MARTY TRIPES' HONDA RC250

INSIDE THE UNTOUCHABLE!

...WE TEAR DOWN
MARTY TRIPES' WORKS
HONDA RC250

Marty Tripes' Honda RC250... CLAIMED!

How stock is Honda's factory team racer? After days of disassembling, measuring, weighing and dynamometer testing, we had the evidence to prove that the name is exactly the same.
By Dave Hawkins and Gordon Jennings

● ANYONE WHO HAS EVER RACED IN A LOCAL motocross has heard someone say, "If I had a bike like (*fill in the name of your favorite factory rider*) has, I could blow him away." Everyone around this kind of optimist suspects that it would be difficult for him to win a three-man race if the other two were on bicycles. Still, it is understood that he does indeed have a point: The bikes supplied to Marty Smith and Bob Hannah are a technological world away from what your local dealer offers.

Factory bikes are the stuff of which motocross dreams are made. Dreams are all they could be—no one outside the factory pale has known how trick the factory specials really are. Until now.

When privateer John Roeder claimed Marty Tripes' RC250 Honda in Sacramento, California, at the first national of the 1979 season, it marked the first time a factory motocrosser has been in private hands legally. We thought this presented an interesting opportunity and contacted the privateer, who agreed to a machine tear-down and dynamometer test.

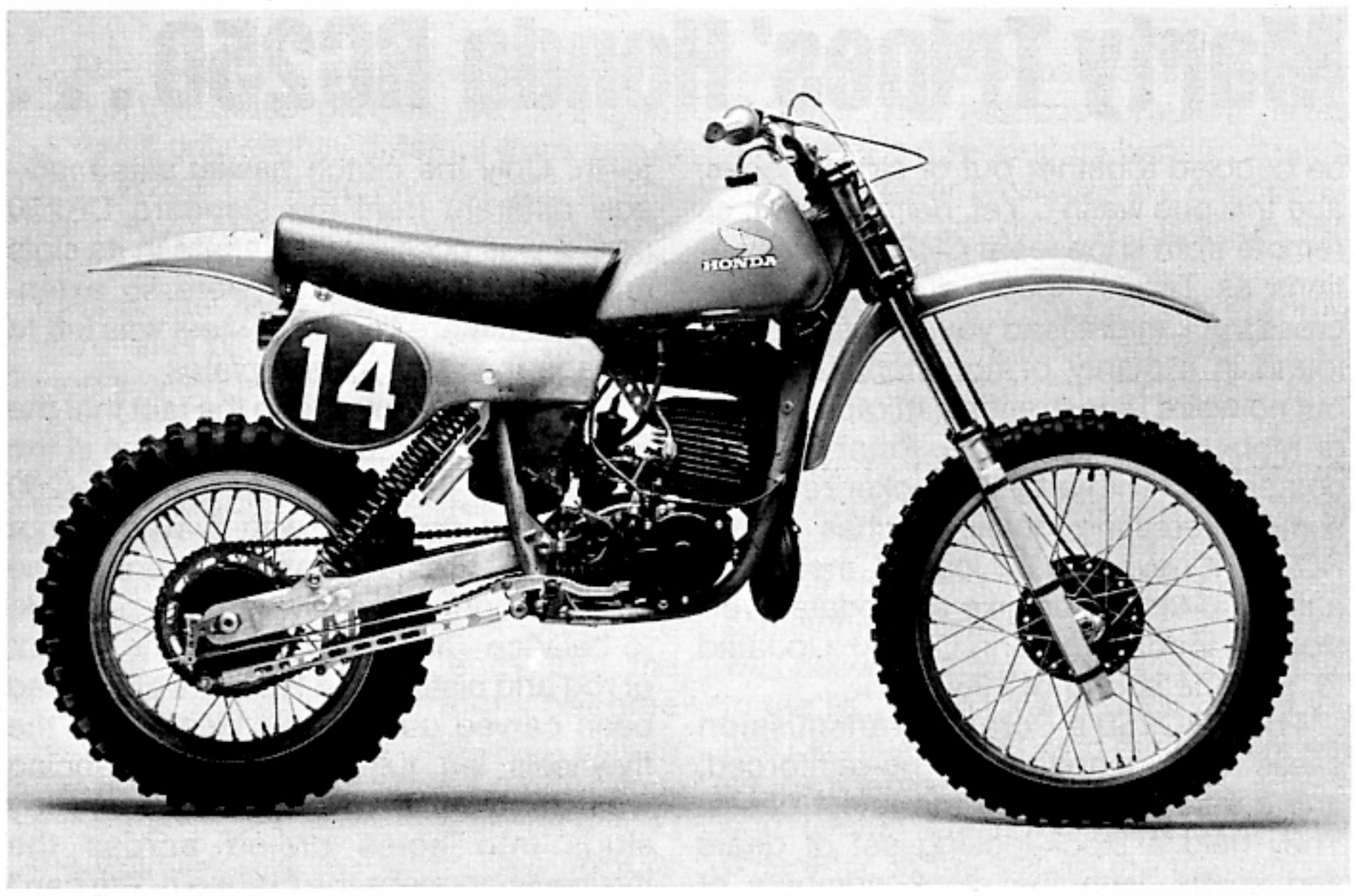
But then we began to have second thoughts about just how special Tripes' RC might really be. When we notified Honda Motocross Team Manager Gunnar Lindstrom and told him what we planned, he said, "We are thrilled to death that you want to do a story on the bike. Since we have already lost the machine, we can at least get some publicity out of it now.

"As far as we are concerned, Roeder got a pig in a poke. Except for the center-port exhaust and the suspension the bike is stock."

Lindstrom's remarks left us really concerned. Just how trick could the bike be if he was ready to go on record saying it is virtually stock. Then we thought if the bike *was* stock, we could present a story on Marty Tripes as the greatest motocrosser in the world. After all, he has shown that he can beat Hannah, and we *know* Bob's Yamaha is not even close to stock.

To us "stock" means that a motorcycle and its parts are or have been generally available from an authorized dealer. After

For the first time in front of non-factory eyes, the internals of a factory racer were revealed. Below, the RC intact. Left and bottom, explosion view of same.



PHOTOGRAPHY: ROBIN RIGGS

inspecting the RC, we found that evidently there is a different definition of *stock* in motocross circles. We found that the RC factory racer and the CR250 production bike are different in far more ways than they are alike.

The most obvious difference between the stock CR250R and the real-racer RC250 is that the factory special engine has a center exhaust port. The center port allows a cleaner exhaust flow from the cylinder, which promotes better scavenging. This exhaust port change is possible because the works bike has a double downtube frame: the expansion chamber exits between the frame members and has a smooth bend. The stock pipe has to curl tightly around the CR's single downtube frame and does not offer quite as smooth an exit for spent gases.

The RC's frame is split at the steering stem area. Both tubes are heavily gusseted near the triple clamp area, then they extend down and bend gently around the engine and back to the footpeg mounts. The frame then is routed upward to rejoin the main backbone tube just behind the fiberglass airbox.

Additional struts are used to strengthen the frame. A tube from the rear junction of the engine cradle and main backbone tubes is routed forward to just below the lower triple clamp position. On the stocker, an engine head-stay from the rear of the head to the frame's backbone completely ties the frame together. The production head-stays are stamped from steel and use the traditional steel bolts and nuts. The RC stays are quite different. They are made from aluminum and drilled to further lighten them *and* are fastened with titanium bolts and nuts. The substitution of exotic materials lightens the factory bike five ounces.

The front engine mounts on both bikes are built into the frame downtubes. However, the rear mounts are not the same. Each rear engine mounting bracket is a combination swing-arm pivot spacer and two-engine-mounts built into one. In composition and weight they differ tremendously.

The CR's spacer section of the bracket is a mild steel tube with the actual mounts spot welded onto the tube at either end.

The RC's bracket is carved out of a single piece of aluminum.

While the stock bike used the standard steel bolts and nuts, the works bike uses titanium. But the factory went two steps further with the bolts and machined a waisted section in them and also cut a concave dish in the bolt heads. For their trouble and great expense designing and building the trick rear bracket, 8.2 ounces were saved.

What did we find inside Honda's RC250 "center port" engine? Many fascinating things, but only cold comfort for those who'd like to believe that Marty Tripes has been hammering them with a berylium piston and cosmic horsepower. You don't expect a genuine Works Team engine to

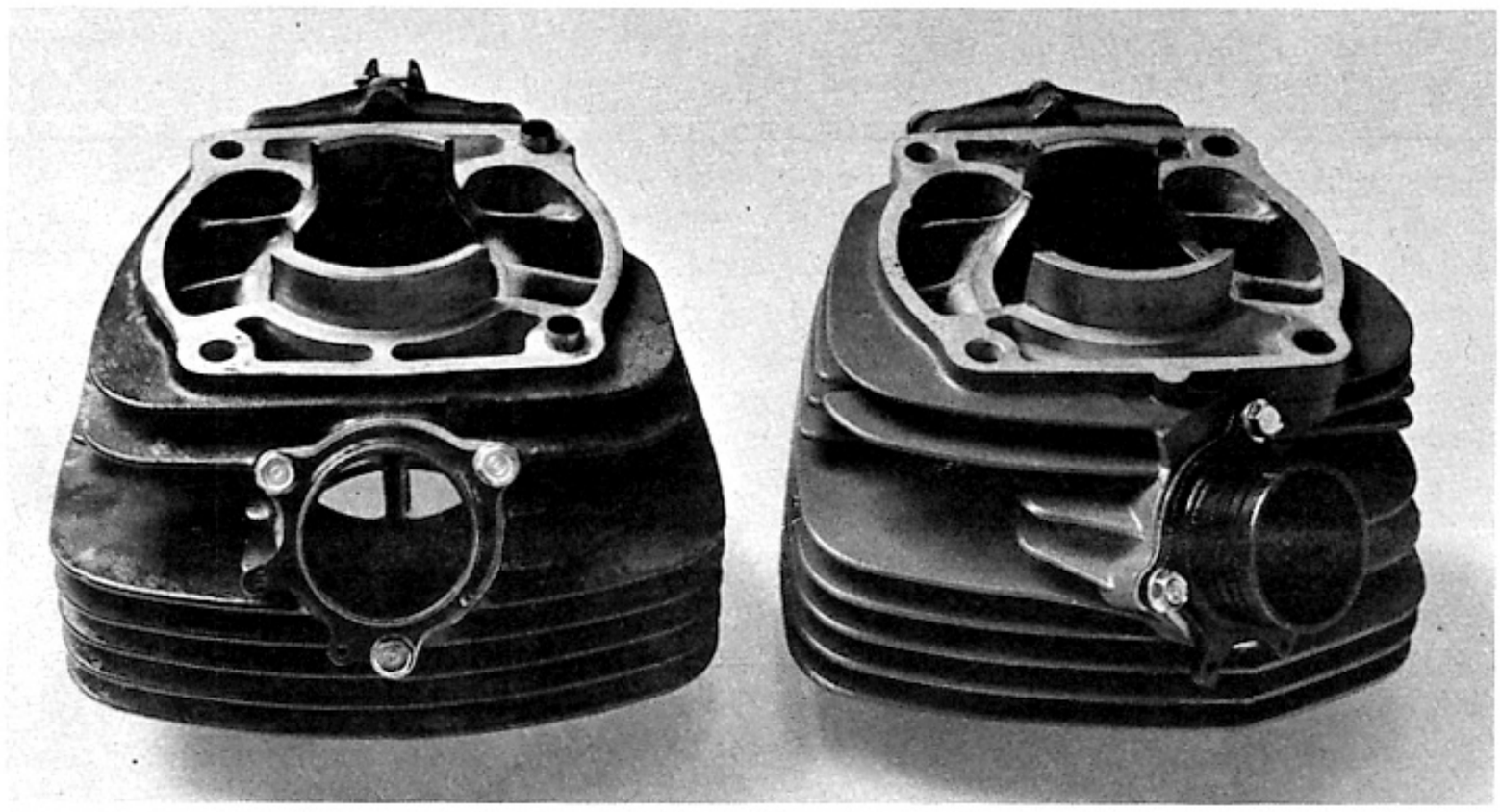
Aluminum body and reservoir Showa shocks give 11 inches of rear wheel travel. The factory swing arm is stronger and .5-inch longer than stock.

Marty Tripes' Honda RC250 . . .

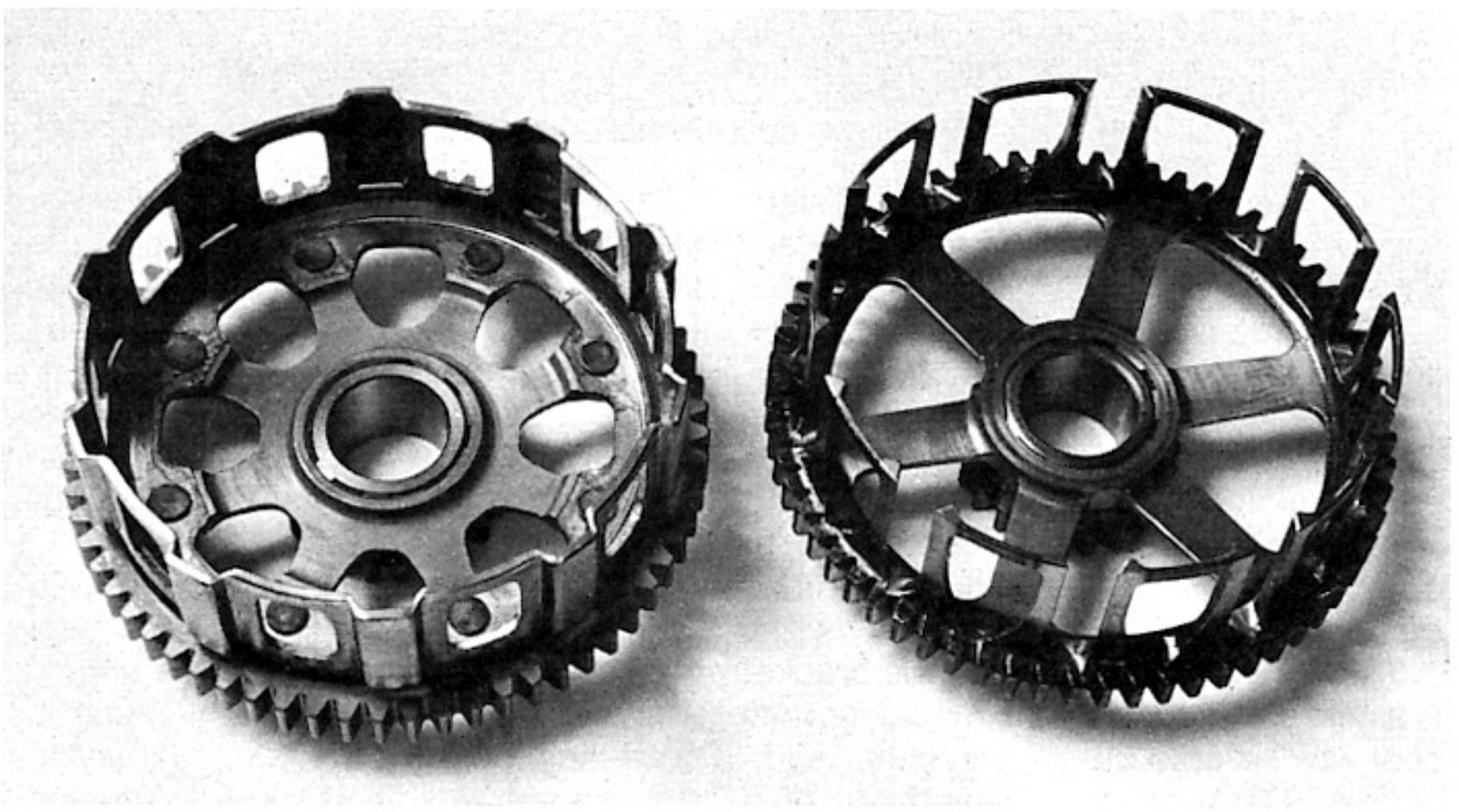
be cobbled together out of stock pieces, and this one wasn't. Yet, neither was it as remote from showroom CR250 specifications as Tripes' speed around a motocross track might lead you to assume. We found in it plenty of non-standard parts but no weird fenestrations, miracle metals or Mobius strip passages. Point-by-point comparison with a 1979 stocker revealed some interesting detail touches in the RC250; it nevertheless looked, measured and dyno-tested just like an updated version of Honda's existing CR250. Updated to, say, the spring of 1980.

The RC250's crank/transmission cases were magnesium, rib-reinforced, and a little tighter than the latest cases. They held a stock-looking set of gears and shafts, with the stock numbers of teeth. Only the clutch basket was markedly different from the standard CR250 part: it was positively Italianate in its slots and perforations, which were so extensive that a mere filigree of steel was left to engage the stock clutch plates.

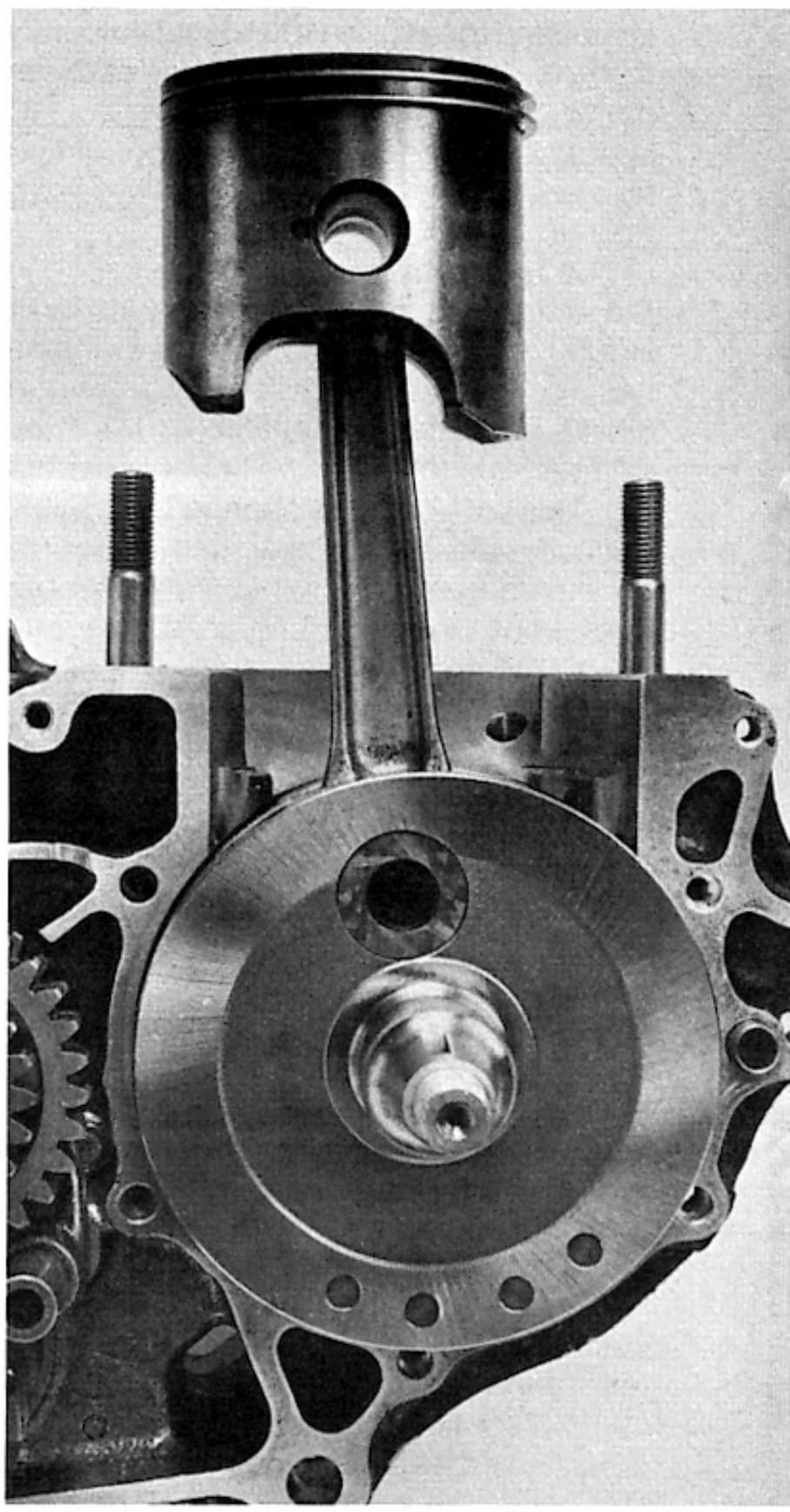
There was no mistaking the fact that the RC250's crank had been fashioned in the Honda R&D machine shop. Stock CR250 cranks are forgings, with flywheels not quite fully circular. Flats adjacent to the crankpin lighten the flywheels on one side to balance—at least partially—the weight of rod and piston. The RC250's crank had been carved out of steel billets, and the flywheels left full-circle. The balancing was done by plugging tungsten-alloy slugs into holes drilled across the flywheels opposite the crankpin. We can't



The RC's center exhaust port (left) allows a cleaner flow of spent gases. The expansion chamber exits through the double downtube works frame; the stock pipe must tuck tightly around the single downtube production frame.



Two-piece production clutch housing (left) is replaced on the RC with a one-piece machine shop special.



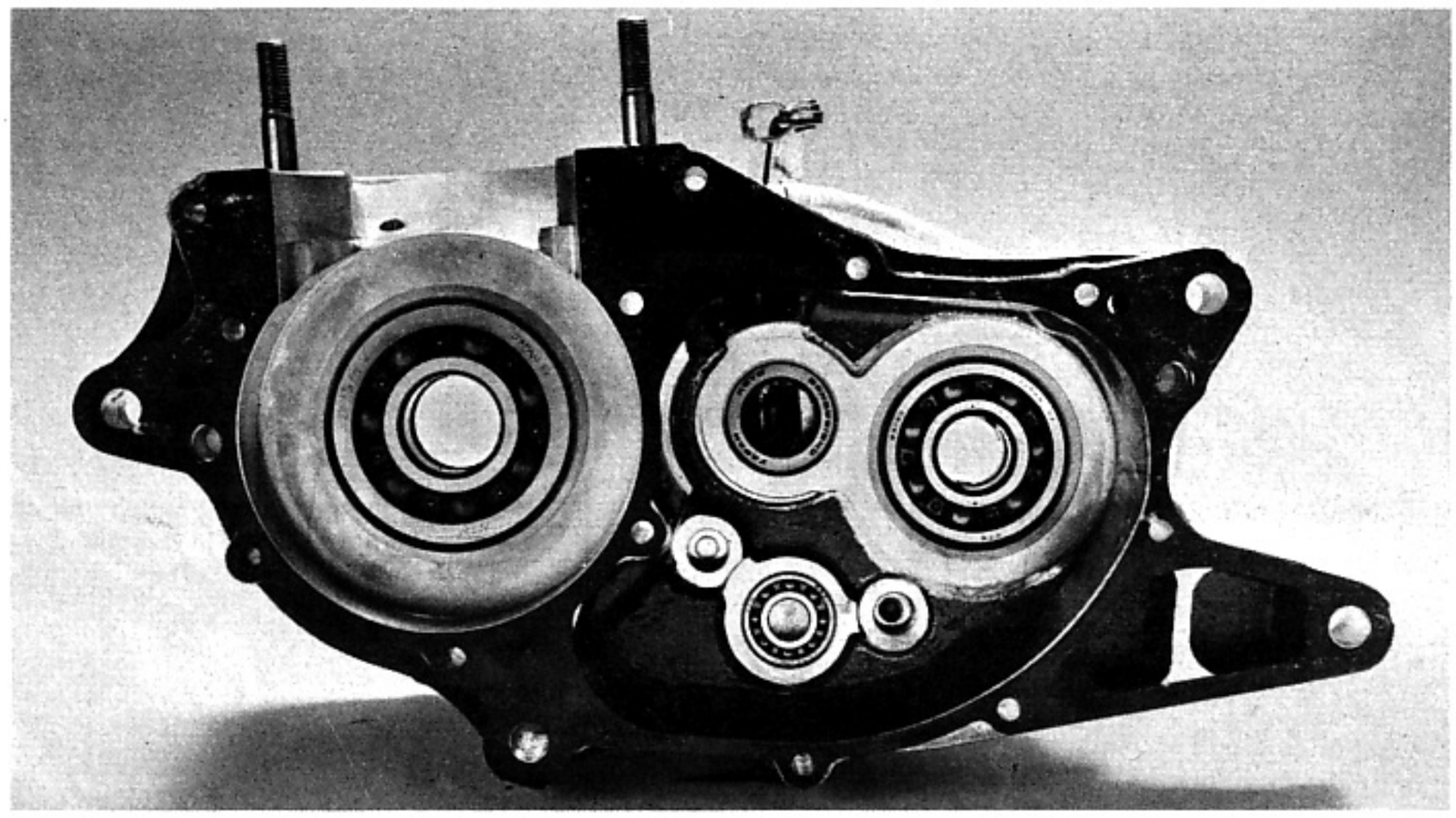
A stock CR piston sits atop the RC's polished connecting rod and a crank carved from steel billets with full-circle flywheels. The production Honda's crank is a forging, and the cast flywheels are not fully circular.

say why this approach was taken; it may represent an effort to increase the engine's crankcase compression ratio.

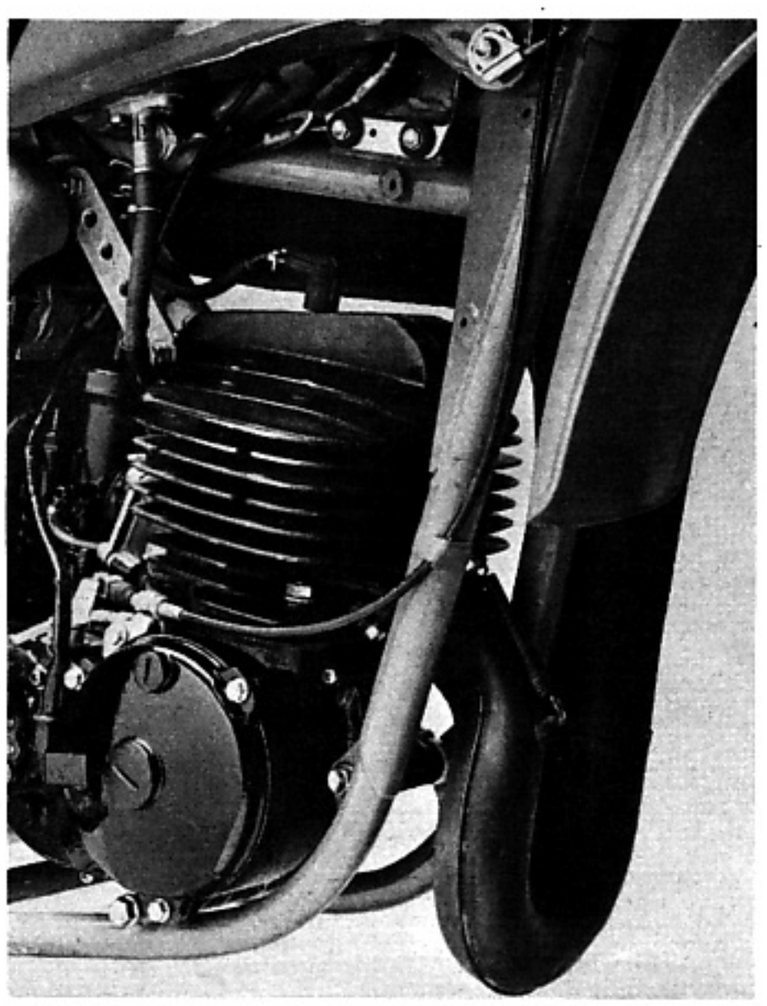
We don't know what to think of the RC-250's connecting rod. It appeared to be a standard CR250 rod forging that had been ground smooth after all the normal manufacturing processes were completed. As a rule, this is not necessarily a good idea. Forging leaves a tough, crack-resistant skin over a rod's surface, and grinding will remove that skin. Good practice is to shot-peen after grinding, but that hadn't been done. It's possible that one of the Team mechanics simply found himself with a bit of extra time and decided to be creative. Possibly, too, the rod had been forged out of some non-standard steel-alloy and heat-treated for added strength. We'll never know, as none of us happened to have a Rockwell tester in our pocket when we disassembled the RC250.

Apart from the straight-ahead disposition of its exhaust port, the RC250's cylinder was only slightly different from that of the CR250. Only slightly, but in a significant way. Conventional wisdom has held that transfer ports should be aimed both toward the rear cylinder wall and upward—this being the path of air flow in a loop-scavenged engine. But it has more recently been discovered that in-cylinder turbulence and the consequent mixing of exhaust residue with the fresh charge is aggravated when the incoming mixture streams are directed upward. The reason is simple. When the transfer ports are pitched upward at their entry into the cylinder, the mixture streams become rather turbulent immediately upon exiting the port windows. If, on the other hand, the transfers are aimed perpendicular to the cylinder axis, horizontal, the mixture streams attach to the piston crown and flow quite smoothly back to the rear cylinder wall. This reduces turbulent mixing, and there is a secondary benefit: straight-across transfer passages are effectively a bit larger, for any given window size, than those that angle upward.

The RC250's transfers were angled back, but they had no upward tilt. The CR250's main transfer passages, those flanking the exhaust port, are pitched upward 15 degrees; the slightly smaller secondary transfers are elevated 30 degrees. Also, in the current production engine the transfer tunnels' entries are somewhat narrowed by the thick, blunt wall between them and the cylinder bore. In the RC250 the lower edge of that wall has been narrowed, and the transfer passages themselves reshaped to smooth and hasten the flow. There isn't much difference in the size of the transfer passages. The main transfers' entry has been

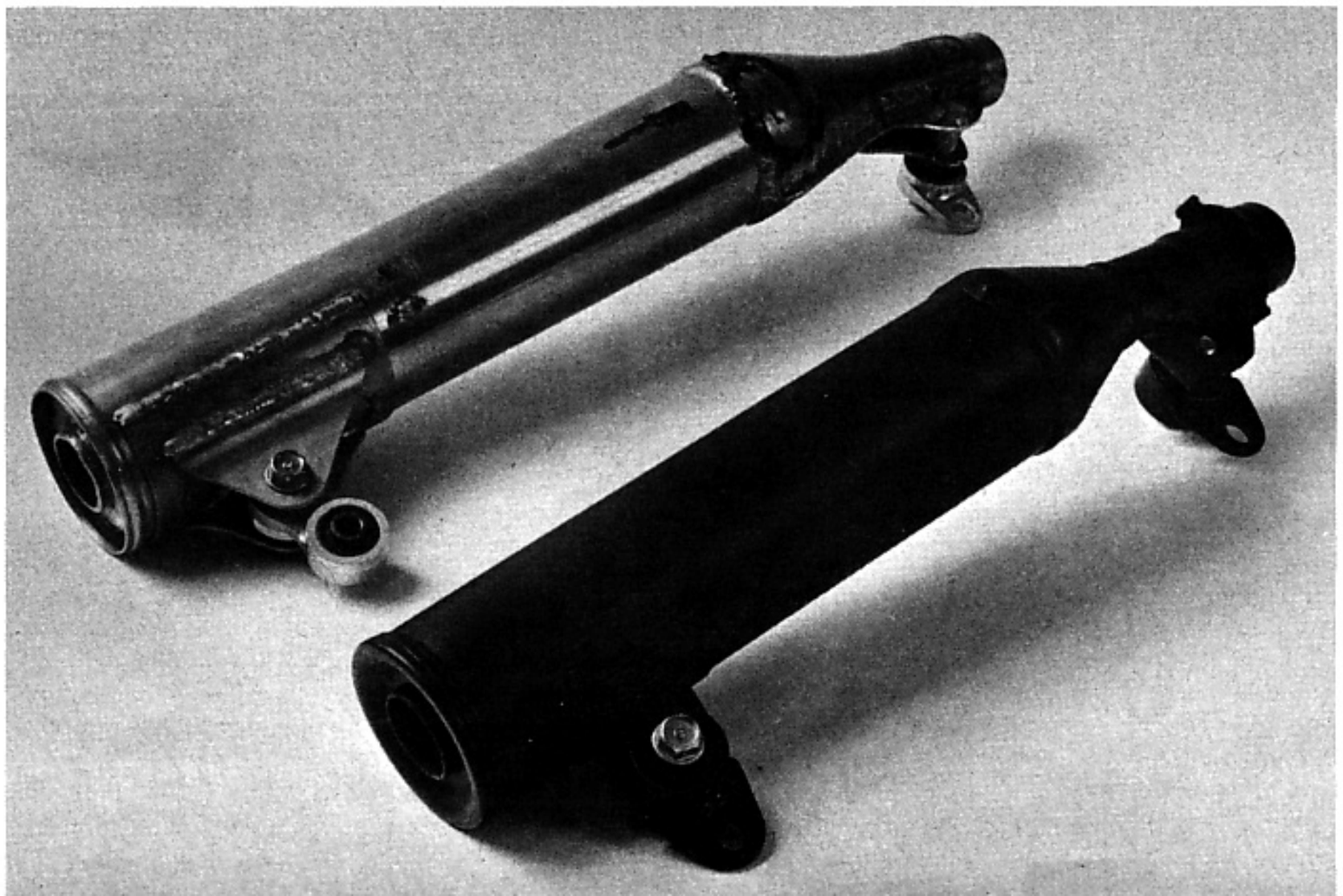


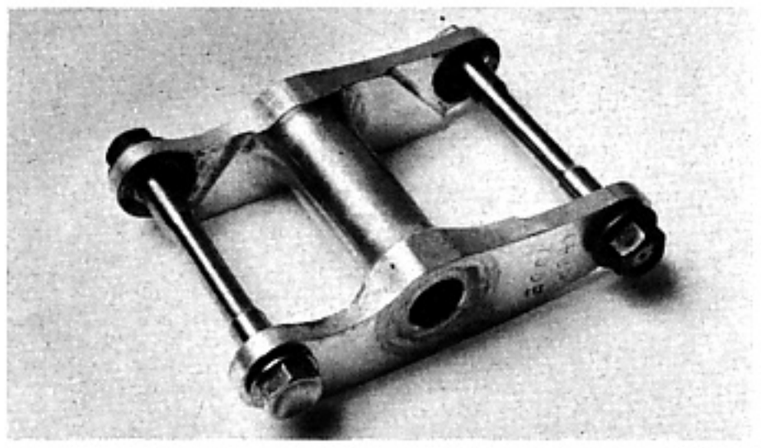
Internal RC finishing and detail work is exactly what you would expect on a factory special. The main bearings were initialed by the installer in Japan. RC transmission gears have the CR's number of teeth.



Double downtube frame allows the use of the center exhaust port engine. Fuel is fed to the RC's cylinder through reed valves by a magnesium alloy 36mm Keihin — five ounces lighter than the stock carb.

Aluminum RC silencer is the same size as black steel stock model but a whopping two pounds lighter.





The RC's combination swing-arm-spacer/dual engine-mount is carved from one piece of aluminum.

Marty Tripes' Honda RC250 . . .

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effectively widened about two millimeters, but the cross-section areas otherwise are about the same.

Unless there was some hidden metallurgical difference we couldn't detect, the RC250 and CR250 pistons were identical. And both carried the same 1.2mm-thick nodular iron rings. The ring faces were very bright but that must have been just burnishing. They couldn't have been chromium plated, as that's the material used as a coating on the cylinder bore. We had half-expected to find that the RC250's bore was coated with silicon carbide particles in a nickel matrix, or some other exotic treatment; it was just chrome plated, like the CR250's.

One thought-provoking oddity we found was the RC250's cylinder head, which was exactly the same as the stock 250 head except for having its combustion chamber machined instead of cast. That would be understandable if the stock head's cast chamber was rough, but it's very smooth. So we have to wonder if maybe the racing department ordered up a batch of heads with solid metal where the combustion chambers should be. That would allow them to machine different chamber shapes for experimental purposes, including one that duplicates the stock chamber. Maybe we happened to get the latter, and others are being tried.

Those funny little passages that connect the crankcase and intake port were present in the RC250, in reworked form. They're almost like a pair of drilled holes in the stocker, and angled upward. Those in the RC250 were larger than 1979-stock, and well rounded at both ends, with a kind of groove leading into them from the intake port floor (perhaps to keep fuel and oil from puddling there). We're still not sure if their most important function is to allow for flow down into the crankcase, or up from it; the attention they had been given says they *are* important. Incidentally, these and all the other changes had been made in the casting rather than having been cut with the tuner's porting tools.

Actually, there was a little hand work to be found inside the RC250. Its exhaust port had been enlarged very slightly, and widened at its lower sides. Also, the "boost" port that angled sharply up at the rear cylinder wall, from the intake port, had been smoothed and the ring-easing chamfers were a little more generous in size than those in the stocker. But the RC250 cylinder fundamentally had been cast to shape and size, and except for the reangled ports, looked remarkably like the one from the CR250. Even the nominal port timings were exactly the same: both the RC250 and CR250 exhausts opened

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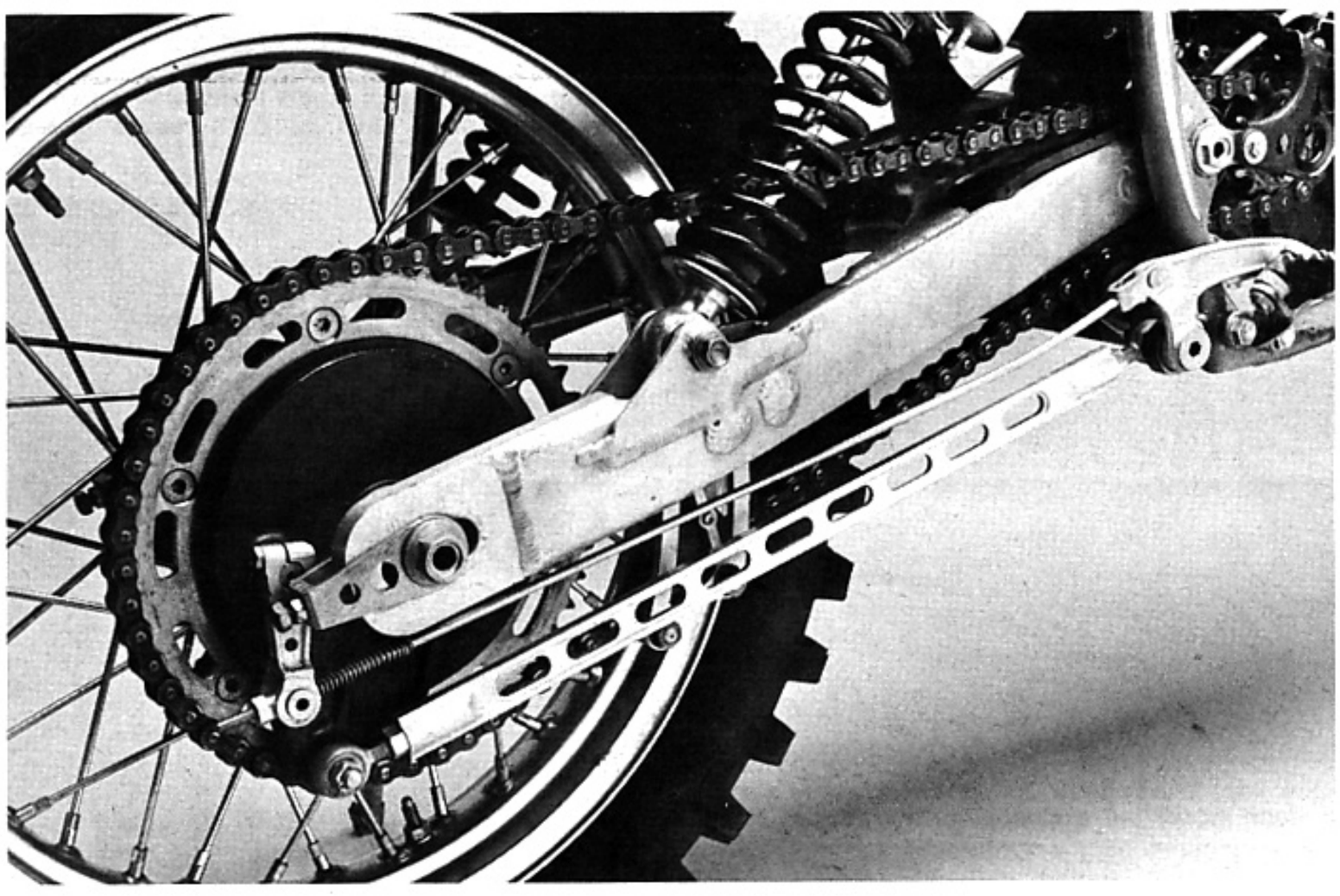
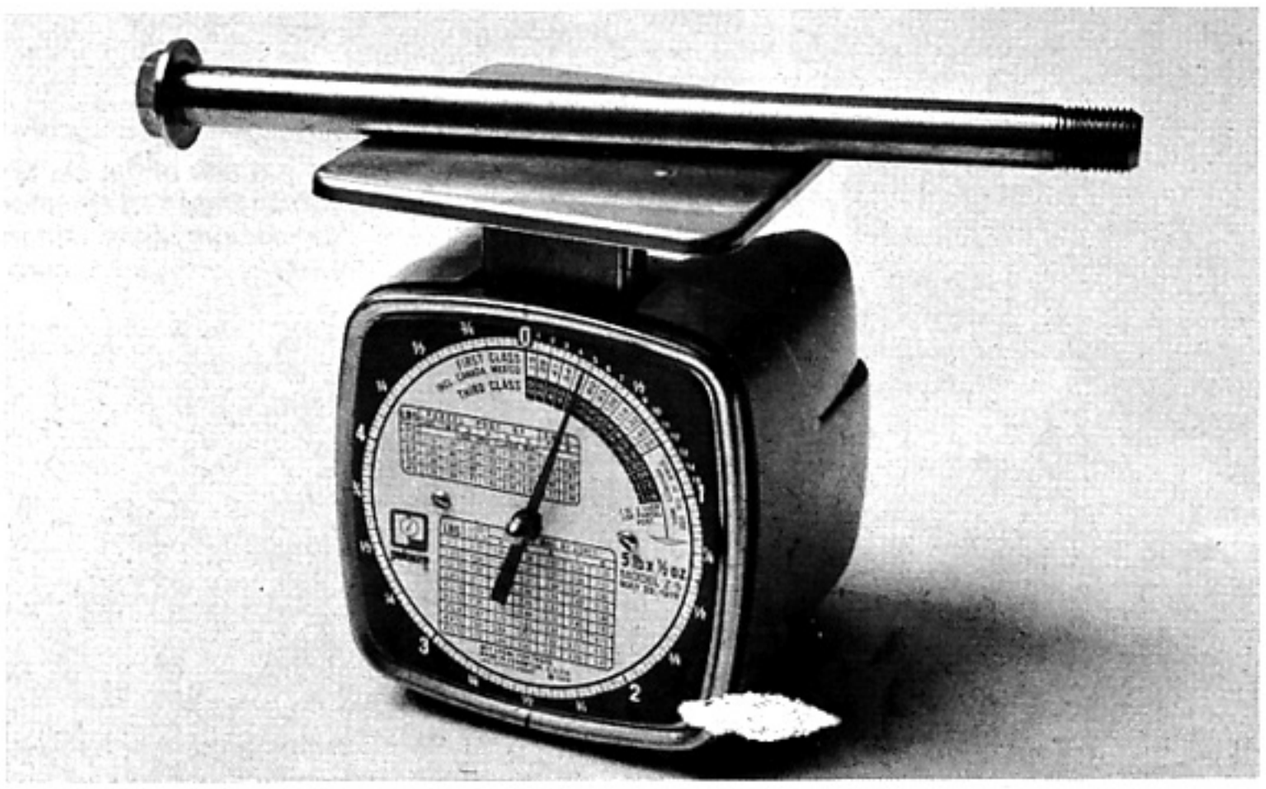


Titanium chain adjuster, aluminum rear brake arm, full-floating torque arm, specially machined chain guide and strong, thick and heavy swing arm all highlight the RC's rear end. The same pieces on the production CR are stamped or drawn from mild steel.



The first-class postage rate on the swing-arm pivot bolt would be only 67¢.

A quarter-ounce aluminum washer is drilled to further lighten the piece.

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You don't expect a genuine Works Team engine to be cobbled together out of stock pieces, and this one wasn't.

at 90 degrees of crank rotation Before Bottom Center, and the transfers opened 28 degrees later. These timings were also used in the original Honda 250 "Elsinore" which actually had larger ports.

The only way we could tell the difference between the stock and RC250 intake reed assemblies was that the former hadn't been stained and marked by running. They were the same parts, and capped by molded neoprene manifolds that were only slightly different. The stock manifold diverges abruptly internally to match the rectangular entry into the reed block. The RC250 manifold had a pair of molded extensions that fit inside the reed block and streamline the carburetor/reed flow. The Team manifold also angled the carburetor downward, nearer level, which had necessitated carving a bit of metal off the tops of the reinforcing ribs cast into the transmission housing roof.

There was less difference between the RC250 and CR250 carburetors than met the eye. The Real Racer carburetor's body was cast in a lighter alloy, but had the same 36mm throat diameter and was stuffed with most of the same parts. It had a 175 main jet instead of the stock 185, and a 28D needle instead of a 28A . The floats carried a different part number, 189 on the stocker and 239 on the RC250, but they otherwise looked exactly alike. We do suspect that the RC carburetor may be better streamlined internally, based on the presence of light reliefs trimmed where the throat passes the slide cavity.

We devoted a lot of time to measuring the stock and Real Racer expansion chambers, and the only thing we now know about them—beyond reasonable doubt—is that both provide a connection between the exhaust port and the muffler. That, and the fact that they aren't much alike. The stock chamber appears to begin with a parallel-wall section about 20 centimeters in length before it begins to bulge. Then it diverges and converges all over the place before necking down to its outlet. It begins with a 44mm inside diameter, ends at 26mm, and bulges to 100mm at its center. You can't really assign angles to its shape, as it changes smoothly and continuously throughout its length. However, it is fair to say the forward "megaphone" section spreads at a maximum angle of about 9 degrees (included). The rear cone closes for most of its length at a shallow 5 degrees, then pinches to 15 degrees, and finally chops in at 18 degrees.

The RC250 expansion chamber is a little closer to what we're accustomed to seeing, but not much. It had a 45mm entry, the same exit diameter, and was

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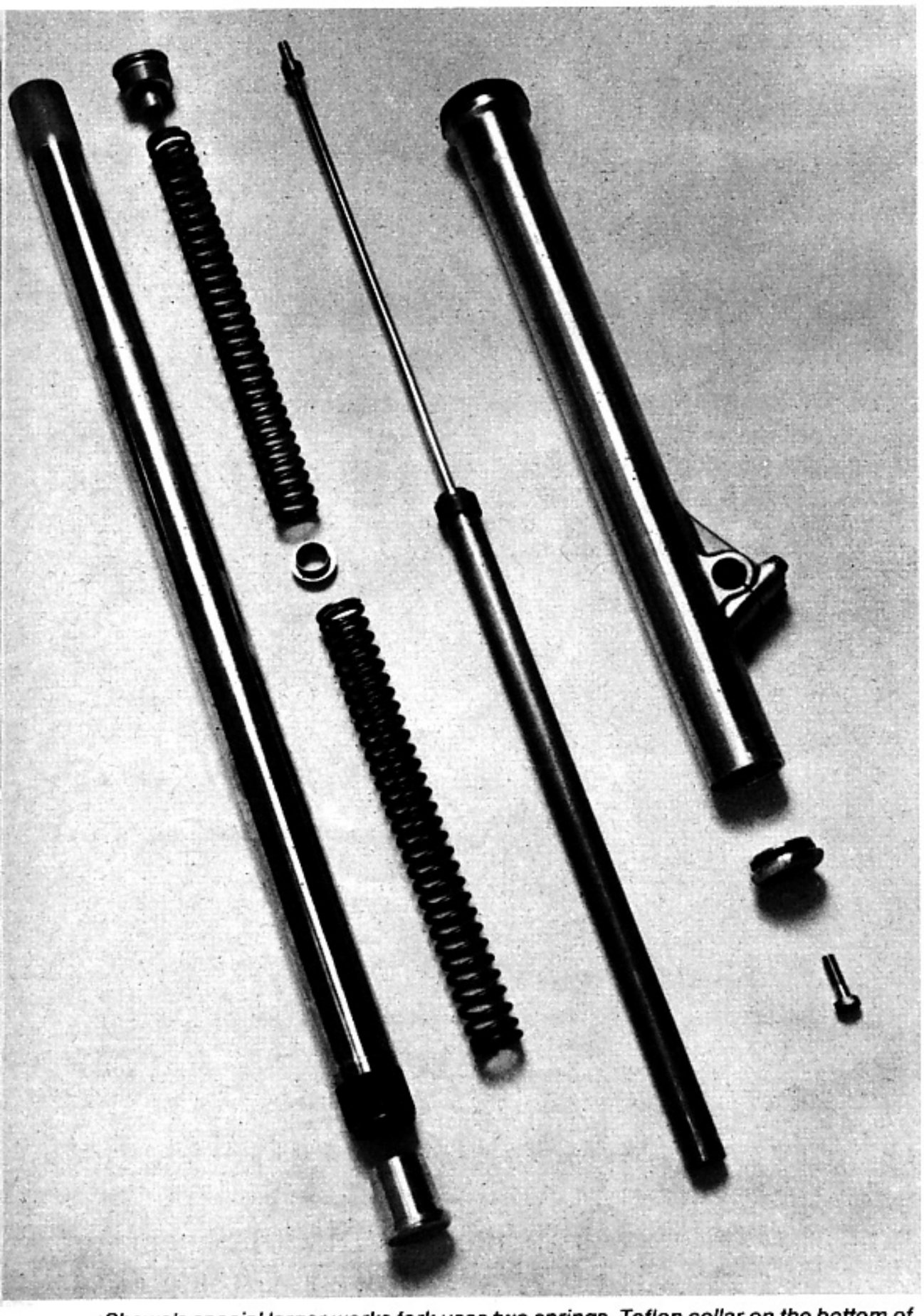
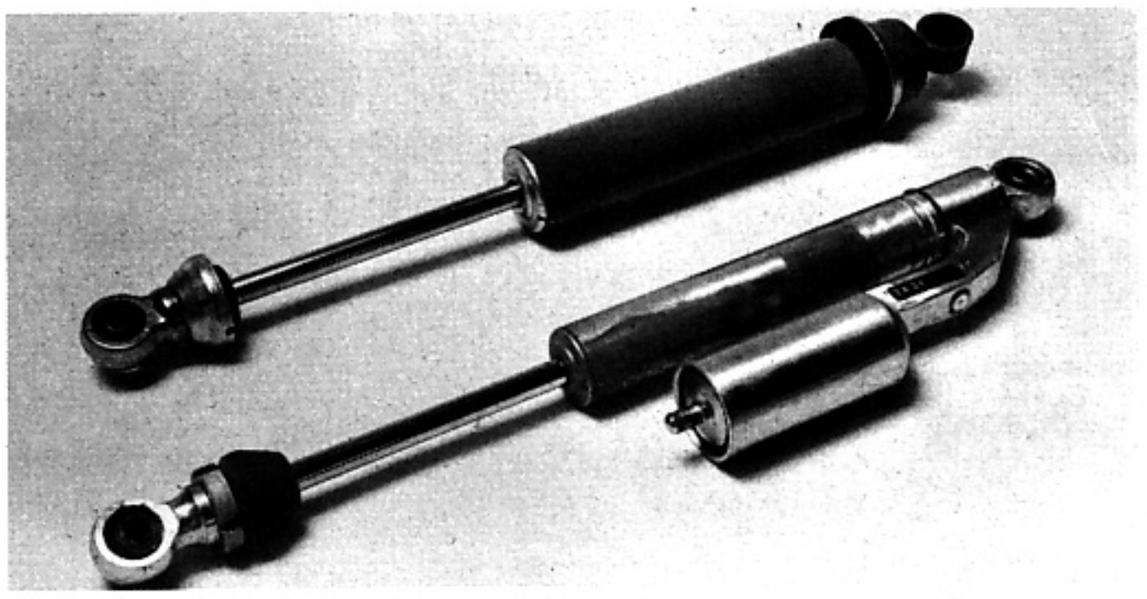
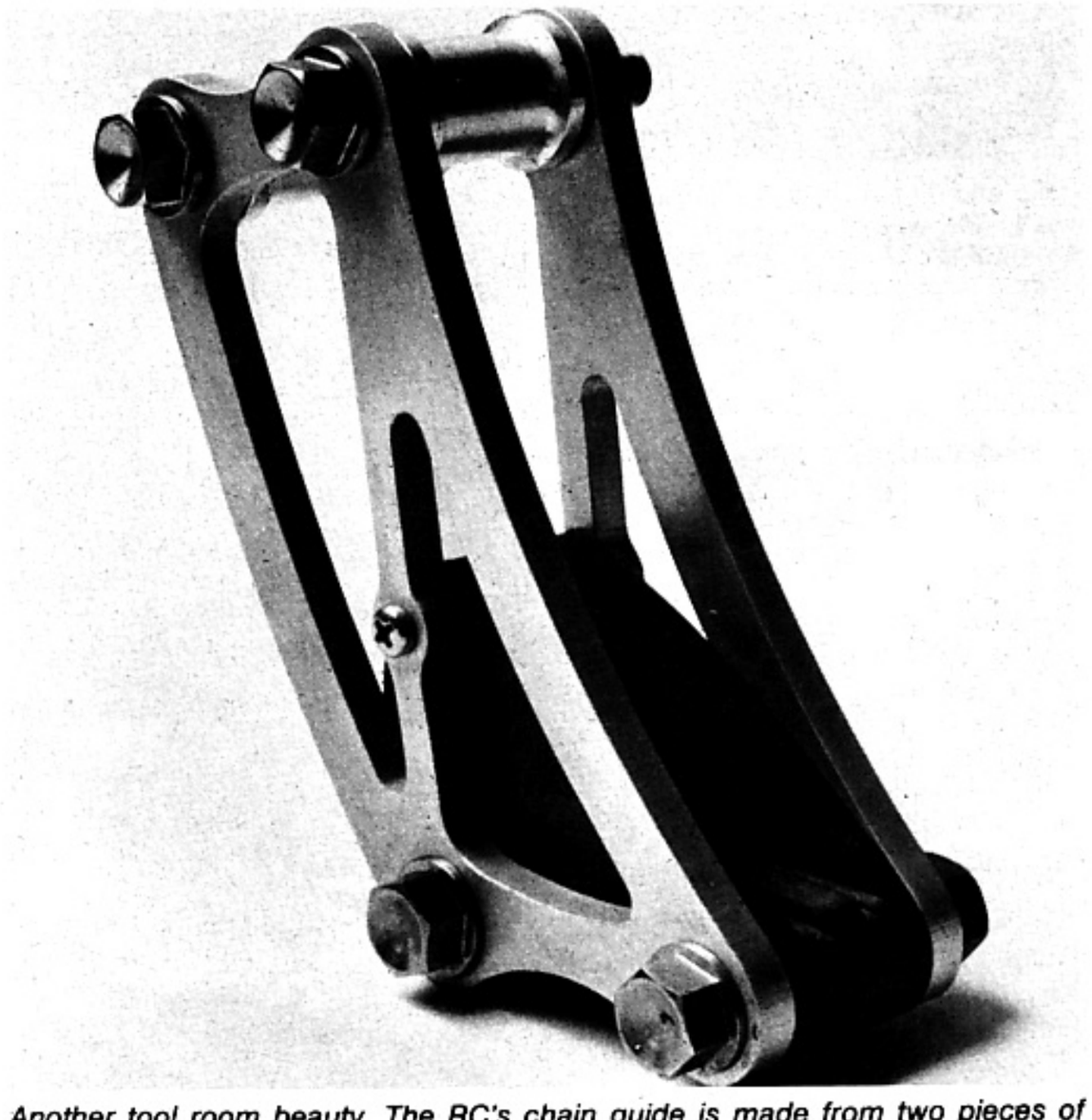


Showa's special larger works fork uses two springs. Teflon collar on the bottom of the tube and ground section on the inner shock's rod helps to eliminate stiction.



Honda's production shock (top) and the factory special are both made by Showa. CR's shock has a thinner rod and less oil capacity but weighs eight ounces more.



Another tool room beauty. The RC's chain guide is made from two pieces of aluminum, and it is fastened to the swing arm with dished-head titanium bolts.

Tripes' RC250 *Continued from page 44*

2mm skinnier at the mid-section. What made it familiar was that it begins with a long 3.5-degree tapered section and then spreads to an 8-degree diffuser. We've seen a lot of expansion chambers with forward sections to that specification. But then it, too, goes strange, closing rather irregularly toward its outlet end. Both chambers obviously are heavily compromised from the standpoint of power in the interest of making them fit their respective chassis. They make it equally obvious that Honda feels sheer horsepower is less important than getting the chamber tucked in where the rider won't have to worry about it.

We can tell you no tales of miraculous horsepower from the RC250 engine, as that is not what it delivered. It was one horsepower stronger at 4500 rpm than the CR250 we tested last year, but essentially the same from there to 6000 rpm. That's where the CR250 began to weaken, and it peaked at 7500 rpm where it made 29.82 bhp. The biggest difference, the RC250's edge, is found above 6000 rpm: it's two horsepower better at 6500 and 7000, and holds a smaller but firm advantage up to 8500 rpm, which is where both engines fall pretty flat. The peak for the RC250 is at 7000 rpm, where it makes 31.51 bhp. The CR250 has to turn another 500 rpm to make its maximum of 29.82 bhp. Both engines have torque peaks at 6500 rpm, and deliver 24.56 and 22.92 pounds-feet respectively. These differences are not large; they are impressive if you consider that the RC250's advantage has been gained without changes in port timing or size, and without raising its compression ratio

What you cannot see in dynamometer figures is that the RC250 engine has a kind of happy willingness in the way it runs. Some similar engines will give much the same power, but they just don't seem to be pleased to oblige. You listen to them as they pull the dyno load, and there's a raggedness to the way they sound. Often, too, there will be more concrete evidence of unhappiness in the rapid movement of the head temperature gauge's needle. The Team Honda showed none of these signs of distress. It just ran, and once its spark timing had been adjusted correctly the head-temperature rise was slower than we have come to expect with air-cooled two-stroke engines.

We must mention here that the RC250 was very sensitive to changes in ignition timing. Best power was obtained with the spark retarded just enough to banish all signs of detonation from the plug (which were much in evidence when we tried standard CR250 timing). Timings a couple of degrees either side of that optimum produced a severe depression in power.

We'll save you the trouble of digging out old copies of *Cycle* to see how other 250 motocross engines would fare in a horsepower contest with the RC250. With most of them it would be Honda by a nose. The 250 Can-Am is appreciably stronger, but only at its power peak. And we'll also save you the trouble of carving up the ports in your stock CR250 to get RC250 performance. If you're going to that much trouble, go ahead and switch to a Suzuki RM250 engine—which has about the same power range with a slightly higher peak output.

The RC250 engine isn't a miracle worker; it's simply a pretty good engine that makes good but not stellar power. Honda unquestionably could make it crank up more horses than it actually delivers. The fact that this hasn't been done is what we find most interesting about the RC250. It is as though Honda is saying horsepower hardly matters in motocross; that it is chassis development and rider skill you will need to be a winner. We can't find it in ourselves, or the RC250 engine, or Marty Tripes' competition record, to argue with that piece of advice.

Have you ever thrown a chain and destroyed the chain-adjusting clamp and locking bolt? That problem is not likely to happen with the RC. Both the adjustment clamp and the bolt are made of titanium. The pressed steel stock adjustment is a mere 2.5mm thick compared to the 4.5mm dimension of the RC. Both machines use steel axles, as required by the AMA rulebook, but the appearance of titanium on the factory special was detected again in the retaining nuts.

Showa of Japan makes the RC's suspension components; they also make the stock pieces. But the two systems' similarities end with the manufacturer's name. The stock shocks are not rebuildable because of the high gas pressures, but the shocks hold just under 180cc of oil—which may explain their reputation for fading very early into a moto. The *one-off* shocks on the RC utilize an aluminum body and an attached reservoir made from a single piece of aluminum. While fear of destroying an equally one-off gasket prevented us from taking the RC's shocks apart, it is quite obvious that the RC shocks have a greatly increased oil capacity. During our brief riding period on the RC, the shocks did not even heat up in a 15-minute practice moto. With the increased oil capacity of the works shocks you might expect them to be slightly heavier; you would be wrong. A complete RC shock, less springs, is a half-pound lighter than the nonreservoired stock shock.

We did find one curious thing with the rear end of the factory racer. The geometry was quite unusual. So much so that we asked Al Baker, one of the best motocross suspension men we know, to come have a look at the RC. According to Al, the rear was "all wrong" on the factory bike.

The works swing arm is the heaviest arm for a Honda CR250 we have seen. The aluminum arm with chain-guide in place weighed 8.5 pounds. Accessory units are available that are a full three pounds lighter, but after a close look at the RC's arm you may doubt if the add-on arm could be any stronger. The works swing arm is one-half-inch longer than stock, which helps the machine's stability over rough terrain. But the shock mounts are, according to Baker, not where they should be. The lower shock mount on the swing arm is 15.25 inches from the swing-arm pivot. The top shock mount is welded to the frame only 11.75 inches from the same pivot.

The longer distance at the swing arm means that the shock works at a 2.09:1 mechanical leverage ratio during the first part of the shock's compression stroke. The farther the shock is compressed the lighter the resistance becomes. At 50 per cent of the shock's compression, the ratio drops to 1.87:1, and at full compression the ratio is only 1.62:1. On the track this

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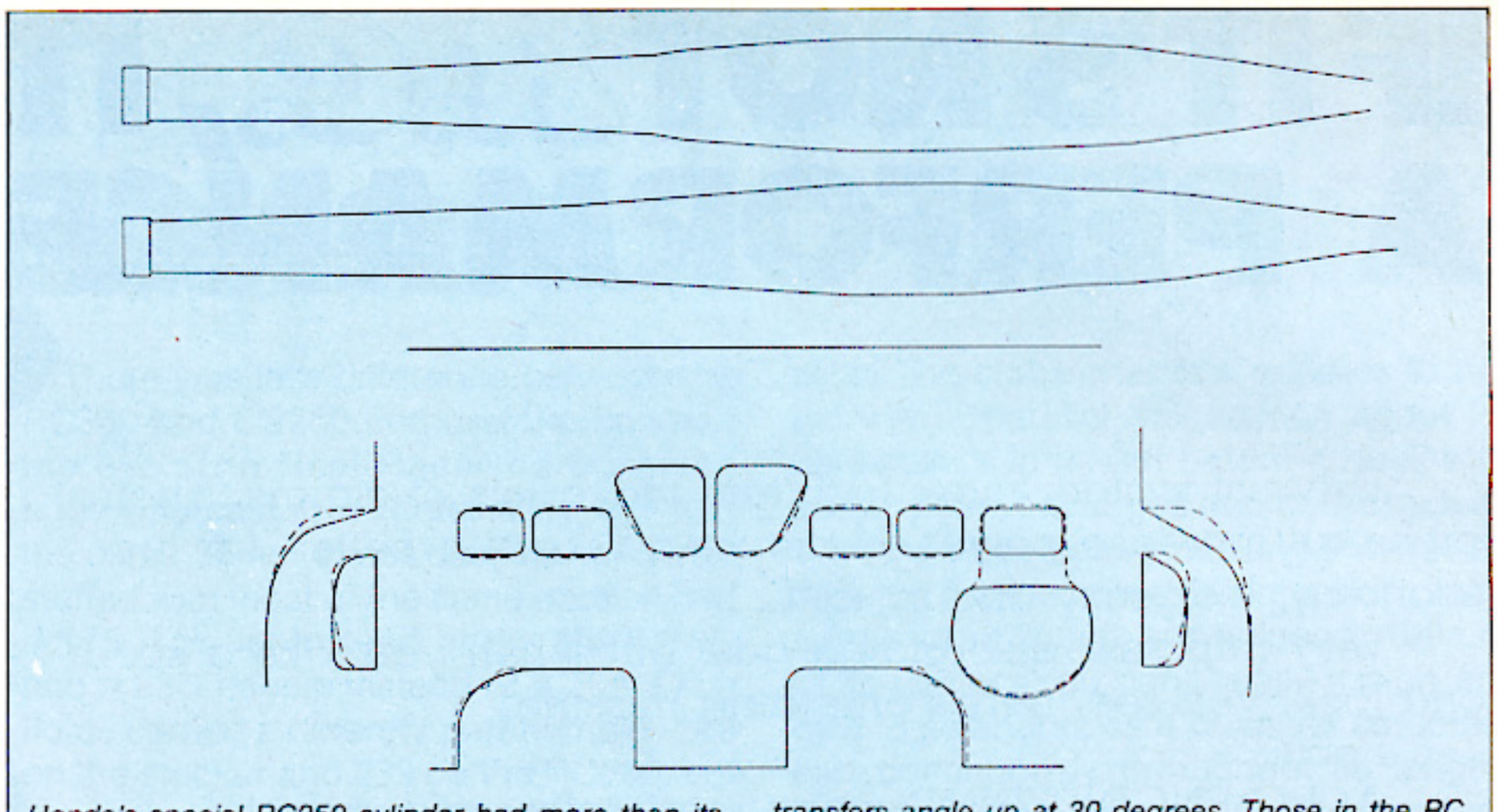

Honda's special RC250 cylinder had more than its centered exhaust port to make it different from the one you get with a stock CR250. All the RC's port windows (dotted lines) had dimensions much like those in the stock cylinder (solid lines) but the transfer passages had been extensively changed. The stock cylinder's main transfers (left side of drawing) are pitched upward 15 degrees; its rear transfers angle up at 30 degrees. Those in the RC cylinder are aimed straight in, and have a very different convergent-wall shape. We have also provided drawings of the expansion chambers, for whatever that may be worth. The RC250 chamber is shown below; the stocker above. In both, angles of divergence and convergence change continuously, which makes dimensioning the drawings impossible.

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particular shock angle transmits the small stutter bumps harshly to the rider because the shock resistance is actually at its stiffest. And over big bumps and jumps where the full length of the shock's stroke is used the ratios become increasingly softer. When you add in the inertia of the rear wheel, the decreasing ratio seems even more inappropriate; and it is.

Unlike the engine area where titanium is abundant to lighten the bike as much as possible, the front fork is almost two pounds heavier than stock. The external differences are obvious. The fork tubes are 39mm in diameter, one millimeter thicker than stock, and the sliders hold 300cc of oil, 25cc more than the CR's sliders. A millimeter here and 25cc there adds up for increased rigidity and insurance against fading.

The big difference between the two forks is in the internal parts. In both forks the damping is handled by individual shock-like units. The cylinder of the inner shock is bolted to the bottom of the slider, and the piston is attached to the top of the fork by a long rod. The piston is held stationary and the body moves up and down. The oil enters the shock at the bottom of the fork tube so there is very little chance of the shock sucking air. The factory racer took the basic stock fork idea but increased the size of the inner shock.

The RC's fork also differed in that the inner shock rod was ground down between 50mm and 120mm travel of the rod when the unit is fully extended. The waisted section is .025 inch at its thickest point and then gradually tapers off. The ground-in section destroys the seal between the shock body and the rod thus allowing oil to slosh past the waisted area on the rod. The oil is not forced past the graduated orifices, so the fork responds quicker over small bumps. Over larger obstacles the ground-in section gradually disappears and the fork returns to its normal damping process.

The factory fork also uses two fork springs with a slightly higher spring rate than the stock fork. The left tube is threaded to accept the front axle without the use of a nut. This practice reduces machine weight by the amount of one nut, but more importantly, if a quick tire change is needed before a moto there is one less nut to lose.

Above all, the single most important thing about the RC was its painstaking preparation. Jon Rosensteil, who maintained the bike, is one of the top three motocross mechanics in America. Thanks to the factory and Jon R., everything had gone together beautifully.

While inspecting parts on a postage scale, we mentioned to Al Baker that Honda said the bike was virtually stock.

"Yeah," said Al. "There's no problem getting replacement parts. All you have to do is make them."

Outside of the very special suspension components, the unique engine, one-off frame, titanium this and aluminum that; the bike was your ordinary factory racer. Which is to say there was very little stock about it at all. ◉