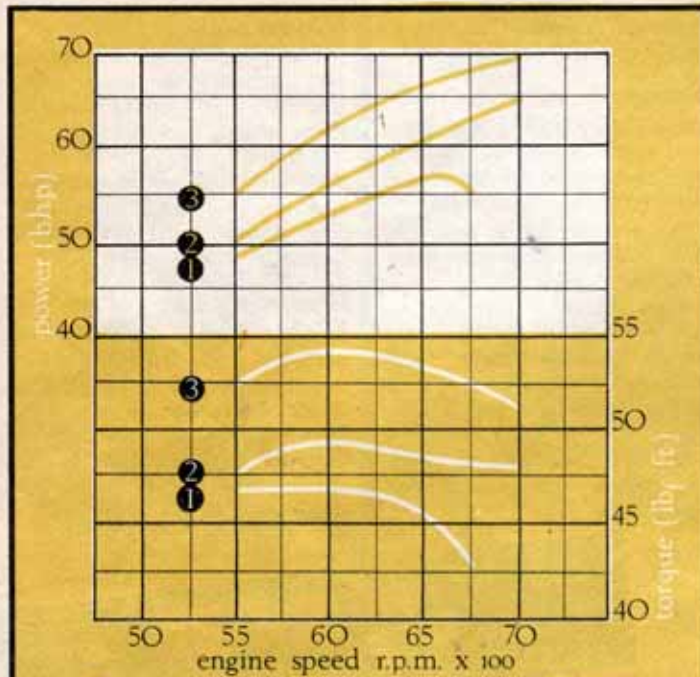


HOT HEADS!

Two valves or four?
Weslake's head design gives more power all round



The graphs above show comparative output figures for a Triumph 650, with and without the Rickman-Weslake conversion, tested under the same conditions. (1) Triumph 650 cc in full race trim; air-flowed head, E3134 camshafts, 2 x 30 mm. Concentrics, megaphone exhausts, 10.5:1 comp. ratio.

(2) Rickman-Weslake 700 cc in full road trim; eight-valve conversion, E3134 camshafts, 2 x 32 mm. Concentrics, Bonneville silencers, 10.5:1 comp. ratio.

(3) Rickman-Weslake 700 cc in full race trim; eight-valve conversion, E3134 camshafts, 2 x 34 mm. Concentrics, megaphone exhausts, 10.5:1 comp. ratio.

Note wider spread of power with eight-valve layouts.

Below: the deflectors on the four-valve head cause the gas flow to swirl in contra-rotating spirals, giving optimum combustion from the central plug.



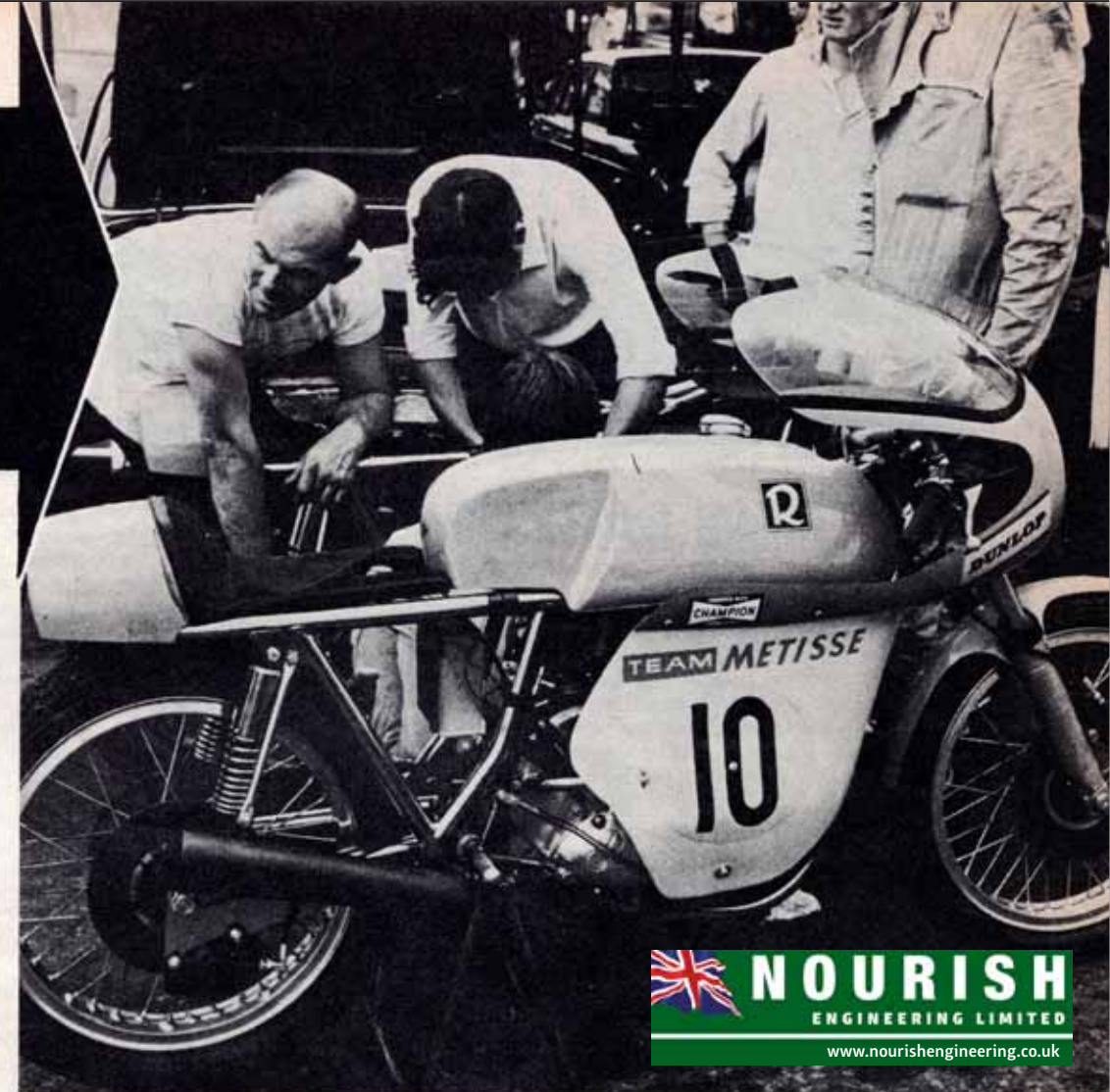
Right valve area can be arranged in the compact design of the Rickman-Weslake head, allowing high c.r. and well-placed plug



Compare shallow, four-valve head with deep head and colossal valves needed on this G50 Matchless. Note plug position



Wooden mock-up heads are used for gas flow testing. Intake port is curved but enters cylinder at steep angle



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There's no real question of two valves versus four valves as far as power, performance or engine efficiency are concerned. The fact is that the four-valve layout has proved itself to be better on all counts, on sports machines.

The reason it is better is largely due to a phenomenon of gas flow—the fact that high velocities combined with the right sort of swirl motion give the best combination of cylinder filling and combustion.

If you can fill the cylinder properly and burn the gas efficiently you will achieve good engine performance, it's as simple as that.

Four-stroke design of motorcycle engines in this country has stagnated for the last 20 or 30 years and it's good to see someone, namely Weslake and Rickman, doing something about it and getting results. Sure, we have good engines, but nobody so far has tried to improve on the design.

When you consider that four-valve heads were being used around the time of the First World War, it's surprising that nobody made use of the design—except Rudge and a few other pre-war types which aren't made now. The other notable exception, apart from the car racing world, is the mighty Honda GP engines, but then they exist almost in another world as far as we're concerned.

Admittedly, the four-valve head has some drawbacks; for a start it is a bit more complicated, but not much, as our photographs of the Rickman head clearly show. This is also a push-rod motor and the design obviously lends itself better to an ohc layout.

With all the extra bits and additional machining operations, you could expect the price to go up. There is no straight comparison available, but as an indication, a new Bonneville head, cylinder block and pistons cost about £45. The Rickman

eight-valve conversion carries a recommended retail tag of £145 for what are essentially the same items. You would, of course, get them for less if your dealer allows an exchange price on the old parts. So, at first glance, the eight-valve job appears to be prohibitively expensive.

However, Weslake's production target at the moment is 35 a week and the parts are hand built. This is where the money goes: Triumph don't talk in 35s, their production line turns out a complete machine every so many minutes.

I think that with good production engineering the price of a new machine would only be bumped up by £20 or £30 if a four-valve head were used in full production.

There is one other disadvantage of the four-valve layout. If one carburettor and one intake port are used to feed two valves, the intake port length has to be fairly long to make the inevitable Y-junction

as smooth as possible. The best place to have the intake port is going down at a fairly steep angle into the cylinder; thus, a long port would leave the carburettor sticking high up in the air where it would foul the frame, tank or rider.

This limitation can be overcome reasonably successfully by making the port curve slightly, bringing the carburettor into a more horizontal position.

So much for the limitations. The advantages of the extra two valves are in better cylinder filling or higher volumetric efficiency, and a design which allows a higher compression ratio and higher bmep without resorting to a badly shaped combustion space. This, with an ideally placed spark plug, means a higher thermal efficiency with a minimised risk of piston distortion and failure.

Note that this is not just increasing the power output, it is increasing the efficiency of the engine. In other words, to

get more power you don't have to waste more fuel.

The four-valve head achieves all this in one fell swoop.

The smaller valves can be arranged to give the right port area to allow the necessary gas flow. They also permit a higher flow at low and intermediate openings, so you don't need really wild cams and highly stressed valve gear.

Whereas the flow from a single intake valve takes the form of a spiral or loop down the cylinder bore, the twin valves can give twin spirals.

This swirl is helped by small deflectors on the Weslake head which also fill up a bit of space to keep the compression ratio up.

The more compact area of the valves allows more room in the head for a central plug, so, having got the gas in, the swirl, combined with a plug in the right place, makes it burn really quickly.

By making the angle between

the intake and exhaust valves fairly narrow a shallow head design can be used with an almost flat top piston.

This allows a high compression ratio without resorting to a high-domed piston with all its wasted surface area and high thermal loadings.

To sum up, the four-valve layout gets the gas in nicely and then gets a high bmep from it. The result is an increase in power at all speeds and the beauty of the design is that it is not affected by other factors in the engine, such as cam design.

Obviously the ultimate in power would have to be achieved by designing the cams and the rest of the engine in conjunction with the head. But as it stands, the head simply increases the output, gives a nice flat torque curve and will do this for a touring machine or a racer, depending on what machine you want.

John Robinson

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