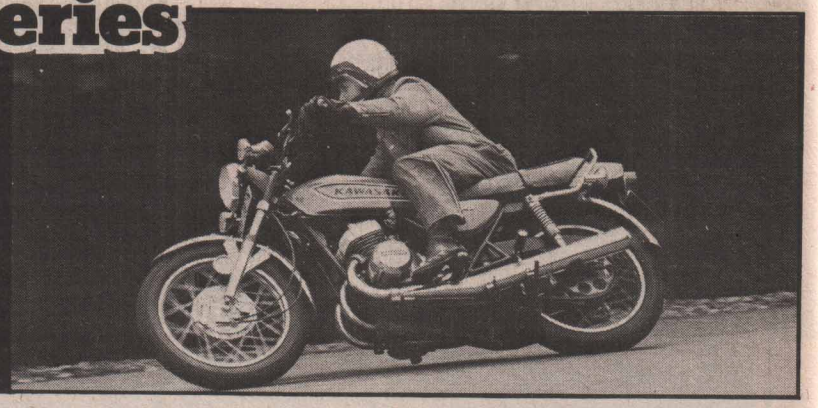
SpeedTune Series

TWEAKING THE TRIPLES

Once upon a time Kawasaki's two-stroke triples were real meanies. Now, a million laws later (so who's counting) the edge has gone — or has it? John Hartley looks at some ways of releasing big K's pent-up power



WITH its howling if muted exhaust, pleasant handling and powerful brakes, the Kawasaki 250 has all the outward signs of being a super-sports lightweight — but over the past few years, the factory has been busy refining and civilising the Kwacker triples so that the performance of the 250 has fallen below that of its two-stroke rivals. Yet there is no doubt that all the Kwacker triples are capable of fantastic performance; the S2 350 had a claimed output of 44 bhp, for example, whereas last year's KH400 was down to 38 bhp.

The early triples were renowned for their sensational acceleration — especially the 500cc H1 — a narrow power band, a banshee howl, and not the most brilliant of handling, and so since then Kawasaki have been gradually reducing the power output, making the engines quieter and reducing exhaust emissions. Originally, there was the 500cc H1, the 350cc S2, and the 250cc S1.

The first significant changes to the 60 x 58.8 mm 500 were made with the introduction of the H1B in 1972. Although the power output was reduced slightly, the low-speed performance was improved, the frame was stiffened to improve handling, and a disc brake was fitted at the front. In 1974, the H1E came along, again with a bit less power, a slightly different frame, and contactless CD ignition.

When they were first introduced, the 250 and 350 engines were almost identical, apart from the cylinder bores and pistons, the dimensions of the engines being 45 x 52.3 and 53 x 52.3 mm. Even the barrels were made from the same castings, so to convert a 250 to a 350 you only need to bore out the barrels, and fit the 350 pistons. You also need to increase the volume of the combustion chambers to that of the 350 to get a reasonable compression ratio.

When the four hundred came along, a complete new barrel was required so the conversion from 250 to 400 is not a practical proposition. At the same time the 250 barrels were redesigned with smaller matching transfer ports. Previously they were designed to suit the 350 — so some power was lost as well. Although the 400 retained the 250/350 bottom end, the bore was increased to 57 mm. It was introduced in 1974.

The KH models were introduced for 1976, and again, the story was one of slightly less power, less noise and less emissions. However, the KH250 got a disc brake, but remained the only Kawasaki triple with points ignition, and it still is. There is a bit of good news, though, for 1977; Kawasaki have been able to get back about 3 bhp without increasing on noise levels.

In standard trim, the 250, 400 and 500 have maximum speeds of about 85-90, 100-105 and 110-115 mph respectively, with pretty useful acceleration as well. Handling is good, and because they are fairly heavy, the smaller machines have a solid feel, and are pretty comfortable. Fuel consumption is another matter though; unless you drive very gently, you'll do well to get 45 mpg from the 250, while the 400 tends to return 35-40, and the 500 about 30. Naturally, there is some vibration at high speeds, but the engines are generally smooth. However, since they rev freely, and the revs tend to be used, the ignition system needs regular attention — whether the engine is standard or not. Kawasaki recommend that the points, ignition timing, and plugs are checked at 2,000 miles, and you will probably want to renew the plugs then as well. Incidentally, Dave Hill of Kawasaki UK, recommends that the first time you check the ignition timing on one of the triples, you use a depth gauge, and mark the rotor so that you can use that subsequently. Then, Brian Flak, the Kawasaki dealer at Graveney, Faversham in Kent, and an acknowledged expert on getting maximum performance from the Kwacker triples, reckons that with the points ignition systems, you should check the ignition timing every 1,000 miles.

Incidentally, there is one feature of the triples that has caused a certain amount of irritation in our normally wet climate — the suppression type plug terminals. These have metal shields which are prone to shorting out in wet, clammy weather. For 1977, Kawasaki are to adopt a new type of suppressing terminal, still with a steel shield, but these are expected to give much better results. If you've got the other sort, all you can do is to make sure that they are kept dry.

To look into ways of improving the performance of the triples, I went to see Brian Flak, who started off five years ago by tuning an H1R racer and then got interested in production racing, which inevitably led to tuning for road bikes. His firm also rebuilds crankshafts, and for the past two years, have been Kawasaki dealers. Nowadays, he modifies about two bikes a week, doing all the engine work himself because he reckons that a lot of care and attention to detail is essential. He needs two clear days to work on an engine, and that'll cost £65, plus any parts that may need replacing, such as piston rings. For that, he claims that the top speed of a 250 can be increased to 110 mph;

a 400 to 118, while the 500 becomes a 128 mph roadburner.

Brian is quite happy about increasing the performance this much because the bottom ends are so strong. "Kawasaki cranks are the best of the lot," he says, "and if you use a good oil you don't get any problems." Like most experienced people in the high-performance business, Brian concentrates on giving more power throughout the speed range and doesn't try to increase maximum revs by much, because this always ends up giving a narrow power band which may be fine for a racer, but not much good for a road bike.

With a two-stroke the basis of any high-performance work has got to be the ports, the trick being to get more mixture into the crankcase and then up into the right part of the cylinder. On the Kawasaki triples, the size of the transfer ports is limited by the close spacing of the cylinders, while the rear pair of transfer ports are very narrow as well. So, Brian's basic philosophy is to widen the ports as much as possible without altering the length of the port opening.

Work starts on the crankcase, and here it is a question of opening out the mouths to align with the gasket, then the transfer ports in the barrels are aligned with the crankcase mouths. The bottom edge of the liner is virtually horizontal on the standard barrel, and the joint with the aluminium is also pretty rough, so here the bottom edge must be radiused off and made to blend the iron liner smoothly into the aluminium. Some tuners advocate a knife edge here, to allow the gas to pass smoothly upwards, but in fact, when the gas enters the transfer port it is flowing horizontally, and has to be turned upwards — hence the preference for a radius.

It is not possible to give exact dimensions because port sizes vary from one engine to another due to production tolerances. It is possible to get an idea of the scope for port modding by putting the piston into the bore and marking the position of the ring pegs. If you widen the port too close to this point the rings will spring into the port and wreck the engine, hence the need for attention to detail.

To increase the area of the inlet and exhaust ports, the opening can be lengthened slightly. Brian extends the inlet opening by lowering the bottom edge of the port by 2.5 mm. The same increase on the top of the exhaust port is also worthwhile. However, one difficulty with this port work is that the transfers are narrow — especially on the KH250 — leaving little space in which to work, and since there are three cylinders, it is difficult to get the ports in the different cylinders the same. If you are tackling an engine yourself, make up some templates and use these to check port shape. At the same time mark off the new heights of the ports from the top of the barrel, to make sure that they are all the same.

Incidentally, although the heights of the transfer ports should not be altered, it is important to make sure that the height of all the windows are identical — otherwise much of the effort will be wasted. Another point to watch concerns the inlet port; this is almost heart shaped on the later engines, and the little projection that extends down from the top edge of the port must not be cut away — it gives vital support to the rings. The metal behind the projection can be blended in more smoothly.

On the subject of the finish in ports, Brian Flak maintains that the inlet and exhaust ports should not be polished, and that the inlet is better with a normal coarse-emery finish. A polished port encourages laminar flow, which is not ideal. The transfer ports can be polished, but a mirror finish is not needed.

Since there are three cylinders, modifying the ports on a Kwacker is a lengthy business and it is easy to spend 40-50 hours on the job. During this time the chance is that somewhere along the line a cylinder bore is going to be marked so some tuners recommend that the high spots are rubbed down, the engine run for 200 miles or so, and then rebored. Kawasaki can supply 0.5 and 1.0 mm oversize pistons, and if the reboring is done carefully, and the running-in is progressive, this alone can give an increase in power of up to 10 per cent.

When Brian Flak has finished the ports, he alters combustion chambers to increase the compression ratio and improve the squish action. He machines the outer portion of the chamber off at 15 degrees, and then machines the face of the head to give a clearance of 1 mm (0.04in) between the squish band and the piston crown.

To suit all these modifications, changes are needed to the ignition and carburation. Brian retards the ignition to give the best results, and with the 250 and 400 he usually richens the needle settings a notch or two. On the 500, he generally fits larger main jets. On the KH500, for example, the main jets are only 75s, whereas on the H1E, 92.5s are fitted, so larger jets would seem essential on any modified KH500. Incidentally, Brian keeps precise records of all the modifications he makes, and his normal attitude, especially with carburation, is to ask the owner to take the bike away, try it out, and then if he thinks any changes are needed, to bring it back.

Don't try to extend the inlet period by cutting the bottom of the piston. Pistons on Jap two-strokes are tapered at the bottom to provide a good seal against the bore and reducing the taper will reduce the pumping efficiency of the motor.

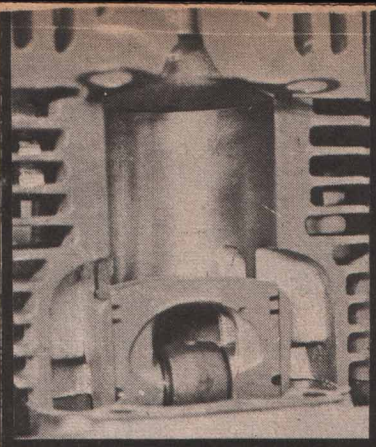
Brian is not keen on using special exhaust systems, not least because his porting is designed to give best results with the standard pipes. He thinks that most special systems are of cosmetic value only, few being designed with the aid of a dynamometer or noise meter. "Too often, they are noisy and don't give any extra power." Not only this, but a special exhaust usually costs as much as his modifications do.

However, one system that seems to me to be worth considering, especially if you are about to replace standard pipes anyway, is the Piper three-into-one. This was designed with the aid of a noise meter, and Piper reckon it gives an extra 15 per cent power, mainly in the low-to-medium speed range. It costs £62 matt black, and £69 for a chromium-plated job.

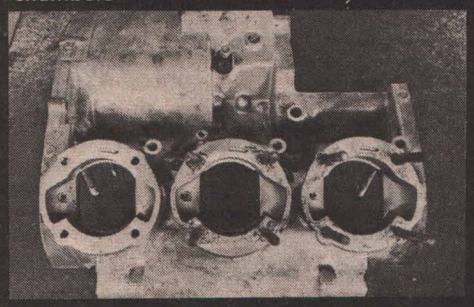
For road use, the Kawasaki chassis are well up to scratch, although Dunlop Red Arrow tyres are probably worthwhile on the 500 with TT100s or Avon Road Runners also being good alternatives.

For racing, Brian stiffens the frame as well. He adds a cross-tube low down between the downtubes at the front, and replaces the cranked crosstube at the rear of the frame — it is cranked to clear the chain — with a straight, inclined tube. He also stiffens up the swinging arm, fits phosphor-bronze bushes at the pivots and puts a couple of gussets in at the tube junction beneath the seat. Finally, he uses a thicker, home-brewed oil in the front forks.

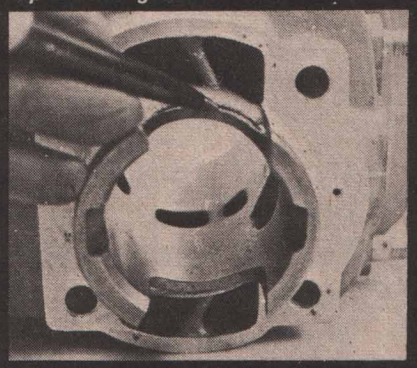
To make the most of the extra performance available, the gearing must be altered but since the ratios are fairly well spaced, it is only necessary to alter the chain sprockets. Brian recommends one tooth up on the front sprocket, and two down at the rear.



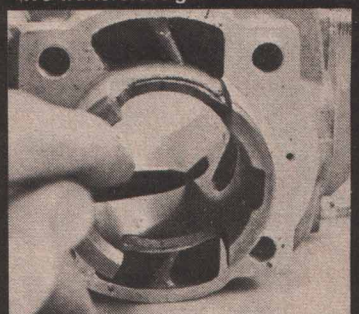
A section through the barrel, showing the four transfer ports and the deep combustion chambers



First step in modifying the ports is to enlarge the mouths in the crankcase to line up with the gasket



The edge of the liner is radiused, and blended in, while the divider between the two transfers is ground to a knife edge



The small rear transfers should be widened

The inclined surface of the chamber is machined at an angle of 15 degrees