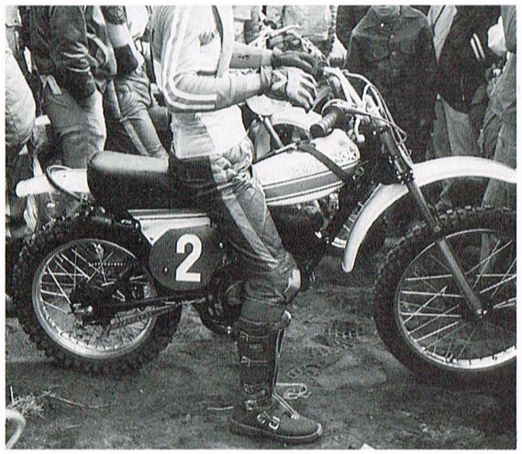
thoroughly tested the 250 using Tilkens' original frame, he ordered up a copy in Reynolds 531, which cut back some of the excessive weight of the first prototype. With this frame, Hallman felt ready to go GP racing. There was just one small problem: the complete system was patented by Tilkens, who was asking what he felt was a reasonable amount of money for the patent rights. Despite being an insignificant amount for a company Yamaha's size, they wanted to be certain they were getting value for money. So towards the end of 1972, a series of top managers beat a path to Hallman's door, armed with stopwatches to measure how many tenths of a second the new suspension would knock off his lap times! More importantly, they asked Hallman as an experienced motocross rider whether the system really was better. Yes, was the answer every time and finally they agreed to buy.

Having convinced Yamaha management of the advantages of the monoshock system, the real work began—convincing the riders. The team riders did not consider themselves to be development riders. They had been hired to win races and they expected the means to this end to be ready and waiting. Andersson was reluctant to use the new machine. He had been doing well at the end of the 1972 season on the conventional twin-shock bike and he wanted to continue with it. Even after back-to-back tests, just prior to the start of the 1973 season, he remained unconvinced. He used the conventional machine at the first two rounds in Spain and Italy, finishing 4th in both GPs.

Hideaki Suzuki had the joint honour of débuting a monoshock-equipped Yamaha in 1973 when he and his brother Tadao wheeled out their 125s at a Japanese meeting in March of that year



The delay in débuting the 250 meant that the world's first glimpse of a monoshock-fitted bike came when the Suzuki brothers, Yamaha factory riders, wheeled out two 125 prototypes for the first Japanese national race of the year. Tadao won, but then left for Europe to contest the first season of official FIM European 125 motocross GPs. At the next 250 round in Belgium on 2 May, Hallman, supported by Yamaha management, insisted that Andersson use the monoshock machine. The result was a 3rd place in the first leg and a win in the second to take an overall win. A week later in Switzerland it was a double win, and from that moment wild horses couldn't have separated Andersson from the monoshock machine. With overall wins in the next five GPs including three double-leg victories, Andersson romped away with the 250 World Championship title. In only their second year of serious competition, Yamaha, relying heavily on the development skills of Torsten Hallman, and the riding skills of Hakan Andersson, had produced a world-beating machine. The intense rivalry between the Japanese companies must have made it an especially sweet success, as it was from Suzuki they stole the crown.

4 Works specials for the common man

The MX range of 1973 was cosmetically identical, this 250 virtually being indistinguishable from the 360

By hiring Torsten Hallman in 1971 to develop competitive motocross machinery, Yamaha had taken the first step on the path to what they surely hoped would be glory on the European circuits. There was only one reason why they were so anxious to produce championship winning GP racers, and that of course was publicity. Just as they had ten years before in road-racing, they were entering factory specials in the GPs in order to win races, gain publicity and sell bikes. Whereas the intention at the beginning of the 1960s had been to sell roadsters through road-racing success, it was now Yamaha's intention to sell off-road bikes through motocross GP success.

In Europe the sales of the T series had been disappointing in comparison with the explosive sales that had occurred in the USA. GP victories would undoubtedly bolster the European market for off-road machines, especially if it were combined with a concentrated sales drive from the European importers. Also Yamaha had decided that yet another lucrative market was awaiting exploitation throughout the world. Having pushed the idea of the dual-purpose motorcycle for five years, and noticing the good sales in the US of their race-kitted T-series machines, the factory decided that the world was ready for mass production of single-purpose motorcycles, off-road competition bikes.

As always, the success of the factory-prepared machinery would have a direct effect on the

sales of mass-produced versions from the same factory. The advertising concept of the factory machines in the winners' circle being linked to the company's mass-produced product always worked, especially if technology identified with the factory machines could be adapted for mass-production without a long time-lag. 1971 was to see both the first year of factory-supported GP competition, and Gary Jones' first US 250 championship win for the factory and 1972, Jones' second title and the launch of the company's first out-of-the-crate motocross racers, the MX250 and 360 and the SC500.

The two MX machines were newly developed machines, departing from Yamaha's policy until then of producing a limited number of race-kitted DT or RT machines within the factory walls. A casual inspection would have suggested that the 360 was purely a bored and stroked version of its little brother, but in fact it contained a number of significant differences. The basic construction was the same. The matt black barrel of both machines contained a cast-iron liner with the seven-port system introduced on the T series. Six-petal reed valves were used with a 30 mm Mikuni on the 250 and a 34 mm for the 360. The foam air filter was tucked out of harm's way in a plastic housing bolted to the rear mudguard. An upswept spring-mounted exhaust was used on both models, something that was not universal on all motocross machines of the time, since it was thought that the resulting shape seriously compromised the production of the resonant waves that were so vital to the correct functioning of the pipe. A demountable stinger was provided for the pipe, leaving it to the discretion of the owner as to whether or not it would be used.

There were two threaded holes in the cylinder heads of both models. One came with the spark plug installed and the other with a blanking bolt. This was a hangover from the 1960s when riders had fitted two plugs to the head so that a quick swap of the plug cap could put the bike back in action on the all too frequent occurrence of an oiled plug. Ignition systems had improved enough to make the precaution redundant. The 360 was fitted with a compression-release valve that was activated by the throw of the kickstart lever. A cam mounted on a dowel pin in the right-hand crankcase half followed a profile in the kickstart ratchet gear, and secured one end of a braided cable. The cable passed up and over the engine to the front of the barrel where the compression-release valve was located. As the kickstart lever descended, the tension of the cable pulled out a small plug in the cylinder wall just above the exhaust port. The plug passed through a small bleed valve that screwed into the barrel, resulting in a drop of pressure inside the cylinder dependent on the size of the venturi in the bleed valve, until the piston rose above the valve and sealed the combustion chamber. It worked quite well, making the pressure required on the kickstart about equal to that of the 250, something a tired rider with a stalled engine at the end of a 40-minute moto would appreciate.

All crankcase bolts, including those joining the vertically split crankcase halves, were Allen bolts, a thoughtful gesture to the mechanic, making the engine assembly/disassembly easier. Conventional Japanese crankshaft design was utilized, with full-circle flywheels running on roller bearings. The conrod ran on a big-end roller bearing and the single ring piston ran on a needle bearing. Primary transmission was taken off the right-hand end of the crankshaft by means of a helically cut gear. In addition, on the 360, two extra sprockets were splined to the crankshaft just inboard of the primary transmission gear. Their purpose was to drive the 'Omni-Phase Balancer' weight running at the top of the gearbox behind the cylinder.

Yamaha were really getting into the spirit of christening any change made to the basic design of a motorcycle with a hi-tech inane name. Joining the 'Torque Induction' (reed valves) and the 'Thermal Flow' rear shocks (external oil reservoir) was the Omni-Phase Balancer, whose purpose was to eliminate crank-induced vibration on the MX360.

This system had been first seen on the ill-fated TX750 which preceded the introduction of the MX350 by a couple of months. The TX750 was Yamaha's entry in the Superbike class, although it hardly lived up to that description. A parallel four-stroke twin based on the 650 released in 1970, it was fitted with a contra-rotating weight that was intended to smooth out the legendary vibrations immortalized on big British twins. Due to the difficulty of installing the drive for the contra-weight without compromising the layout or size of the engine block, a reflected L-shaped drive was necessary. Two idler gears ran on the inside of the duplex chain at the heel and toe, while the chain passed on over the crankshaft sprockets to drive twin sprockets keyed to the end of the contra-weight shaft. Supported by roller bearings at both ends, the weight was profiled to provide an equal and opposite reaction to the forces generated by the rotating mass of the crankshaft assembly. A spring-loaded tensioner was also needed to ensure full contact between the crankshaft sprockets and the chain. It was a sound theoretical solution to vibration damping that proved disappointing in practice.

Inevitably, Autolube lubrication was also provided, driven from the right-hand end of the crankshaft. At this time in Yamaha's history, *all* two-stroke machines they made were fitted with Autolube, whether practical or not. This resulted in the strange sight of road-race and motocross machines fitted with this neat little accessory that had done so much for the street-based two-stroke machines. It was out of place on a racetrack, as Yamaha realized after a couple of years.

On the left-hand end of the crankshaft was the rotor for the CDI ignition. The clutch was of the design adopted by Yamaha from the end of the 1960s. A pushrod passed down the length of the transmission mainshaft to bear up against the outer clutch pressure plate against the tension of six clutch springs and allow the friction plates and clutch plates to freewheel. The clutch basket was spring mounted to the primary transmission gear which acted as a cush drive.

Identical five-speed gearboxes were used on both models although the overall gearing on the 250 was a little lower due to different primary and final drive ratios. The transmission shafts ran on ball bearings on the drive end and rollers at the other end. Primary kickstarting was provided allowing the bikes to be started in gear, an essential feature for all dirtbikes but not universally adopted for some years. The activation mechanism for the drum gear selector differed slightly from that found on the T series. The double gear-change pawl mechanism was replaced by a single pawl operated via two interleaving gear-change quadrants, one splined to the gear-change shaft and the other turning on a shaft on which one of the selector forks ran. The gear-change pawl was clipped to this quadrant. The use of a single pawl for moving up and down the box should, in theory at least, have produced more accurate and smooth changes. All three selector forks ran along rails, with pins following the tracks cut in the surface of the drum.

Both MX250 and 350 models made use of the frame of big brother, the SC500. The general design was similar to that used on the T series, with a number of detail changes. It consisted of a double loop cradle with a short backbone of considerably wider diameter tubing, supported by a pipe running from a crossbar under the headstock to its end. The 30-degree rake fell in line with the geometry of contemporary motocross machines. The front suspension used conventional oil-damped telescopic forks with 32 mm diameter stanchions. The rear swinging-arm with Yamaha's usual plastic bushes was fitted with the Thermal Flow rear suspension units. These were production versions of those used on the works bikes in Europe, offering five levels

of preload adjustment and an external reservoir of damping oil. Both brakes were single leading-shoe drums, 130 mm at the front and 150 mm at the rear. Aluminium alloy rims were used on both wheels with security bolts fitted to prevent the tyres turning on the rim during hard acceleration or braking. The finish of the machines was in a distinctive silver grey with a red stripe on both sides of the petrol tank highlighting its shape.

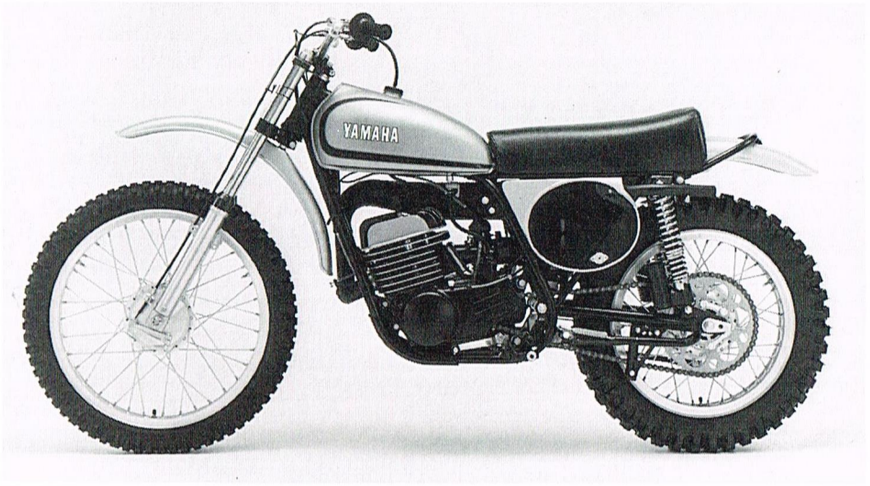
Going into production at the end of 1972, the MXs reached the US and Europe at the beginning of 1973 and were received enthusiastically. The 250 proved to be the better of the two machines, with a far smoother power delivery up to its limit of 7500 rpm, with usable power coming in around 4000 rpm. In contrast, the 360 was pretty docile under 5000 rpm, after which power came in with a bang getting the front end a little light. This coupled with the weight problem suffered by both bikes, made the 360 a bit of a handful. The front brake was about right but the rear locked up too easily, which would also cause some rear wheel chatter revealing a weakness of the rear suspension. Berm bashing was not too easy on an MX mainly due to its excessive weight as well as a rather high centre of gravity, caused by a tall seat height. But with a price in the US of a little over $1000 for the 250 and $150 more for the 360, they were considerably cheaper than the European alternatives and almost as good.

Actually, a third motocross machine was introduced at the same time as the two MX models, but its appearance on the market is one Yamaha would like to forget. Still supposing that the US market adhered to the philosophy that 'a lot is good, but more is better', Yamaha went for a full 500 dirtbike, using the MX360 as baseline. The stroke was kept to 70 mm but the bore was opened out to 95 mm, giving a displacement of 496 cc. The bore of the carburettor was raised to 38 mm, the gearbox lost one speed, but little else changed in the engine. On paper a reasonable-looking bike pushing out 44 bhp—5 bhp more than the 360. But a combination of poor-quality control and basic design flaws emphasized by the size of the bike turned it into a horror story on two wheels that earned the distinction of being included in the list of *Cycle World*'s ten worst motorcycles of the decade.

For some reason it was given a different series classification and went under the title SC500, some speculating that the SC stood for 'Scrambler'. From the start it was plagued by seizures. This was quickly traced to the first batch of pistons, whose skirts had not been correctly machined, and a service bulletin issued. Other frequent causes of complaint were failed ignition systems, cylinder base gaskets poorly matching the transfer ports, terminal detonation and a miscellany of minor problems. Even when running correctly, there was little that the SC500 could do well. Hampered by an enormous gap between first and second gears, slow corners were taken either with the engine revving madly or way out of the powerband, requiring excessive clutch slip. The handling didn't help at all in corners, for with a high centre of gravity and badly flexing front forks, the bike ended up seriously oversteering. As on the MX models, the rear brake locked the rear wheel at the slightest touch, although the front brake was a lot better. Despite the Omni-Phase Balancer a lot of vibration made its way to the handlebars tiring the rider prematurely, a state that was aggravated by the excessive compression damping in the front forks causing the transmission of most of the jolts straight to the handlebars.

All in all, the SC500 turned out to be a good example of one of the bad apples all motorcycle manufacturers seem to manage to turn out at one time or another. To their credit, Yamaha quickly realized this and the SC disappeared into welcome obscurity at the end of 1973.

With the introduction of the MX machines, Yamaha had produced bikes that would appeal to what they expected to be the largest market for motocross competition, the novice and



The big bad apple of Yamaha's early motocross line-up, the SC500, trying to pass itself off as a more docile 360

junior groups and possibly with a little help the intermediate class, all of course being at amateur level. But the way the sport was expanding in the US at the beginning of the 1970s it was becoming clear that a substantial professional group of motocross riders was developing for which the MX series would be totally unsatisfactory. The company decided that the only machines that would attract this group of riders would be replicas of the factory team machines, built as close to the real thing as possible, with only minor concessions to mass production. It would be a limited series due to the size of the market Yamaha anticipated and the high price that would have to be paid for such competitive machines. Only one name was suitable, the one used already to describe the factory team's machine—YZ.

Although of similar design to the MX series, there were virtually no common components. The few YZ components borrowed from their tame brothers came from the SC500. Engine dimensions were the same, the 360 having a bore and stroke of 80 mm × 70 mm, the 250 measuring 70 mm × 64 mm. The iron liner of the MX-series cylinders was rejected in favour of a chromed cylinder wall that reduced friction without compromising the oil-retention properties of the surface. This technique had been perfected by Yamaha during the 1960s on their TD and TR road-racers. The most serious disadvantage of chromed cylinders was that they were usually only good for junk after a seizure, adding to the cost of racing. The same double-securing of cylinder and head was used as on the MX series, but there was only a single central plug hole.

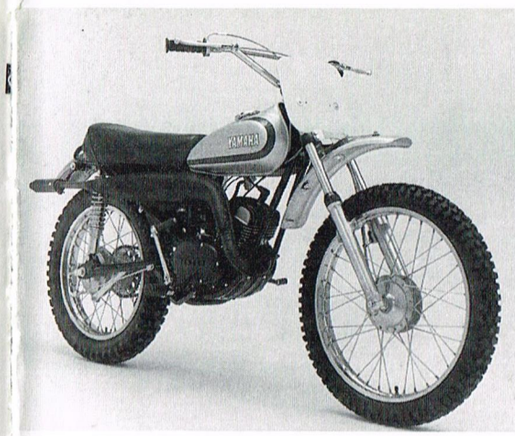
Crankshaft design was the same as for the MX series, with the addition of circlips to position and retain the oil seals and bearings. Both 250 and 360 used the big-end fitted to the MX360, which actually dated back to the RT1. The con-rod had extra oil grooves milled in the big-end eye, to improve lubrication. Windows were not cut in the skirts of YZ pistons. Instead, to gain the maximum intake period free of obstacles in the inlet tract, the skirt was cut away on the inlet side. The cost to be paid was shorter piston life due to the lack of support in this area as it slapped against the cylinder wall in a reaction to the pressure generated during the combustion process.

Primary transmission take-off was on the right-hand crankshaft end and the CDI unit of the same design as on the MX machines was keyed to the left-hand crankshaft half. The 12-plate clutch no longer had the spring cush drive and was activated slightly differently. The actuation mechanism was housed within the left-hand crankcase cover, and was accessible for adjustment via a small window. A short shaft with a worm thread cut in its outer surface was attached to a flange that enabled it to turn in its housing in the left-hand crankcase cover. A stud passed through its centre to butt up against the pushrod of the clutch, and was locked in place by a nut. Hence, as the shaft turned the pushrod would be pushed along the transmission mainshaft to free the clutch. Identical ratios were used in both the 250 and 360 gearboxes, with the gap between first and second reduced considerably with respect to the MX gearing. The old double pawl selector mechanism was retained for the YZs although all three selector forks ran on rails running under the gear clusters.

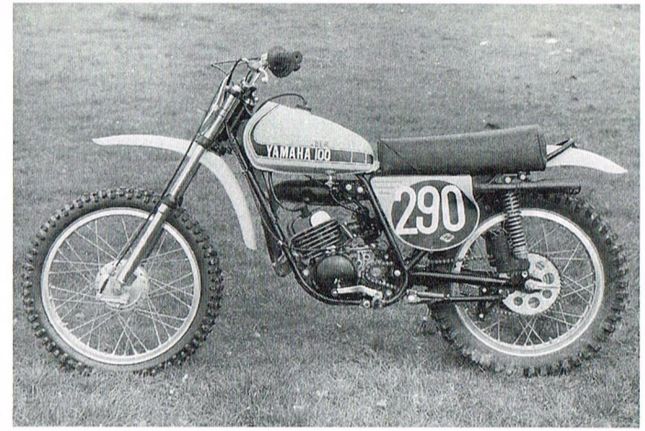
On the intake side, 34 mm Mikuni carburettors were used on both the 250 and 360 machines, with six-petal reed valves from the SC500. Access to the air filter was restricted due to its position behind the sidecovers and under the upswept exhaust pipe. Both had to be removed before the air filter cover could be loosened and extracted. In acknowledgement of the fragility of the exhaust pipe and the consequences a damaged pipe could have to a race, the pipe was spring mounted in three places.

The basic chassis design was unchanged from the MX series, although the tubes used were thicker-walled and of smaller diameter, resulting in the saving of a few pounds. The Thermal Flow rear shocks were cast in an aluminium alloy that also contributed to the dramatic weight difference between the MX and YZ models. The front wheel remained unchanged for the YZ series, but the rear brake shoes were widened 10 mm to increase the swept surface area, although more attention should have been paid to improving the sensitivity—it was as bad as ever. Probably the most distinctive feature of the early YZ series was the inch-wide rubber band round the petrol tank, securing it to clips on the headstock gusseting. While it certainly was distinctive, it was probably not so practical in view of the damaging effect petrol has on rubber. Capping the peaked filler on the tank was a breather pipe that passed under the front of the tank to a spot not easily accessible to dirt and mud. All components that were expected to be sources of heat, including the reservoir of the rear shocks, were painted matt black to increase their degree of radiation and hence improve their cooling. With the silver petrol tank highlighted by the red flash in Europe and the bright competition yellow in the US, the YZs were the cosmetic equal of any other machine on the track.

But were they the functional equal, or better still, superior? As soon as it became known that a batch of race replicas were to be offered for sale, Yamaha dealers were inundated with orders, especially in the US. Gary Jones' championship win in 1972 had prepared the path for the YZ series and from May 1973 they were available over the counter, in theory at least. In fact Yamaha had only manufactured a comparatively small batch of both models expecting the demand for the milder MX machines to be greater and the price to be too high. At $1700 for the 250 and $100 more for the 360, the price was a good $600 higher than the MX models, and $600 could pay a lot of entry fees and full gas tanks. But the YZs were clearly superior to the MX machines. The 250 weighed in at 94 kg, a saving of 9 kg over the MX250. Without the complications of Autolube oil pump, Omni-Phase Balancer and decompression-release mechanism, the 360 lost a massive 17 kg and this, combined with the extra 4 bhp both engines developed, brought the handling and speed up to the same level as the Husqvarna, Bultaco and



The MX125 of 1973 was little more than a race-kitted DT125



The MX100 appeared in the US towards the end of 1973 and set a standard that was to help its successors to survive for ten years

CZ competition. Although considerably better than their stable mates, the YZs were far from perfect. The powerband on the 250 was too narrow, requiring a tap dance on the gearchange pedal to keep the engine on the boil. Both bikes tended to fall into corners due mainly to the high centre of gravity, and there was always that rear brake. . . . So Yamaha had manufactured a good first attempt at an expert's machine, but there was plenty of room for improvement.

During the same month as the YZs began arriving in the US and Europe, another two MX models began running off the assembly lines, the 100 and 125. Just as their larger brothers, they were derived from the T-series MX variants, but qualified for a separate code due to their assembly as fully-fledged motocross machines. The general design differed little from the MX250, except for the lack of CDI ignition; breaker points and a magneto were considered adequate for the tiddlers. Only the four bolts to the crankcase studs were used to secure the cylinder head. A Mikuni carburettor, 24 mm for the 100 and 26 mm for the 125, fed the four-petal reed valves and the exhaust pipe was spring mounted at the exhaust manifold. A five-speed gearbox, Autolube lubrication and Thermal Flow rear shocks completed the spec. Neither available in Europe, the MX100 produced 12 bhp at 10,500 rpm whereas the MX125 produced 15 bhp at 8500 rpm. To catch the attention of the younger riders Yamaha expected the MX125 to appeal to, the petrol tank was decked out in the factory's US racing colour—bright yellow.

In fact Yamaha needed to use every trick in the book, if they were going to enter the 125 class seriously, for, of all the classes, this was the one with the most choice of machines for potential customers. Not only were the other Japanese companies interested, Suzuki already producing TM 125, Honda a CR125 Elsinore and Kawasaki about to introduce the KX125, but European and US competition was still strong. Husqvarna, Bultaco, Penton (KTM), Monark, Rickman and DKW were all established in the market. Yamaha hit them where they knew it would hurt most—price. At $800, the MX125 was anything from $150 to $400 cheaper than the European competition. Only the other Japanese manufacturers could compete in this area.

Jaak van Velthoven was Yamaha's most successful 500 cc class rider from 1972 to 1975

With so much activity on the motocross area, it took the factory until the end of the year to produce the parts required to transform the MX125 into a YZ125. A higher compression-ratio cylinder head along with revised porting and a new pipe resulted in a 4 bhp increase. The mechanical ignition was discarded in favour of a CDI unit. The gearing was lowered for all except first gear, to improve acceleration and give the rider a chance in the race to the first corner. The suspension was firmed-up front and rear, including the light alloy Thermal Flows used on the larger YZs. In fact a comprehensive weight-saving exercise was adopted on the YZ125, with new frame, alloy wheel rims and hubs and magnesium backing plates for the single-leading-shoe drum brakes at both ends, helping to drop the weight by 12 kg. In line with its increased performance the YZ retailed for $960, not only a lot more expensive than its brother but also more than the Japanese competition.

If it had been a lot better than the Kawasaki and Honda, its most serious competitors, it might have been worth the extra $100. But it wasn't. The main culprit was the suspension which was way too hard and of course that rear brake. The two combined to make braking on a bumpy approach to a corner not far short of trying to ride a steer that had just been stung by a hornet! The rest of the bike functioned quite well with a 2000 rpm powerband from 7000 rpm and reasonable gearing, although perhaps a shade too low. It was a fair start to the 125 series, but the price was too high and the ride too harsh.

The MX variant of the 125 was not to remain in the Yamaha range for so long. With only cosmetic changes being performed in 1975, it was 1976 before any significant update was made to the machine. The power plant of the YZ125C was grafted into the original MX125 chassis and the rear suspension improved by the use of twin Kayaba gas shocks, laid down at 30 degrees from vertical and inverted to reduce unsprung weight. The package worked pretty well and offered a machine that was as good if not better than the Honda and Kawasaki 125s, but not of the same standard as the YZ and Suzuki. But for the $890 retail price it was an absolute bargain. Despite this, there were no MX125s included in the factory line-up again.

During 1973, the Yamaha works teams on both sides of the Atlantic did well. Hakan Andersson took the 250 world title on his monoshock machine, and Dutch exile Pierre Karsmakers took the open class title in the USA. Karsmakers campaigned the 250 Monocross during 1974 with considerable success, taking the Supercross 250 title, but was deprived of a championship win in the AMA National championship due to the introduction of regulations requiring US citizenship for all competitors. But the bright yellow Karsmakers/Yamaha monoshock combination was the talk of the US motocross world in 1974 as Hakan Andersson had been in Europe, the year before. With the new models for 1974, Yamaha would make total use of the publicity their works teams had created and completely in keeping with their philosophy of offering last year's works technology on this year's production machines, the monoshock YZ250 and YZ360 machines were introduced.

Yamaha were cautious in their introduction of the monoshock models. They restricted the changes to the machines mainly to the redesign needed to fit the single rear shock absorber and new swinging-arm. The only engine change was the use of a cylinder head that raised the compression ratio slightly. This, coupled with the new pipe that was needed to route around the rear shock, broadened the powerband slightly making the YZs, in particular the 250, somewhat easier to ride.

The exhaust pipe followed a route any rollercoaster would have been proud of in an attempt to maintain the volume and dimensions

necessary for efficient engine combustion, while passing through a maze of engine and chassis components seemingly determined to prevent it. In order to simplify removal, the header was spring mounted to the rest of the pipe, with a copper gasket to provide a good gas seal. The complete assembly looped down to the left-hand side of the machine, round the outside of the duplex cradle frame members, up and crossing over the engine, and was bolted to the right-hand frame member behind the sidecover. A separate stinger silencer was clamped to the end of the pipe and bolted to the upper rear subframe rail.

Another component that suffered from the use of the monoshock was the air filter box. It was no longer possible to mount the air filter vertically behind the carburettor with access under the seat. The new design used a twin element filter lying horizontally behind the carburettor with access via both sidecovers. This was in fact a far better arrangement, simplifying and speeding up the most frequent chore required for any dirtbike, the cleaning of the air filters.

The general design of the frame didn't change much but the area around the headstock was beefed up in expectation of the extra stress to which it would be exposed with the top of the monoshock bolted to it. The reinforcement took the form of extra gusseting between the backbone of the frame and the front downtubes, as well as double bracing rails between the front and back of the cradle. Access to the upper end of the monoshock was via a hole cut in the gusseting behind the headstock. The swinging-arm assembly looked pretty much like the works component, with round tubing for the lower fork and square section for the upper. The production version was made from chrome-molybdenum, the factory item was aluminium.

The rear shock absorber was fully rebuildable, although it was not a task to be attempted by the home mechanic. With the reservoir mounted on the base of the body of the unit, it made use of compressed nitrogen gas to provide the damping. The aluminium reservoir contained a neoprene rubber membrane that separated the oil from the compressed gas. The body of the suspension unit contained two sets of jets through which oil passed on compression or expansion. One set was always open and provided the low speed, small deflection damping, the other, normally capped closed under the tension of a leaf spring, opened up when the oil pressure exceeded the spring tension. As the oil flowed into the reservoir, the gas would be compressed further, increasingly resisting the further compression of the suspension. By separating the gas and oil in this way, the problem of frothing of the oil experienced with conventional shock absorbers disappeared.

Nitrogen was chosen in place of air since it does not expand as much as air when heated and could not form a combustible mixture if the membrane were to fail and the oil and com-

Above **After an injury-plagued season in 1974, Hakan Andersson took this works YZ250B to second place in the 1975 World Championships**

Right **The YZ125C was the best machine in its class and Yamaha's first really proficient motocrosser**

pressed gas were to mix. A measure of damping adjustment was possible by altering the pressure of the compressed nitrogen but it was hardly a trackside task. It was not possible to change the preload of the spring, but three different rate springs were listed as official parts. The new system was also no lightweight, the combination of swinging-arm and suspension unit weighing twice that of the conventional dual-shock A model.

Despite the shortcomings in adjustability, the new rear suspension was far better than the conventional dual-shock systems of the time. Offering 165 mm of travel, the suspension did not respond too well to small stutter bumps, feeling rigid and unresponsive. But the faster you went and the nastier the bumps you took on, the smoother it seemed. Neutral steering, quick turning, good straight-line stability were all characteristics of the new monoshock machines. While most of the credit for this improvement could be given to the rear suspension, the front had also undergone an upgrade. With thicker stanchions and less compression damping, it proved to be far more sensitive than it had been on the A models.

Although clearly distinguished by the rear suspension, the B models also got a cosmetic update, with new chequered decals on the petrol tank symbolizing the racing environment in which the machines were expected to be used. Also the capacity of the bike was shown on a decal on the yellow petrol tank to distinguish the two models. The first real Yellow Zappers were on the loose.

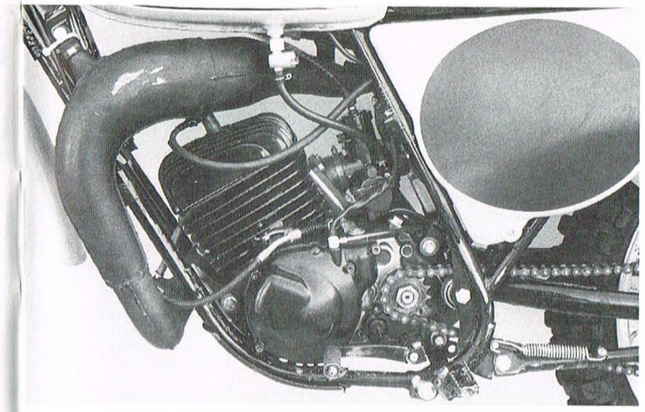
Meanwhile the pint pot class was running a model year behind. The YZ125A had first been available in any numbers at the start of 1974, just before the B models of its bigger brother began arriving in the dealers. Some bright spark decided to get them back in synch by leaving out the 125B designation and going straight on to the YZ125C for 1975. Fine. Only trouble was that no large-capacity YZs appeared in 1975, so the 125 was now a model in front instead of behind its brethren. Tricky things model codes. Anyway, December 1974 saw a new YZ125 rolling off the assembly lines and no mistakes were made with the design; this one was on top from the moment it was born.

The YZ125A had suffered severely at the hands of the Suzuki and Honda opposition. Both engine power and handling finesse had been lacking and the 125 class was proving to be the one with the largest sales volume. The company were determined to get back in 1975 any ground they had lost to the Japanese competition. Major development work went into the engine design resulting in the most powerful 125 available on the market with an output close to 18 bhp at 10,500 rpm. A new cylinder head lowered the compression ratio a fraction and the chromed cylinders were rejected in favour of the conventional iron liner in an alloy muff. The piston was cutaway just above the gudgeon pin, as had become common practice in the road-racing two-stroke engines. This reduced the friction between the piston and cylinder wall, minimizing the heat produced from their contact and consequently preventing the breakdown of the oil film clinging to the cylinder wall.

The transmission gained a ratio bringing it up to a full six-speed gearbox. First gear was a little higher than on the A model and the gap between first and second had grown. The oil pump for the Autolube was discarded, bringing it in line with the rest of the YZ range. The carburettor was provided with a proper choke lever after persistent complaints from YZ owners of the pokiness of the tiny rod parallel to the slide housing on the carburettor that had previously been used to choke the engine. At 30 mm, the carburettor bore was also a size up on the previous model.

A complete monoshock chassis was constructed for the YZ125C, the layout of the frame remaining unchanged except for the modifications to the headstock area to allow access to the upper mounting position of the shock absorber. The design of the monoshock suspension and rear swinging-arm was identical to that of the YZ250 and 360 B models, scaled down for the smaller 125, while the front forks and drum brakes were YZ250B items. The rear brake was unchanged from the A model. In Europe, the paint job on the petrol tank heralding the arrival of a new model was white with black pin-stripes just above the lower tank edge and 5 cm high YAMAHA in red letters. In the US, the mustard yellow of the racing team was continued from the MX125, with speed stripes along the lower edge of the petrol tank.

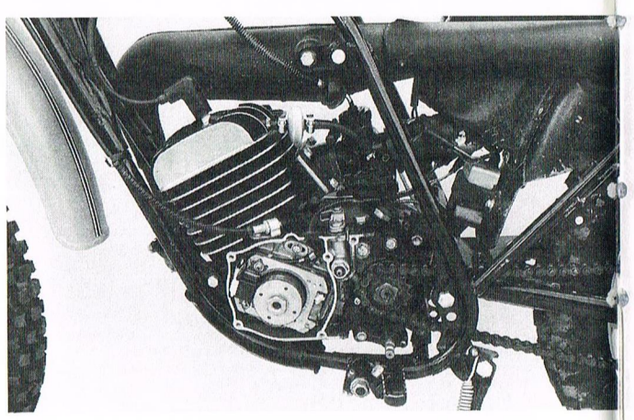
As on all the YZ models, the change to monoshock suspension had resulted in a weight increase, in the 125's case, 3.5 kg. But the new engine design produced so much more power, and the handling was so improved, it was a price the 125 could afford to pay. When it came to the track, the YZ was the leader of the pack, literally. The only other bike to measure up to the YZ was the new RM from Suzuki, who had tackled the problem of long travel rear suspension by fitting twin laid-down shocks. This worked at least as well as the monoshock and also gave a slightly higher rising rate of spring stiffness. It was only the 3 bhp power advantage of the Yamaha that kept the Suzuki at bay. By contemporary standards the YZ125C was difficult to fault and was Yamaha's first truly successful production motocross machine. *Cycle* included it in their ten best of the year in 1975, although it must be said, Yamaha had pulled a fast one on them and passed a semi-works machine through for testing. Despite this, the YZ125C was a worthy entry in the list.



Top left **The YZ125C engine conformed to standard contemporary YZ design. The bulge on the engine cover hides the CDI rotor pick-up**

Left **With a second place on his YZ125C at his home GP in 1975, Dutchman Gerard Rond broke into the world championship scene from nowhere**

Meanwhile, the MX models had marked time since their introduction at the beginning of 1973. In March 1974, the 100, 125, 250 and 360 bikes had been joined in the US by a 175. The 175 class was quite popular and at the time devoid of Japanese machinery, no doubt leading Yamaha to think they could easily exploit the small market for this class. The 175 was almost identical to the 125, with a 10 mm wider cylinder bore, CDI ignition and a 50 mm longer swinging-arm. Far from dominating its class, it turned out to be a dog of a bike, staggeringly under-powered and under-suspended. Pushing out a feeble 16 bhp, with a ridiculously narrow power-band of less than 2000 rpm preceded by a 1000 rpm-wide glitch in the power curve, the springs on both front and rear suspension were far too stiff, giving a very harsh ride. The increasingly famous competition yellow paint job worn so proudly by other Yamaha motocross machines, seemed little more than a bad joke on the 175. Since the competition, CanAm, Bultaco, Penton and Puch, sold better bikes for a similar price, the MX175A was a dead duck. A year later the B appeared, with few changes except a new coat of paint and revised carburation that smoothed out the power delivery, making the machine a little better, but still not a shadow on the competition.



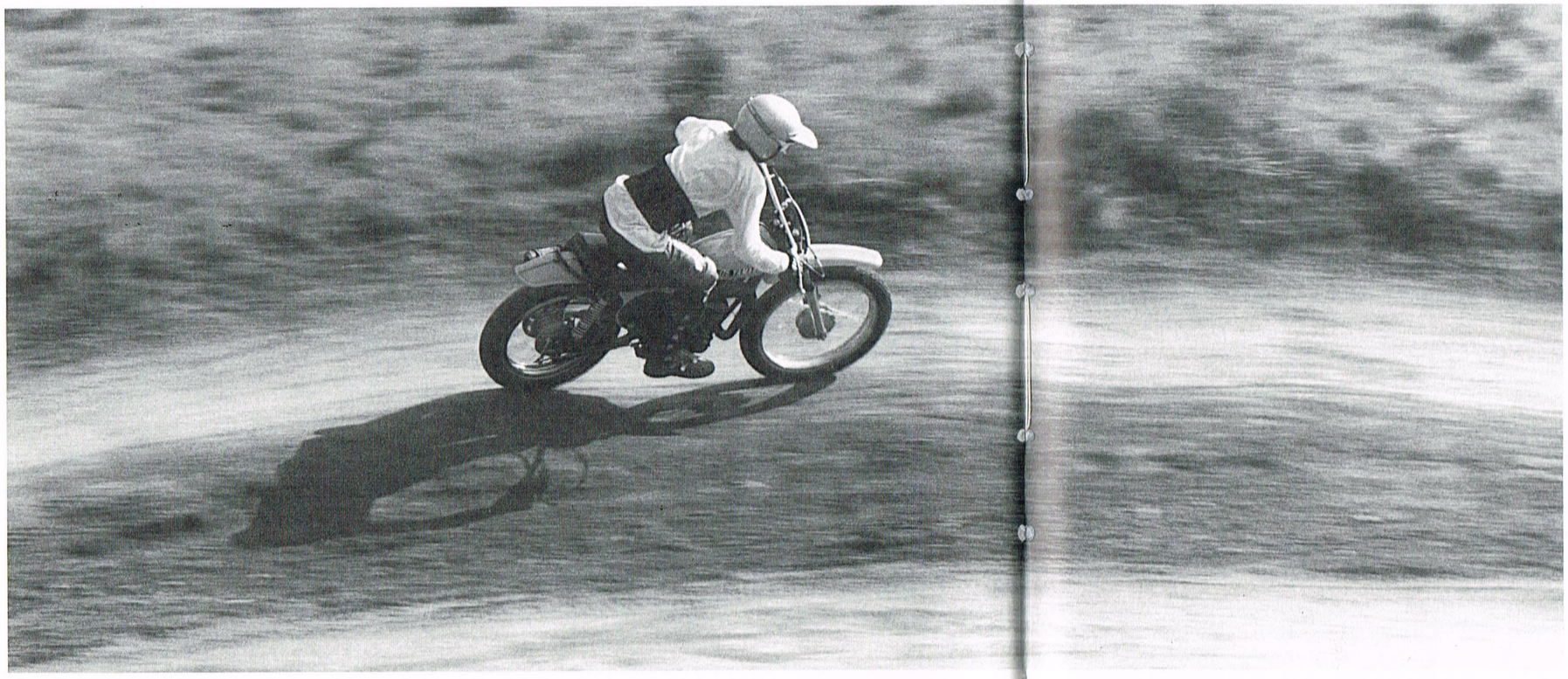
Above **Despite belonging to a different series, the similarity between the engine of this MX175B and the YZ125C was striking. So was the difference in performance**

Surprisingly enough, the 175 motocross machines did not disappear so quickly from the Yamaha range as might have been expected. The class seemed to be dying fast throughout the country, yet for 1976 the factory introduced a full-blown YZ175C, borrowing much from the YZ125, including the complete chassis. With around 22 bhp at 10,500 rpm and a fair amount of torque, the YZ proved to be at the top of the small group of 175 machines commercially available.

Only available for one year, there was no YZ175D in the motocross line-up for 1977. End of story, you might think. Not just yet; 1979 saw the reintroduction of the MX175, now being offered as a mildly tuned off-road playbike, which was exactly what it was. A cross between the on-road DTs and the off-road ITs, it was equipped with the usual reed-valve, CDI, Autolube engine in a monoshock frame. It fitted the bill quite acceptably, although suffering a little from the lack of basic equipment required for street legality. Enough of the MX175 were sold in 1979 and 1980 to justify continued production but it disappeared from the Yamaha range once and for all at the end of 1981.

Price rather than performance had sold the other MX bikes in the US at the local level, and the machines were becoming increasingly in need of an upgrade. But Yamaha were questioning the wisdom of the double range of motocross machines. The original idea of a cheaper, easier-to-ride bike being available alongside its full-blooded brother was a sound one. There were just two factors that worked against this. Someone entering motocross competition usually wants to win, and that was almost impossible on an MX. Worse still, while being considerably cheaper than a YZ, they were not a lot cheaper than the equivalent Suzuki and Honda mounts. Would the MX series be able to maintain a segment of the motocross market in the future? Yamaha were not convinced they could. They decided instead to try getting the price of the YZ models down towards that of the Japanese competition and at the same time produce

Below **Despite its poor performance, the MX175 was a reasonable bike for novices, forcing them to learn the basics without intimidating them by its performance**



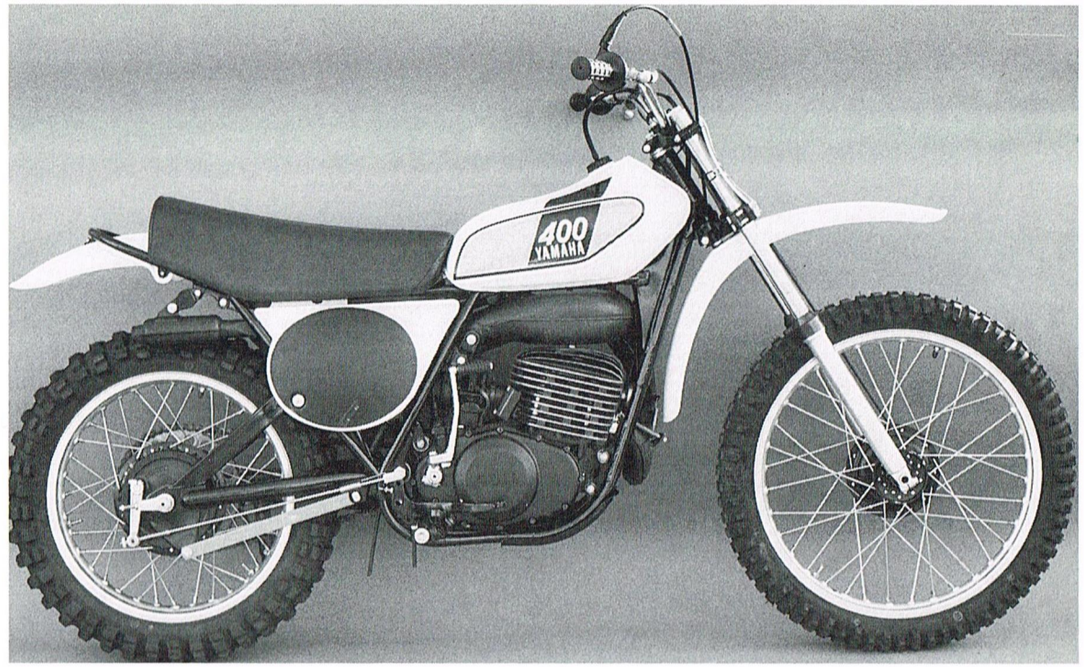
The MX175 as it reappeared in 1979. Technology had moved fast in the MX's years of absence and it seemed a dinosaur in comparison to contemporary machines

engines whose power was easier to use for expert and novice alike.

Strangely enough, Yamaha's first step in the direction of unification of the MX and YZ was to skip the 1975 update to the YZ series. The MX250 and 400 were significantly improved for 1975 and the YZ series for 1975 were in fact identical to these bikes. The factory's philosophy seemed to be that now the previous concept of limited-production YZs was to be discarded, the identity of the YZs more common brother should be used. It only took them a year to realize that the works connotations of the YZ designation was a valuable selling point.

Both bikes were fitted with cylinder heads with radial finning, giving the impression that high compression ratios were being used. Despite a new head design, the extra offset sparkplug hole was still present. The 400 maintained the use of the decompression valve operated by the kick-start pedal. An alloy cylinder with iron liner was provided as standard, but for the guy on the block who had to have the trickiest bike in town, chromed cylinders were available as alternative parts. Rubber wedges were used on both the cylinder and head to cut the noise from ringing cooling fins.

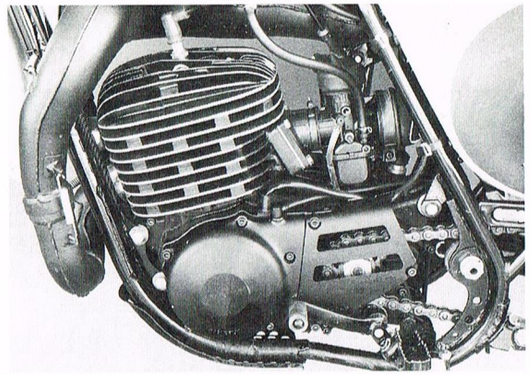
The helical primary gear was no longer splined, but keyed to the right-hand crankshaft half. Autolube went missing on both 250 and 400 and the larger machine was also relieved of the infamous Omni-Phase Balancers that had so stiffled its predecessors. The clutch on the 250 was inherited from the YZ, while the 400 continued to use the clutch basket with the spring-



The last and best of all the MXs was the 1975 MX400B. Despite reliability problems it became the desert rider's first choice in the US

mounted primary transmission gear. Transmission, ignition and carburation were largely unchanged, although the adoption of the monoshock forced the air filter arrangement of the YZ B series to be used. The transmission ratios from the 250 also came from the YZ B series whilst completely new gearing went into the 400. First gear was very low, with a large jump up to second. In fact the gears were all spaced slightly further apart than on previous big-bore models, culminating in a high top gear. The engine would have to produce good torque and have a wide powerband if the transmission was to be effective.

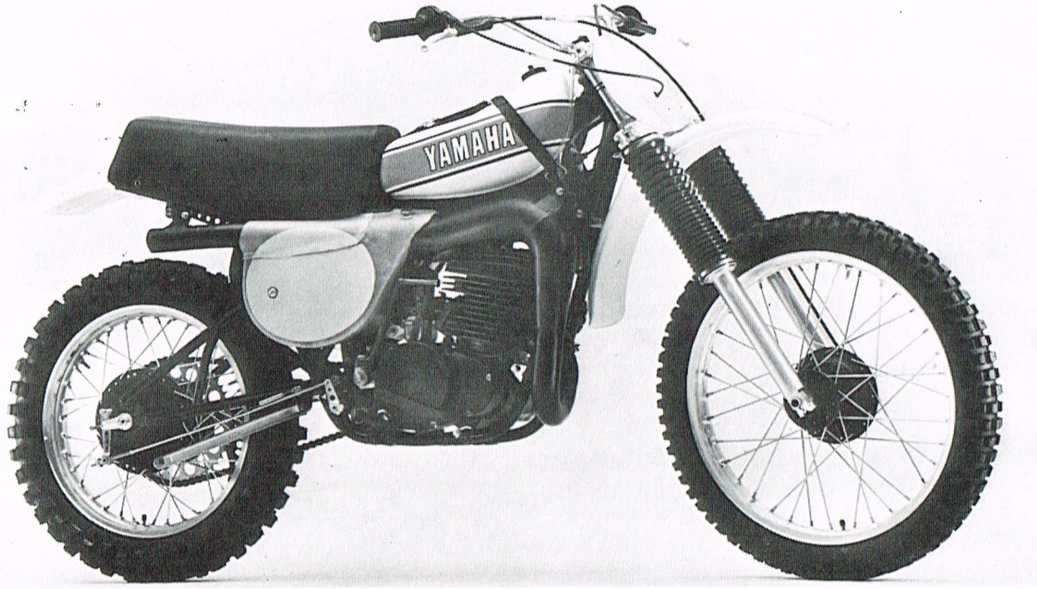
The monoshock chassis was inherited from the YZs, the only notable change being 34 mm diameter stanchions and the availability of front fork springs of different stiffness. However, what had proved to be so successful on the YZs did not perform so well on the new, more powerful MXs, particularly the 400. The larger machine had gained 5 kg over the YZ360B and the extra weight made itself felt on rough courses and in slow turns. In heavy, boggy ground and sand, the front suspension seemed far too soft, with a tendency to flex that gave the rider a lot of work wrestling with the handlebars to prevent the wheel digging in and high-siding him. The 400 seemed more suited to enduro riding and desert racing where it was used to win the 1975 Mint 400, as well as a lot of local amateur-level desert races. The chances to let rip with that gutsy motor and not too many tight turns suited it fine. The 250 was a slightly better MXer, with a good engine seeming to cause the suspension less



Above **Despite the magnesium engine covers, the MX400B was overweight, but this was compensated for by the gutsiest engine on the block**

trouble although at 100 kg it was also a little overweight. Rear brake on both machines needed to bed in before a measure of sensitivity was achieved, a carry-over from the bad old original MX machines. On the 400, pistons started cracking after only a few hundred miles of use. This was caused by a combination of too wide inlet and boost port on the rear cylinder wall and the square cutaway on the inlet side of the piston skirt.

The MX250 and 400B models were the last of their type in these two classes. Effectively, 1975 was the last year of the MXs; another 125 model appeared in 1976 and the 175 was resurrected at the end of the 1970s. The works machines had provided the publicity for Yamaha, the MXs had provided the introduction for many riders, and it was left to the YZ series to build on this foundation and put Yamaha at the top of the motocross tree.



Above **In Europe, Ake Jonsson was provided with this YZ400 for 1975, but it was an uneasy relationship and fourth place in the world championships was the result**

5 The path to excellence

The YZ80 first appeared in 1974, but it was to take Yamaha a couple of models before it arrived at the top of the class

By the start of 1976, all four Japanese companies were locked in battle for the motocross manufacturers' crown, in all of the three main classes. Kawasaki was lagging behind the other three a little despite Jim Weinart's US 500 class crown in 1974 and Olle Pettersson's earlier efforts on the racetracks of Europe. Honda had concentrated on the US and thumbed their noses at those that had labelled them as incapable of making a competitive two-stroke, by producing the Elsinore series. Success was achieved at both national and local level. For 1973, Gary Jones was bought in, after two seasons as National 250 champion with Yamaha. A clear winner in 1973, Gary was pushed hard by Marty Tripes riding Husqvarna in 1974, but still took the title for the fourth consecutive year. In the first 125 series held in 1974, Marty Smith ran away with the championship for Honda and repeated the performance for 1975. For 1973 and 1974, the 125 and 250 Elsinores were virtually unbeatable at local level, but by 1975 Suzuki and Yamaha machines were getting the edge over the Hondas. Motocross competition in the US was about to enter the era of Yamaha's total domination of the 125 and Supercross classes and a see-saw battle in the 250 and 500 class between the factory and one of the other Japanese manufacturers. Glorious days for the company.

The 1976 line-up consisted of six YZ models—80, 100, 125, 175, 250 and 400. The 80 cc class was fast becoming the most oversubscribed class