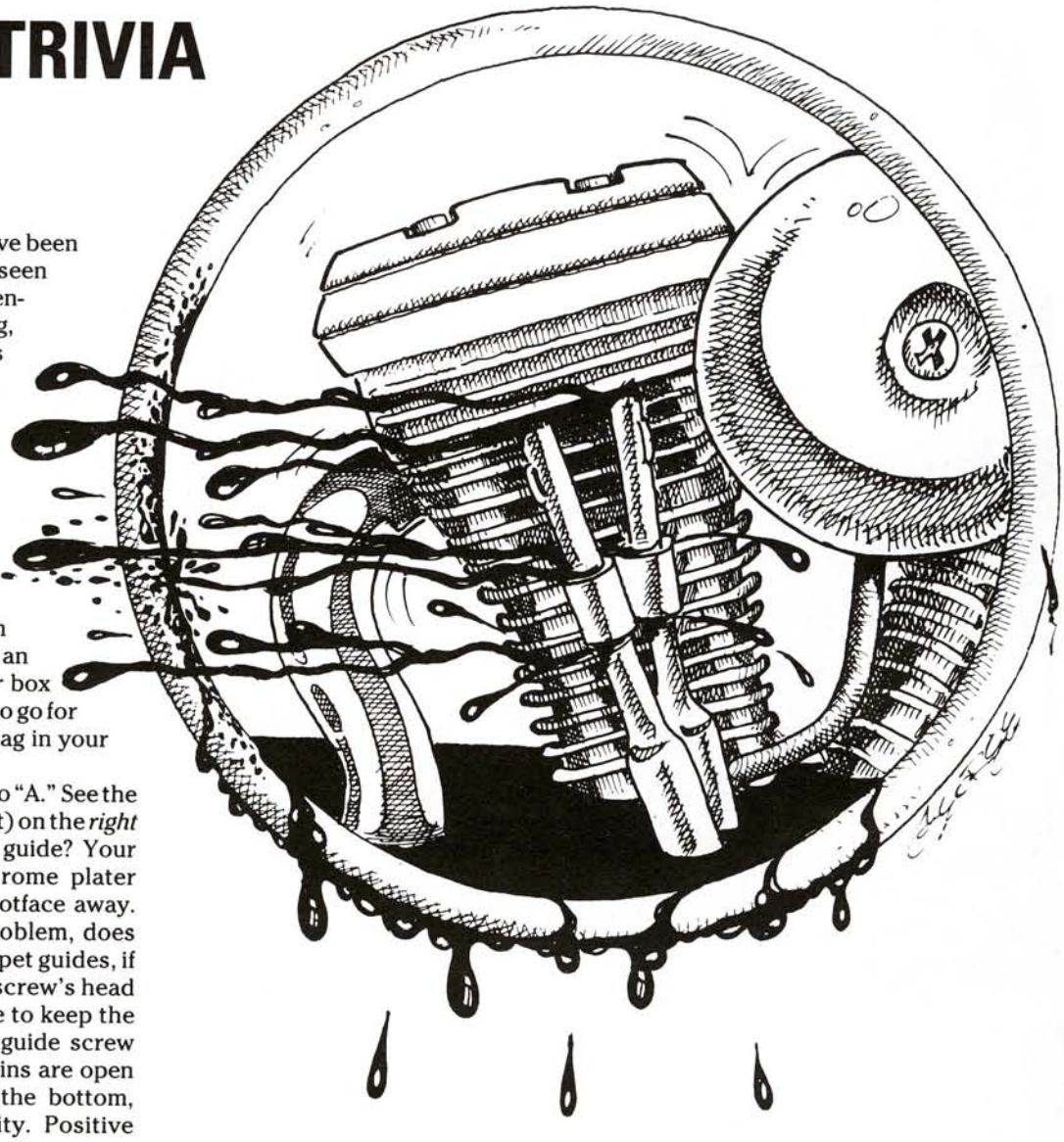
This is a photograph of a part that has been sprayed and baked with solid lubricant. The thickness of the coating can be as much as .0003, but burnishes down easily.



This Evolution head was baked with Kal-Gard's black, thermal set, corrosion-resistant, heat-dissipating finish. It was prepped the same as the internal parts.

TAPPET TRIVIA

Tech by Thompson



During the 30 years that I've been eyeballing scooters, I've seen many otherwise beautiful engines spoiled by annoying, unsightly oil leaks. This is especially common around the tappet guide/pushrod tube area on Big Twins.

In the following article, we'll cover a few of the tips and cures for this problem which I've found to work well. (Cheap, too—that never hurts).

If you pay close attention to these tips, and watch for an upcoming article on rocker box leaks, you may just be able to go for a ride someday without a rag in your back pocket!

Take a close look at photo "A." See the tappet screw spotface (seat) on the *right near* corner of the tappet guide? Your friendly neighborhood chrome plater has partly polished the spotface away. Doesn't seem like a big problem, does it? But, on late Big Twin tappet guides, if this surface is not flat, the screw's head can't seal against the guide to keep the oil in. Most of the tappet guide screw holes on late-model Big Twins are open to crankcase pressure at the bottom, inside the gear case cavity. Positive crankcase pressure forces oil vapor up the screw threads and out from under the head of the screw which is hanging out unsupported on one side. Instant leak. The hard, unforgiving nature of a chrome-plated surface doesn't assist sealing, either.

Easy cure: Place one H-D #6218W seal washer (also available from NEMPCO—#82396) under the head of each screw during installation. It's fixed. These copper washers are quite small in outside diameter and are not objectionable in appearance at all. Makes for a neat, professional-looking installation.

Next problem: chronic leaking at the bottom seal of the pushrod tubes. There are several things which must be checked here. Run down the following list and you should have all the bases covered.

1. Spring Tension

If you can depress the spring cover cap quite easily, then you may have a weak spring which should be replaced.

If your engine has taller-than-stock cylinders, you need extra- long pushrod spring cap retainer clips. Sometimes even a stock height engine can benefit from these. S&S products has a good selection of these clips in five different lengths. Use the longest one you can fit in. Shorten them to suit, if necessary.

Occasionally, you'll find the steel washer (H-D #6762B) which goes between the spring and seal missing. Look closely, sometimes they embed themselves in the cork seal and only appear to be missing.

2. Pushrod Tube Drainage

You know it's not good when you shut off your engine, open up a pushrod tube, and a flood of oil comes out. No seal can last long if the whole pushrod tube is full of oil. The oil drain hole down through the cylinder head and cylinder is not the only way top end oil returns to the crankcase. A portion of it flows down

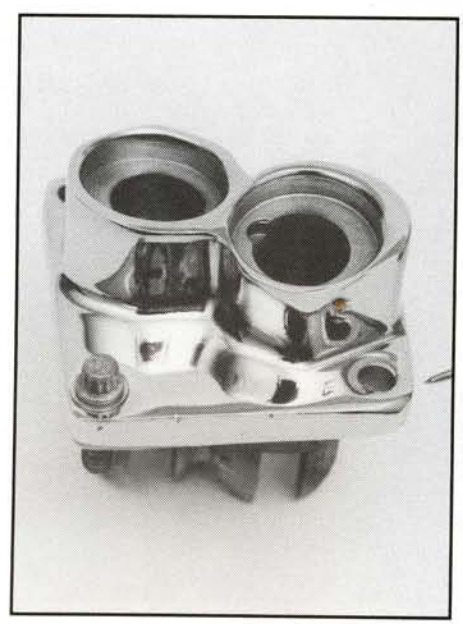


Photo A

through the pushrod tubes, but then comes up against the tappets—you must provide a way around them to the cam gear cavity. There are drain holes in the tappet guides already, all you have to do is alter them slightly and you'll be in business. Using these existing holes as a guide, drill down the cross passage until you can see the drill bit intersect with the clean passage. (The drain passage is the one closest to vertical in photo "B.") Use the same size drill as the passage you are working on; sometimes these passages are slightly different sizes—a machinist's number drill set is helpful here. Drill the drain passage all the way down through the bottom of the guide, so that it is the same diameter from top to bottom.

3. Tappet to Seal Interference

Some tappets, especially solids, are quite tall. When used with very high lift cams, they may hit the lower pushrod tube seal at full lift. Chamfer the top edge of the tappet just enough to prevent contact.

Even if you don't have this interference problem, it's not a bad idea to "radius" the top edge of your tappets. (See photo "C.") This edge can be quite sharp on some tappets and it will cut and wear the tappet guide bores just like a sharp tool bit.

4. Over-oiling

Engines that have been converted to solid tappets do *not* need full oil pump pressure fed to the tappets like hydraulic tappers do. You can eliminate the pressure oil feeds to the tappets by tapping the feed holes indicated in photo "D" with an 8-32 tap and plugging the holes with 3/16-inch-long, 8-32 hexhead set screws. *Note:* Use a good *sharp* tap and work carefully, it's easy to break a tap in this hole as it enters the guide at an angle. Don't tap all the way through into the tappet bore; just go deep enough to allow the screw to be completely hidden inside the casting. There must be incomplete threads at the bottom of the hole for the screw to "jam" against.

If you're a little on the cowardly side, just fill the hole solidly with silicone sealant and let it cure overnight before installing and starting the engine.

No, this modification will *not* reduce tappet service life.

5. Pushrod Tube Damage

Check the tubes thoroughly for bends, dents or any other form of damage at the sealing edges (flanges). Straighten or replace parts as needed.

If you're a little on the cowardly side, just fill the hole solidly with silicone sealant and let it cure overnight

That's it. You should have that ol' Hog dried up now.

This technical article was provided by Jim Thompson at Thompson's Cylinder Head Service Co., 186 River St., Dedham, MA, 02026. Jim, an East Coast Hamster, has been providing quality machine work for over 25 years. You can reach him at (617) 326-8380 or FAX: (617) 320-9351. Mail order service is no problem.

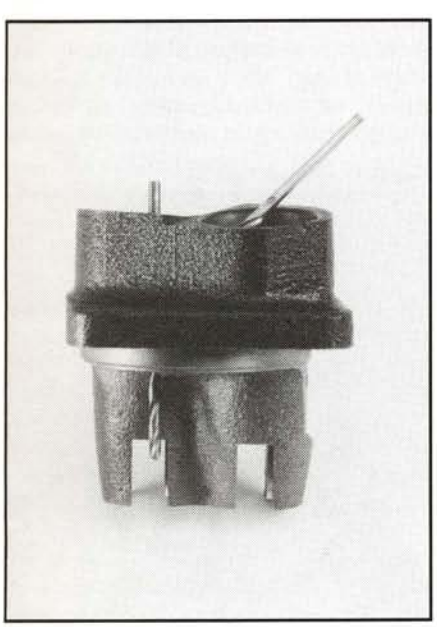


Photo B

Photo C

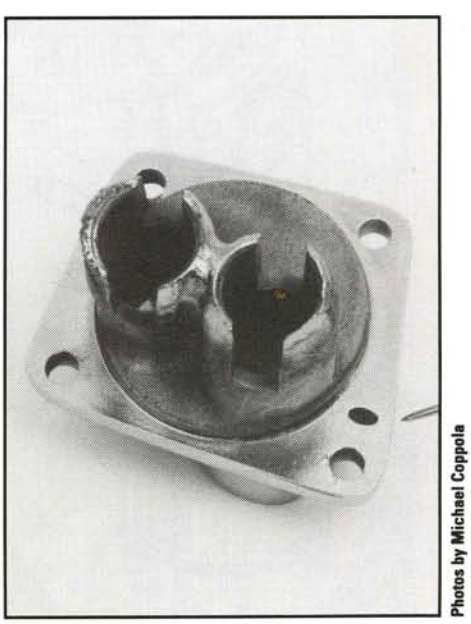
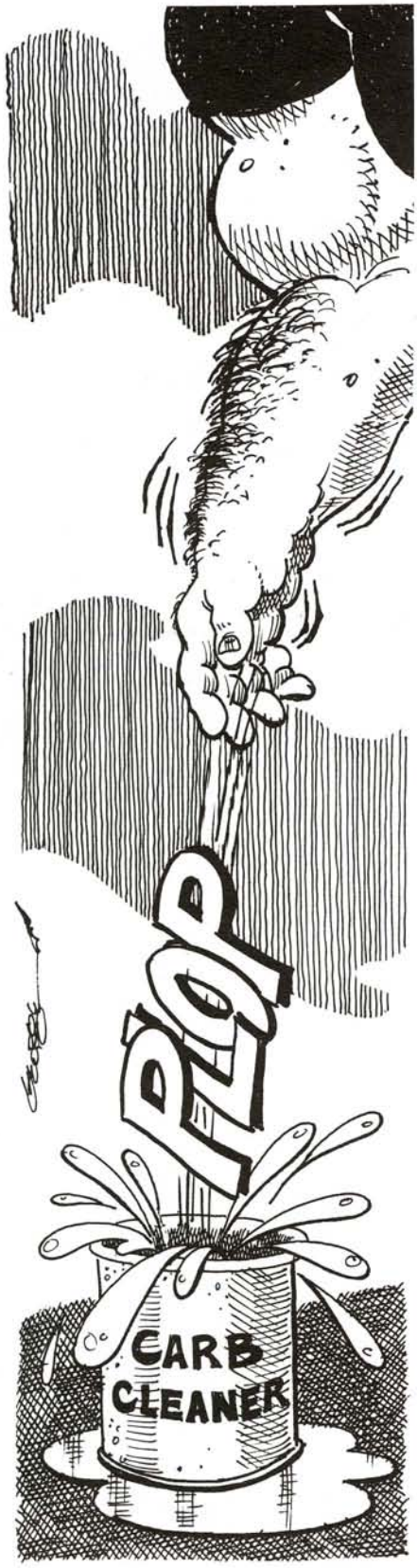


Photo D

Photos by Michael Coppola

S&S SUPER CARB OVERHAUL

Tech by Thompson



All good things must come to an end. Yes, I know you paid a lot of your hard-earned cash for that Super "B" you've been running, but wasn't that quite a few years ago? Unfortunately, all mechanical devices need maintenance sooner or later, and even though the S&S carbs are very simple and dependable as high-performance fuel mixers go, they are no exception to the rule.

Pay close attention and we'll go through the necessary steps to bring that bulky carb back to like-new performance. (Of course, we're taking it for granted that you have definitely isolated your problem and do not have any electrical or basic mechanical problems in your engine.)

The only thing you'll need for this job, that's not readily available in your garage, is a pail of carburetor cleaner. Just take a walk down to the corner filling station, ask nicely, and I'm sure they'll dip the parts for you for a nominal fee. As a last resort, lacquer thinner and small bristle brushes will do the trick.

CAUTION:

Gasoline, gasoline fumes, and lacquer thinner are all highly flammable! Be careful and work safely—giving yourself the sacrificial Buddhist monk treatment is not a pleasant way to check out!

Carb removal should start with a cold engine. For safety's sake, remove the ignition key. Remove the air cleaner, support brackets, and disconnect the throttle cables. Close the fuel valve and drain the carb bowl by removing the 5/8-inch hex plug at the bottom of the bowl. Catch the fuel in a metal container—don't let it splash onto painted surfaces. Unleaded gas will deteriorate some paints. Disconnect and plug the fuel line of the carburetor end. Unbolt the carb from the manifold.

Now's the time to check and replace (if needed) intake manifold seals and gaskets; many maladies unjustly blamed on the carb are caused by leaking intake seals. Evolution Big Twin compliance fittings are particularly troublesome.

Disassemble the carb completely—this is quite easy and the only precaution you need to take is to mark the throttle plate's position (in/out and top/bottom) before removal. This plate is directional and must be replaced with the same orientation. Refer to Figure C.

The intermediate jet is grasped with pliers and twisted out in a counterclockwise direction. The fuel enrichment device unscrews from the body, but can't be disassembled further. Clean all parts thoroughly. Do not immerse rubber-tipped fuel inlet valves in carb cleaner or strong solvents as the tip will deteriorate. (It doesn't matter if you're going to replace it.) Don't attempt to ream out or clean holes and passages with drills or sharp instruments. Some of these holes are metering orifices and their sizes cannot be changed. Be careful—a new carb body costs almost $150.

Inspect all parts for wear and damage; S&S carbs are quite durable and you'll probably find that all you'll need are a new fuel inlet valve and gaskets. Carbs that've traveled many miles may exhibit wear on the throttle shaft where it passes

Photos by Michael Coppola

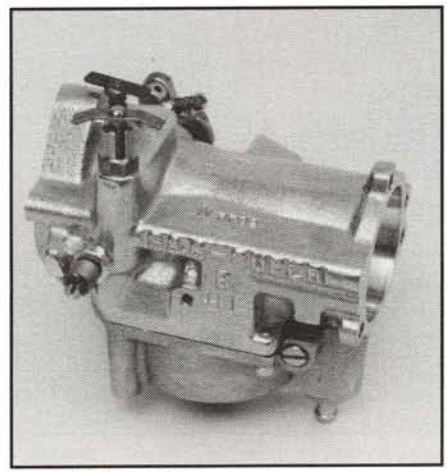


Photo A: The famous S&S Super

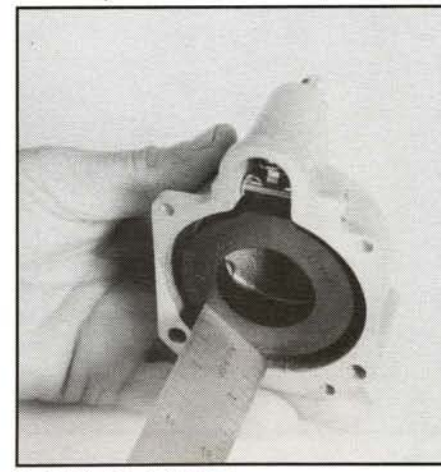


Photo B: Float bowl adjustment

through the carb body. In extreme cases, the body may need to be bored and have bushings installed to cure excessive wear. This is a job for your favorite machinist. Don't sweat this one, it's rare. Blow through all passages in the carb body to make sure nothing's plugged. Examine the body inside the throttle bore where the tip of the idle mixture screw protrudes slightly—if it is cracked around this hole you're doomed; at one time, an overly enthusiastic tuner turned the screw in too tightly and now you need a new body.

Refer to the exploded view (Figure D), determine which style fuel inlet valve you have, and you're ready to purchase your parts and assembly. S&S offers a beautiful master rebuild kit for the Super carbs; use #214A, if you have the style "B" inlet valve and #214B, if you have style "C." These kits include everything you'll need—even new hardware and throttle shaft bushings. If your local dealer is unable to help you, contact Thompson's Cylinder Head Service; we have all the necessary parts and we'll ship UPS to your door. We can also modify your carb body for throttle shaft bushings, if needed.

You assemble the carb in the reverse order of disassembly. Refer to Figure D as needed. Be certain that you align the throttle plate to the throttle bore properly by "snapping" the throttle shaft closed with the plate screws slightly loose. Hold it in this position while you tighten the plate screws—it has a beveled edge. Refer to Figure C. Remember marking this? Use a tiny drop of Loctite on the plate screws. When it's tight, hold the carb up to a light and look in the manifold end—you shouldn't be able to see any appreciable amount of light around the circumference of the plate where it touches the carb bore. If you can, try it again. Obtain the best possible fit. Install the throttle arm assembly and adjust the relationship of the arm and plate angles as shown in Figure D. Turn the throttle stop screw an additional half-turn after contacting the stop boss. After installing the fuel enrichment device, make sure the operating tabs are not hitting the plunger body, preventing it from seating. Bend the tabs upward, if necessary, and tap the plunger with a small hammer to seat it in the body.

Adjust the float level as shown in photo B. Hold the bowl inverted and adjust it by bending the tang on the float inboard of where it meets the inlet valve. Proper adjustment for rigid mount engines is 1/8 inch from the bowl gasket surface to the outboard end of the float. Rubbermount engines need the float level adjustment lowered so that the float, with the spring in the inlet valve compressed, can't touch the bowl gasket. Check the float for binding and smooth operation. Replace the bowl and install the carb on your engine. Adjust the fuel mixture screw—1 1/2 turns out from being *lightly* bottomed in the body.

Using a quality fuel filter is highly recommended. No carb can function properly when dirt is present in the fuel supply. Clean or replace the air filter element. If an air cleaner assembly other than original S&S is used, make sure its back plate doesn't obstruct the float bowl vent hole. Replace the air cleaner assembly, support bracket, and throttle cables.

CAUTION:

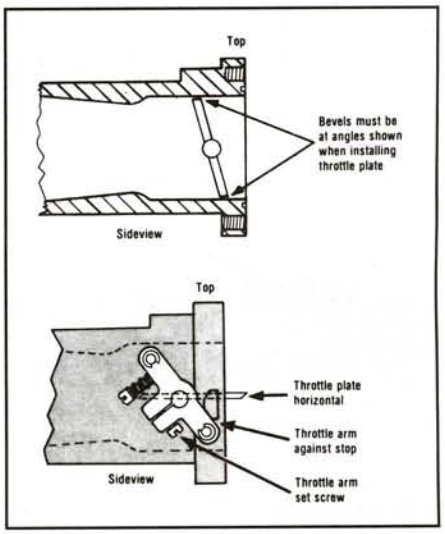
Make sure the throttle works smoothly, without binding, allows full throttle opening, and returns to idle properly *before* you start the engine.

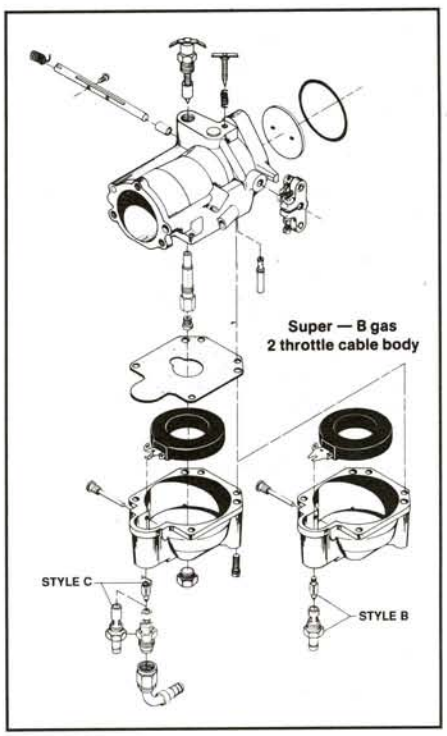
Start your engine and run it until it reaches normal operating temperature. Adjust the idle mixture and throttle stop screws to obtain the smoothest idle possible at 600-800 rpm. (Some engines with long duration cams may need higher idle speeds). Readjust the idle stop screw to obtain the desired rpm. *Note:* Very slow idle speeds cause hard starting and excessive engine wear. You are now ready to roll! Road test carefully and make any necessary fine adjustments.

In an upcoming article, we'll discuss carb tuning, jetting, and their relationship to spark plug heat range. Stay tuned.

This technical article was provided by Jim Thompson at Thompson's Cylinder Head Service Co., 186 River St., Dedham, MA, 02026. Jim, an East Coast Hamster, has been providing "The Finest Machine Work In The Known Universe" for over 25 years. You can reach him at (617) 326-8380 or FAX: 617-320-9351.

No carb can function properly when dirt is present in the fuel supply





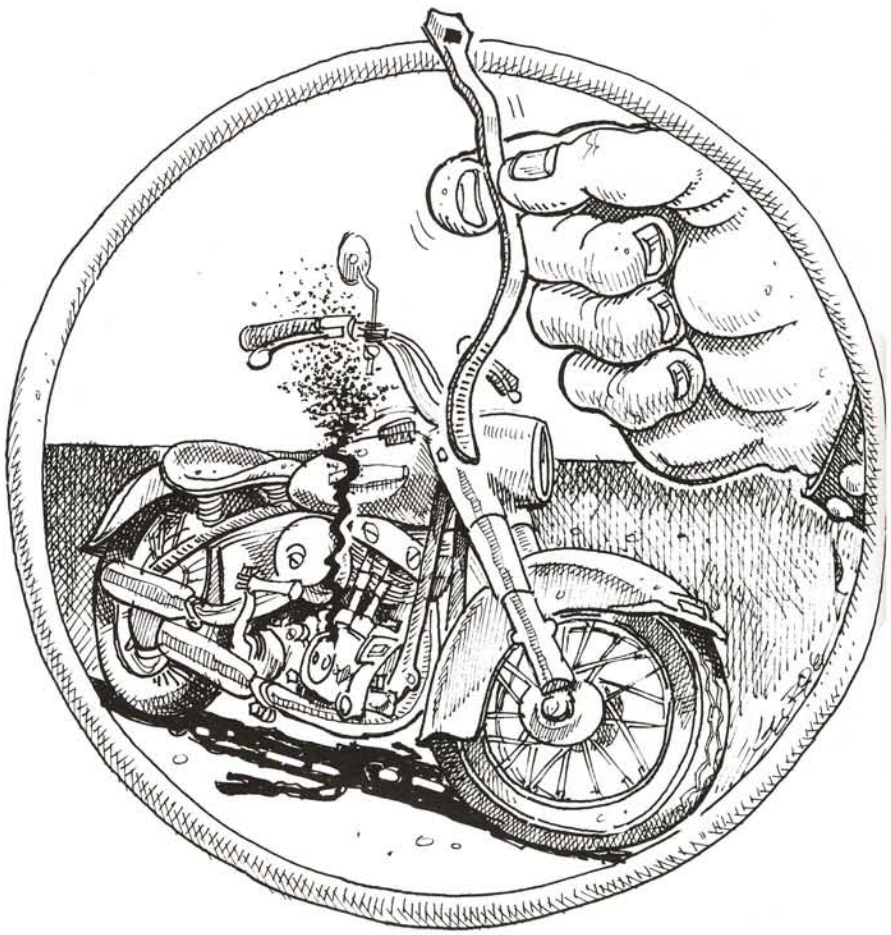
The Dashin' Duo

Point Saver

One of our own crew came screamin' into the garage one mornin' as if he'd just won the lottery. Ol' careenin' Kit had discovered a tech tip and just had to share it with the garage veterans.

Ya see, he'd broken down at about 2 a.m. near Solvang, California, and when he pulled his greasy cone motor points cover off to inspect the points, he discovered the fiber tab that runs on the cam was worn completely off (yer supposed to grease the sucker). His points were closed and, natch, the engine didn't like the lack of spark and quit.

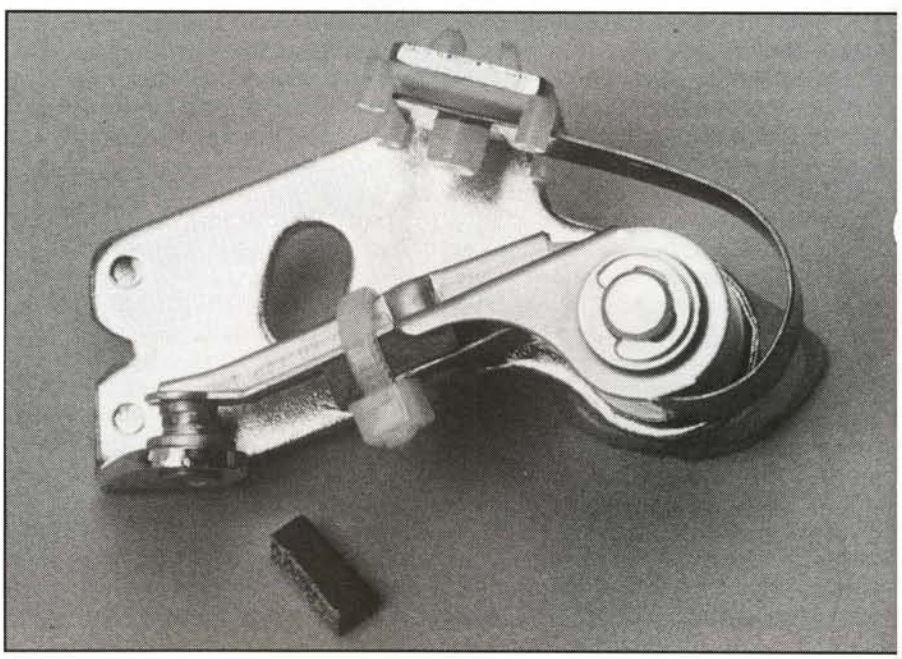
As Kit told the story—being the forthright, honest, grubby biker-type that he is—he stood up, stared down at the points, scratched his head with one of his totally-tat-covered arms, and said,



When he pulled his hands outta his pockets, out came a 3-inch tie-wrap

"What a fuckin' Mickey Mouse breakdown." He dug through his saddlebags but came up with nothin' 'cept rusted nuts and bolts. He stood upright again, shoved both hands into his pockets, and wondered what the hell he was going to do. When he pulled his hands outta his pockets, out came a 3-inch tie-wrap. Just about the time he was going to return it, a flash hit him. Without even removing the points, he slipped the wrap around the points, positioning the junction in the fiber block position. He pulled it tight with a pair of pliers, adjusted the points, lubricated the points cam with some grease from his rear wheel, fired the sucker up, and rode home.

We were so impressed with the suggestion, we all jumped our rides, rode down to the local cantina, and got drunk celebratin'.



Evo Valve Removin' Tool

Rip discovered this device at Young Harley-Davidson in Greensboro, North Carolina. He had stopped to get his bike serviced a few states back and it seems the mechanic took his feed line off the oil pump to drain the oil (bad idea). When the mechanic replaced the line he crimped it, cuttin' off a major amount of the oil flow.

Rip didn't notice it and blazed on through a couple of states until, just outside Greensboro, he caught up with a couple of racin' fools, grabbed a handful of throttle, and brought that 85,000 mile dresser into port. 'Cept when he docked the barge, he heard a terrible clatter.

He immediately pulled his ship into dry dock, and gave them the official Rip instruction (same instruction he gives the girls around here), "Fix it quick, I gotta get on the road."

That's where this tool came in, built by Sonny, one of Young's main mechanics coupled with the design abilities of the owner, Rayvon Young. They called Crane Cams, who overnighted a heavy dresser (1-1001) cam and springs. Sonny replaced

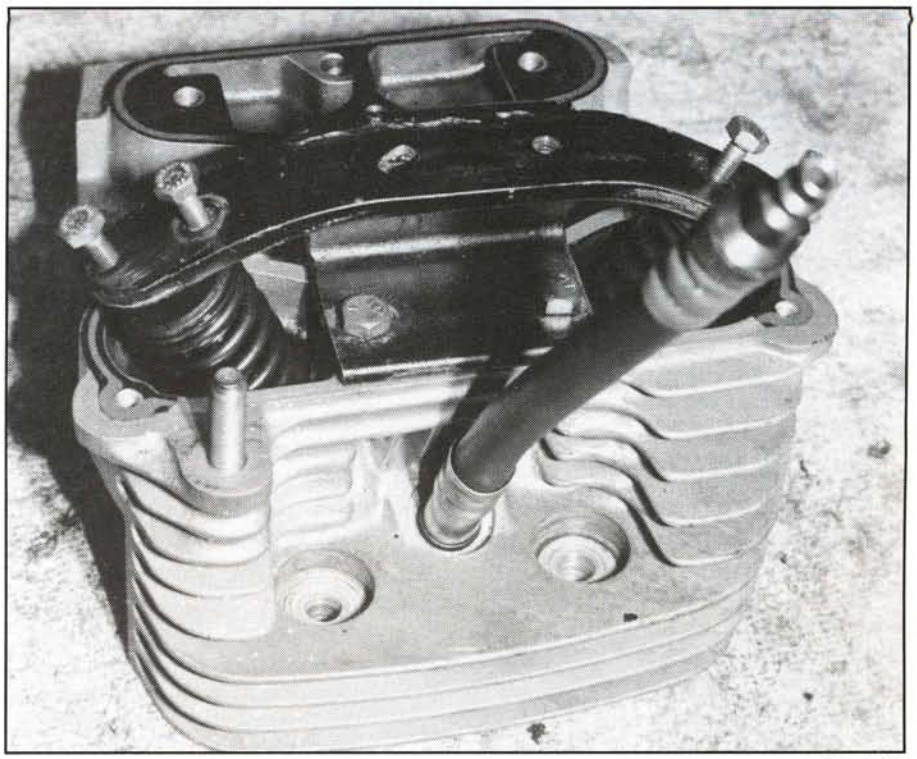


Photo by Rip

I can run the cam of my dreams

the cam, then pumped 100 pounds of air into one cylinder at a time (through the spark plug hole). This procedure automatically checks for burnt valves or busted rings, which hold the valves closed when the keepers are removed.

Then this tool was put into action, bolted to the two center rocker cover bolt holes. Two 7/16 head, 1-inch long, 1/4 X 24 bolts are used to hold down the valve collar and, when screwed down evenly, allow the keepers to be removed, and springs replaced. The old NASCAR trick tool is made out of plain old, 1/4-inch, mild steel strap, and a chunk of angle iron welded together, drilled and tapped. The two holes drilled and tapped in the center are storage for the two bolts used to bolt the tool to the head. And so it is, another major breakthrough in motorcycle technology.

—Wrench

Bulletproof Cases

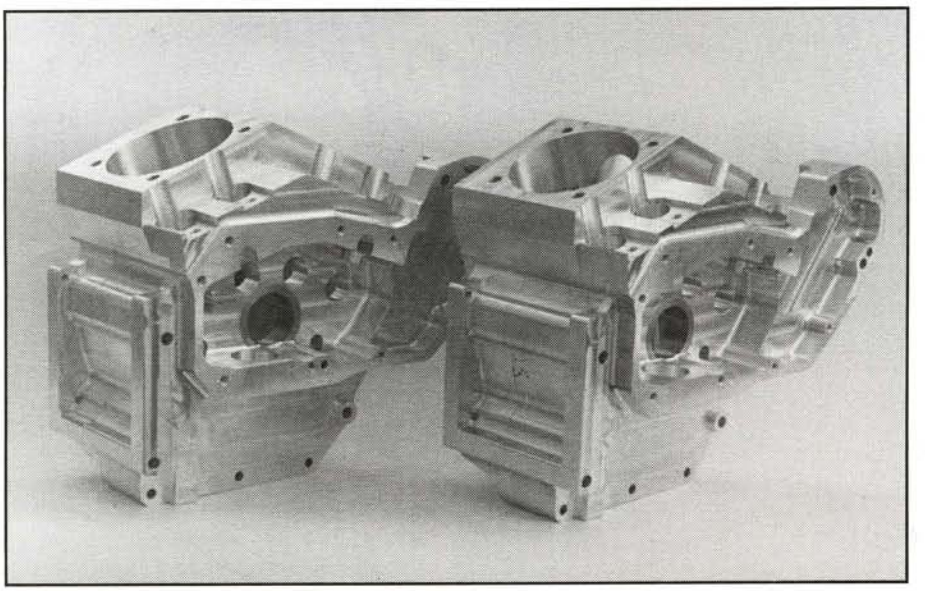
Pushin' The V-Twin To The Limit

As chunks of aluminum go, Harley crank cases can take brutal punishment. For serious, heavy-duty drag racing, though, the big boys cast their own, or machine them out of solid pieces of aluminum. Besides having extra thickness where the pinion and sprocket shafts go through, these high-performance cases are being manufactured to provide for four camshafts—like Sportsters, one per valve, and located to create the optimum angles between pushrods and rocker arms. In addition, they allow a higher deck height, which allows a piston with a longer skirt, and, if used with special cylinders, some even have room for a 6-inch stroke.

Here of late, the big boys have begun to let their monster cases out to the world in general, so if you want to pump up your street Harley to outrageous limits, you, too, can have these ultra high-performance cases to back up your racing formula.

The availability of these cases raises several old arguments, the first being which is better: cast, or machined from billet. The argument revolves around the issues of air bubbles being trapped in the casting mold, of uneven flow of metal into the mold, and of uneven cooling of the casting producing internal stresses that lead to warping.

As the metallurgical generality, cases machined from solid stock should be stronger. However, the generality must bow to particulars. For example, the cast cases from Competition Motorcycles have extra beef at the critical points—so much that some engine builders actually remove some of the metal to make room for their heavy duty components. So, cast or not, Competition's cases leave nothing to worry about in the strong department, and Lonnie Isam, manager at Competition, points proudly to the racing pedigree that proves it.



Jim McClure distributes these cases from Shumaker Racing.

On the other hand, cases machined from solid stock are not exempt from failings. Removing metal from here and there can introduce stresses into the metal, and the machinist must be very careful not to take out too much in one place without taking out some in another to keep the tension in the metal under control. The billet-stock people don't report failures resulting from their machining procedures, but they do acknowledge the possibility.

At bottom, though, the argument proves useless. Neither cast nor billet case makers claim an absolute superiority. Jim McClure, a well-known and highly respected racer, for example, distributes the machined cases manufactured by Shumaker Racing, but McClure expresses complete respect for cast cases. Accordingly, whether on the track or the freeway, it's safe to ignore the question.

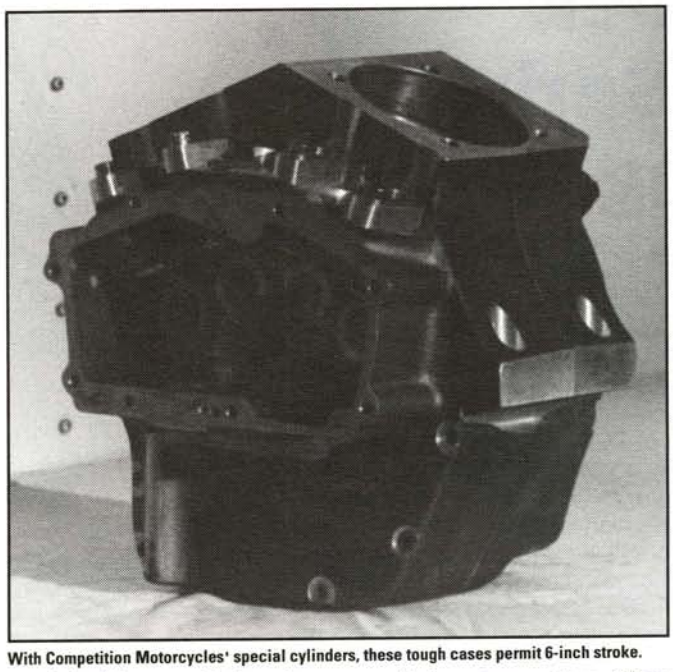
The four-cam business can also be debated, but to no greater purpose. One cam per valve increases the number of pieces, including the number of gears. The good part is that the four-cam system permits the pushrods to work in shorter and more directly straight lines, rather than through several angles. The angles that single-cam pushrods and rocker arms work through absorb energy and lead to valve float at high rpm.

In addition, the longer pushrods can actually bend so much that the valves don't open as much as they should. Thus, one cam per valve, with a shorter pushrod, should be better—and no doubt is for drag bikes.

However, an argument can be made that valve spring impulses can be transmitted back to the gear train and set up unhappy vibrations—not vibrations in the commonly understood sense, but "torsional" vibrations wherein the gears may actually turn backwards momentarily as they rotate.

As a matter of fact, such torsional vibrations no doubt arise. However, the mass of the gears involved is small enough that torsional vibration has, so far, not been a problem. For example, no one reports gears mysteriously shedding teeth at some critical rpm. Accordingly, torsional vibration is more a theoretical than a practical problem and a street rider can use one cam or four and be right at home with either.

The third argument raised by the high-performance case builders is that of the relationship of bore and stroke. Long stroke, of course, means a long, thorough fuel burn and, therefore, very high torque. However, it also means a connecting rod of greater mass and a piston moving through a greater distance. The mass of rod and piston can put such a load on the pinion and sprocket shafts that they distort the holes in cases. Besides that, extra-long strokes can cause the piston to tilt in the cylinder, and thus permit excessive blow-by and loss of compression. Last, excessive piston speed can melt the piston simply because it can't get enough oil and cooling at extremely high piston speed.

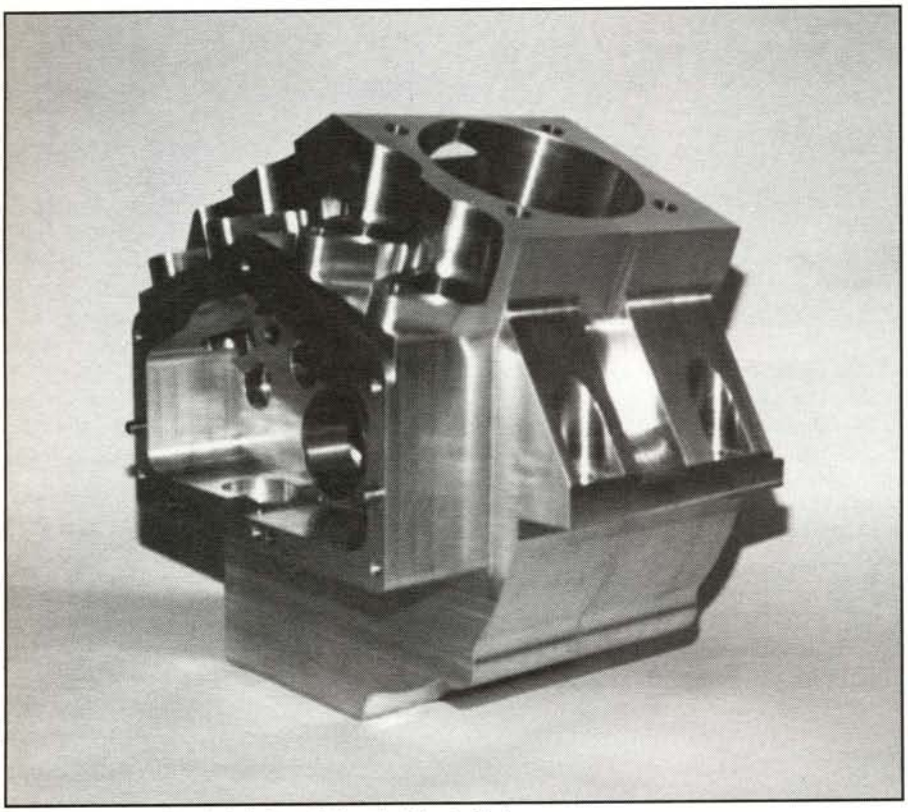


With Competition Motorcycles' special cylinders, these tough cases permit 6-inch stroke.

If all this is true, then a shorter stroke with a bigger bore would seem to be better, and many people think that way. However, short-stroke, big-bore engines get their better torque at higher rpm, and that brings in problems with gear ratios. These issues don't matter much to the guy building a simple freeway flyer to dust off Jap scrap and the stray Porsche or so, but be prepared to hear about them from partisans on both sides.

The high-performance case people don't like to quote off-the-shelf prices because, in the racing world, every customer has his own special little wrinkles that he wants wrought into the cases. Also, the cost might vary, depending on whether the manufacturer is doing a one-off or making a run of cases. They prefer a customer to call for a quotation, but they are all happy to talk, so don't be bashful. However, you will have to give them several weeks to work up a set. Don't worry about fancy stuff to go inside. The cases all accept standard H-D flywheels, and you can get what you need from S&S, Axtell, and a number of other sources that the case manufacturers can recommend.

— Maestro



Delkron's billet cases. Note the bulk of metal below the pinion shaft hole.

Manufacturers:

Competition Motorcycles, Inc.
8318 Braniff Street
Houston, Texas 77061
Contact: Lonnie Isam
713-644-4922

Delkron Manufacturing, Inc.
2430 Manning Street
Sacramento, California 95815
916-921-9703

Jim McClure
Master Performance Racing
3707 Rochambeau Drive
Williamsburg, Virginia 23185
804-566-0544
(cases by Shumaker Racing Components)

Low Buck Valve Spring Spacing

Tech by Thompson

So, you decided you're going to install your own cam. I'm sure that with a little help from H-D's service manual and your bros you'll do a good job at it. Unfortunately, getting the cam to fit under the gearcase cover is just the beginning.

There are several clearance checks and possible adjustments which may need to be performed in order to correctly complete your cam installation. They are: valve-to-piston clearance, valve-to-valve clearance, valve free travel and valve spring travel. Older models and very high lift cams may need other checks as well. Consult with your machinist on this. Valve to piston and valve to valve clearances are usually corrected by machining.

In this article, I'll try to explain the things you need to know to be able to check and adjust your valve free travel and valve spring travel with simple tools. You'll need: a common bench vise, valve spring compressor, vernier calipers, two small, smooth blocks of metal (about 2 inches square) with parallel sides, and a small grinder or file.

It's kind of risky to claim that any certain H-D engine will accept a specific amount of cam lift. But everyone wants to be told how much lift they can bolt into their engine. So, here it goes: Pans, shovels and iron Sportsters will usually accept a .425-inch lift; Evo Sportsters will take a .490-inch lift; and Evo Big Twins will take a .495-inch lift. Remember, these are general statements. Your engine, especially if it's an older model which has been worked on previously, *may not*.

For this article, we'll use the following example: We are installing a .485-inch lift cam in a 1970 shovelhead engine. We assume this engine will need spring spacing as the highest lift cam any cam manufacturer claims will bolt into this model is .450 inches. The valve springs and collars in these heads were Sifton's (red collars).

Let's start: Disassemble the heads and keep the springs and collars separated and marked as to which head and valve position they belong to.

The first check is for valve free travel. Assemble the top collar and keys to each valve in turn and measure the distance available for the valve to move downward. Refer to photo A. This measurement must be equal to valve lift plus an additional safety margin of .060 inches. In our case, that would mean we need .545 inches here.

A bewildering array of shims, collars, and keepers exists for adjusting spring heights on H-Ds

Valve lift:	.485 in.
Safety margin:	.060 in.
Free travel required:	.545 in.

The valve in photo A has .605 inches.

Don't forget to allow room for valve seals *if* you intend to run them. The different types and brands of seals available for H-Ds all require different amounts of room allowed for them. At Thompson's Cylinder Head Service we usually use K-Line seals, the same type as H-D uses on late shovels and Evos. This style seal needs approximately .155 inches of room above the top of the guide, so in this case we would need .700 inches of valve free travel.

Valve lift:	.485 in.
Safety margin:	.060 in.
Room for seal:	.155 in.
Free travel required:	.700 in.

Note: Some early model heads just don't have this much room available without complex machining. *Almost all* models require special machining to be done to the top of the guide for the seal to press on properly.

If you don't have enough free travel you must find a way to provide it. You must machine the top of the guide to shorten it. Photo B shows the special piloted cutter we use to shorten guides. You may grind or file the guide to shorten it if you must but only remove enough material to give the clearance you need—don't overload it; the shorter you make the guide, the shorter you make its service life. Deburr the inside and outside edges of the guide top but do *not* chamfer the inside edge of the guide. If you're not using oil seals this chamfer will collect excess oil and direct it right down the valve guide. Smoker.

An alternative to shortening the guide is changing the top collars. There are several types of aftermarket collars and keepers available which will increase valve free travel. They'll usually increase valve spring *installed* height as well. You may or may not want this. After measuring your valve spring compressed heights and computing the installed heights you want, you'll be able to decide the best combination for your job.

Next step: Check valve spring compressed heights and compute installed heights. Place your springs with top and bottom collars in place in the bench vise between two straight, smooth pieces of scrap metal. Let the edges of the spring overhang the edges of the blocks very slightly so that you can measure the spring lengths easily. Refer to photo C.

Tighten the vise until the coils of the springs touch each other *lightly* (coil bind condition). Don't try to crush them; you'll feel the increased effort in the vise handle as the springs coil bind. Use a

light touch here. Measure the length of the outer valve spring—don't include the collars. The spring-installed height you'll need is equal to the compressed height plus valve lift plus your safety margin.

Spring-compressed ht:	.845 in.
Valve lift:	.485 in.
Safety margin:	.030 in.
Spring-installed ht. required:	1.360 in.

Note: The safety margin on valve spring travel is .030 inches, rather than .060 inches as on free travel, because if valves should *float* it is a much softer stop for them to coil bind than it is for the top collars to hit the valve guides.

Last step: Install the valve spring and collar assemblies into the heads at the appropriate valve positions. You marked these previously, right? Measure (it isn't very likely that you'll get the same dimensions at all valve positions, but don't sweat it) and adjust the spring-installed heights to provide the dimension your new cam needs. This job requires 1.360 inches. So, when installed and measured, let's say you get 1.390 inches. You need to shim under the lower collar to reduce this dimension from 1.390 inches to 1.360 inches. A bewildering array of shims, collars, and keepers exists for adjusting spring heights on H-Ds. Photo D shows just the different shims available. Suppose you get 1.330 inches of installed height: you need to increase this dimension to 1.360 inches. This can be accomplished by either changing to top collars (which allow more spring height), or, if only a small amount is needed, you can machine the lower collar. Take material off the collar's surface, where it seats on the valve guide or cylinder head. It's not a good idea to try to get more than .030 inches in this way.

That's it. Good luck and good riding.

This technical article was provided by Jim Thompson at Thompson's Cylinder Head Service Company, 186 River St., Dedham, MA 02026. Jim, an East Coast Hamster, has been providing his customers with fine machine work for over 25 years. He welcomes inquiries from both retail, wholesale, and mail order customers. You can reach him at (617) 326-8380 or FAX: 617-320-9351.

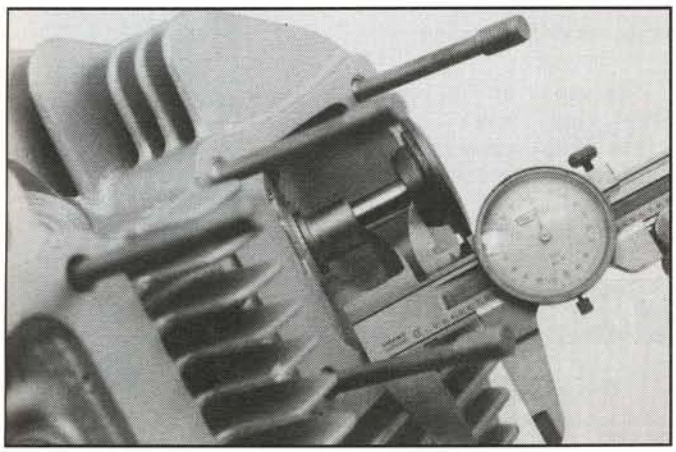


Photo A

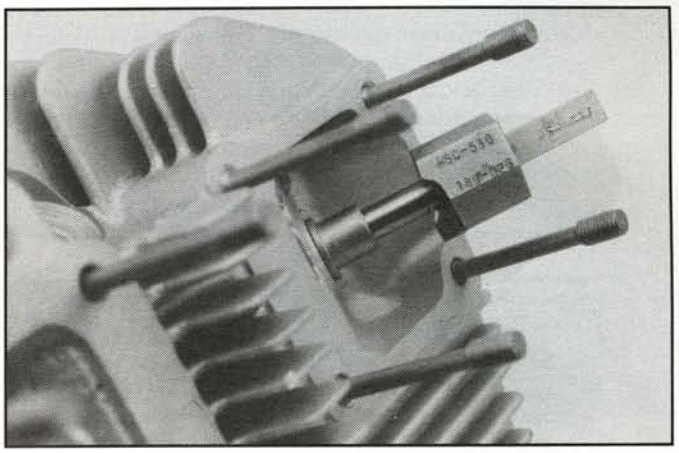


Photo B

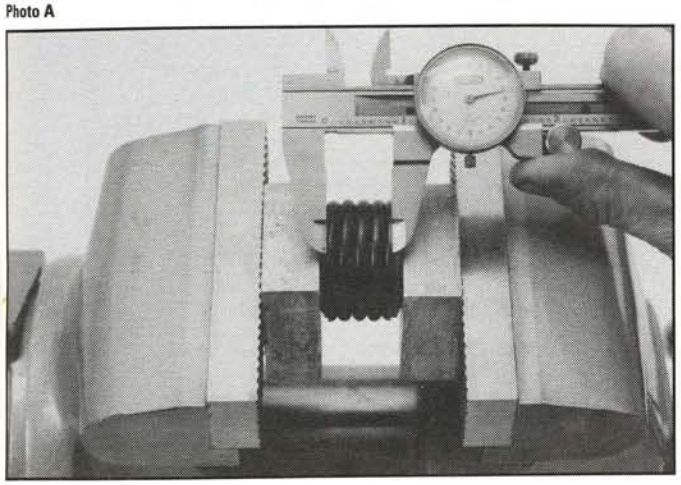


Photo C

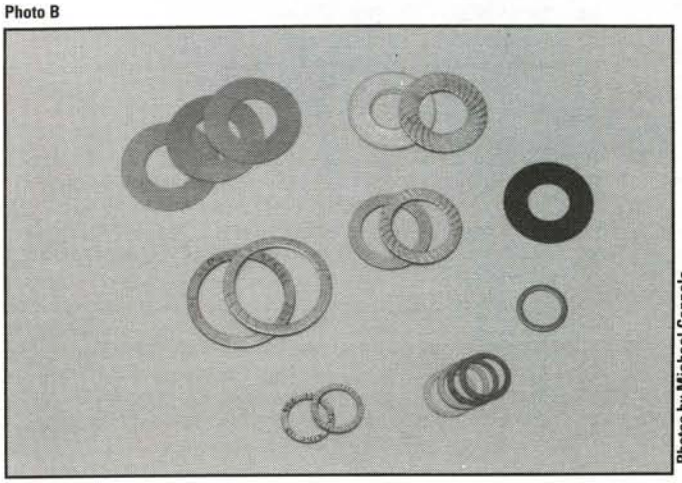
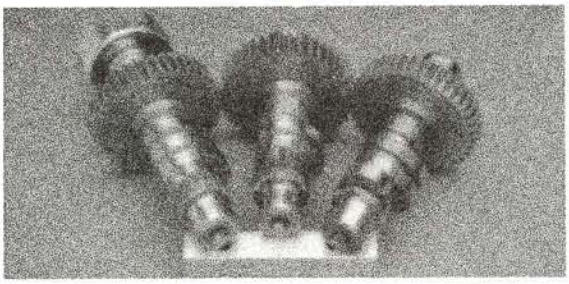


Photo D

Photos by Michael Coppola

EASYRIDERS



CAM GUIDE

By Wrench and Keith Ruxton

We finally did it. With the astute, experienced assistance of Keith "Mr. Streamliner" Ruxton, we've got something here you can refer to forever—a series of guidelines to evaluate any cam for any engine.

So let's get down to business. Cams come in various sizes and shapes for diverse engine characteristics and riding demands. The important parameters are: lift, overlap, duration, and lobe center (timing). You can obtain this information on any cam you're interested in from the distributor or manufacturer, compare it to the cams here, review the considerations, evaluate your motor and riding habits, and you'll know immediately whether or not a particular cam is for you. From now on, when someone discusses a cam with you and mentions lift, etc., you'll know what the hell they're moving their lips about.

What to think about:

What motor do you have?
How many inches?
How far do you want to push it?
Do you want a bolt-in job?
Do you like torque or horsepower?
What rpm range do you want to see power in? ➡

CHART DEFINITIONS

Overlap

Crankshaft degrees of both valves are off of the seats. Each revolution of the engine (crankshaft) is 360 degrees. All cams push both valves open at the same time on the overlap stroke. Bigger numbers require more compression or larger displacement because that indicates how much both valves are open at the end of the exhaust and the beginning of the intake stroke. The more they're both open, the less compression at low end.

Lift

How far open the valve gets to allow air flow. Above .450 lift in shovels and pans, spring clearancing work is needed. That number expands to .500 in Evolutions.

Duration

Crankshaft degrees each valve is open over .053 (note Leineweber's reflects duration after the valve is open .020), larger numbers require more displacement. Also, note Crane Cam model numbers. The numbers represent their duration at .020. For instance, their model C-326 has a duration listed of .252 degrees (intake) at .053 open, but the duration at .020 is 326 degrees. This blurp allows you to compare durations of Leineweber cams to Crane's and, ultimately, the others.

Lobe Centerline

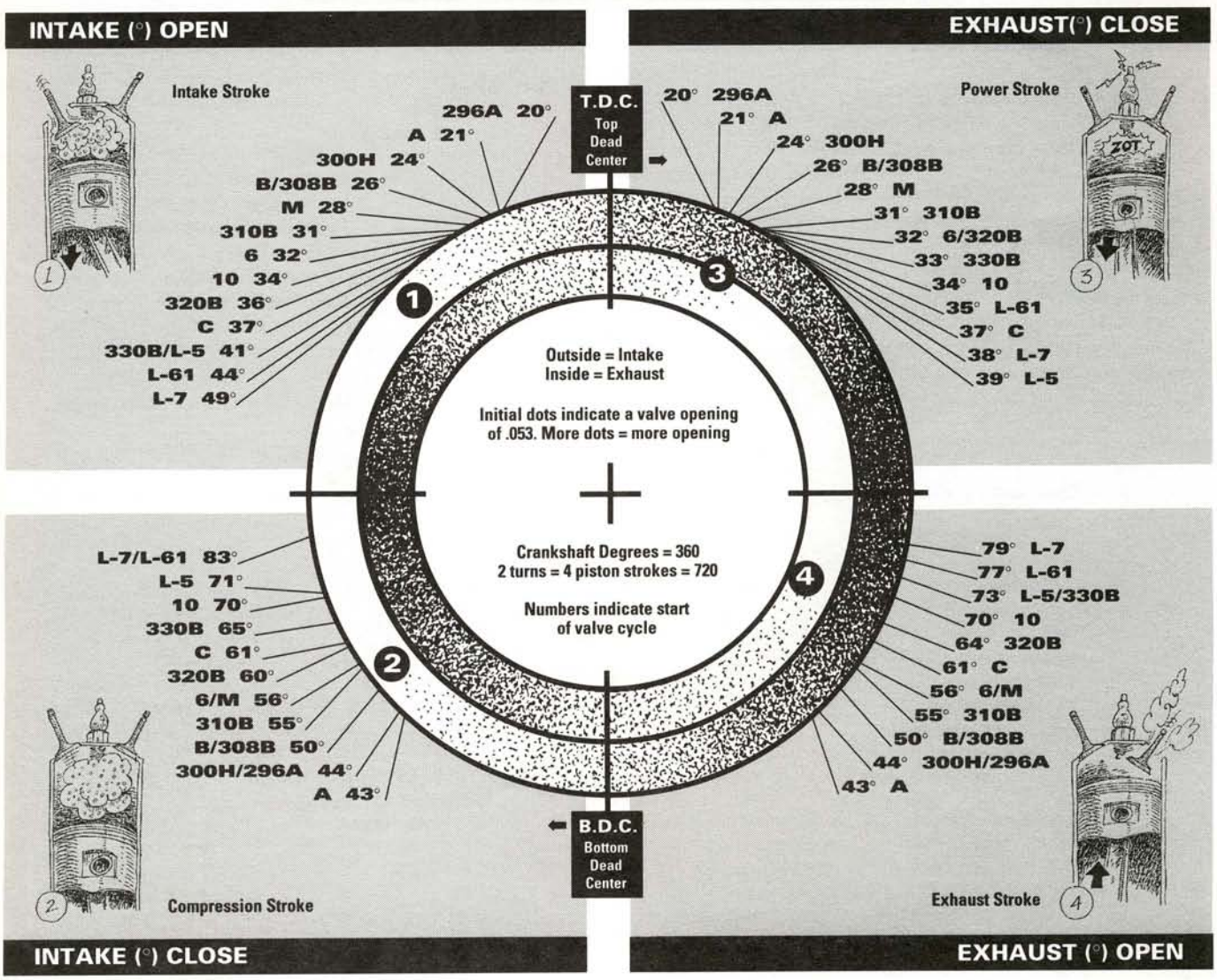
Crankshaft degree that the maximum lift and flow occurs at. Bigger numbers require higher rpm to develop power. As an engine speeds up, it becomes more difficult to develop horsepower ('cause it's harder to get air and fuel into the cylinders). This number represents the position of the piston in the cylinder when the cam is at maximum lift. The higher the number, the more the piston is assisting to pull air into the cylinder for higher rpm efficiency.

SHOVELHEAD & PANHEAD CAMS*

BRAND	MODEL (@ .053" Valve Lift)	OVERLAP (°) (@.053" Lift)	LIFT (in.)	DURATION (°)	LOBE (°)
Andrews					
	A	42	.450	244	101
	B	52	.485	256	102
	M	56	.590	264	104
	6	64	.510	268	102
	C	74	.525	278	102
	10	68	.580	284	108
Crane					
	300H	48	.455	248	100
	296A	40	.455	244	102
	308B	52	.490	256	102
	310B	62 (106 @ .020")	.525	266	102
	320B	68	.550	276	102
	330B	74	.575	286	102
Leineweber					
	L-5	80 @.020	.520	292@.020	105 Intake 107 Exhaust
	L-61	79 @.020	.550 Intake .520 Exhaust	307@.020 292@.020	109.5 Intake 111 Exhaust
	L-7	87@.020	.575 Intake .552 Exhaust	312@.020 297@.020	107 Intake 110.5 Exhaust

*Advertised Numbers

CRANKSHAFT

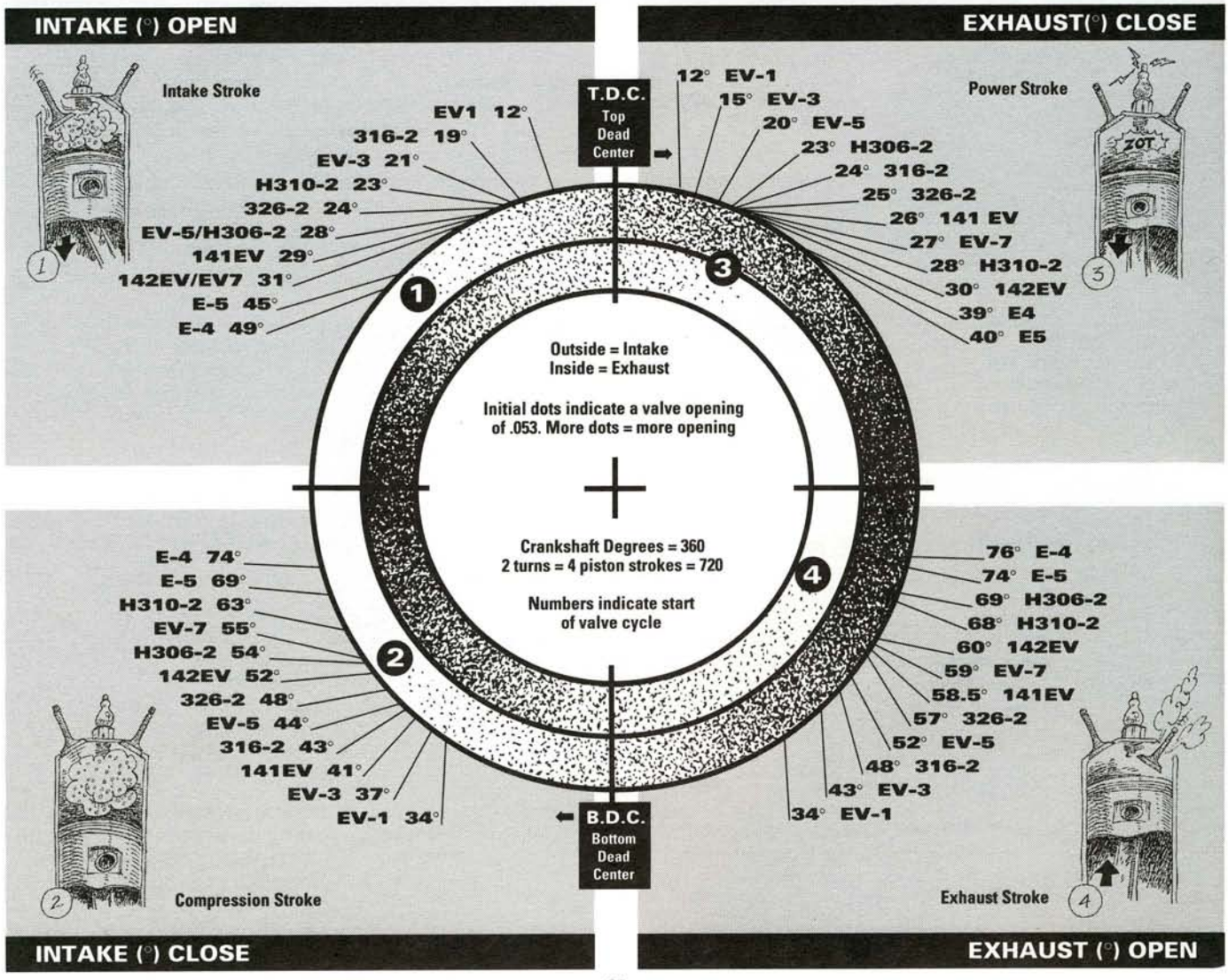


EVOLUTION BIG TWIN CAMS*

BRAND	MODEL (@ .053" VALVE LIFT)	OVERLAP (°)	LIFT (IN.)	DURATION (°)	LOBE (°)	EXHAUST
Andrews						
	EV-1	24	.485	226	101	101
	EV-3	36	.495	238	98	104
	EV-5	48	.530	252	98	106
	EV-7	58	.560	26	102	106
Crane						
	316-2	43	.480 Intake	242		
			.490 Exhaust	252	102	102
	326-2	49	.490 Intake	252	102	106
			.500 Exhaust	262		
	H306-2	51	.500 Intake	262	103	113
			.510 Exhaust	272		
	H310-2	51	.550 Intake	266	110	110
			.550 Exhaust	276		
Leineweber						
	E-4	88 @.020	.560	303 @.020	102.5	108.5
			.545	293 @.020		
	E-5	85 @.020	.540	294 @.020	102	107
			.540			
Sifton						
	141EV	55	.480	250	96	106.25
	142EV	61	.540	263	100.5	105

*Advertised Numbers

CRANKSHAFT



Considerations when you're looking at the figures and chart:

1. Not all cams are listed here, but you can pencil-in the specification from any cam—from any manufacturer—not listed in the chart.

2. If you desire high torque, look for cams with high lift, lower duration, and lower lobe centers.

3. If you're after horsepower, look at longer duration, higher lobe-center degree cams. Definition: *Torque is low-end power. Horsepower is high-end power.*

4. Where the dots start on the chart is where the valve is reaching an open or closing state of .053.

5. Evolutions have higher-velocity ports, consequently they like higher lift, shorter duration cams because of the high velocity port design.

6. Keep in mind that stock ignition modules on Evos will shut down the bike at 5,200 rpms. Cams that don't hit their power curve until 4,500 rpms are useless in bikes with a stock ignition. Look at the characteristics of the Andrews EV3. Anything above that on a stock Evo is wasting cam performance. By contrast an EV7 is a drag bike cam.

7. Regularly pushing the engine past 6,500 rpms is risking reliability. For all models, the more overlap, the less compression and bottom-end torque. You won't feel the power until it hits the high rpms.

8. Leineweber has fast, sharp ramps which are tough on drive trains. In contrast, Andrews has constant velocity ramps, much softer on the valve trains. Leineweber can perform sharper, but each builder must weigh the cutting edge of performance against reliability or mechanical wear.

Let me give you an example: My FXR is stock, no head work, but we installed (through Carl's Speed Shop in Santa Fe Springs, California) the Mega Fire Accel ignition module, an S&S shorty carb, and Carl's Speed Shop's exhaust system with a high-output coil. The cam Carl picked, Andrews EV-3, is designed to kick-in at 2,000 to 2,500 rpms. It gives me that low-end torque to get out of the hole and enough push to jump through traffic up until 85 mph. That's all I want—I'm not drag racing. I don't want to push reliability, but I do want a bike that will make aggressive city and freeway traveling a breeze. Keith Ruxton, the Streamliner crew chief, installed the same cam into his FXRS-SP for the same results.

Regularly pushing the engine past 6,500 rpms is risking reliability

For shovelhead 90-inchers, the Andrews #6, Crane 310 B, and Leineweber L-5 are virtually the same. Head work is a must and all distributor or manufacturer catalogs explain the modifications. Heavier springs are a must, plus lighter valve collars. These cams give the rider plenty of low-end torque (starting at 3,500 rpm), without outrageous overlap—but they're capable of being screamers throughout the rpm range. The 310 B allowed us to reach 8,200 rpm in the *Easyriders* Streamliner. Note: the low-end torque starts at 3,500 rpms. Keep in mind that with lighter flywheels, this motor won't idle under 2,000 rpms (as compared to a stock engine at 1,000 rpms idle).

When in doubt, pick the next smaller cam to prevent over-camming. City and highway shovels need something in line with an Andrews A cam. It makes 'em do what they're supposed to do and no mo'.

We aren't recommending any specific cam here. Look at the characteristics in the charts, compare our examples to other cams, and note the considerations. You may want a more stop-light-to-stop-light cam and go for a different variation. You may want a cam that comes on at 40 mph and will pull strong, well above 100 for your desert express. You may like one company over another and want to find a cam that's comparable to one we've mentioned—now it's a breeze.

CAM MANUFACTURERS & SUPPLIERS

Crane Cams
530 Fentress Blvd.
Daytona Beach, FL 32114
Contact: M/C Tech Dept.
(904) 252-1151

Andrews Products
5212 Shapland Ave.
Rosemont, IL 60018
Contact: John Andrews
(312) 992-4014

Sifton Motorcycle Products
943 Bransten Rd.
San Carlos, CA 94070
Contact: Greg Brown
(415) 592-2203

S & S Products
Route #2 County G
Viola, WI 54664
Contact: Ken Smith
(608) 627-1497

Bartels' Performance Products
9461 Jefferson Blvd.
Culver City, CA 90232
Contact: Bill Bartel
(213) 842-8081

NEMPCO
Box H-7 Perry Dr.
Foxboro, MA 02035
Contact: Bob Kaye
(508) 543-6386

Thunder Tech Products
P.O. Box 1005
Laurel, MD 20707-0941
Contact: Dan Fitzmaurice
(301) 799-9451

Custom Chrome
1 Jacqueline Court
Morgan Hill, CA 95037
Contact: Dennis Ahearns
(408) 778-0500

Leineweber Ent.
17579 Mesa Rd., Unit B-1
Hesperia, CA 92345
Contact: Norma Wheeler
(619) 949-4768

Johnstone Products
P.O. Box 1715
Ormond Beach, FL 32174
Contact: Gordon Johnstone
(904) 673-4714

Cam Corp
708C W. Park Ave.
Edgewater, FL 32132
Contact: Doug Libby
(904) 426-0670

Drag Specialties
9839 W. 69th St.
Eden Prairie, MN 55344
Contact: Jim Betlock
(612) 942-7890

Stabilizing Transmissions

How To Install Roller Bearings In A 1977-1982 Transmission

By Phil Ross

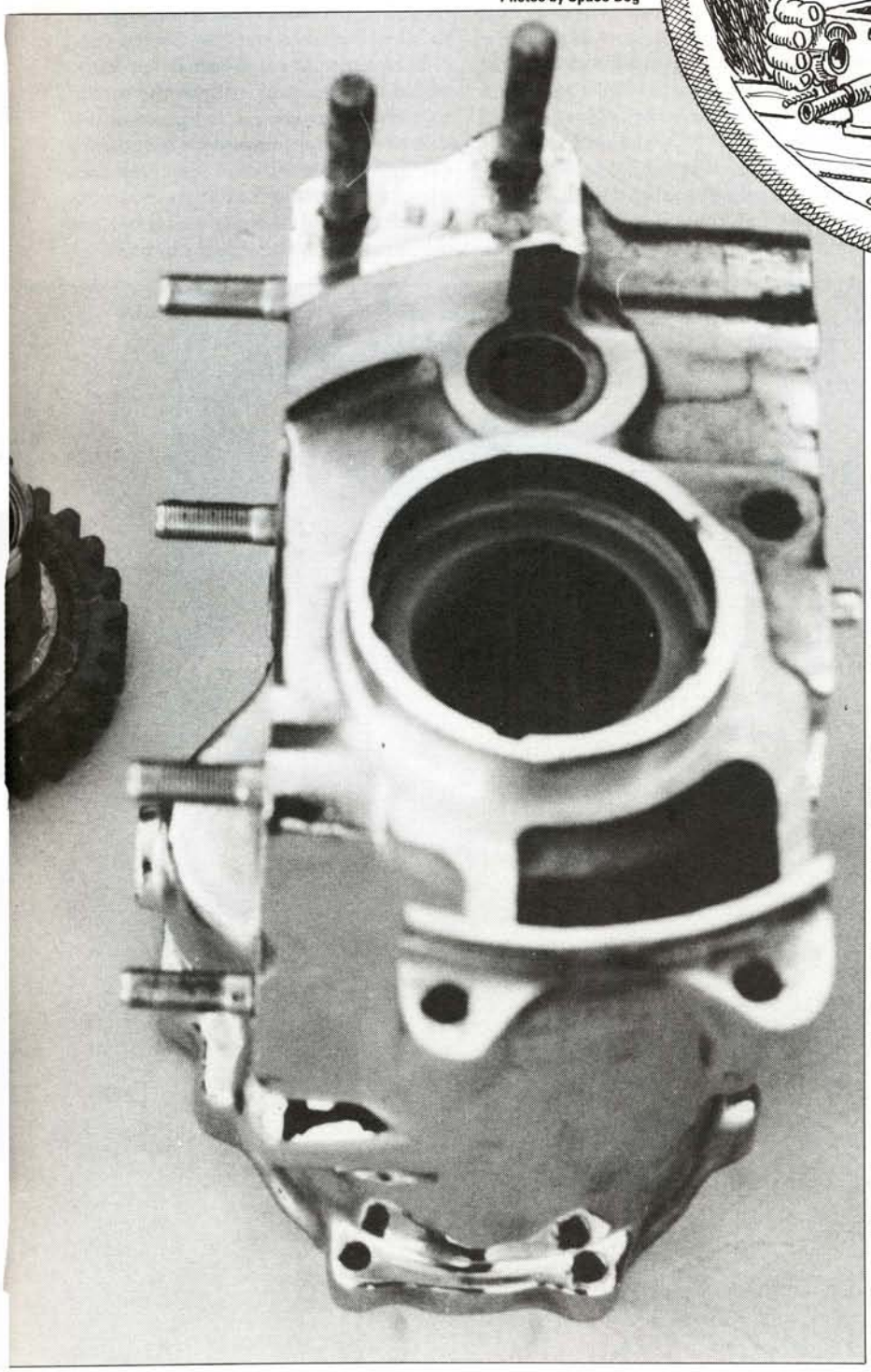
This Big Twin trans case has been modified for the early '70s model roller bearings and 4th gear. For you throttle snapping, tire peeling, go-fast maniacs this modification will improve the performance and life expectancy of your 1977-1982 Harley-Davidson gear case.

During these years the factory switched from the tough roller bearings of the past to the Torrington bearing for production purposes. The Torrington bearing is not as strong, and doesn't stabilize the transmission like the rollers. They also have a tendency to leak and won't last. On this particular case (pre-1980), when we machined for the transmission pulley we cleared out between the upper and lower rear transmission/primary boss. When we performed this, we welded in (actually heli-arced) a new piece of .125 aluminum plate (be certain to use a weldable piece of aluminum to resupport this area—if the job is performed well, a chrome transmission case can be modified without taking away from the appearance.

The installation of the earlier, longer, stronger roller bearings will require the purchase of a new bearing race with the retainer clip, all the early seals, and a pre-1977 (but between '70 and up) 4th gear (with the seal that mounts into the outer end to assist in holding the oil in the trans).

To bore the case, measure the bearing race to be installed (O.D.) and bore the case leaving yourself .003 press fit. Bore the case to size then cut in the outer step (counterbore), permitting the race to protrude (inside the case) just enough to permit the use of the snap ring that holds

Photos by Space Dog



the race from backing out of the case. After installing the bearing race, hone to size for the new 4th gear and hone bushing to mainshaft. When installing the race, freeze the race and heat the case to 200 degrees, then press into place carefully.

In '83, Harley went to a larger Torrington. This one is a very tough modification. The only way to repair it is to bore the entire end out of the case, install a chunk of aluminum, weld it into the case and machine it out for the smaller bearings. This is a long, involved, precision process—so the 1983-1986, 4-speed modification should be avoided.

That's it. Not a tough operation, that is, if you have access to a mill. If not, any reputable motorcycle machine shop can do the job. But here are a few to refer to:

Phil Ross at Super Max in Porterville, California, (209) 784-2222;

Thompson's Cylinder and Head Service in Dedham, Massachussetts, (617) 326-8380;

WRS in Story City, Iowa, (515) 328-3765;

John Blanton of Fomoco in Odessa, Texas, (915) 333-2864; and

Full-Blast Engineering in Sioux Falls, South Dakota, (605) 332-2659.

There are many other shops all over the country, but this is a sampling for those of us who don't know who to call.

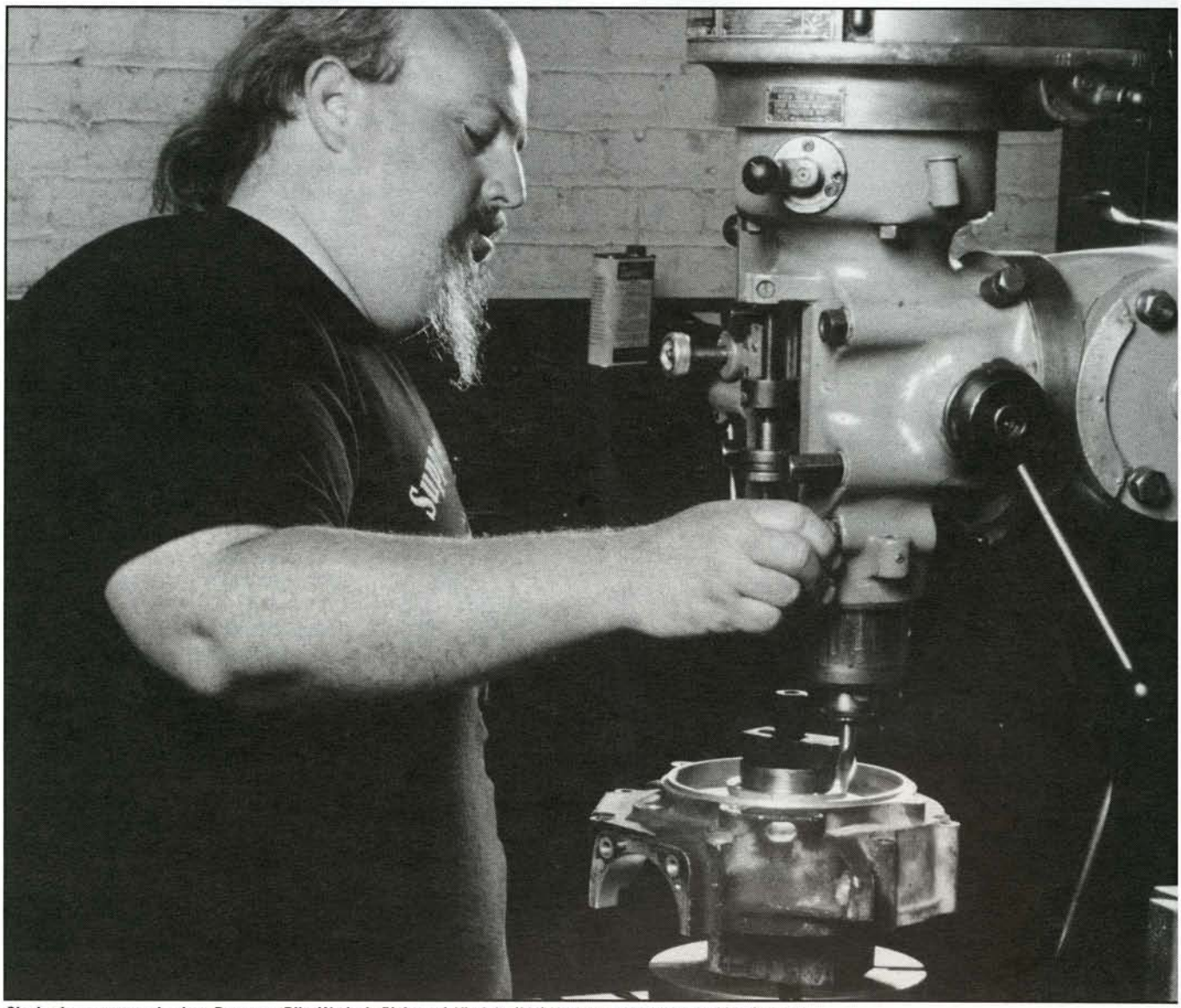
Case Tech

Modifying Cases To Hide Electrics

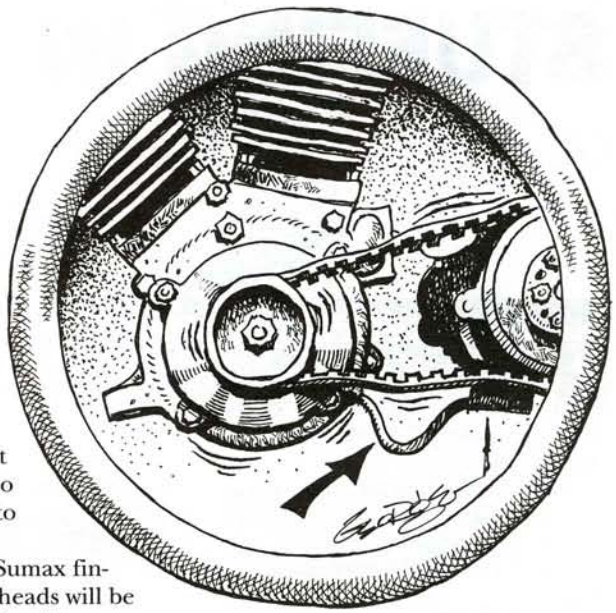
Here's the deal on Bandit's new project bike: He wants nothing to interrupt the line of the frame down to the center of the engine. On Evolution engines the stator plug and regulator are mounted on the left front portion of the engine. That had to change. Pat Kennedy designed the bike so the regulator could be installed under the transmission. The plug was the problem. Giggie, the master mechanic at Lee Clemens' Departure Bike Works in Richmond, Virginia, went to work on the project. He had never attempted this modification, so he took the first run at it with a junk left case.

Once the trial proved a success, he went to work on Bandit's case. First, he machined off excess metal at the boss where the external plug fits into the alternator socket. Then, he filled the original socket hole for the plug. Next, Giggie had to find the best place to bring the wires out. He chose a four o'clock location on the sprocket side of the case because it allows the wires to leave the case in such a position so that the regulator could be mounted under the transmission. Also, the case structure is strong in that area.

Next, he had to make a channel for the wires and a hole for them to come



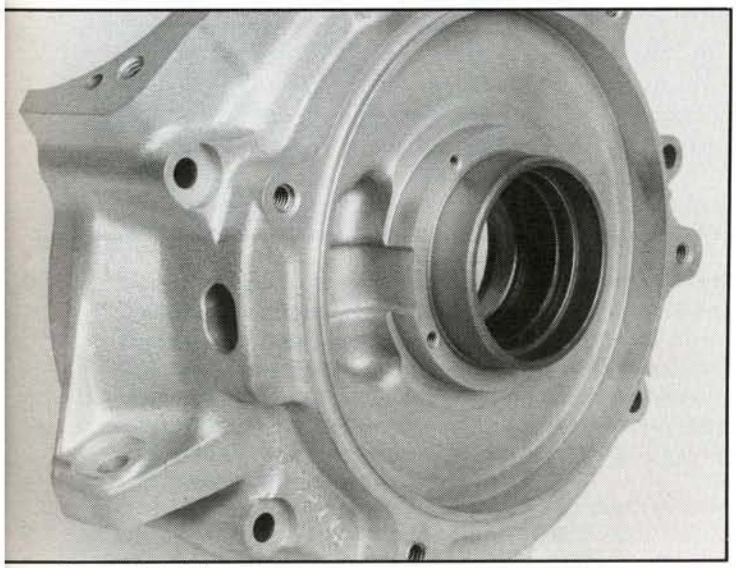
Giggie, the master mechanic at Departure Bike Works in Richmond, Virginia, (804) 231-0244, prepares to machine the case.



out—but only a small hole, one just big enough for the wires (no plug)—or he would weaken the case. He measured the trough and triangle of the area he had to mill out and placed the case on the rotary table for machining. The majority of his time on the two and a half hour job was spent setting up the machine. The key to this modification is that no plug will be used. Giggie added a couple feet to the stator wires and covered each one with shrink tubing. Any number of solid, efficient connectors can be used to connect the stator wires to the regulator.

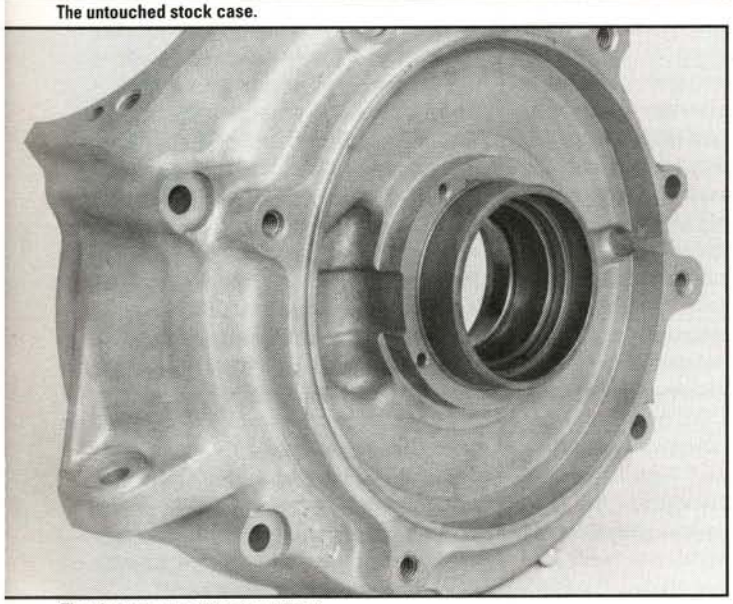
Engine assembly with Sumax finished cases, barrels, and heads will be covered in the next couple of issues.

—Wrench

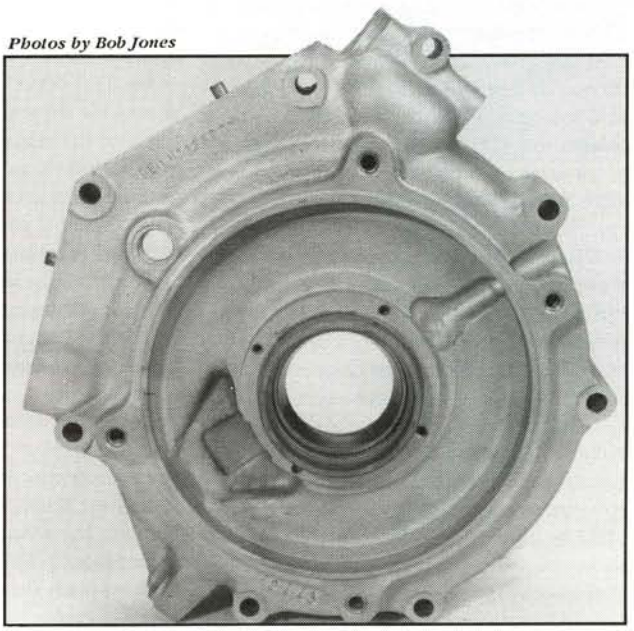


The untouched stock case.

Photos by Bob Jones



The plug area, machined and filled.



The freshly-machined four o'clock position where the wires exit the case.

STUFFING IN AIR ...

Or, Getting Your Head(s) Together

Relatively small changes to stock cylinder heads can make big changes to performance"provided you do exactly the right thing and in exactly the right way. Here's a review of some modifications to the heads for the Evo special Bandit's putting together. Check it out.

First, study the two heads in photo 1. The one on the left is a stock H-D head from the early Evolution engine, along with the piston and valves that go with it. The head on the right is from Departure Bike Works (Richmond, Va.), worked over by their machinist, Giggie, along with an Axtell Angle-Top piston and a pair of Black Diamond valves.

The Departure head has a different shape at the upper right corner, doesn't have the web running from upper right to the exhaust port on the upper left.

The depression that contains the valves and the spark plug is the combustion chamber. The tighter the piston squeezes the air-fuel mixture up in there—that is, the higher the compression ratio—the more heat the air-fuel mix generates and, therefore, the more power it delivers to the rear wheel. That's the good news.

The bad news is that squeezing the mix too much can cause it to explode all at once rather than burn progressively as the piston goes down. At the least, the explosion will produce "gas knock." At the worst, it'll blow the piston and connecting rod out through the bottom of the cases. To play high- compression games, then, you have to control the combustion event.

Whatever the compression ratio, you want to get lots of fuel-air mixture into the cylinder. Furthermore, you want the mix to be thoroughly stirred up. On a stock head (photo 4), the inside of the passage from the manifold to the intake is a little rough, and the roughness provokes turbulence that helps stir the mixture. At the same time, though, the roughness also impedes the flow. The ideal head would have smooth passages to assure maximum flow, but would also have some way of producing violent turbulence to assure mixing.

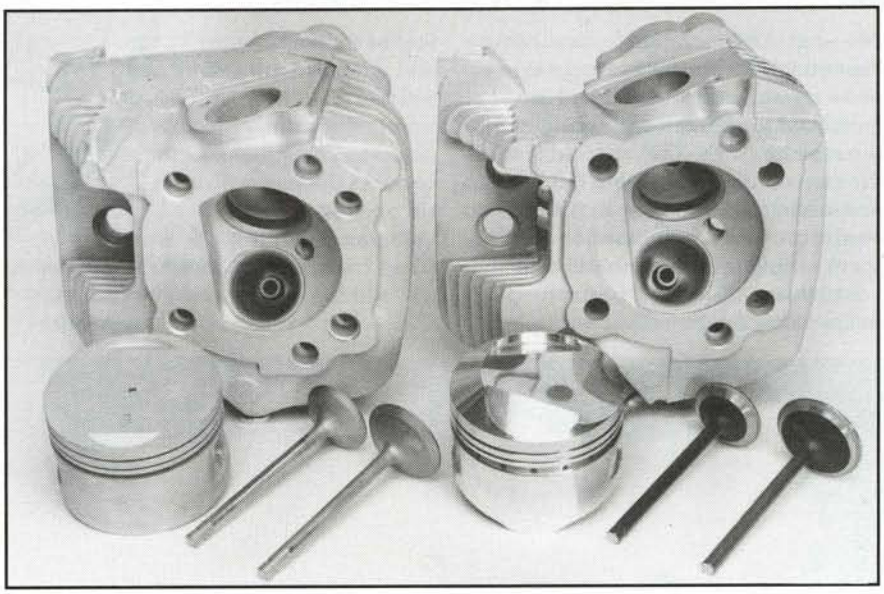


Photo 1

Giggie polishes the valve passages and ports until the air-fuel mix slips through like Jack Daniel's going down (photo 5), and polishes the inside of the combustion chamber until it feels like bar-top lacquer. That lets lots of mixture into the combustion chamber—but what about turbulence?

Turbulence? You want turbulence? We'll give you turbulence! Study that Axtell Angle-Top piston. The depression on the near side accomodates the intake valve. The depression on the far side allows for the exhaust valve. Note the angle of the metal from one valve depression to the other. This is the genius of the Axtell Angle-Top, and it works great if you know a Giggie who can fix the head to match it.

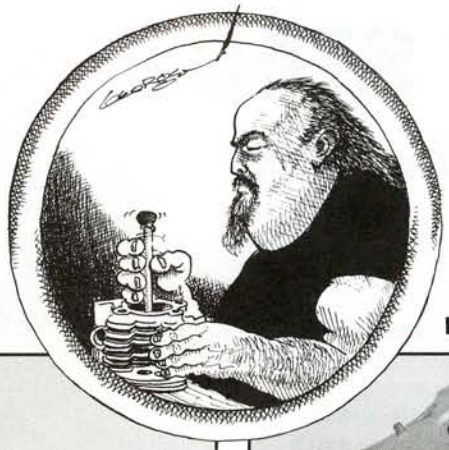
The stock head has a flat area on the left side of the combustion chamber. That's the "squish area." On Bandit's head, Giggie has machined the squish area down to a curved angle that matches the Axtell piston. During the compression stroke, the piston shoves the fuel-air mix into the combustion chamber. Then, wham! Right at the last second, the rising piston traps the mix under the squish area and gives it one helluva push that creates one helluva lot of turbulence. Even Harley-Davidson knows how to do that.

But look at Axtell's way: that upward-angled squish area gives the fuel charge considerable extra whirl up and across the top of the combustion chamber and right into the spark plug. The plug doesn't just sit there waiting for fuel to come by to get ignited. Rather, the squish area feeds fuel to the plug just like a welder bringing the torch up to the striker.

Axtell's Angle-Top, then, makes up for any loss of turbulence due to polishing. Besides that, it sets up a flame front—a wave of fire that proceeds through the fuel charge—that makes the most of the extra fuel that the polishing let in. It does something else, too. The turbulence, and the pace of the flame front, keep the fuel-air charge from going off all at once. Using Angle-Tops, and provided you follow up with the right cams and ignition timing, Giggie can finish a head to a compression ratio of 10.2 to 1.

Photo 2 shows a stock rod (upper) after Giggie has worked it over (lower).

Metal can take a lot of beating, but underneath it is very much like glass: a scratch or imperfection in the surface can open up into a crack that shortly becomes a complete fracture. To bullet-



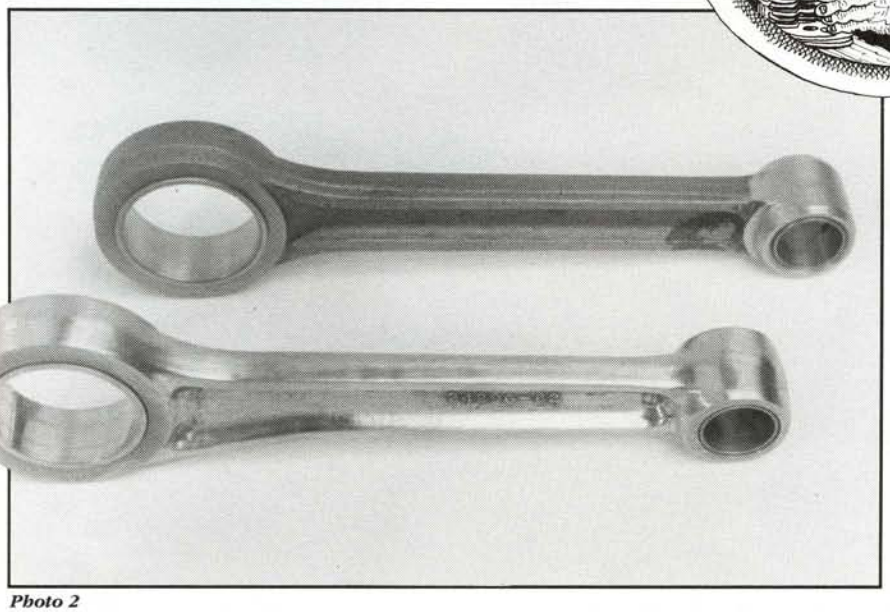


Photo 2

Photo 3

proof a rod, then, you must get rid of every surface irregularity that might act like a scratch. Note how Giggie smoothed out the casting ridges visible on the back and the rough edges of the I-section formed by the sides.

But that rod came out of the casting mold with a certain surface hardness, and the depth of the hardness might well vary. To polish metal off the surface means the depth of the hardness will most certainly vary. Since surface hardness produces a tension that helps the rod keep its shape, to vary the hardness produces a rubber-like rod—not good for going places.

Giggie settles that with shot peening (although some would recommend reheat treating). In case you didn't know, the surface of a hammer that you hit something with is called the "peen." Hence, flat peen, ball peen, cross peen, and so on. When the blacksmith lays hot iron on an anvil and beats the hell out of it, he's "peening" it, although not very precisely.

Nowadays, you peen by airblasting steel shot—just like buckshot—against cold metal. Since the force of the blast, and the weight and the composition of the shot can be controlled, shot peening can put just exactly the right amount of surface hardness on whatever kind of (ferrous) metal you want to harden.

Top end, bottom end, and middle, you have to prepare before you start to assemble. We're about ready, though, so we'll tell you about that next.

—Noose

PARTS LIST

CCI
- **Chrome rocker covers**
- **Rev-Tech valves**
- **Cylinder stud kit**
- **Karata vertex magneto**
- **Crane cam**
- **Crane valve springs and collars**
- **Crane roller rockers**
- **Crane adjustable pushrods**

Sumax
- **Polishing & powdercoating**
- **Garner Westcott 12 point fasteners**

Axtell
- **Wedge pistons**
- **Wrist pins**

Special thanks to Ken "Musky" Berry

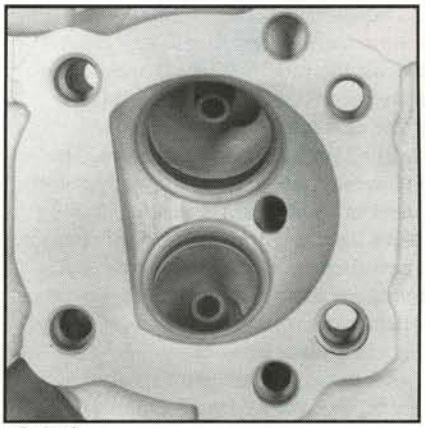


Photo 4

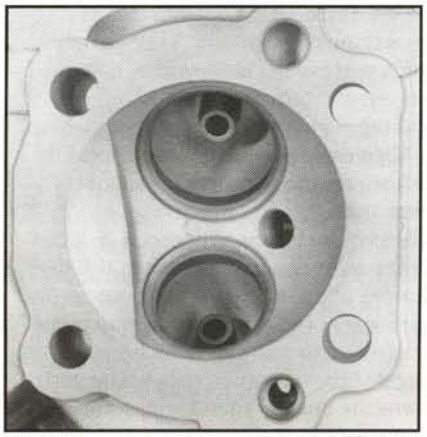


Photo 5

Photos by Bob Jones

LAST STAGE

Proving The Prospect

Nice-looking mess of hardware there, right? Cases shining like new money. Connecting rods and flywheels inside and one cylinder in place. Heads modified to suit Axtell Angle-Top pistons and standing by. Crane camshaft waiting its turn. That round cover belongs on the other side with the alternator, but it can be in the picture, too. The round cylindrical thing is a Karata magneto, and it eventually goes in the top of the Karata gear cover.

This isn't a display, much as it might look like it. It's the engine for Bandit's new custom on the way to completion. That surgical cleanliness is just the way Giggie, the mechanical wizard at Departure Bike Works, Richmond, Virginia, does things. Fancy high-performance machine or street commuter, Giggie says every Harley engine deserves the same treatment.

Clean isn't all. Although everything has been measured and calculated before, the way the Angle-Top pistons fit with the modified heads and the way both pistons and heads fit with the Crane cam and pushrods must be checked with extreme precision. The piston must not go into the combustion chamber so far that it touches, and the valves have to get out of the way before it gets there. A degree off on the gear timing, or a thousandth or so off on the adjustments, and those parts could meet in mutual disaster.

Disaster can come from another source, too: the oil breather timing must also be right, or the parts won't get oil. Because oil breather timing doesn't involve ignition, some people think you can get sloppy with it. Not so. Get sloppy with the breather timing, and the engine will spew oil everywhere.

Giggie checks and double checks as he torques the fasteners down and, here again, he says every engine deserves such care, whether it belongs to the most famous drag racer, the most famous bikin' editor, or just some ordinary guy at the tail end of a Sunday run.

After getting all the parts together, Giggie fills the crankcase with oil and turns the engine 'round and 'round 'til he gets oil everywhere—especially upstairs on the valve rockers. A good coating of oil protects the new parts from any threat of rust or even minute elements of corrosion from fingerprints, and guarantees lubrication when the engine first fires up. In fact, modern oils adhere to metal so well that the engine can sit for a week or more after pre-oiling and still be protected at first firing.

After putting the engine together, Giggie shipped it to Kennedys Custom Harleys. Pat Kennedy no more than got it bolted in the frame when Bandit showed up with two other bikes on a trailer and wanted to haul the new one to Sturgis. After pouring some gas in the tank, they gave it a few go 'rounds with the starter. It wouldn't start.

Bandit had to get moving, so he hauled his new (non-functional) bike to

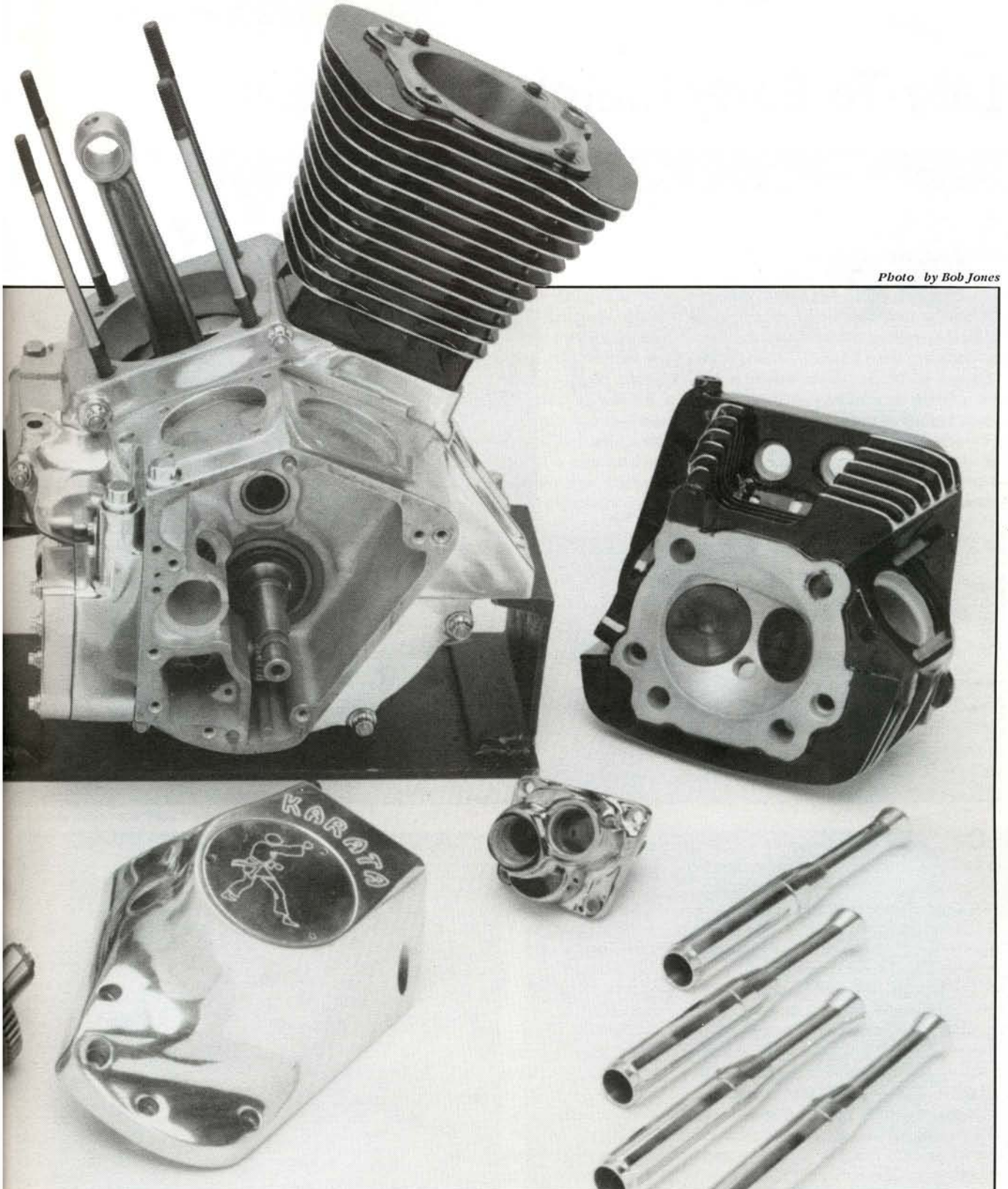


Photo by Bob Jones

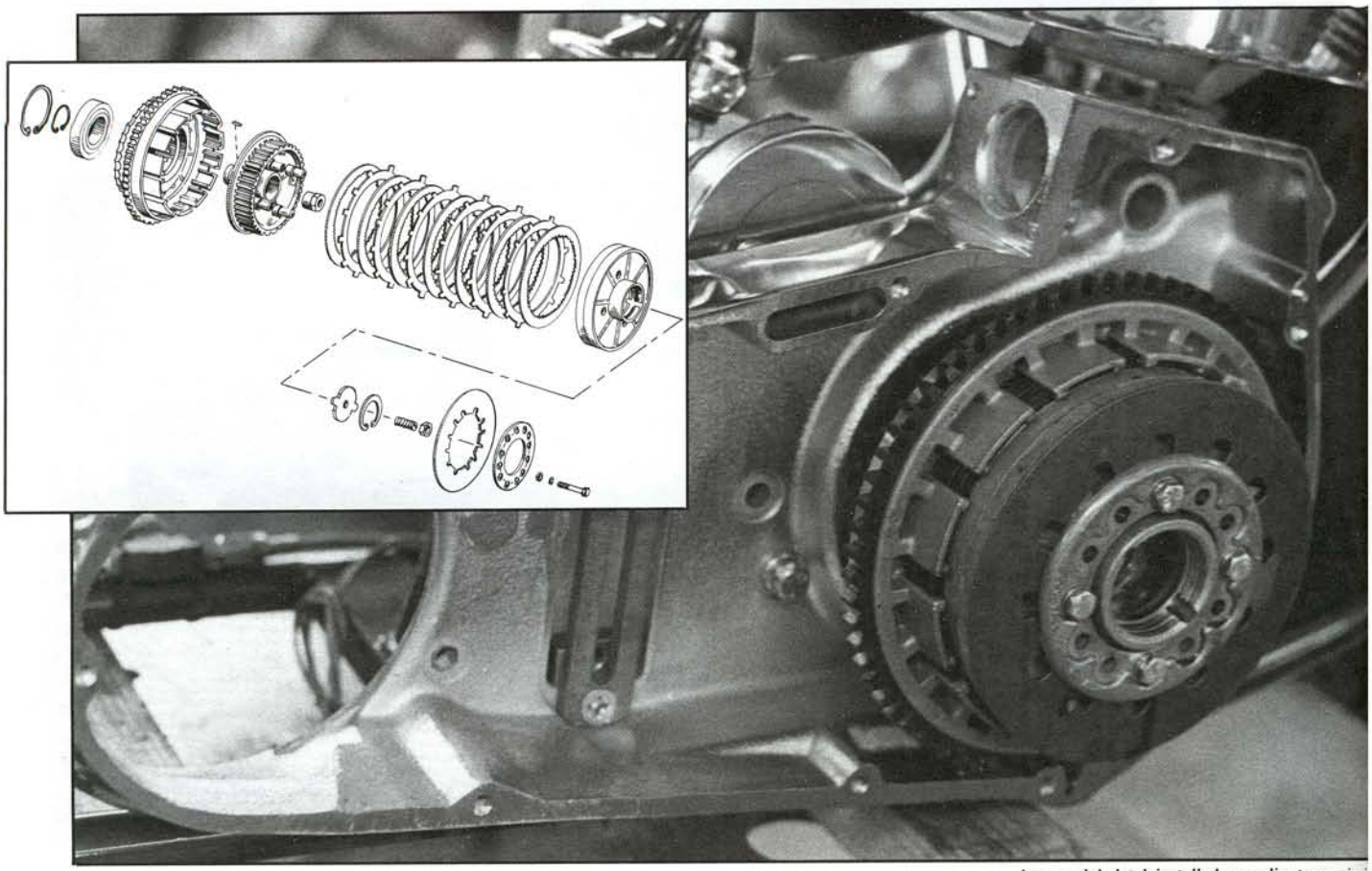
Sturgis and began fiddling with it there. It still wouldn't start. He called the Karata people for advice. They listened patiently (as one does to a dim-witted child) and ever so gently (and tactfully) suggested he turn the magneto 180 degrees. Bandit did and the bike fired up on the first turn.

Now, have you ever heard of such a thing? Ever had such a thing happen to you? Don't you feel better knowing that it happens to everybody now and then? With its magneto on right, the new creation purred like a kitten, ran like a cheetah, and rode like a—well, like a true easy rider.

So Bandit has his new ride, but it's not really his. In a way, that bike belongs to Giggie at Departure, Rod Graves at Graves Plating, Crane Cams, Sumax, CCI, Drag Specialties, Gardner Wescott, and Pat Kennedy. They're the ones who made it, and maybe even Harley-Davidson deserves a bit of credit, too. Bandit says he'll agree that the bike really belongs to the other guys, so long as they let him ride it.

—Noose

Late-To-Early Clutch Conversion



Late-model clutch installed on earlier transmissi

Cubic inches and horsepower top the priority list for modifications today. But all the power in the world is useless if you can't get it to the rear wheel.

For years, Harley used a three-adjusting stud,10-spring clutch hub, and pressure plate. For some riders, the old clutch setup has proved indestructable. For others, the new model is the hot ticket.

Some bros with big-inch motors like the new diaphragm clutch. So that's what this mess is all about—installing the late-model clutch in earlier scooters. Using a Harley Screamin' Eagle or aftermarket diaphragm, which has more tension than the stock unit, also helps/prevents the clutch from slipping, with 100-cubic-inch motors.

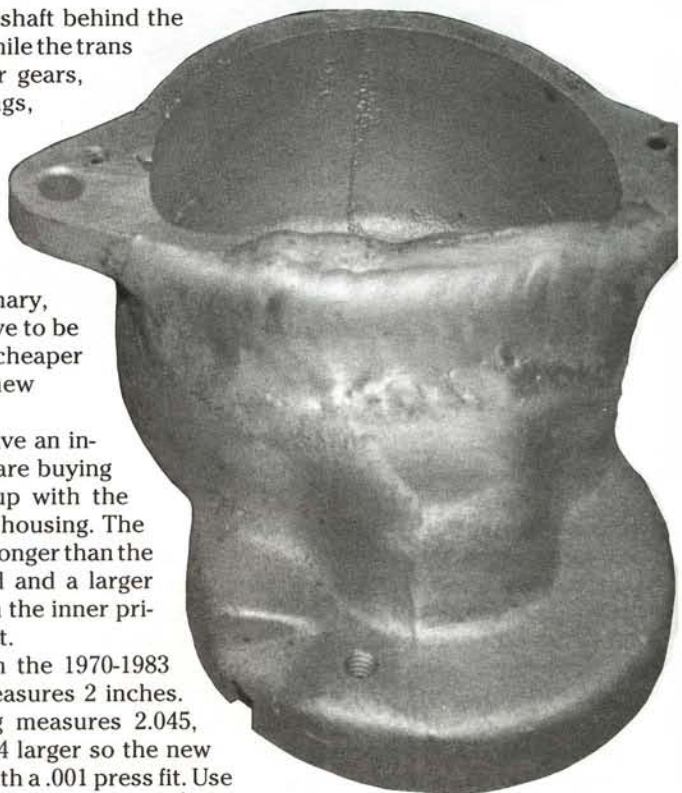
This system can be added to any four-speed trans that will bolt to an aluminum primary. What you have now will determine what you'll need to change. The bottom line is that the bearing support is critical.

You have to use a 1970 to 1983 four-speed trans case. The only part in the transmission that needs to be changed is the mainshaft (H-D part #37800-84) and the inner race (H-D part #34090-84). The race goes on the shaft behind the seal. Of course, while the trans is apart, all other gears, bearings, bushings, etc., should be checked and repaired or replaced if they are worn.

If you're using a '70-'83 inner primary, a few changes have to be made, which are cheaper than buying a new primary.

If you don't have an inner primary and are buying one, get a 1984-up with the later-year starter housing. The new mainshaft is longer than the one you replaced and a larger bearing is used in the inner primary to support it.

The bearing in the 1970-1983 inner primary measures 2 inches. The new bearing measures 2.045, bore the hole .044 larger so the new bearing goes in with a .001 press fit. Use H-D bearing #9135 and seal #12052. Re-



Starter dr

move all oil line fittings and replace them with plugs so the primary becomes a sealed unit. Primary chain oil will no longer be circulating through the engine—good news. (See pages 10 and 11)

The factory has finally gotten around to this modification on the 1990 models. Now, you will be using a little more than a quart of H-D primary oil, so you will need a better seal on your starter drive. A special plate has been designed to take an H-D #12051 seal. (This plate and seal may also be used on stock systems that are having problems with oil leaks on starter shafts.) It is available from Freds Custom Cycle, 3101 North Harbor City Blvd., Melbourne, FL, (407) 259-7111, for $31.95 plus shipping.

To make this plate work, you must build up the bottom side of your starter housing and inner primary with a weld (where the chain always hits when you forget to adjust it). Match your seal plate to both, and grind it slightly to make it fit. (Instructions come with the seal plate).

Make sure the nuts are loose on the four studs that fit through the trans plate, as well as the fifth bolt under the kicker cover. Use a new O-ring on the engine (if it uses one) and install the inner primary cover. Don't forget to safety-wire bolts on the engine. Tighten five bolts on the bottom of the transmission. Then install a new seal plate, starter housing, and other starter parts.

The diaphragm clutch assembly is H-D #37800-84 which comes complete. You may want to buy parts of this kit separately and get one of the heavier springs.

Install the engine sprocket and tighten to 100 ft./lbs. using an air or electric impact wrench. Press the pilot bearing into the outer clutch hub and install a circlip (lock ring). Then, using a press, support the inner race with a sleeve. Press the inner hub into the bearing against the hub shoulder and install an external clip. Install a key into the trans mainshaft and make sure that it is not more than .119 inch above the shaft.

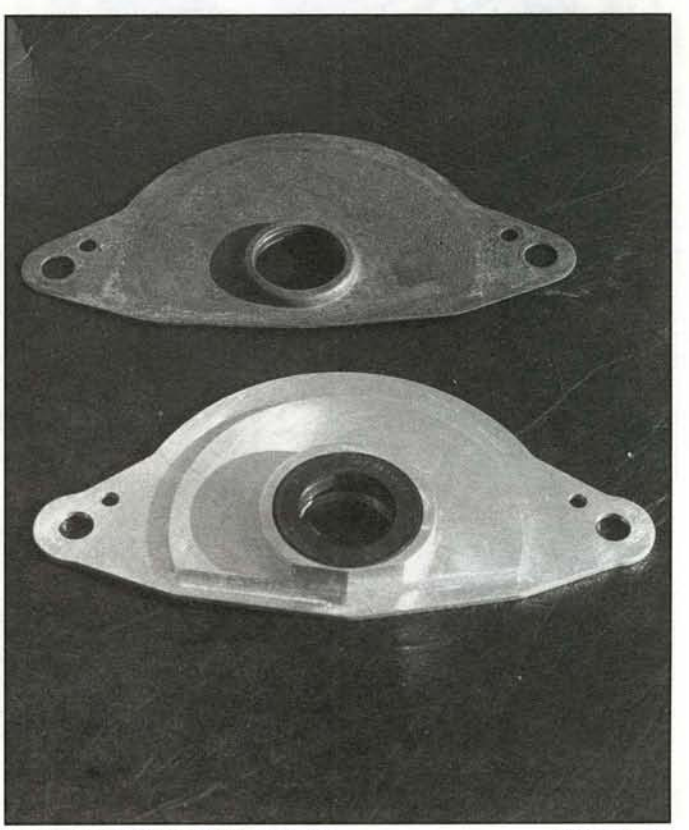
Place the drum and hub assembly on the mainshaft and install the hub nut (which is a left-hand thread) and tighten to 50 ft./ lbs. torque. Place a straightedge across the back side of the hub and engine sprocket, then adjust the spacer on the engine (if necessary) so that the straightedge touches all surfaces evenly. Remove the sprocket and clutch hub and reinstall with chain. Use Loctite 242 on the engine threads and the trans mainshaft. Pay attention to torque. Over tightening the hub nut can cause damage to the bearing. Install steel discs and friction discs, alternating, starting and ending with steel disc. ***NOTE: convex side of spring diaphragm must face out.*** Stack the pressure plate spring diaphragm and adjuster plate with the holes aligned. The cable must be free and the pushrod adjusting screw should be backed out. Lay a straightedge across the face of the diaphragm spring. The spring should be flat within .010 inch. If the spring is bowed outward (convex), the adjuster plate should be moved to the next hole position of greater compression. If the spring is dished inward (concave), the adjuster plate should be moved to the next hole position of less compression. ***NOTE: Bolts used to set pressure plate must be adjusted evenly in or out evenly 1/2 to 1 turn at a time or distortion to pressure plate may occur.***

Set the pressure plate to 8 ft./lbs. torque then take the slack out of cable to give the lever 1/8 inch to 3/16 inch of free play. Position outer cover and add correct amount of H-D primary chain oil. Give a trial check of clutch adjustment. **Do a hole shot and smoke the tire.**

For more information, contact Rogue at Box 184, Melbourne, FL 32902 or Harley Motor Works at (407) 723-0026.

—Rogue

After welding, a mill is used to clearance drive.



Tighter seal plate from Freds Custom Cycle.

Photos by Rogue

Cranking Circuit Modification

Tech by Thompson

How many times have you come out of your favorite watering hole on a chilly night and prayed for cosmic intervention to make that big stroker crank over? Are ya tired of listening to all that electro-mechanical moaning and groaning? Sick of feeding the pig $35 starter drives? If your answer to any or all of these questions is yes, then you may want to try the following simple, *cheap* modification and starting procedure.

Rewire the cranking circuit, so that the engine can be spun over with the ignition system turned off until it reaches a decent cranking speed, and then flick the "run" switch to "on" allowing the motor to light. This allows the engine to turn slightly faster because it isn't "fighting itself," that is; initial spark timing is not pushing the engine backward by lighting the charge in the cylinders at or before top, dead center. At slow cranking speeds, the engine's flywheels have not built up enough momentum to spin it past this point easily and cranking is slow and sluggish.

The accompanying photos show the wires which need to be altered in the 73-81 XL, FX, 72-81 FL handlebar switch housing. 1982 and later switch housing may appear different, but the procedure is the same as Harley-Davidson has continued to use the same color coding on the wires involved, right up to the present models.

The pointer in photo #1 indicates the white wire which should be cut off of its present terminal on the "run" switch. Its end should be stripped and resoldered to the terminal on the "run" switch, which has the gray wire attached already, as indicated in photo #2. We use rosin core solder and a pencil-type, light-duty soldering iron.

The starter switch will now be "live"whenever the ignition switch is turned on. The "run" switch now only switches current on and off to the ignition system.

Don't forget to check and adjust your bike's ignition timing. Make sure mechanical advance weights are operating properly and lubricated with light oil. These will occasionally stick in the full advance position if not maintained properly. Finally, make sure that your bike's battery, charging, and cranking circuits are in top shape. This simple modification definitely allows a noticeable in-

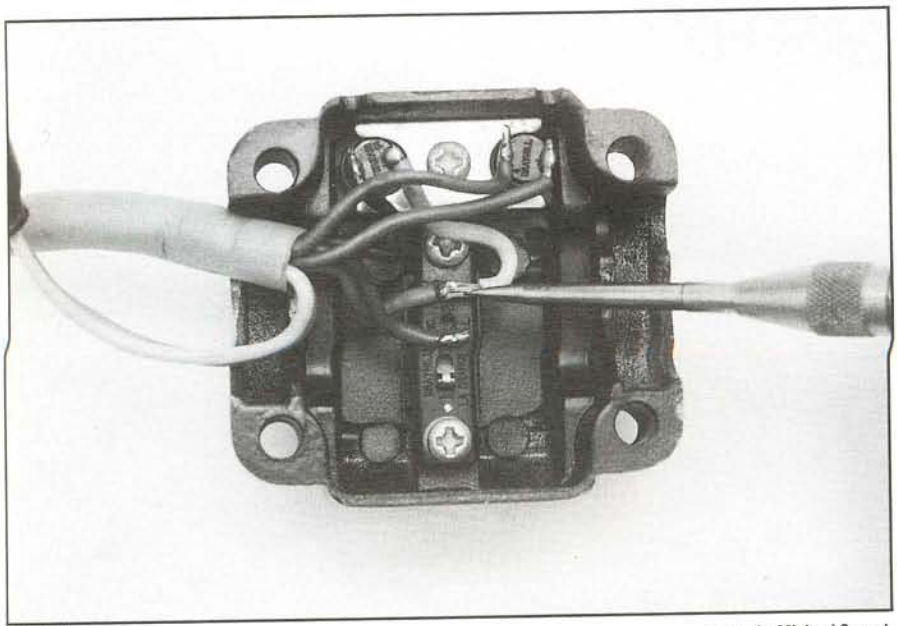


Photo 1

Photos by Michael Coppola

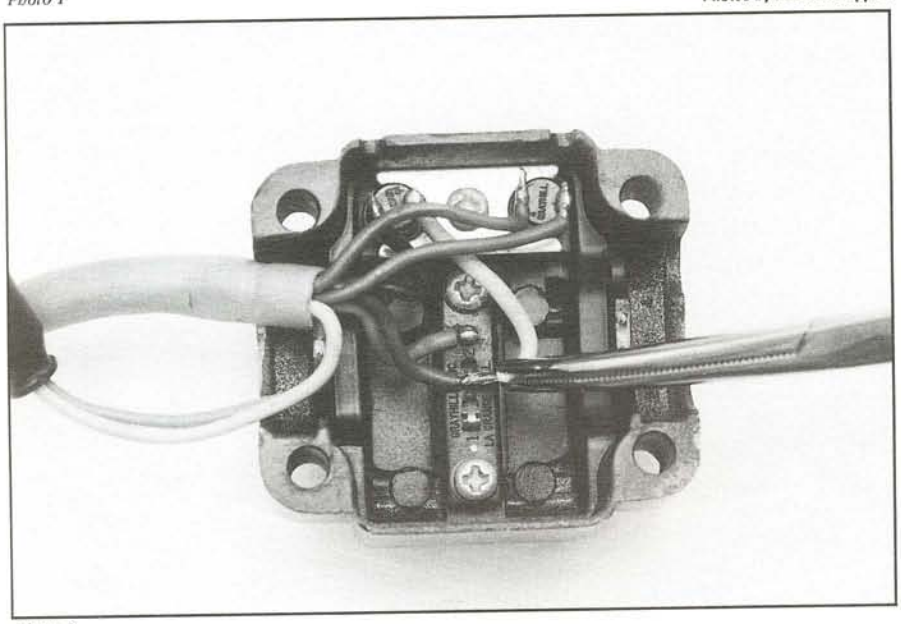


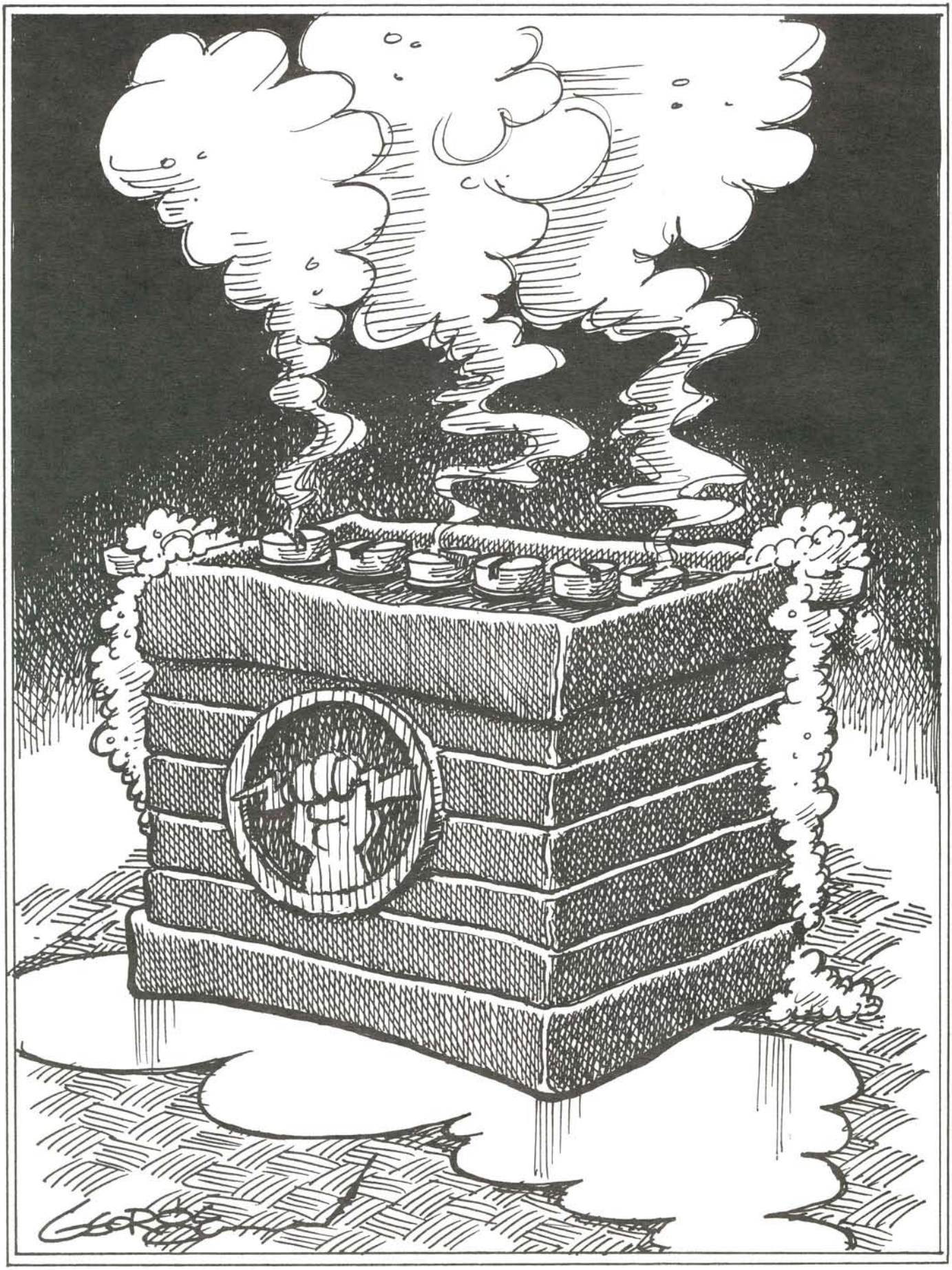
Photo 2

crease in cranking speed, but it can't overcome the handicap of defective or marginal components.

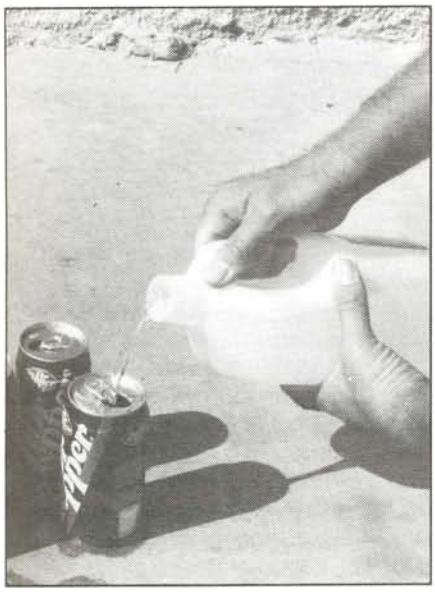
CAUTION:

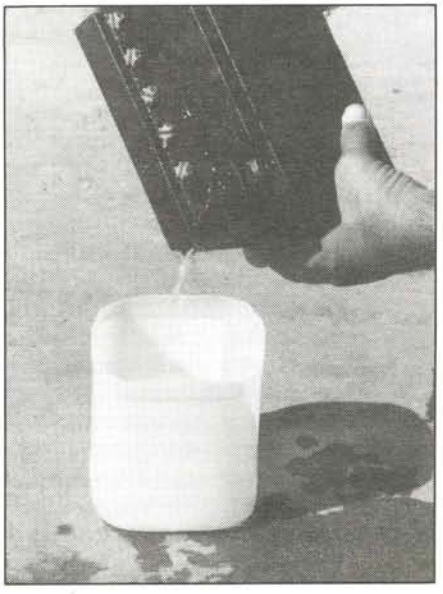
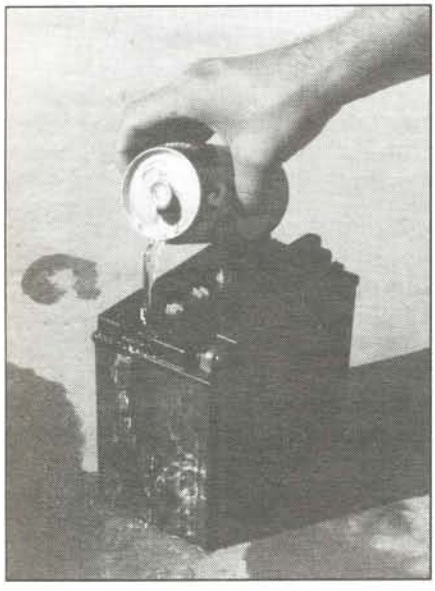
After completing this modification, you will have removed an important safety interlock feature from your bike. *You must realize the starter will now engage any time the ignition switch is turned on.* For example: your bike could be parked, on its sidestand, with the key on so that you can listen to the radio. If someone accidentally pushed the starter button, the starter would engage and crank the engine, possibly tipping it off the sidestand if the transmission was left in gear. So be careful!

This tech tip was provided courtesy of Jim Thompson at Thompson's Cylinder Head Service, 186 River St., Dedham, MA 02026, (617) 326-8380, FAX (617) 320-9351. Jim has been providing quality machine shop service for the Harley aftermarket for over 25 years and welcomes inquiries from both retail and wholesale mail order customers.



The Barstow Battery Benefit



Photos by Mark Chen

I pulled into a gas station on the outskirts of Barstow at 3 p.m. The sun was a living blowtorch doing the Lambada in the sky. Everything smelled of heat. Through the wavy lines burnin' off the asphalt, I spotted two other riders. One was cussin' and kickin' about someone leavin' him waitin' at this fuel spot in the blistering sun and the other, a bit taller, was lookin' downright forlorn.

The shorter of the two was Billy Westbrook, all five-and-a-half feet of him, a sheet metal stretcher from L.A. His wild mane of hair was flappin' to the gestures of his outstretched arms, while his Bill Cody beard and mustache contorted as he cussed out the dude who had stood his little ass up. The other rider had pulled in and filled up, then discovered that his battery was failing.

When Billy calmed down he helped the downed rider remove the tired battery. Then he told him to go into the convenience store and buy a plastic, 1-quart bottle of water. Billy whipped out his Buck and slit 3 inches off the top of the bottle, so it could be used as a funnel. Then he poured the water into some used Coke cans and drained the battery acid into the clean water bottle's bottom. Using one can at a time, he flushed out the battery several times, shaking it violently as he gazed out at the horizon, "That sonuvabitch," he mumbled.

He made sure that all the crap was dislodged from the bottom of each of the cells before the final sediment flush. Then using the rider's bandana as a strainer, he carefully poured the acid back into the cells, then topped it off with fresh, uncontaminated water.

The rider cleaned his terminals and reinstalled the cleansed electrical storage unit. The bike fired and the rider was on his way, back onto the scorching, molten blacktop.

Far as we know, Billy's still at that gas station, hangin' out with the desert rodents and fixin' old Chrysler bumpers. Although he will pump new life in yer battery, if it's in need. —Snake

Springer Project

Installation Of A New H-D Springer On An FXRS With A Prototype KüryAkyn Fender Mounting System

Most of the bros said I was nuts to remove the smooth, cushion ride of the narrow 39mm front end. But I've never cared for the styling of the Sportster-type front end. I wanted a unique look for a new 1990 FXRS—something out of the norm, but with class. So here's how it went down.

After making every effort to have all the parts on hand (don't forget a headlight), a friend of mine who has a business in Santa Barbara, California, about 60 miles north of L.A., told me about the new Harley dealer that'd just opened there—Harley-Davidson of Santa Barbara, owned by Gerry Rode. He was so impressed with the crew, I gave Mary Duggan, their general manager, a call. She, too, was in the process of installing a springer on her FXR. Also, Scotty Swearingen, another one of her mechanics, had worked with the KüryAkyn designer, Mike Wolsleger, on the installation of the 174-PH stainless fender brackets. It seemed like a natural place to perform the operation.

Mary was upbeat, open, and a pro, so I shipped the parts early in the week and then rode up the coast on a brisk, but crystal clear, Thursday morning. As I pulled off Highway 101 at Milpas Street, I pulled right alongside another rider who was packing a cutie wearing a leather miniskirt. "Brisk, ain't it, baby?" I thought and called to him for directions. He indicated for me to follow him. The rider turned out to be Randy Durbin (with his wife, Patty, the countergirl), the service manager and mechanic I would be working with for the next 10 hours. The shop was new and pristine, with a helluva crew, plenty of innovative ideas (thanks to Jerry Farmer, a local scooter designer), and that's all I'm gonna say . . . time to tech.

The FXRS is ideal for this modification, because the only gauges are on the tank. You'll lose your Sportster-type, headlight-mounted, highbeam indicator, neutral indicator, and oil pressure light, unless you devise some custom application.

First jack up the front end in a safe and secure fashion and remove the old front end. Then protect the neck races so that you can grind off the fork lock tab from the frame with a sharp, small, carbide cutting wheel on a pneumatic die grinder (although a hacksaw and files would work). Randy used Harley touch-up paint to fill in after filing, then spray paint after sanding with 600 wet and dry.

Kuryakyn springer front fender mounting system.

Next, he cut off the fork lock tab from the springer. The wheel that comes with the springer kit is a 21, and it's not a bad idea to check the trueness before mounting the tire. The wheel was true. We then proceeded to mount the front tire. I had originally picked the new Avon 21, Roadrunner AM20 90/90 H21 54H, a sharp-looking tire meant to avoid rain grooves, with a larger overall diameter and a broader base for more tread on the pavement and greater stopping power. But the size interfered with KüryAkyn fender mounting and we were forced to switch back to the stock Dunlop Elite.

Before the springer was actually installed on the bike, the stock springer fender brackets needed to be shortened to accept the KüryAkyn fender guides. The caps that hold the guides are measured internally, then the tabs are cut off so the caps come right up to the welds on the rear legs. Once this cut is made, the fender needs to be installed to insure proper clearance for up and down movement. Then the tabs were carefully trimmed some more with the die grinder. The stock Softail springer kit also comes designed for the front wheel to be offset slightly. This is not the case with the FXR models, so the wheel had to be retrued to center. KüryAkyn designed their fender to run in the center, so we were covered. Randy also installed two machined spacers, one for the permanent side of the axle (so when it was tightened the fender bracket would still pivot) and one for the other side, that would assist the axle with centering and accomplished the same freedom of movement. Make sure the fender bracket pivots or the forks will not function. I'm sure KüryAkyn will remedy this obstacle in installation when they release the kit. Because these were two of the first working kits, some experimentation was necessary.

We installed and adjusted the new front end. The required torque setting is only 7-foot/pounds before adjustment. We soon discovered that the KüryAkyn fender brackets or legs made the stock axle slightly short. Two maneuvers would remedy it: Turning the lip on the stationary side of the axle or running a thinner axle nut on the other end. Ultimately, Randy turned a separate keyed axle nut and drilled the axle for a cotter-key.

The KüryAkyn kit needs to be installed with the brackets on the legs first, followed by the fender and then the front wheel. With the tire in place there is no clearance to install the fender bolts. When we remove the fender to have it painted, the wheel will have to come off first.

Once Randy had remedied the spacing by retruing the front wheel and centered the Performance Machine brakes, we installed the risers and bars. The W-1 Flanders bars were designed for the springer of old and it fit perfectly. Because of the 7-inch centers needed for the springer risers, a special set of bars needed to be ordered. Flanders W-1 and W-2 were perfect replacements. Long arms dictated the taller of the two. The installation looked sharp. But Randy was then faced with the wiring in the stock headlight. The FXLR is

ideal for this modification because the handlebar wires plug into the main harness under the fuel tank. The FXRS has all handlebar wiring in the headlight (no plugs under the seat). The FXRS main wiring harness should be modified to the FXLR connectors under the tank for a real class job.

Two of the wire looms needed to be removed and spliced. Being a stock Harley mechanic, he backed all the wires out of the original headlight and made the splices under the tank so as not to disturb the stock handlebar system. Refer to your manual for this operation.

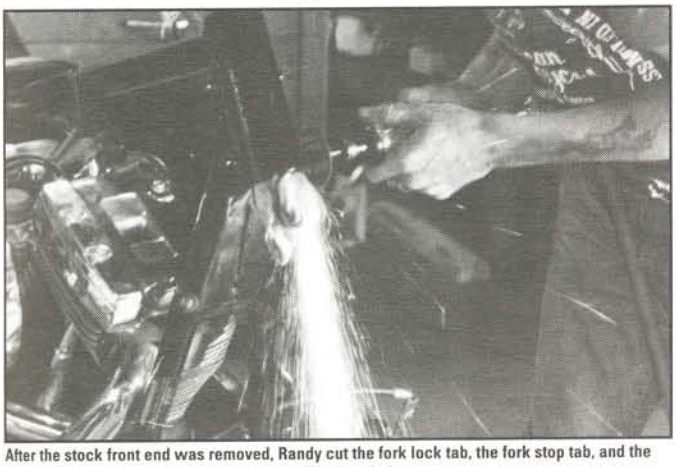
Randy did a masterful job of making the existing wiring reach, hiding the excess under the tank, and cleaning up that which showed. In some cases a longer clutch cable will be needed, but the only major problem we had was the front tank tabs. With the springer installed, the fork stops hit the tank tabs. They either have to be carefully notched or reworked for clearance, so before you paint the tank, make the necessary modification—or be prepared to notch and touch-up the tank.

The operation was a complete success, and class came to the FXRS.

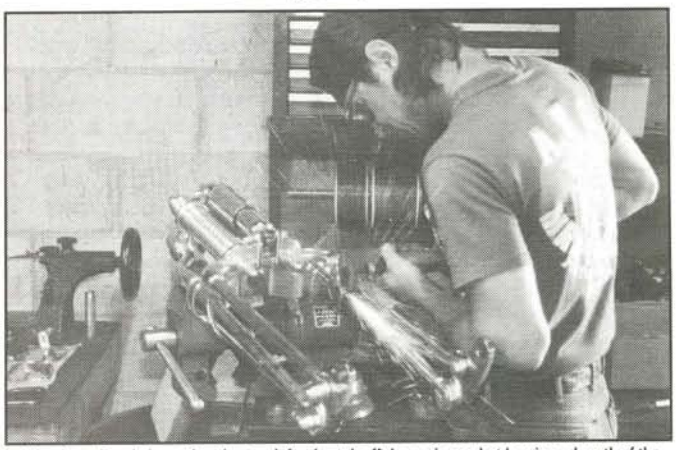
—Wrench

Make sure the fender bracket pivots or the forks will not function

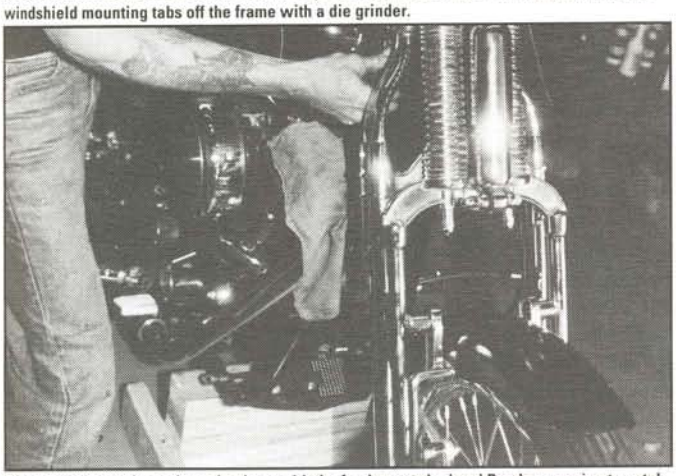
You can get additional information about the KüryAkyn fender mounting system by calling (715) 386-3180.



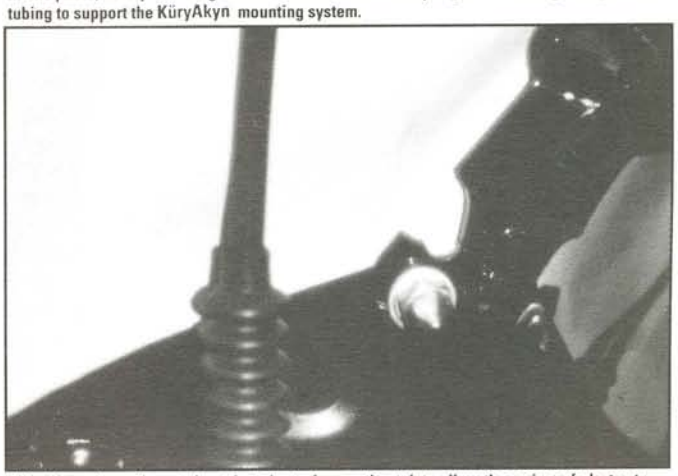
After the stock front end was removed, Randy cut the fork lock tab, the fork stop tab, and the windshield mounting tabs off the frame with a die grinder.



In this photo, Randy is cutting the stock fender tab off the springer, but leaving a length of the tubing to support the KüryAkyn mounting system.



This photo shows the springer in place with the fender attached and Randy preparing to notch the tank tabs. Note the closeness of the fender to the front tire.



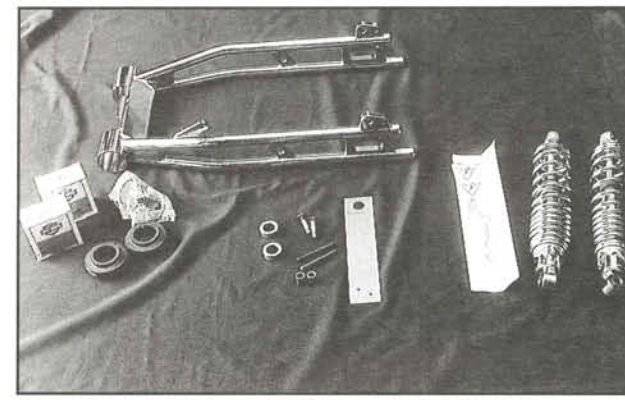
This photo shows the notch cut into the tank mounting tab to allow the springer fork stop to hit the frame. Another solution would be to move the tank back.

Photos by Billy Tinney

TECH TIP

Lowering The FXR

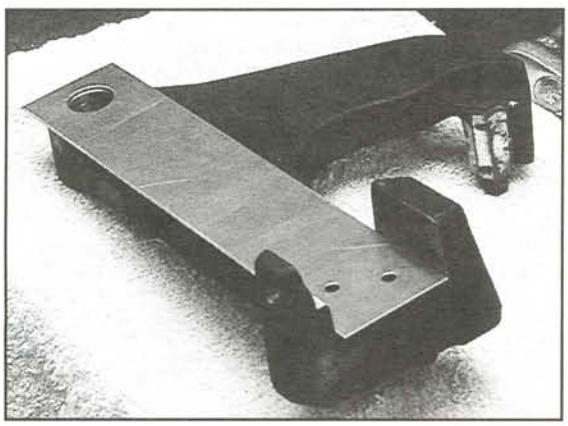
Every Rider's First Priority



Here are the parts needed for the job: Arlen's swingarm, 11-inch Koni shocks, Arlen's template, and a new H-D swingarm bearing kit.

I don't know about the rest of you freeway eaters, but I picked up the agile FXR for the rubbermount, the custom possiblities, the rear belt, the ride, and the electric start. I've been riding rigids too long. I'm getting short.

But, of course, I had to change it, and lowering it seemed to be one of the basics. Change the front end, lower the rear, hop-up the engine, get a new paint job, throw in a handful of accessories, and an FXR takes on a whole new look.



This shot shows Arlen's template in place. The tabs on either side need to be cut off with a hacksaw, then the holes must be drilled and tapped.

We're at the lowering stage. The platform is Micah McCloskey's Custom Motorcycles located in Canoga Park, California, (818) 348-8967. Micah, the main man, instructed his head wrench, Dave Beard, to handle the seemingly simple operation. (Micah was the assistant crew chief on the *Easyriders* World Land Speed Record Run and Dave was a crew member.) Dave, in turn, dialed-up one of the San Fernando Valley's most talented sheet metal workers and fabricators to bob the fender—Bob Brouett, (818) 887-0572. (Bob was responsible for the majority of the fabrication and the paint job on Jim McDermott's white Softail in this issue.) The job took four hours from start to finish.

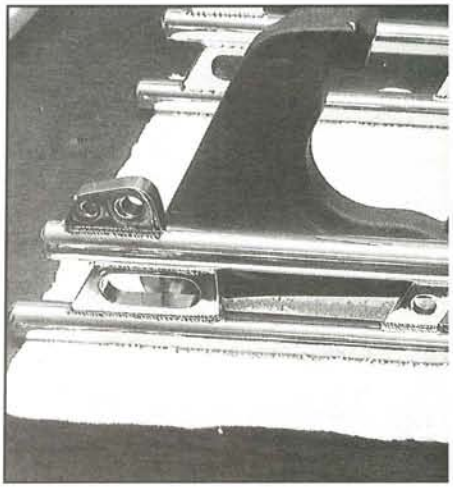
The elements to preform this function were, in general, accumulated from the Arlen Ness design group—which will demonstrate that not all products procured from the Arlen house create bikes that are rocket ships in disguise.

The first step is to jack up the bike, with the engine mounted. Next, remove the rear wheel and swingarm (which was replaced with Arlen's dual rail, chromed arm, which looks a helluva lot better). This will support both custom brake applications and stock brakes. (The only thing that doesn't bolt up is the bottom belt guard.) The engine needs to be raised because the swingarm axle runs through the large rubber grommets inserted into the frame, then the transmission and the frame again. Keeping the two in line allows the axle to be removed easily. The recommended procedure from all local respected wrenches is to replace the bearings, seals, and bushings in the Ness swingarm with a new set. Taking the old ones out of the stock arm and pressing them in a new one usually causes damage to the seals and results in leakage. A press is necessary for this operation, so a shop with the appropriate equipment is a must. Follow the service manual for the dimensions and requirements for pressing in the new bushing kit. This information is critical or the seals will be broken. With the bearings in place, along with new seals, the swingarm was ready to be reinstalled. But wait . . .

The elements to perform this function were, in general, accumulated from the Arlen Ness design group

The stock brake anchoring bracket had to be modified for the Ness arm, which meant slicing off the stock swingarm tabs and then using the handy Ness template to drill and tap the bracket and thread-in bolts that ground the brake to the new arm. All the instructions and hardware came with the new arm. Now the entire assembly could be replaced.

When installing the new arm, first make sure the belt is over the pulley and that you have the caps set for their designated sides of the bike—right for right, left for left. Line up the caps and place the pins in the caps, with the engine lifted to align the swingarm axle (sometimes a pry bar is necessary). Roll the cap bolts in loosely. Once everything is in place, tighten the cap bolts and finally the axle nuts. Make sure the belt is aligned. The final adjustment is the tension on the belt. With the swingarm axle, the wheel axle, and the transmission main shaft in



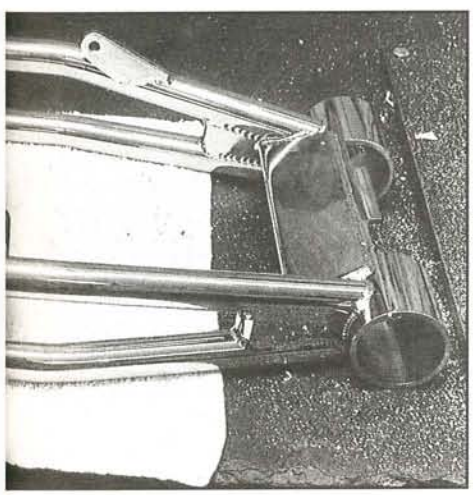
This is Arlen's new swingarm, with the stock H-D bracket modified, tabs cut off and drilled, and studs bolted in place.

.ne, (which is the tightest point of belt travel) there should be 1/2-inch of play in the belt.

I used Koni shocks to accomplish the lowering aspects of the job. Stock shocks are 13 inches long. We replaced them with 12-inch Konis, which are distributed by Arlen after he dismantles them, chromes the springs, and then reassembles each unit. I went with the foot-long shocks because of my height and weight (6 feet 4 inches and 225 pounds). But after testing the bike for a week, I discovered that the adjustments on the shocks, which didn't lengthen them but compressed the spring, gave me more than enough flexibility for my weight and for packing someone. I switched to the 11-inch Konis. These shocks have three adjustments for the spring tension and five adjustments at the top for dampening. Technically, they're 7610 series Konis.

'he engine/transmission must be aligned with the frame in order for the axle to .e fed through the new swingarm.

I wanted the bike to take on a rowdy look, though—short, fast, and standing tall in the front ('cause of my height). So we called in Bob to bob the fender. He wasn't particularly pleased about doing the job on the bike and not being the official painter (Dave Perewitz is working on the sheet metal as this goes to press), but being the madman I am, especially on Friday nights, I didn't have time to spend on a two-week turnaround. We went for it. Bob did a masterful job of taping off the fender just above the taillight, cutting the fender off with a narrow wheel on a die grinder, shaping it with a file, and then touching it up with pinstriping paint.

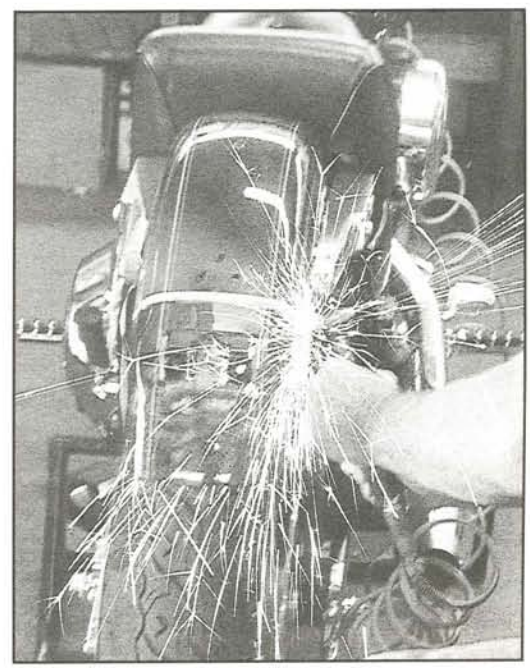


The final touch was an Arlen Ness-polished billet license plate bracket. We didn't use his rubbermounting bracket, though. Dave Perewitz recommended smaller rubber grommets under the bracket, which would support it while allowing it to lie in line with the rear fender. Another way to accomplish the same would be to cut the rubbermount, supplied by Arlen, to any desired angle or height you desire. The rubber grommets we used were approximately 3/8-inch thick. We mounted a catseye taillight and one of the new billet Ness taillight covers, rewired it under the fender (I always solder the connections), and the scoot was ready to roll.

It didn't take long for me to discover how bad the back belt pulley looked against the unpolished wheel and chrome swingarm. I immediately ordered a chrome belt pulley cover from CCI and plan to have the wheel painted black and the ribs and rim polished.

Now, I'm outta here.

— Wrench



Bob Brouett masked off the fender before firing up a thin wheel on the die grinder and cutting off the bottom half of the fender by hand.

Photos by Billy Tinney and Kim Peterson

High Bars With No Strings Attached

By Gene Koch

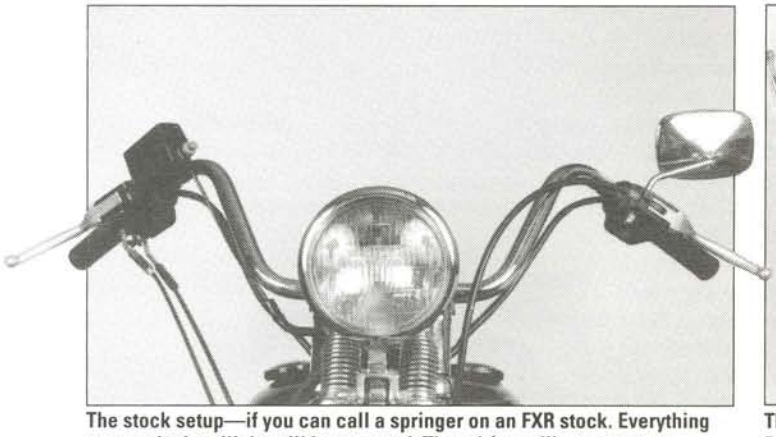
The goal for this project was tall, clean-looking handlebars. In order to accomplish that, all the wiring and switches were eliminated, and everything above the triple trees, including the bars, was replaced.

First, we removed the seat and disconnected the battery. Then the gas tank was removed to perform the wiring work, and also to prevent any dinging-up of the primo Cycle Fab paint job. Next, we disconnected the clutch cable. If you replace your clutch cable, make sure to drain the oil from the transmission. Put a piece of masking tape across the speedometer lens and write: NO TRANSMISSION OIL, to remind yourself to refill it. We then disconnected the throttle cables at the carb and the front brake hose at the caliper and covered the hole to keep dirt out of the caliper.

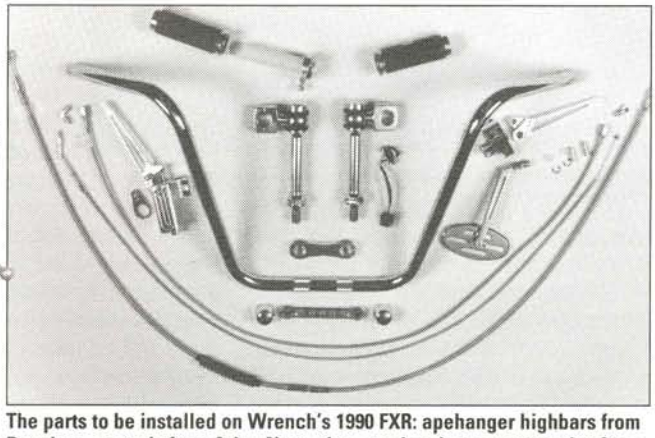
We followed the wiring from the handlebars back to the main harness and disconnected them. It makes the job easier to eliminate as much wiring as possible. We uncovered the main harness, just forward of the ignition switch and behind the connector, and then cut the wires and removed the connector. The shop manual came in handy here. This bike has no oil light, neutral light, turn signals, or horn (Wrench doesn't need one, he's loud enough on his own), so reams of wiring were removed. The handlebars were removed as a complete set. On the springer front end it helped to keep the holes aligned. We replaced one riser at a time.

Before we bolted on any new parts, I finished the wiring. I soldered all connections and used shrink-wrap. The end result will look good and be able to put up with his abuse.

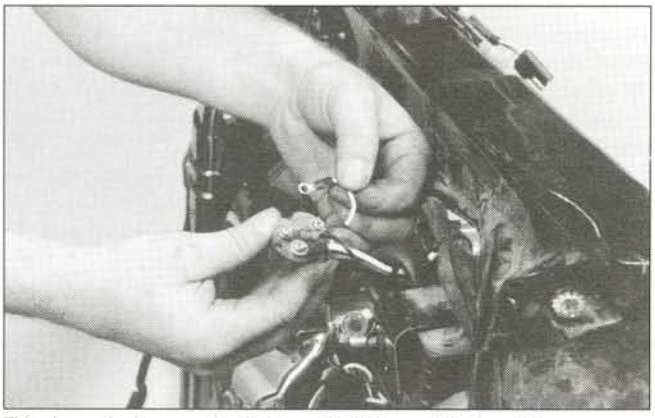
From the main harness, I soldered the gray wire to the white coil wire to bypass the kill switch we removed. Instead of a button, the bike will now be started with a key. We removed the white jumper wire from the back of the ignition switch and put the green and white wire on the ignition post. Then we connected the black wire from the main harness to the light post. The first position was then "off," the second position, ignition and lights, and the third position would engage the starter. The key isn't spring-loaded like on a car, so when the bike fires, the key must be turned back to the first position. Be very careful to have the bike in neutral every time you start it or the damn thing will walk away from you. The orange wire was soldered to the dash lights and gas gauge. The only other



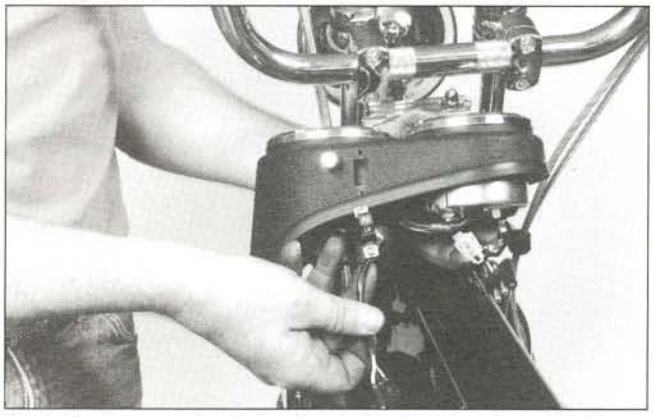
The stock setup—if you can call a springer on an FXR stock. Everything except the headlight will be removed. The wiring will never return.



The parts to be installed on Wrench's 1990 FXR: apehanger highbars from Paughco, controls from Arlen Ness, risers and springer accessories from Custom Cycle Engineering, and the rest from Drag Specialties.



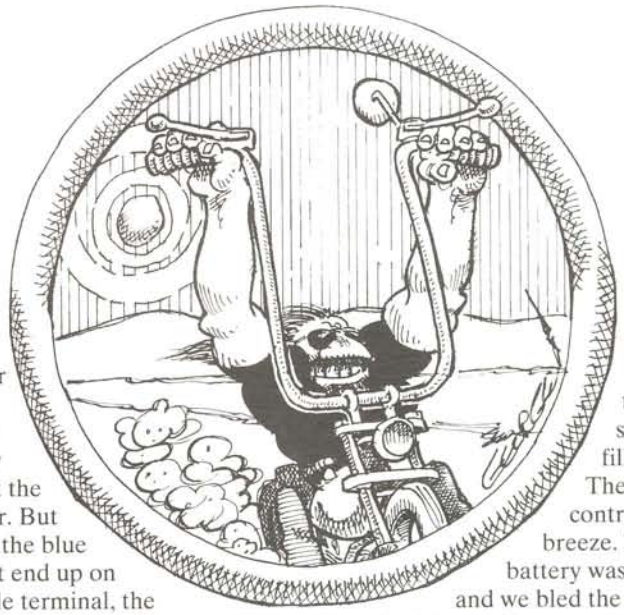
This shows the jumper wire that turns the lights on in both switch positions. It's being removed to free the second position for the starter motor. The lead is white.



This is the dimmer switch before installation. Note the slot cut into the dash and the two screw holes for the mounting screws.

wire we used from the main harness was the blue lead for the headlight.

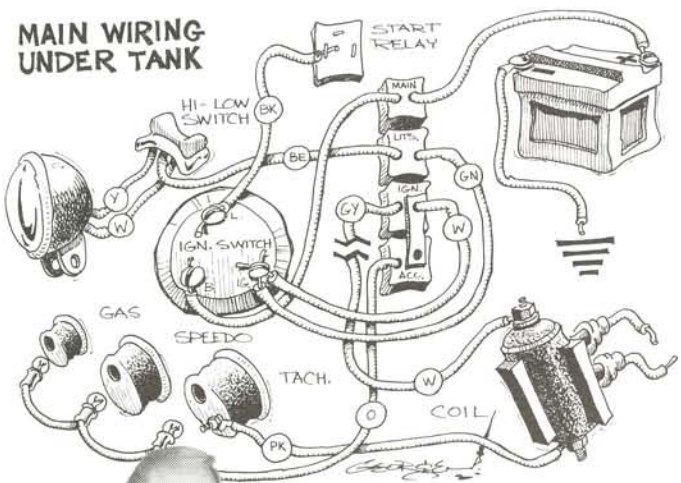
The high-low switch was mounted on the side of the dash panel, which sits on the tank. It required an extra connector to ease tank removal. The blue wire was soldered to the female position on the connector. To get the right wire length, we positioned the new connector alongside the other connector to the gauges. The yellow and white wires from the headlight also were soldered to this connector. To mount the early-style, high-low beam switch, I made a cardboard template and marked the side of the gauge housing. We drilled the two mounting holes and drilled holes in the center of the rectangle, using a die grinder and file to finish the opening. To make the switch mount close to flush, use 1/4-inch spacers between the housing and the switch.



Depending on what connector you use, the color code may change at the connector. But as a rule, the blue wire must end up on the middle terminal, the white wire must be on the terminal behind the rocker end marked "Low," and the yellow wire needs to be behind the rocker end marked "High." This completed the wiring part of the project.

Next came the Arlen Ness controls. We used the old-style clutch pivot pin, with plastic bushings for the new-style clutch cable. There wasn't room for the flanges inside, so I trimmed them off.

The new clutch cable was then installed, and the transmission was refilled with oil. The rest of the controls were a breeze. Then the battery was reconnected and we bled the brakes. The paint job and chrome were protected from scratching from the braided cable with cable clamps. Clear vinyl tubing over the braided area near paint also works well. We also installed a billet brake stabilizer, a top bracket on the springer, and new axle covers to clean up the front end from Custom Cycle Engineering. Not bad—high bars and high life for a reasonably stock FXR.



Photos by Clark Crouse

Gene Koch (all 6 feet of him) sitting on Wrench's FXR after completing the job. It's not legal, but it's cool.

Parts Suppliers

Custom Cycle Engineering (see your local dealer):

billet brake stabilizer
billet top springer bar
chrome axle covers
custom risers

Arlen Ness (510) 276-3303:

Ness Tech front master cylinder and brake lever
Ness Tech clutch lever and clutch lever mount

Drag Specialties (see your local dealer:

textured foam grips
throttle assembly
16-inch apehangers
braided brake hose and fittings
Barnett braided cables
clutch lever pivot pins
Clutch lever bushings
Ness billet cable clamp

Raking An FXR

Just Couldn't Leave The Low Rider Alone

By Wrench

Well, I put the springer on this puppy and was pleased with it, except for the fact that the front end felt a tad light at 100 mph. Then, my brother Barry said, "Ya gotta rake that thing, it looks like you ran into a wall."

So I took the FXR to Arlen Ness. First, he took off the front end and the gas tank. Then, with a Saws-All, he cut under the neck (see illo) to within 1/2-inch of the top. With a wedge or a pry bar, he drew out the neck to the desired rake. A 1-inch spread at the bottom of the neck represents approximately 10 degrees. The important part of this modification is that the two large tubes under the sheet metal must be welded together after you've stretched the neck out (my bike was raked 3/4-inch). If you stretch it just slightly less than your final modification, when you cut and shape the wedge out of solid bar to fit into the area, it will be snug and tight for welding.

Drive the wedge into place and tack it securely on each side (alternating) so the neck doesn't pull to one side or the other. Once tacked, weld it all around.

Next, Arlen cut and shaped two pieces of 1/4-inch plate to fill the sheet metal gap on either side of the neck and welded them into place along with a piece of bar stock along the bottom.

Okay, so the bike sat a tad lower, and the front end tracked considerably better on the freeway and still handled well in the canyons, but the neck looked like hell. The frame needed molding and paint something awful. So here's what I did.

First, I had to locate my ex and the pickup I once owned. This was the toughest part of the project. Then, I had to convince her to let me use the truck and had to make careful arrangements to meet with her and get it. Natch, she wanted it back before I was done with it. It wasn't an easy task.

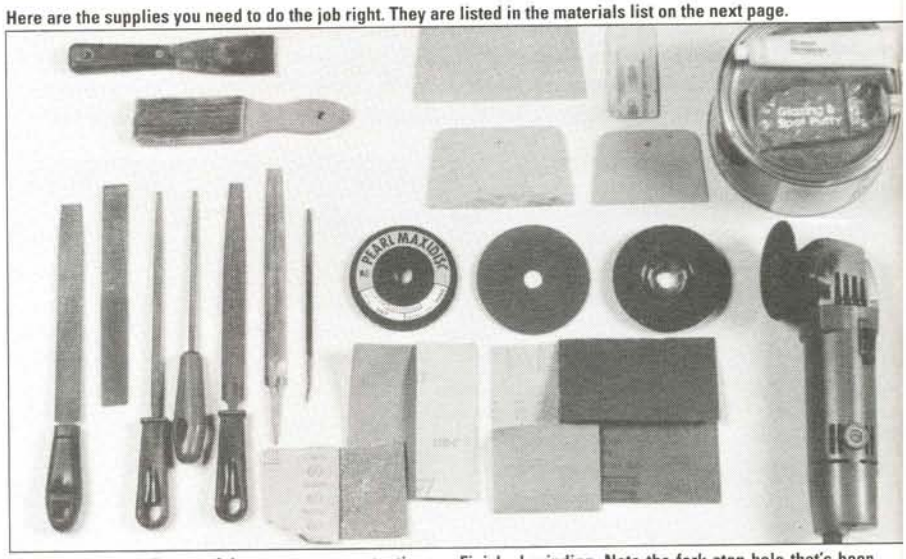
Once the scoot was inside the truck, I crept along the coast toward Carlsbad, California. I was looking for a small, dilapidated warehouse overlooking the ocean. I was told an old Hamster lived there who did good molding. I eventually found the rundown building. It was surrounded by vacant lots and tumbleweeds, dusted by a strong salty wind that raced inland off the cold, gray sea.

Here's what Jim Waggaman, the silver-haired Hamster, did to my sled:

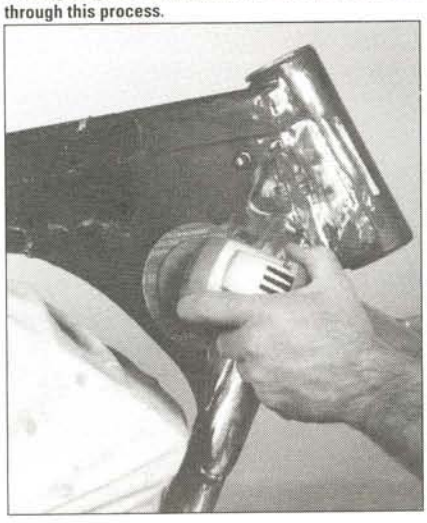
First he took a Makita Disc Grinder (or orbital sander) to the neck area and any area that the molding, or body filler would touch. Then he began laying on the Bondo. Note: Be sure to follow the directions on the can and mix carefully. Too much hardener and it sets up too fast and is brittle to work with. Too little, and it won't set up at all. He stirred in the hardener thoroughly, then applied the Bondo in smooth strokes to get a good grab against the metal and not create pits or bubbles that would have to be filled again.

Initially, he created the basic shape and design with the rasps and files. Once the general form was accomplished, he

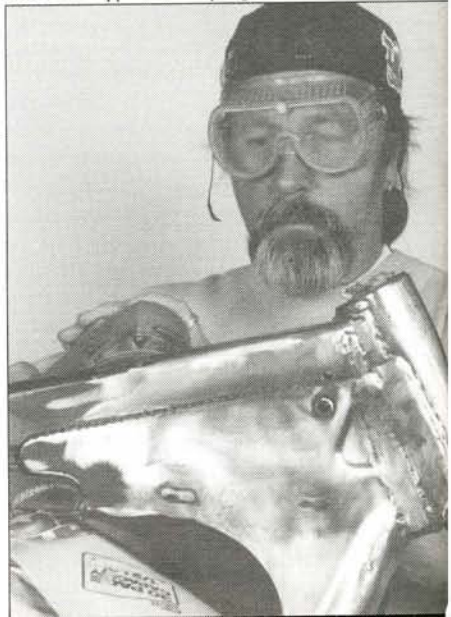
Here are the supplies you need to do the job right. They are listed in the materials list on the next page.

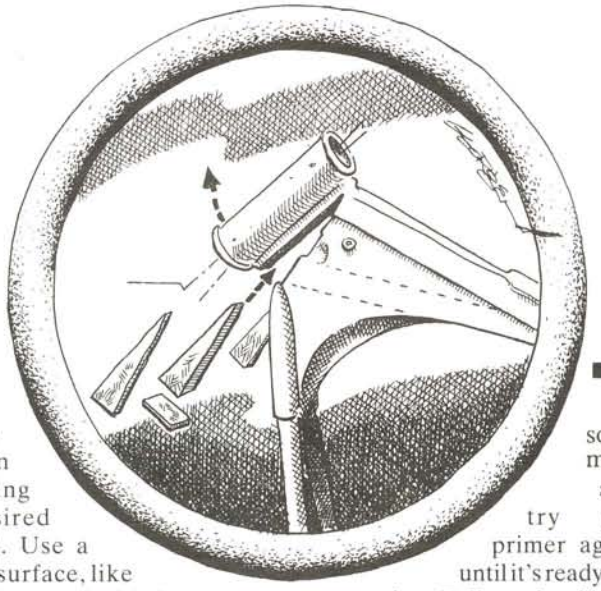


Starting to grind. Be careful to wear eye protection through this process.



Finished grinding. Note the fork stop hole that's been drilled and tapped for the springer.





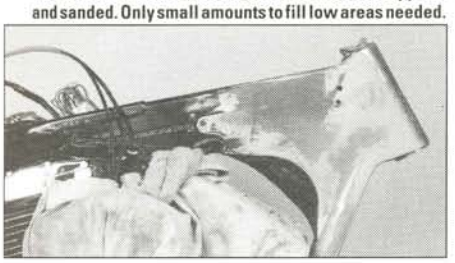
sanded, using coarse papers between coats, and kept laying it on until the desired shape was obtained. Use a sanding block or flat surface, like a chunk of two-by-four to hold the paper flat, so that you don't get low spots which have to be filled again. Then sand. When ya think you're close, shoot some primer on the job and check it out after it dries. Fill it some more and try the primer again until it's ready for paint. Follow the flicks, check out the materials list, and go for it.

Molding takes a knack, but if you have it, you can always find work or score high in a college ceramics classes.

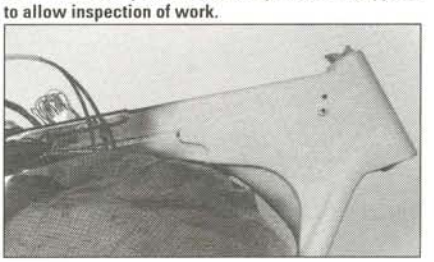
Bondo ready to mix. Note the small portion of hardener.

Applying Bondo to get a good seal and bond with the metal.

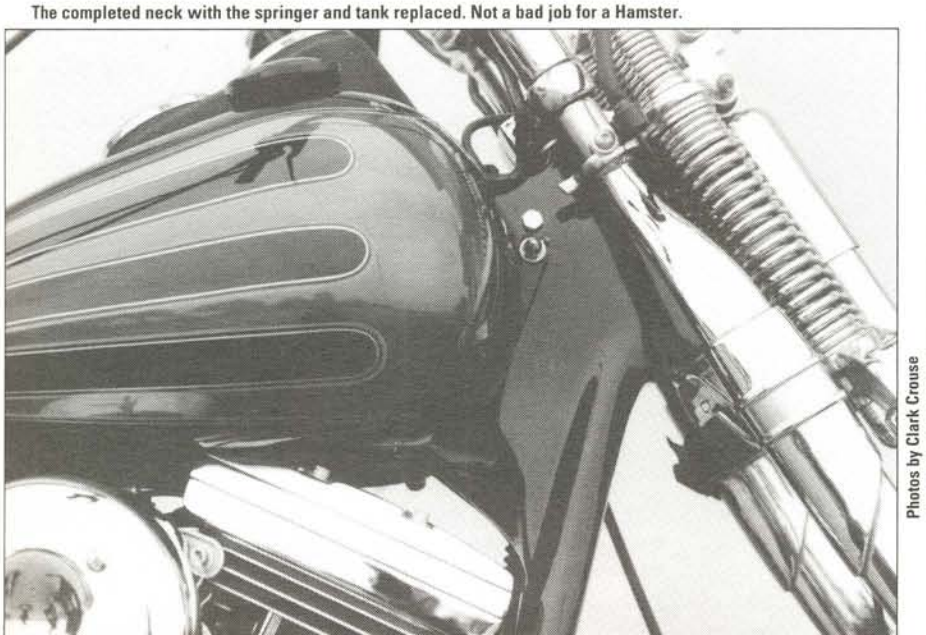
The neck after several coats of Bondo have been applied and sanded. Only small amounts to fill low areas needed.



Bondo work complete and coats of primer being applied to allow inspection of work.



The completed neck with the springer and tank replaced. Not a bad job for a Hamster.



Photos by Clark Crouse

A. Makita Disc Grinder

1. #80 and #120 grit sandpaper discs for removing all paint from areas to be molded

2. #100 and #120 pearl Maxidiscs for knocking down and shaping high areas or welds. They can also be used for removing any excess paint. They may be used in some of the areas for the rough shaping after the first couple of putty applications.

B. Body Filler Putty And Applicators

1. Putty knife or a kitchen mixing paddle for scooping out putty and mixing with hardener.

2. Mixing board or pallet. He uses a 1/4-inch piece of glass.

3. Variety of applicators. Sizes to use vary for different areas being worked on.

C. Assorted Files

1. Rasp combination (flat on one side, domed on the other). It's used for initial shaping to knock-off rough putty areas and high spots.

2. Medium combination with domed side for shaping.

3. Medium and fine rat tails.

4. File brush for cleaning files during and after project.

D. Assorted Sandpaper

1.#60 grit for rough out sanding and shaping.

2.#120 and 180 grits for refining, shaping and finish shaping, and sculpting. Also for smoothing and feathering.

3. #240 wet and dry for sanding out putty for initial primer coats.

a. Initial primer coats are for inspecting work in progress. This allows you to see the highs and lows and any other imperfections.

b. A gray primer is recommended because it allows you to see difficult surfaces with direct lighting—it creates more contrast and shadows.

4. #320 and #600 wet and dry for sanding off primer on any areas that need more work. Primer should be sanded off before applying more putty.

5. Once the molding is completed to the desired look then an overall sanding #320 or #600 wet and dry should be done.

E. Finish Primer and Paint

1. Several wet or heavy coats of a good filler sealer primer (such as Ditzler DZ-7) should be applied.

2. Using a Scotch Bright scuff pad on final coat of primer then it is ready for color coats.

This old Hamster started molding in 1970 and only stopped once to focus on his airbrush and design work in the early '80s. His specialties are custom painting, graphic design, and illustration. He even illustrates for Biker *from time to time. For more info or to give the poor Hamster some work, drop a couple of dimes to (619) 931-5931.*

For more details on frame raking or Arlen's catalog, call: (415) 276-3303.

Fat Rears

Fitting Big Tires On Softails And FXRs

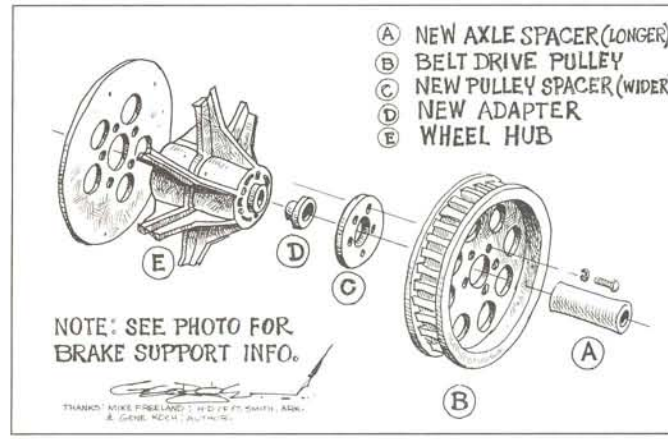
Okay, your rear tire is getting bald and it's time to buy a new one. If you're like me, when you put out your hard-earned cash you want to stand back and see an improvement. So why not buy a tire with some meat on it?

We wanted to provide you with a list of wider tires, by brand and size, that would fit your FXR or FXST without any modifications. Unfortunately, this information is not readily available. On tire charts, the width specified for larger tires is for wide rims. Since this alters the tire width on standard rims, it's a guessing game.

Consequently, we shitcanned the list idea and decided to talk to some bike builders. I called Arlen Ness and Dave Perewitz and picked their brains. The answer is still not carved in stone but the general consensus is most 140s will fit in your belt-driven FXR or FXST without modifications.

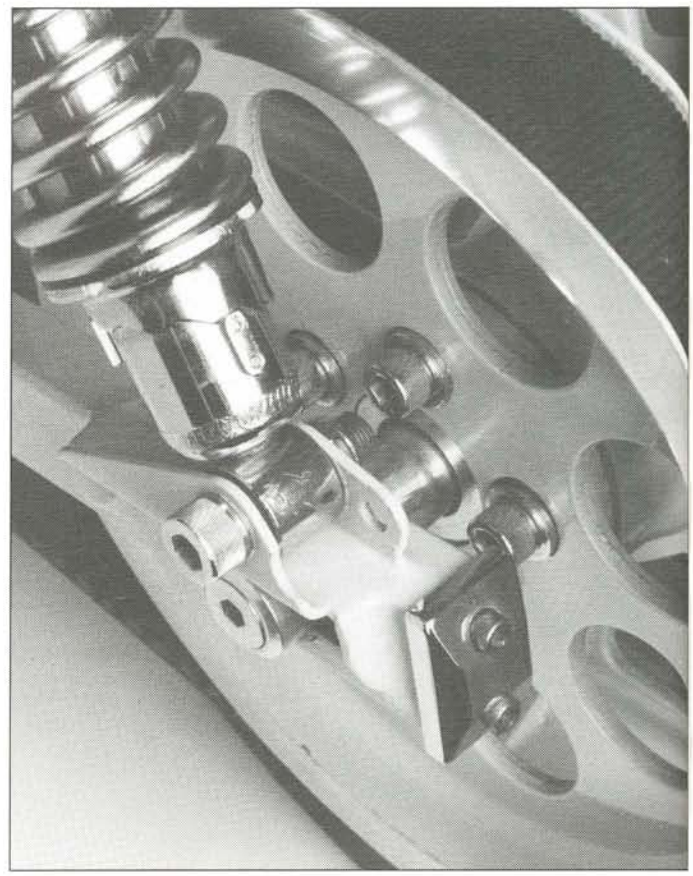
All 140s are not the same width. Some are barely wider than your stock 130, and others are as wide as some 150s. Check the physical width as well as the marked size.

If you need a little extra belt clearance you can put a thin shim behind the rear belt pulley. The front pulley is wider than the back pulley so you can usually cheat a little. If you shim the pulley, make sure you still have clearance between the pulley and the shock absorber and/or the swingarm. Also check the clearance between the tire and the fender bolts.



With more modifications you can go wider still. When I built my FXR I called Donnie Smith, one of my mentors, and asked him if I could use a tire that was 6 inches wide. He said no problem. The FXR rear wheel is off-center to the

6.1 inches of Avon Super Venom look good and have worked well for 8,500 miles.



Had to machine a longer axle spacer and a piece to center the drive pulley with the wheel.

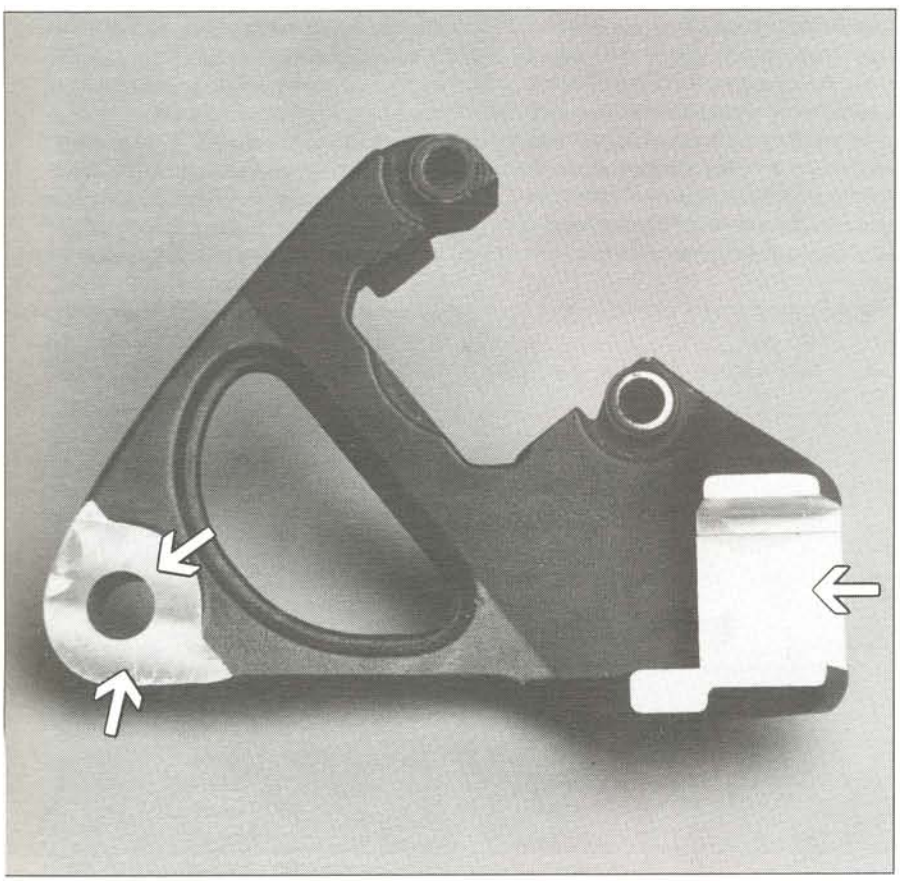
left (drive belt side), so all you have to do is center it. I got my measuring stick out and, sure enough, the wheel was .300 off-center. I machined .300 off the brake support which allowed the wheel to move to the right by the same amount (see photo below). The wheel is now on center line with the frame. On some brake supports you only have to machine by the axle boss. With Harley supports you also have to machine the front stop that slides over the swingarm (see photo).

Whatever you take off one side has to be added to the other. For the left side I machined a new spacer that was .300 longer than stock. I also machined a new spacer for the area in between the drive pulley and the wheel (also .300 thicker). In addition, an adaptor had to be machined so that the drive pulley could be centered with the wheel. This was necessary because, with the thicker spacer, the pulley was too far from the wheel to use the original centering ridge (see illustration). (Also, see top of column #3, pg 63.)

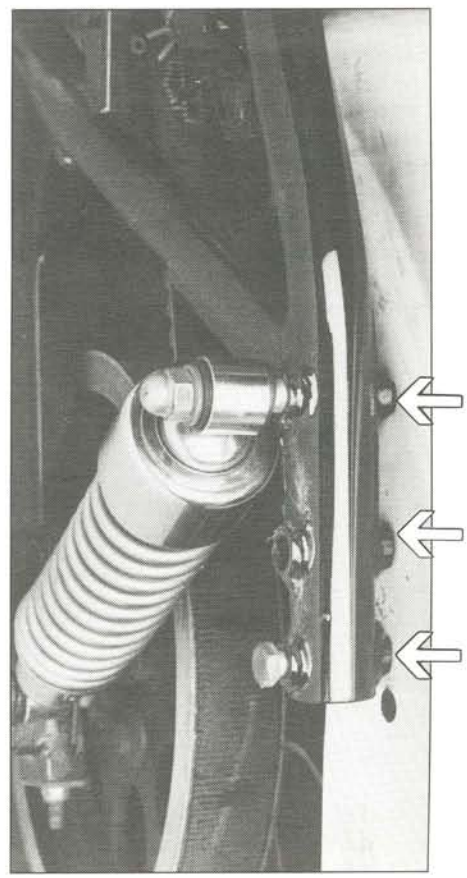
To get added clearance between the fender and the tire I ground the bosses off the rear frame section (see photo) and added a section to the rear fender to make it wider. I used an Avon 150/80 Super Venom that measured 6.1 inches wide on the Harley rim. The bike still goes down the road straight and there's plenty of clearance between the belt and tire. For more information, call Donnie Smith at (612) 424-3545. If you don't want to do your own machining he can probably supply you with a kit.

Without modifications you'll have to stick to a 140. If you want to go bigger there are other modifications you can make and still keep the belt. With a chain kit, you can really go big—widening the frame or running extra wide rims and building wider fenders. Whatever you need, it can be done. According to Bandit, if there's enough interest in this modification we can take it to the next stage in another article.

—Gene Koch



If you use the stock Harley caliper support you have to machine these two areas. (See arrows).



These three bosses were ground for clearance. (See arrows.)

CUSTOM FRAMES

One Size Doesn't Fit All

Like bikers today, cowboys on the cattle drives knew each other by nicknames such as "Slim," "Hogjaw," "Gotch-ear," and so on. If Bandit (the one who hangs around this office, especially on payday) had been there, they would have called him "Highpockets" 'cause the distance from his belt to his boots is greater than the distance from his belt to his hat brim. They would have called his horse "Spindleshanks" 'cause the horse would have needed long legs, indeed, to keep Bandit's stirrups from scooping up dirt.

Horseflesh or iron horse, the mount must fit the rider, and that's one of the things (among several) that Kennedys Custom Harley-Davidsons does: build a frame completely from scratch and tailor it to the rider. Take Bandit's case. He wants a new bike and brings the proposition to Pat Kennedy. They sit down to talk.

Whatever it looks like, a Kennedy bike has to be a rider—and a good one. Bandit says he likes "Easy steering," but he forgets that he lifts weights, and that what feels "easy" to him may feel stiff, indeed, to a bro who restricts his exercise to 12-ounce curls. Pat Kennedy, of course, can't overlook differences like that. In building custom bikes, he has to adjust the specifications to suit riders from the 300-pound gorilla to the 95-pound foxy rider.

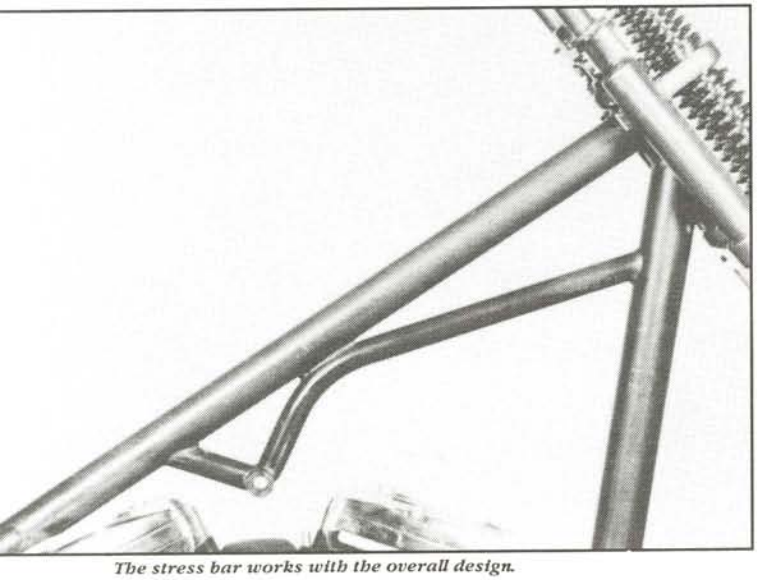
Pat has a full-size frame jig with more adjustments than a Weber carburetor. He clamps pieces of tubing in place, lines them up with a machinist's straightedge, puts a fishmouth at the joints, and tack welds the frame. If need be, he'll install a set of wheels and handlebars and have the client try it before he goes any further. Once the frame fits, he welds it up for good.

In Bandit's case, Pat wound up with 35 degrees of rake and 9-inch-over forks. After that, the familiar "over" and "under" business doesn't apply because Bandit's bike doesn't derive from a factory frame. Rather, it comes from Bandit's particular shape. The downtube, for example, took 6 inches of extension to make sure his feet didn't drag on the ground, and the overall length—rear axle to neck—got 2 1/2 inches of stretch. However, that stretch wasn't added at one single point. Pat spread it out all the way through.

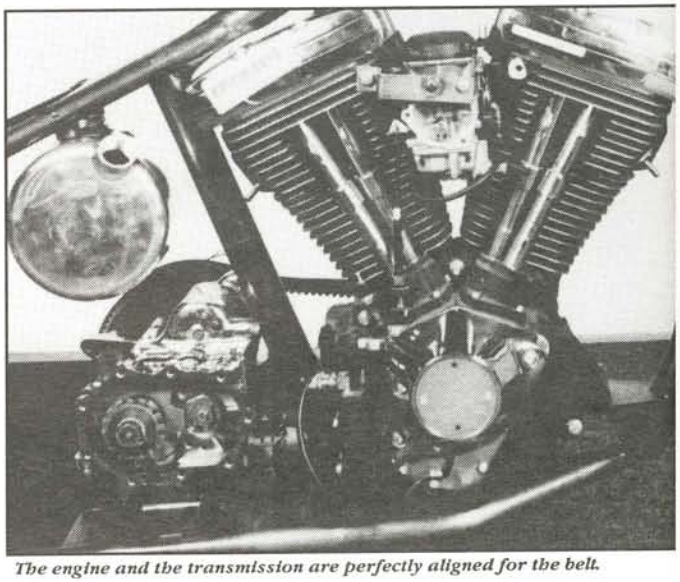
Bandit wants two drive belts, and Pat can handle that—but in his own way: he eliminates the adjustments for engine-to-transmission belt tension, and likewise the adjustment for rear belt tension. Omitting the adjustments means that changing a belt no longer requires moving the trans and rear wheel back and forth, and means that cocked rear axles don't happen anymore: the front and rear wheel always follow the same track. However, eliminating the adjustments also means that the dimensions have to fit the belts that Pat or the client chooses, and must fit them every time. Furthermore, they have to fit the way Pat has found works best.

In Bandit's case, Pat wound up with 35 degrees of rake and 9-inch-over forks. After that, the familiar "over" and "under" business doesn't apply

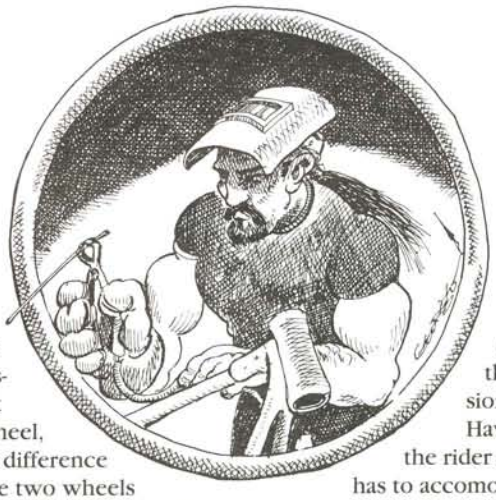
For example, a certain manufacturer may say that at the mid-point between the pulleys, a 10-pound pull should deflect the belt from 3/8 to 1/2 of an inch. That's pretty snug—maybe too snug—but it may be necessary for a stock frame that, in fact, does a lot of twisting and flexing as it bounces on



The stress bar works with the overall design.



The engine and the transmission are perfectly aligned for the belt.



grooved pavement or winds down a twisty road.

The flexing of the stock frame can slacken the belt considerably, if only for an instant. Just as often, it puts an extreme tension on the belt—only for an instant, but sometimes that's long enough to break the belt. When that happens, the rider condemns belt systems in general, puts on a new belt (with all the hassle that involves), and goes on his way cussing.

Pat doesn't want anybody cussing his bikes for any reason, so he leaves the belts a fraction slack—about 1/2 an inch to a full inch of deflection at 10 pounds. This works because Pat stiffens the frame in the engine-transmission area. Potholes, wheelies, hill-climbs, or whatever, the distance between the pulleys stays the same and the belts last even longer than the manufacturer claims they will. Left like that, though, the bike would lose all resilience and feel like riding a lump of lead. So, having lost flex in one area, Pat designs it into other areas by careful choice of tubing.

Belt drives also bring up the issue of fore-and-aft alignment. Some builders, for example, take the easy way out with belts. They line up the engine and transmission, then put the rear wheel slightly to one side. That lines it up with the transmission—but not with the front wheel, and even a slight difference in the track of the two wheels will affect steering and handling. The bike will behave one way turning left and another way turning right, and the differences will be greater with speed.

Pat lines up the two wheels, then centers the engine on that line. This keeps the weight of the engine and its inertia forces exactly in the middle. Then, he mounts the transmission about 3/4 of an inch to the left. That lines the trans up with the rear wheel, but not with the engine, and to fix that Pat installs his own custom-made, offset pulley on the engine. If the design calls for a fat rear tire, he may even offset the transmission pulley, too.

Moving the transmission to one side does mean that the tranny puts slightly more weight on one side of the centerline than on the other. Interpreted at the technical extreme, the extra weight would bias the handling of the bike toward the heavy side. However, the offset is not great enough to make a consequential difference. A fistful of loose change in the rider's pocket would have more effect on handling than the transmission offset.

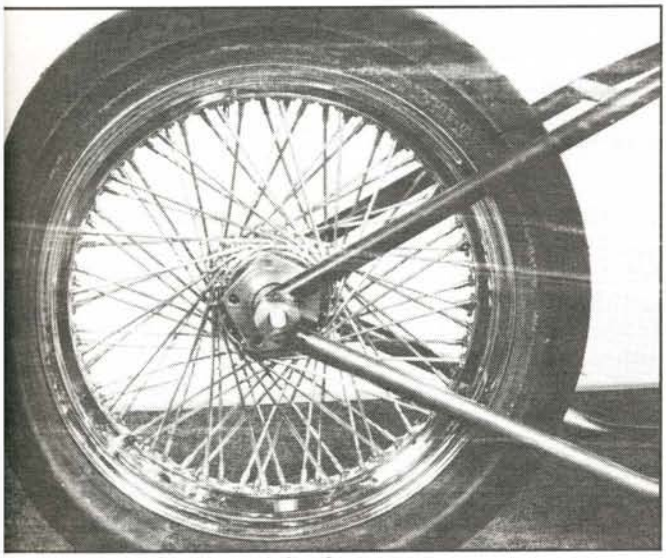
Having taken care of the rider and the ride, Pat has to accomodate the engine the client brings in. Carbs and manifolds vary, as do exhaust pipes and ancillaries like the coil and oil tank. Bandit, for example, got tired of tying wiring to the frame with shoestring and duct tape (like on the bikes he built for himself) and wants the wiring inside, out of sight and out of the way. That means Pat has to provide for getting the wires in and out, including the alternator output wire that Giggie, at Departure Bike Works, cleverly brought out through a special hole in the side of the cases (September 1992 issue, pg. 28). Once you start customizing seriously, you find yourself customizing every detail.

Pat Kennedy measures close. He knows that a bike must fit the rider, not fight him, and he knows how to make one that does just that.

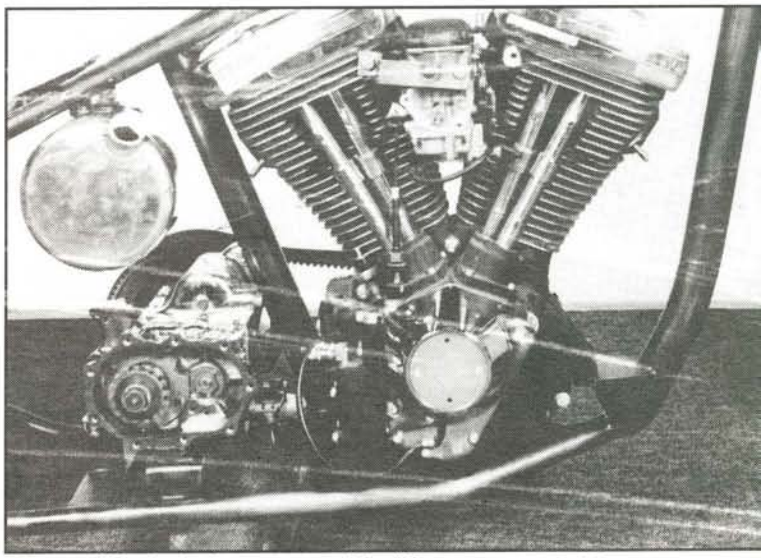
For more info drop by Kennedys Custom Harley-Davidsons and talk to Pat or Brook: 3028 San Luis Rey Rd., Oceanside, CA 92045; (619) 967-5883.

—Noose

(with help from Gene Koch)



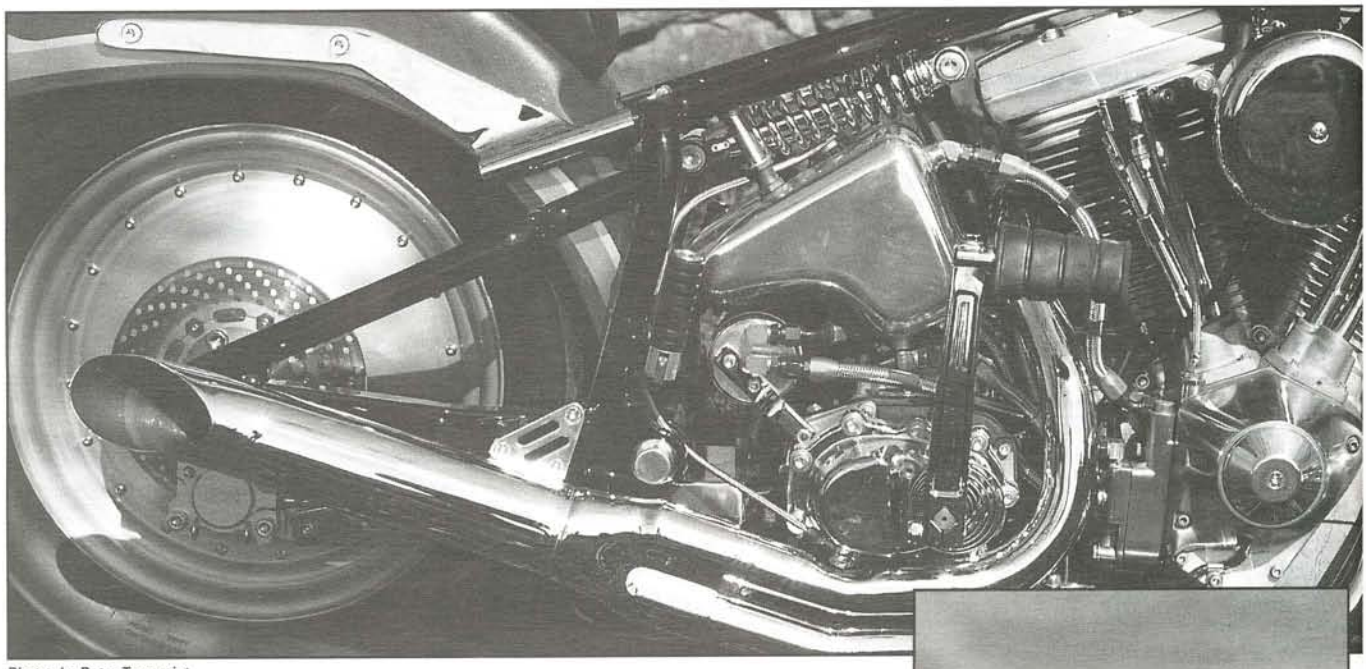
No adjustment for the rear belt—clean.



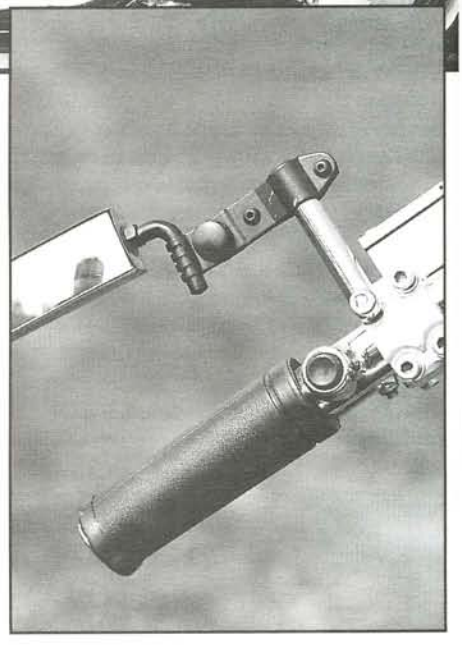
The overall design is clean, strong, and flexible. Photos by Clark Crouse

Swedish Ingenuity

A Cry From The Wilderness



Photos by Peter Tornquist



In these times of Harley factory customs, and mail-order parts by the millions, it's refreshing to see something truly built by the owner/rider. Grab your shorts and hang on for a magic carpet ride into the deep woods of southern Sweden to meet Keith Peterson and his latest project, "Softass Milechaser."

It all started when a truck ran over Keith and his Triumph eight years ago. His spine went the way of the road, but being a hardcore two-wheeled jockey, he got back on.

Rigid frames left his vocabulary, and stock bikes were never in his blood. The solution was to build something. He didn't want to copy the Softail, so, instead, he looked back in time and borrowed an interesting concept from the early Vincent motorcycle with shocks under the seat. He stretched his swingarm 3 inches and, for dampening, he used two adjustable Koni shocks. His creation, "Keith's Softasspecial," frame was built for function instead of looks, but he points out that the double shocks work better than Harley's Softail.

For the front end, Keith chose to have a 14-inch-over-stock wide glide, with a rake of 3.5 degrees in the triple-trees (that he machined himself out of quality 4212 aluminum). The lower legs and damper were rebuilt with progressive springs for less friction. The triple trees combined with the frame's 43-degree rake, give the bike an extremely stable handling characteristic.

The easiest way to put wheels on your scoot is, of course, to walk into your local bike shop and buy 'em. That's not Keith's way of doing things. He made his own tools for manufacturing aluminum disc

wheels and turned out both of these 16-x3-/2-inch wheels. They were expensive as hell, but were honestly made by the owner. He did plunk down the cash on the handmade aluminum oil bag built by L-G Olsson. Olsson builds race tanks and renovations for antiques.

The brakes were a joint venture with ISR Acke Rising, a manufacturer of brake systems for the road racing circuit. They made special calipers, discs, and master cylinders from Keith's detailed drawings.

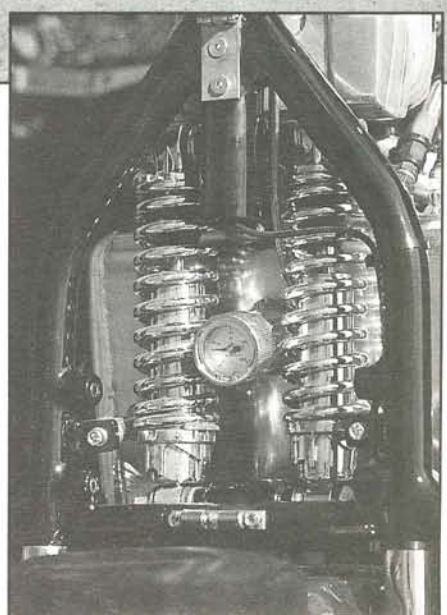
The engine mounts are made from casted steel and are stock look-alikes.

A lot of time went into hiding wire and oil lines and, as always, it's the small parts that take time (for example: the custom luggage rack is one-of-a-kind).

Phil Ross, of Super Max, is a friend of Keith's, so he got special attention for the entire belted driveline. "You really feel safe when you use double rubber," Keith used to say . . . before his ol' lady got pregnant.

Well America, take a good look. The world shrivels more every day. If you like his work, drop him a note. Keith Peterson, Slatthog 340 36, Moheda, Sweden.

—The Sheriff



Lacing 80-Spoke Wheels

How It's Done—By The Only Lady In The Land Who's Doing It

By Gene Koch

Pat Kennedy, of Kennedys Custom Harleys, in Oceanside, California, likes big-inch motors and spoke wheels, but he quickly grew tired of his Monday routine of replacing broken spokes after a weekend of hard throttle twisting. Some years ago, while vacationing in Europe, Pat saw an 80-spoke wheel and decided that's what he needed to solve his problem. Fortunately, Brook Bryant, who works with Pat at Kennedys, had years of experience with lacing wheels. Brook has been around bike shops for 12 years. She also rides—her bike was featured in our April '92 issue.

Bo Erickson, a friend of Pat's and Brook's from Sweden, machined the 80-spoke hubs for them. Then they found a rim manufacturer to dimple 80 spokes.

Kennedys has been capable of producing an all-stainless steel wheel—including stainless hub, spokes, nipples, spacers, and rims—in 14- to 21-inch diameters and 1.85- to 10-inch widths for some time now. The wheels are strong and stainless spokes are easy to maintain.

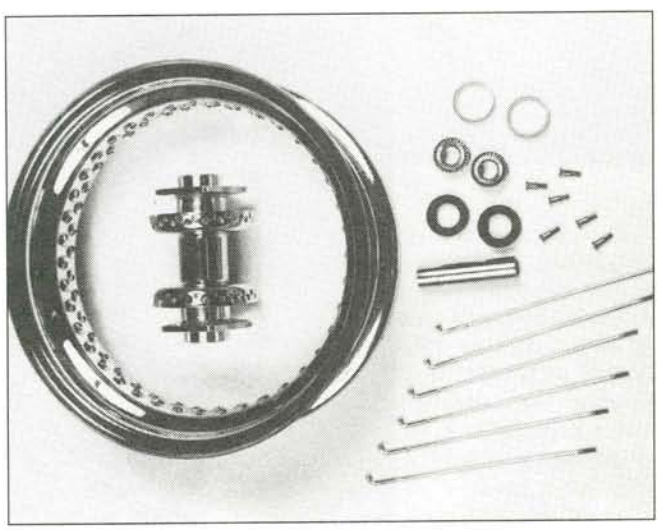
Since double the spokes means double the trouble, Brook prefers to use a Lacemaster to ease her work load. The Lacemaster is free-standing and allows her access from the top and bottom, yet she can still move the rim, getting the proper cross pattern of spokes. With an 80-spoke wheel, you're crossing eight spokes rather than four, and you'll appreciate the extra working space.

First, Brook assembles the hub with bearings, proper length sleeve, etc., slips it and the rim on the Lacemaster, and puts all 80 spokes through the hub. At this point, the rim is loose in the machine. Installing one spoke and nipple at a time, she fills in the top row, every fourth hole, with the spokes going in the same direction, until 20 spokes are in. She lubricates the threads with a light machine oil so the nipples turn easily, turning in each nipple only a couple of threads at this point, to allow movement of the rim. Next, she does the second row of 20 spokes, going in the opposite direction, then the third and fourth rows.

With an 80-spoke wheel, you're crossing eight spokes rather than four

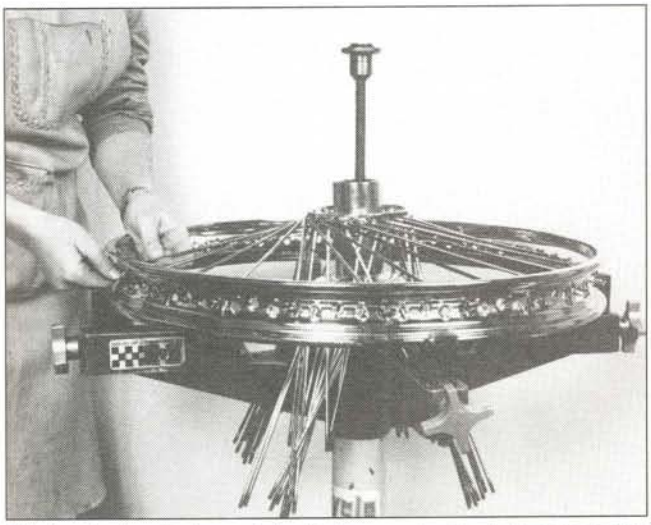
After all 80 spokes are in, she tightens the four clamps, centering the rim with the hub. Using a straightedge, she sets the height of the hub in relation to the rim. Some wheels are on-center and others are offset, depending on the application. Starting at the valve stem hole and working with a group of four spokes at a time, Brook tightens the spokes a little past snug.

The next group of four is opposite valve stem. The group after that is 90 degrees off. Then she goes across, continually alternating with groups of four until all the spokes are snug. This is not the final tightening process, but all spokes should still have the same tension on them. Brook checks this tension by lightly tapping on the spokes. They should all ring the same. With 80 spokes, the space between nipples is limited, so Brook made



80-spoke wheels available in 14- to 21-inch diameters, 1.85- to 10-inch widths. All-stainless, including rim, hub, spokes, nipples and spacers.

Hand tools needed to complete a wheel. Brook had to make her spoke wrench to work on an 80-spoke wheel.



With the wheel and hub mounted on the Lacemaster, Brook starts the lacing process. This is a lot easier than working on the floor or a bench top.

With all 80 spokes loose in the rim, Brook uses a straightedge to set the required offset of the hub to the rim.

Brook trues the wheel up and down and side to side. With 80 spokes, this takes patience.

After the wheel is trued, she sets the nipples into the rim. The wheel will probably have to be retrued after this step, but it will stay true during use.

Threads protruding through the nipple are likely to puncture an innertube so she grinds off any excess and uses Loctite to make sure the spokes stay tight.

Bo Erickson, the talented machinist behind the Kennedy hubs.

Gene Koch is a West Coast representative for Drag Specialties. You can call him at (714) 894-2335.

Photos by Clark Crouse

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her own spoke wrench.

Next, she removes the wheel from the Lacemaster, puts it in the truing stand, and sets up the dial indicator. She trues up and down first, then side to side. Brook likes to get them within .010- to .020-inch, which is closer than factory specs. When tightening spokes to correct a high spot, you may have to loosen spokes on the opposite side first, to prevent over tightening. You should end up with 100 inch-pounds of torque on each spoke. Again, she checks this by tapping each spoke to assure consistent ring.

After the wheel is trued, Brook preseats each nipple in the rim with a hammer and punch and rechecks wheel alignment. Ninety percent of the time it needs to be retrued. This may seem like extra

It takes Brook about six hours to lace a 14 - inch wheel or three hours for a 21-inch, 80-spoke wheel

work but the wheel will stay true and you won't have to go through this process again. When Brook laces a wheel, she doesn't want her customers to have any blowouts. To eliminate puncturing the tube, she uses a grinder and removes any threads protruding through the nipples. To eliminate any spokes from coming loose, she puts a drop of Loctite on each nipple/thread.

If you decide to do this yourself, you should also read the section in the shop manual on wheel lacing. Keep in mind that it takes Brook about six hours to lace a 14-inch wheel or three hours for a 21-inch, 80-spoke wheel. Also remember that she's had plenty of experience. You may just want to give her a call and let her deal with the frustration, she has the patience.

Clutch Adjustment Wrench

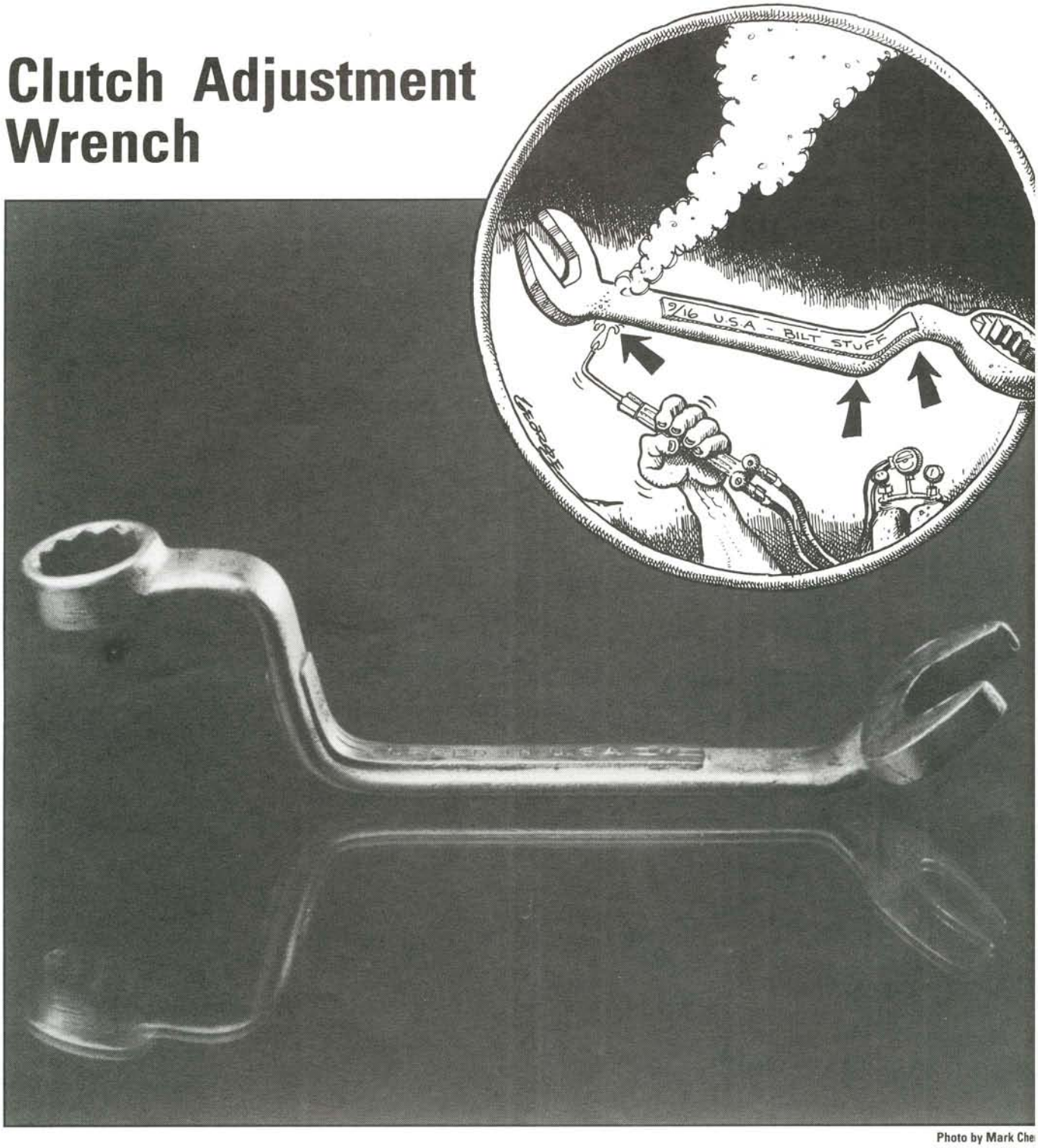

Photo by Mark Che

Ah, the kind of tech tip we're always looking for. Simple and easily handled with a wrench and a torch. If televisions could be repaired with a rosebud, I'd be an electronics wizard.

Chris Schelb of Kasilof, Arkansas, ran into a frustratin' problem many of us have been putting up with for years. That thin, 9/16-inch locknut that holds the clutch cable in adjustment, just under the oil bag, is a bastard to get at. This causes problems with adjustment, tightening, rounding off the corners on the nut, and major, nail-bitin', wrench throwin' pissed-offedness. So Chris took a standard 9/16, box/open-end wrench, heated the handle about an inch from the end of the opened-end end (how's that for a description?) and bent it to almost 45 degrees. Then he made the other end jog by heating about 2 inches in from the other end, bending it 90 degrees, letting it cool, heating it approximately 1/2 inch before the box-end, and tweaking it another 90 degrees.

Spirits willing, when you've completed the above exercise, your wrench will look like the one Chris made in this photo. Chris said he didn't torch a Snap-On tool 'cause it would blow the warranty. The same goes for Craftsman. So, if yer concerned about the guarantee on your wrench, use one that's not worth the powder to blow it to hell.

One other wrench tech. If you dislike adjusting hydraulic lifters as much as I do, anything to make it easier is a welcomed sight. Take a 7/16 -inch, open-end wrench and grind at least 1/3 of the thickness of the tongs off—much easier to work with.

—Wrench

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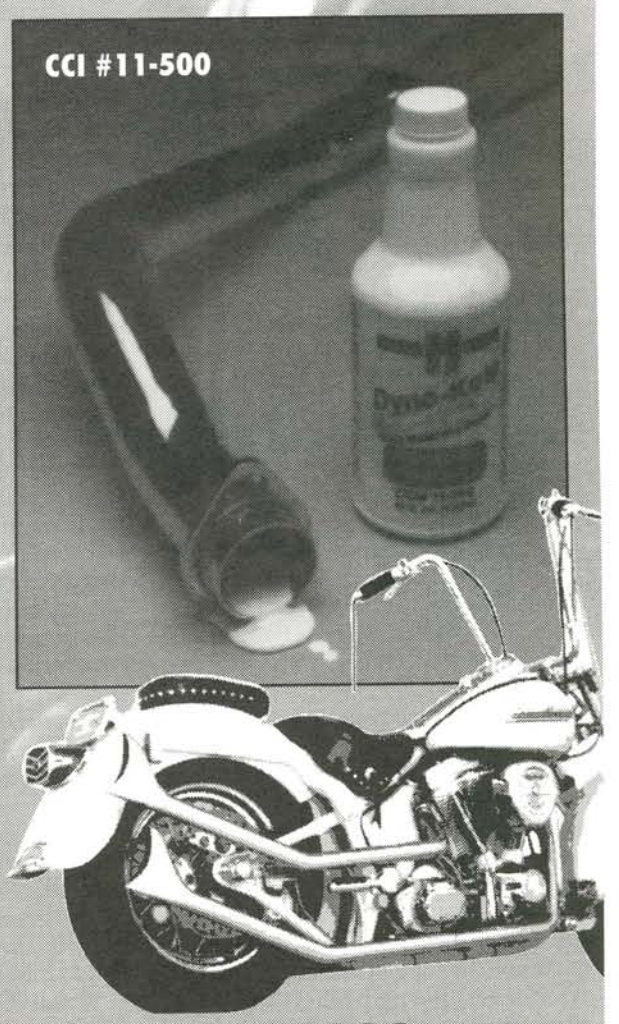

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Speaking Of Spokes

By J.D. Chandler

Spoked wheels are a traditional part of what a motorcycle should look like. However, they require more maintenance than cast wheels. Each time a spoked wheel rotates under a motorcycle, spokes and nipples are stressed and flexed. Eventually, individual spokes will begin to loosen. Loose spokes will result in crooked wheels, reduced stability, and, eventually, wheel failure. None of these things happens if you give your wheels a few minutes attention every few thousand miles.

A crooked wheel with several loose spokes may need the attention of an experienced wheel builder. Also, if you neglect your wheels until spokes begin to break, you may have to completely rebuild the wheel.

Spokes hold a rim in position so that it is centered on the hub and will rotate true. All loads (weight, bumps, acceleration and braking) are transferred through the spokes. Every rotation of a wheel loads and unloads the spokes. If the loads are too great, spokes may stretch or break. If a rim gets bent, the spokes in the area of the bend will either loosen or tighten. You shouldn't straighten a bent rim by over-tightening some spokes and loosening others. Eventually, they will break down.

Correct spoke tension is critical. Too loose, they will form cracks and break. Too tight and they break, pull through the rim, or violently deform the wheel (if it hits a bump hard enough). While there may be tension standards for spoked wheels, nearly all of us tighten spokes by feel and sound.

A spoke will ring when it is lightly tapped with a small tool, like your spoke wrench. The pitch of the sound it makes will be determined by how tight it is. A tighter spoke will make a much higher pitched sound.

If there is a significant difference in the sound after you have straightened a wheel, chances are the rim is bent. Small differences in pitch are okay but large ones mean trouble.

The length of the various spokes determines how far the rim lies from the hub. A rim that is off-center with the hub can be recentered by loosening the spokes on the top or the bottom (making them longer) and tightening them on the other (making them shorter). A wheel with an off-center rim is said to have "hop" in it.

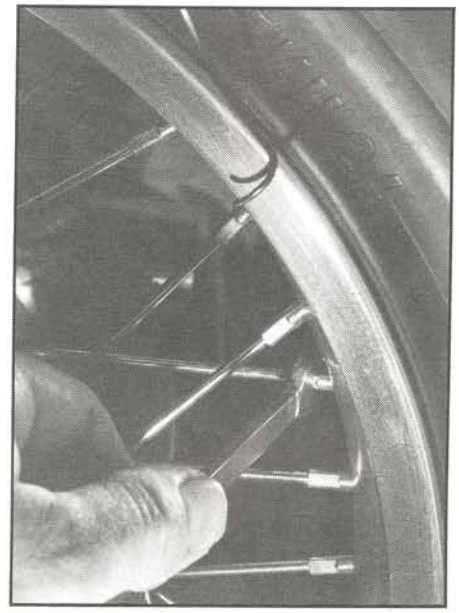


Photo by J.D. Chandler

Half of a wheel's spokes lead to the right hand (RH) side of the hub and the other half to the left hand (LH) side. If you tighten an RH spoke the rim will be pulled to the right. Tighten an LH spoke and it'll go left. A wheel that is crooked from left to right is said to have "runout"

To true a wheel you'll need to be able to tighten groups of spokes at the top and bottom to get the hop out. You'll also need to be able to tighten RH and LH spokes to straighten the rim left to right.

Unless your wheel is bent or has been let go too long, all you'll likely ever need to do is occasionally tighten a couple of spokes and check the left-right runout.

Runout is easy to deal with. Hop is more difficult for two reasons: First, a wheel that has developed noticeable hop may very well have other problems (bent rim, cracked spokes). Second, removing hop demands more skill and experience. If you want to learn to remove hop you should get yourself an old bicycle wheel to practice on first.

You'll need one special tool—a spoke nipple wrench. Harley has one that should fit whatever spoke nipple size you're using. H-D's wrench (p/n HD-94681-80, $6.80, found in the Kent-More catalog) is okay, but you can get a more precise one for $12 from Buchanan's Frame Shop (629 Garvey Ave., Monterey Park, CA, 91754, (818) 280-4003, FAX: 818-280-4106). Buchanan's wrenches are custom made and you'll need to measure the distance across the flats of your nipples so they can cut the wrench to fit precisely. Spoke nipples are generally rather soft and thin in the area of the flats. They can be easily damaged, and a good fitting wrench is essential.

The first thing you need to do is get the wheel off the ground. Second, cut and bend a piece of heavy wire (coat hanger will do) to make a pointer. Arrange the pointer so that it runs close to the rim and tape it to the swingarm or fork leg.

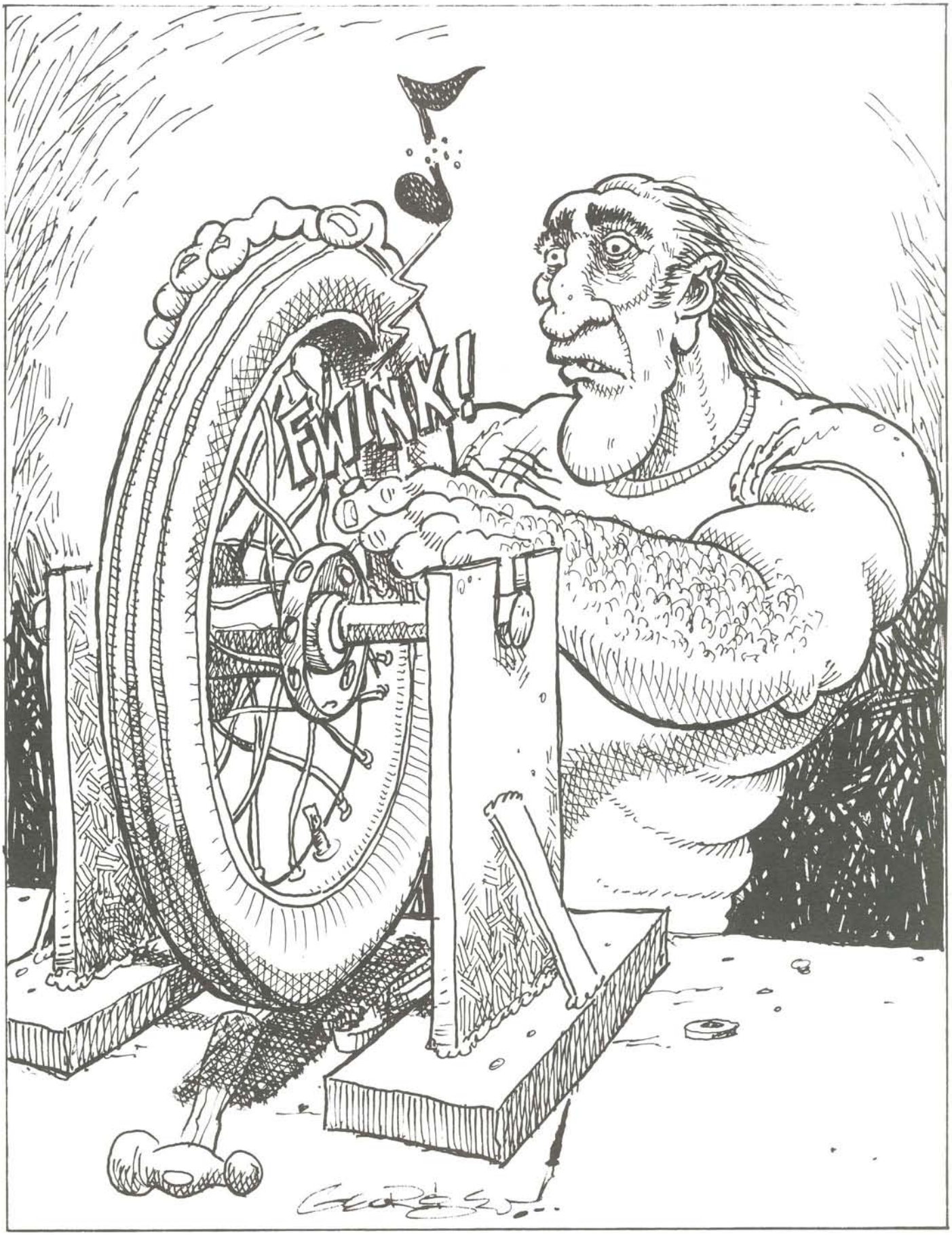
Rotate the wheel and note where the rim comes closer to the pointer and where it runs farther away. There will probably be one or two short sections of the rim that come closer, and one or two that go farther away. Most of the rim will probably run straight. I use a grease pencil to mark the areas.

Those sections that run closer to the pointer will need to be pulled away, and those that run farther away will need to be pulled toward the pointer. Before you start tightening spokes, check their tension by rapping them with the wrench. You might have to move a section of rim by *loosening* the two or three spokes on the bulging side rather than tightening those opposite the bulge. If the spokes on the side of the bulge are a bit loose or are nearly normal in tension, tighten the spokes opposite the bulge to straighten the rim.

Rather small changes in spoke tension can have a large effect on rim position. It may be that a half-turn on two to four spoke nipples will be enough to pull a rim into perfect alignment.

As you work on the spokes you should frequently check two things: spoke tension and rim runout. Every time you make a change in spoke tension, turn the wheel to see what effect the change has had on runout. If you find that several groups of nipples need a turn or more to get the wheel straight, be sure to recheck the spoke tensions. If your freshly straightened wheel's spokes are too tight, loosen all of them, say, a half-turn, and recheck the runout.

Unless you have practiced on that bicycle wheel, I recommend that you leave hop to an experienced wheel builder. If your local mechanic cannot do the job, talk an experienced bicycle mechanic into doing it. If you check spoke tightness every 5,000 miles or so you shouldn't ever have a problem with your wheels.


EWINK!

Bearing It All

By J. D. Chandler

Perhaps the single most critical, safety-related, mechanical assembly on your motorcycle is its steering head. If the steering head is loose, too tight, or the bearings are worn-out, you could get into a terminal high speed wobble—which is when the front end violently oscillates from lock to lock. Very loose bearings can cause wobbling at low speed if the bike hits a bump that happens to steer the front. It generally happens at over 75 mph and results in complete loss of control.

There are other possible causes of wobble like loose fork sliders, loose spokes, loose wheel bearings, and low tire pressure. But the most common cause is a poorly adjusted steering head bearing assembly.

Harley recommends steering bearings be lubricated and adjusted every 10,000 miles. My own experience is that you won't have to relube them that often. They should, however, have their adjustment checked every 5,000 or so.

I do two simple tests. Both require you to raise the front wheel off the ground, making sure that it is free to swing from side to side.

Squat down facing the front wheel. Grab the lower fork legs and try to move the whole front end fore and aft. If the bearings are loose, you'll hear a rattle or clicking as they move in their races. If there 's no looseness, you're cool.

With the front wheel facing straight ahead and elevated several inches higher than the rear wheel, slowly push the wheel to one side. After it's moved about 2 inches, it should start to fall to the side. If is starts to fall off after the first inch, the bearings are too loose. If the wheel sticks at 3 inches, it's too tight and the bearings need to be loosened. When you adjust steering bearings, be sure that you recheck them after you've tightened the nut holding the top triple clamp and/or the fork tube caps.

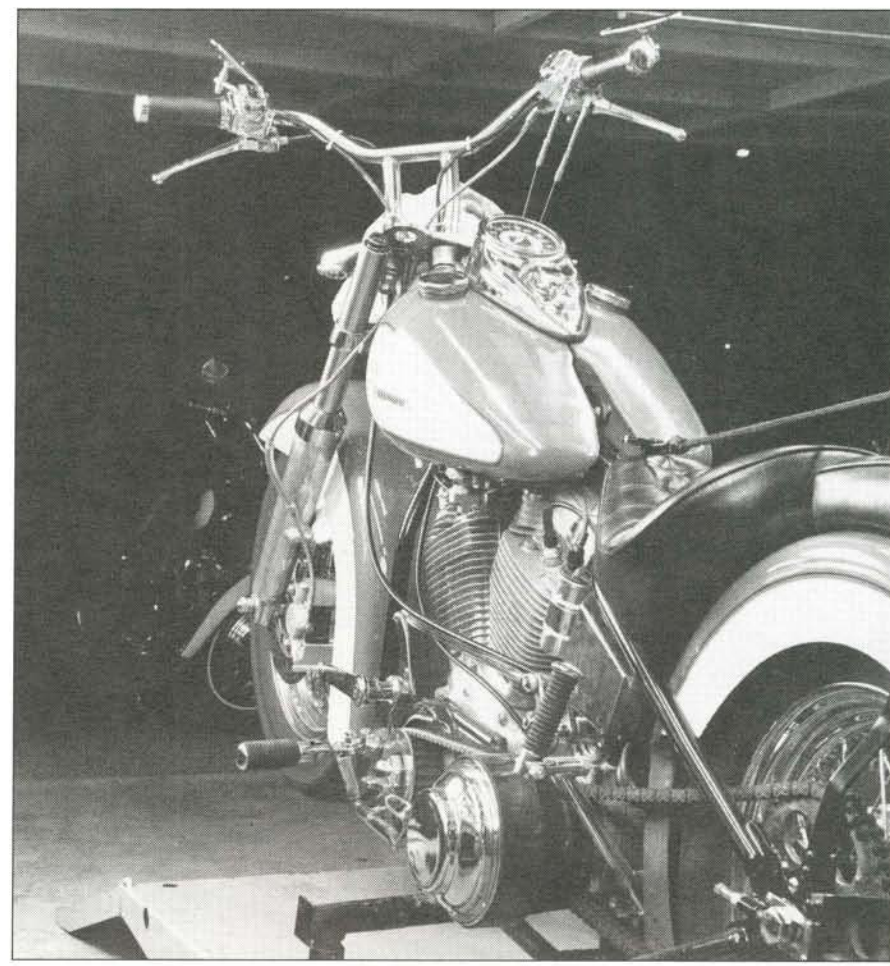
If you notice the bearings seem to have both tight and loose spots (as you turn the wheel from side to side), then, most likely, they're dented or worn-out and need to be replaced.

You don't need (and shouldn't use) heavy wheel bearing grease in your steering head bearings. Light chassis grease is best. Heavy, long fiber grease will just get pushed away from the bearings and they'll end-up running dry. The grease needs to be light and nearly liquid so that it will pull in behind the rollers as they turn. The right grease will stay in the bearings for a long time and will let you run longer before you have to take your front end apart to relube it.

Perhaps the single most critical, safety-related, mechanical assembly on your motorcycle is its steering head

It's easy to forget about steering bearings. After all, they mostly just sit there and turn a bit from time to time. They aren't as obvious as a spinning wheel bearing or drive chain. But, if you ignore them long enough, they can jump up and bite you. Hard.

Another set of bearings that often get ignored are the fork sliders. Every little bump or crack in the road moves the front wheel and sliders up along the fork tubes. The quality of the oil between those parts will determine how much



they wear and how smooth the ride is.

Sliders do wear, that's a fact of life. The worn particles stay in the fork oil, get between the moving parts, and increase the wear rate. It is a good idea to drain and replace that oil about every 10,000 miles, just to keep it fairly clean.

Fork oil serves another purpose besides lubrication. It's also the working fluid for the damper valve built into the fork slider assemblies. A light oil will reduce the amount of damping, heavier oil will increase it. Oil that's too heavy will give a harsh ride on bumpy roads. Oil that's too light will make the front end feel uncertain and loose. Most pre-Evo forks work well with 10- to 30-weight oil. Evolution forks work better with 5- to 20-weight. If you find your fork gives a better ride with heavier oil than these, chances are it's worn-out and needs an overhaul.

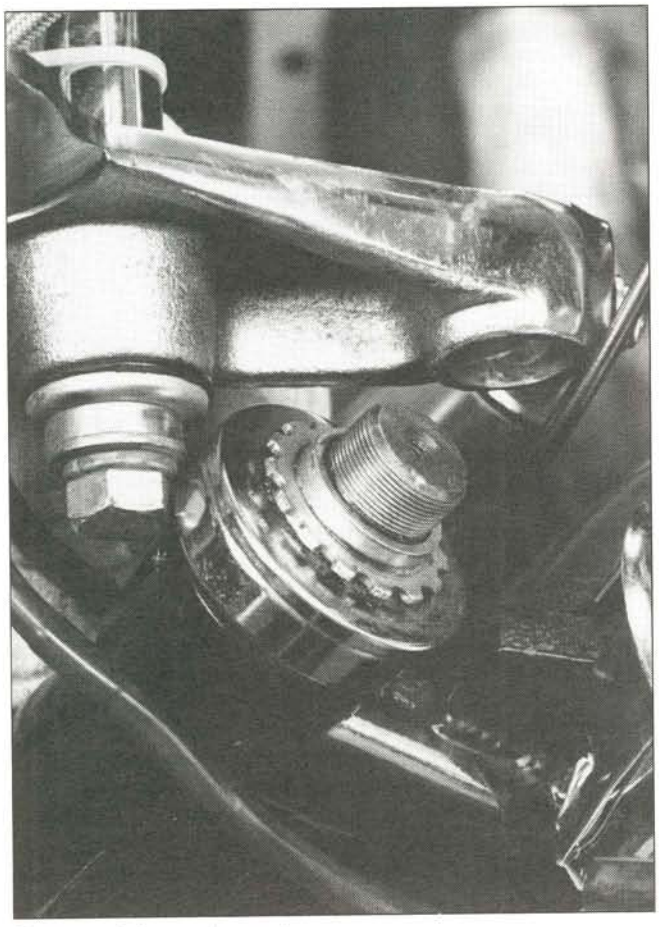
The type of oil you use in your fork isn't too critical. It can be a commercial fork oil or engine oil. However, there is one brand of fork oil that does have an advantage. Kal Gard's "Smooth Stroke" fork oils (5W through 30W) have Moly (molybdenum disulphide) in them and will reduce friction and wear between the sliders and tubes.

Fork oil volume is as important as weight. Too much oil will limit the fork's travel and can give a harsh ride. Too little, and the damping won't work properly and there may be accelerated wear. Consult your manual to find out how much yours takes. There are simply too many variations in required oil volumes for us to cover them all here.

Occasionally, forks develop oil leaks. There are two sources: the seals mounted in the sliders and the washers or O-rings at the top of the fork tubes. Seals sometimes simply wear out but, more often, they leak because they've been cut by something. Either a bit of dirt or a nick on the fork tube will cut the seal lip. If your seals start to leak, you should take a close look at the tubes when you replace 'em. Small nicks in the tubes can be stoned out (or wrap 400 grit wet and dry around a hard, flat block of wood). If you don't do this, the new seal will soon start to leak. Also, keeping fork tubes wiped down will help to keep grit away from the seals.

Most late Harley forks have O-rings on the top fork bolt. They'll still sometimes leak. The smaller bolt that clamps the fork bolt to the top triple clamp, on the other hand, has no O-ring and is probably the most common source of fork leaks. Bandit has found an excellent way to seal this bolt. He uses a rubber or plastic washer from an ordinary garden hose under the top bolt. These washers fit just fine in the top triple clamp and have the right thickness to do the job. Besides, you can get all you want for less than a buck at any hardware store.

Photos by J.D. Chandler



Common garden hose washers work perfectly to seal top-fork caps.

This is the special nut to adjust the neck bearings. Check adjustment again after the entire front end is assembled.

A First—Proportioning Brakes On a Harley

By Joe Minton

Motorcycles and bicycles are the only vehicles on the road today that still have separate front and rear brakes. There is no special advantage to separate brakes. In fact, there's a bunch of reasons why motorcycles might be better off with connected (integrated) brake systems. So we tried it. First is safety: Good testing has shown that a motorcycle with a carefully designed integrated brake setup will make an emergency stop in a shorter distance than the same bike with separate binders, even when the rider is very skillful. Second is also safety: A rider with only one braking foot or hand simply cannot stop a normal motorcycle as fast. A third reason for looking into integrated brakes is styling. How would you like to build a scooter with no levers on the handlebar? No master cylinder lump that still looks like a lump even if it is chromed.

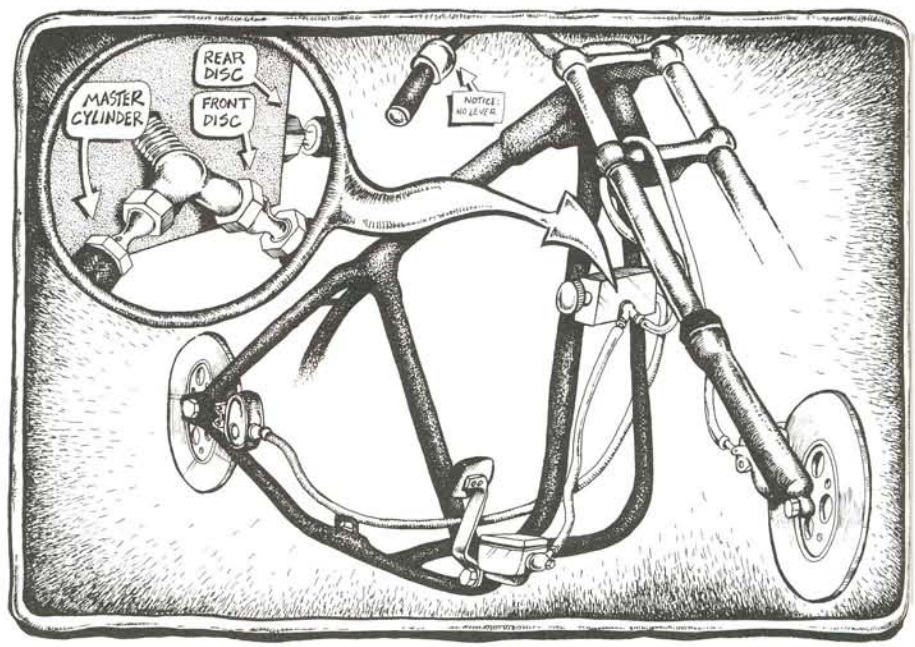


Illustration by Jon Towle

About 10 years ago, a couple of motorcycle enthusiasts and engineers, John Zellner and Michael White, did a study titled, *Advanced Motorcycle Brake Systems*. It was a nice piece of work and you can get a copy of the published report by contacting the National Technical Information Service, Springfield, VA 22161. What they discovered was that a bike fitted with integrated brakes would stop faster than one without them—a lot faster. They also found that rider skill didn't have much to do with it.

An integrated brake system can take the disability out of stopping a motorcycle

There is more to integrating brakes than connecting both front and rear calipers to the same master cylinder. The braking power at the front and rear wheels varies. A passenger adds more weight and traction to the rear tire which, in turn, means that the rear brake can be used harder without skidding. The faster a bike and its rider are stopping, the more load gets transferred to the front wheel and the less the rear wheel carries. This weight transfer, while braking, can become so great all the braking power can shift to the front tire and the rear wheel can actually be lifted off the ground.

Weight transfer is the reason why the rear tire will sometimes skid when a rider has to stop fast. He is used to pulling on the front lever and pushing on the rear brake pedal a certain amount to get a routine stop. When an emergency arises and he needs to stop twice as fast as normal, he will naturally pull and push about twice as hard on both lever and pedal. Weight transfer will add traction to the front tire and take it away from the rear. The result can be a rear tire skid with possible loss of control. In other words, a hydraulic proportioning valve is the key to this setup.

A hydraulic proportioning valve will let the pressure in the system go up evenly until a predetermined pressure is reached. It will then limit how much pressure goes downstream from the valve in relation to the full line pressure. The Brembo valve (from a Guzzi police model) I use on my FLST's integrated brake system lets the pressure in the braking system go up evenly until it reaches about 400 pounds per square inch (psi). Then, the valve kicks in and limits any increase in line pressure to the rear caliper to about 50 percent of the gain in the rest of the system. For instance, if I press the pedal hard enough to generate 1,000 psi in the system (a good hard stop), the front caliper will get the full 1,000 psi but the rear will only see 700 (400 plus half of 600). That valve works very well on my bike since it's never ridden two-up. It wouldn't do as well on a bike that carries a passenger.

The adjustable proportioning valve, from Performance Machine, we installed on Bill Latuf's Softail (see photo) allows Bill to adjust his braking setup for solo or two-up riding. The further in he turns the adjuster knob, the higher the line pressure gets before the valve begins to work. Most serious race cars have such a valve mounted to the firewall so the driver can adjust what the car boys call braking bias. A fully-fueled car generally has more weight over the rear wheels. The resulting extra traction means that the front tires would skid first, something that simply must not happen. A front-first skid is even more dangerous on a motorcycle and that is why an adjustable proportioning valve is important for a motorcycle that will be ridden both solo and with a passenger.

When Latuf wants to carry his wife, he

cranks in another half-turn on the valve and he's all set. If he were to leave the valve on the higher setting when he rides solo, the front tire might skid first during an emergency stop and he could lose control.

It's possible to link the valve to the rear suspension so that braking bias is automatically adjusted for weight. This was done by White and Zellner in their study and it worked very well. Some pickup trucks now have these variable proportioned brake systems. However, such a system would take a lot of time to develop and doesn't seem to be needed on most Harleys due to their long wheelbases and the fact that they carry most of their weight low in the frame.

Bill Latuf had a truck turn left in front of his FXST a few years back. The accident left the bike wrecked and Bill's spinal cord damaged so that he has no feeling below his knees. He can use his legs and feet but must look at his feet to know where they are. He can use a regular rear brake but must take the time to look down to see that his foot is on the brake. He also can't sense how hard he's pushing on the brake.

For a year and a half Bill Latuf rode his beautifully restored Softail with only the front brake to stop with. When Bandit met Bill at an *Easyriders* Rodeo, and saw his problem, he told him about the testing I had done. We got together and converted Bill's FXST. The results were spectacular. Now, not only does Bill have use of both brakes, but they work better than they ever did. These days, Bill's able to out-brake most folks who have full use of their limbs. If he'd lost the use of his right hand, we could've hooked the brakes to the brake pedal. An integrated brake system can take the disability right out of stopping a motorcycle.

Both Bill and I fitted a second caliper to the rear disc as a backup. If, for some reason, he lost pressure in the main system, he would still be able to stop. Also, the second brake allows us to do other things with our hands and feet. If I get off-balance to the right, while stopped on a hill, I can hold the bike with the hand lever and put my foot down. Bill has the option of holding his Softail with his foot while freeing his right hand.

At this time, there is no simple conversion kit for any particular Harley. But the essential parts are available from Performance Machine. They carry the Wilwood proportioning valve and, of course, have an extensive line of first-class calipers and brake rotors.

It's simple to install a proportioned brake system. First, you need to find a place to mount the valve. Bill mounted his on the front down tubes of the frame. My smaller, nonadjustable valve's mounted behind the tranny, where the factory pressure switch and junction blockwere. Then it's just a matter of running brake lines from the master cylinder to the front caliper, the valve, and from there to the rear caliper.

Because of the length of the brake line in an integrated system,you must take care to make all the brake parts as rigid as possible. The brake line should be the stiff "-3" teflon line that's covered with braided stainless steel. This is the line used to make Russell brake line sets. Performance Machine can furnish this tubing along with the necessary fittings.

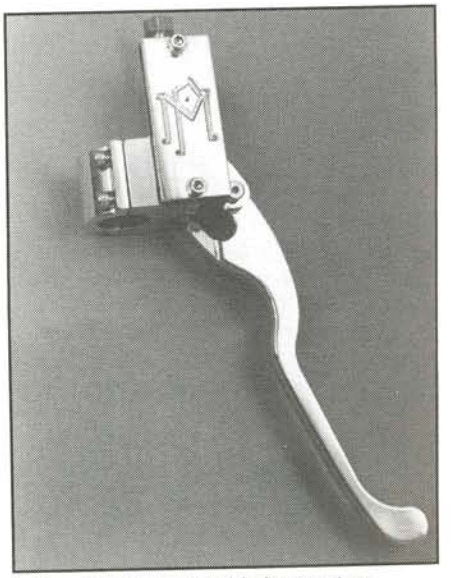
You must use DOT 3 (or 4) brake fluid instead of Harley's normal DOT 5 silicone fluid. The DOT 5 fluid is compressible and will hold air in solution. The combination of its compressibility and the air will make the system too mushy to work. Both Bill's and mybike have DOT 3 in them and we've had no trouble. Harley's master cylinders work with the DOT3/4 fluids.

While DOT 5 fluid has a higher boiling point than DOT 3/4, temperature hasn't been a problem. Race bikes use DOT 4 and they really get things hot. There're some high boiling point DOT 4 fluids available but, in my opinion, they aren't needed. DOT 3/4 fluid will attack paint, though, and you won't be able let it slosh around like you can the DOT 5.

While you can bleed your new integrated system the usualway, by pumping the air out with the master cylinder, a power bleeder makes it easier to get all the air out of the lines. Most auto repair shops carry them.

If you're willing to give up the backup brake, you can eliminate either the brake pedal or hand lever. One of us herehas an idea for a custom scooter with no levers on the handlebar. An integrated brake will allow him to do this and still have a very powerful set of stoppers.

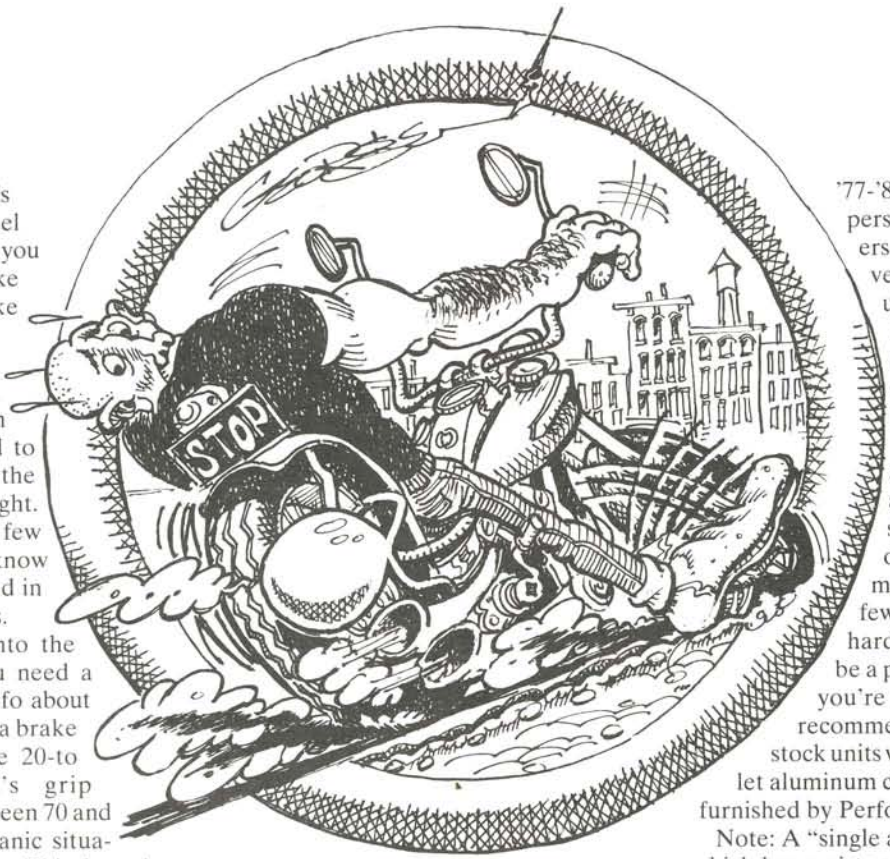
1. This Wilwood Engineering adjustable proportioning valve is the secret to a good integrated brake system. Distributed by Performance Machine, the valve allows the rider to set the front/rear brake line pressure to suit his bike's load.



2. When you convert your stock brake system to an integrated one, you will need to fit a larger diameter master cylinder, one that, like this Performance Machine 7/8" bore example, was designed to operate two calipers instead of a single standard caliper.

A Prescription For Anemic Brakes

Tech by Thompson



Does your bike's front brake feel pitiful? When you grab a handful of brake lever, do you feel like you're squeezing rotten fruit?

So, you claim you've spent enough cash on brake fluid to buy a new cage, but the braking still isn't right. Well, there are a few things you need to know which you won't find in any service manuals.

Before we get into the nuts and bolts, you need a little background info about the forces at play in a brake system. An average 20-to 40-year-old man's grip strength varies between 70 and 110 pounds. In a panic situation, this can double. This force is transmitted to the hydraulic system through a lever which has a mechanical advantage of between 5 and 7 to 1. This force is applied to a very small piston in the handlebar master cylinder (it varies between 5/8-inch to 3/4-inch in almost all H-D systems). This adds up to an internal hydraulic pressure of between 500 pounds per square inch (in a normal stop) to as much as 1500 pounds per square inch (in an emergency). These pressures can be even higher on rear brake systems where you can exert much more force with your leg, or on high-performance brake systems with small diameter master cylinder bores.

These high pressures cause some weird things to happen. One of these is neoprene "hose swell"—when the internal pressure in the system exceeds the strength of the hose. When you squeeze the lever, the hoses actually "balloon" outward and then relax when pressure is released.

This is why the lever always feels "spongy" no matter how much you bleed the system. The problem is that the hoses are not rigid enough to contain the hydraulic pressure properly.

You can't see this happen. The condition worsens as the hoses age—their exposure to heat from the brake fluid softens them and causes them to deteriorate rather quickly. (Normal fluid operating temperature is 300°-325° F).

Replacing your neoprene hoses with new OEM or equivalent items will help, but only for a while. The only permanent cure is to replace the neoprene hoses with high-quality braided stainless steel hoses. These hoses are Teflon™-lined and resist fluid temps up to 550° F. Their burst strength exceeds 5,000 psi. They won't swell. My choice for hoses are those made by Russell Performance Products.

The outer surface of a braided stainless hose is more abrasive than neoprene: When routing the hoses, be careful that they don't rub on other parts.

The other problem caused by these high hydraulic pressures is caliper distortion. Calipers will actually distort and "spring" open when subjected to high braking pressures. Most OEM "single acting" calipers suffer from this. The '77-'83 dual disc front calipers are the worst offenders. Sometimes it's severe enough to allow unwanted piston advancement in the calipers and will cause a dragging front brake.

I've never been able to come up with a practical, inexpensive way to cure this one. It doesn't matter much, though, because few people work a brake hard enough for this to be a problem. If you think you're one of the few, I'd recommend you replace the stock units with high-quality, billet aluminum calipers such as those furnished by Performance Machine.

Note: A "single acting" caliper is one which has a piston on only one side. It must slide on its mounting fixtures for the brake pad on the opposite side to contact the rotor.

Excessive lever travel is caused by too much clearance between the brake's components (pistons/pads are too far away from rotor). This is caused by excessive "knock back" or piston retraction.

The factors which control "knock-back" are rotor lateral (sideways) runout and wheel bearing end play. Piston retraction is controlled by piston/seal/seal groove design.

Let's look at piston "knockback" first—you're going to need a dial indicator for this one. It should read in 1000ths of an inch and have the ability to be clamped on different components while being used. Photo 1 shows an indicator set up to check rotor runout.

As the wheel revolves, any lateral runout in the brake rotor is transmitted to the brake pad and in turn, the caliper's piston. Each time the high spot on the rotor comes around, it "knocks" the caliper's piston back into its bore. This creates excessive clearance between the

Photos by Hal Geyer

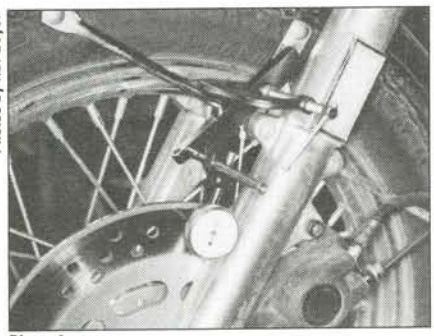


Photo 1

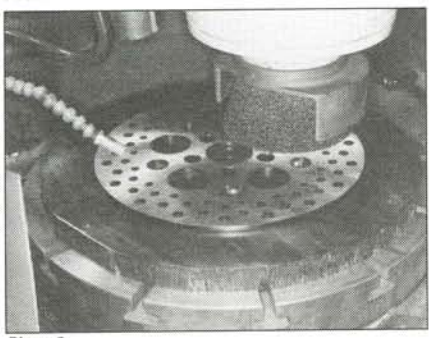


Photo 2

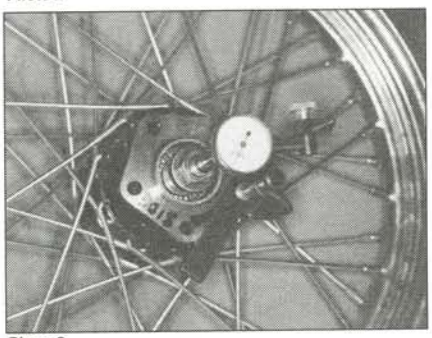


Photo 3

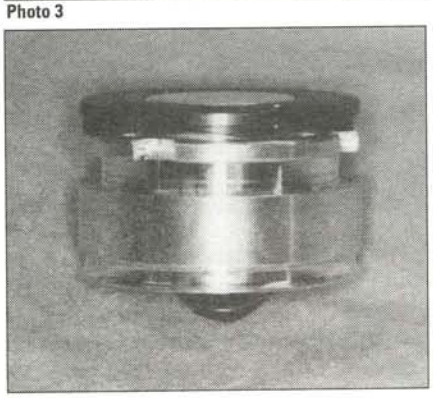


Photo 4

parts. The small quantity of fluid displaced by the master cylinder is not sufficient to overcome this extra clearance, thus the lever must travel further to displace more fluid and take up the clearance. Maximum rotor runout should be .004-inch. If you have more, it should be corrected. Have your rotor resurfaced by a reputable machine shop. Photo 2 shows a rotor being resurfaced at Thompson's Cylinder Head Service.

Note: H-D rotors are thin and can only be ground to the minimum thickness specification stamped on the rotor.

Excessive wheel bearing end play contributes to piston "knockback" by allowing the wheel to float from side to side as left-to-right cornering loads are applied; naturally the rotor moves with it and pushes the calipers piston back into its bore.

H-D allows .004-inch to .018-inch end play with the axle nut tightened to 60-65 ft. lbs. Measure this carefully and adjust to as close to the minimum .004-inch as you can get. Do not go under .004-inch. Note: Wheel bearing seizure is a possibility if you completely eliminate end play. Take your time and make careful measurements and adjustments. There are three different length spacers available for each H-D wheel. If one of these doesn't give you exactly what you want, anyone with a lathe can shorten your spacer. Later models use shims to allow more accurate adjustments. There are universal shims available which will work on almost all models.

You can reduce the time required to adjust end play be doing it off the bike (see photo 3). Use your axle and axle nut with some appropriate spacers to allow you to torque the nut and clamp the bearings and spacers together.

Piston retraction is not something you can change much. You must, however, verify that the components in your system are working properly and are the correct ones for your application. '72-'80 H-D "Banana" calipers are a good example of incorrect parts causing problems: These calipers were used in both front and rear positions on Sportster, FL and FX models. They look and mount the same, but they have different pistons, seals, and sometimes retraction devices mounted on the pistons. When used in the wrong position they can cause either dragging brakes or excessive lever travel. If your caliper uses a plain piston and square seal ring you're all set. This is the late 1980-style caliper. If you have the earlier-style caliper, which has a piston retraction device on it (photo 4), make sure the piston you're using is stamped "016F" on the outer surface. This can be seen without removing the piston from its bore or disturbing the dust boot. If your piston isn't stamped, you need to purchase H-D part #44109-72B. This piston retracts .016-inch to .018-inch instead of the .020-inch to .031-inch retraction of the older piston. Of course, there's a fly in the ointment. This piston has been obsoleted by H-D and superceded by #44006-80A, which is a complete caliper assembly costing over $175. If you can't find this piston, send me your old one and I will alter it to provide the new retraction amount.

Any caliper found to be dirty or have a sticking piston should be overhauled. Damaged mounting components should be replaced. While it's apart, check for damaged threads at the inlet fitting and make sure the bleeder screw is not frozen.

Brake parts are not a good place to save money. Use high-quality parts, DOT 5 fluid where appropriate and road test carefully after repairs.

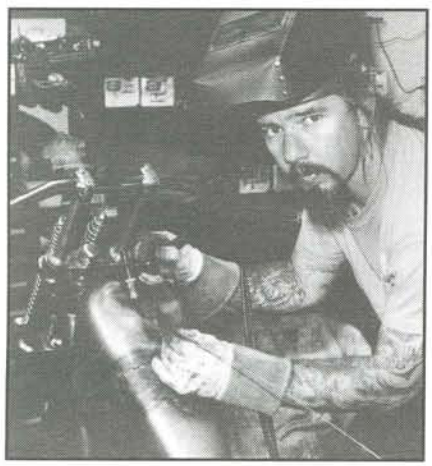
If your braking system was repaired properly to begin with, utilizing these simple tips should give you a good, solid brake you can really rely on.

This article was furnished by Jim Thompson of Thompson's Cylinder Head Service Co. Jim's been helping Harley riders and shop owners solve their problems for years. If you have problems obtaining any of the parts or services mentioned in this article, call him at (617) 326-8380, FAX: (617) 320-9351 or mail/ship to 186 River St., Dedham, MA 02026.

A LESSON IN SHEET METAL

Pat Kennedy: Talented Fabricator

Just as the right dress really sets off a fine woman's body, the sheet metal "clothes" on a custom bike bring the parts into an eye-catching whole—provided you do the sheet metal right.

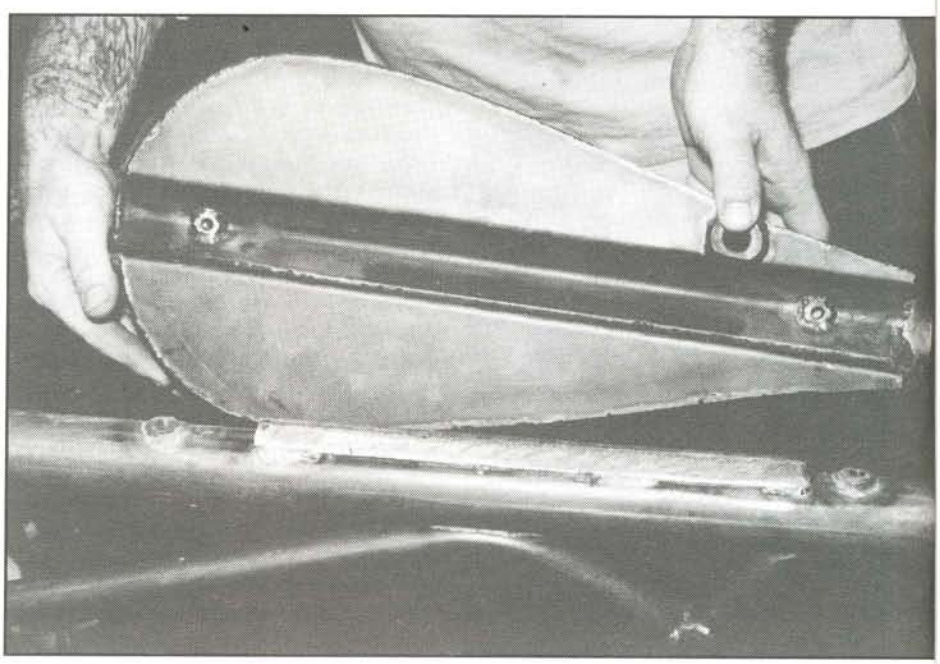


Pat Kennedy, of Kennedy Custom Cycles (800-331-9903), does it right. For example, Bandit wants a narrow look for his tank, so Pat started with a Sportster tank from Drag Specialties. The object: to take 2-1/2 inches out of the width, and lengthen it by 5 inches.

Pat first scribed a line right down the middle, front to rear, then scribed parallel lines to the right and left of center and exactly 1-1/4 inches away. Cutting the tank along the parallels gave him two matching halves. Since he had his own ideas about mounting the tank, and since his ideas called for a new treatment underneath, he cut the bottoms out of the halves, too.

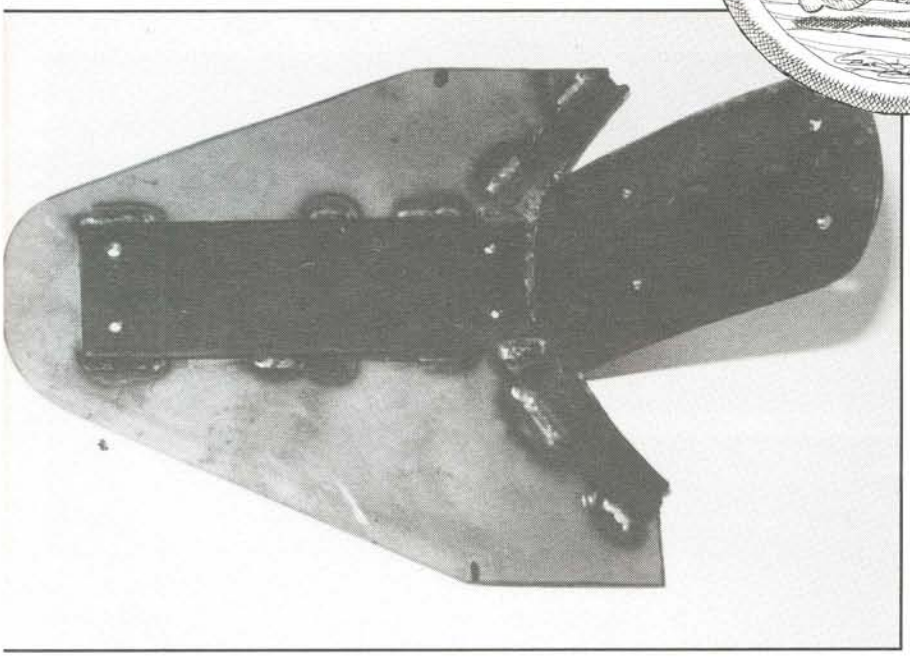
The width established, Pat welded the two halves together. Now for the length. Pat wanted to add 5 inches. Picking a place a few inches from the front, he cut the tank in two again, this time from side-to-side. Now, he had to shape a band of sheet metal to match up with the curves of the front and rear pieces.

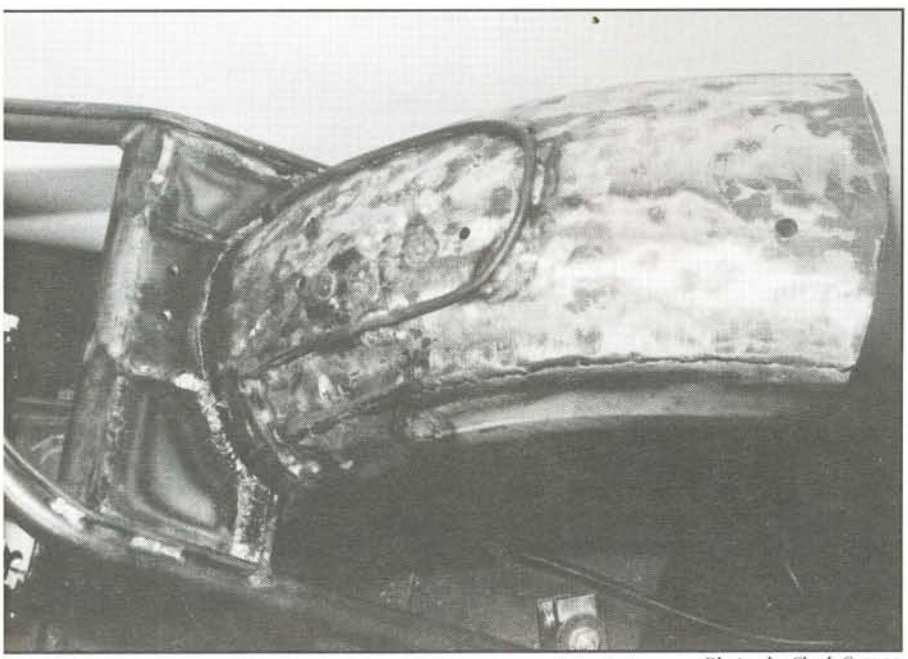
With the shape established, Pat set the tank on the frame—and reckoned the tank needed some extension at the rear so it would flow into the lines of the frame. To find the right amount, he cut a piece of cardboard, bent it into shape, and taped it to the rear of the tank. He didn't like the first one, so he made another. After several trials, he found the shape that fit, and the final piece became the template for the sheet metal to fill out the end of the tank.



The endpiece was a masterwork. With the metal cushioned against a sandbag, Pat spent hours tapping and nudging the metal into shape, then welded the end on the tank.

With the rear of the tank shaped up, Pat started on the bottom. First, he





Photos by Clark Crouse

welded a 1 x 1 angle, 12 inches long, from front to rear, to serve as a mount. Then he filled in the open spaces on each of the angles with sheet metal. Bottom in place, Pat picked a place for the petcock, cut a hole, and welded in a petcock mount.

Pat welded a second piece of 1 x 1 angle on the frame to match up with the angle on the bottom of the tank. Next, he drilled mounting holes through this frame angle and on through the frame, then welded spacing sleeves into the holes. The sleeves give the mounting bolts something to tighten against without crushing the frame tube. To refine the job, Pat countersunk the sleeves on the bottom so the bolt heads won't be visible.

Pat set the tank in place and located the mounts. At each location, he welded a nut on the angle on the bottom of the tank. With the bolts through the frame tight against the sleeves, the tank can't move. Tabs on the tank and frame would have been easier, but would have let the tank vibrate or get bent out of line.

Bandit's design calls for a super-wide rear tire on an 18-inch rim, and that calls for a super-wide rear fender. Pat started with a flat piece of the right length and pounded the inside until it took on the curve of the tire. Next, he had to form in a crossways curve to follow the tread of the tire. This is the tricky part. The radius has to be uniform all along the length of the fender. At the same time, the radius has to be formed evenly on both sides or the fender will twist like a corkscrew. This requires several patient passes—one screw-up means backtracking or starting over. Not a job for beginners.

To finish the fender off, Pat cut the side beads off an FX front fender and welded them on the new rear fender. Here again, a lot of careful work was needed to make the cut fit and to avoid distortion from the welding.

Now that he had a nice rear fender, Pat had to find the best way to attach it to the custom frame. He decided to use the seat pan as a support, which was okay since he had to make a seat pan anyway. He cut cardboard for a pattern, cut 1/8-inch flat steel from the pattern, and hammered the steel into a shape to match Bandit's butt. That done, he drilled eight holes in the pan. Four of these he transferred to the fender and the other four to the frame. The net result mounts the seat, secures the rear fender, hides the attachments, and fits the style of the bike. Time now for molding and painting the sheet metal — but that's the next chapter.

—Gene Koch

MAKE IT BLACK

Custom Upholstery By Bob Le Pera

When it came time to throw a saddle together for Bandit's project putt, he went straight to the king. Bob Le Pera's been shaping, stretching, cutting, tucking, pop riveting, and designing custom upholstery for over 30 years. His family-run business, Le Pera Enterprises, Inc., not only handles custom work but also manufactures Harley seats distributed worldwide through Custom Chrome, Drag Specialties, Chrome Specialties, Nempco, Mid-West, Mid-USA, Jammer, Zodiac in Europe, Cassons in Australia, and Moto Van in Canada. And although Bob's reputation has earned him a whole slew of celeb clientele, from Hulk Hogan and Tom Cruise to Mickey Rourke and Bruce Springsteen, the project he's been chompin' the bit for is the one he finally sunk his teeth into—Bandit's bike.

When Kennedys Custom Harley-Davidsons (Pat Kennedy designed and built the seat base) sent the seat base plate to Bob, he asked Bandit what he was after. Thinking he was gonna get an hour-and-a-half lecture about this incredible wonder scoot and all the intricate needs for some revolutionary seat design, Bob was caught flat-footed when Bandit simply said, "Black." Bob responded, "Okie-dokie." 'Course, it's only fair to mention that Bandit had already sent Bob an artist's rendering of his scoot, including the seat. The problem was that the angles of the frame to fender on the actual bike were too tight to accomodate the seat design in the drawing. The other problem was the fact that the bike's frame had been offset to accomodate a belt drive, which meant that the seat base plate ended up 1-1/2 inches half wider on one side. So, as Bob had done many times before when confronted with this type of dilemma, he consulted his company's design department whiz kid, who also happens to be his son—Bob Jr.

Bob told his kid they needed to come up with something "low and zoomy," but with enough lift to fill the fender-to-frame angle, and at the same time something capable of absorbing (hiding) 1-1/2-inch width variance. Bob Jr. knew that the top of the seat would have to end up perfectly centered on the bike, so he'd have to target the bottom portion to compensate for the offset. After disappearing into a pile of foam with a carving knife, Junior returned, tossing around a foam configuration with the aerodynamic fins, curves, and recesses of an advanced fighter jet. Bob looked at his kid's creation, scratched his head, and mumbled to himself, "How in the Hell did he do that?" With prototype in hand, it was time to call out the rag's writer and photog to cover the actual assembly.

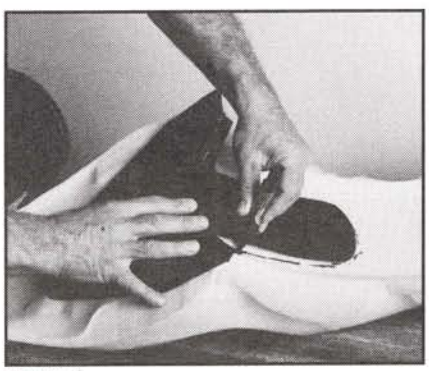


Figure 1

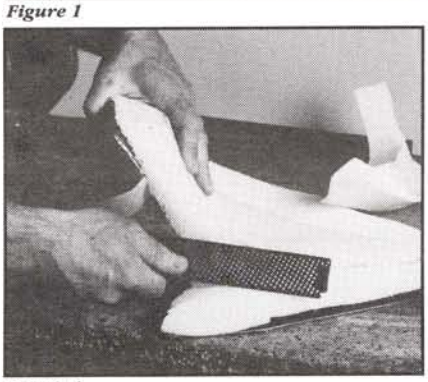


Figure 3

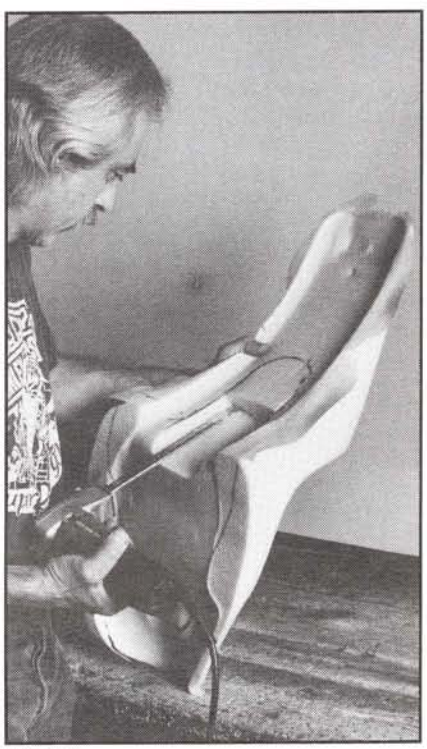


Figure 2

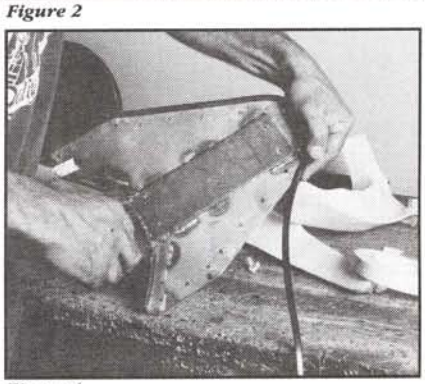


Figure 4

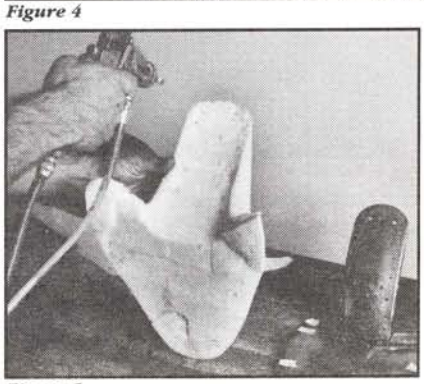


Figure 5

The process began with a hot cup of Joe served by a drop-dead gorgeous young receptionist. The seat building procedure was off to a good start. Bob and his son began with a rough premolded foam pad for a full-sized FXST with a similar (tight) fender to frame angle (1). They marked the dimensions on the polyurethane pad and used a foam cutter to trim it down to fit the custom base plate (2). Bob took a file to

it to insure a smooth surface for the next phase (3). He also put a vinyl edging around the sharp metal base plate to prevent it from cutting the eventual cover (4). Then Bob took a glue gun to the top of the base plate and the bottom of the pad and sealed them together (5). He glued a 1/4-inch poly foam to the pad for additional comfort, then cut away the excess (6).

Referring back to their prototype's sleek floating design, Bob decided to accentuate the sleekness by running a basket weave along the top of the seat, giving the smoother material the appearance of melting into the fender and frame. The basket weave portion will also be perfectly centered with the bike, which will help further resolve the offset problem. (But, right about now, the writer has to take care of his problem in the john and hit on that good-looking secretary just one more time.) Not making any real headway with the knockout "coffee server," there wasn't much else to do but see if Bob and the photog were set up for the next phase. Almost. Damn—couldn't even get her name. Shoulda brushed my teeth.

After pinning the basket weave over the pad (7), Bob marked it according to his design (8). The smoother material was then lined up and marked according to the pattern. Bob sewed the basket weave center piece to the outer smooth material, mindful not to include one of his fingers (9). He pulled the finished cover tight over the seat and pop-riveted it to the bottom of the base plate—after drilling the necessary holes (10). When he pulled the material tight around the "fins," he double and triple checked to make sure there were no wrinkles before his final rivets (11). To protect the paint, he glued a felt pad to the seat bottom.

Bob Jr. walked over to scope out the finished product from his original foam prototype. "Bitchin', Dad," Junior said. Now let's just hope Bandit agrees. And if he doesn't, next time we'll just write about the bombshell babe who serves the hot java. Ooops—just found out she's Bob's daughter. Hey, chill, bro!

—Clay Dog

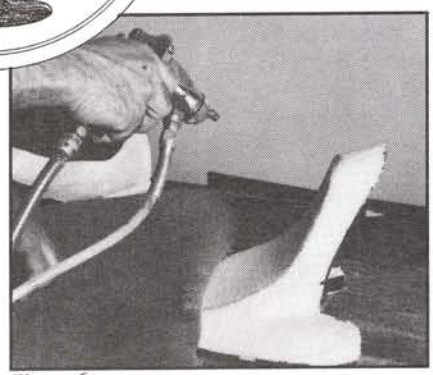


Figure 6

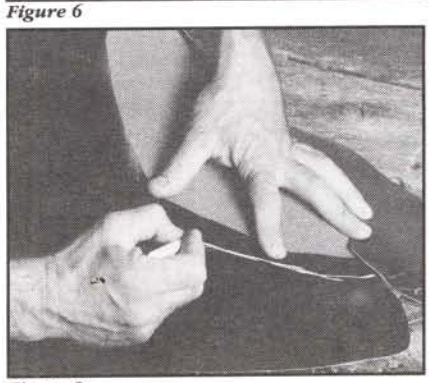


Figure 8

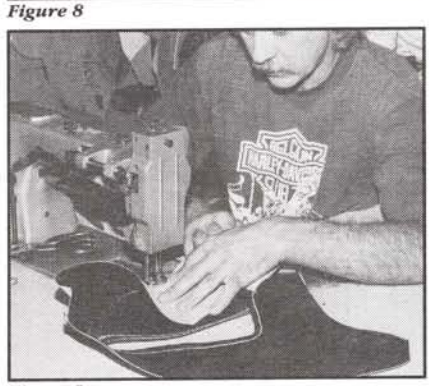


Figure 9

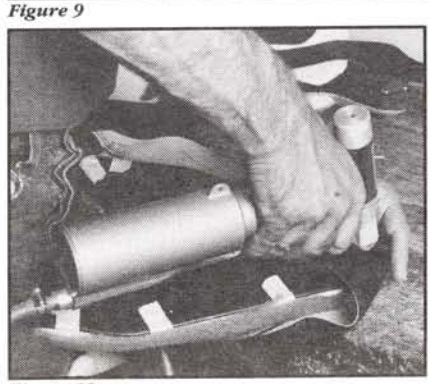


Figure 10

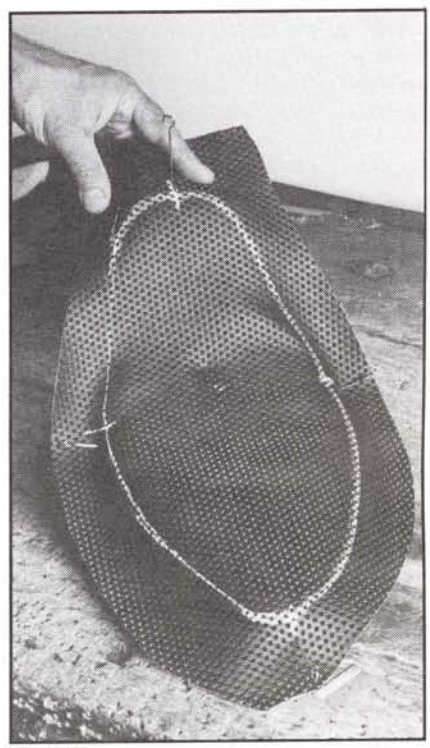


Figure 7

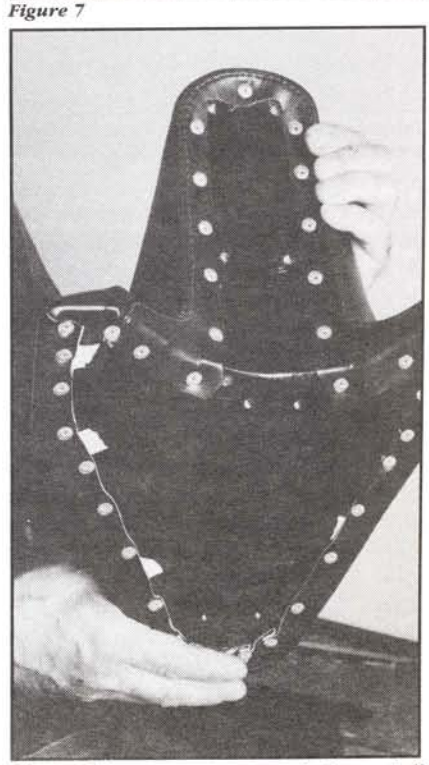


Figure 11

Photos by Marcus Cuff

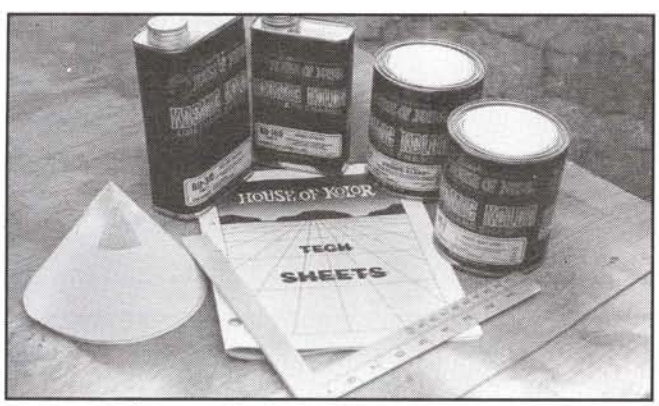
PAINTING YOUR SCOOT AT HOME

Saving Bucks By Doing It Yourself

Okay, okay. Not everybody is gonna run right out and borrow a paint gun and compressor just to lay some new color on their scoot, right? Too much hassle, and besides, only a high-dollar pro can lay on trick pearls and candy colors. But what if I told you that for less than $400 in materials and a couple weekends of spare time, you could have a great-looking new, two-color, candy pearl, urethane paint job—and the rush that comes from doing it yourself?

Here's the proof that it can be done. Using Jon Kosmoski's House of Kolor materials exclusively, some of my bros and I were able to refinish a tired Low Rider shovel, with no hassles, right in my own front yard. We used an old compressor with only a basic water trap, a $20 gun from a swap meet, and no other special equipment—except for a good charcoal respirator to keep from breathing the toxic paint fumes.

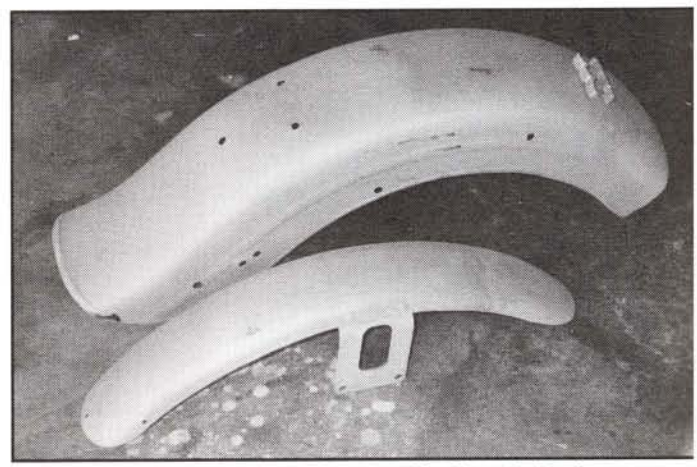
We began by deciding the colors we wanted: Candy Pearl Gold and Candy Root Beer. Then, we worked out a paint design that would look good and fit the overall theme of the bike. With a fatbob rear, narrow glide front fenders, and CCI 5-gallon fatbob tanks with Eagle Iron '46 knucklehead trim, we took some time to figure out a paint scheme that would look like "Harley did it," yet be totally unique.



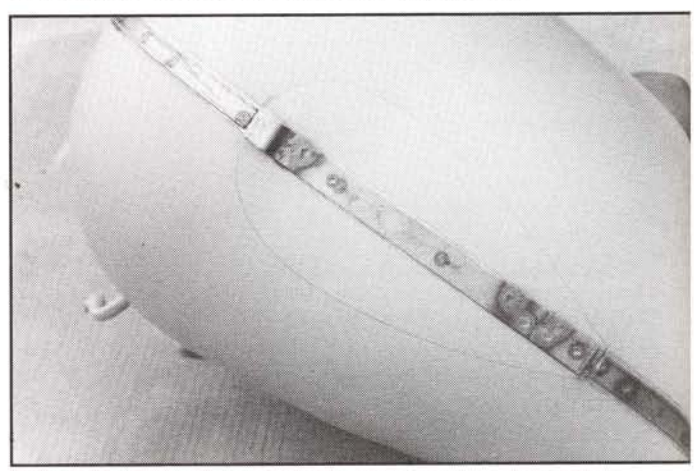
Jon Kosmoski's House of Kolor quality, user-friendly materials made painting a Harley a sharp, in-home accomplishment.

We ordered the paint in urethane, rather than lacquer, including all the compatible primers, sealers, basecoats and toners, directly from Kosmoski's House of Kolor (2521 27th Ave. So., Minneapolis, MN 55406; (612) 729-1044/(800) 328-5139). We sandblasted and repaired the battered fenders and spot-welded the emblem backing strips to the tanks. We also Kreemed the tanks and filled the filler neck seams with 3M Drip Chek Calk to prevent future problems.

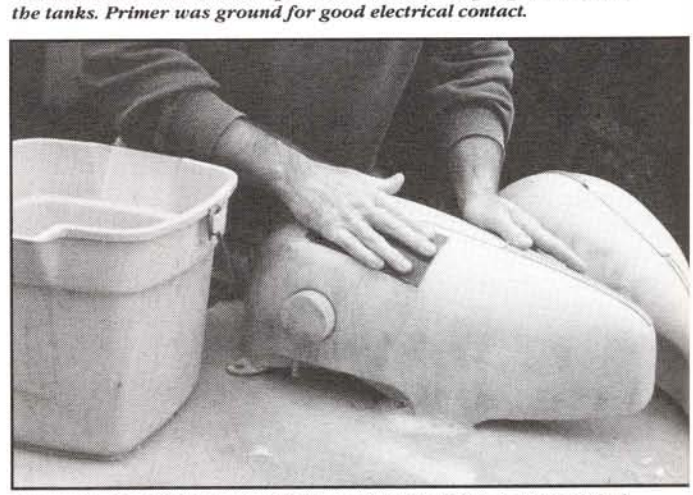
We found the Kosmoski's House of Kolor materials to be extremely easy to work with, including the two-part Kwikure Epoxy Primer. It filled quickly, sanded easily, and allowed us to block sand the minor ripples from the fenders and tanks right after filling. After a light second coat of spray can black-primer, wet-sanding with 500-grit paper brought the surface to absolute perfection.



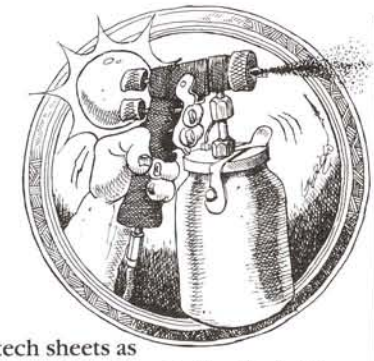
It is imperative that everything to be painted be cleaned right down to bare metal. Basic bodywork techniques fixed the fenders.



'46 knucklehead tank trim required attachment strips spot-welded to the tanks. Primer was ground for good electrical contact.



Primer builds thickness and block-sands (with 500-grit wet and dry) easily. Palmolive dish soap prevents fingerprints and clogging.



Using the House of Kolor tech sheets as a guide, we mixed and applied the Lite Grey Ko-Seal first, followed by the White Shimrin Universal Basecoat and the Gamma Gold Shimrin Universal Basecoat. Applying the white basecoat first makes the gold basecoat even brighter and more radiant. We then applied a light dusting of gold pearl toner for added brilliance. Because we would be applying tape to create the two-tone paint scheme, we sprayed three coats of Inter-Coat Klear to protect the Shimrin Basecoat from tape marks. The Klear also allowed us to color-sand the surface to eliminate the few bits of airborn trash we'd accumulated (all our spraying was done outdoors with no spray booth).

After color-sanding the parts completely, we laid out the two-tone scheme using 3M Fine Line Tape, a vinyl material which leaves a crisp edge. To completely cover the areas which would remain gold, the Fine Line was followed by narrow masking tape, wide masking tape, and, finally, masking paper. The second color, semi-transparent Candy Root Beer

The colors are deep and rich, and the surface has a smooth, glossy, wet look that will stay for years

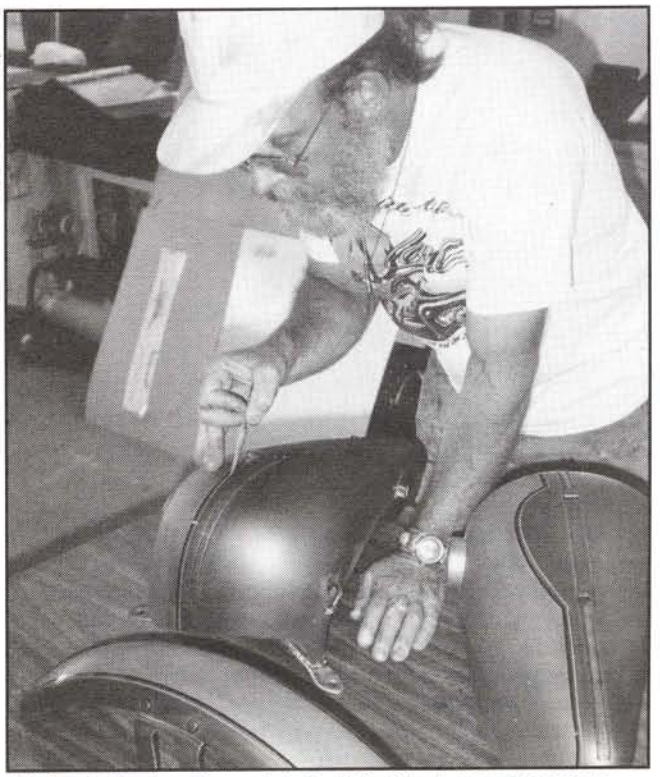
in this case, was mixed with Klear to dilute it slightly and applied over the areas we'd left exposed. The gold color was used as the base. It took three light coats to achieve the color we wanted—a good thing, since care must be taken to avoid excessive material thickness. This was followed by a full wet coat of Klear to allow wet-sanding of the surface without affecting the Root Beer color.

Once we removed the paper and tape, we wet-sanded the parts again to smooth the tape edges and prepare for the final coats of Klear. Bob Bond, a well-known striper from Sylmar, California, applied the pinstripes which separate the two colors. Because we wanted a factory-like appearance, Bob made his stripes the same width as Harley-Davidson does, one thicker than the other. He used One Shot sign painter's enamel, but mixed it with Kosmoski's House of Kolor catalyst to prevent a reaction with the same urethane Klear which would follow.

After waiting a full week for the stripes to completely cure, we mixed and applied the final coats of Kosmic Klear. The results speak for themselves. The colors are deep and rich, and the surface has a smooth, glossy, wet look that will stay for years. No rubbing or buffing required—or desired, for that matter.

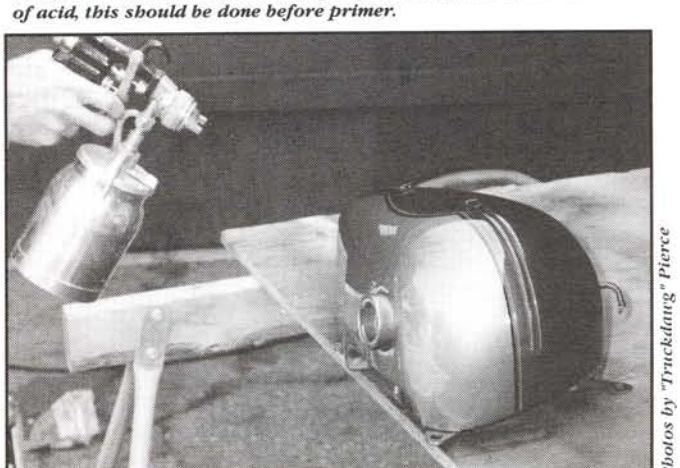
The final finish is just as it came from the gun—smooth, deep, and so colorful your bros will think you paid a helluva lot more than you did. But once your scoot is back together, you had best be mellow, because nobody's gonna believe you did it yourself.

—Eric "Truckdawg"



Bob Bond mixed urethane catalyst with painter's enamel to prevent reaction. Parts were color-sanded to prep for Klear.

Tanks were coated with Kreem to prevent rusting and leaks. Because of acid, this should be done before primer.

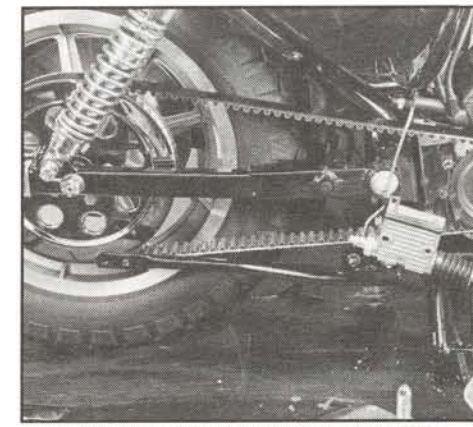


Final finish shows through when the final coats of Kosmic Klear are applied. No color-sanding or buffing required.

Photos by "Truckdawg" Pierce

Sportster Rear Belt Drives That Last

Let Phil Ross Of Super Max Take You Through The Motions



This unit was installed by Jim Lopes on his wife Gail's 1989 Sporty

Phil is the proverbial belt drive perfectionist. He's built a number of products that many of us use on our bikes on a regular basis. This particular project has been slicing its way onto the drawing board ever since Phil created his Super Max Belt Drives in the early '70s. And now, Sportster owners nationwide can cut down on vibration and maintenance by installing a belt drive to the rear of their scoots. No more messy chains floppin', singin', jerkin', or rustin' up Sporty rear ends. A great deal of thought and planning has gone into this installation and only the best and strongest belts are being used—the 1-1/2-inch RT Gates, poly chain. If you break one of these, they are also available from H-D dealers—the Softail belt fits Huggers and the stock four-speed belt fits most other applications.

Below are instructions for installing the Super Max final drive on a 1983 Sporty. Various model years involve different alterations. We'll cover a few at the end of this article, but for the straight dope you can contact Phil at (213) 516-0500. And if the modifications seem too much for your tool box, Phil will modify the swingarm and trans sprocket cover for a small bag of gold, in about a week, and ship 'em back to you. Here goes:

Installation of the Super Max final drive on the 1983 XLX Sportster:
Time started: 9 a.m.
Time finished: 3:15 a.m.

Installation performed by Ron Standeven, owner of Palmdale H-D, Palmdale, California. The following is a step-by-step account of the installation of the rear belt on a 1983 Sportster. Super Max Products furnished the basic kit, consisting of two pulleys and a belt. All of the spacers and so forth that were used were common to most bike shops. (See parts list.)

1. Remove rear brake caliper.
2. Remove rear chain and right shock.
3. Remove axle and rear wheel from the motorcycle.
4. Remove sprocket from wheel.
5. Install rear belt pulley on wheel, using flat washers under the bolt heads.
6. Level the motorcycle swingarm, (from side to side). Put the axle through the slots and check it with a level. When level is obtained, strap down the bike and be certain it is secure and will not move. This is very important.
7. Run the nuts on the axle adjusters back until the adjusters are all the way to the front of the slots.
8. (a) Install the axle (that is supplied) through the slots (also the adjusters) and recheck the level of the swingarm. Then, clamp on a piece of angle iron and be sure it's the same level as the axle (to use as a reference point when the swingarm is finished).

(b) Install the axle flat washer and axle nut, leaving a .500 gap between the flat washer and the swingarm (right side of swingarm).

(c) Install a Porta Power or a hydraulic jack between the arms of the swingarm just behind the bend. (See photo).

(d) Heat the swingarm to a slight red glow for the bending operation that is to follow. (*Do not overheat*). Keep the heat between the head of the Porta Power and to within .500-inch of the welded portion of the front of the swingarm.

(e) Slowly apply pressure to the jacking device to spread the swingarm .500 inches, checking the front of the spread area as well as the back—remember to check for *level—most important*. We don't want any ill-handling bikes, so check your work—*only you are responsible.*

(f) Sand and repaint the right side of the swingarm.

9. (a) Remove the right foot peg and e-clip, which retains the brake pedal.

(b) Remove the Phillips screw and clamp, which are located directly above the master cylinder.

(c) Unbolt the master cylinder and remove the cylinder and pedal simultaneously.

(d) Bend the brake line slightly to hold the master cylinder out of your way.

(e) Remove the remaining allen screws in the side case.

(f) Remove brake stop.

10. Remove trans chain sprocket (with a puller.)
11. Remove the mounting "Hex" and install a .170-thick spacer (or 3 flat washers) behind the Hex. Reinstall Hex.
12. (a) Place the transmission belt drive pulley on the shaft so that the mounting Hex may be marked where it will have to be ground for clearance.

(b) Use a scribe or marker to determine the area that will have to be ground.

(c) Remove the trans pulley and the mounting Hex from the case.

(d) Using your mark for a reference, grind away the area that interferes to a depth of .250 inches and allow an extra .050 inches for pulley expansion (radial). Reinstall Hex and don't forget the spacer.

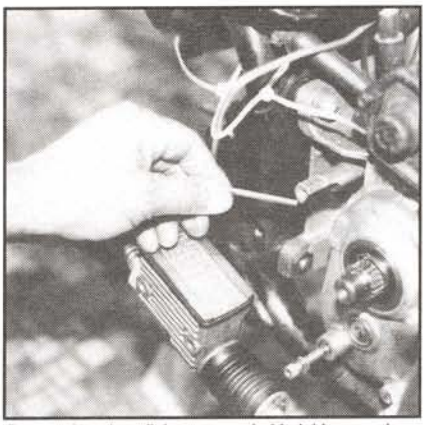
13. Reinstall the trans pulley, using an impact wrench, then spin the pulley to be certain that there is sufficient clearance. The bike must be in neutral.
14. Side cover modifications. (This can be done by hand—but a mill makes the job easier.)

(a) Layout: To find the center of your side case, measure in 2.9 inches from the front of the case, at the same time keeping in mind the location of the size and center of where the pulley will be.

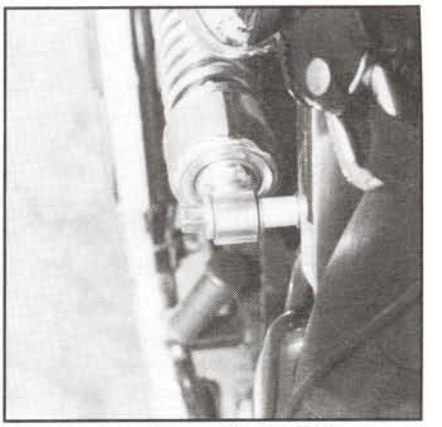
(b) Measure upward 3.25 inches from the center of the lower hole. Intersect the lines on a level of 90° to each other and this will be your center. (Good use for a protractor.)

(c) Remove the brake arm pin from

On the 1979 to 1983 models, the swingarm can be widened without being removed from the machine. Do not overheat.



Be certain to install the spacers behind this mounting Hex before you grind for clearance.



Shot of the top shock mount of Gail's 1989 Sportster. Early shock mounts demand different techniques to modify. Some harder, some easier.

the side cover.

(d) To acquire the correct spacing on the side cover, and if there are no custom spacers available, you can silicone 3 flat washers together and install them on the trans mounting tubes before you cut the side cover. Let the silicone set up while you're doing something else. When reinstallation is under way the washers will be secure.

(e) Countersink the brake arm shaft hole for a 1/2 x 13 allen screw or remove the top of the existing bolt with a grinder or in the lathe (about 1/2 thickness is usually enough). This will give you more clearance for the trans pulley.

(f) To clear the side case a mill should be used and makes the job a clean one. However, hand grinders may be used to clear this cover. At Super Max we also offer machine shop services for this particular operation for your convenience. (Seven working days in our shop.) To set up the side cover in a mill, you may use the brake pedal hole to secure the cover to the mill table and an additional support should be used on the opposite end of the cover to give it all of the security it needs for the cuts. (Clamp down securely. Flying parts can hurt.)

(g) Remove the webbing to the 2 different levels (call Phil for his drawing).

Rear Wheel Pulley:

15. (a) Reinstall the rear wheel into the swingarm with all of the proper spacers. (.500 is what we used.)

(b) Put the wheel all the way forward in the axle slots.

(c) Slide the belt onto the transmission pulley and then over the rear wheel pulley. Then slide the flange back onto the pulley.

(d) LocTite all of the 10 x 24 allen screws back into the rear pulley (and flange if you remove it).

*Special note: If you should strip the side holes, simply rotate the side flange 1/4 turn to give yourself some virgin material and redrill the holes one at a time with a 5/32 bit. The pulley will accept the threads with no tapping necessary.

16. Reinstall the side cover with one bolt and reach in to spin the trans pulley to be certain that it doesn't rub. If all's clear, you can bolt down the cover. There will be about a .150-inch height difference.

17. (a) Reinstall lower shock mount bolt.

(b) Reinstall the top shock mount bolt plus the .500-inch spacer that is needed to realign the shock. (Must be straight up and down.) A level that can be used vertically here may help.

18. Visually check out all clearances. The belt must track true and have about one-inch deflection when on the floor.

19. A square or straight edge should be used to check for pulley alignment.

20. Rear chain guard: Hammer flat the rear bracket on the stock guard. Repaint the tab.

21. Bolt the forward bracket to the outside of its mounting tab. Change the bolt to a 1-inch long and install a flat washer and nut. (Looks better.)

22. Install pant leg guard with two .250 spacers to keep it off the belt.

23. Reinstall brake caliper and all covers. Check brakes prior to riding.

Spacer And Parts List:

1) 5 ea. 7/16 flat washers for rear wheel.
2) 1,1973 + Big Twin axle. (Not required.)
3) 1 ea. .170 spacer for side cover mounting Hex.
4) 6 ea. 3/8 flat washers for side cover spacers. (3 times for each stud.)
5) 1 ea. 1/2 x 13 allen bolt. (Brake pedal shaft.)
6) 1 ea. .600 spacer for top shock mount.
7) 1 ea. 1-inch, 1/4x20 for front chain guard mount.
8) 2 ea. .250 spacers for pant guard.

Now, that wasn't too bad. You can bend/modify all 1979 to 1983 swingarms, but 1984 to 1989 models have additional sheet metal that runs to the bend of the swingarm and must be cut and spliced—not for me. Send the swingarm to Phil or ask him for the plans and take it to a capable welder. In 1979 the factory put the master cylinder behind the sprocket cover, also on XRs. The master cylinder must be moved. The 1984 models need only longer bolts to adjust the right shock. On '87 models the permanent shock mounts need spacers.

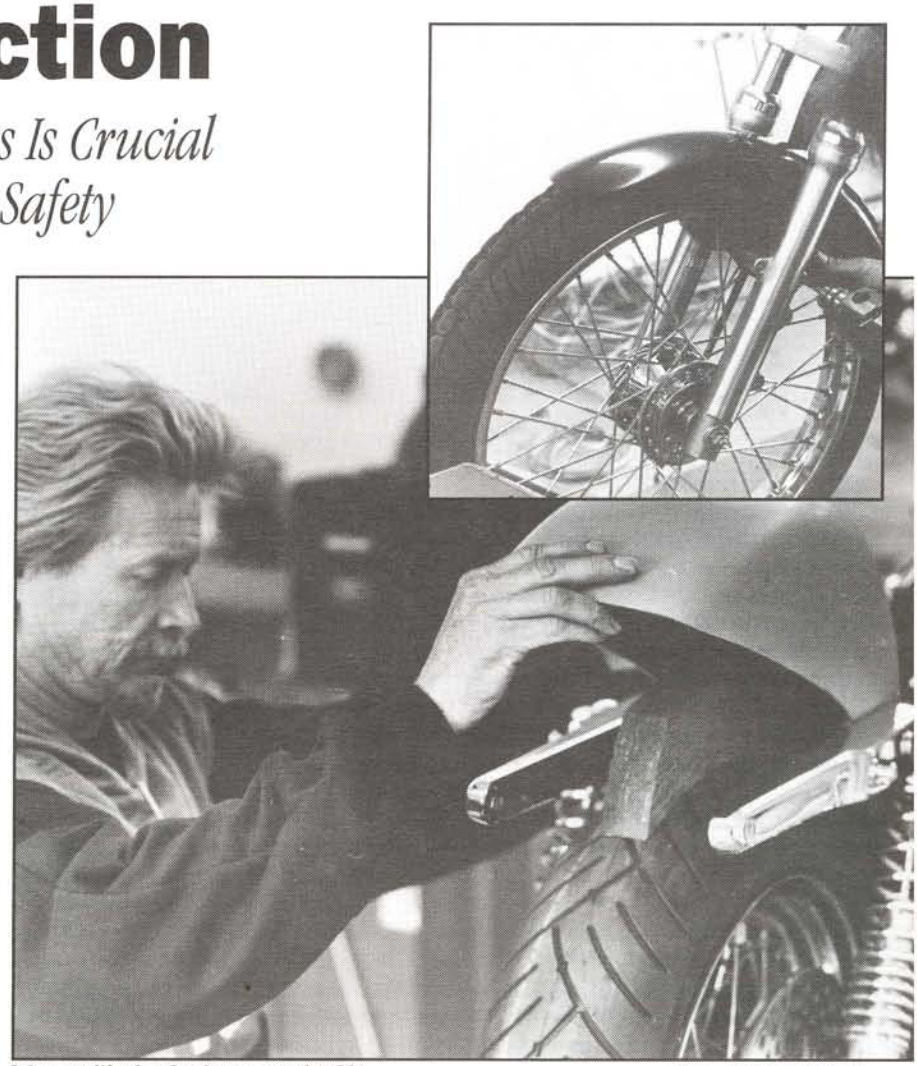
Phil also has kits for Huggers or K-models. The Hugger demands different gearing and the K-models and early 1957-'58 models require more work, but it can be done. And if you want to change gearing, numerous pulleys are available and disc brakes are required for earlier Sportsters.

The above should give you the basics, but don't hesitate to call Phil (Tuesdays through Fridays) if you have questions or run into a problem. Keep those Sportys alive and running quiet and smooth.

—Wrench

Fender Action

Installation Of Fenders Is Crucial To A Scoot's Looks And Safety



Arlen positioning fender on wood guide. *Photos by Gary Elmore*

How's that for a subtitle? Sorta like, "Put the rods in the lower end backwards and yer screwed." In reality, more scoots don't get the feature nod because of the screwy way the rear fender is mounted. Natch, we went to the main man of customizing for the straight action on mounting fenders, Arlen Ness, from Arlen's in San Leandro, California.

When you're setting up new fenders, keep in mind that for looks the fender should appear to be concentric with the tire (or parallel), and for saftey the fender needs the proper amount of clearance so you don't tear chunks of tire out on bumps or have a mounting bolt designing new tread patterns on your tire.

Here's what the master recommends. First off, Arlen has been building bikes, and fighting fender installation, for some 20 years, so he designed jigs for this tedious but crucial job. They can be made out of wood—2x6 or 2x8s will do the job. Just measure the diameter of your tire and cut two rings, one the same as the tire and if you have a rigid frame the other cut should be 1 to 1-1/2 inches from the tire circumference. If you're working on a swingarm model or Softail the distance should be about 3 inches.

Now that you have the form, lay that wooden masterpiece on your rear tire. Put the axle in through the frame and wheel, center it in the adjustment slot (where it will run most of the time), and tighten the axle. Don't forget to install the brakes first and even the chain, so you know the wheel and tire are running true. Now set the fender in place.

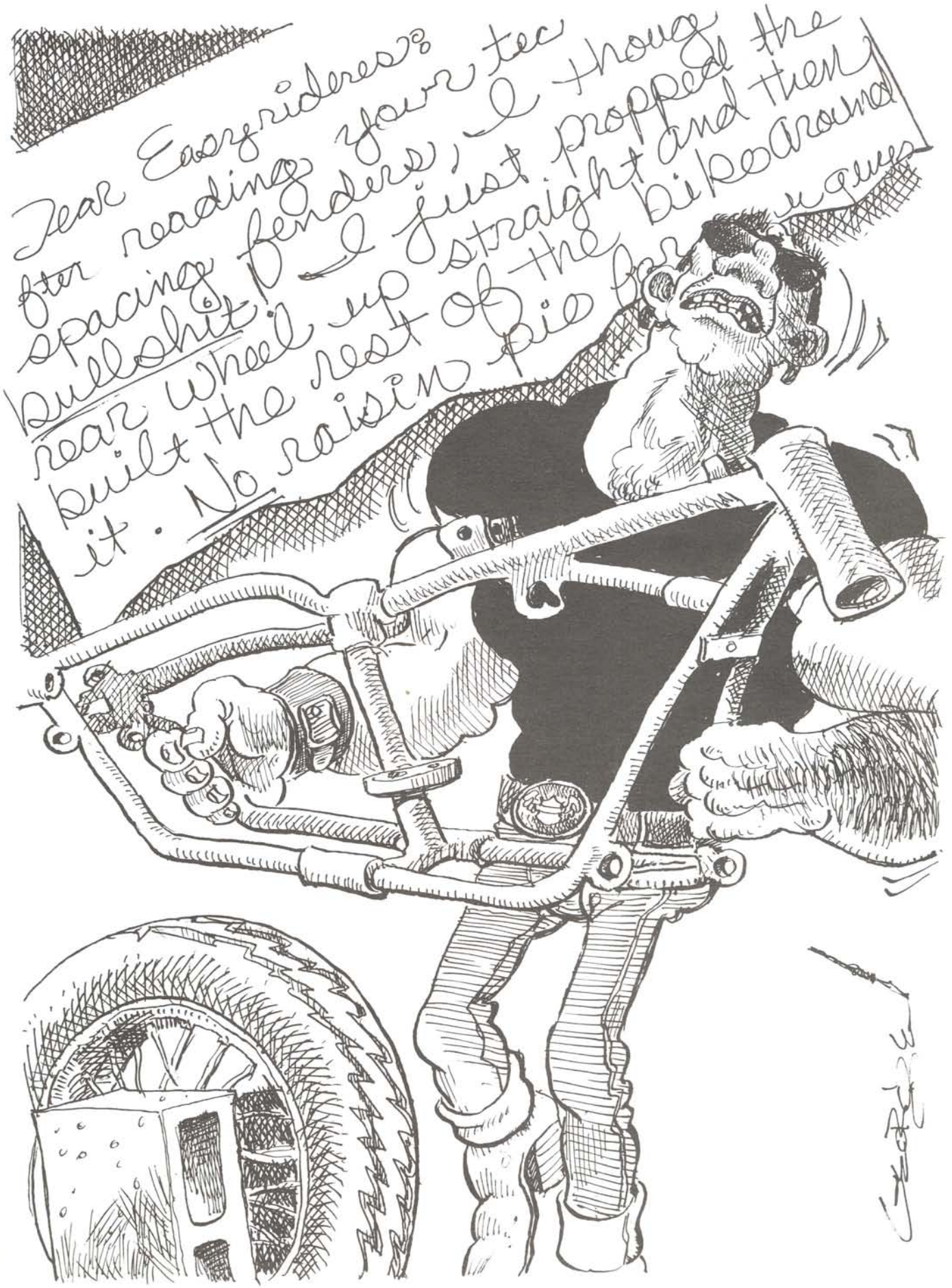
On a rigid, start by mounting the fender straps over the frame rail behind the top of the oil tank or battery. This is where a lot of riders miss the mark. Often, if the fender straps are mounted directly to the fender, they'll pull the fender out of round with the tire. Those straps were orginally designed to bolt the old fat (plenty of space) fender in place. So, depending on your style, the fender may need to be spaced away from the frame, up to 1 inch or more. Start with a chunk of 1/2-inch steel, equal in length to the straps, and drill two 5/16-inch holes to match 'em. You might want to start with wood forms until you know what you need. Arlen recommends that the fender be bolted into place with bolts just long enough to get a flat washer and a self-locking half nut in place. Or, depending on your equipment and the thickness of the fender, an insert gun can be used to apply an insert to the inside fender, so that no nuts are necessary and the bolts can be even shorter and a safer distance from the screaming tread. Also, pronged studs (T-nuts) can be used to do the same.

Watch when it comes to mounting the sissybar or fender struts. Different makes may need additional spacing. Don't force the fender down on the sissybar mount. Put something between the two to keep the design of the fender right. No one will see the strap under the fender. If you build your own sissybar or struts, mount the fender first then build the struts to leave the fender in the perfect spot.

For swingarm or Softail frames a slightly different direction must be taken. Put your 3-inch thick wood slab in place and set the fender on it with the wheel positioned as noted above. When it's exactly where you want it, mark the hole in the center of the fender strap and drill it, then mount the fender with one bolt to see if it's just where you want it. If it's cool, drill the rest. If not, reposition it and try again. To relocate the fender slightly, run washers on the inside of the fender rails, against the outside of the frame, for a wider look or to straighten the appearance of a tweaked rail.

Front fenders can be tricky. The wood model process is the same (can be thinner though, 1/2-inch). Or, you can use an old drive chain wrapped around the front tire. On some bikes, however, you can't get to the hole, so the aluminum ear protruding from the lower legs must be marked. Precise measuring is required or a template must be made of the mounting tabs. Drilling undersized holes can help prevent mistakes.

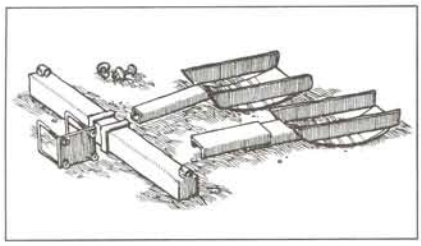
—Wrench


Dear Easyriders:
After reading your tec
spacing fenders, I thoug
bullshit! I just popped the
rear wheel up straight and then
built the rest of the bi around
it. No raisin pie
Jim Pa

Terrible Threesome —

How To Hook-Up And Haul

By Keith Ruxton



There are two models of this bike hauler: the first is a a bolt-on unit for "custom" heavy duty bumpers, the second is for "Class III" - type, plug-in hitches. In either case, your hitch must be able to withstand the full weight of the motorcycle being hauled.

Before loading the bike, make sure the transmission has a full supply of oil, because the gears will be turning. This doesn't hurt the transmission as long as it has oil in it. However, rear chains need to be lubed occasionally during long hauls.

The easiest way to load the bike is to find a curb or deep driveway dip so the hitch is as close to ground level as possible. If you are going to load the bike by yourself, not only is this mandatory, but make sure that you have all the tie-down straps laid out within easy reach.

The straps are hooked to the handlebars or upper fork legs, and must be angled out and down to the ends of the bumper or to the ends of the optional tie-down bar if there isn't a secure place to hook to on the ends of the bumper. Next, make sure to strap the wheel down in the carrier so it won't get bounced out.

A stop light, taillight and, maybe, turn signals will be needed. A light bar can be easily fabricated, just use a couple of dual filament trailer lights or an old set of Harley front turn signals or anything similar. This bar is then tied on to the bike being hauled. If you are not planning on hauling anyone else's bike, you could get fancy and wire in a four-wire plug on your bike and use the existing lights on your bike. But you *must* make sure the the ignition system is not on or being supplied power, or it could be damaged. The light bar method is safer and it will allow any bike to be hauled.

The next detail to be thinking about is how to back up with the bike on the EZ Haul. Looking in the rear view mirror (inside mirror if you have one), all you can see is the front end. You probably won't be able to see which way the back end of the bike is going, while backing up. Extreme care must be used because the short wheelbase of the bike will allow it to "jack knife" rather quickly. I tied a broom stick to the back end of the bike, sticking up in the air, so I could tell where the rear wheel of the bike was pointing.

The EZ Haul is available through the *Easyriders* catalog, or call: (800)572-1386

More Garage Security

Concerning your "Garage Security" tip, issue #215, I'd like to suggest a way of making this device "trip proof."

Take some expanded polystynene sheet and fill the tube, leaving a lump sticking out each end. Carve the ends to suitable shape, and along the tube top at floor level. After the concrete is set, the polystynene can be broken out. Or, spray it with carb or brake cleaner and it will dissolve. This leaves a level floor, with two, 2-inch holes to let the chain or cable through.

Steve Blyth
England

A Brand New Bag

I came up with this idea while deciding whether or not to put bags on my 1975 FX. If you have a permanently mounted seat, it's a real hassle to take it on and off. The seat would have to be removed to attach the bags.

Anyway, this was my solution: I sewed pockets on the inside of the bags. They are made of heavy-duty leather and slip over the saddlebag support brackets. Then the straps are pulled up into the pockets. Instead of laces, I installed snaps. There are eight of 'em, so no-way will it pull apart.

These bags have been mounted like this since last spring, and after many comments from my bros, I decided to share the tip with you.

Bill "Monk" Phillips
Pittsfield, Mass.

The Easy Way to Load and Lift

Save yourself back-breaking labor with the EZ-Load and EZ-Lift.

EZ-LOAD

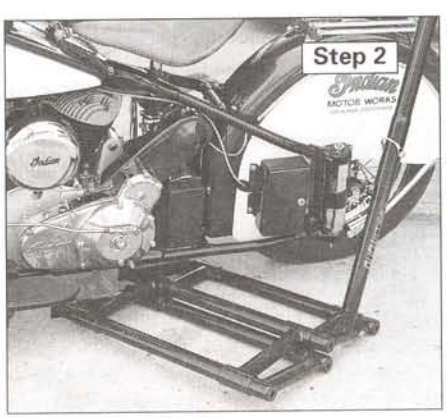
The EZ-Load Ramp is a 3-piece ramp made of the best U.S. tubing and steel and strong enough to load any dresser. It's made to fit between the frame rails to keep the bike from high-centering, and features a 20-degree bend to fit flush on the tailgate, cleats to keep it from slipping, safety clips to keep it together, round rail guides for tires, and expanded metal floor for traction. This is the safest, easiest, and fastest way to load a motorcycle!

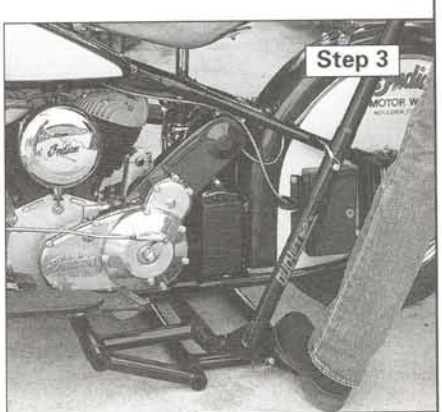
NEED A LIFT?
Get The Duo-Lift

Made of the finest American tubing and steel, this one-man operation puts both wheels in the air but keeps the bike solid and stable. Features include:

- Detachable handle and fold-up feature for easy storage.
- Locking pin and safety clips to prevent the bike from being pushed off the side.
- Works on all Harleys (rigids, swingarms, Softails, etc.) with standard front ends.
- Powder coated for extra durability!

Extra Lift Bar for extended front ends sold seperately.





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Cylinder Base Tools Or How To Get The Job Done

. . . Without Stripping Nuts Or Busting Knuckles

Tech by Thompson

Cylinder base hardware—base nuts, cap nuts, screws, etc.—doesn't seem like there's much to talk about here, does it? You tighten them when you put the pig together and that's the end of it, right? *Wrong.*

Such an extensive array of cylinder hold-down hardware exists, that even experienced mechanics sometimes look a bit dazed when confronted with choosing the proper goodies.

Take a look at photo A. Pictured are the different types of cylinder base hardware I picked up by just walking around my shop and taking samples from the jobs in progress. The larger group at the top is for pre-Evolution Big Twins and the smaller group at the lower right is for iron-head Sportsters. There are other types available as well.

Which one is best for you? You have to decide, considering strength, physical size, appearance and difficulty of installation and service.

Difficulty of installation and service? What's this guy talking about? You just spin them on and tighten them up well, right? Look at photo B. It shows wrenches from my tool box which are used just for base nuts and screws. Many of them are standard tools which have been altered (cut, ground, welded, bent, etc.) to suit particular types of hardware and clearance problems. Most of these aren't needed for assembling an engine on the workbench but, after it's in the frame, you may find that the hardware that installed fairly easily on the bench can't be tightened by anyone except a very small man with rubber wrenches.

Photo C. Here you have a wrench which is modified to tighten "Sidewinder"-style base nuts more easily when the engine is in the chassis and totally assembled. S&S recommends that a Snap-on wrench #RXS16 be used to tighten their base nuts. This is a good choice—it's an open end wrench with an extra thick head that won't deform when you really lean into it. However, it doesn't allow access when the engine is in the chassis with the pushrod tubes in place. This one's easy: buy another one (yes you wimp, I know they're expensive—approximately $18) and alter it by cutting off the business end and welding it back on at a 45-degree angle to the handle. It will now work great for checking and tightening those nuts as we all know we're supposed to.

Even experienced mechanics sometimes look a bit dazed when confronted with choosing the proper goodies

Photo D. This photo shows a box end wrench (the one on the left) which has had the end ground slightly so that it will fit around a base nut and not jam on the outer surface of the cylinder casting. I've been using this wrench for over 20 years and have had good luck with it. You can alter most wrenches this way if you use a little discretion (just grind it enough so that the wrench will fit—and no more).

CAUTION! Any modifications such as the ones shown in photos C and D are done at your own risk. Your friendly neighborhood tool dealer is not likely to want to give you a new one if you break it after modifying it. Whining about skinned knuckles won't do you any good, either.

How tight is tight? Most of the early H-D service manuals are pretty vague about this. Some say you should tighten the cylinder nuts very tightly or draw cylinder nuts down evenly. Not very informative, to say the least. **It is important** that cylinder base hardware be kept properly tightened! A **small** amount of Loctite won't hurt here (a drop about the size of the head of a wooden match). Many mysterious catastrophic engine failures can be traced to loose nuts. Oil leaks and/or a cracked cylinder are the least you can expect. If you wish to use a torque wrench to tighten these you will need one of the Snap-on "dogbone" adapters shown at the lower left of photo B. You will more than likely need to remove some or all of the pushrod tubes to provide access. Use the torque wrench adapter formula from the July issue's Tech Tip on head gaskets to figure your torque wrench setting. The proper torque specifications are as follows:

iron head Sportster: 25-35 ft./lbs.
(high hex nut)

early Big Twin: 32-36 ft./lbs.
(high hex nut with lockwasher)

late Big Twin: 32-40 ft./lbs
(flanged nut with triangular plate underneath)

Custom hardware is another matter. Some of the things available won't stand much more torque than the stock items and some, such as the 12-point nuts, will withstand substantial increases in tension. Use good judgment here—try about 10 percent more torque than stock figures first. If this feels good and solid (not rubbery), try another 10 percent increase. Leave it at that—you're in good shape.

Think twice before you remove your studs and substitute cap screws, even high-quality 12-points or Allens. The stock stud/nut arrangement is a good, stable method of securing these parts. Changing to cap screws risks stripped crankcase threads and increases the chance of these parts loosening in service. One of the reasons for this is that on finned cylinders there is sometimes not enough room between the base flange hole and the lowermost fins to allow installation of a screw long enough to do the job properly. Finless drag cyl-

inders don't have this clearance problem, so you may see a cap screw being used on some race engines. If you insist on this make sure your screws engage a **minimum** of 1-1/2 times their diameter in crankcase material. For example, 3/8-inch diameter screws used on Sportster engines should engage **at least** 9/16-inch of crankcase threads.

The final component we need to speak about is studs. Stock items are generally of fairly good quality and have a nice 3 to 5 percent interference thread fit which retains them in the cases. Some of the aftermarket studs have a free running thread fit which allows the stud to spin in and out of the cases with finger pressure, just as if it were a cap screw. Don't use these, they'll only create problems for you. Some people with custom cylinders that have extra thick base flanges, or those using stroker plates, may need extra long studs. Those using special nuts ("Sidewinder"-type or acorns) need to check the height of their studs and make sure they don't project so far that the nuts bottom on the end of the studs before they actually clamp the cylinder base down. The installed height of the studs for S&S nuts is 1.175 inches from crankcase deck to the end of the stud.

This technical article was provided by Jim Thompson at Thompson's Cylinder Head Service Co., 186 River St., Dedham, MA., 02026. Jim, an East Coast Hamster, has been providing quality machine work for over 25 years and welcomes inquiries from retail, wholesale, and mail order customers. He offers a complete range of parts, special machining, and repair procedures for H-Ds. You can reach him at (617) 326-8380 or FAX (617) 320-9351.

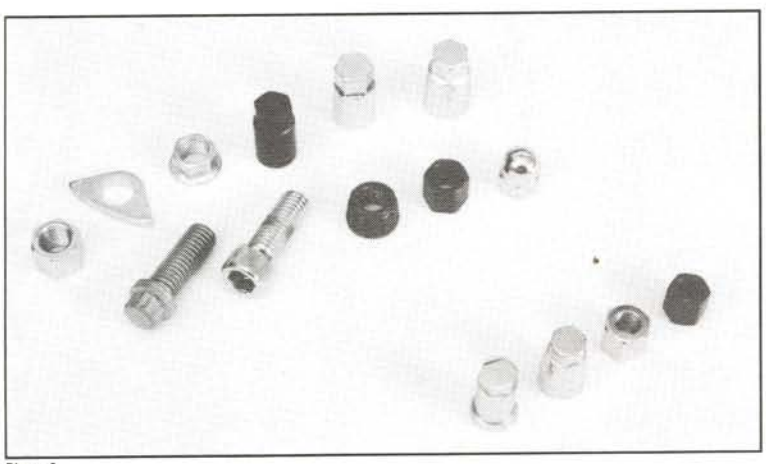


Photo A

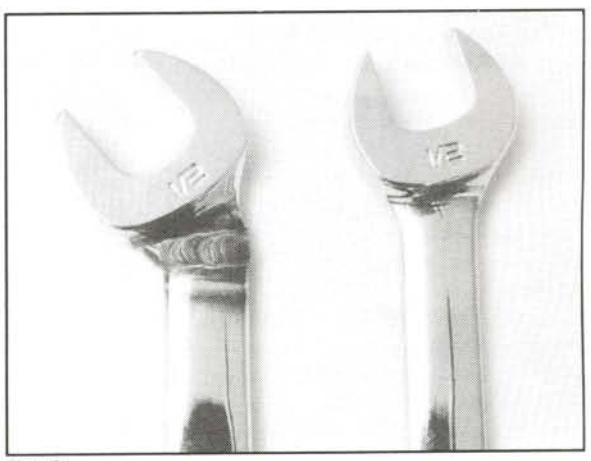


Photo C

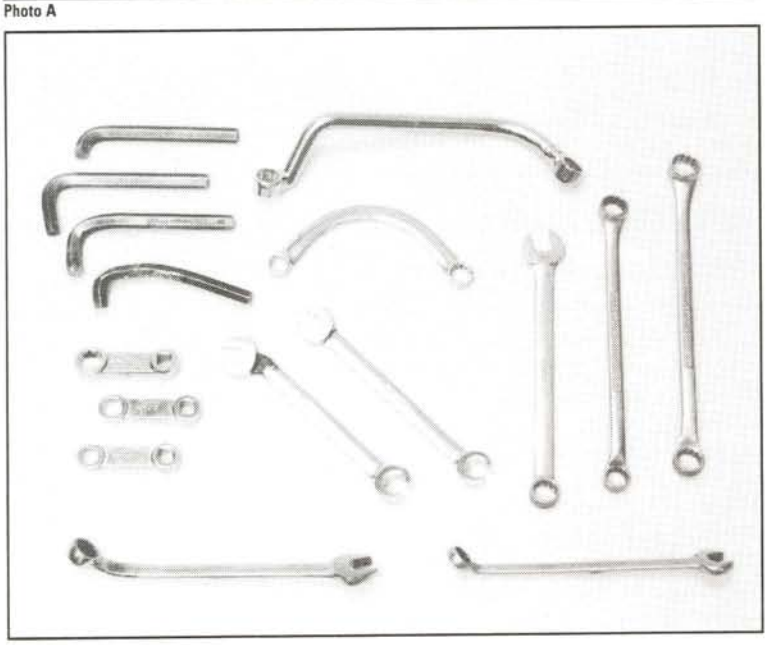


Photo B

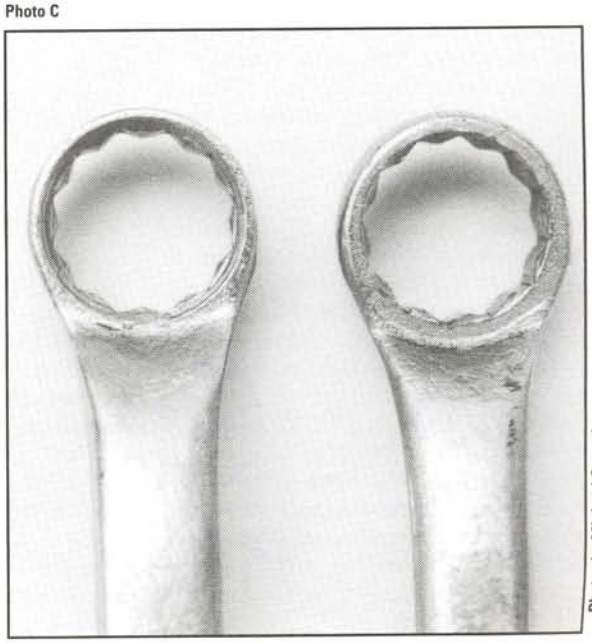


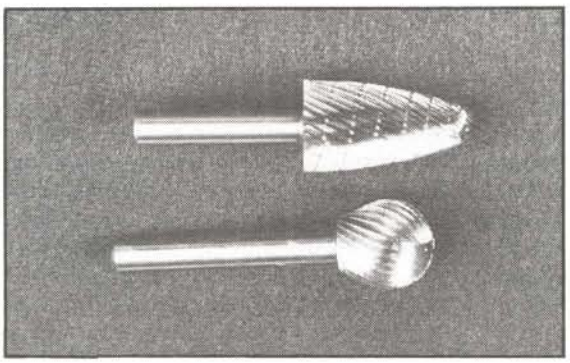
Photo D

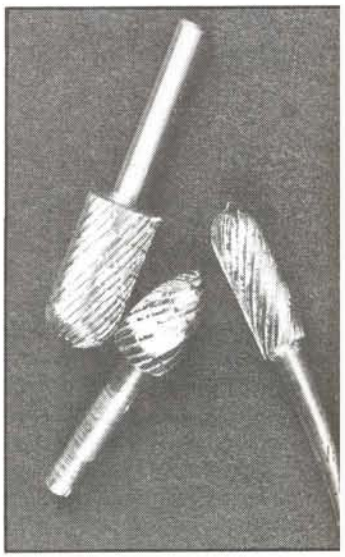
Photos by Michael Coppola

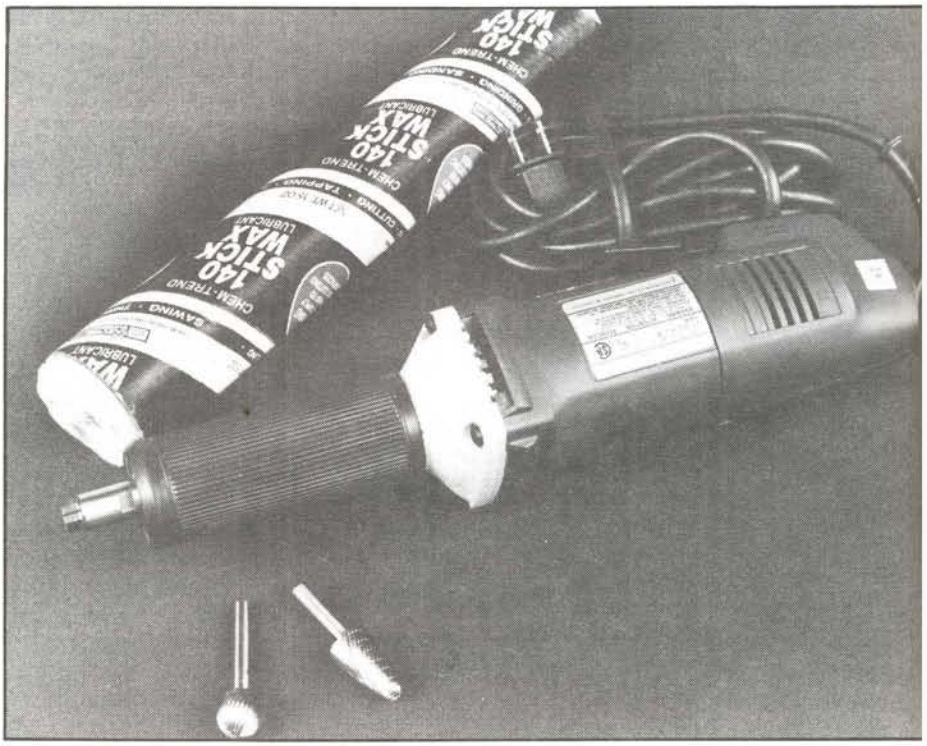
For Good Grindin'

It's All In The Tool...

By J.D. Chandler







Photos by J. D. Chandler

Sometimes scooter parts don't fit. If you're lucky, you'll be able to make'em match up by cutting, filing, or grinding. However, files, saws, and grinding wheels won't help much when you've gotta take a bunch of metal out of a hole or off an odd-shaped casting. Then you'll need to reach for the die grinder.

Those of us who have been around Harleys for a while have had some experience with rotary files (also called burrs, mills, or fluted cutters). Chances are those experiences were less-than-happy ones. With the right tools, you'll be able to remove metal without any hassle. Unless, that is, you cut too much.

The single most important part of making the job easy is having the right rotary file. They come in all sorts of sizes, shapes, and materials because cutting requirements vary so much. Most of the jobs we do around Harleys, like routing out aluminum or trimming a fender, can be handled with just a couple of different files. The coarse-pitched files for aluminum generally work all right on mild steel, but a fine-cut steel file will load up instantly on aluminum. So, if you're only going to have one set of files, buy them for aluminum.

A rotary file for aluminum should have widely spaced flutes (5 to 8 teeth per inch) and should not have chip breakers (see photo). Chip breakers tend to make the tool load up. Steel cutters work better with slightly finer pitched cutting teeth (9 to 16 teeth per inch).

Egg- or rounded-tree- shaped cutters generally give the best results. Cylindrical cutters are much harder to control and tend to leave a series of notches or grooves in the surface of the material you're working on. Ball-shaped cutters can lead to disaster; they will catch in the surface and "walk" around to areas you don't want touched.

Carbide cutters are much less likely to load up than high-speed tool steel cutters. Carbide will survive higher operating temperatures, such as when cutting steel. Also, carbide rotary files last so much longer than those made of high-speed steel that they are actually much cheaper to operate.

Lubrication is critical. There are wax-based lubricants that have been developed just for this sort of work. You should load up the file before you begin to cut and relube it frequently as you work. The wax will not only prevent loading but it will greatly extend the life of the tool.

There are wax-based lubricants that have been developed just for this sort of work

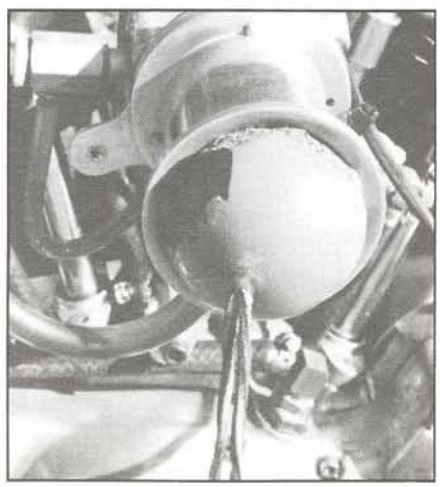
If you have plenty of air available (at least 10 cfm @100psi) you may prefer an air die grinder. They are cheap and can be easily fitted with a valve that will let you adjust the operating power and rpm. Because air tools need a large compressor, most of us will end up with an electric grinder. If you choose electric, spend the extra money and get one with a variable speed motor. It'll give you greater control.

Finally, don't rush the cutting. If you push the tool too fast, it'll load up if you're cutting aluminum and will burn if it's steel. Mess up the cutter an' you'll have to go back to that rusty pile of dull files in the bottom of your tool bag.


WE E NNYAA
ACME
TURBO

Suck It, Suck It Good

By Rip



Photos by Rip

To me, these shots depict a humorous side of the drag racing fraternity. They were taken last October, at the finals of the 1989 HDRA drag racing season in Farmington, North Carolina.

As we all know, air cleaners are made to keep impurities out of the intake passages of our motorcycles. Natch, on drag bikes, the ideal setup is not having any restrictions whatsoever.

This group of riders and racers is devoted to the quickest means of blowing through an 1/8 or 1/4 mile, not filtering air. But, while in the pits, the velocity stacks are blocked with creative contraptions (such as tennis balls) to keep shit from falling into them.

Here's an assortment of the wildest carb plugs in the pits—enjoy. And don't miss American motorcycle drags, they're getting wilder by the second.

ANDREWS

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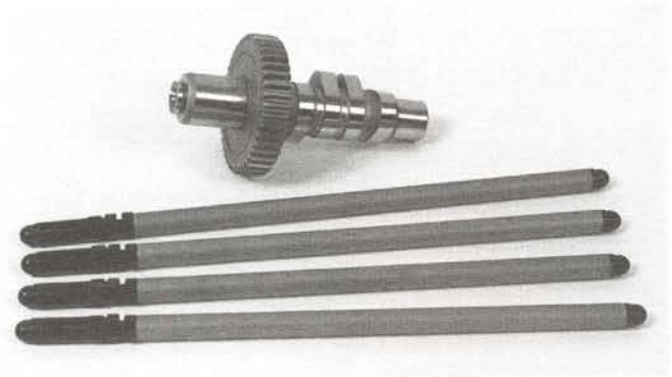
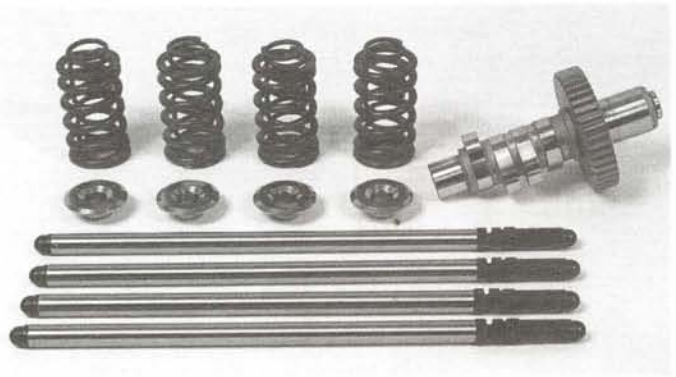
EVOLUTION 80 CAM KITS - (ALUMINUM PUSHRODS)



EV-80 camshafts and pushrods are available with either aluminum or steel pushrods. Standard cam kit includes 4 adjustable aluminum pushrods. Cams in this group bolt into any EV-80 engine and combined with pushrods are a great addition for street or touring bikes.

PART# 292115 (Standard EV kit, aluminum pushrods)
For kit pricing to apply, one camshaft **must be purchased** with each kit. EV13, EV27, EV3, or EV46 cam should be ordered with kit.

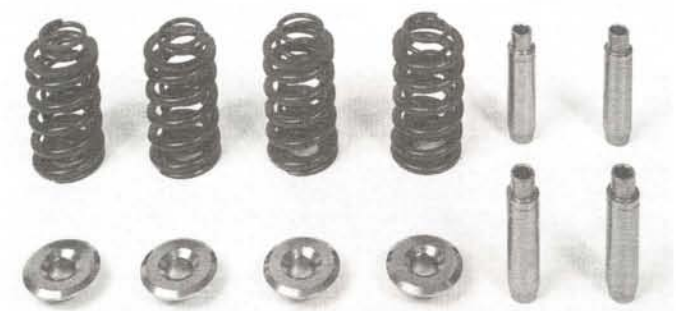
EVOLUTION 80 CAM KITS - (STEEL PUSHRODS)



High lift EV kit includes 4 adjustable chrome moly steel pushrods, 4 titanium high lift spring collars and 4 inner and outer springs. Steel pushrods are super rigid for high RPM performance. Titanium collars add +.050 spring travel over stock. For modified engines to 6000+ RPM.

PART #292225 (High lift EV kit, steel pushrods)
For kit pricing to apply, one camshaft **must be purchased** with each kit. EV 59 or larger cam should be ordered for kit pricing to apply.

EVOLUTION VALVE GUIDES, COLLARS AND SPRINGS



EV valve springs, upper collars and valve guides are available as individual piece parts and fit all Evolution engines.

PART #294150 (High lift springs) includes 4 inner and 4 outer springs.

PART #293110 (Titanium collars) includes 4 pieces in a set.

NEW FOR 1996! (Valve guides)
PART #294511 (+.001 oversize)
PART #294512 (+.002 oversize)
Material is alloy cast iron.

Special cams can be made to order with extra high lifts, 2 front head set-ups, etc. Call for information!

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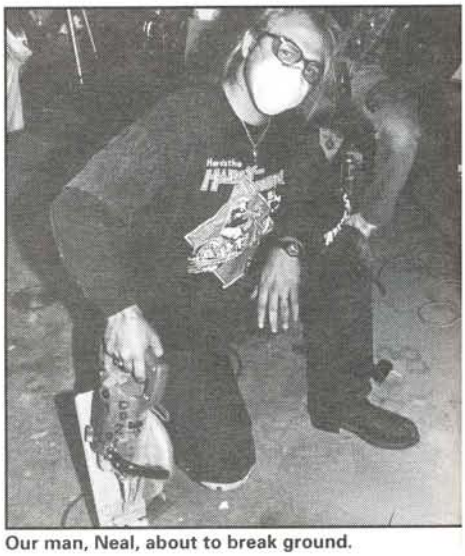
Photos by Kim Peterson



Our man, Neal, about to break ground.

Neal places the Lockdown.

How often do you roll around at night, unable to get maximum shut-eye 'cause yer worryin' about every little noise emanating from your bike's garage. Each wind gust blowing tree limbs against the pad causes the nerves to jangle. Jitters give way to irritability, and the next thing ya know yer restlessness leads to givin' the ol' lady hellfire.

Knucklehead Neal, from out here in the San Fernando Valley, is a good bro who was faced with this daily and nightly dilemma. He tried to get insurance for his knuck, but soon found most companies exclude "antiques" from theft insurance. Go figure. Exacerbated by the hassle, Neal proceeded to deal with it in his own way.

Neal and his bro, Mike Brown, developed their own insurance solution—the Lockdown. An in-the-garage security system that you can install yourself, the Lockdown is a solid, anchor-like device that is sunk into your garage or shop's foundation. It consists of a serious pipe, schedule 80, and half-inch plates.

Two thick, 5-inch, steel bolts are affixed between a couple of circular, machined, steel plates, welded to a six-inch length of schedule 80 pipe on the top plate that will eventually sit on the top of the floor, enabling a hefty chain to slide through it, and through your scoot. The remainder of the anchor is submerged.

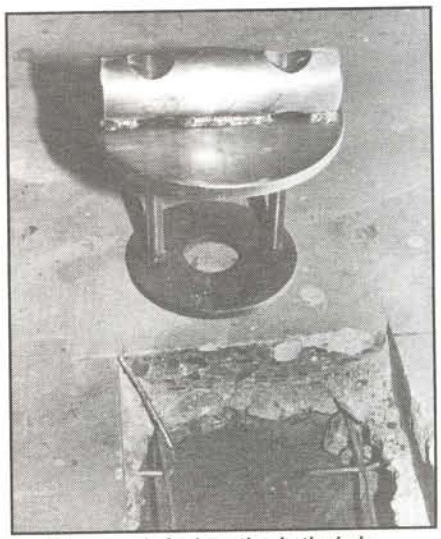
Neal recently stuck one in Bomber's garage, starting by figuring out the best spot for the permanently-lodged, anchored-in-cement, Lockdown security apparatus. It made the most sense to put it on the side of the garage, where the bike could be rolled easily into place, yet out of toe-stubbing range.

The handlebar measurement called for 20 inches from the wall—enough to keep the buckhorn bars from hitting the wall. Ideally, you want the lock to be centered where a chain will run through the wheel, frame, around the pipes, and then be connected again.

The preferred lock is Cobralinks. They offer a variety of lengths. Cobralinks are not the only way to go, but they are substantial. More on that later.

Now to get started. With the Lockdown centered, draw four, 8-1/2-inch lines

Crushin' the concrete square.

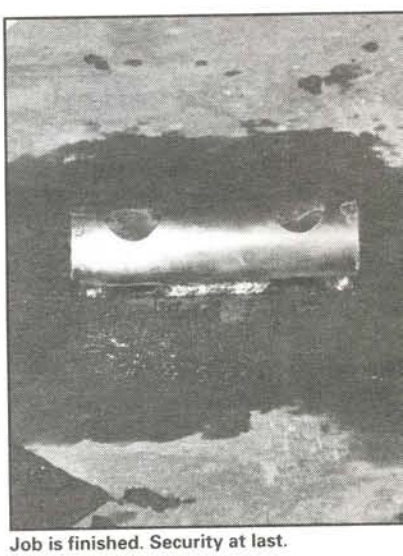


Lockdown ready for insertion in the hole.

Pourin' the cement.

Troweling the 'crete.

Lockdown gets a gloss finish.



Job is finished. Security at last.

around it, using a straightedge. Now get a powersaw with a masonry blade. A sharp blade is a must. The 7-7, 1/4-inch Vermont American (made in the USA) blade worked best (only took two blades, after going through five of an inferior, imported brand).

Begin your cuts into the foundation, following your crayoned straightedged lines. Be sure to use a facemask and eye protection. The blades are made of asbestos, which kills more than lab rats.

No doubt about it, there will be a mess. A concrete dust cloud will cover everything, includin' your lungs and eyes. Take care of 'em, you'll need 'em on the road.

A masonry drill bit pierced the square's center and each corner of the now-cut concrete, before Neal, wielding a sledgehammer, slammed away at the middle of the concrete (careful not to ruin the rest of the garage's floor).

After pounding through the 4-inch slab, reaching dirt, dig and smooth the dirt around to fit the Lockdown so that the top plate is flush to the floor.

Next, stir up a bucket of concrete mix, he used half a 60-pound sack ($2 dollars on the open market). Lay some 'crete on the bottom, about 2 inches worth, then slip in the Lockdown and trowel in cement around it, bringing the mix even with the floor's slab, covering the top plate. The milky "cream" from the bottom of the bucket can be skimmed on the top plate, leaving you with a classy gloss finish. Let it set, then wipe with a damp sponge to bring the plate's surface up. Chrome is optional.

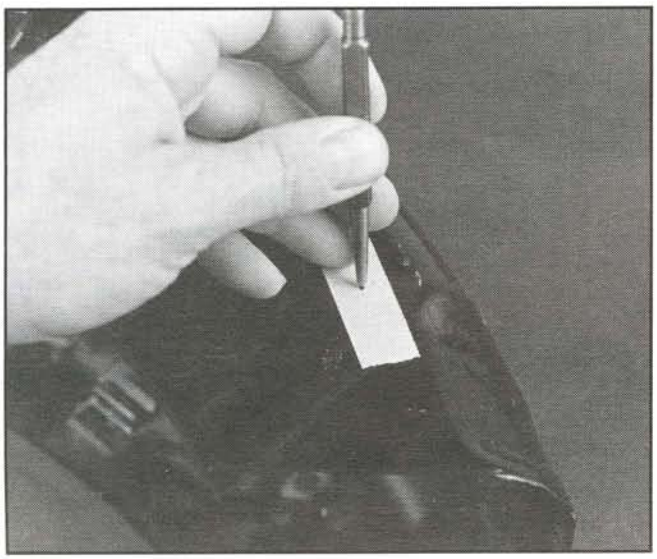
The next day, when the cement has hardened, you'll be ready to run a chain through the pipe—and your ride. Cobralink provides case-hardened, mesh-covered, snake-like chains in lengths of 5 feet, ideal for Sportys; 7 feet, for most rigid and swingarm bikes; and 8 feet, for dressers. Bomber's runnin' an 8-footer that runs clear through the frame of his pan, right up to his ol' lady's side of the bed. No insurance needed.

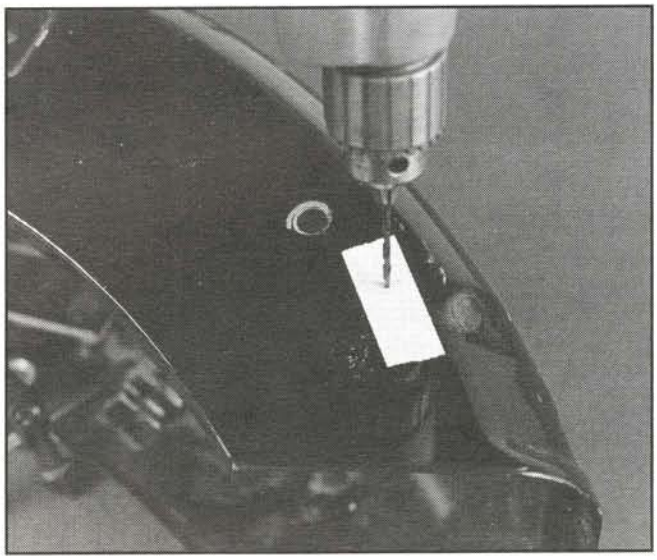
—Buster

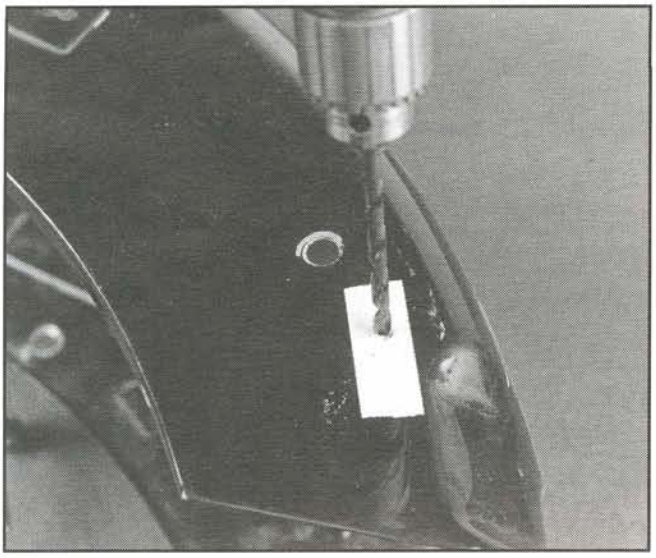
To get in touch with this enterprising backyard biker and his security system, call H&M American Ent., (800) 346-4331.

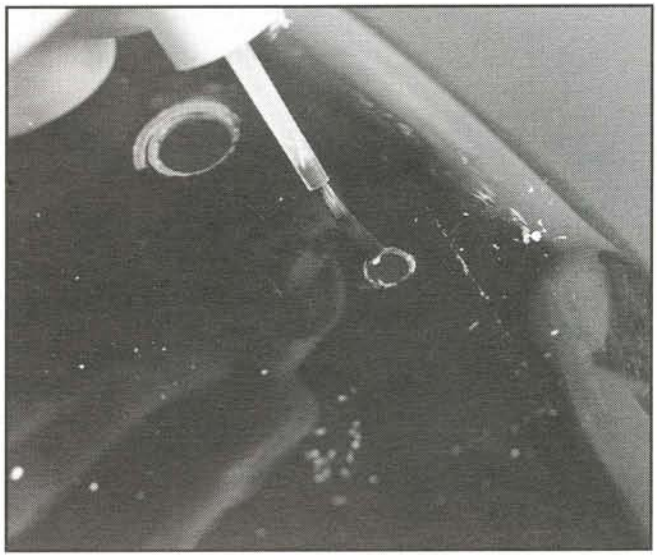
Paintin' Blues

By Wilburn Roach with Bob Stark









Everyone is faced with this dilemma sooner or later. Someone gives ya a front fender light for your fat fender, or ya sent somethin' out to the painter and forgot to drill one last hole. Well, here's how to drill that hole the right way, from one of the most respected Indian restoration experts in the country, Bob Stark of Starklite Cycle, Fullerton, California.

One of the major problems when drilling holes in a painted surface is chipping the paint at the edge of the hole. Here's the best method we have found to prevent this problem:

1. Put a piece of masking tape over the area where the hole is to be drilled.

2. Locate the hole center with a pen or pencil.

3. Use a center punch to put a very slight dent at the center of the hole. (Take your time—you only want to drill this once.)

4. Use a small drill (usually a 3/32-inch or a 1/8-inch bit) to slowly drill the initial hole.

5. Enlarge the hole in increments not exceeding 1/8-inch till the desired hole size is reached. Drill slowly.

6. After the desired hole size is reached, lift the masking tape around the outer edge and slowly peel it away from the paint by pulling it toward the hole. Do not pull from the hole outward or it can pull the paint off.

7. After the tape is off, use clear enamel on a small paint brush to coat the bare metal and paint edge inside the hole. This will seal the paint so the weather can't get in and start problems.

8. Allow the clear enamel to dry and insert your fastener.

That's it. It takes some additional care, but good work in general and fine detailing in particular are damn rewarding. So take your time, and you'll be proud of the finished scoot. Besides, the paint job will last a helluva lot longer.


WHEEYAAAH
DRILL

Restoration Project

Gettin' A Feel For The Hard To Find

By Maestro

This 1936 VLH has gone a long way from its original condition, and the way back will be just as long and hard — no run for the weak of spirit.

Among the devotees of motorcycles, from custom choppers to bone stock dressers, the biker fraternity includes a finicky sect that finds its pleasures, not from changing a Harley or Indian or whatever from the way it started out, but in putting it back the way it originally was when new, even if "new" means 1921.

Many of us have attempted to join the restoration brotherhood, but as the respected vintage authority, Mike Egan warns, the membership dues take as much time, money, and long-term devotion as any other two-wheeled passions.

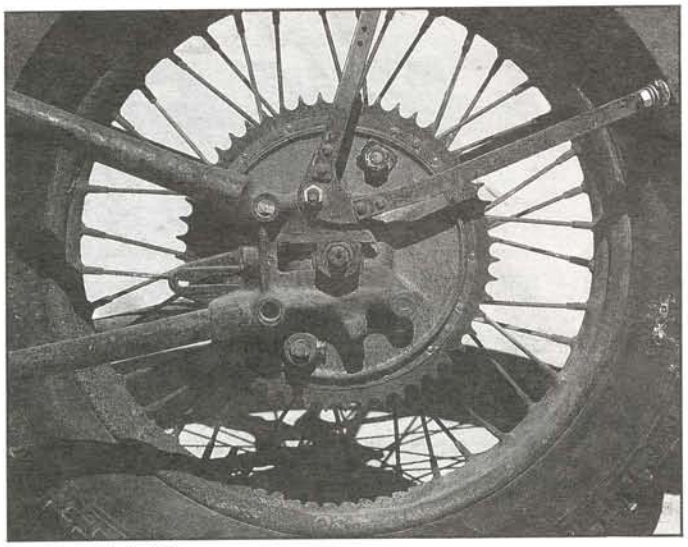
Egan restores bikes and sells vintage parts as M.F. Egan's Vintage Motorcycle in Santa Paula, California. Mike has been rebuilding antique and modern Harleys (not to mention Indians, Triumphs, and a bunch of others) for nearly 30 years, along the way seeing a sad number of restorations fail simply because people didn't realize what they were getting into.

"Restore," in this context, means to rebuild the bike identical to the way it rolled off the assembly line at the factory, and the true believers will not tolerate exceptions. Sure, some bros *will* take the tool box off a 1936 VLH to see if the mount is truly original, 'cause who'd want some bastardized one whittled out of a later model? On the other hand, when somebody sees a 1953 K model with duct tape on the grips, the reaction is, "Who cares?", 'cept for our pal, Skeeter Todd, and a handful of other K-freaks.

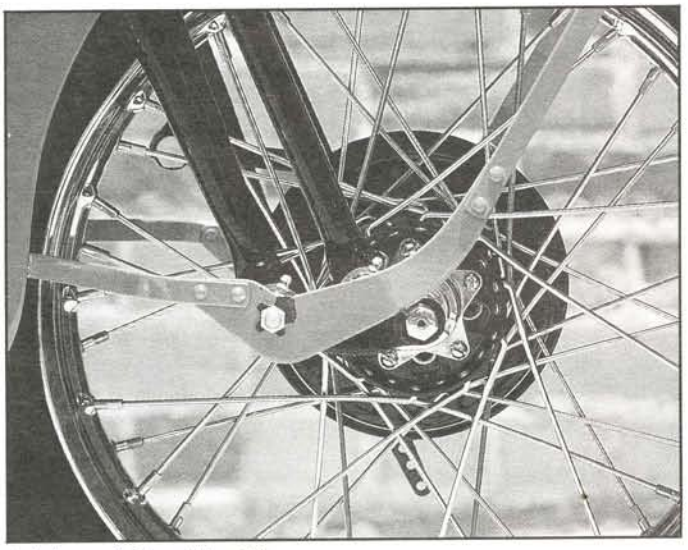
You see where this leads: not all restorations command equal respect. For instance, what's the point in spending up to $20,000 for a restoration that nobody would buy for $2,500? To get maximum value, your hard earned cash and labor to restore should go into a bike with some kind of distinction. For instance, Egan suggests the '36 VLH, which was the first of the 80 cubic-inchers, or the '48 pan, the last of the springer forks and the first of the tin tops. These things go in fashions, too, so naturally, knuckles of all years are desirable restorables, even though they are not particularly rare. Of course, restoration is a private and personal matter, too. If you just admire a particular model—it was built the year you were born, the year you got married, or the year you got divorced—and want it for your own satisfaction, then suit yourself. Just don't look at it as a money-making project.

Once you get your choice item in hand, you'll fall into the initiation phase of your new membership. Find out about the vintage shops in your area, and check their pedigrees carefully. Some haven't fully earned the title and may not be the place to go. Likewise, you'll want to check out vintage swap meets and get acquainted with the regular vendors. Let them know what you're looking for. If they don't have it, they may know someone who does.

The next step is to make some tough, honest decisions about: 1) what you can do yourself and 2) what you better farm out to a specialist—that is, a qualified one. If you don't know how to handle rust, for example, you can destroy more than you save just getting things apart. You can also screw up with enthusiastic ignorance: dunk a frame in a caustic chemical bath, and the caustic liquid will

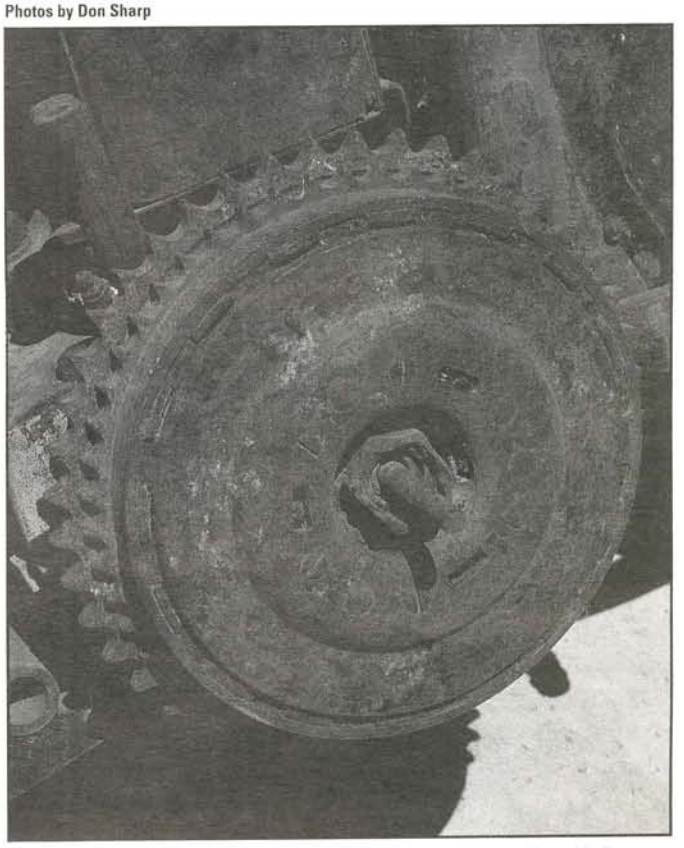


Rust. You'll fight it all the way.



And when you finish, you'll have this.

Photos by Don Sharp



Cobble work to fix — an off-year clutch with the hub nut gouged out by a blunt chisel.

creep into tiny crevices in the metal and ooze out months later to spoil a paint job. These are just two of many sources of potential disappointment. A restoration, Egan advises, more than any other project, means that, "If you don't know, you better ask someone who does."

You can usually get a shop manual for the bikes that people ride, even a scoot 50 years old. For the real oldies, and for the *real* rarities like Pope, Excelsior, Superior, Cleveland and others, you'll find yourself photocopying drawings from a 1916 issue of *Popular Science*.

The upshot is, you virtually have to write your own manual as you go along. Get an auto-exposure 35mm camera and take pictures of everything, especially details of disassembly, from several angles. Black-and-white film is fine, but you'll have trouble finding a processor nowadays, so you may as well use color. Make notes along the way, and diagrams. Sometimes whether the bolthead goes inside or out makes the difference in things going back together, months after you've forgotten how they came apart.

Do not—and Mike Egan gives this warning great emphasis—do *not* take things apart without doing your documentation. The bitter tears of failure stain many of those basket cases you see for sale: somebody got it apart, scattered the hardware, and couldn't figure out how it went back together.

Vintage specialists, such as the various clubs and swap meets do an amazing job of supplying parts and expertise for restorations. Mike Egan, for example, has 100 tons of new and used parts and accessories for both modern Harleys and candidates for restoration—enough goodies to fill a 160-page catalog. He also offers full rebuilding services for 45 and Big Twin engines, and maintains an inventory of vintage and classic cycles, (805) 933-1557. Nonetheless, you can't expect a restoration to be easy (just absorbing and interesting). Hassles will arise, gaskets being a special problem. Auto parts stores can supply the common paper and cork gasket material, but you'll look long and hard for that ultra-thin gasket paper used between cases and at transmission end plates. If you absolutely can't find the thin paper, let the specialty shop solve the problem.

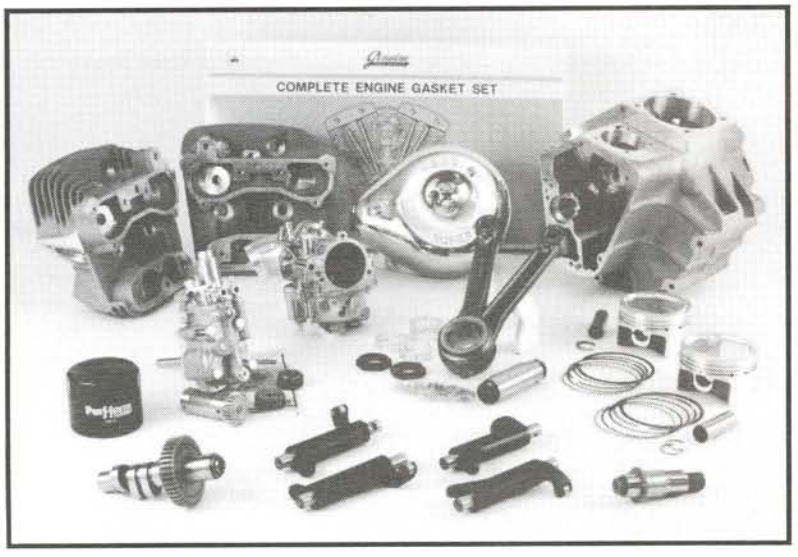
This is just the tip of the iceberg. You'll also have the problem of finding the right pegs, the right stand, getting old stuff rechromed, finding instruments (and getting their faces repainted), getting the paint and the logo right, and having the right size spokes—this is still all on the outside. Inside, you'll need engine bearings, transmission thrust washers, and even special lock-tab washers. In other words, a restoration project is not for a guy who demands instant results.

On the other hand, if you get your pleasure from preserving the original truths whence the latest Evo springs and want to get elbow and billfold deep into restoration, let us know. Drop a line to:

Restoration Project
Box 3000
Agoura Hills, CA 91301.

If you need advice, lay the question on us. Also, tell us what bikes you're working on, or are interested in.

AMERICAN Nempco MADE



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- HASTINGS Rings
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- PERF-FORM Oil Filters
- SIFTON Cams
- S & S Supreme Rods
- S & S Ultimate Oil Pumps
- S & S Super E Carburetors
- S-T-D Heads
- WISECO Pistons

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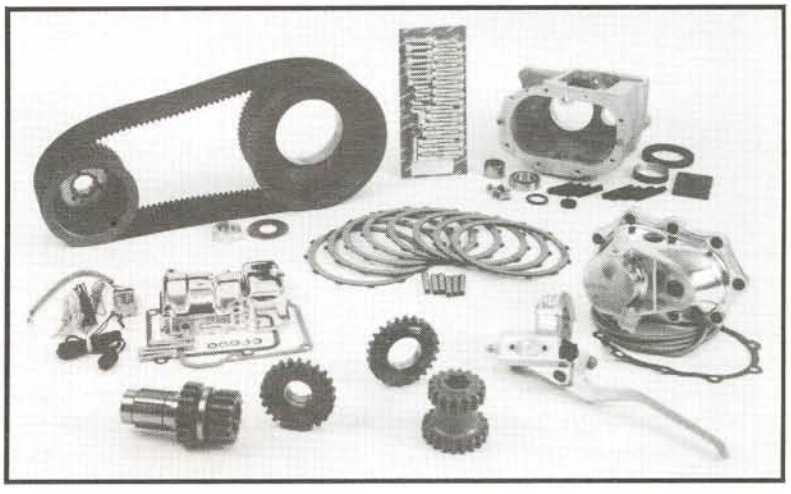
- BARNETT Kevlar Clutch Plates
- D.P.D. Hydraulic Hydra-Clutch
- GARDNER-WESTCOTT Chrome Allen Bolts
- HOLESHOT PERFORMANCE Powershifter
- PRIMO Belt Drives
- SPUTHE Conversion Transmission Cases



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MODEL HISTORY OF THE WORLD'S BEST

Harley-Davidson 90th Birthday Is Just Around The Corner

Harley-Davidson of Milwaukee, Wisconsin—not just America's oldest motorcycle company, but the oldest in the world. Other marques began as early, but died on the market trail or lost themselves in amalgamations that robbed them of their identity. Of the original turn-of-the-century bunch who set out to put the world on two wheels, only Harley-Davidson survives.

Officially, the company dates itself from 1903, but the story really begins in 1901 with William S. Harley and Arthur Davidson trying to build an engine for a bicycle. Arthur's brother, Walter, a railroad machinist, joined them in 1902, shortly followed by yet another brother, William A. Davidson. By late 1902, they had an engine that ran well enough by the standards of the day, so they designed a "loop" frame to go with it and got ready to build motorcycles.

Noting that the "kids" were playing with gasoline down in the basement, the Davidson father, William C., built them a nice 10-foot x 15-foot "factory" in the backyard. Harley and the Davidson brothers painted *Harley-Davidson Motor Co.* on the door and spent most of 1903 putting three prototypes together. In December, they sold the first one. After that, they kept on building.

Harley-Davidson raced against the best in the early days, went to war in 1917, survived and made progress during the Great Depression, went back in uniform in '42, and made Glide forks as much a part of the '50s as tailfin cars. The success or failure of a family business can sometimes turn on a dime, though, and in 1965 they had to "go public" to raise money. That opened the door to a friendly take-over by American Machine and Foundry in 1969, a take-over that provided a new factory in York, Pennsylvania, but which also diluted the H-D name with a line of low-displacement bikes of foreign extraction.

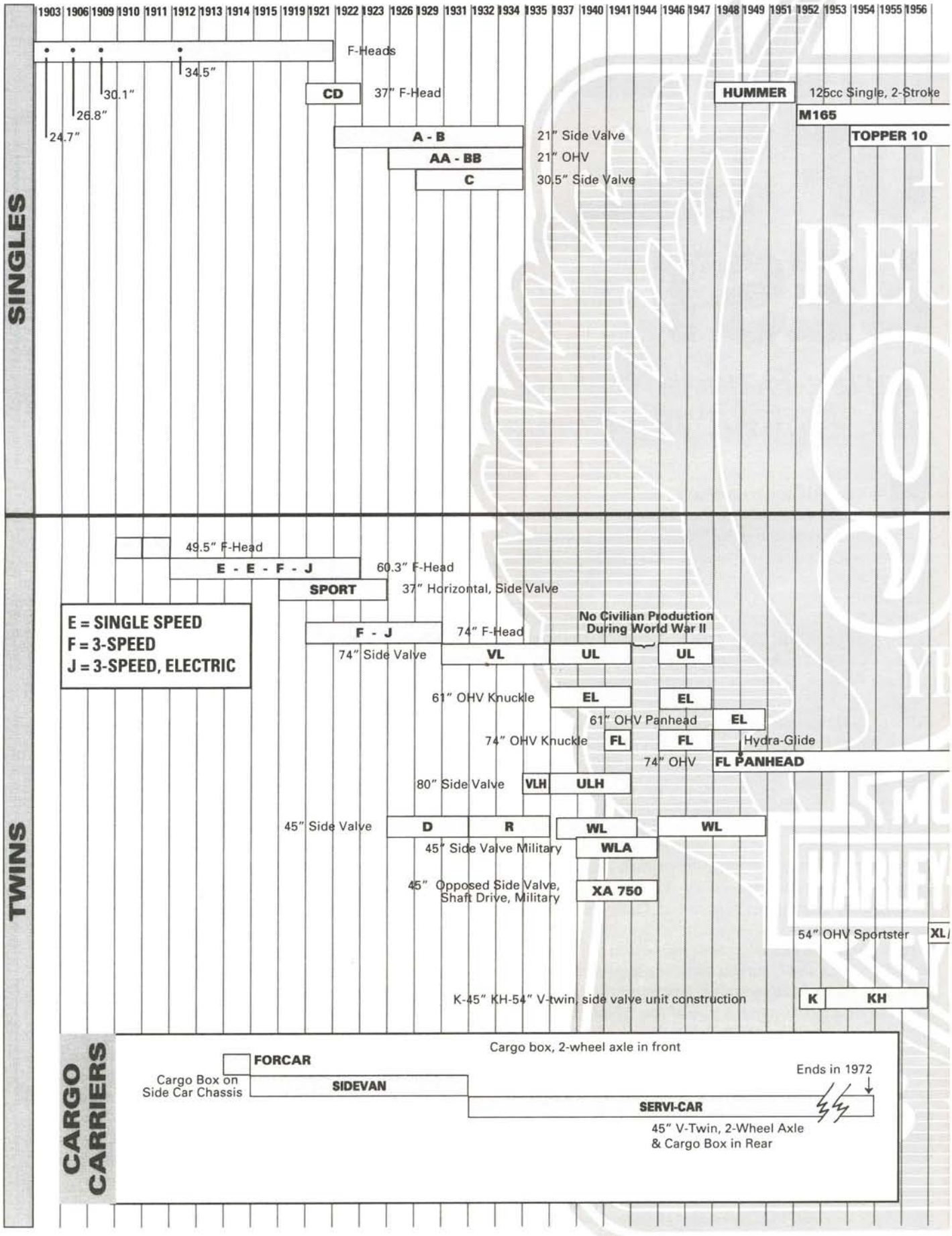
The Nixon-Carter years were bad for H-D (and for everybody else building things in this country). By 1980, AMF corporate management had about all of the motorcycle business it could take and began regarding H-D as a candidate for a mercy killing. Fortunately, a group of H-D officials mounted a plan to buy the company and run it the way it started out: by a close-knit group devoted to motorcycles. After the buy-out in 1981, and after some initial hassles getting re-organized, the new management brought out the new Evolution engine, along with several new designs, including the Softail that has become so popular. They also set up the Harley Owners Group (H.O.G.) and encouraged all other Harley riders to support their runs for the Muscular Dystrophy Association (MDA).

Not a bad record for 89 years. Consider, for example, the hundred or more American companies that built bikes at one time or another but disappeared leaving no more than traces. In the same way, as many as 2,500 companies once built cars in America. Note likewise the way aircraft, truck, and farm equipment names have disappeared from the national roster. Yet, Harley-Davidson survived all that and now builds a bike that more people want the most.

Even Harley riders have trouble explaining the attraction, though all would agree that the V-twin rumble accounts for a lot it. No matter the reason, Harley-Davidson remains, as one Citicorp banker observed, about the only product name that people tattoo across their chests.

To celebrate the past 90 years, in June 1993, H-D invites its riders to come to Milwaukee for a big birthday party. On the way, those who like can participate in a series of national MDA runs that will depart from L.A. and San Francisco in Calif.; from Orlando, Fla.; from Kitty Hawk, N.C.; and, from San Antonio, Texas. Canadians will depart from Edmonton, Alberta; Vancouver, British Columbia; and Montreal, Quebec.

As a birthday salute we dusted off our H-D History Chart, did our damnedest to update it (with some assistance from the factory, thanks John) and have reprinted it on the following pages—enjoy. —Maestro


1903 1906 1909 1910 1911 1912 1913 1914 1915 1919 1921 1922 1923 1926 1929 1931 1932 1934 1935 1937 1940 1941 1944 1946 1947 1948 1949 1951 1952 1953 1954 1955 1956
SINGLES
F-Heads
24.7"
26.8"
30.1"
34.5"
CD
37" F-Head
HUMMER
125cc Single, 2-Stroke
M165
TOPPER 10
A - B
21" Side Valve
AA - BB
21" OHV
C
30.5" Side Valve
TWINS
49.5" F-Head
E - E - F - J
60.3" F-Head
SPORT
37" Horizontal, Side Valve
E = SINGLE SPEED
F = 3-SPEED
J = 3-SPEED, ELECTRIC
F - J
74" F-Head
No Civilian Production During World War II
74" Side Valve
VL
UL
UL
61" OHV Knuckle
EL
EL
61" OHV Panhead
EL
74" OHV Knuckle
FL
FL
Hydra-Glide
74" OHV
FL PANHEAD
80" Side Valve
VLH
ULH
45" Side Valve
D
R
WL
WL
45" Side Valve Military
WLA
45" Opposed Side Valve, Shaft Drive, Military
XA 750
54" OHV Sportster
XL
K-45" KH-54" V-twin, side valve unit construction
K
KH
CARGO CARRIERS
Cargo box, 2-wheel axle in front
FORCAR
Cargo Box on Side Car Chassis
SIDEVAN
Ends in 1972
SERVI-CAR
45" V-Twin, 2-Wheel Axle & Cargo Box in Rear

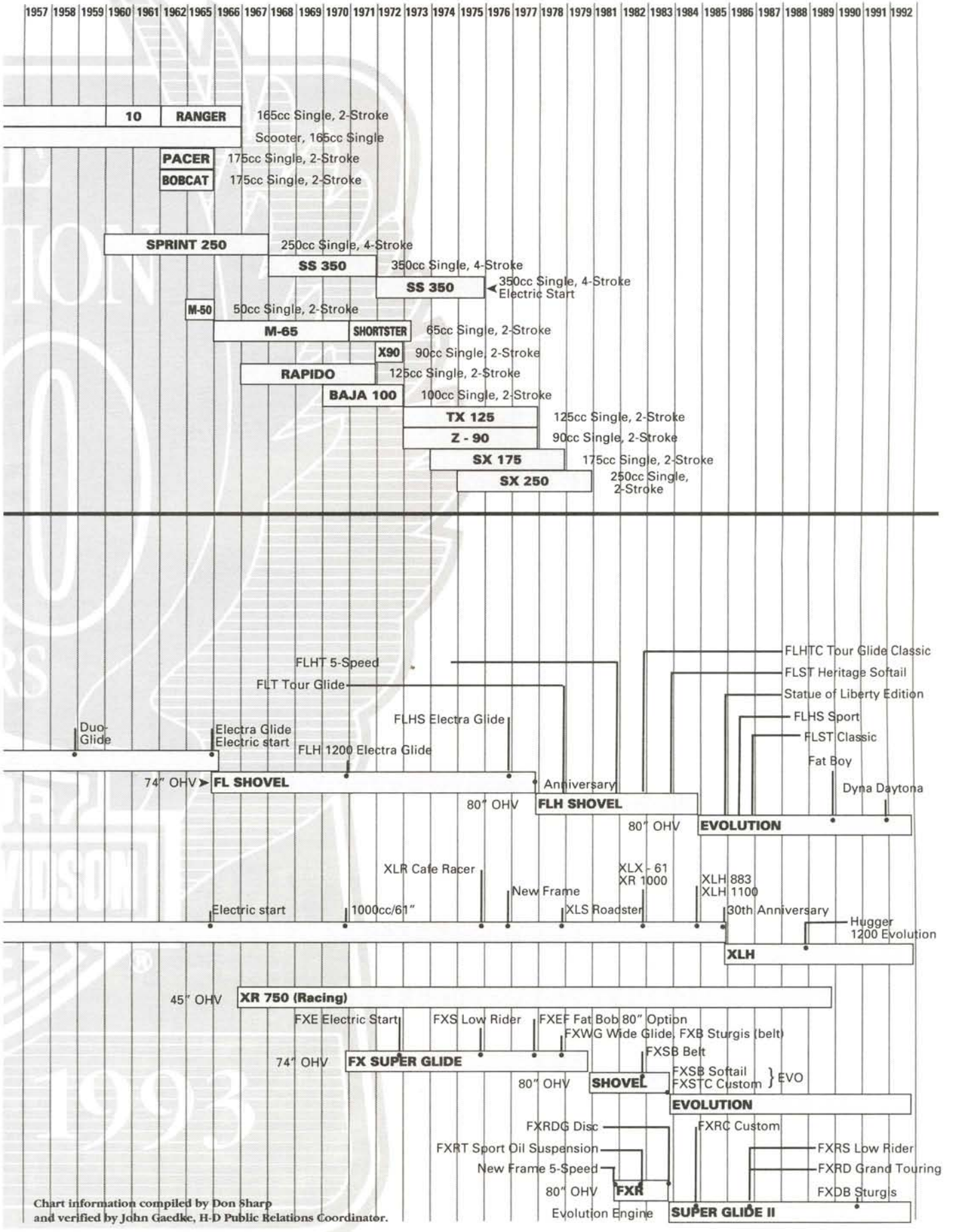


Chart information compiled by Don Sharp
and verified by John Gaedke, H-D Public Relations Coordinator.

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Welcome to Kal•Gard®, the world leader in lubrication technologies! Kal•Gard® lubrication products deliver the ultimate in quality, performance and value for all your lubrication needs. In fact, the entire concept of the science of lubrication is taken very seriously at Kal•Gard®, we feel that it is our major obligation to produce the very best possible product. Consequently, we deliver the same quality and professionalism to all of our customers, whether they are Boeing, NASA, or the motorcycle shop down the road.

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KAL-GARD ***CHAIN KOTE*** is a specially developed lubricant for heavy duty roller chain applications. Chains have a unique requirement in that the lubricant must be very thin to penetrate the critical inner roller area, but thick enough to resist being thrown off at high speed. CHAIN KOTE is the perfect answer. It has a thin, penetrating lubricant that carries a high concentration of Moly and a high viscosity bonding agent which bonds directly to the areas of maximum load and wear. CHAIN KOTE will not be thrown off your chain at high speeds when properly applied, as per manufacturer's recommendations. It should be applied more often under competition of extremely dusty conditions.

KAL-GARD ***FOAM FILTER OIL*** is a special blend of oil and a high-tack bonding agent that stops sand, dirt and other contaminants from passing through the filter. This product will be especially popular with off-road and racing motorcycle riders. FOAM FILTER OIL is easy to apply and penetrates quickly into the smallest crevices to trap the maximum amount of dirt, contributing greatly to increased engine life.

KAL-GARD ***CONTACT KLEANER*** contains a special formulation of fast-drying, water-displacing solvents which rapidly cuts through oils and greases, leaving practically no residue and is excellent for ignition points, plugs and deep-cleaning bearings and drive chains, prior to lubrication.

KAL-GARD ***ENGINE GARD*** When added to 4 to 5 quarts of oil, ENGINE GARD offers the perfect Moly blend for all motorcycle engines and crank cases. ENGINE GARD will significantly reduce the friction and wear within your engine, providing a smoother shifting transmission, and giving you an increase in horsepower. Factory racing teams and touring riders around the world use ENGINE GARD to protect their expensive machinery. ENGINE GARD's Moly additive sets up a protective barrier of lubrication to prevent damage, even during starting and high load conditions.

Add ENGINE GARD next time you change your oil or when you need to top up your present oil and give your engine the best protection available. Also add ENGINE GARD to your manual transmission for the ultimate in performance and protection. We think your engines and transmissions are worth it.

KAL-GARD ***COMP 2*** has a very complex combination of ingredients with synthetic and petroleum based lubricants that provides outstanding film strength with extremely low ash content. The petroleum -based element is used to achieve excellent lubrication at low to medium engine speeds. The synthetic element provides lubrication at temperatures and engine speeds will in excess of those that can be reached by any two-stroke engine. The additive package in this oil is the finest combination of ashless chemicals available, specifically designed for use in very high performance two-stroke, and far exceeds the capabilities of conventional lubricants.

KAL-GARD ***FILTER KLEANER*** is the answer to a motorcyclists prayer. All you need to do is spray this product on your greasy, dirt-clogged filter, rinse with clean water, and that's it! Kal•Gard FILTER KLEANER works fast and is extremely effective. Even the thickest grunge just melts away instantly, leaving your filter clean and ready to use. There is no need to use gasoline or other flammable liquids ever again. FILTER KLEANER is completely water soluble and biodegradable. It can be used on all foam and fabric filters.

Indian History

In comparison to Harley-Davidson—and the comparison cannot be avoided, for it will always be made—Indian drew the better cards, but played them very badly. The early founders, George M. Hendee and Oscar Hedstrom, ran afoul of investors who loved money more than motorcycles. In the middle years, Indian wasted considerable energy and money in ventures—for example, outboard motors, automotive shock absorbers, gas cookstoves, and a convertible coupe powered by a 74-cubic-inch V-twin—that lay outside their competence. In the last days, the company fell among thieves who squandered its good name on unworthy machinery and left the famous marque holding aces and eights.

George M. Hendee began building bicycles in Springfield, Massachusetts, in 1898. This connection led to an acquaintanceship with Oscar Hedstrom, a racing cyclist. In those days, riders on a tandem bike ran ahead of a solo rider to break the wind for him. Engines were adapted to these pace bikes, which still carried two riders—one to steer and one to look after the engine. Hedstrom rode mechanic and built a pace bike that became famous for its reliability.

Hendee invited Hedstrom to join forces in building motorcycles. Hedstrom agreed, and while Hendee rounded up enough investors to get started, Hedstrom built a 13-cubic-inch, F-head engine of 1-3/4" hp that fit nicely into Hendee's standard frame. In 1901, he tested the protoytpe on Springfield's Cross Street Hill, a formidable 19-degree grade. The bike won the contest and Hendee Manufacturing Company built and sold 143 of the first models in 1902.

Hedstrom never slowed down afterwards. Indian had springer forks in 1905, a V-twin engine in 1907, a two-speed transmission in 1910, and rear suspension in 1913. Indians did not dominate in early racing, but they certainly kept the competition sweating to keep up or stay ahead.

Some shareholders, alas, were only interested in immediate dividends. Their distaste for Hedstrom's insistence on spending money for the best materials and to support a racing team led Hedstrom to resign in 1913. Hendee himself resigned in 1916. Without the two founders to provide focus, Hendee/Indian rather floundered for the next dozen years or so. They improved and expanded the product line, and maintained their eminence in racing, but the company seemed always on the verge of failure.

In 1923, the shareholders changed the name to Indian Motocycle Company—no "r" for legal reasons. Astute management by General Manager Frank Weschler got the company's finances in order by the late 1920s, despite a misguided effort to manufacture stationary engines. An equally misguided effort to develop a low-displacement motorcycle for a market that did not exist also wasted considerable money, but was at least balanced by the acquisition of in 1927. The four-cylinder Ace, designed by the William G. Henderson who originated the Henderson bikes, was the direction to go: bigger engines, not smaller ones.

Feeling flush, the shareholders voted to use the cash reserves to play the stock market, rather than plow them back into the company. Weschler resigned, and for the next few years Indian was the victim of its own opportunistic owners. Nonetheless, the engineers developed, and the production workers built, some of Indian's better works, particularly the 101-model Scouts.

The playing of stock-market games eventually degenerated into to borderline fraud. The threat of exposure led some members of the board of directors to sell their shares to Du Pont Motors, a producer of luxury cars headed by E. Paul Du Pont. Du Pont took over at Indian, and gave the company the stability it needed to survive the Depression and to improve the Scouts and Aces.

WWII initially helped Indian because of overseas orders, but ultimately the war almost killed the company: In the first place, Indian didn't make good profits off their military contracts. Second, the Army cancelled contracts in 1944, leaving Indian holding a large inventory of parts that could not be immediately shifted to civilian production.

As a final blow, in 1945 the company fell into the (deeply indebted) hands of Ralph B. Rogers, who apparently believed that the day of the big V-twin was over. Rogers planned to turn Indian into a builder of smaller motorcycles modelled on British lines. Accordingly, he authorized only enough production of the Chief models to keep dealers from resigning. When the small-displacement Indians finally became available, few people wanted them but people who wanted Chiefs couldn't get them.

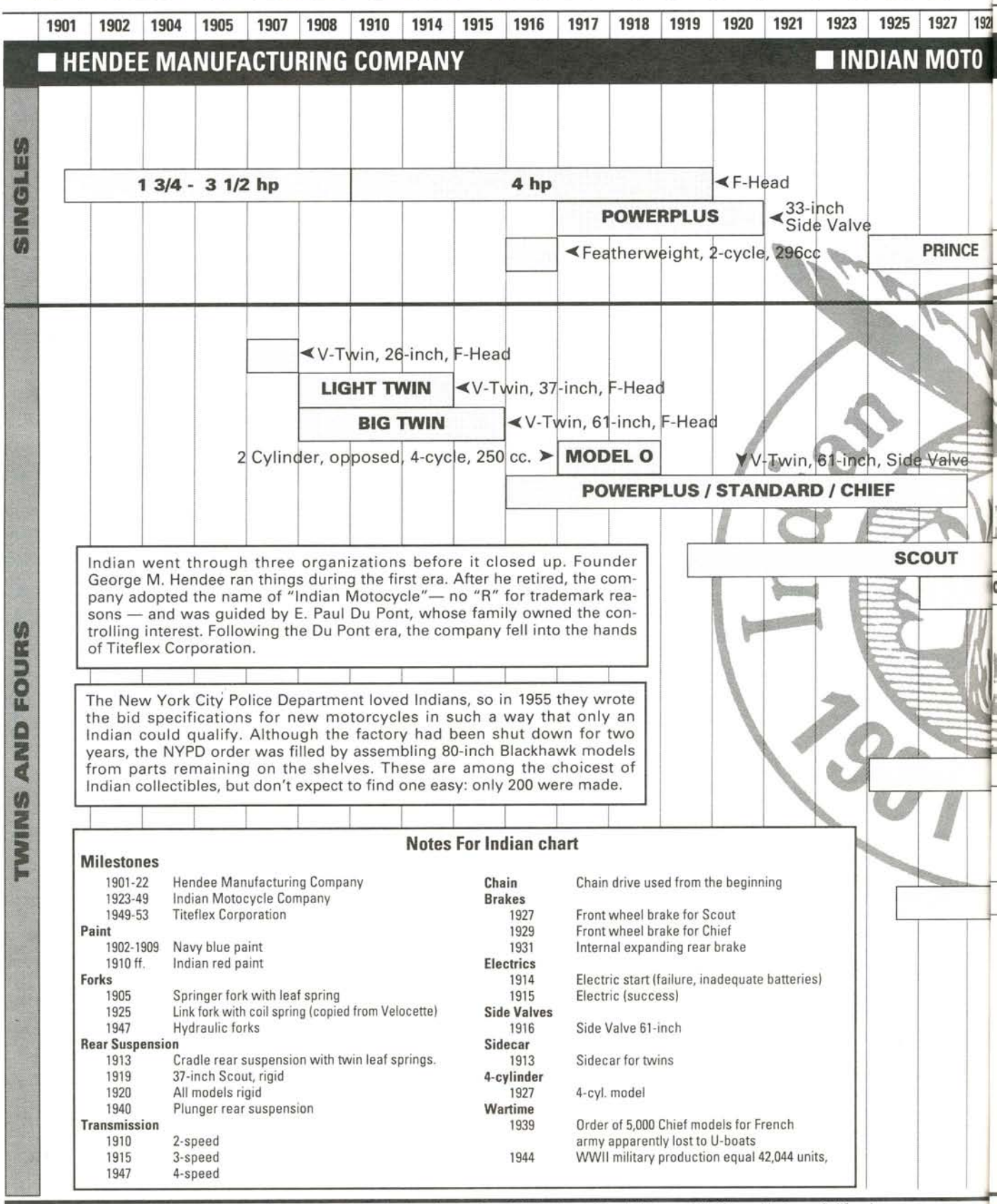
Financial problems next led a mauling at the hands of the people who provided financing for Rogers, namely the Atlas Corporation of New York and Brockhouse, Ltd. of England. In 1949, Atlas and Brockhouse divided the company into separate manufacturing and sales units, with manufacturing under the supervision of Titeflex Corporation, one of Atlas' properties. Titeflex built Chiefs and 500cc Warriors until 1953, then shut down the factory and sold the tooling.

Brockhouse and its successors were mainly interested in using the Indian name to impute Indian quality to the British iron they imported. The pretense did not last long, and neither did the Brockhouse successors. Indian was last used as the name of a motorcycle in 1959.

But a legend—and a reputation—that good won't die. In fact, it can even come back to life. Wayne Baughman, of Indian Motorcyle Manufacturing, Inc., of Albuquerque, New Mexico, proposes to build up-dated replicas of the original Indians. He expects to demonstrate prototypes by late 1992, and to have his new Indians available for sale by mid-1993. So, maybe the name hasn't ended, after all.

—Maestro

INDIAN LORE 1901-1955



Indian went through three organizations before it closed up. Founder George M. Hendee ran things during the first era. After he retired, the company adopted the name of "Indian Motocycle"— no "R" for trademark reasons — and was guided by E. Paul Du Pont, whose family owned the controlling interest. Following the Du Pont era, the company fell into the hands of Titeflex Corporation.

The New York City Police Department loved Indians, so in 1955 they wrote the bid specifications for new motorcycles in such a way that only an Indian could qualify. Although the factory had been shut down for two years, the NYPD order was filled by assembling 80-inch Blackhawk models from parts remaining on the shelves. These are among the choicest of Indian collectibles, but don't expect to find one easy: only 200 were made.

Notes For Indian chart

Milestones

1901-22	Hendee Manufacturing Company
1923-49	Indian Motocycle Company
1949-53	Titeflex Corporation

Paint

1902-1909	Navy blue paint
1910 ff.	Indian red paint

Forks

1905	Springer fork with leaf spring
1925	Link fork with coil spring (copied from Velocette)
1947	Hydraulic forks

Rear Suspension

1913	Cradle rear suspension with twin leaf springs.
1919	37-inch Scout, rigid
1920	All models rigid
1940	Plunger rear suspension

Transmission

1910	2-speed
1915	3-speed
1947	4-speed

Chain

	Chain drive used from the beginning

Brakes

1927	Front wheel brake for Scout
1929	Front wheel brake for Chief
1931	Internal expanding rear brake

Electrics

1914	Electric start (failure, inadequate batteries)
1915	Electric (success)

Side Valves

1916	Side Valve 61-inch

Sidecar

1913	Sidecar for twins

4-cylinder

1927	4-cyl. model

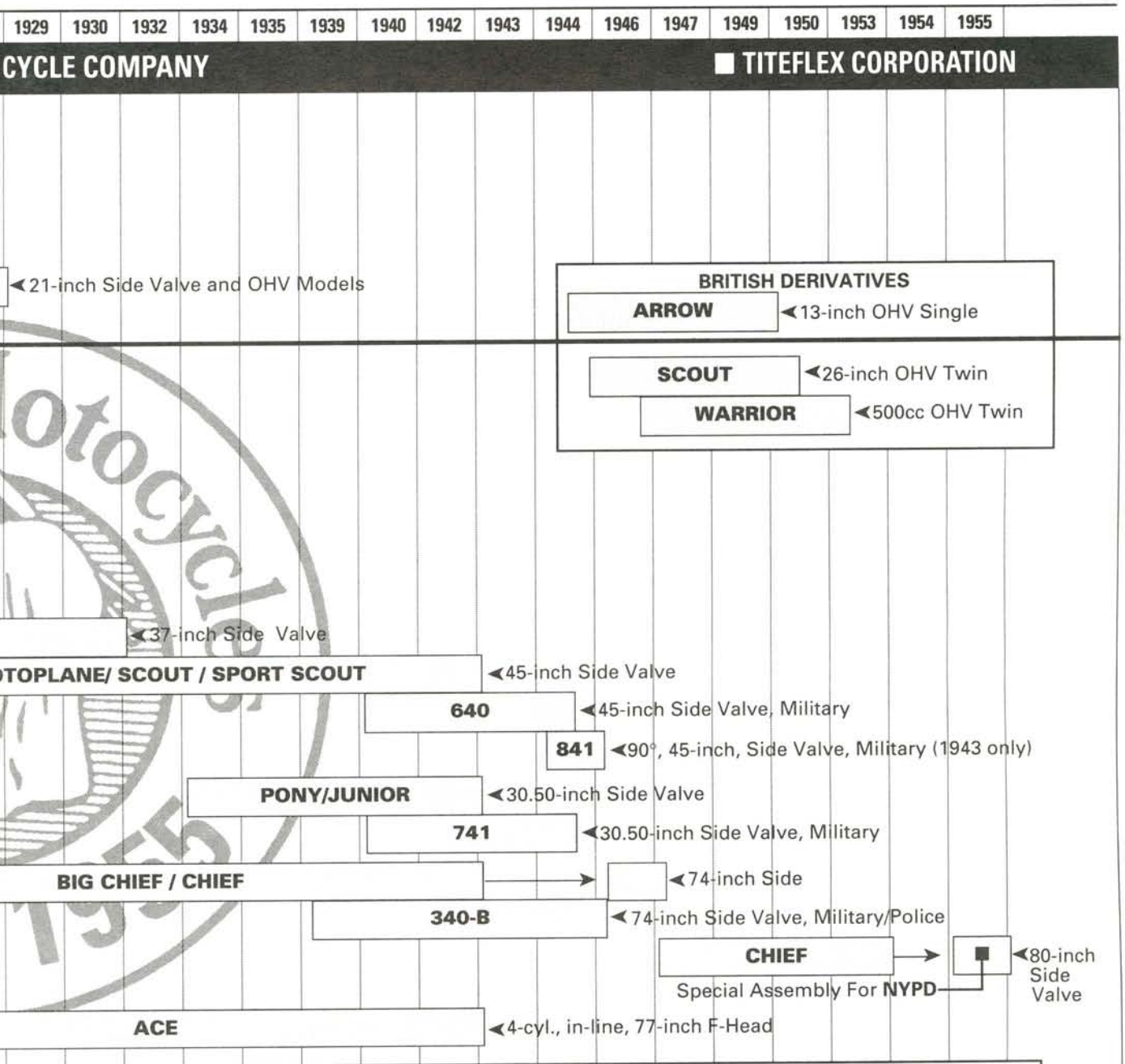
Wartime

1939	Order of 5,000 Chief models for French army apparently lost to U-boats
1944	WWII military production equal 42,044 units,

Coming in September: a list of shops that do Indian work.

Special thanks to: David Hansen, The Shop, Ventura, California
Morton Wood, Antique Motorcycle Club of America

Here's your capsule history of the Indian marque. Sources differ about what year a particular model came out, and we've generally assigned a model to the first year it was available rather than to its official model year.



Henderson, Ace, and Indian

William G. Henderson designed an F-head four and began producing motorcycles in Detroit in 1912. In 1917 he sold the name and patents to Ignatz Schwinn of Chicago, who built bicycles and Excelsior motorcycles. With design changes along the way, Schwinn produced Excelsiors and Hendersons until 1931.

Henderson designed a new engine, found some financing, and began producing Ace motorcycles in Philadelphia in 1919. Unfortunately, he was run down by a car while testing a bike in 1922, and financial starvation brought production to an end in 1924. The buyer of the name and tooling moved production to Blossburg, Pennsylvania, but shut down within a year. A new firm, Michigan Motors Corporation, put Ace back in production in Detroit in 1926. In late 1926, Indian bought Michigan Motors, moved production to Springfield, and added the bike to their line as the Indian Ace, later the Indian Four.

The Four was simply one way to get more cubic inches. As V-twins got bigger, the Four had less reason to exist, so Indian did not produce it after WWII.

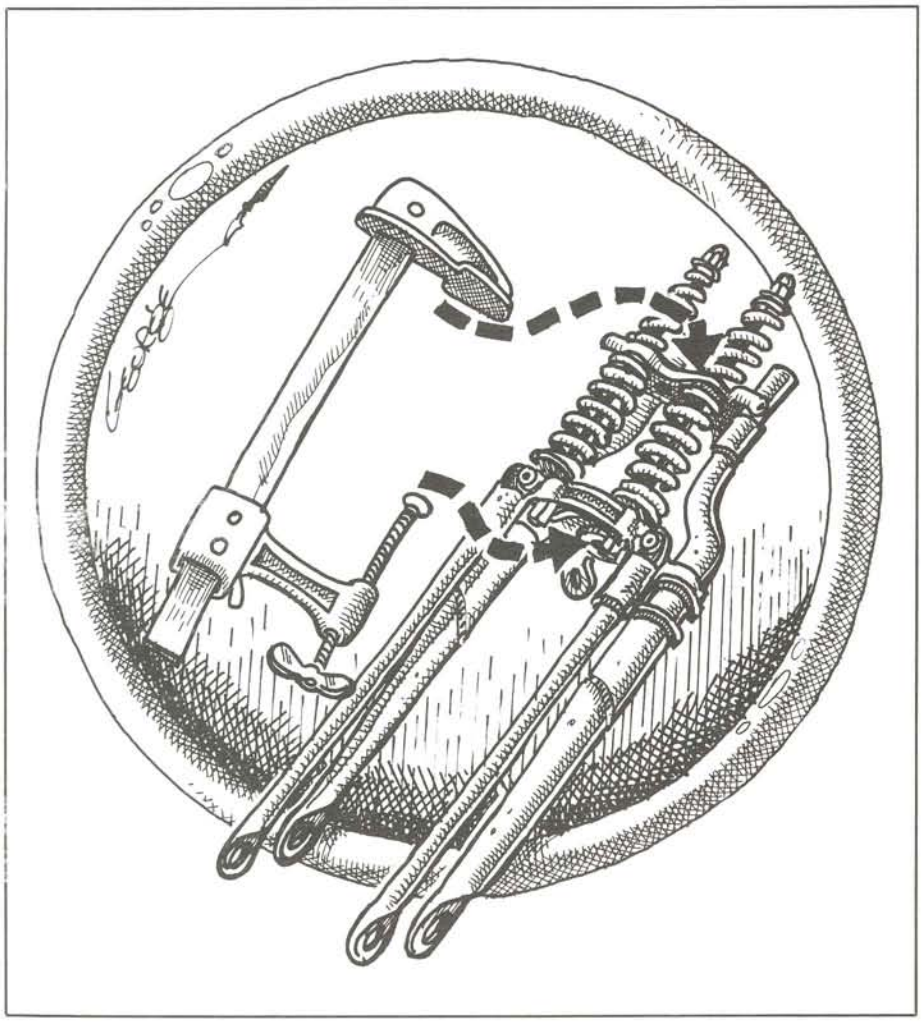
When post-war production resumed in 1946, Indian offered three Chief models: the plain Clubman, the fancier Sportsman, and the full-dress Roadmaster. After 1950, all Chiefs carried the Blackhawk designation.

Based on Harry V. Sucher's, *The Iron Redskin*, Haynes Publications, Inc., Newbury Park, California (1977).

FIX TIPS

SPRINGER SPRINGS

Removing And Installing Springer Springs



Now you can paint or chrome the springer parts you want—and put them back together without harming yourself, your bro, or the front end!

Ever been up against the problem of trying to disassemble a springer front end without having the springs end up in the next county?

I happened upon this easy way one day, as I was kickin' back, gazing at the tools on my pegboard. There it was . . . a giant-sized clamp I had used time and time again on welding and assembling projects. This particular one is made in the USA by the Jorgensen Co., the part number is 4518.

It has a very large reach and, if used properly, can be clamped between the crossover area on the front fork (between spring rods) and on top of the crossover area on the rear fork. This will compress the springs down, as you draw in the large "wing head bolt" on the clamp, and release the tension against the nuts on top of the springs.

It is a helluva lot easier than simply loosening the nuts and watching them sail into your bro's crotch, ending a friendship. Oh yeah, did I mention to have the front end "off" the bike and rockers removed?

—Terry Williams
Latham, Ill.

American Motorcycle Manufacturers

Who Built What, When And Where?

About a dozen years ago, Michael Gerald and Jim Lucas, a pair of respected motorcycling wordmongers, hunted up the names of all the American motorcycle manufacturers they could find. The list they compiled earned the approval of the vintage motorcycle people and *Easyriders* published it in the February, 1992, issue.

And promptly got a complaint from a reader in Germany. The reader submitted a list compiled by one Wolfgang Wiesner, which we publish here as "Wolfgang's List," and gave us some heat for not knowing about the names Wolfgang added to Gerald-Lucas.

Problem is, we don't entirely trust Wolfgang's list. The antique clubs don't recognize it, and the office ancient thinks the Yardman Motorette was a garden tractor. To check it out, we turned to the sources we could find in our desks; *to wit and viz.*, Harry V. Sucher's history of Indian motorcycles, *The Iron Redskin*; Erwin Tragatsch's *Illustrated Encyclopedia of Motorcycles*; and a few issues of *Vintage Mounts*, the now defunct antique magazine of several years ago. In checking on Wolfgang, though, we found arguable elements in the Gerald-Lucas list, too.

A few remarks about these sources. Sucher has been condemned for occasional (or frequent) errors. On the other hand, the biker adage says "If you ain't been there, shut the hell up." That is, Sucher's book runs to 334 fair-size pages of small print, meaning the typescript must have run close to 1,000 pages. If you've never put together a 1,000 page manuscript that covers 60-odd years of confused history, you won't appreciate the job Sucher set for himself. Yeah, maybe he got a few things wrong, but he still provides the starting point for anyone interested in Indian, tells a lot about other motorcycles, and gives detailed reports on the early races. Give the man a little slack.

Like Sherwin-Williams Paints, Tragatsch's *Encyclopedia* covers the earth. You will have no idea how many different bikes and scooters have been built somewhere, at one time or another, until you check out Tragatsch. However, since his scope is international, his list of American manufacturers includes only about one-third of those on the Gerald-Lucas list.

Vintage Mounts was published in Jacksonville, Florida, with Gene Edwards as Publisher and C. Tim Riley as Technical and Historical Consultant. (If you guys read this, give us a call.) *Vintage Mounts* cleared up some fuzzy details in the other sources.

The lists raise the question of what a name had to do, or be, to get included. Take Pennington, for example. As Sucher tells it, Pennington was a hustler in Trenton, New Jersey. In 1894, he built a bike with a two-cylinder engine mounted behind the rear wheel. The connecting rods ran to the rear axle, which also served as the crankshaft. Alas for two-wheeled progress, Pennington made no provision for cooling, so he had to keep his demonstration runs very short to assure that the pistons didn't seize up and spoil the impression he was trying to make. A hundred yards per ride didn't persuade would-be investors, so Pennington took the idea to England and sold it to one Harry J. Lawson. Lawson built two bikes to Pennington's design, but neither would run. Pennington, meanwhile, took Lawson's money and came home before he could be prosecuted for fraud.

Sucher says the affair ended in 1899. Tragatsch lists it as an English effort of 1896-97. Gerald-Lucas don't list it - after all, the Pennington never ran and was never sold (to anybody but Lawson, and he wasn't interested in riding it). Wolfgang lists it but locates it

in Cleveland, Ohio.

We'd trust Sucher on the location, but the question remains: Does the Pennington belong on a list of motorcycles that were once "manufactured"?

As an illustration of the way a simple listing obscures the facts, we learn from *Vintage Mounts* that Merkel originated in Milwaukee (in 1902 according to Gerald-Lucas), but merged with the Light Motor Company of Pottstown, Pennsylvania in 1909, which accounts for the Merkel Light. (Wolfgang puts Light in Marietta, a village about 50 miles west of Pottstown, but let it pass.) In 1910, the company built the Flying Merkel, a purely racing machine that was not available to the public. Although built in limited numbers for only one year, the Flying Merkel stayed prominent on the racing circuit for several years afterward. In 1911, the company merged with Miami Motorcycle Company, and moved operations to Middletown, Ohio.

Question: if the Flying Merkel was a limited-edition racer that was not sold to the public, does it belong on the list? If it does, then every racing special built by Indian and Harley-Davidson belongs on the list, too, right?

Picking up the story from Sucher, much of the Merkel reliability came from the ball bearings the company bought from Germany. WWI cut off the supply of bearings and Merkel went into decline. In a desperate, last-ditch effort of 1922, the company designed a bike with the engine incorporated into the rear wheel, and proposed to sell this aberration as the Merkel Motor Wheel.

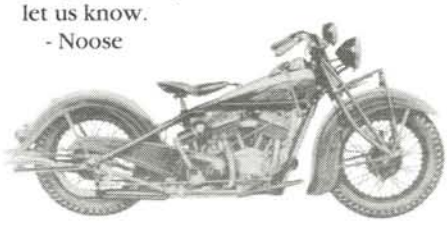
Merkel bought castings from Brown and Sharpe, who also made castings for Indian. B&S talked Indian into assembling the Motor Wheel for Merkel, and the castings were shipped to Indian. Shortly thereafter, Merkel collapsed completely, so Indian assembled 200-odd engine-wheel contraptions and installed them in Indian frames. The result was neither a mechanical nor a market success (engine in the rear wheel? whaddya expect?). Indian got rid of the things any way they could, and, like a bunch of guys after a wife-swapping party, tried to forget what they'd done (perfectly undertandable).

Sucher and Gerald-Lucas end the Flying Merkel in 1916. Tragatsch assigns it to 1909-15. Of the three sources, only Sucher mentions the Motor Wheel. Wolfgang lists the Motor Wheel but locates it in Rochester, New York, in 1917. Per Sucher, the Motor Wheel should be assigned to Indian of Springield, Massaschusetts, in 1922.

A few other examples of confusion: *Vintage Mounts* assigns Marks to San Francisco in 1896-1902 and shows the picture to prove it. Gerald-Lucas don't list Marks, but Wolfgang assigns it to 1902, the year Marks merged with California, which itself later merged with Yale to form California-Yale. Gerald-Lucas assign Rocket to Columbus, Nebraska, but the Rocket we find in *Vintage Mounts* was built by Mitsubishi and looks like a one-lunger Brit. Gerald-Lucas give the J.B. Special to Long Island, but Tragatsch says it was built in Germany by Fichtel and Sachs and imported to America by a guy named Joe Berliner.

This gives you an idea of the documentary thicket you have to claw through to sort out motorcycle history. The net conclusion is that we don't have any one list that is complete and beyond question. Bros, if you know anything about any of these obscure names, let us know.

- Noose



Two-Wheeled History

Here's your chance to catch us chasin' women instead of studyin' history. Below is a listing of all the two-wheeled motorized vehicles produced in the United States between 1869 and 1979. It was originally compiled by Michael Gerald and Jim Lucas, and published by *Road Rider* magazine in August of 1979. It has been altered some since then and with your assistance, we'll continue to improve it.

Name	Location of Mfgr.	Production Year(s)
Ace	Philadelphia, PA	1920-24
AMC	Chicago, IL	1912-15
America	La Porte, IN	1904-06
American	Chicago, IL	1911-14
American	Louisville, KY	1921
American Rocket	Monterey Park, CA	1952
Apache	Denver, CO	1907
Argyle Scooter Club	Memphis, TN	1957-61
Armac	Chicago, IL	1911-13
Arrow	Chicago, IL	1909-14
Aurora	Aurora, IL	1912
Autocycle	Philadelphia, PA	1907
Autoped (Eveready)	New York , NY	1915-21
Badger	Milwaukee, WI	1919-21
Bayley-Flyer	Chicago, IL & Portland, OR	1913-17
Barr Steam	Middletown, OH	1940
Black Diamond	Philadelphia, PA	1905
Blackhawk	Rock Island, IL	1911-12
Bradley	Philadelphia, PA	1905-12
Breed	Bay City, MI	1912
Buckeye	Columbus, OH	1905
California	San Francisco, CA	1903-?
Centaur	New York , NY	1961
Century	Chicago, IL	1917
Champion	St. Louis, MO	1911-13
Chicago 400	Chicago, IL	1905
Clark Cyclone	South Gate, CA	1947-48
Clarke	St. Louis, MO	?
Clemcut	Hartford, CT	1905-09
Cleveland	Hartford, CT	1902-04
Cleveland	Cleveland, OH	1915-29
Cleveland Welding	Cleveland, OH	1950
Columbia	Hartford, CT	1900-05
Comet	Elwood, IL	1911
Cpoeland Steam	Phoenix, AZ	1885
Crawford	Morgantown, WV	1913-14
Crescent	Hartford, CT	1905-06
Crocker	Los Angeles, CA	1936-41
Crosley	Cincinnati, OH	1943
Crouch	Stoneham, MA	1905-06
Crown	La Porte, IN	1910
Curtiss	Hammondsport, NY	1903-12
Cushman	Lincoln, NE	1938-42, 1945-47-?
C.V.S.	Philadelphia, PA	1911-?
Cycle-Scoot	Indianapolis, IN	1953-55
Cyclemobile	Toledo, OH	1917
Cyclone	St. Paul, MN	1913-15
Dyton	Dayton, OH	1911-18
Delaware	Delaware, OH	1909
Delong	Phoenix, NY	1902
Deluxe	Chicago, IL	1912-15
Detroit	Detroit, MI	1910-11
Detroit Bi-Car	Detroit, MI	1911
Doodlebug	Webster City,IA	1954-58
Duck	Stockton, CA	1905
Dukelow	Chicago, IL	1913
Dyke	St. Louis, MO	1903-06
Dynacycle	St. Louis, MO	1949-52
Eagle	Minneapolis, MN	1909
Eagle	Chicago, IL	1910-15
Electra	?	1912
Elk	Elkhart, IN	1911
Emblem	Angola, NY	1909-17
Erie	Hammondsport, NY	1909-11
Eshelman	Baltimore, NY	1954
Evans	Rochester/Albany, NY	1918-27
Excelsior	Chicago, IL	1907-24
Fairchild	Pasadena, CA	?
Feilbach Ltd.	Milwaukee, WI	1912-15
Flanders	Detroit, MI	1911-14
Flying Merkel	Pottstown, PA & Middletown, OH	1911-16
Fowler Four	Cleveland, OH	1924
Franklin	Mt. Vernon, WA	1899-1900
Freyer & Miller	Columbus, OH	1902-07
Geer	St. Louis, MO	1905-09
Gelbke-Auto Four	Chicago, IL	1971-72
Gerhart	Mt. Holly Springs, PA	1912-13
Gibson Mon-Auto	New York, NY	1915-17
Globester	Joilet, IL	1946-49
Greyhound	Buffalo, NY	1907-14
H&H	San Diego, CA	1902-03
Harley-Davidson	Milwaukee, WI	1903-
Haverford	Philadelphia, PA	1909-14
Hawthorne	Chicago, IL	1912
Heald	Benton Harbor, MI	197?
Henderson	Chicago, IL	1911-31
Herring	St. Joseph, MO	1899
Hilaman	Moorestown, NJ	1906-12
Hoffman	Chicago, IL	1906-07
Holley	Bradford, PA	1902-11
Horten Autbette	Detroit, MI	1911
Hudson	Middletown, OH	1910-11
Imperial	?	1903
Imperial	?	1910
Indian	Springfield, MA	1901-53
Indian Scout	El Monte, CA	1968
Iver-Johnson	Fitchburg, MA	1907-15
Jack & Heintz	Cleveland, OH	1949-55
J.B. Special	Franklin Sq., NY	1950
Jeepette	Los Angeles, CA	1943
Jefferson-Waverly	Jefferson, WI	1911-14
Johnson	Terre Haute & SouthBend, IN	1918-22
Kaye-Pennington	Racine, WI	1895
Keating	Middletown, CT	1901-02
Kenzler-Waverly	Cambridge, WI	1910-14
Kokomo	Kokomo, IN	1909-11
Kulture	Rochester, NY	1909
Langford	Denver, CO	191?-21
LaRay	Milwaukee, WI	1946-48
Leo	Oakland, CA	1905
Light	Pottstown, PA	1901-08
Lowther		
Lightning	Joilet, IL	1949
Lunford	Marble, NC	1916
Majestic	?	1912-13
Manson	Chicago, IL	1905-08
Marathon	Hartford, CT	1912
Marman	Inglewood, CA	1948
Marsh	Brockton, MA	1900-06
Marsh-Metz	Brockton, MA	1906-13
Marvel	Hammondsport, NY	1910-13
Maxim	Hartford, CT	1893
Maxim	?	1914
Mayo	Pottstown, PA	1905-08
MB	Buffalo, NY	1916-20
McDonald	Chicago, IL	1905
Meadowbrook	Hempstead, NY	1905
Merkel	Milwaukee, WI	1902-22
Merkel Light	Pottstown, PA	1909-10
Meteor	Chicago, IL	1909
Metz	Waltham, MA	1901-06
Miami	Middletown,OH	1905-08
Midget Bi-Car	Lynbrook, NY	1908-09
Militaire	Cleveland, OH & Buffalo, NY	1911-17
Militor	Jersey City, NJ & Springfield, MA	1911-22
Michaelson	Minneapolis, MN	1908-13
Minneapolis	Minneapolis, MN	1910-14
Mitchell	Racine, WI	1901-06
MOHS	?	196?
Monarch	Oswego, NY	1912-15
Monark	Chicago, IL	1950-55
Moore Car	Indianapolis, IN	1917
Morgan	Brooklyn, NY	1902
Morse-Beauregard	Detroit, MI	1912-17
Motopede	Rutherford, NJ	1921
Moto-Glide	Los Angeles, CA	193?
Moto-Scout	Chicago, IL	1946-48
Mustang	Glendale, CA	1945-61, 1971
Nelk	Palo Alto, CA	1905, 1912
Ner-A-Car	Syracuse, NY	1922-27
New Era	Dayton, OH	1909-13
New London	New London, OH	1896
Nilsson's Uno Wheel	?	1936
Nyberg	Chicago, IL	1913
Oakes	Johnstown, PA	1916
Orient	Waltham, MA	1900-05
Pam Autocycle	New York, NY	1921-22
Pansy	?	1905
Paramount	Columbus, OH	1917
Patee	Indianapolis, IN	1901
Peerless	Boston, MA	1912-16
P.E.M.	Jefferson, WI	1911-15
Pierce	Buffalo, NY	1909-13
Pirate	Milwaukee, WI	1913-15
Playboy	Oakland, CA	1956
Pope	Hartford, CT & Westfield, MA	1911-18
Powell	Compton, CA	1939-42, 1945-52

Wolfgang's List

Name	Location of Mfgr.	Production Year(s)
Ace II	Blossburg, PA	1925
Ace III	Detroit, MI	1926-27
American	?	1939
American Motor Bicycle	Hartford, CT	1901
Atco	Pittsburgh, PA	1912
Auto-Car	Pittsburgh, PA	1899-1904
Auto-Scoot	?	1938
Barber Special	Brooklyn, NY	1900
Bi-Auto-Go	Detroit, MI	1908-12
Bonanza	San Jose, CA	1967-69
Briggs and Stratton	Milwaukee, WI	1919-?
Buffalo	Buffalo, NY	1984
Caille Traveler	Detroit, MI	1933-37
Camden	Camden, NJ	1906-08
Camfield Steam	?	?
Clement	Hartford, CT	1903-09
Clinton-Tower	Cleveland, OH	1895
Comet	Minneapolis, MI	?
Commando	Minneaplois, MI	1950
Constructa-Scoot	Chicago, IL	1935-37
Cooper	?	1972
Culp	Columbus, OH	1903
Cyclemotor	Rochester, NY	1916-27
Driver	Philadelphia, PA	1903
Duesenburg	Garner, IA	1903
Eagle	St. Louis, MI	1911
Eagle	Brockton, MA	1913-20
Fleming	White Plains, NY	1901
Hafelfinger	?	?
Hausmann	Milwaulkee, WI	1918-?
Hercules	Hammondsport, NY	1903-04
Holmes	?	1900 ?
Kaestner	Chicago, IL	1903
Kellogg Bearcat	Rochester, NY	1950
Kiefler	Buffalo, NY	1909-11
Lamson	Abington, MA	1902-03
Landgraf	Chicago, IL	1906
Lewis	Brooklyn, NY	1901-02
Liberty	?	1918
Light	Marietta, PA	1913
Mansen-Marsh	Brockton, MA	1906
Marks	San Francisco, CA	1902
Mead Ranger	Chicago, IL	1938
Merkel Motor Wheel	Rochester, NY	1917-?
Michaelson	Minneapolis, MI	1908-13
Michigan	Detroit, MI	1911
Monarch	Hartford, CT	1902-04
Montgomery-Ward	Chicago, IL	1911-12
Motormaster	Cleveland, OH	1939
New Hudson	?	?
Okay	Brooklyn, NY	1916
Parkin	Philadelphia, PA	1903
Pennington	Cleveland, OH	1895-96
Phoenix	Milwaukee, WI	1906-08
Pioneer	Jersey City, NJ	1903
Pony Cycle	Clarkston, MI	1955
P.T.	New York, NY	1900
Puddle Jumper	Kearney, NE	?
Razoux	Boston, MA	1903
Red Arrow	Athens, OH	?
Regas	Rochester, NY	1900-02
Rockola	?	?
Rollway Motor Attachment	Toledo, OH	1919-23
Salisbury	Chicago, IL	1895
Skootmobile	Chicago, IL	1938
Smith Motor Wheel	Milwaukee, WI	1915-18
Spacke	Indianapolis, IN	1911-14
Steam Flyer	San Francisco, CA	?
Sturges	?	1900 ?
Thompson	Beverly Farms, MA	1909
Tiger Special	New York, NY	1906-09
Tinkham	New Haven, CT	1898-99
Trimoto (American Bicycle)	Hartford, CT	1900-01
Victoria	?	1900 ?
Victory Clipper	?	?
Waltham Orient Aster	Waltham, MA	1899-1903
Wasson	Haverhill, MA	1903
Williamson	Philadelphia, PA	1903
Willis	New York, NY	1903
Wilson	Wichita, KA	1910
Woods and Meagher	Richmond, VA	1896
Wysecycle	Dayton, OH	1947-50
Yale-California	San Francisco, CA	1904-08
Yardman Motorette	Jackson, MI	1959
Pratt	Elkhart, IN	1911-12
R & H	Brockton, MA	1905
Racycle	Middletown, OH	1905-11
Rambler	Hartford, CT	1904-14
Reading - Standard	Reading, PA	1903-22
Redman	?	1902-90
Reliance	Addison & Oswego, NY	1903-?
Riotte	New York City, NY	1895
Rocket	Columbus, NE	1962
Rokon	Keene, NH	196?-7?
Roper Steam Velocipede	Roxbury, MA	1869
Royal	Worcester, MA	1901-09
Royal Pioneer	Worcester, MA	1909-10
Ruggles	Brooklyn, NY	1909
Rupp	Mansfield, OH	196?
Salsbury	Oakland, CA	1936-42
	Pomona & Inglewood, CA	1945-51
Schickel	Stamford, CT	1912-15
Scout	Detroit, MI	1911
S.D.M.	Brooklyn, NY	1910-1
Sears	Chicago, IL	1912-16
Safticycle	La Crosse, WI	1945-50
Shaw	Galesburg, KS	1912-14
Simplex	New Orleans, LA	1935-42, 1945-64
Sinclair Militor	Springfield, MA	1912-22
Singer	?	?
Snell	Toledo, OH	1905
Spiegel Airman	Chicago, IL	1948
Springcycle	Los Angeles, CA	1938-42
Spiral	New York, NY	1896
Stahl	Philadelphia, PA	1910-14
Starlite	Crystal Lake, IL	196?
Steffey	Philadelphia, PA	1900-10
Super X (Excelsior)	Chicago, IL	1924-31
Thiem	St. Paul, MN	1903-14
Thomas Auto-Bi	Buffalo, NY	1902-12
Thor	Aurora, IL	1908-16
Thoroughbred	Reading, PA	1905
Tiger Autobike	Chicago, IL	1915-16
Torpedo	Geneseo, IL	1909
Torque	Plainfield, NJ	1945
Tourist	Newark, NJ	1906-07
Tribune	Hartford, CT	1903-?
Triumph	Detroit, MI	1912-13
Twombly	Portland, ME	1895
Valiant	?	1956
Vard	Pasadena, CA	1944
Victor	Cleveland, OH	1911
Wagner	St. Paul, MN	1901-14
Warwick	Springfield, MA	1903
Westover	Denver, CO	1912-13
Whipple	Chicago, IL	1906
Whizzer	Los Angeles, CA & Pontiac, MI	1949-62
Williams	New York City, NY	1917
Wizzard	?	195?
Woods	Denver, CO	1914
Yale	Toledo, OH	1902-15
Yankee	Chicago, IL	1922-23
Zimmerman	Cleveland, OH	195?

New Parts For An Old Friend

By Dutch Stevens

Do you know what it's like to scrounge, hunt, and dig around at swap meets for that special or hard-to-find part? Or make what seem to be endless phone calls to parts shops and warehouses for old or new stock?

Well, my bro, M.J., does. See, M.J. used to own his own bike shop, and after years of wrenching on and machining parts for other bro's scoots, he scored this 80-inch, 1945 Indian.

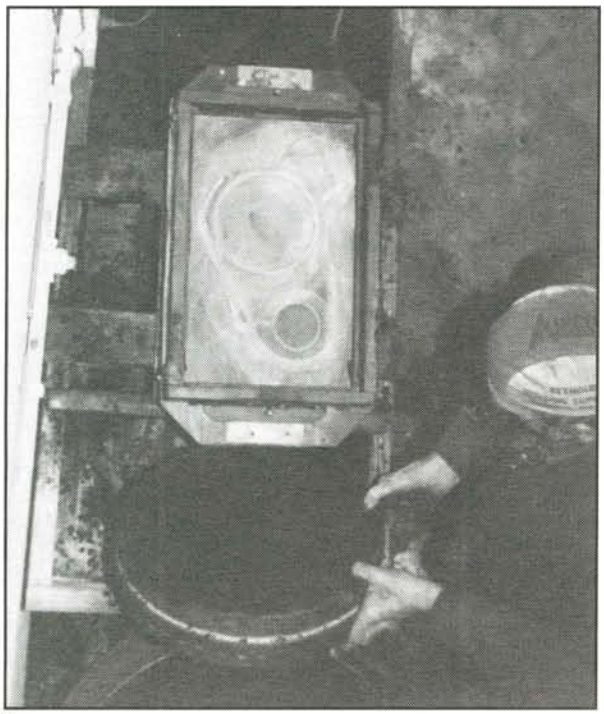
M.J. began putting together his prize, piece by piece, only to discover that the majority of parts were either worn out or gone.

Tired of digging through wooden crates, boxes, and junk at swap meets, M.J. started scrounging around at his local library. Yeah, you know, that little brick building on the corner of 5th and Main. While there, M.J. ran across a book on casting. No, I'm not talking about fly fishing. I'm referring to a way of shaping objects—in this case, the primary case and cover for his Indian. You take a liquid, pour it into a mold, and let it harden, right? Well, basically. Here's the process in more detail:

PICTURE 1: First, you have to make a pattern of the part that you're going to cast. This is what the actual parts are made from. These could be made from wood, metal, fiberglass, etc.

PICTURE 2: Most metals are cast in green sand, a mixture of sand, clay, water, and a binder that holds the sand together. This mixture is then packed in and around the pattern.

PICTURE 3: Here you have half of



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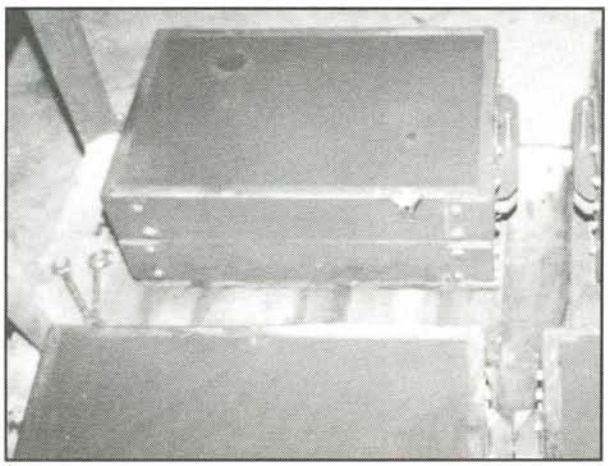

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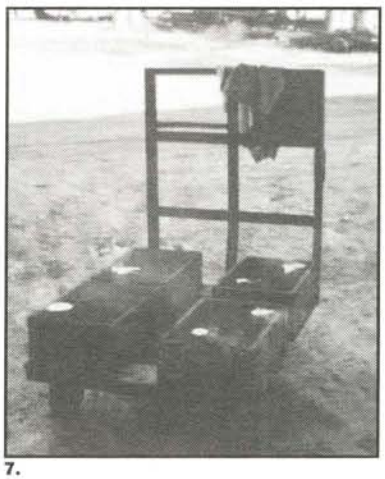

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the sand mold. The top is called a cope, and the bottom is called the drag. You perform the same process for both top and bottom.

PICTURES 4 & 5: Next you melt the aluminum or whatever metal you're going to use. At a mere 2300 degrees F, your steel will melt. And no, you can't use your ol' lady's cooking stove.

PICTURE 6: By the time you get the aluminum heated to a ripe pouring temperature of 1500 degrees F, you should have your flask (cope and drag) fastened together. You now pour the metal into the sprue (pour basin).

PICTURE 7: Let it cool approximately 45 minutes to an hour, depending on wind chill. Up here in the Northland it takes about a New York minute.

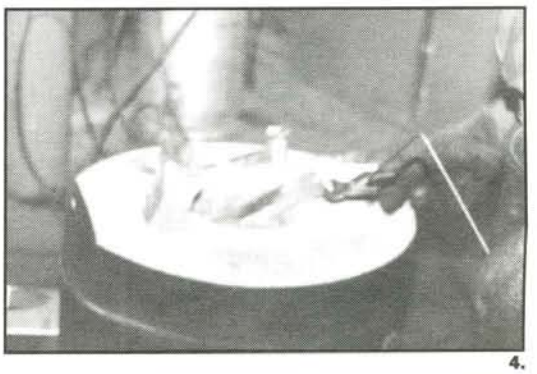
PICTURE 8: Take the flasks apart, pop that puppy out of the mold, and then clean off the sand.

PICTURE 9: Now you have your new primary case and cover.

PICTURE 10: Remove the sprue and smooth the metal where it was attached.

Even though your writer/photog has made light of this process, it took M.J. many hours of hard work to make the patterns and three years of working with different types of aluminum and sand to make these fine parts.

3.



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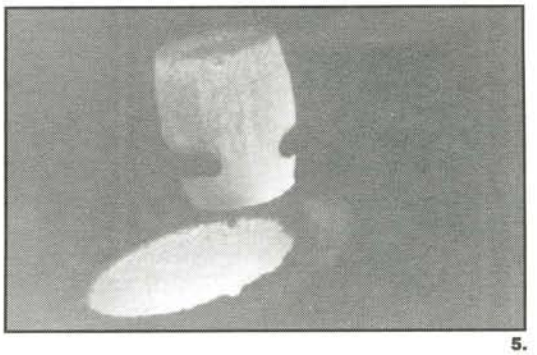

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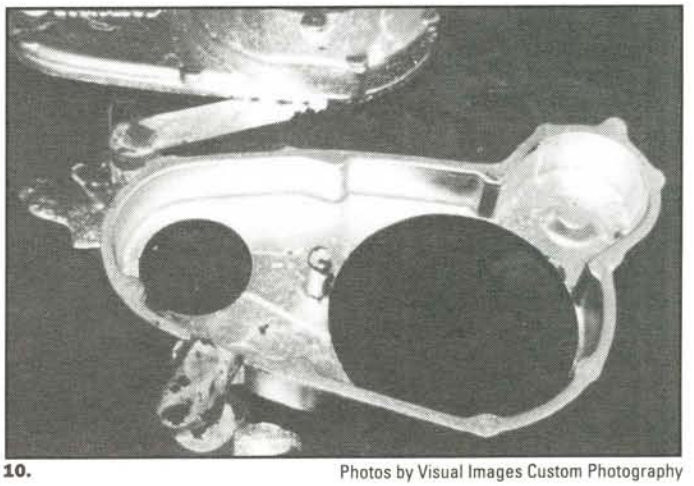
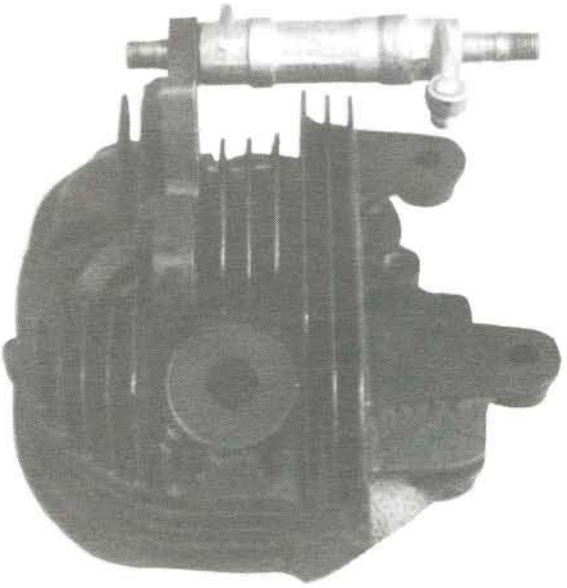


10.

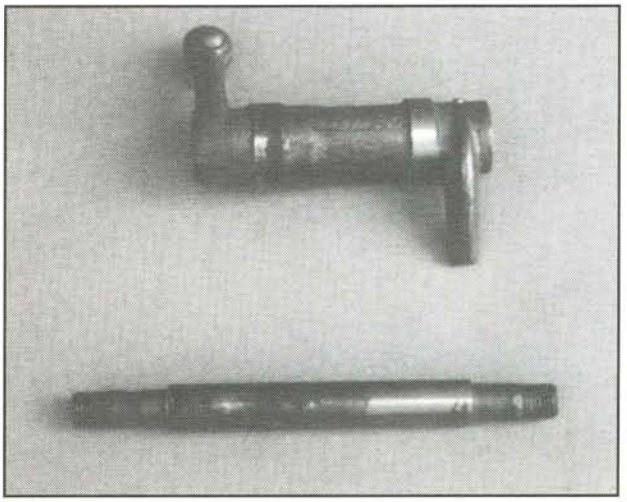
Photos by Visual Images Custom Photography

Restoration Blues

Still being manufactured in Nashville after 50 years.



A knucklehead with a frozen rocker shaft and arm—bummer.



After proper treatment and careful tappin' dem parts are free.

Recently, I rode out to Santa Paula, California, an old agricultural community back in the hills behind Oxnard and Ventura. Besides an oil museum (a remnant of its black gold days), wide-open farm land, and some hellfire burrito stands, not much else is going on.

But Santa Paula does hold a major attraction for bikers into restoration projects or just old American two-wheelers. M.F. Egan's Vintage Cycles on Ojai Street is a museum in its own right, a treasure of pre- and post-war ingenuity and Mike Egan, the owner, is a concerned authority on restorations and such.

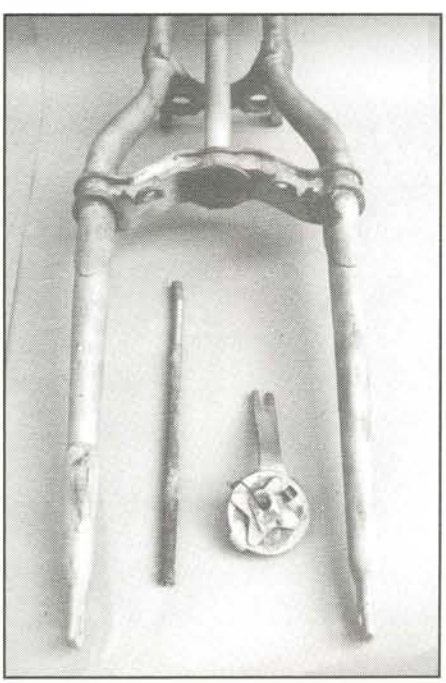
Last time I was in his shop, he told me about the difficulties of tryin' to break frozen parts and an oil from back East, by the name of Kroil, that works hard to free dem parts. It's dubbed "the oil that creeps," and, with respect to the parts you're tryin' to split, it works.

The key to the success of getting that frozen rocker shaft out of the rusty knuckle is patience. Put some of this oil near the frozen areas and tap the shaft once or twice a day. Then reapply the oil. Don't bang on the part, and don't hit it with anything harder than a brass hammer, or oak or ash wood.

Apply Kroil with a squirt can. Don't try to soak parts in it— it's too expensive and won't perform any more efficiently. Just be patient and tap or bump the part daily.

It also works well on valves stuck in guides or frozen springer front ends. You can only obtain this miracle cure by writing 50-year-old Kano Laboratories, 1000 South Thompson Lane, Nashville, TN 37211, or calling (615) 833-4101.

—Wrench

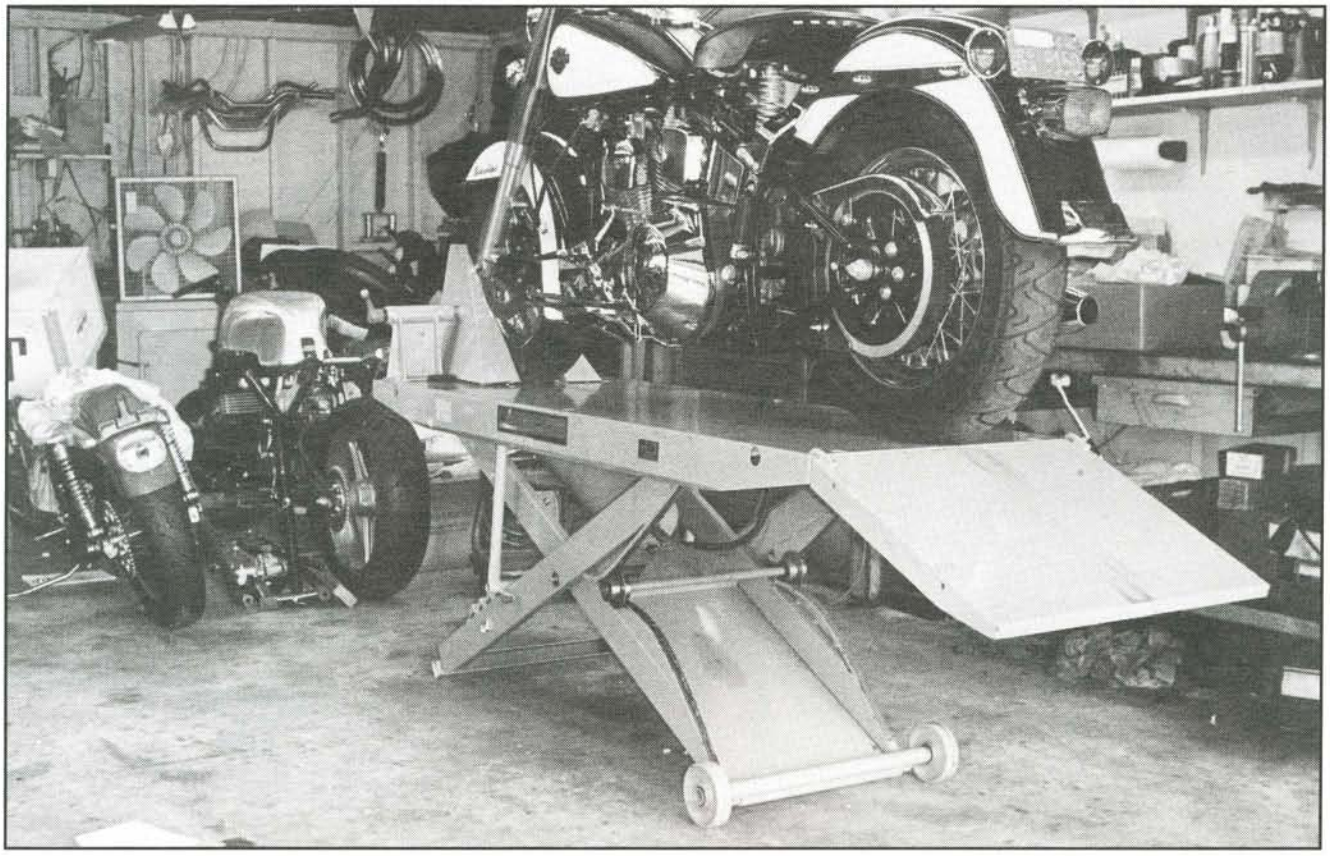


This original springer had the ride adjustment shaft frozen in place until treatment with the oil that creeps.

Photos by M.F. Egan

The Almighty Answer—

To Workin' On Your Motorcycle



I've been wrenching on scoots for 20 years now, and have always thought about how bitchin' it would be to have a hydraulic lift in my garage. Well, a couple of months ago, I went to a brother's shed, and there in the middle of the floor sat this steel plate on rollers.

We were planning some adjustments to my clutch, so he instructed me to roll the bike up onto this platform—which stood about 4 inches off the ground. I did, and he clamped the tire into a vice at the front of this slab of steel, casually stepped onto a pneumatically operated floor switch, and, presto, the bike rose to the height of his work bench (or any height he had a notion to raise it to). I about fell over.

The Air Lift, manufactured by Western Manufacturing in Marshalltown, Iowa, forms its own bench, can lift the front wheel or the rear wheel off the bench, and operates by a separate air compressor (they also make a model that runs electrically). It can lift 1000 pounds to 31 inches in 30 seconds. Anything up to that weight can be placed on this sucker and lifted to bench height.

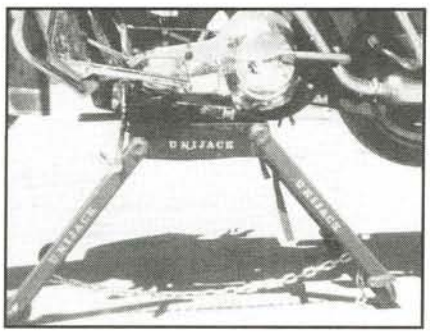
I was knocked out. No longer was I going to crawl around on the floor to drain oil, adjust the clutch, or anything else. I had to have one of these puppies. But in all fairness to other manufacturers, we began an investigation into other lifts. From the looks of the industry, the Air Lift is the most widely used in shops and H-D dealerships. In fact, we recently spotted several of them at Harley-Davidson of Washington, D.C., that had skirts on either side to form a wider bench area (interesting possibilities for major teardowns). It runs about $500 and change, but if you purchase in quantity (by getting several orders together from brothers) you get a price break. That's what we did. Five of us got together on the deal.

But in an effort to present the broad spectrum of lifts that are available, we've included a vast array of jacks that are, in some cases, more economical, smaller, shorter, or whatever.

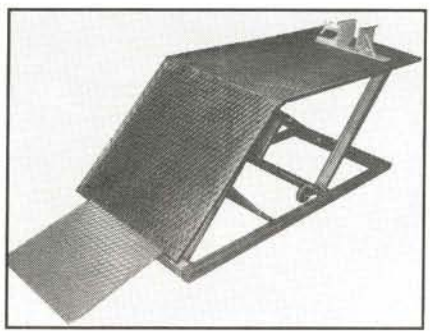
Perhaps the next most convenient lift is the Garzia, distributed by the Carlson Company. When the Grazia lift is up, the entire rear platform can either be hinged down or remain locked in the up position. When the hinge is down, it affords access to the rear wheel. It lifts to the same height as the Western Manufacturing unit and can be operated by a food pump or compressor. The wheel clamp, however, is not nearly as substantial as the one on the Air Lift. It

1.
Western Manufacturing Corp.
Western Industrial Mall
702 South Third Ave.
Marshalltown, IA 50158

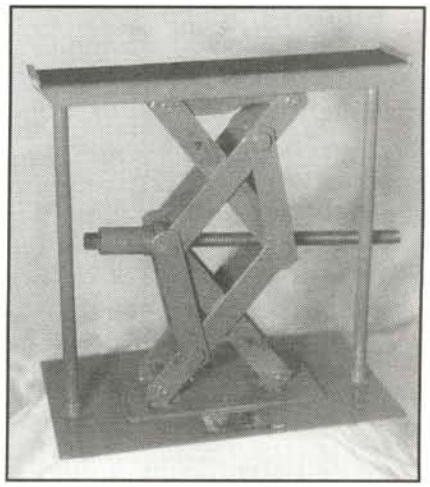
2.
Lincoln Manufacturing Company
Box 30303
Lincoln, NE 68503



3.
Mechanico Dynamics
Box 17
Hartsel, CO 80449



4.
The Carlson Company
Box 15051
Santa Ana CA 92705-0051



5.
National Dynatronics
Division of P. W. Dodge Corp.
334 E. 9th ST., Ste. 11
New York, NY 10003

doesn't appear to be a bad unit, though. Unfortunately, the Grazia lift (which is made in Italy) is more costly. The foot pump version sells for $950 while the air-operated version costs $1,170.

National Dynatronics recently started to manufacture the Quik-Stand. They collaborated with Harley-Davidson of New York to design a stand that would fit all Harleys. This model doesn't form a bench and only raises the bike from 5 to 12 inches. On the other hand, this tower of strength doesn't run on anything, air or electricity, and costs only around $100.

Here's another compact lift unit which will hold up to 1000 pounds and has the ability to rotate 360 degrees. The Cycle Jack, manufactured by Lincoln Manufacturing Company, Inc., weighs in at only 80 pounds and can raise a scooter up to 14 inches. It takes no power, other than what ya got in yer arms, and I'll guess that it costs around $200.

Finally, the most spindly one of the bunch: the Unijack, from Mechanico Dynamics Inc., in Hartsel, Colorado, raises from 4 to 24 inches and can handle 1,500 pounds. It functions with the use of a hydraulic jack that you pump like a car lift and will raise a bike in approximately 1-1/2 minutes. This lift sells for $349.

Well, that about covers the lot. If you have a lift, and use it on a regular basis, let us know your thoughts, so we can pass them along. And if I run into any hints or comments about my new Western Manufacturing lift, I'll let you know. Oh, here's one: George from Holliday's Bike Shop in Camarillo, California, suggested that we glue indoor/outdoor carpet to the vice jaws to minimize scratching the front rim or brake drum. And, if you have fat 16s, front and rear, elongate the mounting holes for the stationary side of the vice about 1/2-inch to allow the tire to roll into place for clamping.

Gotta split now, just got my lift home. I've been holdin' off a major maintenance list waitin' for this.

—Wrench

FLO DYNAMICS

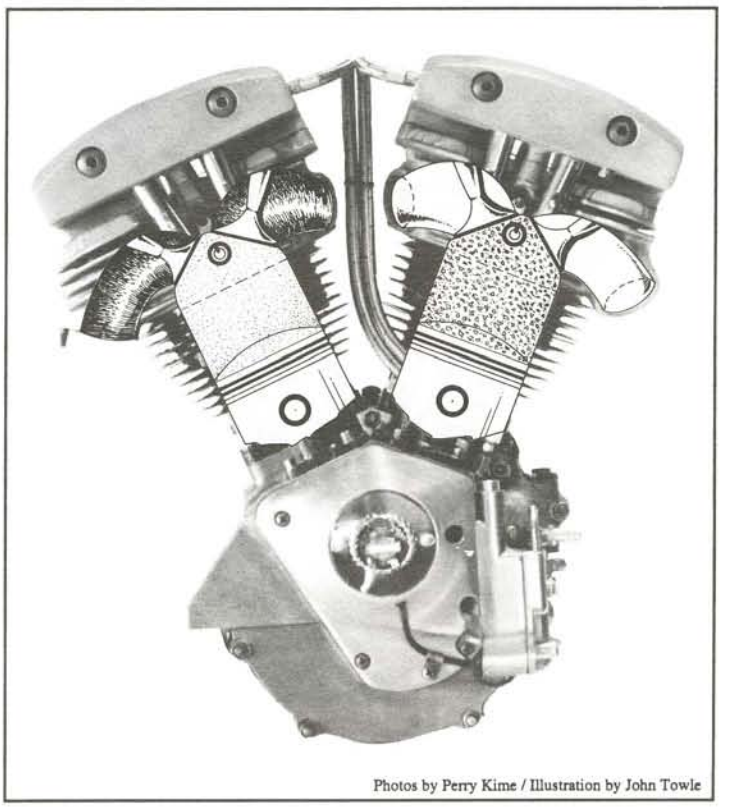
TECH TIPS

DETONATION

TROUBLE IN PARADISE

For the most part detonation is invisible. You can't feel it, you cant see it, and most of the time you cant hear it. But for 99.44 percent of the people who ride Harleys on pump gas, it could be going on right now inside your engine.

Now that I've got your attention we will discuss in detail the cure. The key words are Atomization, Flame travel, and Complete burn. Its like taking a trip to the center of your combustion chamber where Volumetric Efficiency is the final judge of how you live or how you die.

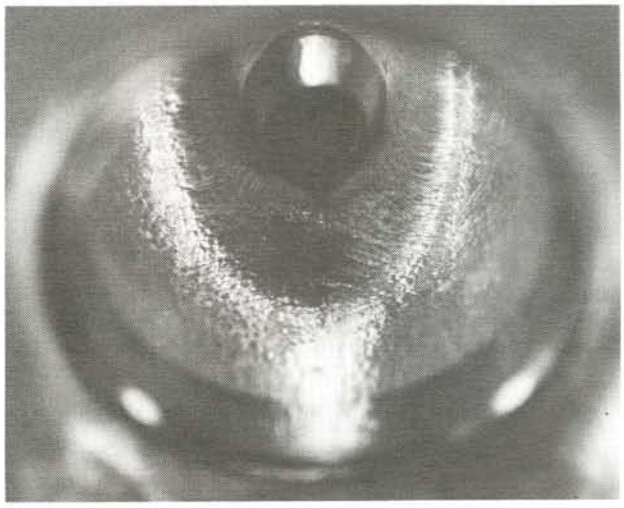


Photos by Perry Kime / Illustration by John Towle

In 1985 the EPA passed a new law that has drastically changed the requirements of pump gasoline. Prior to this new law premium leaded gas was rated at 98 octane with 4 grams of lead per gallon. Today the best gas available has 92 octane with no lead or 88 octane with one tenth of a gram of lead. As a result your cylinder heads have become the most important part of your engine. Detonation and extremely high temperatures which were previously no problem are now causing warpage and cracks, valve seats and guides coming loose, burnt valves and seats, bronze valve guides seizing, valve stems gauled and excessively worn, holes burned right through pistons, rings that have been so hot that all the spring tension is gone. The bottom line is your cylinder heads are serious Hi-Tech business. The use of space age materials and technology is now absolutely necessary for the survival of your heads. Solutions to these problems haven't come easy. Many years of effort and extensive research and development have paid off and now its time to give you the hottest Tech Tips ever released to the public.

Atomization is achieved in the intake port, primarily by the rough surface of the casting. If you are one of the unfortunate people who has sent your heads to a person or company who claims to be knowledgeable in the area of flow characteristics and your heads come back with the ports polished you have a problem. Not only will your motor go slower but it will run hotter and detonation will be much more apparent, considerably shortening the life expectancy of your top end.

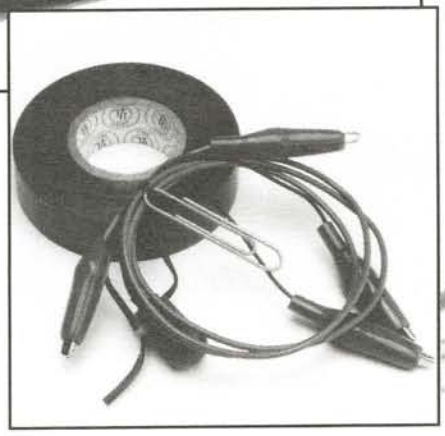
The next key word is Flame travel. Your HD motor has one spark plug located on the left side of the combustion chamber. This chamber is deeply concave in shape and partially filled with the piston dome at the point of ignition. Because of the location of this single spark plug and the piston dome the flame travel is partially blocked and does not cover the piston evenly. High compression pistons increase this problem considerably. In 1970 Warner Riley set a new land speed record at Bonneville of 202 MPH with a Harley Davidson. In 1972 he went faster with lower compression pistons and it was later discovered that the flame front was partially blocked by the piston dome. Flame travel notches were used in the later 1970s by many knowledgeable engine builders.



Last but not least is the Complete burn. This is achieved by simply adding another spark plug to the opposite side of the combustion chamber and increasing the voltage at the plugs to at least 15,000 volts each. Dual plugging alone of a stock motor will eliminate most detonation, stop plug fowling and hard starting, increase horsepower by 5 percent or more, increase gas mileage, double spark plug life, and lower emissions. Some tuners have reported 6 to 8 percent increase in gas mileage. Dual plugging is nothing new. In the USA it was first used by Liberty Aircraft in 1917. A little later by Continental and Lycoming in the 1920s and 30s. Primarily used as a safety factor it also reduced spark plug fowling and detonation and increased RPM by 6 percent.

Well Bros now you've got the straight answers to all those questions you been askin'. Our thanks to Perry at FLO Dynamics for coming clean with us. If you can handle the bare facts about your scoot give him a call in Oceano, California. 805-481-6300.

Gettin' Bagged —*Yer Tools, That Is*



Photos by Mark Chen

We've all heard that gettin' there is half the fun. Maybe, but South Dakota is a long way from yer garage. Here's some tune-up and tool roll, Sturgis-bound advice.

First off, perform a major tune-up, change all the fluids, replace the chain (with a good one), and tighten all the major nuts and bolts. Then get yer front wheel off the ground and observe the recommendations in the Tech Tip in last issue regardin' front end maintenance. Then raise yer rear wheel off the ground and check it for alignment and loose bearings. If they're loose, check 'em out, replace 'em, or have the damn hub rebuilt. And if you're into batteries, service the bastard or replace it and check all the battery leads and connections at switches. Long hard miles will take a major toll on a loose wire. If yer battery leads are eaten alive, don't just clean 'em. The acid has gone way up under the insulation. Trash the twisted shit and replace it with the right gauge stuff with fresh soldered-on leads.

Tools:

Different scoots need different tools, natch. So now that you've performed an all-encompassing, high-tech, state-of-the-art service to yer sled, note the tools used the most. Take an extra pair of plugs, points, and a condenser.

An Evo owner won't need points. Harleys with cast wheels use tubeless tires that can be sealed with plugs. The owner of a wire-wheeled bike will need some way to get the tube out so he can work on it. Take a pair of tire spoons.

Pull out yer most commonly used tools. Now's the time to choose those tools which can pull heavy double duty.

A roadside repair, in most cases, is designed to get you where yer going. You'd never use a pair of Vise Grips to replace a broken footpeg at home but they'll do just fine when you're 40 miles from the nearest water. There are any number of uses for mechanic's (balin') wire. I once made a shift lever out of an allen wrench and baling wire. An adjustable (Crescent) wrench fits a lot of bolts.

Pliers are a must. I carry a pair of 7-inch lineman's pliers. They are strong, have sharp gripping teeth, a built-in wire cutter, and can be used as a hammer. Because they're a tad bulky for some uses, I also carry a pair of needle nose pliers for more delicate jobs.

Channel-Lock makes a variable socket (part number 906) that will adjust to fit nuts and bolts from 1/4 to 5/8 inches. The tool is a little bulky for a single socket but it's certainly smaller than the collection of sockets it will replace.

Electrical problems can be among the most frustrating you can face. After all, an electrical fault often can't be seen. A wire that has broken inside its insulation will look the same as a perfectly good one. You can make a simple and compact test light, or Radio Shack sells small lights with wires attached. Carry plenty of wire, electrical tape, connectors, fuses, etc. Also, throw in a few alligator clips and paper clips.

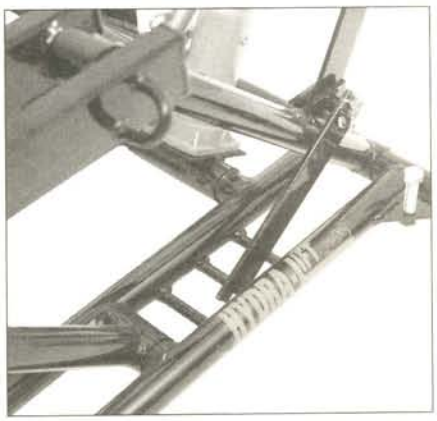
Take tools to adjust that new chain and, if you have the room, pack some lube or even a small can of that tire leak fix-it goo. Tire pressure gauges found at service stations are often way off in accuracy. Pencil gauges, on the other hand, are accurate, cheap, tough, and small. Carry one and use it every couple of days. Take some shop rags and a film can filled with hand cleaner. It'll beat tryin' to get oil and grease off your hands with sand.

Okay, so we used our own *Easyriders* tool bag as a base for this rambling. But a decent bag is a must. It's not a bad idea to roll yer tools up in something to keep those thousands of miles from wearing the electrodes off the spark plugs.

If you have an early shovelhead, panhead, or knucklehead, don't forget the allen wrench used to undo the wheel lugs. In fact, an allen wrench set fits easily. Having a strong bag means security crossing the desert and friendship to a stranded brother or sister. If you come along and help a rider get back on the road, well, you'll have started the party early.

—J.D. and Wrench

HYDRA-LIFT

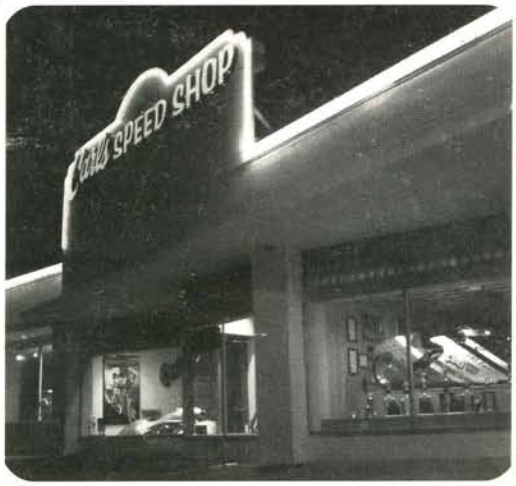


HYDRA-LIFT. This newly designed, heavy-duty, tubular construction lift is for use with all Harleys. It lifts the frame a full 18 inches off the ground and slides under bikes with less than 4 inches of ground clearance. Features full-floating, 4-ton hydraulic jack, double wall gate hinge construction, ground locks and levelers, double duty safety locks and stops, rubber-covered lifting surfaces, plus a hold-down strap. Lifting surface is notched to accommodate forward brake control support.

WHEEL PACKAGE. Makes your Hydra-Lift more portable, with or without your bike on it. Wheel package includes a set of 4 wheel assemblies. When removing motorcycle wheels this package allows you to expand the base from 30" to 45" for extra stability (working like an outrigger). Wheels mount easily to the Hydra-Lift and safely lock in place.

Extra shipping charge may apply for these items.

***To order the Hydra-Lift call* 1-(800) 247-6246** *(ATT3HL)*



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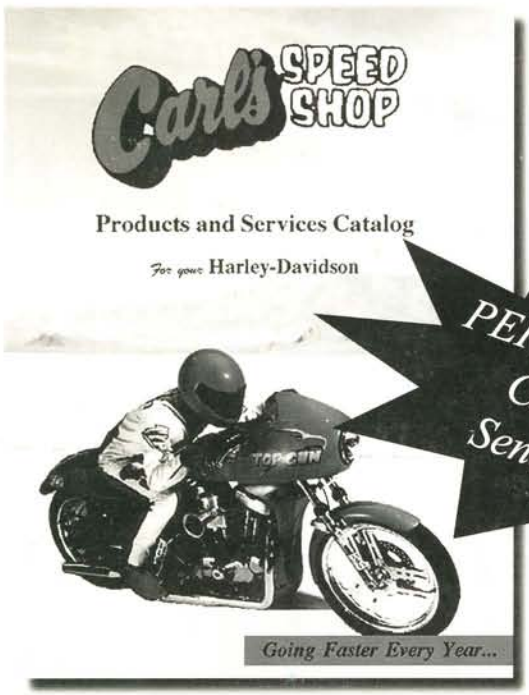

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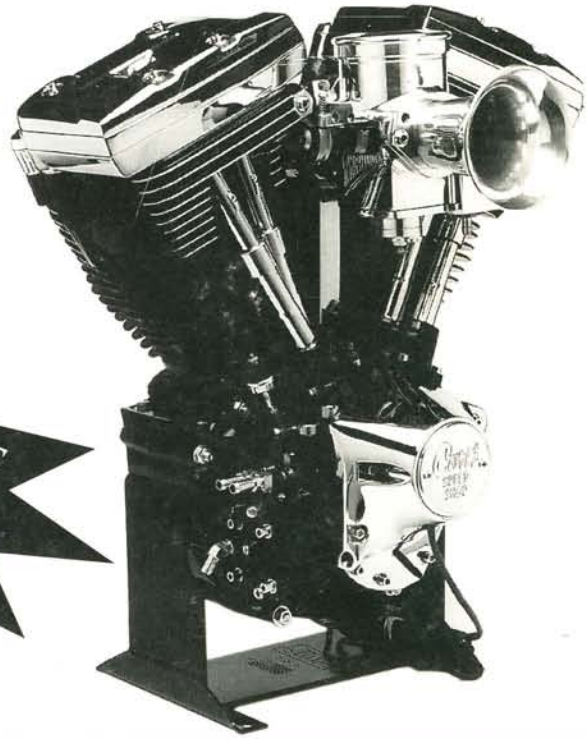

Carl's Speed Shop is your one-stop supplier of High Performance parts and services for your Harley-Davidson.