

THE EUROPEANS

DUCATI OIL FILTER

ROYCE CREASEY tells how to lengthen the life of your classic single.

□ Now that we have been assured (see R Brown's letter in *Classic Mechanics* Autumn '84) that the Triumph oil pump and its associated filter arrangements are beyond reproach, it is appropriate to consider in detail the question of oil filtration for those of us unfortunate enough not to own a Triumph.

Readers of that issue may have noted my determination to equip a recently rebuilt Ducati 450 motor with a modern filtration system. This modification, now assembled and run, can usefully form the basis of a study of the components required and some of the practical difficulties that need to be overcome. But first let us examine the theoretical aspects of oil filtration.

The term itself is in need of further definition. I am informed by usually reliable sources – i.e. filter manufacturers – that the particles that cause most damage to engines lie in the 15 to 30 micron range, this translates to an approximate imperial range of .004in to 0.11 in. Clearly, wire mesh filters are unlikely to have much effect on these particles. In addition, mesh filters are particularly poor at stopping slivers of metal which may be quite long, but very thin in cross-section. Such particles are, of course, ideal for damaging gear type oil pumps and jamming open the non-return valves of plunger pumps . . .

The answer, adopted internationally for at least two decades in all fields except motorcycling, is the paper filter. If you are concerned about this material turning to sludge in your oilways you will find it instructive to visit your local car garage where you can practice tearing up a used element. Bear in mind that most car owners change their filters once a decade and that the large oilways and trochoid oil pumps incorporated in such engines routinely operate at pressures in the 80-100lb pressure range.

In actual fact, modern filter element materials are about as close to the paper this is written on as Bayflex is to Bakelite. Paper is great for filtering coffee, for oil we use something else. To fully illuminate this I will quote the performance figures for the Crossland 673 element, designed for the Citroen 2CV, Dyane 4 and 6, and the Ami 6 and 8; this is the same element that was used on the ex-Commando filter housing, and supplied by Norton Motors (1978) Ltd.

The filter consists of a wall of material which is virtually transparent to oil, generating an insignificant 0.6lb back pressure at a flow of 60 gallons per hour; a Ford Escort produces about 130 gallons an hour, at which flow this element generates about 1.6lb of back pressure. Pressure does then rise as the design flow of the filter is exceeded and at a maximum tested flow of 250 gallons per hour it's up to a heady 6.8lb.

Should you be careless or unlucky enough to have the filter clog completely with powdered engine, then it will unseat to allow free flow between 13-18lb; this is the only pressure recorded which is near to operating pressures even in roller bearing engines. The unit also incorporates a non-return valve in a piece of neat industrial origami to prevent oilways from draining at a standstill.

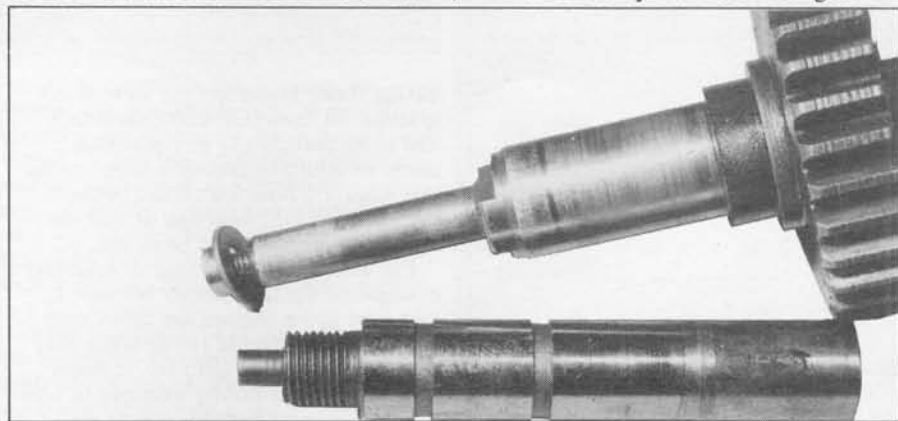
The standard of filtration universally provided by this type of element is most useful: paper filters stop all particles down to about 12 microns and a steadily decreasing proportion of all particles down to about 5 microns. They are particularly good at stopping the long thin particles that slip so easily through a mesh. A performance check on such a filter will show that its efficiency in trapping the smaller particles increases slightly with age as the easier routes become clogged; on the other hand, it has been demonstrated that damage from large ragged particles can cause very slight reductions in filter efficiency early on in its life.

This is all terribly interesting and impressive, but what does it actually mean? Well, let me draw your attention to the two shafts shown. The shaft with

the gear comes from that Ducati; it claims to have covered 8,600 miles, is lubricated by oil run through Ducati's version of the Triumph tennis net and all it does is drive the contact breaker. The other shaft has to my knowledge covered 60,000 miles and came fitted to a used engine. It was lubricated by oil run through a felt filter, which has a similar performance to paper, and supports that brutal device Velocette call the M17/8 cam.

The Velo cam spindle is, not surprisingly, worn out; the Ducati unit almost on standard dimensions, but the surface condition (assuming the image is still visible after the six transfers needed to put it on your page) shows that the Ducati shaft is wearing at a much higher rate. This tallies exactly with my own experience of fitting filters to everything from the Hewland FG400 Formula One racing gearbox to Triumph engines. Everything will last twice as long, some parts will last for ever. Forever is still not very long in motor racing but I can offer that M17/8 cam as a more mundane example. I have personally watched one of these units cover over 100,000 miles on filtered oil without appreciable wear, or indeed deterioration, of the surface condition. This compares well with the rather milder cams fitted to well known parallel twins.

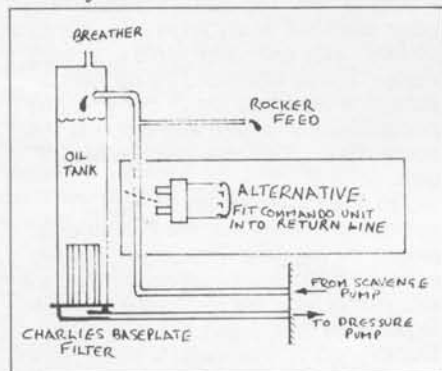
We can now, I hope, accept that the modern filter is not some devilish plot concocted by J Lucas to stitch up the surviving examples of British motor cycles. It may also have caught your attention that the replacement cartridge costs on the Crossland unit are usefully lower than the prices for the various felt elements used by the more intelligent



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British designers. It merely remains then to consider the various ways in which you can connect the thing to your classic motor cycle.

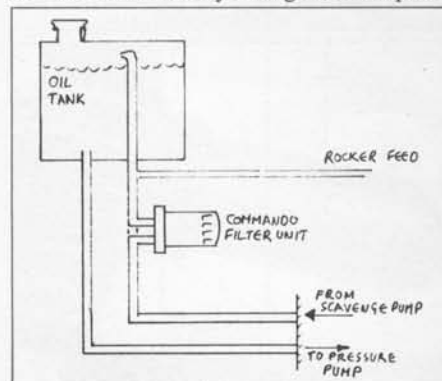
We Brits are exceedingly fortunate in that the separate oil tank has survived almost to the present day on our motor cycles. There is almost invariably a return line to this tank which can be readily interrupted by the filter assembly which is thus fed under pressure to the oil tank. This avoids the questionable practice of having the engine feed pump sucking through the filter as happens on the modification supplied by Charlie's Motorcycles here in Bristol. This



Oil filter options for oil-in-frame Triumphs

objection was noted in my original article and perhaps more eloquently by Mr Brown in his letter, but Charlie's have tested the unit up to 2,000 miles and are certainly not alone in regarding it as a valuable improvement, especially for the oil-in-frame Triumph. It is of course quite possible to fit the Commando filter assembly to oil-in-frame models should 2,000 miles filter changes prove inconvenient.

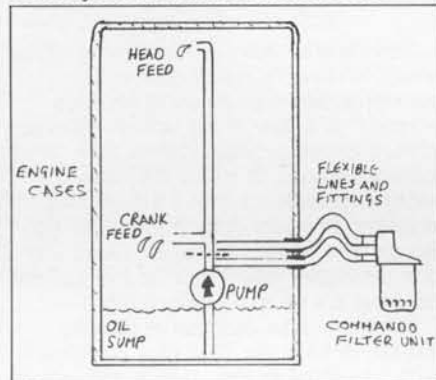
Note the simple sketch showing the system layout using the Crossland/Commando unit; this arrangement is suitable for any motorcycle with the same system components. A filter life of 6,000 miles, or every other oil change would be appropriate and paranoia about the element unscrewing from the mount can be eliminated by fitting a hoseclip to



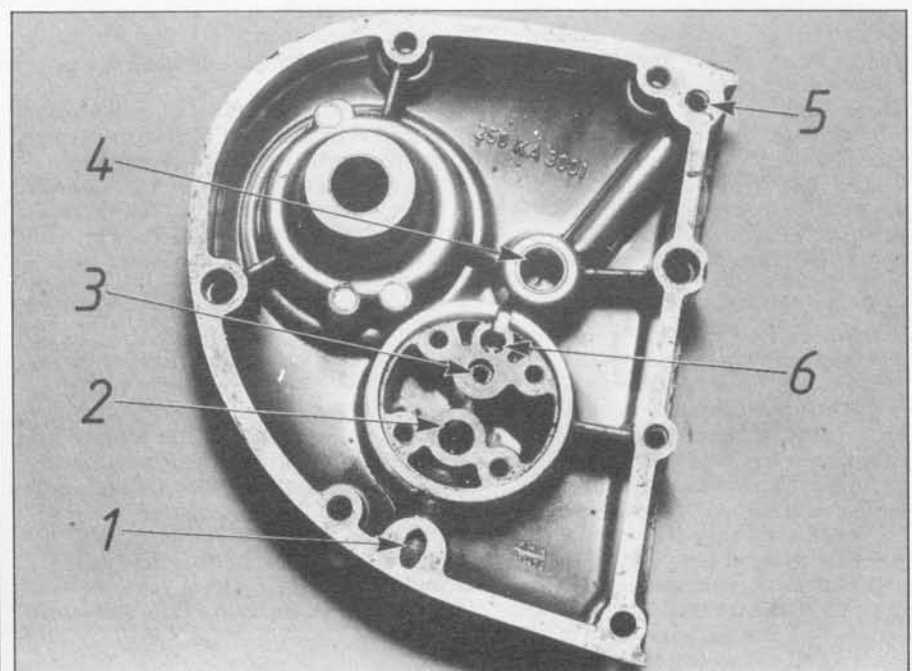
Standard dry-sump system showing Commando filter insertion

the element so that the worn assembly of the clip fouls on some passing piece of the motorcycle.

Some of us are of course Europeans rather than Brits with more of a challenge to face due to the penchant of these dastardly continentals for using wet sump layouts. There's not much wrong with wet sumping of course; English motorcycles are almost alone in not



Wet sump system showing Commando filter insertion



having them. However, the lack of any external oil lines (GPZ900 excluded) and more particularly any scavenge pump or return to pressure lines, means that even if a filter isn't fitted between the pump and the bearings its still the only place where it can be of use.

I'm using the 450 Ducati as practical example of the task simply because I own one; some engines are much more difficult (like Laverda twins) some may be rather easier (do tell!) but in many respects this is a classic example of how to fit a modern filter to a classic wet

sump engine. All the post-classics already have filters.

The photographs of the inside of the unmodified Ducati timing case show the relevant points. At the bottom, (1) in the edge of the casing is the pick-up from the sump; this connects to the lower port in the oil pump mounting boss (2). Oil is passed by the pump into the port (3) above and the pressure relief valve outlet (6) just above that. The boss above the oil pump mounting connects directly to the big end (4). The top hole, at the upper edge of the casing supplies oil to the cylinder head (5).

A filter which will clean all the oil can only go between the oil pump outlet and the big end feed: a small space. In addition, the filter has to go downstream of the pressure relief valve as it's physically impossible to interrupt the flow between the pump and the valve. This means that the pressure relief valve must exceed, substantially, the blow-off pressure for the filter, otherwise, if the filter blocks, flow stops. Fortunately there is a large gap between the Crossland filters 13-18lb and the 70-80lb required for an oil pressure relief

valve.

The only reasonable way forward with the Ducati case is simply to continue the pump supply bore and the big end feed bore right through the case to atmosphere, and fit a remote filter: obviously the remaining oilway between these points must be blocked. This is just what I did and although the result works fine it certainly wasn't as easy as it sounds.

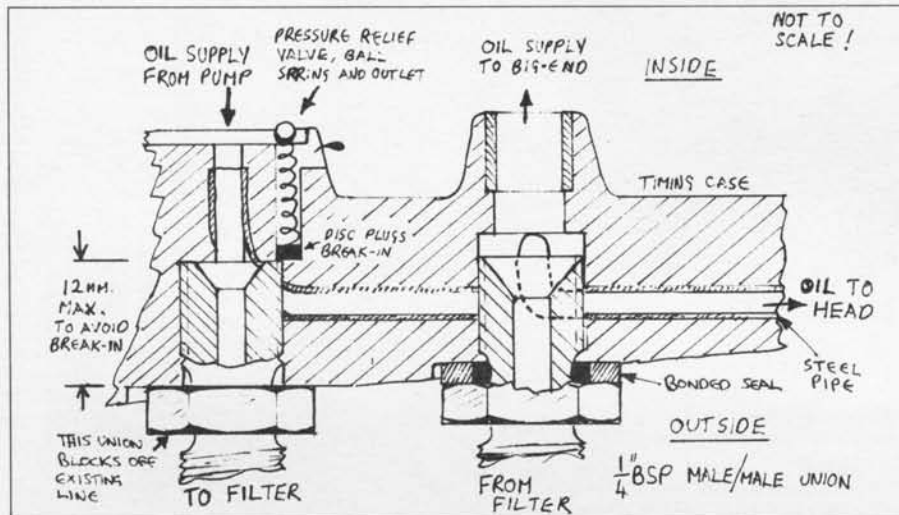
First part of the job was to run the bores out through the case and machine the outer ends of the holes to take

suitable hose connections. Ducati's little trick on that idea is to have run a steel tube through the casting (!) to carry the oil. This follows an elegant curve, as did the drill which was meant to make a neat perpendicular hole through the case (this is a stand-drill job) and as a result the outlet hole moved towards the underside of the pressure relief valve spring recess. When this happens and the counterbore for the external oil union is deeper than

A close look at the outside of the Ducati case will show that the outlet union isn't sitting on a bonded seal and has in fact been screwed straight into the hole. This is where we solved the third part of the operation, blocking off the existing oilway between the two bosses we connected into. It turns out that the union itself, screwed to the bottom of that 13mm hole, seals off the oilway; very convenient, but there's bound to be

be removed without spilling its contents; the engine will be happier too because you will be able to fill up the new unit with clean oil before fitting it, thus providing an oil supply much sooner after start-up. The oil lines should be reasonably short too although liquid flow is not restricted by line resistance in the same way as gas flow is. What it means is that in very long lines you have a lot more oil between the pump and the bearings to get moving from cold; once working temperatures and pressures are reached I don't think line length makes much difference.

A further advantage of running this type of filter is that when removed during routine replacement it can be cut open and the contents readily inspected. This will give you a sure-fire indication of what's wearing out: non-ferrous (pistons, white metal shells, bronze selector forks, bronze bearing cages) can be detected with a magnet and the naked eye, steel flakes (bearings) can be separated from steel chips (gears) and granular dust which is usually piston rings and bores. Filters should clean up after 6,000 miles of engine life and continue to run clean until final decay sets in somewhere. Aircraft and racing engines are routinely changed purely on the evidence of particles found in the oil filters. It's like finding alcohol in the blood: you know that before too long the user is going to display a marked deterioration in performance. Given the cost of rebuilding a classic, you can see that it's a good idea to strip the motor just before a failed big end metal sprays the moving parts, instead of just after. Looking at a real filter is the only way to be certain.



Fitting details, 1/4" bsp aeroquip system to Ducati 450 timing case

12mm you break into the spring recess. It's OK, just make up a little disc to fit into the recess with a light press and cover the break-in. The spring will hold it in should it loosen and the spring pressure is upped should you be worried about blow-off settings. Next time we'll try and get the hole to run a little straighter.

The bore out of the big end feed boss is rather easier to achieve: the steel tube runs across one side of the bore and is already cut. If the slight run-out it tends to cause the drill is unacceptable, a small vertical mill would no doubt cope.

On the outside the case is tapped 1/4in BSP and spot-faced to provide a seating for the inevitable bonded sealing washer. This permits direct connection into the Aeroquip low-pressure 1/4in bore range of lines and fittings which I strongly recommend for all motor cycle oil and fuel lines. No tools are required to fit the hose to the end fittings and no additional security is required to meet 250psi working pressures and a 1,000lb burst pressure. I fit the O clip crimps as well because they look pretty.

You will be deeply impressed by the performance and scope of this range of hose equipment and very happy with the prices charged by the suppliers Trist Draper Ltd on a trading estate near you. My local branch in Bristol can also supply the O clips and the bonded seals, but for the PTFE TAPE (mentioned below) you'll have to go to your local plumbing suppliers.

an oil leak up the threads of the union. PTFE tape, wound round the unions' threads, provides an effective and reliable seal against everything from hot engine oil to British Gas.

You may also have noticed that I've replaced the connections on the Commando filter mounting with more Aeroquip unions. This is rather marginal as the holes are very close together and the hose fittings have to be cut about somewhat if they are to be screwed on. Lots of people I know have been happily running the standard push-on-a-pipe system with jubilee clips for years without trouble, but I have seen similar systems fail while Aeroquip has always been totally reliable.

For many people, 450 Ducati owners included, a major problem to be overcome before irreplaceable castings are casually cut, is the actual location of the filter assembly. Triumph owners may note the method described by Tony Emery in a letter in the Autumn '84 issue of *Classic Mechanics*, as one of several ways of slipping the unit in behind the gearbox, under the swinging arm, or thereabouts. I have neatly avoided having to work out where it goes on a 450 Ducati motor cycle by not fitting this particular 450 engine into such a device. This will become apparent in a future issue.

When looking for a home there are a few points worth keeping in mind. Principal of these is the fact that you will enjoy life much more if the element can

Filter Mounting available from Norton Motors (1978) Ltd., Lynn Lane, Shenstone, Nr. Lichfield, Staffordshire.
Direct line to stores for mail order: 0543-481393.
Filter mounting part No. 063139 (£6.53 retail).
Filter element part No. 063371 (£3 retail).
Alternative supplier for filter element, any European automotive components supplier under Crossland filter part No. 673.

Aeroquip system components available from: Trist Draper Ltd., nationally available, for address of distributor nearest you contact head office 804-818 Bath Road, Bristol (0272) 777093.
Systems listed used 2556 low pressure rubber covered hose and suitable BSP fittings in the low-pressure push-on range also supply O clips, bonded (Dowty) washers.

PTFE tape, from any plumbing supplier worth visiting.