

MOTOR CYCLE MECHANICS

JUNE
1978

50p

Norton Power Tune



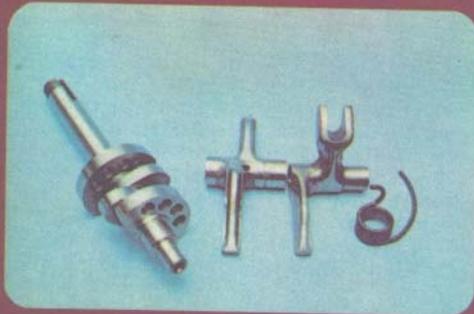
FREE
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**Hailwood's
T.T. Ducati
secrets**

Win Suzuki's new 100 mph 250

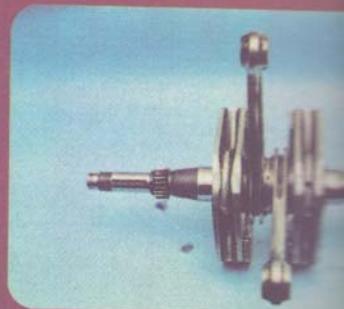
Details inside



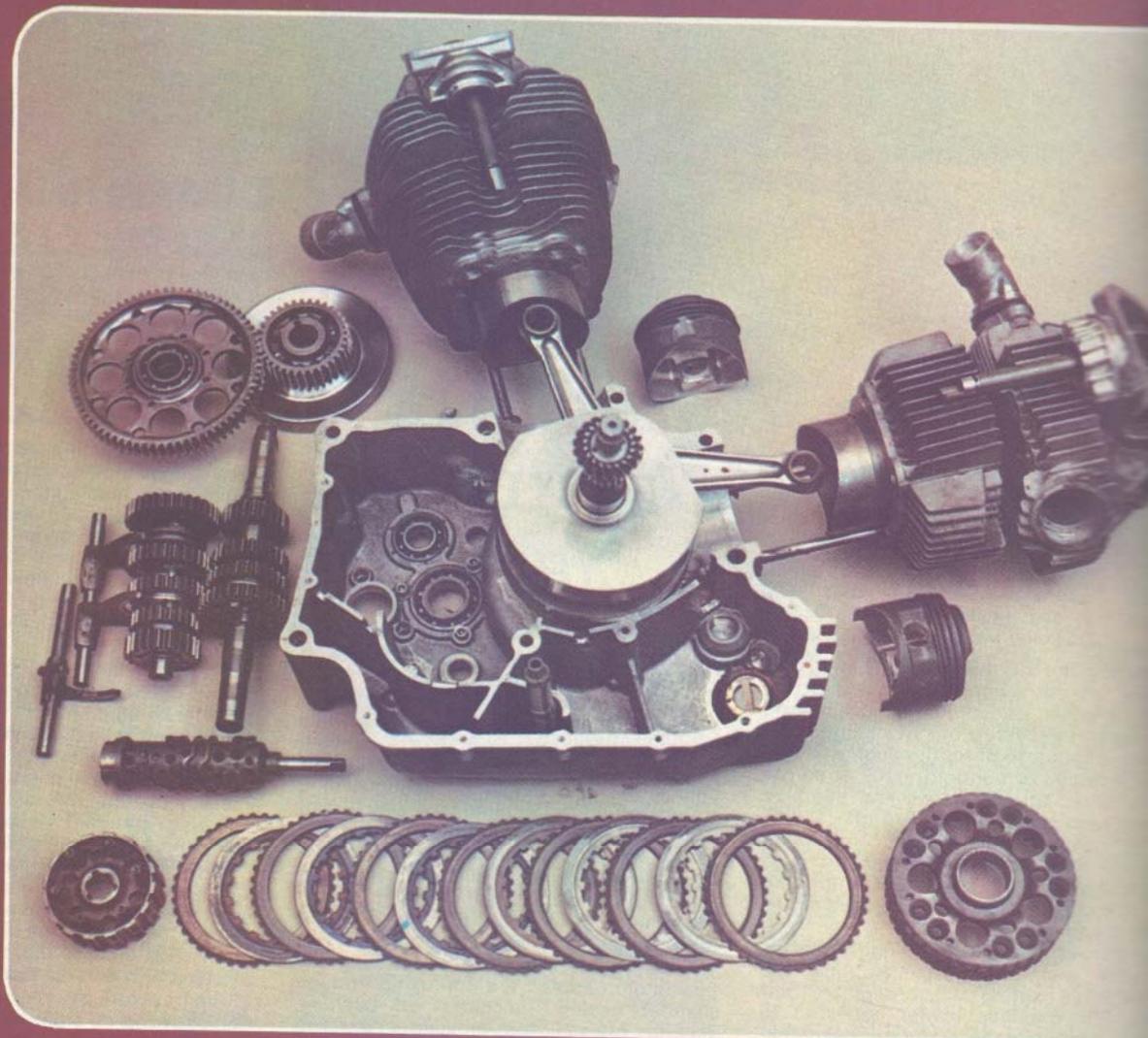
The full race camshaft operates via standard camshaft followers, they are more than strong enough.



Teflon coated 11:1 piston (right), standard (centre) and endurance 8:1 (left).



Due to the heavier crankpin and gear, it has to be re-balanced.



Hailwood's T.T. Ducat

A works motor, plus Sports Motorcycles race-craft

by Dave Walker

MOTOR CYCLE MECHANICS



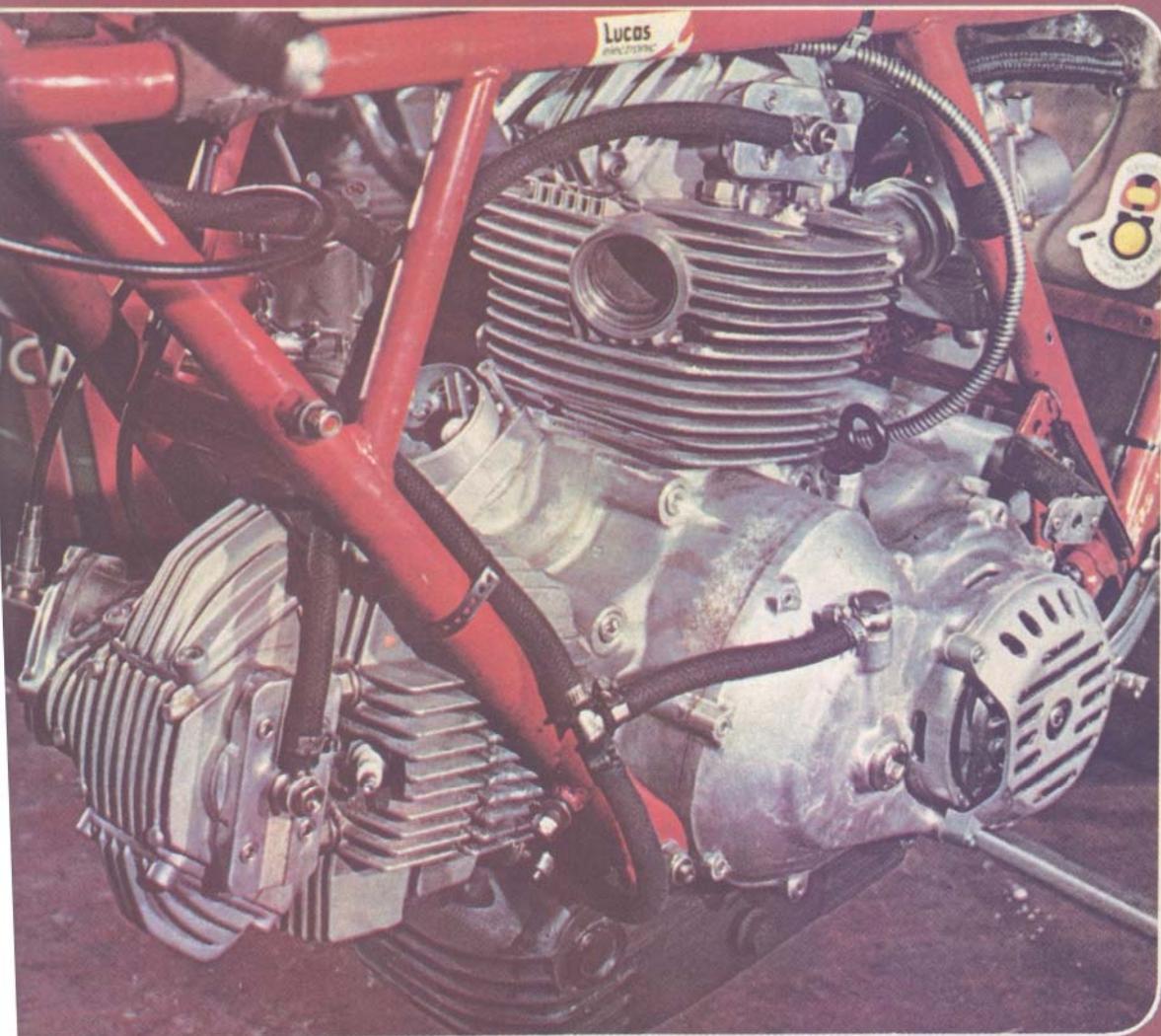
Flywheel is lightened and polished: drive gears are special factory jobs.



A close ratio five speed gear cluster is fitted, many of the gears are drilled for lightness.



Running with a dry clutch means a special mag. alloy casting for the primary drive.



HAILWOOD could have had any machine he wanted for the Isle of Man TT race — he chose Ducati. To be more precise he chose Sports Motorcycles' Ducati and, as I found out when I visited the factory in Manchester, there is a big difference. I, like many others, was under the impression that the Hailwood "works" TT bike was to be ready to go by the factory and Sports Motorcycles' job was to add the petrol. As I very quickly found out this is far from the truth. Steve Wynne has built the motor up from scratch, incorporating his own hard earned modifications learned from racing.

When the engine arrived from the factory it was fitted with race-spec flow heads and a dry clutch set up. The bulk of the motor was standard. Starting at the heart of the engine, the crankshaft,

Steve has found that the big-ends will fail when the engine is used hard. Finding the answer was expensive.

Since there is plenty of metal around the crankpin an oversize pin was made up and pressed into the standard flywheel. The standard rods are retained, but machined out to accept the new big end rollers. The finish on the rods is superb, like a mirror, but Steve wouldn't take credit for it: the rods are polished as standard.

With the new big end assembly fitted the engine will be a lot more reliable but Steve knows from his own experience that the next problem is to prevent the piston breaking up. The answer in this case is better pistons. Simple answers can also prove expensive because the new pistons had to be bought in from America. They are Teflon



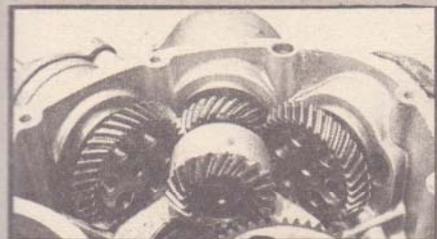
1 A new crankpin is turned up and the standard rod bored out, to prevent big end failure.



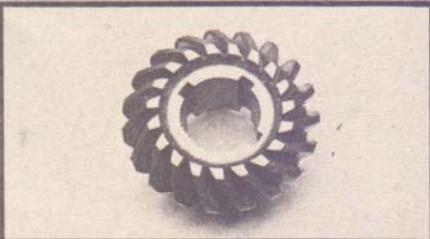
2 This is what happens when you exceed 8,200 rpm with the standard piston; very expensive.



3 With the special clutch cover the oil filler is blanked off. The clutch is alloy on this machine.



4 A small error in each of these camshaft drive gears adds up to very inaccurate cam timing.



5 Extra keyways, cut offset in the bevel gears, means two more chances of spot on cam timing.



6 The hydraulic steering damper is located on alloy brackets, again to save weight.

Hailwood's T.T. Ducati

coated and a lot stronger than standard: with a raised crown on the top of the piston bringing compression ratio up to 11 to 1, they need to be.

The barrels had to be bored to plus 40thou to accept the new pistons. This is not to increase the capacity, it's simply to fit the piston which does not come in a smaller size. The slight oversize also helps the compression ratio.

Naturally with the larger big end and heavier pistons the crankshaft had to be re-balanced. Rather than add weight to the crankweb, Steve removed it from the crankpin area of the flywheels. The flywheels were also polished around the crankpin. The small external wheel, just outboard of the primary drive gear, was lightened by reducing its width.

The cylinder heads were prepared at the works but started life as the standard Desmo unit. Both ports were opened out and gas flowed, but most of the attention was paid to the inlet which is opened out to within a hair's breadth of breaking through the cast-

ing. It feeds out into the cylinder around a 2mm oversize inlet valve. The combustion chamber was also polished but the shape remains standard. On the outlet side the exhaust valve is also 2mm oversize.

There is nothing very special about the camshaft which is the Imola, or full race cam. Timing is quoted by the factory as 65-95/95-55 degrees but Steve has found quite large discrepancies from one cam to another. To overcome this two extra keyways have been machined into the timing bevel gears, and this, combined with offset keys, allows the cams to be set up spot on.

When you consider that the factory quote their figures as + or - 5 degrees, you begin to understand what Steve is getting at. The main advantage of the desmodromic valve gear is the control it gives over valve acceleration. The valve can be fired off of its seat, straight to full lift without having to worry about valve float pulling the follower away from the cam face. Once fully open the valve can be left there until the last minute when it can be slammed almost shut, then gently lowered back onto its seat. The main advantage is, therefore, the amount of time the valve can spend at full lift for any given set of timing figures.

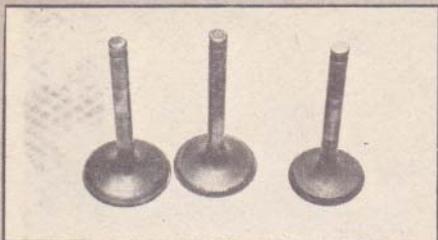
While it is true to say the desmodromic valve operation helps the free revving of the engine, it is not a licence to spin the motor at the speed of light. With its very long stroke, piston speed is the limiting factor for this big V-twin. Don't run away with the idea that the Ducati 860 is an old fashioned long stroke motor, at 86 x 74.4mm it IS over-square. Having only two cylinders the stroke has to be longer than average to get the capacity, yet maintain a realistic bore to stroke ratio.

On the carburation side there are no fancy magnesium body instruments to be found. Breathing is through a pair of 40mm Dell'Orto carbs the same as can be found on any 900 SS production machine. Steve has found, through many hours of experimenting, that they perform best when the bell-mouth length is reduced by half. This appears to give the best overall inlet tract length.

You can get a pretty fair idea of just how



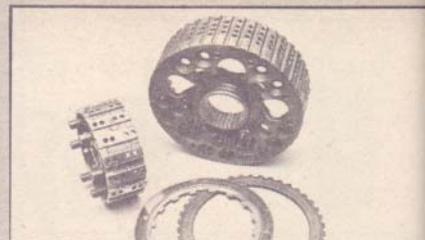
Steve Wynne and the big Ducati which is now nearing completion for its historic appearance in the Island.



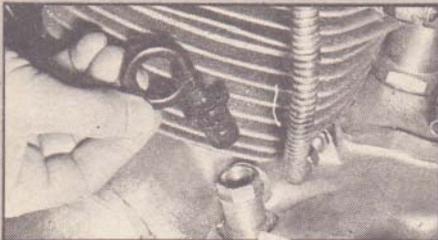
7 Two millimeter oversize valves are used on the inlet and exhaust. Standard valve in centre.



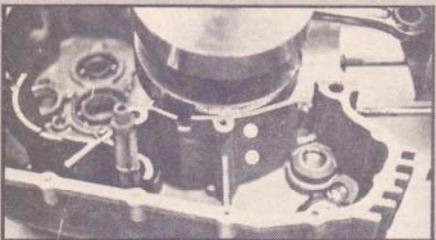
8 Since there are no valve springs this ramp on the camshaft closes the valve.



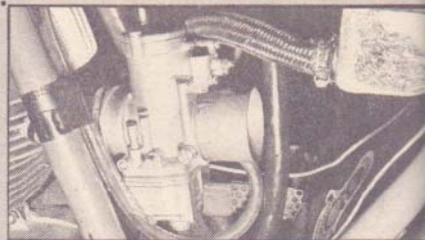
9 The clutch has sintered bronze plates and an alloy drum. These drilled units are from last year's bike.



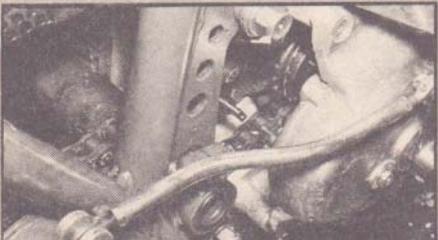
13 The crankcase is drilled for this quick filler oil plug. The fairing obscures the original.



14 This crankcase web can be drilled with two half inch holes to help drainage from flywheel.



15 To get the best overall inlet tract length the standard bellmouths are cut in half.



19 Weight reduction can become an obsession, even the gearbox sprocket has been drilled!



20 The rear shock absorbers are Girling gas units, the latest road type with pre-load adjusters.



21 The clear section in the fuel tank allows pit crew an instant check on petrol.

Hailwood's T.T. Ducati

efficient the engine is when you consider the fuel consumption which is an astonishing 40mpg at racing speeds! Helping here is a Lucas Rita ignition system. Steve found that when running with contact breakers the ignition could wander by as much as two degrees during a short race. The electronic set up doesn't vary at all and Lucas arranged for the "magic box" to be fitted with quick release jack plugs. If the ignition does give any trouble on the Island the whole set up can be replaced instantly.

Although the standard Ducati is now fitted with electronic ignition, much of it is located under the crankcase clutch cover — where it's difficult to get at in the event of trouble.

The primary gear, taking the power to the gearbox, is a special lightweight job from the factory. The driven gear is normally part of the clutch drum but on this motor it's separate, allowing the clutch drum to be fabricated from aluminium alloy. Before Steve got the alloy job from the factory he used the standard unit, but drilled it so full of holes it looked like a piece of Swiss cheese.

Like most racing machines the clutch runs dry, the friction plates being made from sintered bronze. When we road tested the Ducati Darmah we thought that the clutch might prove something of a weak spot if slipped excessively. This engine has the clutch springs from the Ducati 450 single

fitted, and Steve tells us this is also a good mod for the road bikes.

Since the clutch does run dry, a new casting was required on that side of the crankcase. The factory cast this from magnesium alloy along with the little cover which stops the rider's toes getting mangled in the works.

A close ratio gear cluster is fitted but Steve had to modify the fourth gear somewhat. He has found that when the motor is race tuned and the gearbox thrashed to within an inch of its life, fourth gear jumps out. This always seems to happen as the motor approaches maximum revs, which is a bit like sitting on a grenade.

To prevent this happening three of the selector dogs were machined away. This doesn't sound right; until you know how the standard gearbox works. In an attempt to reduce gearbox backlash three short dogs are fitted between the main ones. These don't help the initial engagement, they simply reduce the backlash on the over-run. These were ground away and the original main dogs cut a little deeper. This is strictly a racing mod; the box never gives any trouble on a tuned road machine.

The chassis is exactly the same as the one used last year. It is based on the 750 road bike design but has extra bracing struts around the steering head. Naturally, the tube is a special lightweight type.

The rear swinging arm is very interesting,

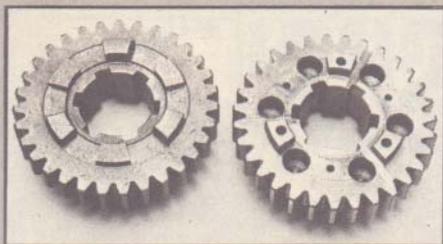
being a cross between the 750 and the 860 set ups. Like the standard road 750 the pivot at the chassis end is fixed. On the 860 it is mounted on eccentric adjusters. To tension the chain an eccentric spindle is fitted to the rear end of the fork, similar to the 860, but the "wrong" end.

Ducati seemed to have been carried away with the idea of eccentric adjusters. The footrests are fitted with them, allowing the riding position to be tailored to the rider during actual track testing. The engine forms part of the frame structure and helps to keep the centre of gravity low down.

Although I obviously couldn't ride the bike, I was allowed to sit on it and put make-believe racers for a little while. It felt like a 250 — with an all up weight of around 370 lb, I should think it handles like one as well. The riding position fits like a glove thanks to a very clever seat and tank design.

On the suspension side, Girling gas shocks are to be fitted to the rear, not the motocross type, but the new road shock absorber. The spring rates will depend on Mike Hailwood's test session. Up front Marzocchi forks lead the way. The legs carry two Brembo calipers, and these clamp down onto standard diameter cast iron discs. In an effort to reduce the unsprung weight, and help heat dissipation, no less than 140 holes have been drilled, and countersunk, radially in each disc. A good mod for DIY types who are handy with a Black and Decker.

That was the state of the bike when I left Steve Wynne polishing the twin filler caps with his shirt sleeve, and quietly smiling at himself, as every proud father has a right to



10 The standard gear on the left has three of its dogs machined away. The remaining ones are cut deeper.



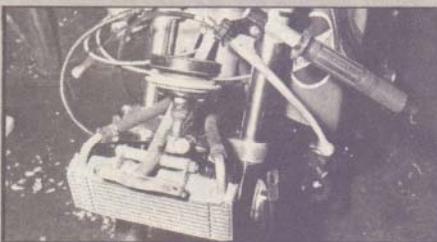
11 The selector drum, for the close ratio five speed box, is peppered with holes to reduce weight.



12 Lucas Rita electronic ignition replaces the contact breaker set up on the 750 style crankcases.



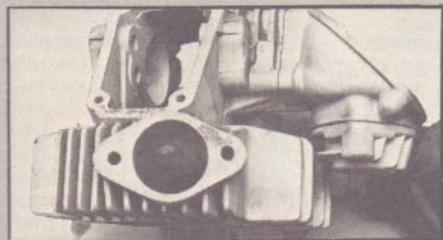
16 The cast iron disc has 140 holes drilled in it. This reduces weight and helps cooling.



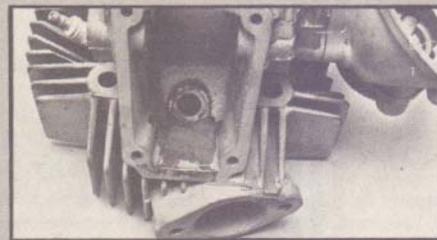
17 Short circuit scratchers don't need an oil cooler but in long races it's essential.



18 The rear set footrests are mounted on eccentric adjusters for instant adjustment.



22 For home tuning the inlet needs to be as big as possible. If you should break . . .



23 . . . through at the top of the port, it can be repaired with Araldite, like this.



24 When cleaning up the exhaust, avoid the bottom of the port, it's very thin just here.

ROAD MODS

With Mike Hailwood riding for them John Sear and Steve Wynne, the men behind Sports Motorcycles, could be forgiven for sticking their heads into the clouds, and having a little less time for the average mortal. If they were just businessmen instead of motorcyclists that might well have happened. While I was being shown around the bike the 'phonæ rang; a Ducati Darmah owner wanted some information on tuning his road bike. He wasn't a customer of Sports Motorcycles, but Steve still spent the best part of thirty minutes giving a fellow Ducati enthusiast a list of worthwhile mods.

Would they mind us passing on these hard earned tips to the general public, and their production racing competition? No, they wouldn't, the more quick Ducati twins around the better as far as they were concerned.

Starting at the engine, Steve says they would go plenty quick enough, if they were only set up as the designer originally intended. Camshaft timing is the main problem. If you invest in a degree disc and a dial gauge, you can find a fair bit more top speed by correcting the valve timing. This takes time and you will probably have to make up off-set keyways to put matters right.

The heads can be ported and polished by the average home tuner — but don't overdo it. The walls can get rather thin at the top of the inlet. If you should break through, you can effect a repair with Araldite. The idea is to get them: "as big, and as straight, as

possible", and smooth out any obvious lumps and bumps. Polishing the port to a mirror finish is a harmless pastime, but don't expect any extra power — just plain smooth is good enough.

On the exhaust side the port can be cleaned up, but leave the bottom of the port alone. It is the pipe length that really helps the power. After making up countless systems, Steve found the best pipe length to be 24ins. These should feed into the standard silencer. With pipes this length you will have to make the one from the top cylinder a high level job.

The carbs from the 900 SS are the best units for maximum power but they are not a must. Whatever the size of your carbs they will benefit from being shortened. Nothing as subtle as squashing them in a vice, you simply cut the bellmouth in half.

The engine will also run better at high rpm if the carbs are rubber mounted. There are no kits available, so car radiator hose and home made adaptors are the order of the day. It is easiest to fit the rubber between the manifold and the head, rather than the manifold and the carb. However you do it, keep the overall inlet tract length the same.

The heads are not fitted with gaskets but the seal can be guaranteed by lapping the head with fine grinding paste. Unless you have an old barrel that you can break the fins off you will have to get a suitable collar made up. Anything the same diameter as the barrel spigot can be used as long as its surface is flat.

Steve says you can get a useful gain in

acceleration by reducing the width of the external flywheel by 50 per cent.

Although after these mods the motor should produce the sort of power the designer intended, it won't go any faster because the clutch is going to slip. Clutch springs from the 450 single are the answer.

As I said earlier, the latest 860 engine is fitted with its own electronic ignition. If you have a 750 with contact breakers and coils, the Lucas Rita set up is worth considering. Set the 750 timing to 10 degrees static.

If you just happen to be stripping your engine there is also a mod for the crankcases. Steve recommends drilling a couple of half inch holes in the bottom of the case baffle plate which improves drainage from the flywheel back into the sump.

The gearbox is quite up to hard road use without any mods. If you want to improve the change action a little you can gently radius the detent holes in the gear change plate.

On the chassis side there are one or two mods you can make to improve the already good road holding. An obvious mod is to swop the rear dampers. The standard set up on the Ducati twins is a little on the hard side for this country, and Steve recommends 13in Girling gas shocks with the 100lb rate springs.

At the front end the sting can be taken out of the Ceriani forks by removing the preload spacer from under the top nuts. These should be replaced with Triumph twin valve springs! They just happen to be the right diameter and give the front fork springs a little progressive action.