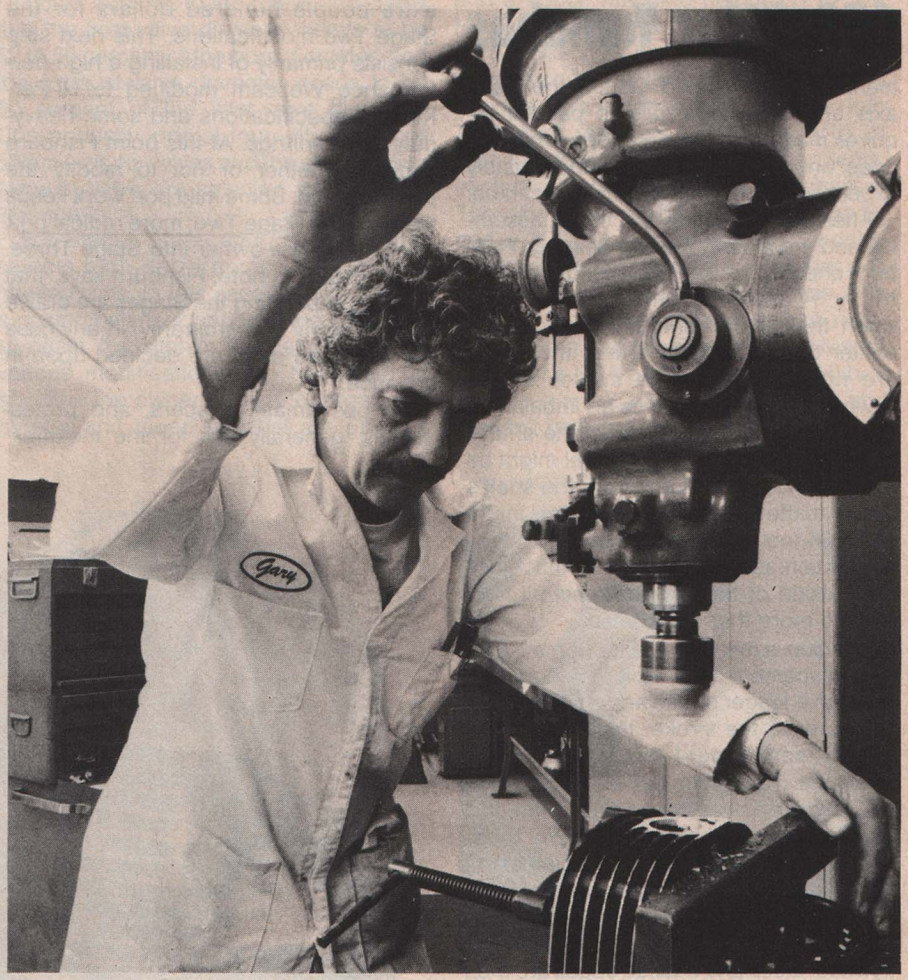

Cycle
SCOTT

Some people build high-performance four-stroke singles by bolting on huge carburetors and wild camshafts. Hi-Per-Kinetics Inc. converts Yamaha 500s into ground shakers through the simple expedient of adding cubic inches. Their method works.

By Don Phillipson



World's Biggest Thumpers: The Hi-Per-Kinetics

650/716cc Yamahas

● GENERAL MACARTHUR SAID, "OLD SOLdiers never die. They just fade away." His insight has inspired one thousand and one variations. Here's another one: "Old dirt racers never die. They turn to four-stroke singles."

Gary Fishburn, President of Hi-Per-Kinetics Inc., and Rich Kouns, engine builder, cater to old dirt racers and active professionals alike. They build high-performance engines—primarily Hondas, Yamahas and BMWs—for Class C pros, road racers, speedway, desert and café racers. In one particularly deft move, Fishburn and Kouns pass their wands over Yamaha XT, TT and SR 500s to conjure up 650 and 716cc giants. The existence of these leviathans prompted us to investigate Hi-Per-Kinetics' method of enlarging the 500, and to see if we could talk our way into a ride on a 650.

Fishburn asks two questions of any customer who brings him a 500 for surgery: 1) What kind of riding do you want to do? 2) How much do you want to spend? Depending upon the answer, the owner gets Stage One, Two, Three or Four modifications. In all stages there are two keys to extracting horsepower from the big single. The first is simple and straightforward: more cubic inches. The other key is the quality of construction.

Trail riders most often go for the Stage One update. Since the most basic work consists primarily of boring and stroking the 500 to 650cc, an owner sometimes opts for the work when his stock 500 has lunched its top end or simply needs a new piston and bore job. The Stage One work costs about $400, so making the jump to a 650 doesn't cost too much more than patching up a worn-out 500.

There are several steps involved in increasing the Yamaha's displacement. Fishburn first disassembles the entire engine for an inspection of all bearings and replacement of same where necessary. He then checks the relation of the case tops' plane to the crankshaft's centerline, which must be parallel. This is a particular problem area because according to Fishburn the two planes are often out of alignment by several thousandths of an inch. If the case tops aren't parallel to the crank's centerline, then the piston and rod (which are mounted at a 90-degree angle from the crankshaft axis) are not in the same plane as the cylinder (which is mounted at a 90-degree angle from the case tops). This misalignment can be tolerated, but only to a minute degree. Most factories maintain the misalignment to as close a tolerance as is economically possible. But even during normal use, tolerances shift. Fishburn emphasizes that in mass production, some misalign-

650/716cc Yamahas

ment is to be expected. Getting the crank axis and case tops' planes parallel requires machining the case tops, which he does and which would be inordinately expensive in a mass-production machine.

After disassembling the crank assembly and inspecting the rod bearing, Fishburn checks the crank halves for concentricity. A crank half has concentricity when the pinion shaft is exactly in the center of the flywheel. Often, the shafts are not exactly in the center of the flywheels, which produces an imbalance. For example, the radius from the shaft's center to the *top* of the flywheel might be 3.000 inches. The radius from the shaft's center to the *bottom* of the flywheel might be 3.004 inches, again, a result of mass-production assembly. Fishburn machines the outside of the flywheel until all radii vary no more than .0005 inch.

The 500 is then ready to become a 650, a displacement hike which is achieved through a longer stroke and a larger bore. To increase the stroke, the crank pin is moved more toward the outside of the flywheels. To do this, the crank-pin holes in the crank halves are partially filled by a certified aircraft welder; Fishburn trusts only aircraft welders for this crucial operation. Next, the welded crank halves are mounted in a lathe on the original crankshaft axis set by the factory. The shaft, flywheel faces and outside edges are then machined for squareness in relation to that axis. From the lathe, the crank assembly goes to the boring mill and new crankpin holes are bored to increase the length of the stroke.

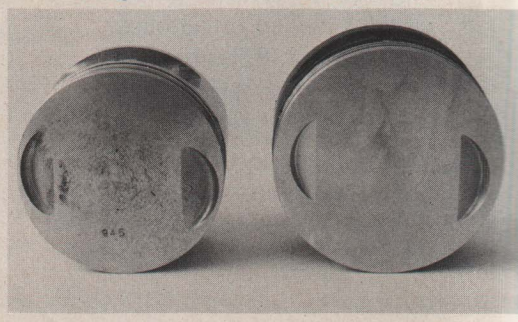
Next, the cylinder comes under Fishburn's scrutiny. It is inspected for cracks, then the stock sleeve is removed. The cylinder is bored to accept the new sleeve; Fishburn aligns the bore 90 degrees to the cylinder *bottom*—the portion of the cylinder which actually touches the case tops. Many machinists rebore entering from the cylinder's top, which is not always exactly parallel to the cylinder's bottom, and Fishburn says this method is inexact because the bore consequently isn't exactly perpendicular to the case tops. You'll note the cases' top plane has already been aligned parallel to the crankshaft's axis. It is this nearly perfect alignment which results in more power, enhances reliability and reduces vibration.

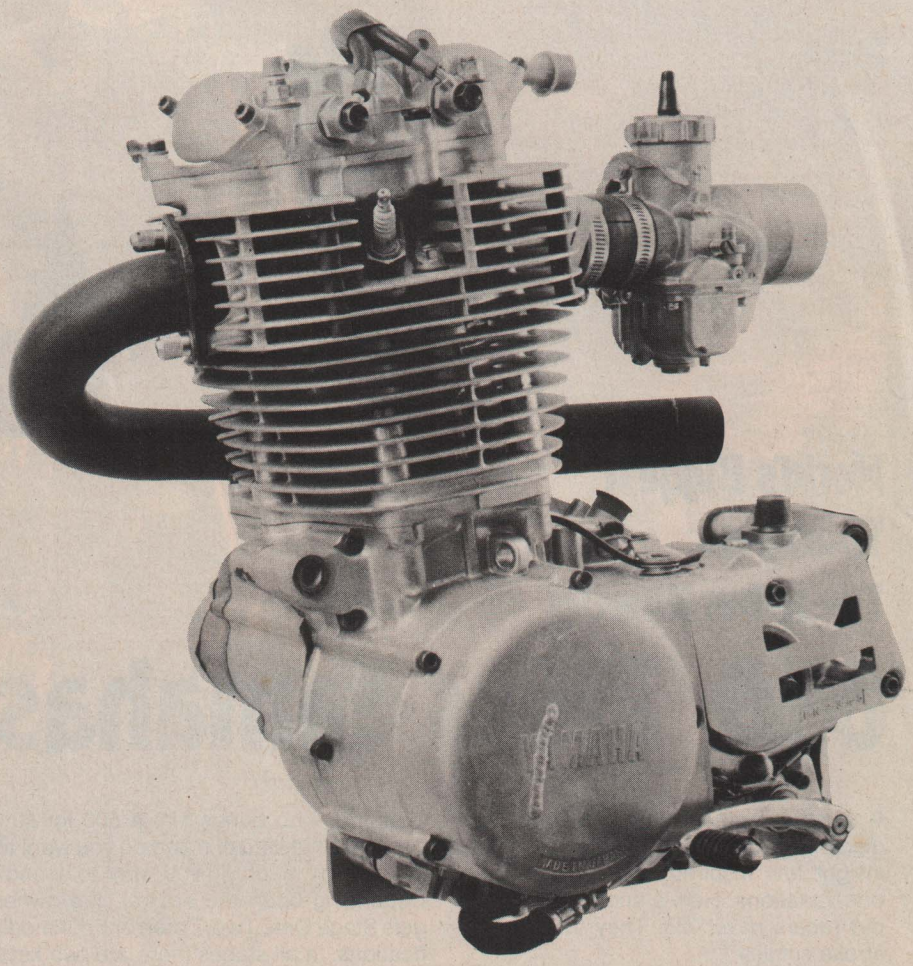
Fishburn uses Venolia piston forgings for the big thumpers. He sends the forgings to a Houston company, Performance Polymers, for an anti-friction coating. The final step in Stage One is machining the cases to accept the larger piston.

The boring and stroking, and care and attention paid to the job, make up the foundation upon which Stages Two, Three and Four are built. More power-hungry trail riders, amateur desert racers and flat trackers usually want to spend the extra couple hundred dollars for the Stage Two modifications. This next step consists primarily of installing a high-performance Webcam modified to Hi-Per-Kinetics specifications and some heavy-duty valve springs. At this point Fishburn decides whether or not to modify the cylinder head. Some mild port work keeps the owner in Stage Two; more radical port work brings the owner into Stage Three. It's important to note, Fishburn says, that the lines separating the Stages are drawn rather loosely and arbitrarily; in any case the work and price are decided upon in advance.

Serious amateur racers, and professionals, generally ask for the modifications Fishburn labels Stages Three and Four. They consist primarily of head work, installation of a high-performance connecting rod, and some detail work necessary with the new rod. Fishburn has a flow bench which he uses when building a super high-performance bike. But he emphasizes its use is expensive, and it's usually only good for that extra two percent of power a professional needs. Though stock Yamaha 500s come with enormous valves (the XT with a 45/39mm inlet/exhaust combination, the SR and TT with a 47/39mm combination), the 650 still needs a slightly larger intake valve.

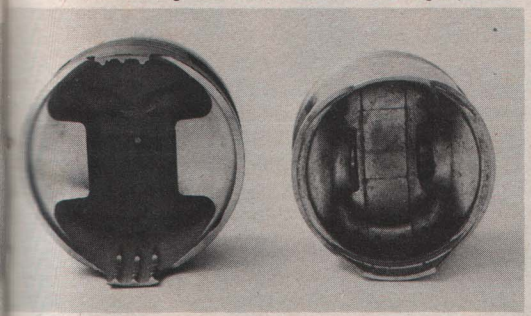
Stock 87mm and large 97mm pistons use similar dome and skirt designs. Hi-Per-Kinetics sends their modi-





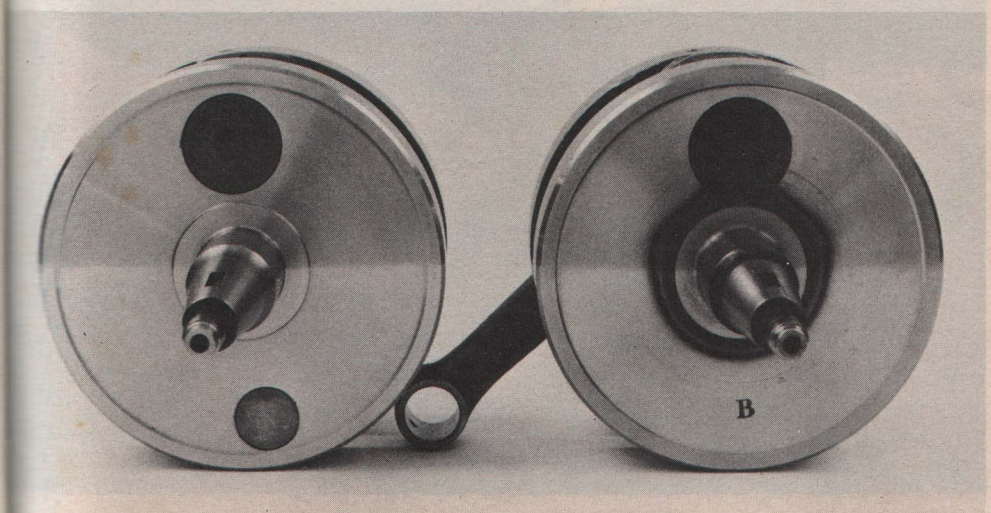
This particular 650cc engine has several modifications (not found in any specific stage) including a 36mm carburetor, Jardine exhaust pipe and dual oil lines to the camshaft. Stage I consists of boring and stroking; II includes a modified camshaft and valves; III and IV embrace extensive head work and a new rod.

fied pistons to Houston for an anti-friction polymer coating, seen as the black on the larger piston.

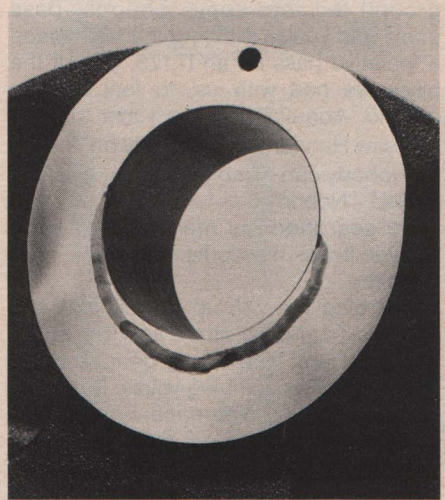


Fishburn adheres to the rule which states that the inlet-valve diameter needs to be 52 to 55 percent of the bore diameter, and the exhaust-valve diameter needs to be 60 percent of the inlet-valve diameter. Consequently, one of four—45, 47, 48 or 50mm—intake valves and the stock 39mm exhaust valve are selected for the 97 x 88mm 650.

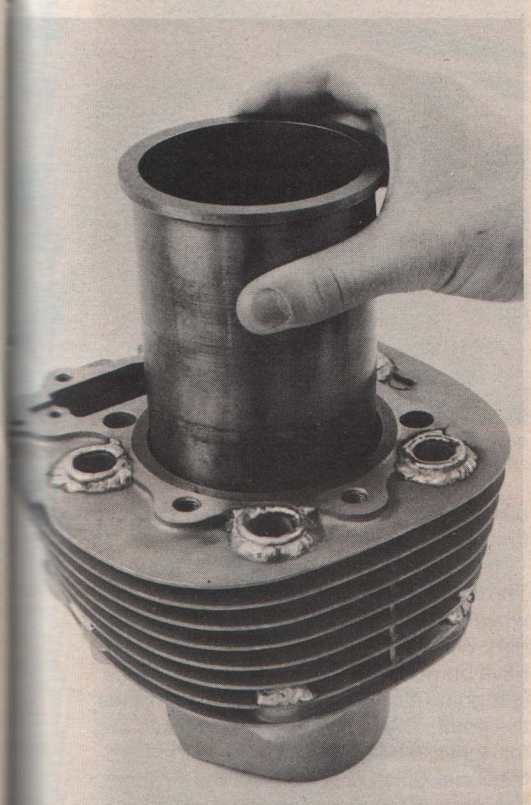
For Stages Three and Four, Fishburn selects high-performance Carillo connecting rods. In this case he also adds a tungsten balancer opposite the crank pin to offset the slightly heavier rod. Other various modifications can be added at any time the owner wishes. A larger carburetor and tuned exhaust are obvious and a 650cc machine belonging to Jim Hunter, a customer of Fishburn's. Fishburn's bike gets its extra-extra displacement through a longer 97mm stroke. Though he's made only four bikes into 716s, he's reported satisfaction with all four. In addition to the giant powerplants, each bike had a highly modified chassis. Though Fishburn's had a stock frame, he had a YZ fork and Motorsport shocks. Hunter's used a C&J frame, a YZ fork and Curnutt shocks. Hunter's bike was also unusual in another respect: it had right-side shifting and left-side braking. Hunter, owner of a BSA parts house in La Habra, had been a decades-long BSA rider and couldn't bear to leave behind the familiar



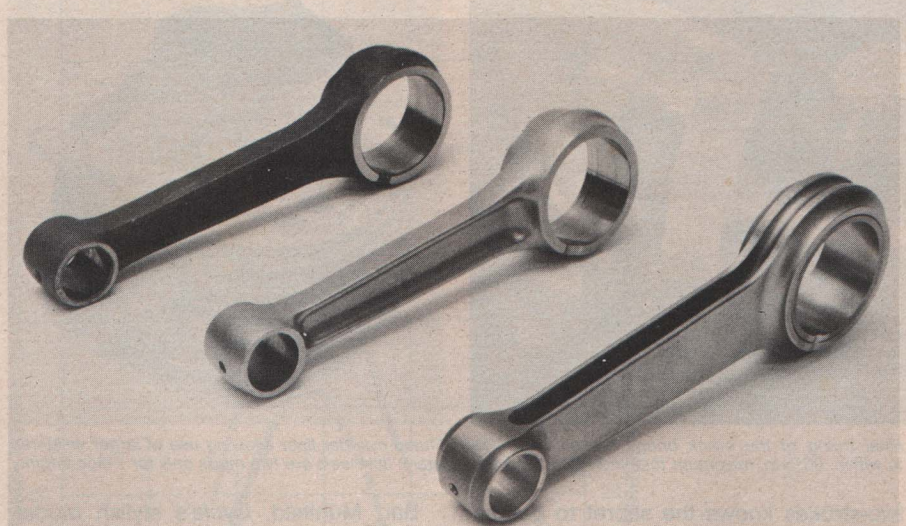
Crank pin is moved radially to increase stroke; tungsten insert is used only when heavier rod is added.



Felt-marker line shows stock crank-pin location which has already been welded in; new hole has been bored.



Stock sleeve is dwarfed by 10mm oversize bore. New, longer-than-stock cylinder studs (holes are shown unfinished) extend through fins for added strength.



Left to right: stock rod; polished and magna-fluxed 650 rod; Carillo rod used only in Stages III and IV.

power boosts which most owners choose early in the game; Hi-Per-Kinetics will add these items and tune the engine to them, but does not consider them part of any specific Stage.

No impression of a motorcycle is complete without a description of what it's like to ride it; coaxing horsepower out of a machine with mill and flow bench is useless if the bike doesn't hold together. We took two bikes out for a riding impression—Fishburn's personal 716cc Yamaha British shift/brake pattern.

After a full day of riding in the desert and snow-covered hills, we had gorged ourselves on torque, feasted on raw single-cylinder horsepower and thumped our way to satiety and beyond. Slides—great dirt-showering slides—were exactly one twitch of the wrist away. Fishburn's 716 used a 17-inch rear wheel and a 5.10 x 17 low-profile Metzeler tire inflated to six psi. The huge tread left an imprint as wide as some of the trails we rode on. The 716

spun that tire in every gear in nearly any rpm range.

We left our high-desert camp and rode toward the ridges a few miles away. Fishburn wanted to show us some hillclimbs: sand hills 600 feet high. The highest hill beckoned us. "Some guys have me build them 650s just for this," Fishburn explained, pointing toward the hill. "They come out here to try to climb the hill. All day long they go at it, then pack up and go home."

The hill was actually one half of a pair of canyon walls, so there was virtually no approach to the climb. Fifty feet of flat ground led into some whoops—pass those and you're climbing the hill. I made a tentative pass on an IT175, one of the bikes we had with us, to feel out the ground. About 75 feet up I lost traction.

"I saw Hannah climb that hill on a 250."

"Nobody can climb that hill on a 250," I replied. "Nobody."

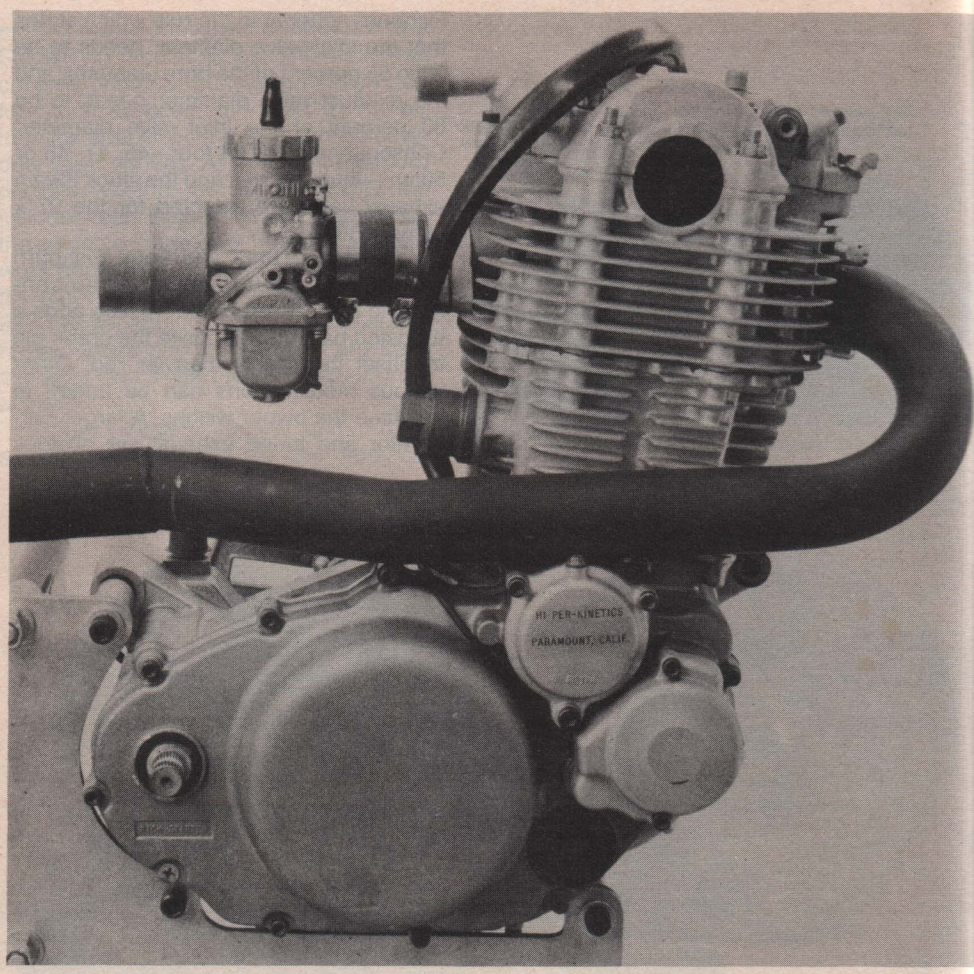
He searched his memory and said, "Maybe it was his works 400."

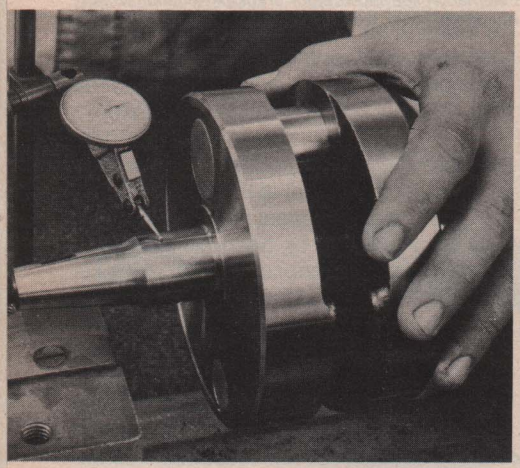
Maybe.

Charging the 716 up the hill was like easing a Top Fueler off the line. Too much throttle at any time in any gear, and the rear wheel was spinning wildly. But there was also a major difference: I had to pull myself forward until my thighs touched the handlebar.

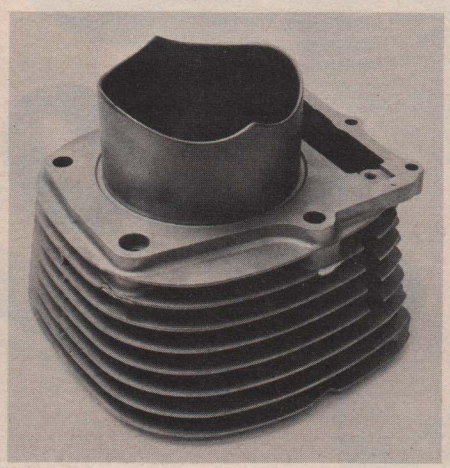
Anyone who's done much dirt riding on two-strokes knows the secret to getting up hills is to keep the whole bike moving and the engine in its powerband, which means keeping the throttle wide open. That's a hard habit to break. Clicking the 716 into third gear and cracking the throttle, I shot toward the hill. I could feel the wheel spinning and bike *accelerating up the hill*. A few rough spots got the wheel hopping and I lost traction; a down shift for a quick zig-zag ended the first run.

In the process of backing off the throttle to downshift then gassing it up again I'd felt something: better traction and not much less speed at half throttle.

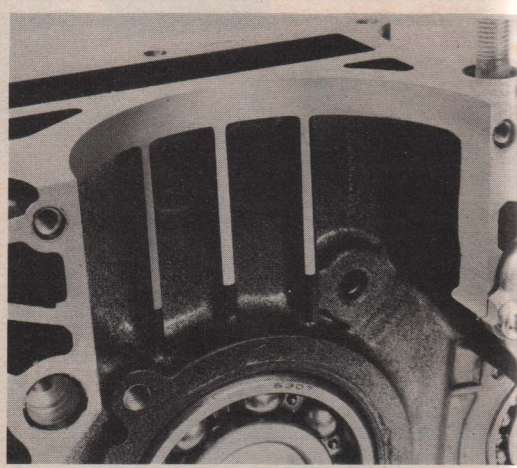




Final truing of the crank brings the pinion shafts to within .0015-in. maximum total indicated readout.



Fluted cylinder liner allowing use of larger weighted crank flywheels are two mods only for 716cc engine.



Both case halves must be machined to accept a larger cylinder liner when the stock 500 is bored to 650cc.

Bart Muhlfeld, *Cycle*'s stylish model, hopped on the right-side-shift 650. Two almost-made-its brought only one remark from him. "I'm not leaving here 'til I climb that hill." His third try was successful, as was mine.

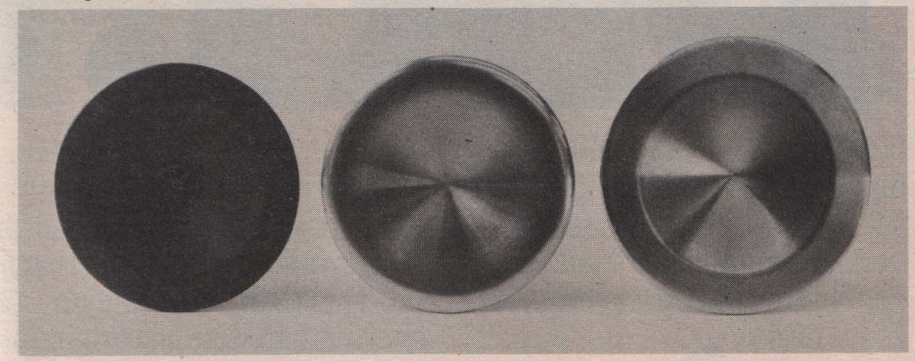
We were converts. Hillclimbing!

A couple of other riding impressions ought to be mentioned. Both the 650 and the 716 are smooth—very similar in vibration levels to the stock XT or TT500. There's a lot more mass twirling up and down and around in that engine, but the close tolerances everywhere keep the engine more than acceptably smooth. Both bikes are also easy to start. Generally, one firm kick fired the engine.

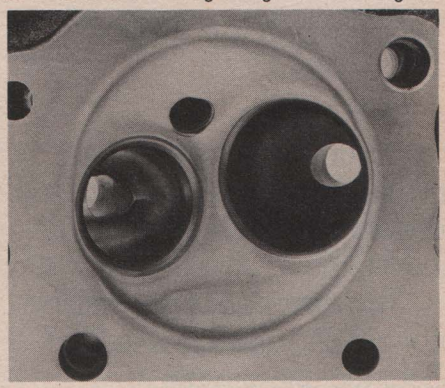
The big singles are strictly for fun. Throughout the rest of the day we slid, wheelied and jumped our way through the hills. We weren't going as fast as we could have on good 250cc cross-country bikes. But going fast over rough terrain misses the point. These 650 and 716cc bikes are for thrills. Hi-Per-Kinetics prepares professional Class C bikes and road racers, but leave those unashamedly serious machines to the pros. Yamaha 650/716s are for play. Dedicating oneself to entertain-

(Continued on page 214)

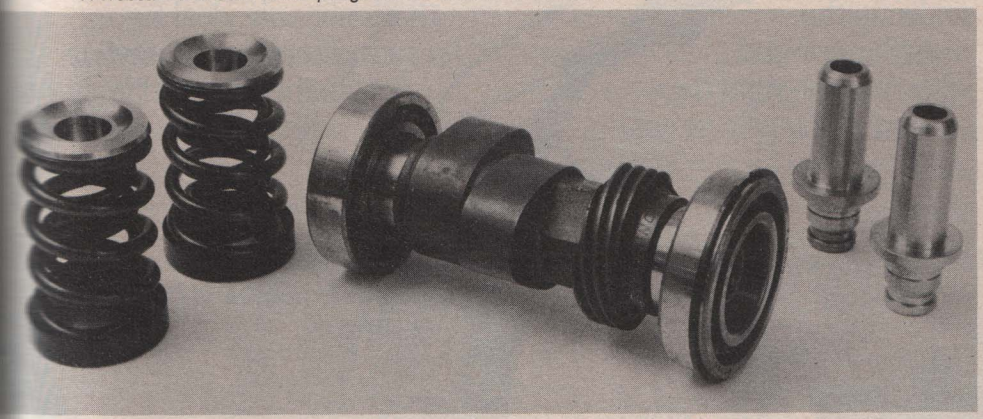
Left to right: Stock 45mm inlet valve; 47.5mm valve for Stage II updates; 50.8mm valve for Stage IV mods.

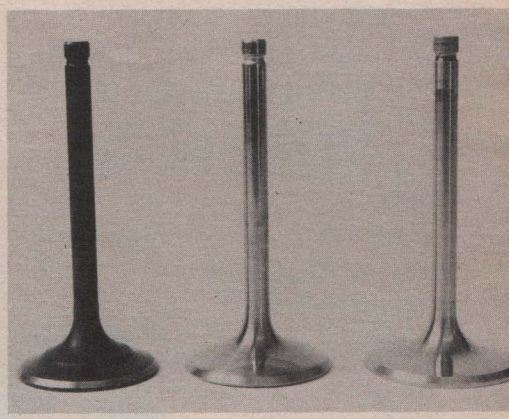


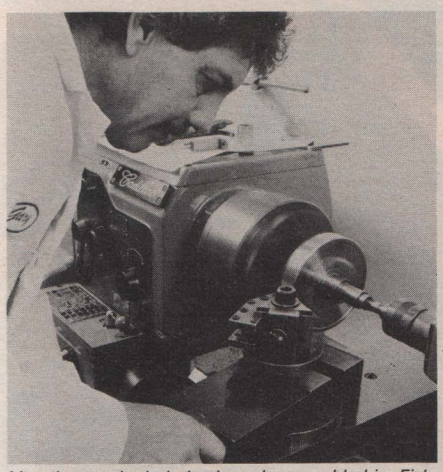
Stock inlet/exhaust ports (top) are ready to be modified. (Bottom) Three inlet valves: 45, 47 and 50mm. Inlet needs enlarging for Stages III and IV mods; stock exhaust valve is big enough for 650cc engine.



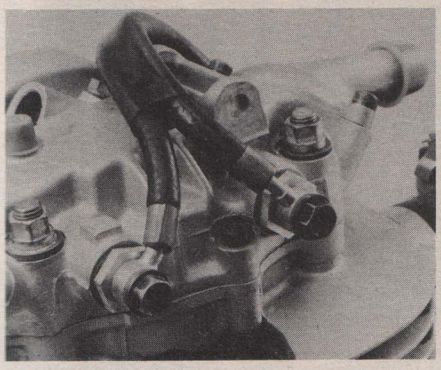
A Webcam and S&W valve springs are modified to Hi-Per-Kinetics specs and installed for the Stage II mods.



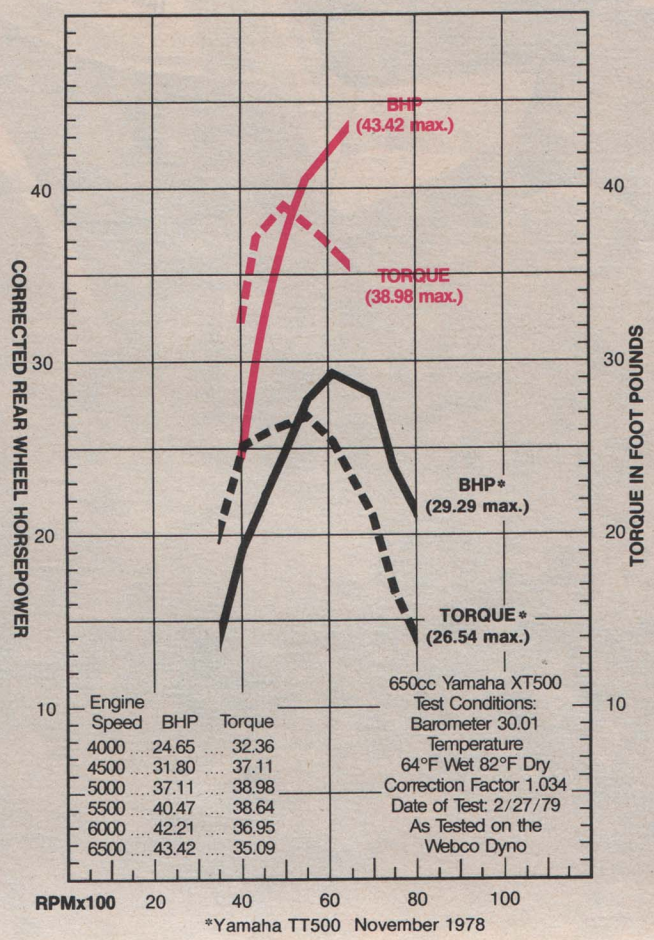




After the crank-pin holes have been welded in, Fishburn machines the flywheels to retain concentricity.



Stock single line feeds one rocker arm and relies on splash to oil the other; Fishburn uses a dual line.



*Yamaha TT500 November 1978

650 Yamaha *Continued from page 124*

ment is what four-stroke dirt riding is all about. Yamaha, Honda and Suzuki know it, and that's why they all manufacture four-stroke off-road playbikes. Fishburn knows it too, and that's why he makes 650 and 716cc Yamahas. If power and torque are the ingredients which make four-stroke singles fun, then more power and more torque equals more fun.

How much power does the 650 really produce? We took one of Fishburn's 650s to the Webco dyno. It had been subjected to the Stage One modifications; in addition, it had a straight pipe and a 36mm Mikuni carburetor in place of the stock 34mm unit. As *Cycle* knows from experience with the dyno, innumerable variables affect an engine's performance when it's hooked to the pump. The Hi-Per-Kinetics 650 didn't run cleanly below 4000 rpm. Near the end of the dyno run we discovered that holding the throttle at low-rpm running apparently caused an engine resonance that confused the carburetion. We can attest to the fact that out there in the real world where a bike's wheels touch earth and soak up vibration, the 650 pulls without hesitation right from idle.

Dyno figures on the 650 are available starting at 4000 rpm. At that speed, the 650 makes 5.6 more horsepower and 7.3 lbs/ft more torque than a stock 500. Also at 4000 rpm, the 650 makes 4.0 horsepower and 5.1 lbs/ft more torque than a Honda XR500. At 6000 rpm the 650 makes 13 horsepower and 11.3 lbs/ft more torque than a stock Yamaha 500, and 10 horsepower and 8.8 lbs/ft more torque than an XR500. At 6000 rpm, that's about 40 percent more horsepower than the Yamaha 500 and about 30 percent more than the Honda, neither of which is exactly a slouch.

How does the 650 compare to a highly modified Yamaha 500? Nicely. Gordon Jennings ran a long series of dyno tests on an SR500 late last year. He experimented with new camshafts, carbs and airboxes. The best figures he came up with were 37.72 horsepower and 25.01 lbs/ft of torque at 7500 rpm. That's 5.7 horsepower and 10 lbs/ft of torque less than the 650 turned at its 6500-rpm peak. We didn't have a chance to dyno the 716, which according to Fishburn (and according to the seat of our pants) makes substantially more power than the 650 in the mid-range. The 650 didn't stop making power at 6500 rpm; everyone present in the dyno room agreed a 650 turning over 6500 rpm would surely produce 50 horsepower. But high-rpm running demands a stronger connecting rod, and that's a Stage Three or Four modification.

As it sits, the Hi-Per-Kinetics 43-horsepower Yamaha 650 is a thumper fanatic's dream. ◉

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