Norton Roadholders - The Hole Story

by Peter Crespin

Most of the British Motorcycle manufacturers of the classic era deserved their reputations for producing well designed and solidly-built machines. Yet even the proudest names occasionally produced designs which became famous for their faults rather than their finer points. Triumph fans prefer not to talk about the sprung hub and Norton devotees change the subject when you mention Commando Combat engines. Royal Enfield buffs admit that the Crusader five-speed gearbox was "Made like a gun" only in that it regularly exploded with a bang. BSA, Velocette and others all made the occasional blunder.

As the saying goes: "A man who never made a mistake never made anything." In fact it is this fallibility that attracts many people to these older machines today. There is often the real chance of actually improving in old design with today's materials and technology. If such modifications are done sensitively, only the most fussy of concours types can object. For those of us who actually ride our machines regularly, modern paints, electrics, tyres and so on are welcome developments.

This article describes a couple of simple modifications to the later of the two Norton Roadholder fork designs. These mods improve the forks' damping characteristics, without affecting the appearance of the machine.

The original Roadholder design, itself a development of a pre-war non hydraulic version, was launched In September 1946 for the following season. It used a double-taper damper rod which passed through a restrictor inside the bottom fork bush. The design worked well enough at the extremes of travel as the taper took effect, but the damping provided around mid-travel was limited to moving oil in or out of the space between the upper and lower fork bushes. This was the so-called Long Roadholder.

The later Short Roadholder fork was fitted to Featherbed-framed models from 1953 onwards. It was to continue largely unchanged until Norton ceased manufacturing in the mid-Seventies. It also appeared on some of the hybrid AJS and Matchless machines made in the final years of the Associated Motorcycles (AMC) empire. For normal road use, this later design was a distinct improvement and closely followed the pattern of the Matchless Teledraulic fork. The fork now used a separate internal damper tube and shuttle valve arrangement which gave more precise control over the middle portion o fork travel. It is easily distinguished from the earlier design by the lack of an external spring and the presence of a damper rod screwed to the underside of the fork top nut.

Unfortunately, it was at this stage that two design flaws, not present in the original Matchless fork, crept in. As the faults only affect damping near the extremes of fork travel, it is perhaps understandable that no mention of any deterioration was made in the road test reports of the day. Doubtless, if riders of the brand new Featherbed machine, introduced in 1953, had gone for a quick blast round the local slag heap, some of them would have noticed that all was not well with their forks. More specifically" the new design lacked proper hydraulic bump stops to cushion the final metal-to-metal contact at the two extremes of front suspension movement.

The other Roadholder features which made it such a good example of its type in the Fifties, were still there: the large-diameter stiff fork stanchions, the solid fork yokes and the light alloy sliders. The bumpstops, however, had effectively disappeared. Most, if not all, motorcycle forks with hydraulic damping incorporate some arrangement for minimizing noise and uncomfortable metal-to-metal clashing at the extremes of travel.

Car designers, with their concealed suspension systems, usually resort to crude but effective rubber bump stops. These are normally tapered, to give a progressively firm control as the suspension nears the limit of its movement. In motorcycle design, where appearances have to be taken into account, this simple solution is not often employed except on spring/damper units, where a rubber collar is often fitted round the damper rod as a bump stop for the rear suspension

As an aside, many enterprising riders in the heyday of the cafe racer seemed to use this system on their front suspension (or a fibreglass-in compression variant), judging by the number of badly-fitted and tyre-marked fairings around in those days! The more conventional methods used by telescopic fork makers almost always involve either a tapered, moving restrictor arrangement or a progressively blanked-off hole system. By such methods the damping over the last inch or so of travel is rapidly increased, in order to avoid metallic contact between sprung and unsprung components.

Those of us reared on old British field bikes will remember the sickening crash of slider on stanchion, audible at a hundred yards, as we launched our tired steeds off yet another death-defying molehill. In our youthful exuberance, we took these jolts as a matter of course and marveled all the more at Messrs Smith, Eastwood, Bickers et al. Little did we know that two-bob's worth of oil and new oil seals would have made the old banger float like a butterfly!

Getting back to Roadholders, the Norton designers tried to include both of the above methods, viz a blanked-off pair of holes (one large then one small, in sequence) at full extension, and a tapered restrictor on full compression. Sadly, unlike the Matchless version, neither arrangement works properly. A quick glance at the illustration shows that as the slider moves down the stanchion, the oil trapped in the space between the top and bottom bushes is squeezed out through the large upper holes and the smaller lower holes. This provides some damping to supplement the effect of the separate damper assembly.

In theory, as the slider nears the end of its travel, first the large holes and then the small holes are blanked off as they disappear inside the top fork bush. This leaves a small cushion of oil trapped between the two bushes to stop them hitting each other and putting excess strain on the materials (and your eardrums). As far as it goes, this design is perfectly sound. Unfortunately, it literally doesn't go far enough. Unlike the Matchless, Triumph and countless, other designs, the large and small oil passages are not actually blanked off at all; this is because the slider never moves far enough down the stanchion for the top bush to cover them. What happens is that the delicate damper valve assembly strikes the underside of the damper tube top at a point where the stanchion oil-holes are still about an inch below the top bush. In practice, therefore, instead of a nice oil cushion providing a proper bump stop, the damper valve has the job of limiting fork extension when it suddenly hits solid metal - a job it should never really be expected to do.

If those of you with Roadholders don't believe me, remove the fork top nut from one side of your forks, (having first taken off your front wheel and mudguard) and fully extend the fork leg. You will notice that the damper rod disappears an inch or so below the end of the stanchion. In other words, when the top nut is in place, it and the attached damper rod stop the forks from extending as far as they otherwise would. For those doubting Thomases who are still unconvinced, have a look at the underside of the damper tube top and you'll see the tell-tale marks in the alloy where it has been struck by the damper valve.

You may have noticed during the earlier procedure that the last bit of fork extension happened only slowly, no matter how hard you tried pulling the slider down (assuming you have some oil in the fork leg). This was because the hydraulic 'lock" - ie the bump stop - was working for a change, since the damper tube no longer limits fork travel when you take the

top nut off. In a moment you will learn, if you haven't already guessed, how to get that bump stop working properly with the fork fully assembled.

Meanwhile, what about the other bump stop, the one supposed to work at the point of full compression? Well again the Norton designers missed the chance to design a proper system. In fact if, as seems likely, they more or less copied the Matchless design, their copy was not as good as the original. From the illustration you can see that as the slider rises on the fork, the base of the stanchion and its bottom bush act like a piston, forcing the oil up between the stanchion and the damper tube. As the forks near full compression, however, the base of the damper tube (which is tapered) progressively restricts this escape of oil. The widest part of the tapered section almost completely blocks the passage of oil up the inside of the fork stanchion. The oil is therefore trapped and forms an hydraulic cushion that prevents bottoming out under normal circumstances. Or rather it should do, but again the Roadholder idol turns, out to have feet of clay. In this case, the design is flawed because there are holes drilled on or under the taper section of the damper tube, rendering the desired hydraulic lock impossible.

Naturally, some sort of hole is required in the damper tube to allow oil to flow in behind the damper valve, as it travels up the tube during fork extension. The Matchless design, amongst others, puts this hole (or holes) near the base of the damper tube but just above the taper. In this way the oil can enter the damper tube freely during extension, but when the fork nears full compression the oil has nowhere to escape from below the taper, so the proper cushioning effect is available. At first, the Norton people put four 1/4 in. holes in the plain section at the very bottom of the damper tube below the tapered part. With four such holes the oil is never really compressed below the taper on full bump, it simply flows away up the damper tube past the open shuttle valve. Since no hydraulic lock can possibly occur, the forks may bottom out on rough surfaces.

By the time the Commando appeared, the Norton designers had hashed the hole (sic) idea, so that now there were two holes instead of four and they were drilled through the flanks of the taper itself rather than below it. In as much as this modification allows the very last part of the fork travel to form an hydraulic lock, it represents an improvement over their first attempt. However, in so far as it represents a repeat of the earlier mistake, albeit in a less spectacular fashion, it really is rather daft. It does not take a degree in mechanical engineering to work out that there may as well be no taper at all above the lowest edge of the holes. This is because, as before, there is no real restriction of oil movement during fork compression, since it just squirts up inside the damper tube through the holes. Only when the bottom of the stanchion passes beyond the lower edge of the holes, does the taper cause any restriction and thereby provide a belated cushioning effect.

Now you know why Norton never used an offset spindle like Velocette and Royal Enfield did - they had to keep the spindle under the bottom of the fork leg to stop the stanchions poking through when twin leading-shoe brakes were invented (don't laugh, it might be true!). Still, despite everything I've said so far, most people seem more or less content with their Short Roadholders as they are. Certainly they give a reasonable ride - commendably free of fork flex - over average road surfaces. Nevertheless, by means of a couple of simple modifications, their behavior on poor surfaces can be transformed. As some of our roads begin to resemble the rolled and graded scrambles tracks of yesteryear, the modifications will be of benefit to almost any machine fitted with these forks.

To provide a proper bump stop on full extension, it is only necessary to arrange for the holes already in the stanchion near the bottom bush, to be blanked off in sequence. At first sight, the easiest way might seem to be to make up a longer damper rod to allow the forks to extend fully. However, even if the fork springs were packed up to provide the extra extension

required such an arrangement would not be desirable because of the limited overlap, or engagement, of slider over stanchion. To maintain adequate stiffness of the front forks, there should be several inches of stanchion inside the slider even on full extension. The best way of providing a bump stop in this design is simply to make longer top bushes - about one and a half inches longer in fact. The exact length is adjusted so that even when completely extended, with top and bottom bushes in contact, the damper valve stays just clear of the underside of the damper tube top.

With such bushes fitted and the fork topped up with oil, the last fraction of travel is properly cushioned as the oil holes are blanked off in turn until the hydraulic lock occurs. The effect is immediately obvious if the engine is out of the bike, since even under such circumstances (when the rolling chassis on its own is seriously oversprung) it is impossible to top out the forks. If making special fork bushes is not possible, then the insertion of a collar under the original fork bush is a reasonable compromise. Again, the extra collar should be about one and a half inches long, with the final adjustment best made by measuring up the various fork components to see -how far below the top bush the stanchion oil holes are kept by the damper assembly at full extension. Unlike an extra-long top bush, the collar will need to be prevented from falling down inside the slider and the best way of doing this is to make it a snug fit in the top of the slider and a looser fit over the stanchion. In this way the collar can be tapped down into place as the top bush is fitted. A drop of Loctite Bearing Fit could be smeared on the outer diameter if there is any suspicion of looseness further down inside the slider.

Triumph used a separate bush like this (made of a plastic material) in the forks they manufactured between 1964 and 1971. With the Roadholders it is possible to use an old fork top bush if you can't get a spacer made up. A slightly worn bush is probably best, as there is less chance of it being pulled down the slider by the stanchion. Trim the brim from the top hat shape and ensure the bush is a firm fit in the slider don't forget to check that it is actually long enough to stop the damper valve touching the underside of the damper tube top. In an ideal world it would be possible to give the required length, accurate to the nearest millimetre, but where old British bikes are concerned it is often unwise to be so precise. Each (possibly mixed-up) set of fork components should be measured for the best results. In fact, by experimenting with different damper rod and top bush (or spacer) lengths, it is possible to adjust the effective length and travel of Roadholders I quite easily. However, this should only ever be necessary if the forks are fitted to a non-original type of frame, when the ride height may be incorrect. The average home mechanic is advised to leave this kind of thing well alone.

Arranging a credible bump stop on full compression is even easier than providing one of full extension. All that is necessary is to block the existing holes in the lower section of the damper tube and re-drill them in a position just above the taper. The only question is, how to block the holes?

Those with brazing or welding gear (and the skill to use it properly) will even now be reaching for their goggles and spark igniter. The rest of us will have to indulge in a bit of lateral thinking. A simple method is to tap the holes (say 8mm) and insert a suitable bolt or screw. Using Loctite, and with the bolt head cut off and the ends peened over, this works quite well. It can even look reasonable if the ends are dressed with a file, but as nobody is going to see the result it only matters that you preserve the taper and don't leave any metal protruding. The seal doesn't have to be totally oil tight either, although a good job will be and it is as well to aim for this.I use a simple piece of alloy rod cut to length, with the ends squashed in a vice after fitting and then filed smooth.

Those of you with the earlier pattern tubes with four holes can obviously not use the bolt or rod method for the second pair of holes at right angles to the first. Instead, you can fit a collar over the lowest part of the damper tube to block off all four holes; this can be held in place by the taper above and the bottom of the slider below. Of course, it must be no wider than the taper at its widest point, so that the base of the stanchion can pass over it.

Alternatively, the bottom of the four hole damper tubes could even be filled with Isopon or an epoxy resin, but I'm sure you can do better.

Having blocked off the original holes, by whatever method, the two replacement holes (only two are necessary about 1/4 in.) can be drilled just above the taper, as in the original Matchless design. The position is not critical, as long as they are below the lowest point reached by the damper valve inside the tube: there is plenty of leeway, so just above the taper will do.

Having performed these simple modifications, your bike will have a set of forks the equal of most and better than many. On the neglected roads of the Eighties, the need for good damping at the extremes of suspension movement is becoming more pressing and as these alterations are totally concealed, they should not offend the purist or devalue your machine. Instead, they should give you that little bit more pleasure as you ride your classic. Those of you ready, willing but unable to carry out these changes, will be glad to know that a kit of parts is available to do the job. The kit consists of two alloy bushes, four alloy dowels and fully illustrated instructions (in English, French, German and Dutch). It costs L10, including postage and packing in the UK, and is available (by mail order only) from Covenant Motorcycles, 4 Cburcb Road, Great Stukeley, Huntingdon, Cambridgeshire