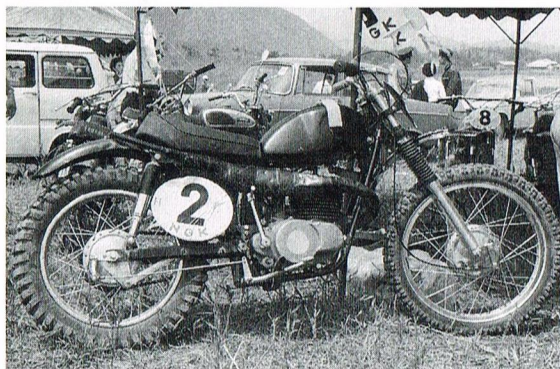


### 3 Factory fame and fortune



An incognito works Yamaha 250 that won the Japanese National championship in 1967

The best thing that ever happened to Yamaha's racing department was the decision by Husqvarna's motocross team manager to put Torsten Hallman out to grass at the end of the 1970 season. Hallman had been with the company since 1958 and brought them four 250 World Championship titles. They were anxious to cut the 250 team to two riders, hoping that the higher per capita expenditure would enable them to successfully take on the Suzuki steamroller that had landed the first three places in 1970. So Heikki Mikkola and Hakan Andersson were chosen. Ironically both were later to play leading roles in Yamaha's onslaught on the GPs. But what to do with Torsten? They couldn't fire him—14 years with the same motocross team is a lifetime in the racing world. Husqvarna and Hallman were synonymous. There was only one solution, make him an offer his pride wouldn't allow him to accept, and maybe he'd leave on his own accord, buy himself a motorcycle business in some quiet corner of Sweden and settle down with his memories of past glory.

And it almost worked. They made him an offer for support in the 1971 season that he couldn't accept and he left of his own accord. But he didn't settle down and slip into obscurity. Knowing his age counted against him, Hallman realized that his most valuable asset was his experience and he had a shrewd idea who might want to make use of it—Japan.

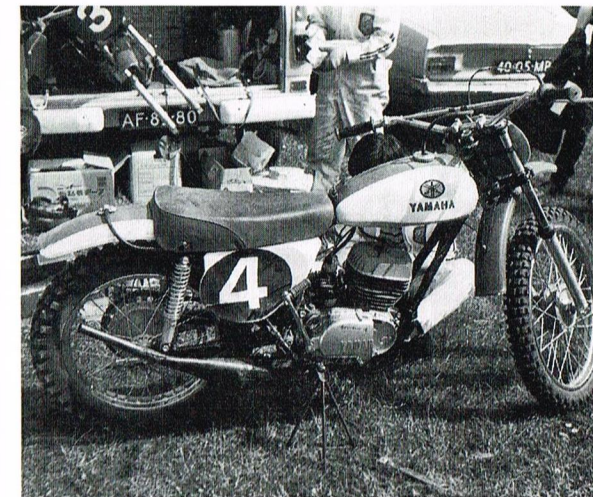
At the end of the 1967 season Suzuki were



Hideaki Suzuki hurrying his GYT-kitted DT1 to a win in the 1969 Japanese junior 250 championship

looking for a European rider to develop their RH 250 machines that had been campaigned without success for two years. As they had done six years before in the road-racing world, they didn't hesitate, but went straight to the 1967 World Champion, Torsten Hallman. They were two days too late, for Torsten had just re-signed for Husqvarna. Disappointed at the lost opportunity, Hallman nevertheless recommended that they contact Olle Petterson, who subsequently joined Suzuki and helped develop the machines into the championship winners they were to become.

At the 1970 Italian GP, a squad of Yamaha engineers armed with cameras and endless supplies of film had swept through the paddock photographing and noting everything there was to be seen. A couple of weeks later, Hideaki and Tadao Suzuki turned up at the motocross events held at the Isle of Man during the road-racing TT week, with two factory DT1-MXs and came away with a third and sixth place in the international field. Clearly the factory were considering an entry into world championship motocross



One of the factory Yamahas that were campaigned in Europe during 1970. This shot was taken at the Isle of Man TT race motocross meeting in June of that year

competition. But why in Europe? Surely with the enormous growth in off-road sales in the US and the expectation of a similar explosion in off-road competition, the people to be impressed by factory successes were on the other side of the Atlantic. To understand why Europe was so important, the state of motocross competition in the two continents should be considered.

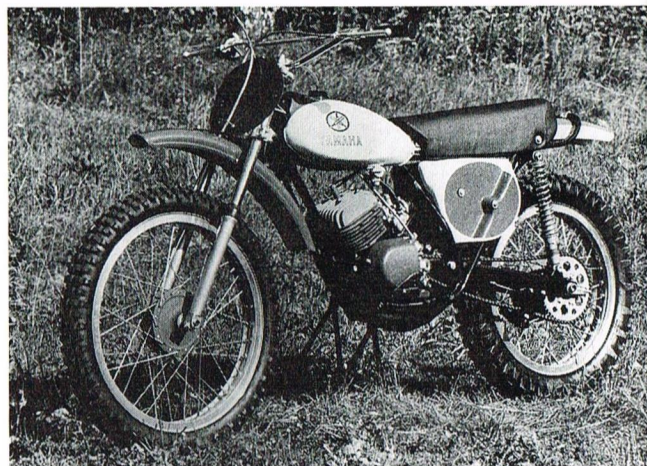
With a heritage dating back to a time before World War 2, European motocross had matured into a rider's sport. The initially slow development of pure off-road machines had led to the need for riders to compensate by honing their own skills to enable them to master the cut and chopped roadsters that were to pass as motocross motorcycles for so long. Even with the introduction of more suitable machinery from the beginning of the 1960s, these skills lived on, passed from old to young in the continuous process of renewal which all sports undergo. In contrast, US motocross racing was in its infancy at the start of the 1970s, undoubtedly gathering momentum in its rush towards fully-fledged acceptance in the US world of racing, but



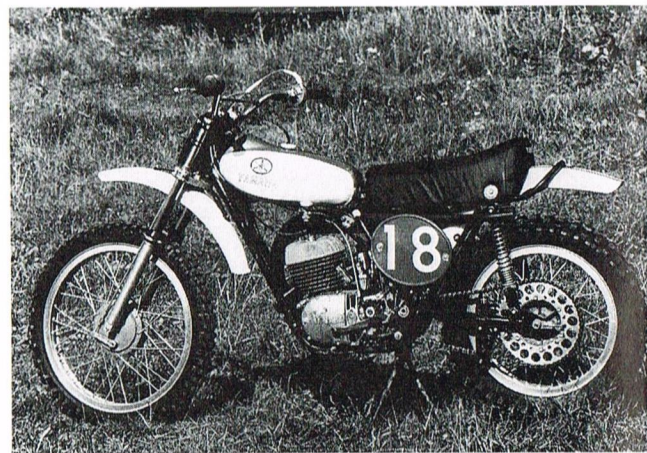
without the pedigree to be found in Europe. US riders were still in the process of developing from gifted amateurs with a stack of enthusiasm into cool hard-headed professionals. The European riders that toured the US in the famous Trans-AMA series of the early 1970s were treated as demigods capable of miraculous things on a dirt-track. Typically, the young Americans were quick to learn and as the sport blossomed their skills kept pace until by the end of the 1970s, their ability had matched, if not surpassed, those of the Europeans they had so admired. But it was professionals that the Japanese needed when they entered the sport at the end of the 1960s. Only they had the experience to turn the drawing board specials into championship winners. Success in their hands would be respected on both continents, and with respect would come sales of the mass-produced race-replicas.

The phone call Hallman made to the director of Yamaha's new European HQ, Kuramoto, when he realized he must leave Husqvarna, must have seemed like manna from heaven. Not realizing the work required to produce a good machine, Yamaha were initially only interested in a one-off analysis of their machines, but Hallman convinced them that a full-time long-term development rider was essential if they were to stand any chance of success. One month after his initial contact with Kuramoto, Hallman left Yamaha Motor NV with a three-year contract to develop the machines that were to become the YZ series.

Within a couple of weeks two pairs of machines arrived in Sweden. Hallman's contract had been to develop the complete range of Yamaha motocross machines and he received the 125 and 250 immediately. At the time, the beginning of 1971, the only Yamaha machines that could be considered motocross bikes were the MX versions of the AT, DT and RT series. Expecting to have to start with these mediocre packages, Hallman was surprised to find completely new engine units. Not only new, but of a radical new



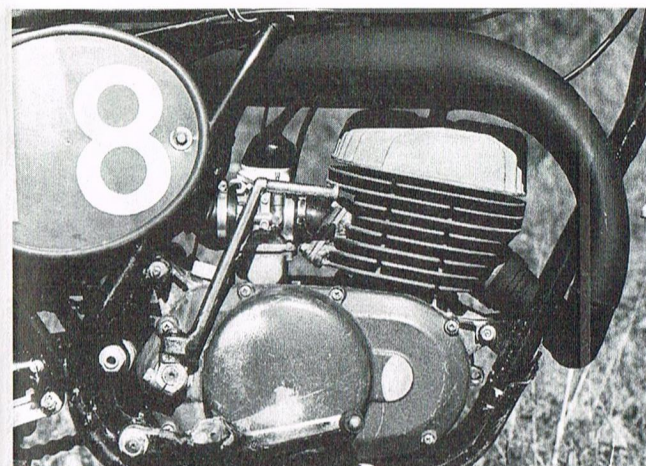
*Above* The factory AT1-MX that was delivered to Torsten Hallman at the start of 1971, which Tommy Jansson used to win the Swedish championship



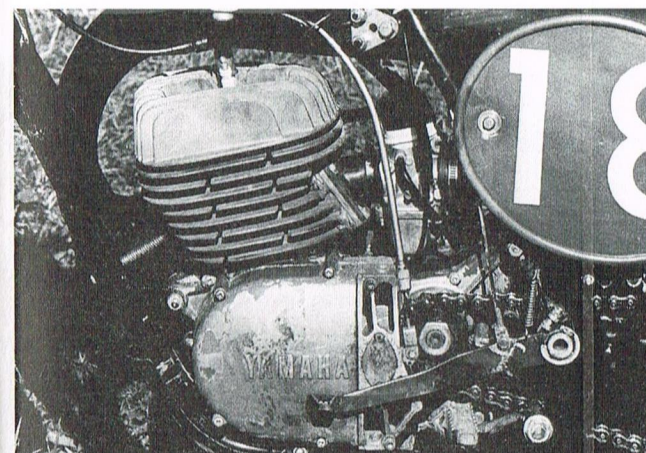
*Above* The DT2-based 250 that Torsten Hallman received from Japan to develop into a world championship-winning YZ

design. The reed valve had made a reappearance on racing motorcycles. Later that year the DT and RT machines were to appear with the first mass-produced reed-valve engines.

Clearly a lot of work had gone into the design of a totally new power plant for the new motocross machines, with very promising results. Hallman did a little work on the engines



*Above* Note the lack of oil pump on the clutch side of the 250 engine block



*Above* In true contemporary two-stroke fashion, dual spark plugs were provided on the works 250 to allow a switch when the first one oiled up

to see if he could improve the power, but soon decided that the engine was good enough as it was, if only the power could be used. Typical of most Japanese motorcycles of the time, the handling left a lot to be desired. Hallman decided that the machines would be competitive, if the chassis was improved.

Showing that little had changed in the inter-

mediate five years, the factory were quick to respond to the call for redesigned parts. Minoru Tanaka was assigned to act as contact man between Hallman and the factory. He had been one of the first Yamaha employees to come to Europe as a mechanic for the road-racing team in 1963. His role was crucial in communicating, quickly and concisely, the design changes required for new parts coming from Japan. It took the factory just two weeks to redesign, produce and dispatch a new rear hub after both of the original hubs failed. Yamaha had bought into the motocross world and were placing their full weight behind the endeavour.

Not long after the start of the 1971 season, the bikes were considered to be competitive enough to enter some of the non-GP international meetings that were held throughout Europe. The 125 was entered in the Swedish National championships, where it was raced by Tommy Jansson to a championship win. Despite the fact that in the years before the 125 class was awarded GP status there was little factory interest in this class, the championship win was a considerable achievement, coming in the machine's development year. The 250 class was a lot more difficult. Hallman gave the machine its racing debut at Steyr in Austria, being flagged off as the winner only to be disqualified for cutting the course. By the middle of June, Hallman was confident enough to enter the 250 in the Dutch GP. Riding in pouring rain on the sand circuit of Bergharen, Hallman brought Yamaha their first GP points with a 9th place in the first leg backed up by an 8th place in the second, to take 7th overall. This confirmed Hallman's own feeling that the development was heading in the right direction and demonstrated to the Yamaha management that their trust in Hallman's development skills was not misplaced.

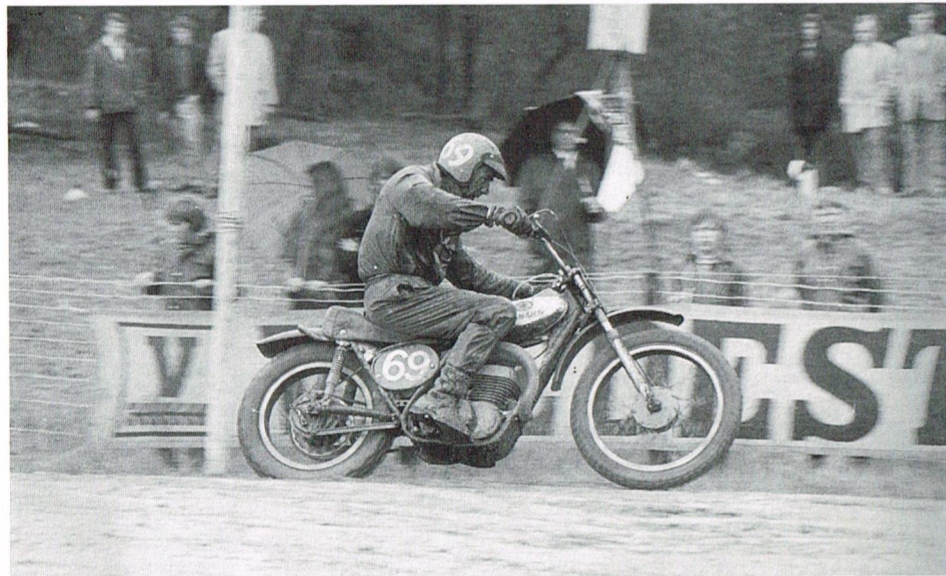
In the meantime, two new crates had arrived in Amsterdam for the attention of Hallman and Tanaka. The open class machines were ready for analysis. The two machines were very different.





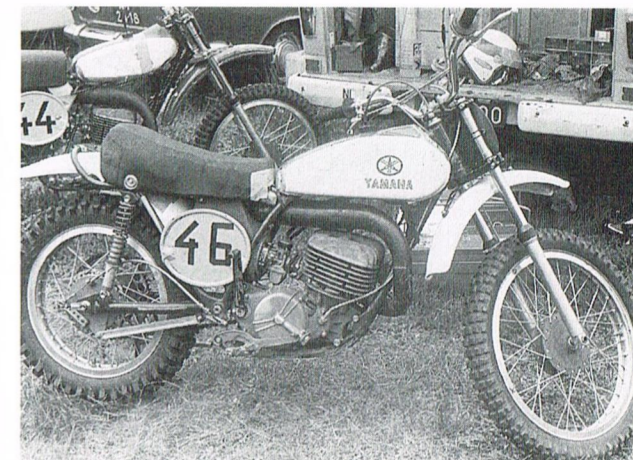
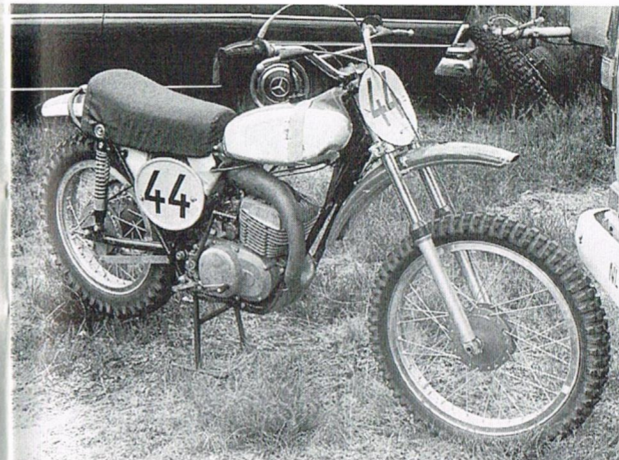
Above Tanaka making last-minute adjustments to Hallman's machine prior to the 1971 Dutch 250 GP

Right Hallman getting his head down in the pouring rain to finish seventh and bring Yamaha their first world championship point in Holland in June 1971



One was an RT1-MX power unit slotted into a frame very similar to the one being used for the 250. The engine was not 100 per cent standard, with a re-ported cylinder and more efficient exhaust pipe. The other bore no resemblance to any existing machine, with sandcast magnesium crankcases, a totally new diaphragm clutch, identified by the reinforced ribbing on the engine covers and the external worm gear operating mechanism, and reed-valve induction. The barrel was base-mounted to the crankcases, allowing fuller use of the cylinder for the transfer ports. No Autolube oil pump was provided, the lubrication being provided by pre-mix as was usual in the race world. Capacity was around the 400 cc mark, producing about 40 bhp transmitted to the rear wheel through a five-speed gearbox.

It was decided to race the two new arrivals back to back in a Dutch international meeting at Lichtenvoorde. Hallman asked Arne Lindfors, a successful Swedish national rider, to help him out. Lindfors used the 400 special and finished an overall 3rd behind Husqvarna riders Gerrit Wolsink and Christer Hammargren. Hallman took 4th place in the first leg, after a split exhaust



Above and above right The two open class machines that arrived in Holland in the summer of 1971. The first was clearly derived from the RT1, whereas the second was a completely new machine. Note the compression-release mechanism operated from the left-hand handlebar

had relegated Lindfors to 5th place, but in doing so aggravated an old back injury that prevented him finishing higher than 9th in the second leg. An encouraging debut for the machines, which then disappeared behind closed doors for further development work, not to reappear that year.

Yamaha management were satisfied enough with 1971 as development year to decide to officially enter the motocross GPs of 1972 with two riders in each class. Once again the factory went to the top riders of the period to solicit their services at Yamaha. Runner-up to the all-time great Joel Robert, World Champion in the 250 class, was Hakan Andersson, one of Husqvarna's works team members. Flying in the face of his extremely conservative nature, Andersson was persuaded to leave the Husqvarna fold and to lead Yamaha's attack on the 250 title, supported by Lindfors. For the open class, Husqvarna were again robbed of two of their riders, Swede Christer Hammargren and Jaak van Velthoven of Belgium. The 250 was very similar to the one rid-

den by Hallman the year before at the Dutch GP, although a winter's development had brought the power up to a very respectable 35 bhp at 8000 rpm, comparable to the Husqvarnas and Suzukis of the time.

Again, two machines were available for the 500 class, a 351 RT1-MX clone, with 40 bhp on tap at 7000 rpm and a full 490 cc version of the 400 that had appeared the year before. This was a monster of a bike said to produce the incredible figure of 50 bhp at 6000 rpm, a full 10–15 bhp more than the other works machines in the class. Despite the enormous power output, the engine power delivery was flat enough to allow a four-speed transmission to be fitted. Jaak van Velthoven was given the unenviable task of wrestling the machine through the GP season.

In an attempt at improving the race-long consistency of the rear suspension, new shock absorbers were used with an external oil reservoir to assist in the cooling of the damping oil. This was the eternal bugbear of motocross suspension since the oil in the shock absorbers used to damp out the resonances of the suspension spring reaches very high temperatures under race conditions. The higher the temperature, the lower the viscosity of the oil and the poorer it does its job of damping. The external

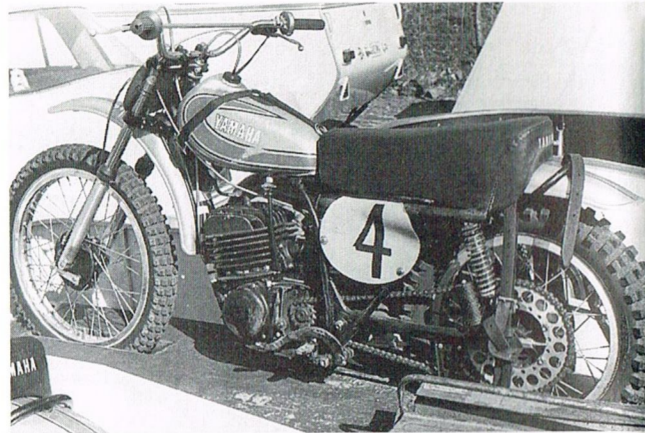




The 1972 360 machine that Jaak van Velthoven was happy to race and win on

reservoir helped in two ways, it enabled more oil to be present in the suspension unit and it kept it cooler. The disadvantage of using such a unit lay in its vulnerability to damage during a crash and its addition to the total unsprung weight of the machine. The shocks were also rebuildable with the possibility of adjusting compression and rebounding damping separately, by the use of different jets within the body of the unit.

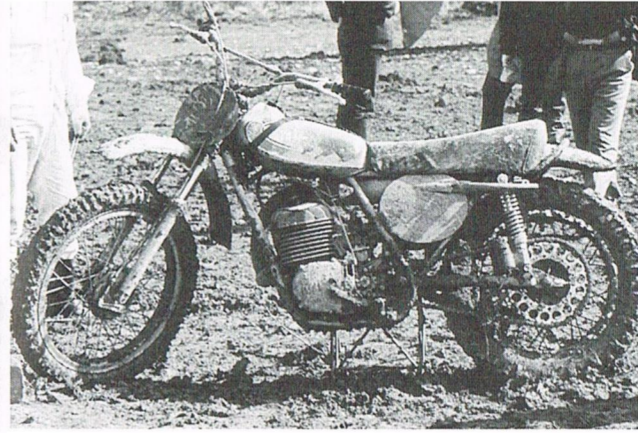
The year 1972 turned out to be unbelievably successful for Yamaha, after an initially disastrous start. While training in Belgium at the end of March, before the first of the GPs, Hakan Andersson crashed heavily and broke his right wrist. He was unable to ride in the first two rounds in Spain and France and was only able to circulate slowly, way off the pace at the Dutch GP. But then he started getting into his stride; a 3rd and 8th in Czechoslovakia, a 5th and 8th in West Germany, 2nd in Poland, 4th in Russia, 3rd in Finland and finally, the triumph of his home GP. Racing at the track in the town of Husqvarna, a stone's throw from the factory, Andersson brought Yamaha their first motocross GP victory, adding insult to injury by beating Husky-pilot



The 1972 490 machine that Jaak was happy to leave on the trailer, even with a 420 cylinder mounted

Arne Kring in the process. Continuing to ride well and getting good results meant that Andersson finished second in the world championships in Yamaha's first year of competition. A tremendous achievement, only shadowed slightly by the performance of the World Champion for 1972, Joel Robert. Riding for Suzuki, he was already World Champion by the middle of the season. The combination of Robert and Suzuki was almost unbeatable.

The 500 class produced less sensational but quite satisfactory results. Pre-season testing of both the 490 machine and a sleeved-down 420 convinced van Velthoven that he would be better off sticking to the proven 360 engine. The first two GPs were disappointing, with Hammargren finishing just within the points and van Velthoven retiring. From the third round in Sweden, van Velthoven began to feel more confident on the 360, and started turning in some good solid rides into top five places. He even took the 420 out for an airing in the UK and West Germany, taking 3rd place overall at both GPs. Back on the 360 for the last GP at Luxembourg, on a mudbath of a circuit, he came home second in both legs to win the Grand Prix. The date 13 August, the

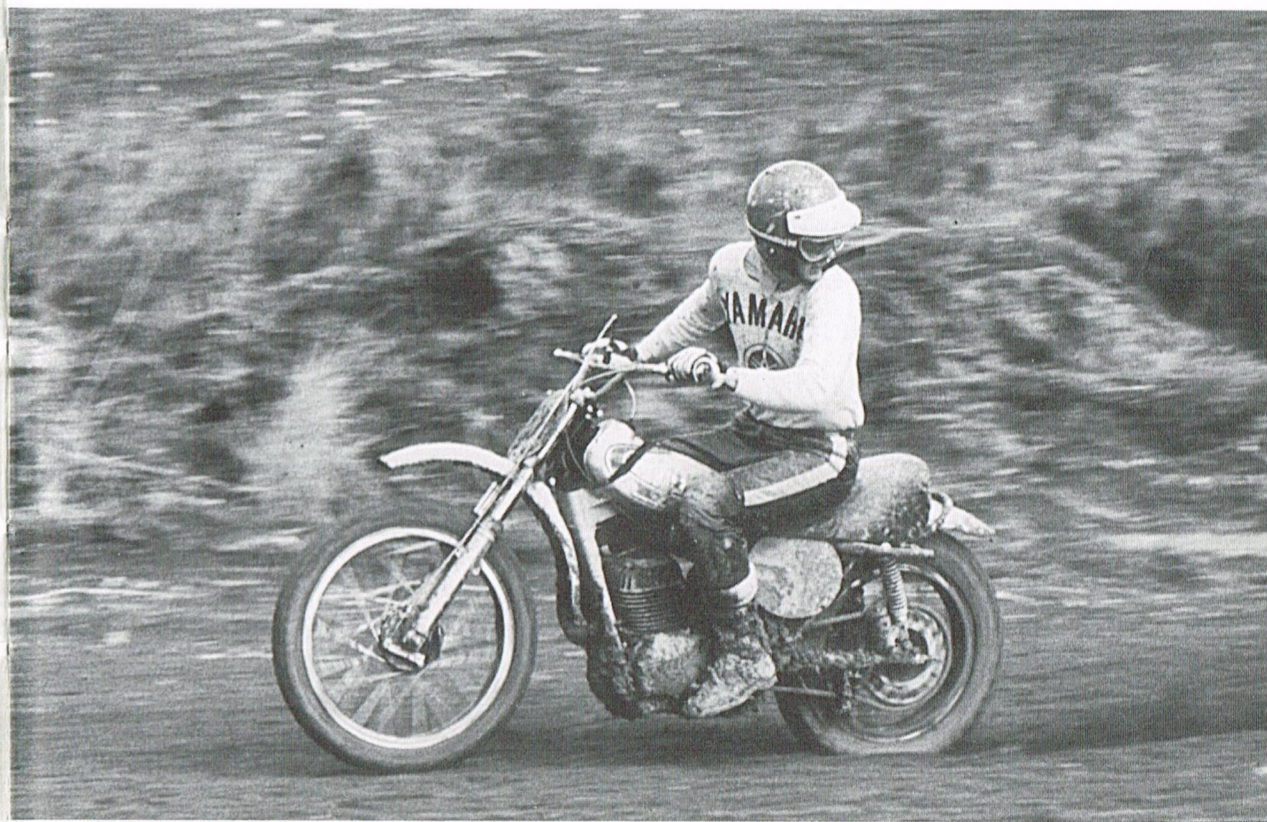


Above Scarcely recognizable after a particularly muddy meeting in 1972 is Hakan Andersson's pre-monoshock YZ

time 17.00, a couple of hours after Hakan Andersson had brought Yamaha their 250 GP victory in Sweden, making it one of the most important days in the annals of Yamaha's competition history. Final position in the world championship was a solid 5th place, a very satisfactory start to Yamaha's challenge for the 500 crown.

While Andersson and van Velthoven were busy racing the machines developed during 1971, Hallman was working on the next season's bikes. In particular he was concentrating on a new suspension system that would result in the most radical change in motocross chassis design ever witnessed: the monoshock suspension. In

Below Hallman discovering that the 1972 360 machines needed a little more rear-end travel

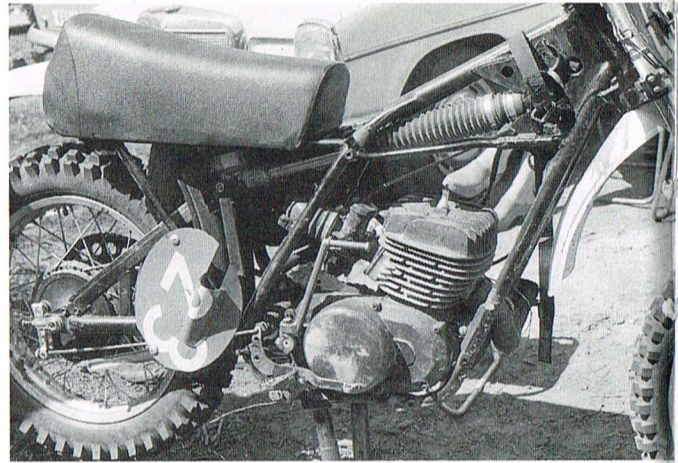




the world of off-road competition, the chassis has always played as large a role, if not larger, in the success of a machine as the engine. An underpowered machine with a good chassis can often outperform a powerful machine in a poor chassis. It has always been a question of usable power and on the arduous motocross circuits of the world it is the chassis that holds the key to success. The 50 bhp 490 monster of the factory had proved the point.

Power can only be transmitted to the ground when the rear wheel is in contact with it. On the rough terrain of a motocross circuit, the profile of the surface can only be followed by the rear wheel fitted with soft suspension, which would then bottom out on jumps making the machine uncontrollable and exhausting the rider. In order to allow a reasonably soft spring but to reduce the chance of bottoming of the suspension units, designers were tempted to increase the stroke of the suspension by fitting longer units. However, this raised the height of the rear subframe on which the rider was sitting, making it more difficult for him to reach the ground as needed to stabilize the bike. The result was the inevitable compromise, offering reasonably sensitive springs and a manageable seat height.

Lucien Tilkens thought he had a better solution. Recognizing that the limitation on suspension stroke arose from the upper mounting of the rear dampers, he developed a cantilever system reminiscent of that used on the Vincent roadsters of the 1950s. The conventional swinging-arm was topped by a wishbone-shaped second fork that ran up from the rear axle at 45 degrees and whose apex was a point behind the rear wheel. A bolt passed through bushes welded to the end of the upper fork and acted as pivot mount for the lower end of the suspension unit. Both upper and lower forks had cross-bracing just behind their pivot mounting points. Additional vertical bracing ran between the two forks a few inches from their join and between each

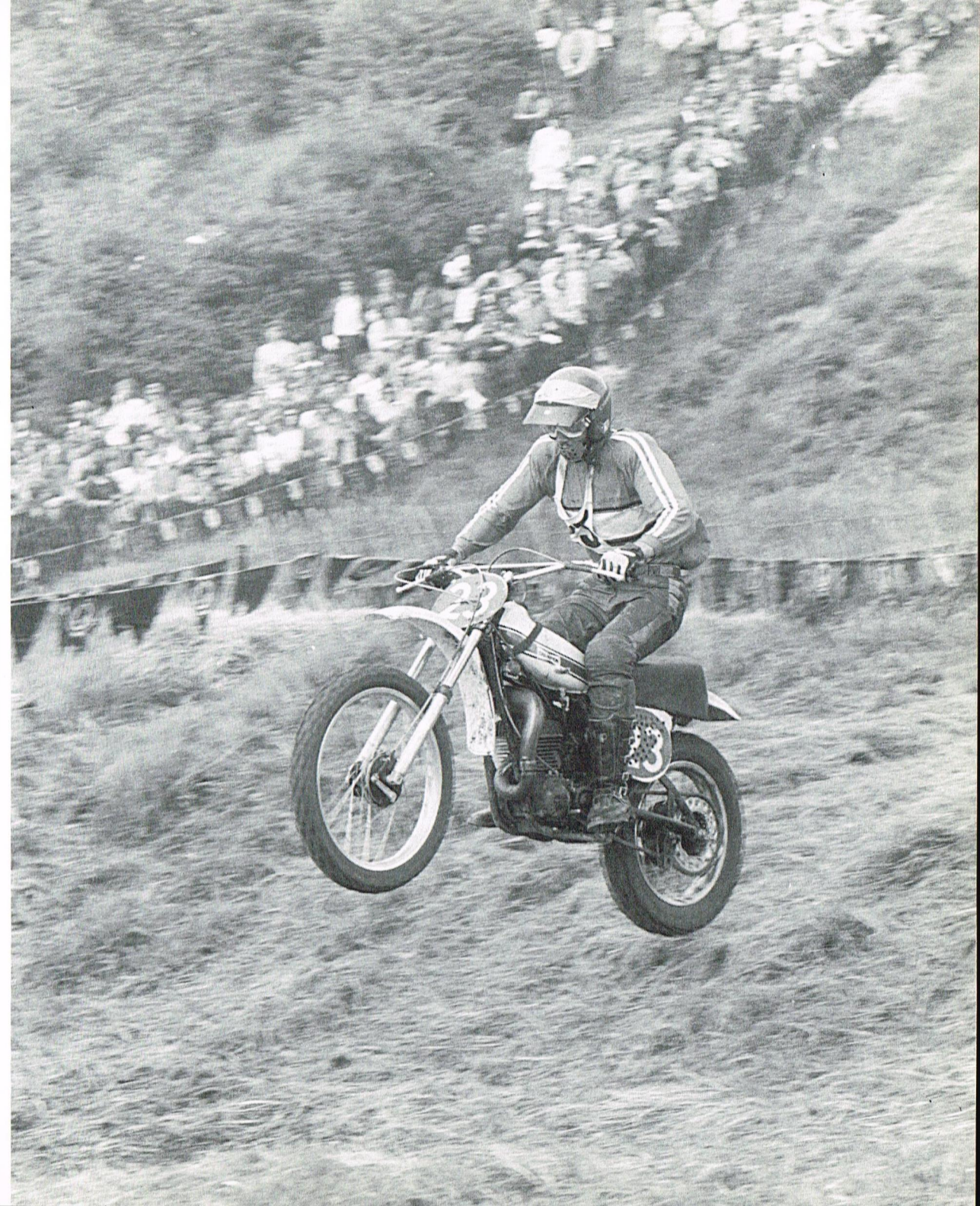


*Above* The monoshock revealed. A chassis design that was to become very familiar to production YZ owners during 1974 and 1975

*Right* Hakan Andersson flying to the 1973 250 World Championship aboard his monoshock YZ250

fork's own cross-bracing, making the rear swinging-arm assembly fully triangulated. Initially circular-section tubing was used, later to be replaced on the upper fork by square-section to improve the rigidity further. The pivot shaft for the lower fork ran on roller bearings, a departure from Yamaha's usual practice of using bushes. The suspension unit extended from behind the wheel to be fixed to the bottom of the headstock by a rose joint. Total wheel travel increased by 100 per cent for the same seat height, making softer springs possible, thus helping to keep the rear wheel in contact with the ground. In addition, the triangulation greatly improved the lateral stiffness of the swinging-arm, prevented the rear fork from twisting under the high lateral forces experienced when diving into and driving out of a berm. It had to be a winner.

Hallman was convinced that the monoshock system was better than the conventional twin Girlings so universal at the time. Having





thoroughly tested the 250 using Tilken's 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 Tilken's, 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 stop-watches 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

**Hideaki Suzuki had the joint honour of debuting 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 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.

The delay in debuting 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