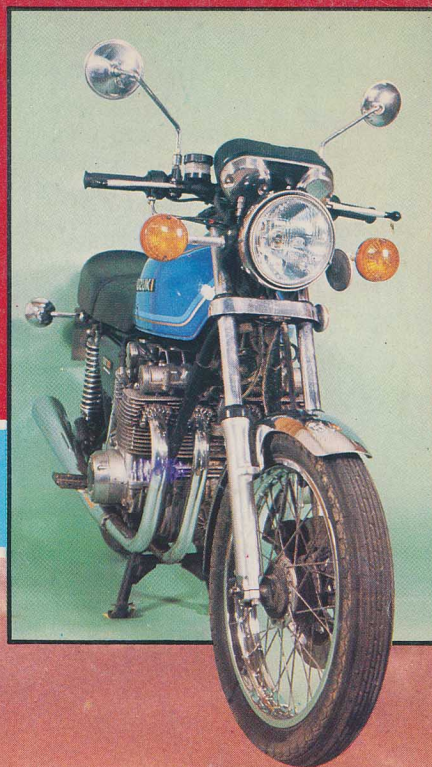


MOTOR CYCLE MECHANICS

MARCH 1977 35p

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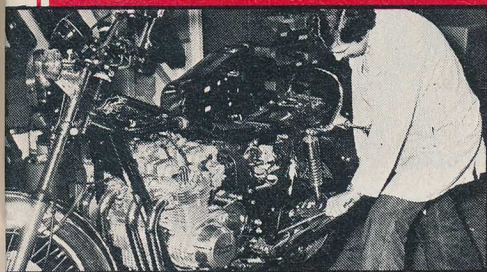
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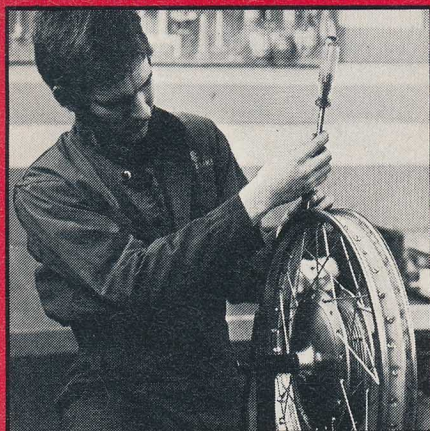
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ABC CERTIFIED SALE,
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111,692.



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WIN our fabulous CUSTOMISED 750 HONDA

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THE RD250/350/400 YAMAHAS CAN BE TWEAKED

John Hartley reports

YAMAHA'S two-stroke twins have established an enviable reputation for searing acceleration and high performance.

The factory started producing the RD models with reed valve "Torque Induction System" in 1972, and the 250 and 350 share the same bottom end, the 250 being a 54 x 54mm motor, the 350 being 64 x 54mm. Earlier models had five-speed gearboxes, but for a couple of years now, six speeds have been in use. As Dave Walker explained in the February issue of MCM, these earlier models had six-speed gearboxes, but sixth was blanked off, and it is a fairly simple matter to liberate the extra gear. Once you have done that, incidentally, there is no need to modify the gearbox, even for production racing.

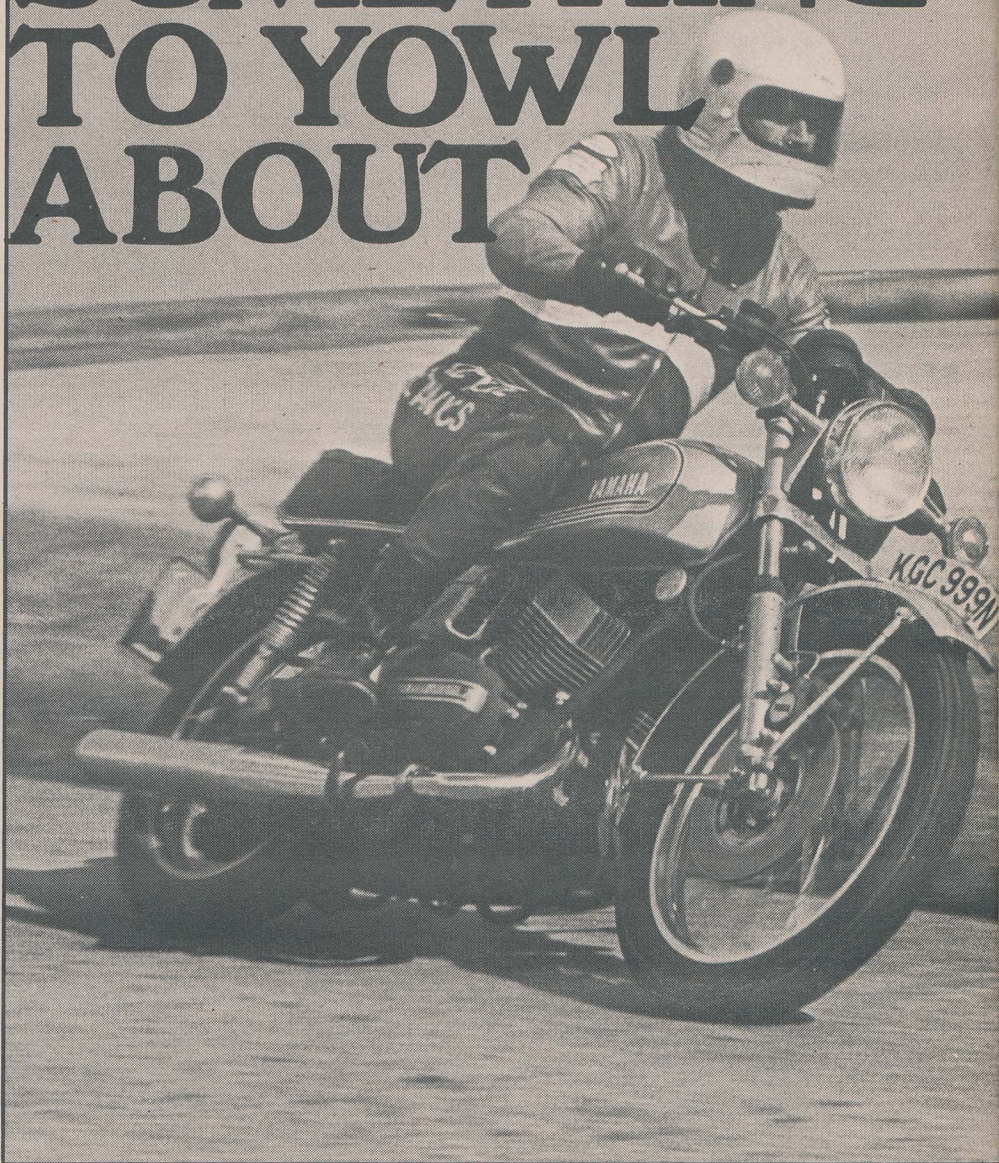
When you are thinking about getting more power out of your bike, it is always worth considering whether you can increase the capacity — in this case from 250 to 350cc, or from 350 to 400cc. Assuming that you can stand the extra insurance, it is quite feasible to fit the RD350 top end on to the RD250 bottom end. But since you need the heads as well as the barrels, this is a fairly expensive job, costing well over £100 using new bits. If you can get hold of some good second hand bits, or if your engine needs a rebore anyway, this is certainly the easiest way of getting more power. Unfortunately, you can't go from 350 to 400 in the same way because the 400 is a stroked version of the 350, with a bore and stroke of 64 x 62mm, and consequently the crankcase is different.

REED VALVES

Before considering ways of tuning the RDs, it is worth recapping on the reed valve induction system, and how this influences things. The reed valves are very thin spring steel plates that cover windows in the inlet tract. These windows are inclined so that when there is a depression in the crankcase, it opens the reed valves, allowing the mixture to enter. Then, when the piston descends, and the pressure in the crankcase becomes positive, the force of the pressure closes the valves. The advantage of this layout is that the long inlet opening needed for maximum power can be used, yet at low speeds the valves are closed by the pressure in the crankcase so that the engine is much more tractable than if it had the same timing with piston controlled ports. On the other hand, the reed valves do offer some restriction to the breathing, so if a road machine is being converted for racing, bigger reed valves may be needed.

On the Yamahas, there is also an extra transfer port formed as an inclined slot upwards from the inlet port. There are also a pair of holes in the piston skirt, and as the piston comes down, so these holes align with the inlet port, allowing the gas trapped beneath the piston crown to shoot up into the cylinder. In practice, the use of reed valves means that there is no point in enlarging the inlet port, since it is the reed valves that restrict the breathing. Then, if the transfer ports are raised, that "seventh port" should

SpeedTune Series SOMETHING TO YOWL ABOUT



be raised to the same height. In other respects, tuning the Yamahas by modifying the ports follows conventional techniques. One point that is worth bearing in mind, though, is that the 250 is already fairly peaky, so it is important that the ports aren't raised too much, or the machine will become virtually unrideable in traffic.

Two firms that do go in for tuning the Yamahas are Sondel Sport of 1 Stapleton Hall Road, London N4, and Hamilton Motors, Chester-le-Street, Co. Durham. Both firms can modify the ports, and also supply special expansion chambers, while Sondel Sport is also developing a 500 conversion for the RD400. Hamilton Motors find that many people prefer to have the expansion chambers fitted, since this is a bolt-on job, and they normally fit the Campbell Geometrics pipes, which retail at about £55 a pair for straight

black pipes. There are three stages of port-work, costing £20-£30 plus VAT for the labour. Sondel Sport charge £40-£50 for the port-work and for machining the cylinder heads to raise the compression ratio and, as with Hamilton Motors, any parts are charged extra.

Sondel Sport also say that there is quite a demand for pipes alone, and they import the J and R power pipes from the USA. Unfortunately, they are rather expensive, a pair for a 250/350 costing from about £73, and for the RD400 from about £90. However, according to the power curves provided by the manufacturers, the pipes really do give quite a lot of extra power — all at the top end, mind you. On the 350, they give slightly less power than standard up to about 5,750 rpm, and then the power really takes off, so that by 6,000 rpm there is an extra 4 bhp, and from about 6,500 upwards they give an extra 6 bhp. Between

5,000 and 5,500 rpm, there seems to be a bit of a hole in the power curve, though. On the 400, the increase in power is rather more gradual, but again, the transition point is at about 5,500 rpm. Above this speed, there is quite a lot of extra power available, and the maximum boost over standard is 5 bhp.

Of course, the problem with fitting such pipes is that you are stuck with the sort of power curve that the designer had in mind, whereas if you have the ports modified, you can specify the sort of performance you want, and where you want the power. At Sondel Sport, Ron Rayliss, the managing director, gets closely involved in the tuning side of the business, but Bill White is the man who is actually responsible for the tuning. Bill says that even for production racing too much top end power can be an embarrassment if the rev. range is too narrow, so he concentrates on trying to get more power at the top without ruining the bottom end.

On all the engines, Bill White starts off by opening out the mouths of the transfer ports so that they match the gasket precisely — they are always smaller than the cut-outs, and there are usually differences from port to port. He also blends the liner into the aluminium to give a smooth entry of the gases into the port. Because the 250 is fairly highly tuned as standard, he doesn't advocate raising the transfer ports at all, but he does make sure that the top edges of all the ports are at the same height — small differences here can make a big difference to the power output. He also improves the shape of the "seventh port", that little inclined slot at the back, since normally there is a slight lip or peak in the surface, and this should be smoothed out.

On the 350 and 400, the transfers receive the same treatment, but with the additional raising of the port heights by 1mm for road use, and a little more for racing. Incidentally, Bill echoes the words of most two-stroke tuners when he says that you don't want a polished surface in the transfers, just a good, smooth surface that blends in smoothly, so that the gas has an easy passage.

SKIRT CUT

To increase the length of the inlet port opening, and thus boost power at the top end, it is far easier to cut away a portion of the piston skirt, rather than to modify the inlet port height. It is worthwhile to clean up the inlet port shape a little, and to make sure that the reed valves can open properly without fouling the casting, but that is all. If you are going to have a go at altering the inlet timing, it is a good idea to modify some old pistons experimentally first, so that you get the height about right. The bottom of the skirt is cut away locally so that, in effect, the port opens earlier and closes later. Here, you can grind off about 2-3mm, but no more. Another reason for modifying the piston, is that you want to open up those two little windows that feed the seventh port as well. These holes are virtually circular, and are quite small. In theory, they should extend for the height of the inlet port, but in practice, it is reasonable to raise them about 3mm.

On all the models, the exhaust port can be raised, and, of course, this has a significant effect on the power output. On the 250/350, the port can be raised by about 3mm, the shape of the top edge and corners being similar to that of the standard port. On the

400, the port can be raised a little higher, as it can be on racing versions of the 250/350.

Incidentally, just as it is worthwhile to experiment on an old piston, so it is advisable to rebore the barrels after reshaping the ports, and this necessity — because you will have almost certainly nicked the bore somewhere — can be turned to advantage. The point is that there is always a temptation to raise the ports too high, thinking: "Ah well, if he says 3mm, I can raise them 5mm because I only use my bike on the open road." In fact, if you overdo these things, the bike becomes pretty unpleasant wherever you ride it, with wheelies cropping up when you least expect them. So, it is best to start off by raising the ports just one mm or two, put the barrels back, and see how it goes. If all is well, run the bike for a few miles, and then get it rebored. If not, take another one mm off, but no more, and try it again.

Even if you do modify the ports yourself, there is one job you can't do, and that is to raise the compression ratio, since this involves some precision machining. Sondel Sport raise the compression ratio by up to 0.4 of a ratio, and this completes the modifications. With standard exhausts, Bill Wright reckons that these changes are worth about 4 bhp, up from the 39 bhp that Yamaha claims to 43, or from about 34 to 37-38 real horsepower at the back wheel.

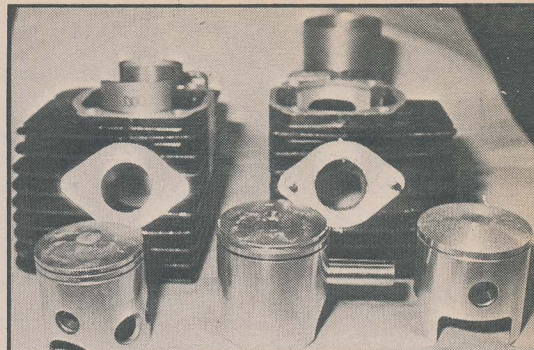
500 CONVERSION

If you are planning to hot up an RD400, and rebore it as well, Sondel Sport have developed a 500 conversion. The parts will be available on an exchange basis, and as with the other prices, these are quoted on the basis that you remove and replace the barrels etc, on your engine yourself. The basic price of the 500 conversion is currently £108 plus VAT, which doesn't sound too bad when you consider that you can spend almost that much on a pair of expansion chambers.

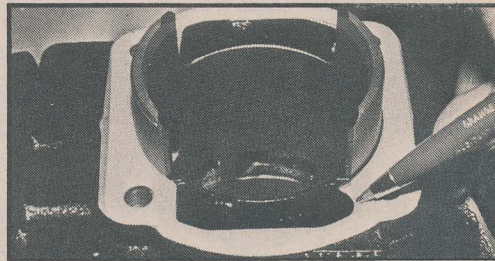
Sondel Sport bore the liners out of the old barrels, fit new liners, and then shape the ports in line with their procedure for the 400. The current plan is that the bore be increased to 70mm, giving a capacity of 477cc, the advantage of this size being that Yamaha pistons can be used for the road machines, although the American Wiseco pistons are to be used for racing.

This same conversion forms the basis of the "Boss" Racer that Sondel unveiled at the Racing Show in January. For that model, though, it is planned to use some special, larger reed valves. For road use, the standard carburettors and reed valves are retained. Incidentally, if you are doubtful about the big bore, remember that the 70 x 62 has a slightly bigger stroke to bore ratio than the 64 x 54 of the 350, so it should be an excellent combination. Ron Bayliss hopes that the engine will produce about 48/50bhp, which seems reasonably conservative. Of course, the extra capacity will give quite a lot of extra power down at the bottom end as well, so this 500 really could be quite a machine. It will need to be geared up quite a bit, and the necessary sprockets will be available in due course.

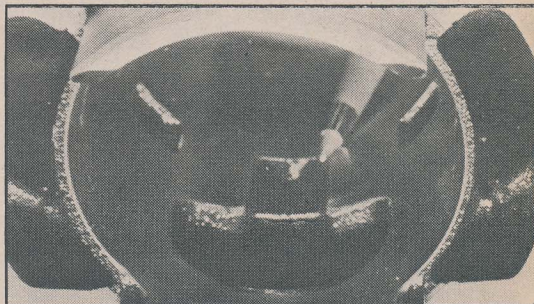
Chassis wise, the Yamahas are pretty good, and the only change that is normally made is the fitment of either Koni or Girling rear shocks, but whether that will be enough for the 500 remains to be seen. □



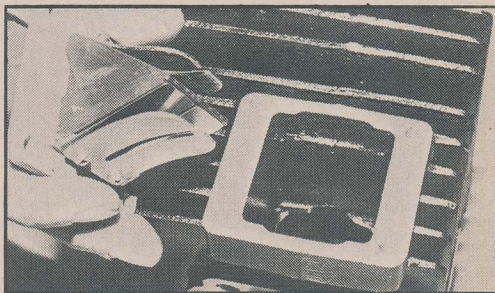
The standard RD400 components left, with the bored out barrel, liner and pistons for the 500 conversion. The piston in the middle is for road use, and that on the right for racing. Note the circular windows in the standard piston.



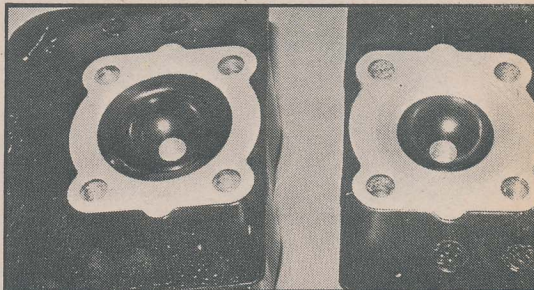
The entries to the transfer ports are enlarged to mate up with the gasket.



The small seventh port must be cleaned up, and should be the same height as the other transfer ports.



The reed valve and the inlet port which require very little attention.



The head is machined to increase the compression ratio, and to make the squish band more distinct, right.