MOTOR CYCLE MECHANICS

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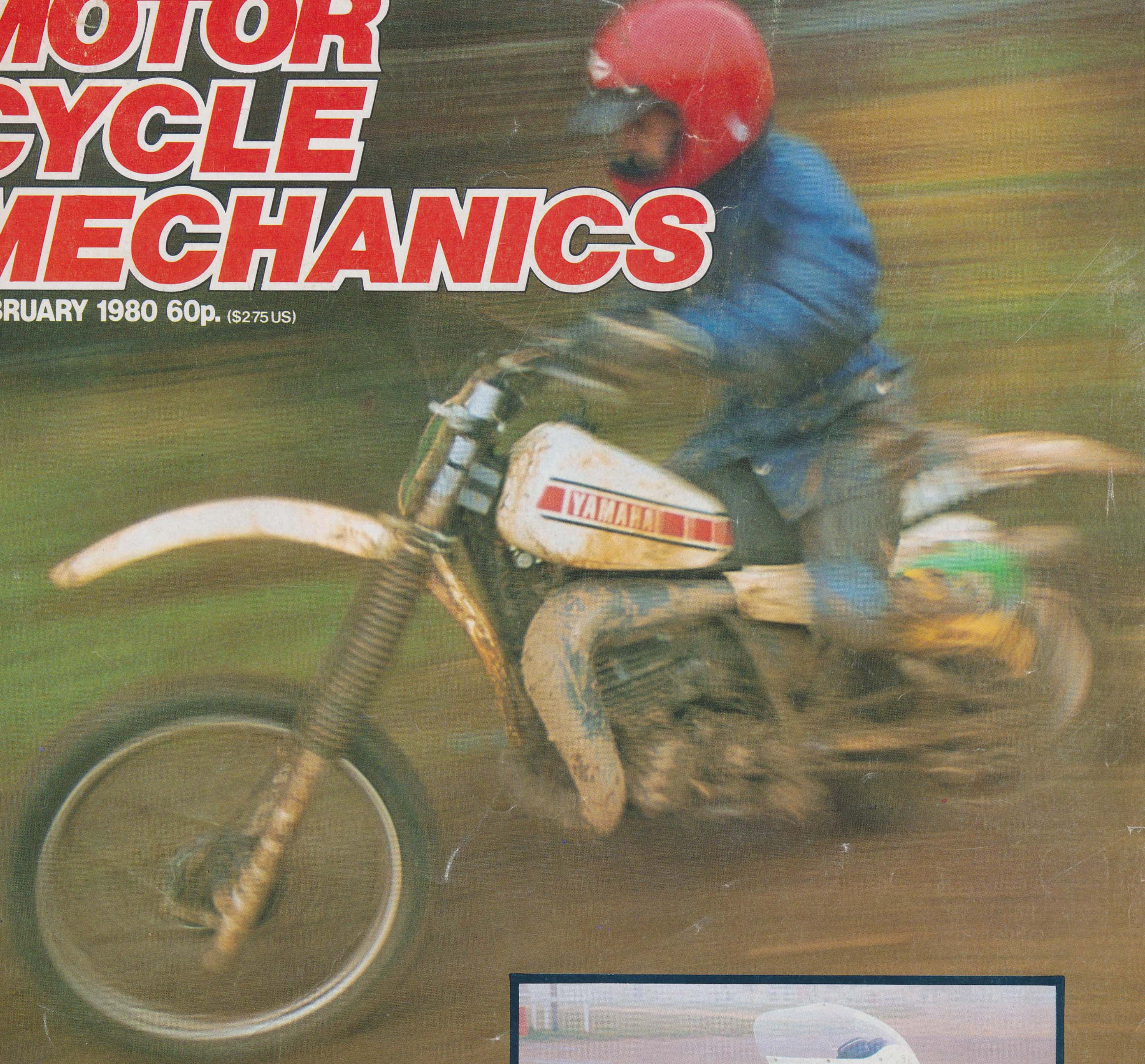
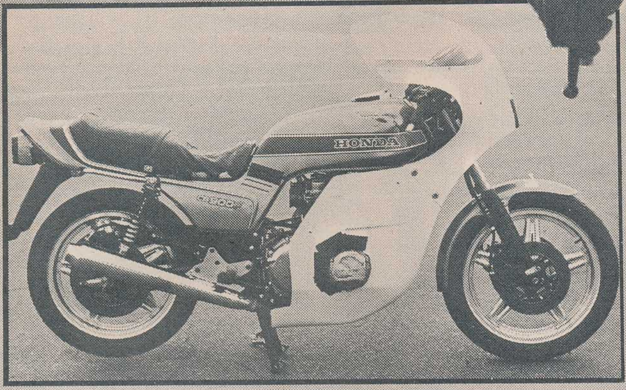


Yamaha's wild ones

LIGHTING- our critical survey

Kawasaki's workaday wonders

143mph Honda 900FZ tune-up



Liberated Honda...

Taking a CB900 to 143 mph — the easy way

The stock 900 Honda doesn't leave a lot to be desired — but the quest for more power or any kind of improvement has always been an irresistible challenge. Without resorting to drastic or expensive measures, Leon Moss of LEDAR gradually inched more and more power out of the 16-valve motor.

The exercise revealed a lot, not only about the Honda but also about the general state of the Japanese art. For one thing, it's getting more difficult to make any significant improvements. But that doesn't mean it's impossible — or even particularly expensive.

A cam job, with two shafts and sixteen lobes would have to be expensive. So would replacements for the four CV carbs. Bigger carburettors would still be faced with the restriction of the air cleaner and its box. And the project was meant to be as painless as possible.

The stock motor gave 82 bhp at 9500, the end of a long, steady, civilised spread of power. Leon's first step was to work on the exhaust, intending, originally to produce a four-into-one system. He also intended to keep a reasonable level of silencing and this made it difficult to beat the stock system. The best power reached with an *unsilenced* 4-1 was 80 bhp!

Eventually he settled for a 4-2 and the only significant difference from the standard exhaust was a short cross pipe linking the two collectors. In fact, this was used on the stock pipes and gave a decent increase between 6000 and 8000 rpm but peak power was the same, at 82 bhp.

That in itself would be a cheap and worthwhile modification but later it was used with different header pipes and Abbey silencers as shown in the pics. These were chopped and welded to tuck in as close as possible, partly to get more ground clearance and partly to make room for a fairing to be fitted.

The gain in the mid-range was followed up by attempts to improve the air-flow at the carburettors. Removing the choke plates and the air cleaner element gave a small increase in peak power after the carbs had been re-jetted but it also chopped off the bottom end performance. It might have been OK for racing but Leon had set his sights on a much wider power band.

Although the air cleaner was causing a restriction it's not a bad idea to keep some form of filtration for street use. As far as we can tell, K & N filters would have the same effect as removing the stock element without losing the protection of the filter. The problem was with the carburation and this would apply whether the filter was removed altogether or whether the standard element was replaced by K & Ns.

The Keihin carburettors have primary and secondary main jets which, on the 900 are size 68 and 98 respectively. The secondary main is the one immediately below the air slide and needle, while the primary is set further downstream.

To compensate for the lack of air cleaner, the jets had to be changed for a 125 primary and a 110 secondary which gave clean full-throttle carburation. The problem was on part throttle, where the Honda ran extremely rich. The carbs are sensitive to the speed of the air going through them, which means that they recognise four basic engine conditions. That is, low speed and high speed, part-throttle and full throttle.

When the throttle plate was only part-open, the air slide was also lifted a small amount and the needle was governing the fuel flow from the secondary main. But

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there was a large depression over the primary and because this jet was now twice its original size it was flowing far too much fuel. The problem was to arrange for the primary to give the flow of a 125 jet at full-throttle while behaving like a 68 jet at part-throttle.

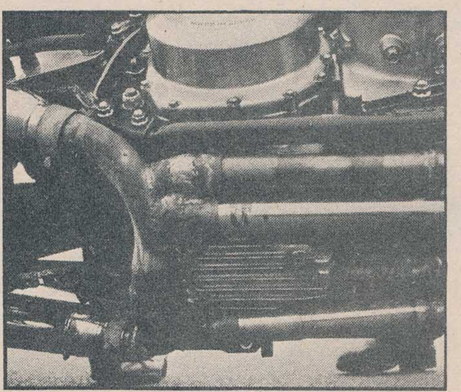
Leon weakened the part-throttle flow by back-bleeding the carburettors. Estimating the throttle position where the rich mixture began to have an effect, he made a 1mm drilling just upstream of the throttle plate. The drilling went through to the float chamber (see diagram) and Keihin conveniently provide a blank boss in just the right position.

Fuel in the float chamber is normally at atmospheric pressure, vented by two outlets. The back-bleed would reduce the pressure as long as the engine was removing air faster than it could be replaced through the two vents. Having the float bowl at a lower pressure would mean that less fuel would flow through the jets. There was scope for tuning this, in the size of the drilling and by fitting air jets into the vents although, as it happened, this proved unnecessary.

So the effect of the 125 primary was reduced and the part-throttle mixture weakened off. As the throttle was opened further it effectively moved the bleed downstream where it had little or no effect; on full throttle it would be insignificant and the 125 jet would behave like a 125.

At wide throttle openings the air slide would also be lifted, opening up the secondary main which had already been tuned for full throttle running.

The carburation was as clean as the stock set-up and the 900 was run in this condition for the rest of the tests. An alternative solution might be to fit a stop, preventing the air slide going all the way down. By leaving a larger area open below the slide the gas speed would be reduced at small throttle openings and would not take as much fuel off the primary. The slides on the



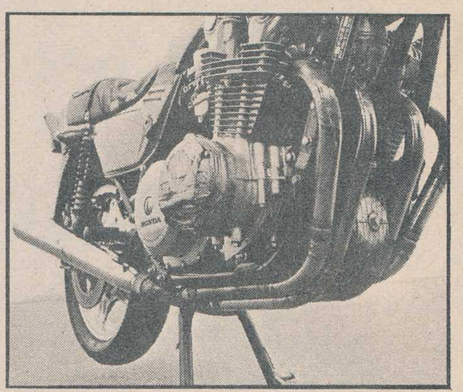
The modified exhaust with cross-pipe; the same mod can be used on the stock system.

works RCBs are jacked up, presumably for this reason. The problem here is in making up a suitable stop and it also demands a needle which is not tapered for the distance which the air slide is lifted, otherwise it would alter the flow through the secondary system.

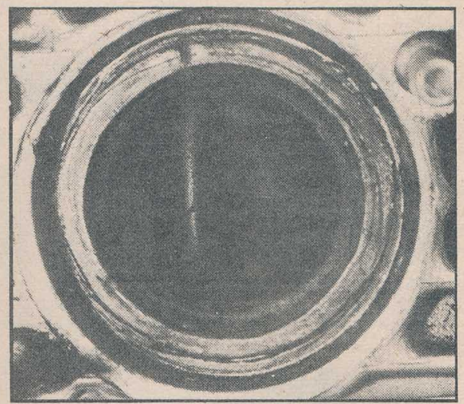
The Formula One Hondas have the primary main blanked off which means all tuning is done on the secondary jet just like the traditional Amal and Mikuni type carbs. The pilot jet is fed from the primary, and this means that the rubber blanking plug over the pilot jet has to be removed if the primary is blanked off.

Other carburettors have used an extra compensating device — a high-speed spray bar (like the "power jets" on TZ Yamahas and accelerator pumps on some other carbs). The main jets are then tuned for low speed, and the spray bar comes in at high speed to give the extra fuel.

Of the various alternatives, Leon decided that the back-bleed was the easiest and most effective. It affected the pilot mixture



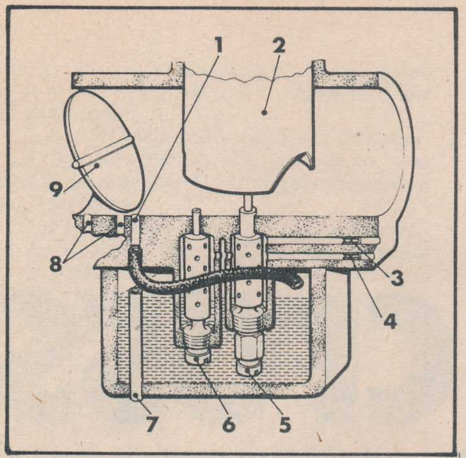
Reworking the exhaust tucked it in closer to allow the fairing to be fitted.



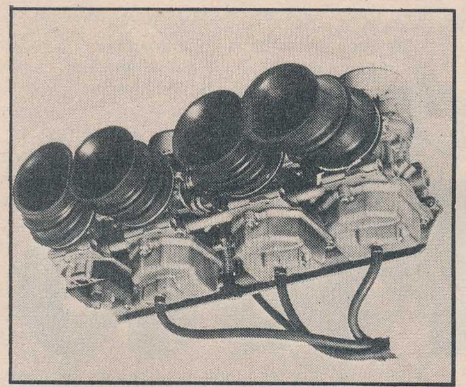
The crack in the dividing web between the ports.

but this was adjusted simply by opening up the volume screw at the front of the carb. There was a more practical problem caused by having the back-bleed at the front of the float bowl. Under braking, a big dollop of fuel could surge up through the drilling, gassing up the engine. To avoid this, a thin tube was taken from the drilling around to the rear of the float bowl.

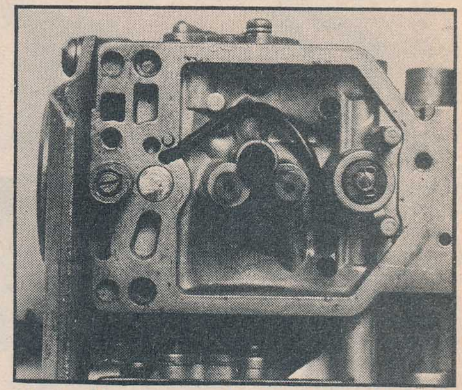
Getting the carburation right was the biggest problem and there's no easy way out. The trouble is with the later, refined



Detail of the back-bleed: 1. back-bleed drilling; 2. air slide; 3 and 4. secondary and primary air jets; 5. secondary main . . .

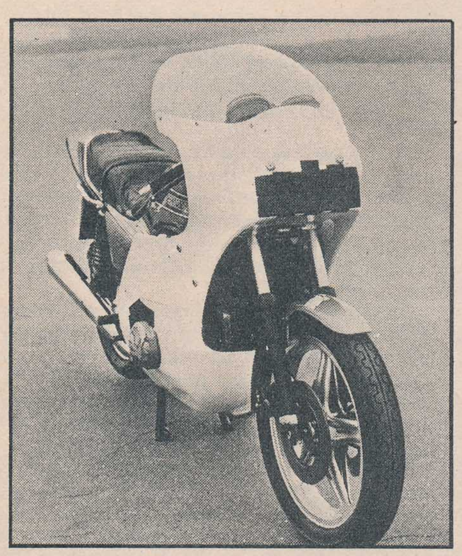


. . . 6. primary main jet; 7. vent tube; 8. pilot outlets; 9. throttle plate. The carbs (above) need the standard rubber trumpets.



Underside of the modded carb. The blanked off jet in centre is the pilot system.

CONDITION	bhp at rear wheel (engine torque lb-ft)										
Engine Speed rpm	4500	5000	5500	6000	6500	7000	7500	8000	8500	9000	9500
1. stock		43 (45)	48 (46)	52 (46)	58 (47)	63 (47)	68 (48)	75 (49)	77 (48)	80 (47)	82 (45)
2. 4-2 exhaust with cross pipe	41 (48)	45 (47)	51 (49)	55 (48)	61 (49)	69 (52)	73 (51)	76 (50)	79 (49)	80 (47)	82 (45)
3. exhaust with cross pipe, Abbey silencers, no choke plate, no air cleaner element	41 (48)	45 (47)	52 (50)	58 (51)	64 (52)	70 (53)	76 (53)	80 (53)	83 (51)	85 (50)	85 (46)
4. As 3 but with air cleaner box removed	—	—	49 (47)	53 (46)	64 (52)	71 (53)	77 (54)	82 (54)	88 (54)	89 (52)	—
5. As 4 but with compression ratio raised to 11.3:1	—	—	—	67 (59)	70 (57)	76 (57)	82 (57)	86 (56)	90 (56)	94 (55)	94 (52)
Engine Speed rpm	4500	5000	5500	6000	6500	7000	7500	8000	8500	9000	9500



carburettors. They have the scope to give long, smooth spreads of power with enough control to meet various emission laws and other developments. Earlier carbs were simpler as there was less overlap between the various jets; now, a simple step like removing the air cleaner involves re-setting the whole carburettor.

There is an intake horn on the back of the 900's airbox which was deemed to be restrictive, so it was removed. This lifted the power right through the range, with a peak at 84.5 bhp. Removing the complete air box increased this to 88.5 bhp but made the engine obnoxious below 5000 rpm. The next step was to see if the air box acted as a still air reservoir when the bike was actually moving. With a variety of rear wheel sprockets, the 900 was taken to MIRA.

Running on just the bare carburettors, it spluttered and misbehaved. Fitting the standard rubber trumpets which lead to the air box cured this and, with the benefit of a mild tail wind it ran 138.8 mph. So it didn't need the air box, but it did need the trumpets. The 900 also had a lowered riding position, made by cutting foam out of the front of the seat and by changing the handlebars and footrests.

The next step gave a predictably large boost to the power, by raising the compression ratio. To do this, the 900 was fitted with CBX pistons which cost around £70 for four, complete with rings. The only modification needed on the pistons was to mill back the gudgeon pin bosses. The pistons themselves take the compression ratio to around 10:1 and they are lighter than the 900's. They also have a lighter gudgeon pin but the thicker pin from the 900 was used because the standard pistons showed wear on the bottom of the gudgeon pin bearing and Leon felt that this might be a weak point. The 900 pins were too long and had to be ground to leave room for the circlips.

This change wasn't quite good enough because the squish band on the piston was too far from the head. So 0.5 mm was machined off the block, taking the compression up to 10.6:1 and the motor was reassembled without its base gasket, which is worth another 0.5 mm. This brought the compression ratio to 11.3:1 and made the squish clearance 0.25 mm — which Leon judged to be the optimum. There were no problems with valve clearance or difficulties with cam chain adjustment.

Lowering the head would, in fact, retard the cam timing by something in the region of 3 degrees. If anything, this would be beneficial as the usual result is to move the power peak further up the rev scale.

The ignition timing needed retarding — again by almost 3 degrees — and by this time the motor was giving 94 bhp from 9000 to 9500 with more power everywhere above 6000 rpm.

At this point the first signs of stress appeared. The motor pinked on 4-star fuel and it probably would have been better to have kept the compression ratio below 11:1. Instead, we used an American additive, Moroso, to uprate the fuel.

The engine had also become sensitive to spark plug grades. It overheated the original D8 plugs and now needed grade 10 or 11 — which it got thanks to the prompt help of Lester Simms at NGK.

Wear at the small end was attributed to running the long stroke motor at such high speeds and was a good reason for using lighter pistons but keeping the stronger gudgeon pins. The other potential problem was that the head had cracked between the twin ports, along a casting division. A reliable source at Honda UK tells us that this is normal and shouldn't cause problems. The only certainty is that it won't get better; perhaps it won't get worse either, but after uprating the engine by some 15 per cent it will obviously be worth watching.

As a final boost, a P & M fairing was fitted. Unfaired the bike ran 136.6mph at MIRA (without the benefit of a tail wind this time) and with the fairing it went up to 143.4 mph. Maybe we were expecting too much from the fairing but we'd hoped for slightly more. It is quite a bulky piece and perhaps a slimmer fairing would help more. Even so, at that sort of speed it's a real struggle to get every extra mph.

From a bike which would give 125 to 130 mph, Leon had finished up with an easy 143 mph, without losing flexibility or silencing and without spending a fortune on parts. Not counting LEDAR's development time the major costs were the fairing — at around £75 without brackets — and the pistons plus some machining.

John Robinson