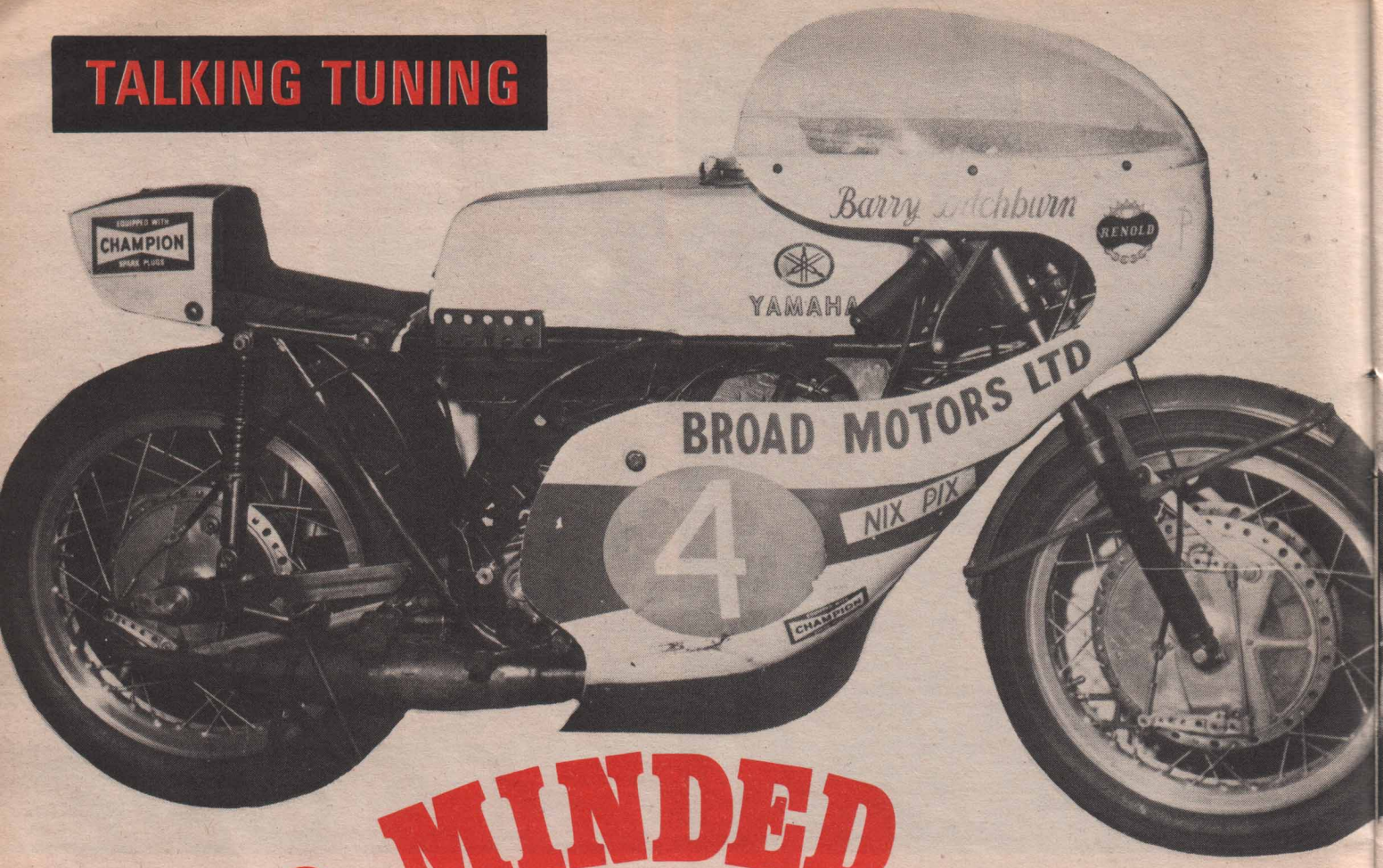


BROAD MINDED

Anyone watching Barry Ditchburn blowing the opposition into the weeds might reasonably think there was something special powering his 354 Broad Yamaha. Especially when the opposition is 500-, 650- or even 750-mounted.

But they'd be wrong—Ted Broad, originator of the machine, apologises and says there's no quick, simple trick, or a complicated one for that matter, which will make one Yam faster than another.

He reckons the only way to do it is to apply yourself to the problem—and in his case that means something around eight years of painstaking work on Yamaha machines. Every detail, every modification during this time has been carefully recorded, and gradually he has been able to make the bicycles go, and, more important, keep them going.

As he explains, it's not just a question of getting x amount of power from an engine. You've got to be able to *use* that power on the track. As an example, the 750 Suzukis almost certainly had more available power than any of the machines in the recent Anglo-American Match Race, yet they were blown off by a fifteen-year-old iron-barrelled pushrod motor. . . .

And that brings us to the next point in the Broad philosophy; having got a usable machine, you have also got to find the right man to use it.

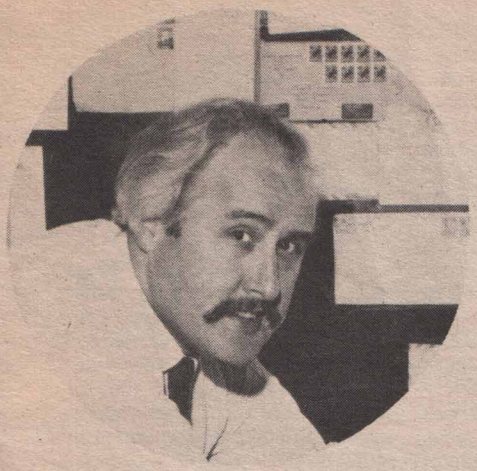
Still, first things first, and that 354 motor must get some attention . . . but if you're expecting a host of special equipment you're in for a let-down. Both the 350 and 354 are so near to stock Yamaha you wouldn't believe it.

The major difference of the 354 is that it is stroked, rather than bored, to give this capacity.

This is only done to make the machine legal—the rules say 351 cc or more. Does it give more power? Ted supposes it does, but as it's only an extra 6 cc, it can't be that much.

So why the complication of stroking, when reboring is cheap and simple? Mainly because you can keep the standard barrels and pistons which are readily available. Also because, for no known reason, the slightly longer stroke makes the engine run a bit smoother, and if you've got the right equipment for assembling crankshafts, the job isn't that difficult.

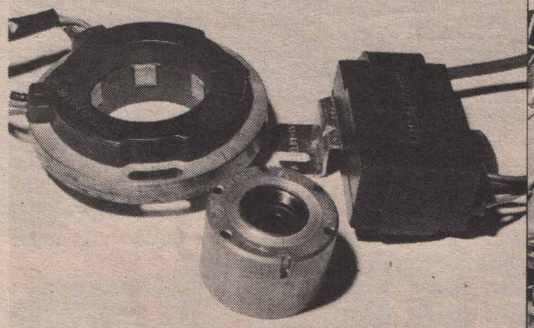
The way it's done is by making



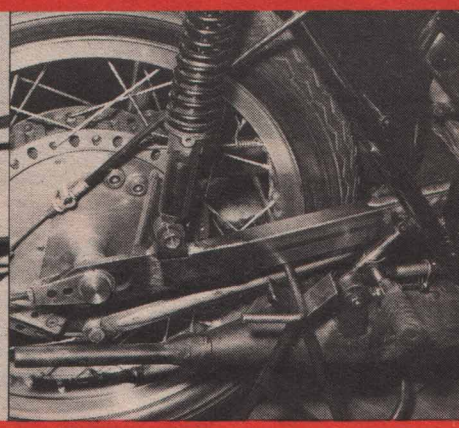
Basis of the 354—the crankpin with the eccentric journal. Timing marks on the end are to align it correctly in the flywheel

Modified rod, nearer camera, has 1 taken off the big end boss and extra groo machined. Two extra thrust washers are u

Ted Broad talks to MCM about his Yamaha racing philosophy



The new electronic ignition system needs no battery and has the coils integral with the encapsulated electronics system



The Yamaha frame is standard, exc for this swinging arm, built to ext the wheelbase and keep front wheel do

a crankpin with an eccentric journal, as shown in the photograph. The big end journal is 0.012 in. eccentric, and this increases the stroke by 0.024 in. to give the extra capacity. There are timing marks on the ends of the pin so that it is assembled in the right position in the crankshaft.

The crank is pressed together, and the pin is an interference fit, but made 0.0001 in. bigger than the standard pin. So there is obviously some pretty precise machining required.

This means that the piston will be travelling further along the bore, and to compensate for this Broad fits two base gaskets on the cylinder barrels. The really incredible thing is that the crankpin doesn't move, but Ted has an engine that has done 800 racing miles to prove the point.

He doesn't believe in polishing the rods—he says the works racers never had polished internals, and as the factory went to all the trouble of copperising them, why rub it all off? What he does do is to machine 1 mm off each side of the big-end boss, machine extra grooves in the boss, fit a narrower cage and use double thrust washers.

Crankshaft assembly is all-important as a strong bottom half means reliability. Ted sets the crankshaft up true to within 0.0005 in. all along its length.

Yamahas have a reputation for wearing out pistons, but the only attention they get is a minute inspection for cracks, especially around the gudgeon-pin boss, and the skirt clearance is set carefully to 0.0015–0.002 in. Ring gaps also have to be carefully checked.

Standard heads are used, running on a compression ratio of, Ted says, six or seven to one from the top of the exhaust port. His tongue is well and truly in his cheek here, though, because from the bottom of the bore that runs out at something nearer 15:1! All that tells you is roughly how high the exhaust port is. . . .

Talking of ports, he admits that the shape and size are modified a bit, but stubbornly refuses to say by how much. He says that the difference made by a combination of porting, timing and exhaust system makes such a marked difference to the power that it's not unusual to have one set of barrels and pipes for one circuit and another for another.

On the expansion box, the cone part is the same for all circuits and the tailpipe length doesn't seem to make a lot of difference. But the front pipe really changes things—by altering it peak power can be moved up and down the rev scale at will. A shorter front pipe pushes the power up to the top and narrows the power band, while a longer one gives a bigger spread of power.

Ted draws the red line at 10,200 rpm, as opposed to the Yamaha recommendation of 9500, but has never bothered to brake-test the engines. As he says, the proof of the pudding is always in the eating, and it's what happens out on the circuits that counts.

At the moment the engines use Krober electronic ignition, but he has just got a new device made by the Spanish Fensa concern for Yamaha. This consists of a generator cum pulse pick-up, doing away with a battery, and has the coils incorporated into the "black box" encapsulated unit.

The power goes on to the road via a standard Yamaha frame; to quote Ted, "Yamaha handling has always been OK, it's just that they take some getting used to. There's never been any need for special frames, but people are only just discovering this."

The only problems the Broad Yamaha had was in keeping the front wheel on the ground, and they've got around this by making a special swinging arm, a box section which lengthens the wheelbase by two inches, and Ted is experimenting with a modified frame which moves the engine a couple of inches further forward.

Top speed, measured on a fast circuit (Snetterton in fact), is 146 mph, but the top potential is over 150 mph.

But this is not an overnight happening. It may seem that way because Broad doesn't believe in making a lot of noise about his machines until they've achieved something—now they have, but it's taken time, money and a lot of hard work.

Ted Broad goes racing because he enjoys it, and his one ambition is—to break even. That's not likely to happen, though, no matter how much success he has, because there's always something new to go on to, and I'm sure I caught a twinkle in his eye as he said that.

JOHN ROBINSON