

## •8 World Championship Motorcycles

World championship motorcycles fall into two broad categories, road racing and motocross. The FIM (*Federation Internationale Motocycliste*) awards six world titles in road racing and three world championships in motocross. As a corollary, the FIM calculates manufacturers' championships in world title competition. Almost always constructors' championships follow the individual titles. For example, in 1974 Giacomo Agostini won the 350 World Championship in Road Racing on a Yamaha; after the season's points had been tallied, Yamaha earned the 350 Constructor's title.

The FIM hands out world prizes in areas other than road racing and motocross, but such titles are minor league in comparison. These additional titles are: Team Speedway, Individual Speedway, Best Pair Speedway, 1,000-Meter Sand Track, Ice Racing, and Trials.

Traditionally the FIM rulebook has been very thin. World championship bikes, in motocross and road racing, need not be based on production-line models. Manufacturers who are major contenders normally build ultra-special one-off racers. Consequently, in the world-title series, enthusiasts will see the grandest monuments to no-expense-spared engineering. In efforts to stay competitive, factories may substitute one experimental bike for another from one grand prix to the next.

Those who love to scrutinize lavish racing hardware always find something new to see at every event; but though one may gawk in the paddocks, the observer will not likely gather much hard information. Factory mechanics and riders stay tight-lipped about equipment changes. "This engine," quipped one mechanic, patting the latest factory racer, "is a model of uncertain dimensions built out of unobtainium."

*With his title on the line, 125 World Champion Kent Andersson rockets out front on his water-cooled Yamaha twin.*





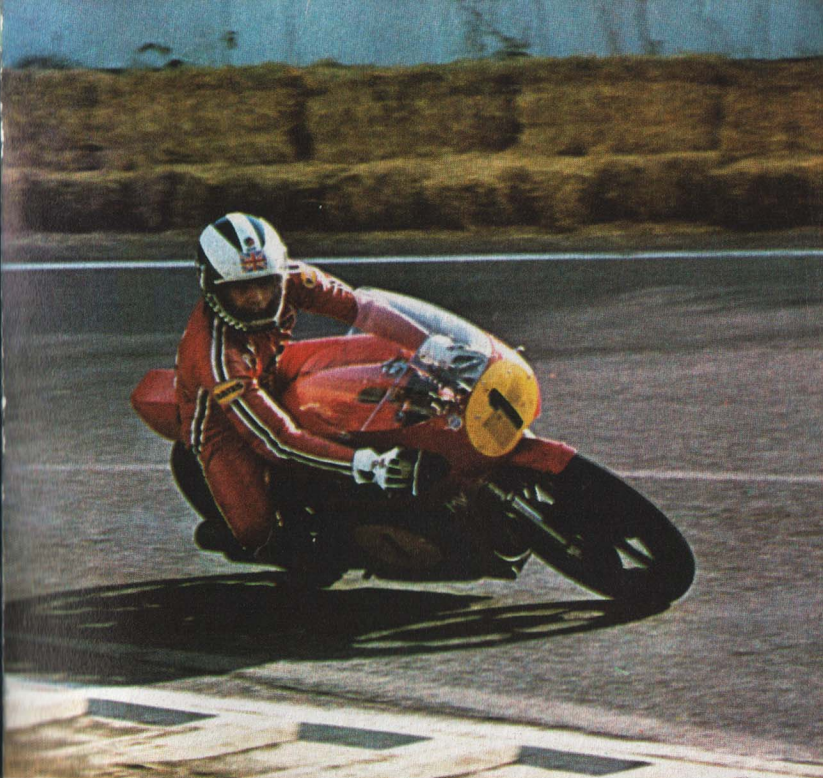


### MV Agusta 500

In 1974 MV Agusta carried Phil Read to his second consecutive 500 World Championship in Road Racing. The Italian maker, which has practically owned the 500 championship series since 1958, faced its most serious challengers in seven years—Giacomo Agostini and the Yamaha four-cylinder road racer.

The MV Agusta is the most competitive four-stroke solo bike in world series racing. Generally, four-stroke engines make less horsepower than two-stroke designs of comparable size—and four-strokes are far heavier and more expensive to build. Despite the odds, MV Agusta pressed ahead in 1974, and won.

The double-overhead-camshaft engine, with four valves per cylinder, produced over 90 horsepower at a fantastic 16,000 rpm. Bore and stroke measure 57mm x 46mm. The short stroke is necessary to achieve high cranking speeds; and only this elevated rpm ceiling, which allows



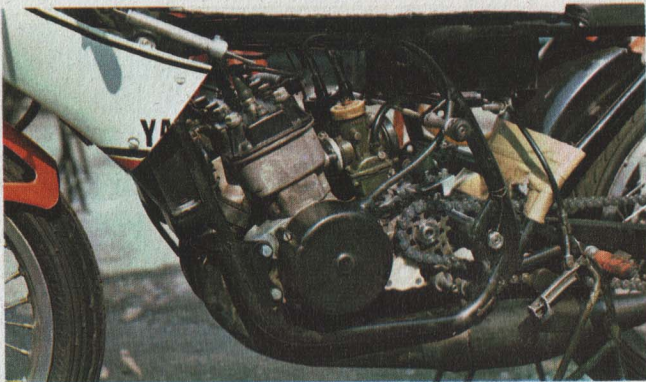
the engine to combust great quantities of gasoline and air every second, has kept the MV Agusta in the same horsepower league with the two-strokes.

Great horsepower creates handling difficulties. The 1974 four-cylinder MV made at least ten horsepower more than the previous MV championship bike, a three-cylinder 500. Throughout the 1974 season MV experimented with frames having curved tubes, and others with straight-line members, and still others with subtle combinations. In the search to steady the 500 four's handling, MV even installed an idler sprocket on the lower chain run; theoretically the extra sprocket was supposed to damp out chain whip that could upset the handling. The legendary MV road holding gradually returned.

MV Agusta has no significant motorcycle production. Indeed, the company's business is the manufacture of helicopters, so MV does not race for commercial reasons. For this Italian concern, world championship road racing is a matter of love and honor.

*MV 500's small size becomes apparent in the pit—and on the track with World Champion Phil Read in the saddle.*





### Yamaha YZR-350

Nowhere did Yamaha's battle plans succeed so brilliantly as in the 350 world championship series in road racing. The 350 water-cooled twins swept all adversaries away. The only serious opposition came from MV Agusta, which tried to match the Yamaha 350 twin with a four-cylinder four-stroke. So devastating were the Yamaha twins that the MV opposition was driven off. After early-season appearances, MV withdrew their 350 fours from world competition, leaving the title to an intramural fight between Yamaha riders Dieter Braun and Giacomo Agostini. In the end, reigning 350 World Champion Agostini prevailed on a works Yamaha.

The factory-supported 350cc twins were essentially refined TZ-350 production-racer Yamahas. The twin-cylinder, water-cooled factory bikes were significantly lighter than those machines sold to privateers, thanks to magnesium crankcases, lightweight frames, and other special bits. Some paddock tipsters claimed the works Yamaha 350's had been shaved back to 250 pounds. The six-speed factory bikes never lacked power, with 72-76 horsepower on tap from 11,500-rpm engines. Those figures produced a power-to-weight ratio which was close to that of Yamaha's 500cc four-cylinder grand prix racer.

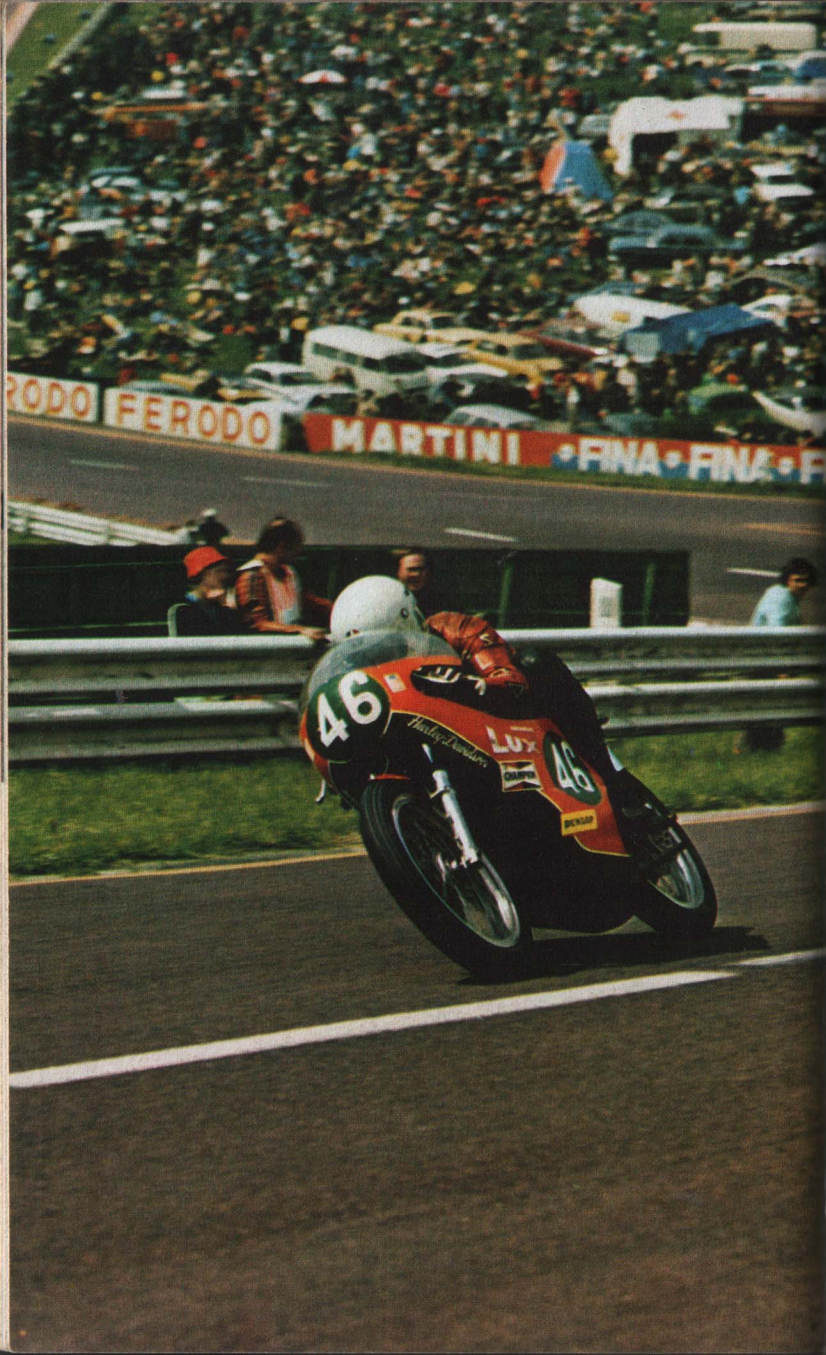
The 350 twin has benefited from three years of development. First used in Europe in 1972, the water-cooled TZ-350 arrived in private hands early in 1973. After a long period of steady improvement, the engine has probably reached its final stage; lap times can be dropped further only by working on weight reduction and handling refinements. Which is exactly the path Yamaha followed in 1974.

**142** Though the fortunes of grand prix wars change season to season, the fully developed Yamaha twin holds its world crown more firmly than any other victor in international road racing.

*YZR-350, similar to, but distinct from, the production TZ-350 Yamaha, powered Giacomo Agostini to another championship.*







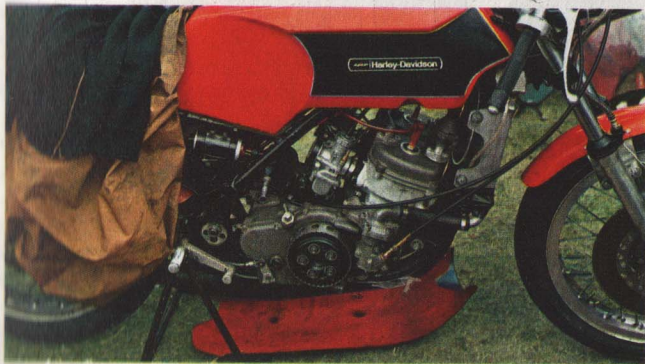
## Harley-Davidson 250

After more than a decade, the Italians returned the 250 World Championship in Road Racing to Italy. The last 250 title won by an Italian on Italian equipment occurred in 1960. Thereafter, the golden age of Japanese power—Honda and Yamaha—began. The best 250 Italian showing came in 1969 when Australian Kel Carruthers won the light-weight crown on an Italian Benelli. So Walter Villa's victory on the Harley-Davidson/AerMacchi in 1974 capped a long struggle.

The Harley-Davidson two-stroke racer first splashed into the center of international racing in 1972 when Renzo Pasolini finished second in world class competition. This early air-cooled version gave way to a water-cooled model in 1973. A year later, the Italian racing 250 sported twin disc brakes. The slow pace of development always left the Latin twin trailing the Yamaha 250's by a half-step.

In 1974 Harley-Davidson caught up with Yamaha in Europe. The Italian and Japanese bikes are quite similar. Both are water-cooled, piston-port two-strokes with chrome-plated aluminum cylinders. Both bikes mix fuel and air with 34 Mikuni carburetors. The Harley-Davidson controls the firing of spark plugs with an electronic triggering system. So does the Yamaha racer. Both bikes have six-speed gearboxes. The Harley-Davidson engine dimensions measure 56mm x 50mm, while the Yamaha remains perfectly square at 54mm x 54mm. The Italian racer will rev a little harder (12,000 rpm) than the Yamaha. With about 55 horsepower on tap, both the Harley-Davidson and Yamaha can pierce the 150-mph barrier.

Given the similarities between the two racers, only superior organization, greater determination, and harder riding by Villa gave the Italians the 250 world title.



*The Harley-Davidson racer, like other works two-strokes, has the power characteristics of a light-switch: all-on or all-off.*



## Yamaha YZ-623

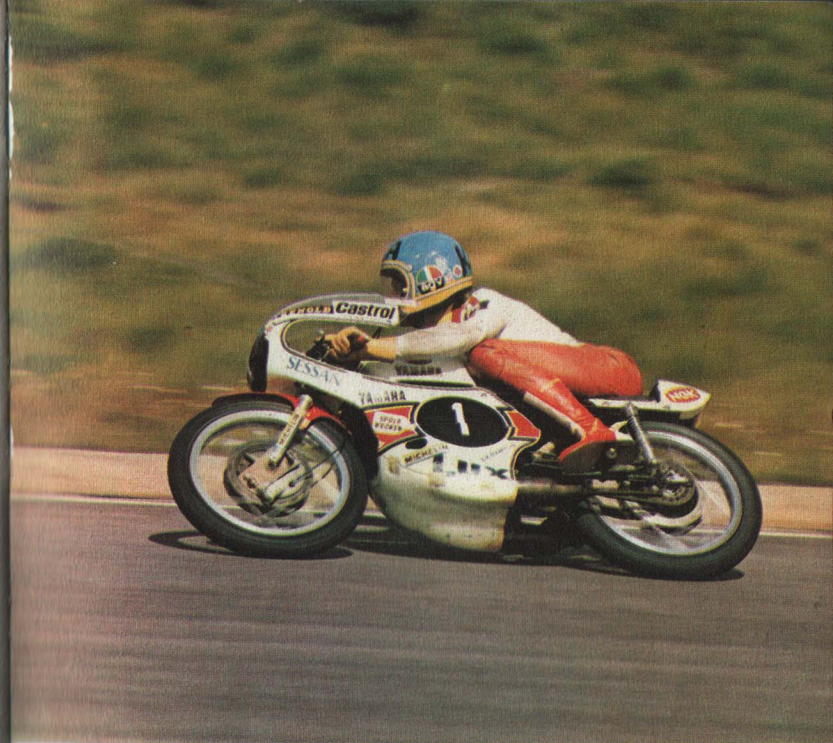
Defending champions in the 125cc class, Kent Andersson and the 125 Grand Prix Yamaha, squeaked out another world title in 1974. Like the 500 and 350 classes, the hotly contested 125 championship hung undecided until the close of the season. In fact the 125 World Championship in Road Racing proved uncertain until the last corner of the last lap of the final grand prix race of the year.

At the Czechoslovakian Grand Prix, the year-long tussle between Yamaha and the Italian Morbidelli came to settlement. The Italian pilot, Paola Pileri—who was racing with a broken collarbone—had Andersson's Yamaha well covered. Then the Morbidelli coughed and sputtered to a stop in the final corner. Pileri had run out of gas! His nearly clinched title escaped. Andersson won.

FIM rules for the 125 class limit manufacturers to engines with two cylinders and gearboxes with six speeds. Therefore all 125 racers line up in a general pattern: water-cooled twin-cylinder two-stroke engines, electronic ignition systems, dry clutches, lightweight running gear, and super-efficient streamlining.

The 125 Grand Prix Yamaha produces about 40 horsepower at 15,000 rpm. The machine weighs around 180 pounds, and its top speed ranges upward to 140 mph. The YZ-623 employs piston-port induction and draws its mixture through two 26mm carburetors. Both the Italian Morbidelli and Spanish Derbi have rotary-valve induction systems, a more complex set-up which has great horsepower potential—in theory at least.

146 Nevertheless, racing is more than a set of blueprints. Even luck has its place, as Kent Andersson will acknowledge.



Under the plumbing live two tiny 60cc cylinders. The large canister is the oil-trap bottle for the breather system.



### Van Veen Kreidler

Continental motorcycle enthusiasts sustain the 50cc World Championship. The tiddler class shrivelled and died in England after enjoying brief popularity in the 1960's. And 50cc racing never came alive in the United States. But on the Continent, the Dutch, the Spanish, and the Germans form the backbone of 50cc racing. Kreidler, Jamathi, and Derbi all field impressive machinery.

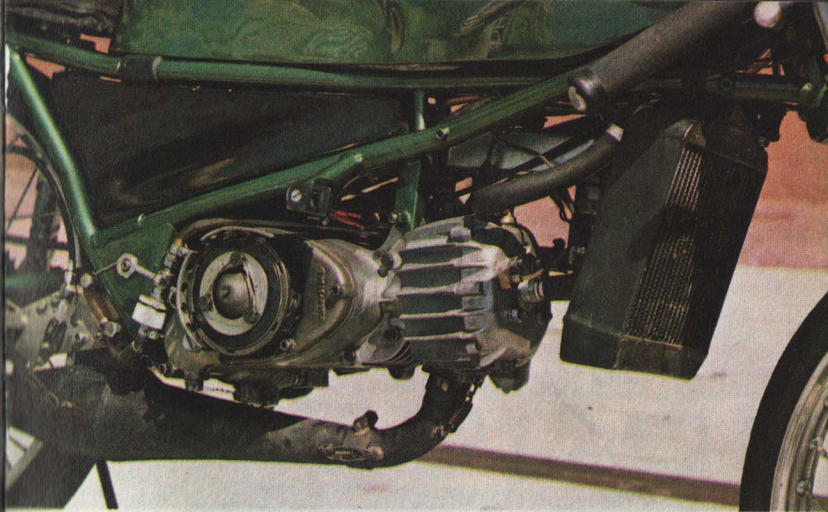
The FIM formula for the 50cc road-racing class mandates single-cylinder engines and six-speed gearboxes. These limitations keep the machines relatively simple and encourage small manufacturers to participate. Major contenders include German Kreidlers, Spanish Derbis, and Dutch Jamathis. Van Veen, the Kreidler importers for the Netherlands, also constitutes a major force. Aboard the Van Veen Kreidler, Henk van Kessel won the 1974 50cc World Championship in Road Racing.

The Van Veen racer has a water-cooled, disc-valve, two-stroke engine. The powerplant develops about 19–20 horsepower with a piston the size of a bourbon shot-glass. The 26mm carburetor is nearly the size of the cylinder. The power peak occurs at 16,000 rpm, but a knife-edged powerband will not do. Six-speed gearboxes force a fairly wide spread of power. Every ounce of output must go a long way, so Van Veen Kreidlers are very light: 125 pounds. The tiny machines require small riders who won't overwhelm the fragile bikes. All 50cc racers look as if they have been stretched (and lowered) like a piece of taffy.

Frail appearances should not imply sluggish racers. At the Belgian Grand Prix held at Spa-Francorchamps, the fastest 50cc mighty mites can lap the course at an average speed of almost 100 mph. The maximum top speed for the Van Veen Kreidler is dazzling: 127-plus mph!

148

*Though he's not a giant, World Champion Henk van Kessel dwarfs the tiny Van Veen Kreidler.*





### Zundapp 125 MX

As the most recent addition to the world championship schedule in motocross, the 125cc class continues to gain momentum. The world-title chase has already attracted European factories, including Zundapp, Bultaco, Montesa, and Husqvarna. Though no Japanese manufacturer has begun a full assault on the title, that time approaches rapidly.

In 1974 the age of super-special factory racers had not arrived in the 125cc class. The young Belgian rider, André Malherbe, claimed the title on a Zundapp—a production-line motocrosser which appeared almost disgustingly standard. Indeed, the motorcycle had a very heavy steel frame and production-stock wheels. Zundapp did not bother to craft the gas tank or fenders in super-light plastic. The tank was common steel; the fenders, aluminum. Nothing special distinguished the front fork. And only late in the season did Koni shock absorbers replace the Girling units. Zundapp offered no dazzling suspension tricks. The rear dampers were canted just slightly forward, and the German factory didn't use any large-capacity, long-travel shocks.

Malherbe's engine, however, really performed. The all-aluminum engine had a special high-compression cylinderhead and a 30mm Amal carburetor. With some porting changes and its six-speed transmission, the Zundapp was the fastest, quickest bike in the 125 world class.

So much stronger was the German engine, some competitors mumbled that the Zunnie must be a 150cc or 175cc engine. Yet no one had enough confidence in that theory to protest the winning machine. Thus, the "big engine" talk amounted to a backhanded compliment for the super-power 125 Zundapp and its equally potent rider, André Malherbe.

*Whether aviating or blasting out of the corner, the Zundapp 125 showed its superior power throughout the season.*







152

### KTM 250 MX

In 1974 Gennady Moiseev became the first Russian to win a world championship crown in motocross. The USSR rider battled all season aboard his Austrian KTM. His main adversary was Czechoslovakian Jaroslav Falta on a works CZ, and the last race decided the championship. Indeed, the title remained unsettled even after the event. Falta "won" the race; he had, however, jumped the start, and after the FIM jury assessed a time-penalty, Falta's placing fell from first to ninth. That descent erased the margin necessary to beat Moiseev. It was the Russian's day, and his championship.

Moiseev's grand prix bike was no Austro-Russian secret weapon. In fact, the machine had amazingly standard specifications, almost identical to the Penton (KTM) motocrossers sold over-the-counter in the United States. Luck and trick-machinery played no large part in Moiseev's success. He had winning talent—and so did his KTM.

Suspension tuning was a constant throughout the grand prix season. Early in the year, an Italian Marzocchi fork went on the KTM as a Ceriani fork came off. The Marzocchi fork legs had 8 inches of travel, and early versions were nitrogen-pressurized. At mid-season, Moiseev mounted experimental (Bilstein type) shock absorbers which had no springs whatever; gas controlled all rear suspension action. Seal failures prompted KTM to abandon the gas-only shocks and to switch to gas-filled Marzocchi rear dampers with springs. At the same time, the rear suspension configuration changed from a forward-mount shock system to a cantilever position.

If KTM did a fair amount of experimentation with the suspension, the firm left the engine department virtually untouched. Moiseev tried very minor changes in tune, but he retained the stock engine with its 36mm Bing carburetor. And why not? KTM bikes were the fastest 250's all year on the grand prix circuit.

*Massive cylinder and cylinderhead completely dominate the engine bay of Moiseev's KTM 250.*

153





### Husqvarna 360 Grand Prix

Heikki Mikkola captured the 500cc World Championship in Motocross from the saddle of a Swedish Husqvarna. A development of the 1973 GP bike, the 1974 Husqvarna had different cylinder castings which produced various states of tune. At the start of the 1974 European season, the Husky engine had a very pipey kind of horsepower. In fact, the engine was so peaky that the motorcycle was hard to ride; with so much sudden power, the rear wheel spun easily and traction vanished.

Husqvarna tamed the vicious power characteristics by altering port-window shapes and fitting a larger flywheel magneto. A bored-out 38mm Bing carburetor matched the porting demands nicely. The power fed directly into a small, all-steel clutch and thence through the six-speed transmission. With cases cast in magnesium, the engine contri-

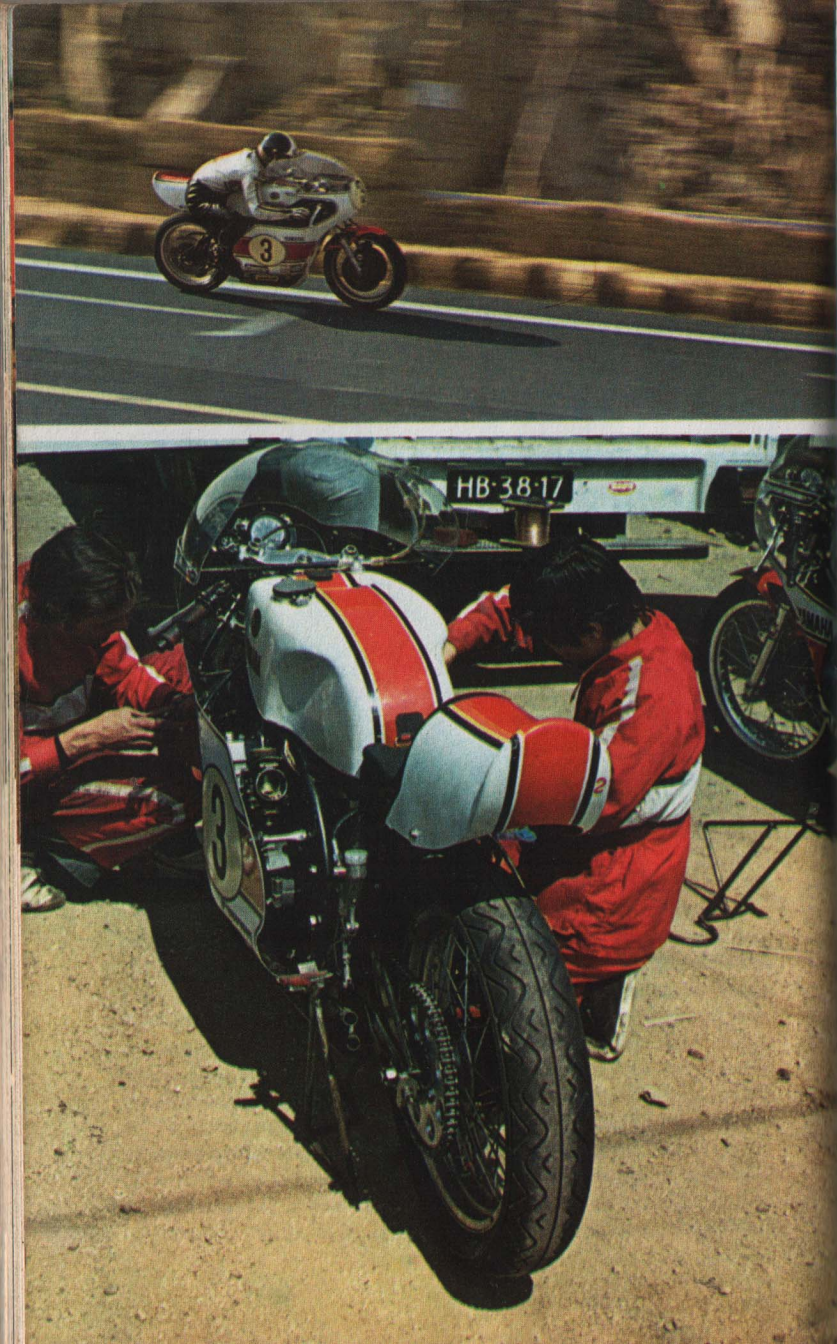
buted to the motocrosser's lightness—215 pounds at the season's end.

While Husqvarna sorted out the engine, there was much progress with the running gear. An early frame change dropped the engine elevation and lowered the center of gravity. Shortly thereafter, the factory lengthened the swing arm and heavily gusseted the chromemoly frame to withstand the stresses imposed by the forward-mounted shock absorbers. Mikkola first tried Bilstein gas dampers, but later he permanently switched to new Girling gas-oil units. By the close of the season, rear-wheel travel reached 8.5 inches with laydown shocks, and the front wheel had over 8 inches of suspension movement.

In 1974 Husqvarna's grand prix bikes had built-in toughness. Heikki Mikkola demonstrated that point well—for he rides with pounding savagery. His style may lack perfect grace, but no one can quarrel with his effectiveness.

*Hardware alone won't win a grand prix motocross; riders like Mikkola are great athletes in superb condition.*





## Yamaha YZR-500

Yamaha intended to chase the Italians out of the 500 World Championship in Road Racing. The Japanese planned a two-pronged attack. First, they hired Giacomo Agostini—who had won thirteen world championships on MV Agustas—away from the Italian concern. Second, Yamaha went to the grand prix wars with fabulous racing equipment.

By a narrow margin, Yamaha failed to make Agostini the 500 World Champion again. Technically, however, the four-cylinder Yamaha 500 won the constructor's title, though the Japanese factory refused to accept the prize. Major grand prix stars, and the official MV and Yamaha teams, boycotted the German Grand Prix in 1974 as a protest against hazardous riding conditions. A private Yamaha won the German Grand Prix, which—despite the boycott—officially counted toward the world title. In this way Yamaha won the manufacturer's award. But in a demonstration of gentlemanly sportsmanship, Yamaha refused the title, since the German event had not been won by an official factory Yamaha.

Yamaha, winner in absentia, did battle with a transverse 500cc four-cylinder engine. Originally, the piston-port two-stroke engine was just a smaller version of the water-cooled TZ-700 Yamaha road racer. As the grand prix season unfolded, Yamaha unveiled a lighter, narrower version of the 500 which produced 93 horsepower. But Yamaha concentrated on frame design more than engine tweaking. This soon became apparent when Yamaha introduced a frame which had a cantilever rear swinging arm controlled by a large damper and spring. This shock absorber mounted under the fuel tank and anchored to the steering head.

At first the frame and engine enjoyed great success. Yamaha reputedly trimmed the weight down to 300 pounds—or slightly less. Despite its outstanding credentials, little problems plagued the bike; and these setbacks, together with the normal misfortunes of racing, upset the grand Yamaha plan in the 500 class. That was too bad—because Yamaha brought the first burst of technical innovations in a generation of 500-class racing.

*Most distinctive feature of the YZR-500 is its mono-shock cantilever rear suspension.*