

to use the later black plastic type. White plastic examples were used on the production racers; they are equally good. Watch out incidentally for Dunstall banjo bolts which have a restrictor to prevent over oiling—used in the days before inlet guide oil seals to reduce oil consumption. Remember that the head is **oil cooled** as well as air cooled. *If you must use early all metal feeds (perhaps on your all standard Dommi) then please use Tinmans solder and flux from your hardware shoppee, not electronic flux cored solder, as it isn't strong enough. Similarly, for any repairs or alterations to the oil feed/return banjo at back of timing chest.*

### ODD ITEMS

**Head gaskets:** Don't forget to aneal the copper one on first and every re-use. Heat to red all over quench in water.

**Shimming:** Equal gap both sides cuts down low frequency shaking.

**Head gaskets:** Some people when following the Service Manual find that a replaced blowing head gasket goes again within 100 miles or so, the reason being omission to re-tighten the head bolts after 50 miles.

**Clutch drag:** Following the Service Manual has you putting engine oil into the primary case, this tends to cling onto the clutch plates causing drag. After a good clean of the plates, refilling with Castrolite or similar lightweight oil is preferred.

**Worn exhaust port threads:** these are very often caused by allowing the nuts to come loose, but they are stopped from falling out by those rattley tab washers. The whole issue then vibrates and clatters, knocking out the threads. Cure for worn threads can be to have sleeves fitted, but a very much recommended method is steel helicoils; the thread is then better than new.

**Any trouble with sleeve gear bushes** can be checked as follows: check primary chain tension with a finger and with other hand haul up and down on rear chain. Any change in primary chain tension spells trouble.

**If there are rumbles when clutch is operated** it could be clutch centre bearing going dodgy.

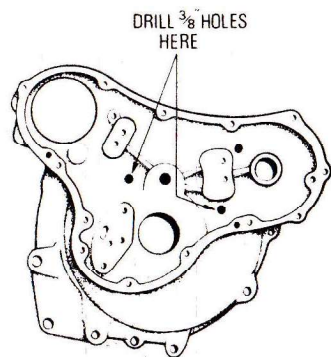


Diagram 4. Timing side crankcase showing holes for 850 breathing. See page 14.

**FORK YOKES:** 750 — Engine Nos. 221545-221644 and 230536-230685, 850 — all. All these had the revised steering geometry by new (850) frame 064140. Also new fork yokes 064078 (lower) 064080 (upper with stem) the yokes must be used in pairs. **Do not** mix old and new ones. The factory release states also do not fit old yokes to late frame or vice versa. T.R.S. states this was due to lack of knowledge of the effect. See Page 24.

## GROUP 4:— Crankcases, breathing and main bearings

**CRANKCASES:** In comparison with the fairly clever design of the Norton head, the crankcases are well, not to put too blunt a point on it, unsophisticated. It has been said that they only serve to keep the oil in and they're not very good at that!

Anyone who has read "Tuning for Speed" will remember that bosses on crankcases ought to go all the way across, not just halfway, even when the engine is not used as a stress-bearing part of the structure. On the Commando, there are two such bosses at the front, where the isolastic bolts on, and three at the back, which hold the gearbox cradle (and an assortment of shorter bosses and stud holes, all of different lengths and not one going right across!).

The three back bolts simply hold the gearbox cradle, but when you think about it, you will realise that they take all the pull from the primary chain when driving and on the over-run and they take the load when you put the back brake on. These forces combine with those from the out-of-balance of the engine (which also constantly change in magnitude and direction) to give the crankcases and the through bolts a particularly hard time. This will show in any of several ways.

Early engines before engine 200,000 were mostly fitted with studs and nuts all made of mild steel and infernal serrated washers. (Yes, infernal—as well as internal!) These washers are jokingly referred to as "shakeproof", but I can think of no instance in engineering where serrated washers couldn't be replaced by something better. Here where the load is constantly varied, they serve only to dig into the gearbox cradle and the back of the nut, until they have loosed one from the other when disaster follows. At the same time, the serrations serve to let salt water into the hole, and this can seize the studs into the case. Plain washers, lock-nuts and high tensile bolts were introduced later, to eliminate some of these faults, and I would strongly advise any one still with the early type to change. Use Nyloc nuts, though, not the all-metal type used on production, as you can check and tighten them much more easily and they don't gall and seize on the bolt when you want the engine out. The top rear bolt seems to be the one which is the most stressed and even if the bolts themselves do not loosen the crankcases may well crack around the LH end of the boss. Look at the corner of the machining where the boss meets the crankcase—I have seen more cases cracked here than anywhere else. The cure is to apply a dollop of weld, just like the weld on Peter's bike, and for the same reason. If you don't weld the crack up it will only spread very slowly. Very little oil will ooze out of the grey line produced, and I have seen machines do 10,000 miles in this condition without disaster occurring. They weren't racing machines, though!

Finally, that oil leak between the top rear boss and the base of the barrels. Any 750 owner will show you the one I mean. If you take a used pair of crankcases apart—any crankcases, not just the Nortons, you may see areas of the joint face which are a dark grey colour, compared with the original bright machined finish everywhere else. This effect occurs when the faces in contact have been moving in relation to one another—a process known as shuffling. You get the same thing with crankshaft assemblies where they shuffle (and they do!). The only type of gasket compound I know, which will stand this sort of movement is the silicone rubber type, **Hermetite RTV**, or **Dow Corning RTV** (Room Temperature Vulcanising) or in France, **CAF 4** or **Loctite plastic gasket 275**. When glueing and bolting up the crankcases, incidentally, always put suitable bolts and spacers into every bolt-hole, to clamp the case up solid while the gasket compound sets—so that it sets in the condition it will be in when the engine is finally in the frame. This applies to all cases and all gasket compounds (although if I catch any of you using **Red Hermetite** anywhere on

any Norton, or any other proper motorcycle, you will have to write out 100 times, "This is the Twentieth Century").

As well as salt water getting into stud threads, Gunk is another culprit; regular Gunk cleans all the oil and grease away so eventually they'll get water in and seize, barrel studs being a prime example.

**MAIN BEARINGS:** There are, so far, only two types of bearing I would recommend anyone to use in any Norton twin (500 up anyway). These bearings are both Superblend Roller Bearings—one from Ransome and Marles, Norton No: 063906, and one from F.A.G., Norton No: 064118. Either should be used in 500-750 engines; the factory reckon only to use the F.A.G. bearings in the 830s. ~~There will be some end float with the double roller-bearing set up~~ which previously was controlled by the ball-bearing in the timing side—this should be between 10 and 30 thou (0.25-0.75mm), but don't worry if it's not, as long as there is some float. The outer rings of the bearings are glued in at the factory by Loctite Bearing Fit, so there's no reason why you shouldn't use it too, as long as you make sure that the rings are hard home before the glue sets, not when you find you haven't got any end float! Only use bearings with one of the following nos: NJ306E (E is very important, NJ306 is weaker) or 6 MRJA30. The 6 may be hand engraved on the bearing. The timing side bearing need not be a particularly tight fit on the crank. Again don't use just any roller bearings, these ones are barrelled to allow crankshaft whip. Another number is NJ306E M1. (Harder.)

**BREATHING:** The pre 200,000 motors had a timed breather which was so small it wasn't really much good. The 200,000 series had a right angle joint at the bottom rear of the crankcase, joined to the oil tank by a bit of washing machine hose. This system was, if anything, worse than before—at high r.p.m., more oil went up the breather than up the scavenge pipe. Don't be tempted to replace the rubbery hose pipe with plastic on 200,000 series motors—I have seen a nylon reinforced pipe melted by the hot oil going up it! The other oil differences on late 750s are the elimination of the sump filters, and the resiting of the oil pick-up at the front of the sump. I will never know why the filter was eliminated, but was put back on the 850.

The 830 breather is much better than both earlier systems, but really you need 830 cases to make it work, so that you get good oil return from the sump and a filter, but you can get good results by fitting a pipe of about  $\frac{1}{2}$ in bore into the back of the timing chamber where the magneto used to go (in the days when Lucas ignition systems were guaranteed for two years, including points wear). The pipe should stick through the case about  $\frac{1}{2}$ in and slope downwards, so that oil running down the inside of the case doesn't get carried up the pipe with the air going out. Oil runs down from the inlet valve as well as sloshing about from the timing gear. How you fit the pipe is up to you; you can't just buy the bits and slap them in. It is also necessary to drill holes in the timing side crankcase—try and get a look in an 830 timing cover and copy the size and position and I don't recommend drilling the holes without dismantling the engine; no Malcolm, put that brace and bit down immediately! See Diagram 4, page 12.

Oil leaks from the rev. counter drive can be a problem; try using two O rings at the same time and try grinding a scroll on the spindle so that it tends to screw the oil out again, but remember, steel and aluminium needs lubrication, so if no oil gets up there it will seize up and wear out the gear cut on the camshaft, so don't overdo the pressure on the O ring. The later 830 has a modified type with the O ring at the outer end, and it's supposed to be both better and interchangeable as an assembly. *Not so, L. Em.*

Final consolation of the late 750 owners, without sump filters—there is a magnetic drain plug which has a chance of catching any bits of metal on the way to the pump—unless the metal is aluminium, brass or bronze.

## GROUPS 5, 6, 7:— Gearbox

**THE GEARBOX:** This area is, I suppose, that with the most history behind it—for a start it is generally referred to as the AMC gearbox as it was introduced when Nortons were fairly new to the AMC empire and shortly afterwards it found its way onto the **AJS and Matchless heavyweight range**. Before that, Nortons had a box with similar gears and an oval horizontal cover; this is known as the Norton-Burman box and takes us back to about 1947. Before that even, almost identical gears were used in a box with an upright outer cover—the positive stop mechanism was in the upwards bulge and before the war this upwards extension had a separate lid of its own. This was the Sturmey Archer box, also used by other makes such as Brough Superior. Sturmey Archer were a Nottingham firm, as were Broughs and they are now part of the Raleigh organisation. One sign of the antiquity of the design is the use of cycle threads for studs and nuts. When you think that the AMC box was designed to cope with 30 bhp from a 500cc machine, it is not surprising that on 828cc machines giving about twice the power the reliability of the box is not what it should be.

**SHELL, CLUSTER, SPROCKETS:** The main items to note are: Gearbox Shell with Bushes and Studs—often this part is supplied without bushes or without studs or completely bare. The shell should arrive with seven studs, two dowels and two bronze bushes already fitted. Don't throw away the old case before removing at least the studs, as cycle thread studs have something in common with Rocking Horse substance. The ends that screw in the case is BSF—just in case you need a helicoil they are easier to find. Nothing wrong with the BSF threads, or cycle for that matter, in the right place. Better than this UNF nonsense any day.

**SLEEVE GEAR & LAYSHAFT BEARINGS:** These two components are very close together and the metal between them can crack—this will allow bearing rotation and gradual wear of the case. The bearings sometimes rotate anyway; this can be recognised by a polished, not ground, surface on the outside of the bearing when it is removed. No real cure—Loctite sometimes works and is much better than centre-punching the case where the bearing fits (aaargh!) and much less complicated than having the outer race of the bearing plated over-size. One of the first things to go on an 828—or even on many 745's, is the layshaft bearing in the case. First symptom of this is a kickstart shaft which moves round on its own and springs back to dig you in the shin. At the same time you may get jumping out of gear. As there is next to no side load fit a roller bearing equivalent, NJ203C3. If all else fails (which it easily can, once a bearing goes) you can remove the layshaft completely and carry on in top gear only—make the change at the top of a long hill though, as the kickstart will be inoperative. The other fault which can cause the kickstarter to go round on its own a failure of the kickstarter pawl—we're coming to that!

Sleeve gear bushes are always coming loose—sometimes the outer bush moves inwards to the centre of the sleeve gear—then all you need do is to Loctite a new bush in the end. Leave the old one in and it will prevent the new one moving inwards, i.e. fit three bushes in your 750 a la 850. Sometimes the bush moves outwards and gradually mills itself away on the sharp edges of the circlip which locates the clutch. That's worse because eventually the bush disappears completely and all the pull of the back chain comes on the sleeve gear bearing. No wonder the bearings come loose. Often the first sign of sleeve gear bushes going is striking "gold" in gearbox or primary drive oil, watch it! Here the answer is to buy two new bushes and a clutch location shim (060894 or 060895). Push both bushes—Loctited on the outside—into the sleeve gear—the middle one stops the outer from moving in—and then put the shim loose on the shaft to avoid the bush wearing on the circlip even if it does move. It is an advantage to grind the outer edge of the shim so it will pass through the hole in

the primary case (or file or even clip it away with tinsnips to about half the radial thickness).

**J.H.:** I believe layshaft ball bearing failures are more frequent when:—

1. The 22T gearbox sprocket is used as on 850s and
2. Every failure I have seen has been a Portuguese SKF bearing.

In Birmingham they insisted on Hoffmann 117 bearings being used here but, of course, as Tim rightly points out we did not have so much power. Even so, the Hoffmann bearing—now RHP—would probably stand up better to present 850 conditions.

It seems to me very unfortunate that they did not change Commando gear ratios by using alternative engine sprockets, because with a larger engine sprocket and retaining say, a 19T on the gearbox (as was standard on all Norton Nortons from Model 50 to Atlas and Manx) the speed of the box would be increased without such a heavy journal load on the bearings and tooth loading on the pinions themselves.>>

Any rider of an 850 Commando in particular, but 750 also, should stop immediately if he feels the slightest sudden roughness in the intermediate gears especially if the kickstarter flies back because this is a sure indication of layshaft bearing failure.

As well as the sprockets listed (19T to 24T) there are 17T for Matchless etc. and 16T for sidocar scrambling—available from your local friendly. This brings us to the kickstart pawl. These break. Only sometimes and much less often on recent machines than on 1970 and 1971 bikes. Recent pawls are cast from steel (by lost wax process, by the way) and have an M on the side; they are much more reliable. If the pawl does break, the side bits of the T shape wedge in the bottom gear pinion and the kickstart is carried down on its own and can then stay down—waiting for you to go round a right hander. If the kickstart flies up again there is no reason why it shouldn't happen again—or the bits can get between any of the other gears—rather to the detriment of the shaft straightness and freedom from broken teeth and broken cases. So, for whatever reason the kickstart plays up—don't just carry on. You can get the covers off at the roadside with the tool kit and a large brick—the long black spanner is 15/16in at the large end—not exactly 1/2in Whitworth, but only 0.0175in too big, and in these circumstances no one will argue about 17 thou. That's to get the mainshaft nut off. Of course, you can get the clutch operating housing unscrewed with the brick and a tyre lever. Brutal, but inevitable—there's no special tool unless you make your own special tube using a piece of 1 1/2in I.D. tube and filing as per diag. 1. To use the tube you'll have to remove the roller and operating lever. This part must be screwed up with the slot in the housing in line with the cable hole in the cover, so mark the position before unscrewing it. If it is not lined up correctly the clutch operation becomes stiff because the cable has to go round too many corners.

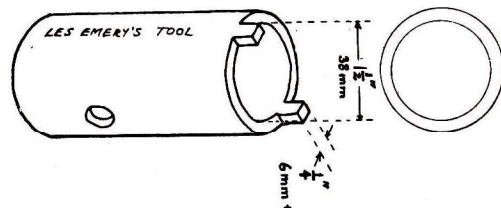


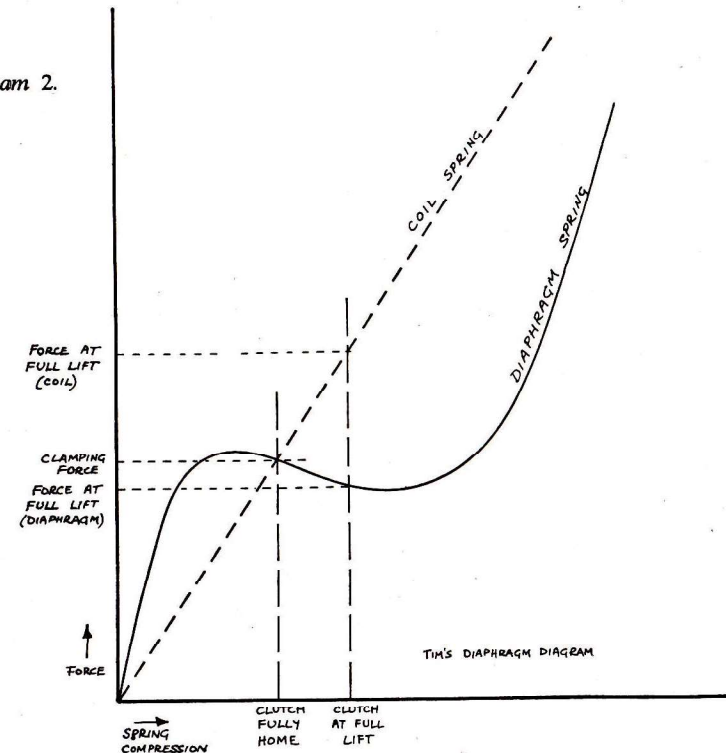
Diagram 1.

Another cause of stiff clutch action is the operating lever that fits in the slot. The outer profile of this bears on the roller in the end of the slot and if profile is notchy so is the clutch action. You can alter the profile with a grinding wheel (or by trying another lever) so that the lift is gradual and

smooth; finish with a stone or emery. After a while the ball gets flats on it they are very cheap, so polish the operating lever and a new ball, and a nylon lined cable and you should have the clutch the envy of others (except Vincent Owners).

There are pattern kickstarts about with the top retained by a cap and roll-pin instead of the thread and nut which is standard (as this fitting is similar to Ducati kickstarts I suspect that the pattern parts originate somewhere in the middle of the Mediterranean). Problem is—the pattern parts often foul the exhaust pipe, making starting difficult. The 825 starter is a different shape at the bend and is about 1in longer and will fit the 745 making starting on cold mornings a bit easier.

Diagram 2.



**STOP PRESS:** At the last minute a number of ex factory service releases have come to life. Here and in other odd corners are the basic facts of importance.

**HEAD GASKETS:** If there is any trouble keeping the copper one, especially, oiltight then a smear of Silicon RTV or Plastic Gasket on both surfaces will help, especially around the push rod tunnels but do be very careful not to block the oil drain hole. Similarly when using Silicon Clag as substitute for a base gasket don't block the oil drain hole it can cause disasters.

**CON ROD NUTS** should only be used once we are told correctly, but new assemblies when supplied have nuts to retain the big end cap for machining. Therefore these nuts have been used once, so discard these nuts and use the new ones that should be supplied with the rod.

**REAR WHEEL SPACER:** This was made of improved material as Part No. 065290 to overcome the early soft ones loosening the wheel spindle while in service! P.S. For interest sake the rear spindle nut and dummy axle nut should be done up to 80 ft/lbs. i.e., lots.

## GROUP 8:— Primary case and clutch

**PRIMARY CASE:** There is a commonly held opinion that all Commando primary chain cases leak oil. In many cases, oil drops from the lowest part of the case—just where the joint is. Sometimes this oil collects from the rear chain—oil flings from the chain onto the cast cover over the gearbox sprocket—then down the back of the case. The chain case can leak, though, especially if the wrong number of washers is fitted on the centre bolt before the inner case is fitted. *Or washers left out, the case then buckles and cracks, leaks oil especially at the front, the alternator is then off concentricity, touches, overheats, burns out etc. I know. . . .* So check correct washers when you next take the inner case off, allowing for the gasket as well. When the new washers or shims are set so that the case is not distorted—you can check on assembly by offering up the case and trying to rock it. If it rocks about a horizontal axis you have too many washers on the bolt—if it rocks about a vertical axis you need another washer or two. The washers come in two thicknesses, thick and thin, and you can get it near enough by combinations—or any old flat  $\frac{3}{8}$ in washer. Our continental friends can use 10mm washers as long as Ogri isn't looking. If the outer cover of the chain case is difficult to fit try pulling one of the steel dowels out—but not both as this would enable the outer to swivel round and mess up the timing scale location. Leaks, if they are there, can be cured with our old favourite Silicone clag—RTV. Now for what goes on inside—

The position and adjustment of the shims behind the clutch and alternator is all in the workshop manual, but they don't tell you about the exploding alternator rotor. Norton dealer Jean Souper at Montgeron (near Paris—Jean being French, is a feller!) has a row of exploded rotors in his workshops—there is over a yard of them stuck over the door. He is only one of many dealers who could tell the same story, but perhaps they haven't all got magnetic lintels. What happens is this—the engine as it rotates produces considerable torsional vibration—not just due to the firing pulses but also the fact that every revolution the pistons come to a dead halt together and then rush along at about 100 mph together, twice. This is not very good for alternators. The centre of the rotor is made of hexagonal bar, the 6 magnets are placed round it and then a grey substance made of melted down carburettors is poured round them. When you shake such an assembly 14,000 times a minute (twice every rev, see) and whirl it round at the same time, the magnets can start to fly outwards. The first sign can be a tendency of the strobe mark to wobble about when strobing the machine. Another symptom is a smear of grey-black dust outwards on the rotor from the back of the centre washer. If you examine the rotor carefully in this condition you will detect that the magnets are slightly proud of the aluminium between them—only just enough to feel with a finger nail. Next step is for the magnets to move further out, and then the rotor makes a noise very similar to failed main bearings. Just in case any reader has no experience of mains failure this is a low pitched rumbling noise, the same under load as on the over-run, and in bad cases audible on kicking-over the motor. Once the rotor has got this bad it will rapidly use up all the clearance inside the stator, and then seize. This can cause any of the following:—

1. The hexagonal centre can spin free in the rotor, leaving the rest stuck around the inside of the stator by magnetism. The red light in the headlight will come on (no charge) but you can get home on what's left in the battery. Perhaps the real purpose of that red light is to tell you your rotor has exploded.
2. The rotor can seize in the stator and bring the engine to a sudden halt. You can then only restart by removing the seized alternator and substitute a spacer to hold the engine sprocket on—but it's worth a try without the engine nut if the tapers are O.K. and you take it steady.

3. The rotor can seize in the stator and twist the end off the crankshaft. Then the tapers have got to be good. The woodruff key gets cut in half, if you are lucky.
4. The whole lot can seize and go round with the motor, taking the studs out of the back of the primary chain case. (So if you see your wiring harness all disappearing down the hole at the back of the chain case accompanied by a cruching noise you'll know what has happened—the wires are wrapped round the crankshaft like a bobbin!)

Now the good news—they are not all like that! About 1974 Uncle Joseph, patron saint of the British bike owner, started to weld the magnets to the centres—and they are identified by a little W about  $\frac{1}{4}$ in high stamped on the centre. I have never seen one of these exploded.

In the meantime—keep an eye on your rotors, remember Lucas stuff is guaranteed for a year—by Lucas, not Norton, and don't buy any rotor not stamped with a W, Pt. No. 54202275.

*I've never seen the W but the welded rotor is also numbered 54201143 and is also recognised by the centre sleeve, half steel half alloy, on welded one, all steel on normal rotor.*

**THE CLUTCH:** An ordinary coil spring, as used on most other clutches, gets progressively harder to squash as it is compressed from the free position. The clutch needs a certain spring force to prevent it from slipping, and with this conventional spring action the force to lift the clutch gets greater and greater as the plates are separated and the springs compressed. This means the muscles in your left hand have more and more to do as the clutch plates are separated. With a big bike, i.e. lots of torque, so strong springs, this can be hard work.

A diaphragm spring doesn't rely on the torsion of a coil of wire, but as it is compressed the metal in the centre of the spring is compressed and the outer edge is stretched. The load to compress the clutch goes up as the "flat" position is approached, and as the plate goes through the flat position the load drops again for a bit and then rises again as the spring begins to become conical the other way. If the dimensions are chosen to use the force as it starts to fall to hold the clutch together and prevent slip the force needed to lift the clutch actually gets less as the plates are separated—so—you don't need such a strong left arm. See diag. 2, which (I hope) shows how the force at full lift is greater than the clamping force for a coil spring, but less than the clamping force for a diaphragm spring, as the plates are separated from the clamped to the free position.

How the diaphragm spring actually produces this miraculous effect is difficult to explain—but it's the same effect as when you take a steel tape measure—the sort made of curved thin steel strip—and bend it back on itself—it becomes stiff, and then, with a click, goes easy. You can get the same effect by putting a Commando spring on the floor and treading on the middle. Support the spring in a clutch drum so there's room for it to go well over centre. If you are about 15 stone you will feel the clutch suddenly go over centre with a sort of click as you put your weight on it—unfortunately if you are only 8 stone you will have to find a friend of the same dimensions so you can do it together. Or obtain a pair of lead wellies. Here endeth the lesson.

The clutch itself has had one or two interesting modifications over the years. To start with the friction plates were steel with postage stamps of cork compound stuck on both sides. The life and reliability of these plates was good (not so, in some cases, when the postage stamps all fall off and stick together in one place: the results are interesting, clutch slips and drags and will not clear) but eventually the edges of the plates would dig into the splines on the centre. This made the clutch hard to free-off as the plates got stuck in their notches. Then the solid cardboard—I mean friction material—plates were introduced and the notching problem disappeared, but another problem

appeared, read on.

The drum itself is made of case-hardened steel, and with many more splines than the centre so there is no tendency for the plain steel plates to notch into the drum. The innermost friction surface on early clutches was a separate steel plate located by two tiny little roll-pins in blind holes in the back of the drum. Once the clutch was together this was O.K. but if the pins came loose (as they did) it was almost impossible to put the thing together and locate the backplate properly. It was also impossible because of the hardness to drill through the roll-pin holes so that proper rivets could be fitted—unless you had access to fancy equipment for spark erosion, but it is possible to tack-weld the back plate in position if you grind a couple of notches in the edge of the plate so you can get in with arc-welding equipment without spoiling the splines. Later the drums avoid the problem by having the back plate held in with three rivets to start with. John Hudson has advised that there is no need to re-rivet or weld this plate in, just remove the remains of the pins and let the plate do its own thing, quite safe.

The main problem with the later solid friction plates was the reduction in friction when they eventually became oil soaked and glazed—so the clutch slipped at maximum torque. This could be relieved by grooving the plate surface radially—six grooves each side, with the corner of a square file (or the edge of a grinding wheel if you are in a hurry—but DON'T breathe the resulting dust). Wash the plates in petrol and be prepared to do it again at 10,000 mile intervals. I have never seen a worn out Commando clutch—even with slip you have enough drive to get home. Those of you with scientific inclinations can look again at the diaphragm spring diagram to appreciate that a bit of wear on the plates actually increases the clamping load slightly—whereas with coil springs the load drops quickly as the plates wear, aggravating any tendency to slip.

The 828cc models (and the very last 745cc models) have bronze plates so that they can be thinner and get more in, increasing the torque capacity. Even so, they tend to form a sticky slippery surface in time and need to be washed off occasionally.

One queer thing which does happen is this. If the alternator starts to come loose the clutch will tend to slip at the same time. I suspect that this is because of the extra snatching-vibration caused by the loose rotor, which lowers the effective friction. Just as a brick won't slide down a plank but will start to slide if you drum on the end of the plank with a hammer. Anyone got any other theory?

### CARBURETTORS: continued from page 21

all the oil off the bore, mixing with the oil, and getting down the exhaust pipe ready to split the silencer when a spark gets in from the other cylinder. Both these things should be done if the head gasket blows—and if possible it helps to jack the exhaust valve open slightly to relieve the compression—do this by over tightening the rocker adjuster on that cylinder—but not by more than a turn or so or the valve may hit the piston. Ah, happy days. . . . If you have twin cables all the way and twin pull throttle, to be recommended as cable life is considerably lengthened, then to run on one cylinder just remove the cable outer end stop on the offensive side. For Boyer/Rita owners removing a coil lead isn't advisable so a spare plug wired/taped to earth with plug cap fitted to let spark go in free air is recommended. No need to remove the original plug, as it doesn't load the engine and stops the ingress of dirt/grit on the suck stroke.

**CARBURETTORS:** The carbs themselves are the traditional Amal deal; they work quite well but don't last very long—the slides rattle about in the bodies, a fault exaggerated by the fact that the engine shakes about anyway. Viton (synthetic rubber) tipped needles with brass bodies are better in the float chamber than the nylon white ones originally fitted, but even so Amal will not guarantee that the carbs will not flood when left standing. So always turn your petrol off so that you don't fill the engine up with the precious liquid—not only a waste of petrol but can also cause bent con-rods, blown head gaskets, and disastrous fires when you next try to start the engine.

One thing which some owners do have difficulty with is synchronising the carbs. Go about it this way:—

1. Set the ignition up with nice clean points and a good ATD unit so that everything is as Uncle Joseph intended.
2. Go for a ride of about 10 miles to warm everything up.
3. Screw out the throttle stop screws a bit on each side to make sure the slides aren't hanging on the cable. As you do this the tickover should slow down and stop. Now screw the screws back in to get the tickover right again, and try the effect of altering the pilot screws (the horizontal ones) about  $\frac{1}{4}$  turn at a time each way to get the best (fastest) tickover on each cylinder. Get each cylinder pulling equally hard by ensuring that the puffs of exhaust are about equal, and finally check that the machine stops in the same time when you hold each set of points open with a screwdriver (A more civilised method than pulling the plug-caps off alternately). If one cylinder carries on when you do this, but the other cylinder stops quickly when you try that side, the first cylinder is obviously working harder, and needs the slide lowering a touch.
4. When all is to your satisfaction, switch off, park the bike in a draught so it cools off, and go and have a Castletown Ale.
5. Now make sure that both slides open together—this is the difficult bit, but there is a dodge—if you put a finger against the end of the slide-stop screws (the ones that angle upwards) you can feel the slide lift and fall as the throttle is opened and closed. Go on, try it, but don't press too hard as it does need a certain degree of sensitivity of the finger ends. I suppose those of you who are bricklayers may have difficulty, but those who only wield a piece of chalk should find it no problem. The clever bit lies in the fact that it is possible to put a finger and a thumb against both screws at the same time (so you can tell which carb is opening first), by standing on the right of the machine and leaning over the tank with your left hand, reach under the pair of carbs with your palm upwards, you should be able to rest a thumb on one screw and the end of a finger on the other, leaving the other hand to open and close the throttle. Difficult with a hot engine—hence the recommendation of the Castletown Ale. Properly set up in this way the bike should stay set up until the carbs are next disturbed. *The screw adjuster in the cable(s) is not a tickover adjuster but to cut down cable inner/outer slack when run (pulled) in.*

One last thing about carbs. If ever it is necessary to ride a bike on one cylinder (silence all you Model 18 owners, I mean one that has more than one cylinder to start with), the best procedure is to prevent both sparks and petrol from reaching the dead cylinder. Don't just take off the plug lead, but remove one low tension wire from the coil instead—this saves the coil from destroying itself—and take out the drain plug of the carb and stuff bits of rag up inside to hold the float shut—thus preventing petrol getting into the cylinder, washing

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## GROUP 10:— Engine mountings

**ENGINE MOUNTINGS:** This is the part of the bike which sets the Commando apart from other machines, for although rubber engine mounts are used in all cars and bikes made by BMW, Sunbeam, Suzuki, MZ, Villiers and many others, nobody else had gone to such lengths to ensure that the swinging arm is mounted on the engine plates, thus avoiding the chain pull problem. The first two firms mentioned cheated rather by using a transmission which was not affected by rubber mounting the engine, and most of the others have not got the enormous out of balance forces from a long stroke large parallel twin.

Isolastic mounting was developed as a way of producing a lighter, smoother motorcycle by spending as little as possible on research and development. Once the development had reached a stage where the system worked it was put into production, and from 1968 to the electric start models we have all been stuck with an under-engineered system, along with all the other bits and pieces like valve clearances, points clearances, ignition timing, primary chain tension, cam chain tension, rear chain tension, clutch clearance, front brake adjustment and rear brake adjustment. The problem is further complicated by the strangeness of the system—the average dealer still does not know how it works—and the feeble way in which it was constructed. A .010in clearance has to be maintained in an assembly of unplated steel washers and two bits of soft plastic situated directly behind the front wheel, and covered with a loose-fitting plastic tube so that the rain and grit which gets in cannot get out again.

Let's have a look at what there is.

The head steady up to the 850 was a single piece pressing with an S bend in the middle. This bend was strengthened by a lip each side which was stretched in the pressing operation and had cracks in it from new. Cracks and alternating stress mean fatigue, and so the head steady breaks right across the middle. The head steady supports the engine when the back wheel is twisted either way, when cornering, for instance. Please, all of you, fit the later box section 850 head steady; it does not break, and it resists the twisting much better. Part no: 064179 or 065459.

Never mind what the factory fits, the three socket screws and the six  $\frac{1}{2}$ in A.F. nuts should each be fitted with one plain flat washer only. "Shake-proof" washers are an abomination because they allow water down the threads so that the screws seize into the head.

While the head steady is off, check the tightness of the rubbers in the frame using, if necessary, a pair of slip-joint pliers on the steel part of the rubber mounting nearest the head.

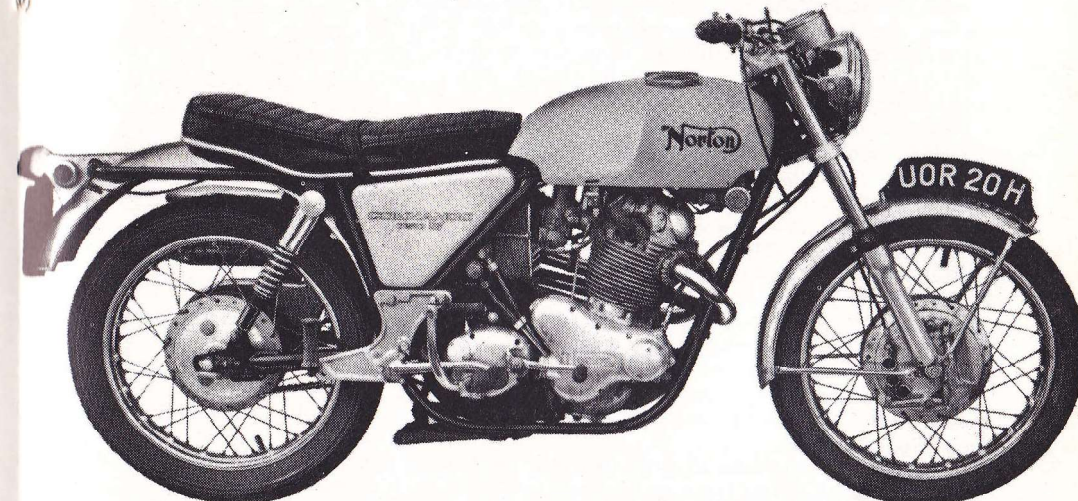
The best for the front mounting is to take it right off and fit the Mark III unit which has threaded adjustment rather than shims, but as this would be expensive you can get reasonable life by using bronze impregnated PTFE mounting washers instead of the plain yellow polyurethane ones. The early bikes (pre 1973) had buffer rubbers which were not located on the centre sleeve, and which always tended to work over to one side, affecting the way in which the engine moves in the frame. If this happens and the rubber becomes very loose on the centre tube they must be replaced, but if they are still reasonably tight you can keep them apart by using a bit of garden hose or by binding the centre tube with insulating tape to form shoulders to locate them. More recently the buffers were located by circlips and do not therefore wander. You have to take the end rubbers out to see what goes on inside; to do this hold the mounting assembly in one hand, and insert the centre bolt about 1in. Use the bolt to prise the end rubber out—go on, you won't hurt it, but watch it does not finish up on next door but one's pigeon loft. It can be persuaded back in without the recommended special tool by lubricating the outside of the rubber with brake fluid, Castrol R or rubber grease, and prodding it with a suitable blunt instrument until the rubber is about 1/16in (1.5mm) below the edge of the outer case. Smother the shims and so on with rubber grease or silicone

grease (not ordinary grease as it will attack the rubbers and cause them to swell, although I know of riders who use ordinary grease and it does not seem to do much harm. A fairly thin sticky grease is best. Vaseline is not a good lubricant (Not in this context anyway). Then surround the lot with one of the later type rubber gaiters each end, not the shiny PVC ones used on 750's

Treat the back unit the same way when the opportunity presents itself, but as the back unit is wider, higher, better protected, and, you will agree, harder to get at, it does not go wrong so quickly.

Engine bolts should be bolts not studs, the washers should be plain, and the nuts should be Nyloc or plain. Here again no star washers and no all metal locking nuts as they cannot be checked tightened.

The centre stand is a joke. Having said that, I know of a 750 which has done 50,000 miles on the same stand. Well, off the same stand, if you see what I mean. Of course the prop stand is worn out. The 850 stand is stronger at the pivots and the cross tube, and is, theoretically, available as a kit to fit 750's. Part no. 064874 is what you should ask for.



*The 'S' type made for the Americans and one of the faster early models (1970). Note the lack of cush drive rear hub (bolt up as Dommie), and the T.L.S. front brake. Both exhaust pipes up the left side made a beautiful sound.*

Photo credit: Motor Cycle

### STOP PRESS:

**OIL IN TIMING CASE.** When re-starting a post '72 engine which is **completely** dry, pour oil into the inlet rocker cover so that it drains down to oil the timing chain.

**CARRIER:** Fittings on the bolt that is also the top suspension bolt, check here for  $\frac{1}{4}$  inch of clearance between carrier and spring collar.

**REAR SUSPENSION UNITS:** On models with Engine Nos. 750 200000-255509 and 850 300000-305500 there were a few faults in construction, in that the centre tube of the rubber ferrules is too short allowing the whole assembly to be locked up solid when the bolt is fully tightened. There should be sufficient gaps between the frame and the suspension unit to allow free movement. If there is any doubt change **both** suspension units in case of weakening.

**ISOLASTIC SHIMMING:** The gap in this assembly should be reduced to 0.005 inch or even less, as long as some movement exists all is satisfactory, although **never** lock the shimming up solid as this breaks the frame and/or the head steady. A broken **head steady** should never be repaired by welding or such. Fit the later box section one.

## GROUP 11:— Frame, swinging arm and suspension

**FRAME:** Now all is to be revealed: the green eyed monster which appeared at the 1967 Show had a frame with a tubular spine like all Commandos since, but without the smaller horizontal tube below it. Instead it had a gusset plate wrapped round between the spine and the steering head, and they used to break at the junction of the gusset and spine, along with the two front down tubes. This was caused by our old favourite, metal fatigue—due to the nodding of the front end of the frame all the time the front brake isn't on. The process ably assisted by the stiff, short travel forks, and the unbalanced front wheel. The credit for putting the matter right, putting the tube in, goes to Ken Sprayson of Reynolds Tube. Later frames don't break (not there, anyway).

Almost every year the frame was changed—it went something like this:—

- 1968 First frame, gussetted, centre stand on frame.
- 1969 Bracing tube added, Featherbed-type side stand.
- 1970 Centre stand tube strengthened (it still twisted).
- 1971 Centre stand removed from frame—side stand on a peg held by the smallest circlip in the world (it fell off).
- 1972 Side stand bolted on.
- 1973 Steering head angle (rake) change from 27° to 28° (yokes also changed).
- 1974 Reinforced G6771 rear loop—gusset as continuation of inside rear damper mounting.
- 1975 Epoxy paint standardised—previously a thin coat of vaguely black varnish covered the rust.

In any case where a new frame is needed I would recommend the early 850 type frame (although the change-over is a bit complicated for a pre-1971 model with Featherbed-type yokes and adjustable steering bearings). The steering is more positive at high speed with 850 geometry, but to get the greatest benefit you also need the 850 yokes (but the 750 type will fit and give the desirable increased trail).

It may be appropriate to say a few words about high speed weaves.

1. The worst machines are 750s from 1971–1973 with top boxes and wide handlebars.
2. Light, short riders on their own are most often affected.
3. Dunlop TT 100 tyres cause more problems than Avons.
4. I have never had problems with any bike brought back to the works with handling problems, even hands off at 100 mph, so it is a personal thing, too.
5. The ONLY time I have been worried by the handling of any Commando was a Fastback with a 3.25 x 19 front and 4.00 x 18 rear trials tyre with about 8 psi. At about 90 mph it showed an unnerving tendency for the rear wheel to run alongside the front one. Worse, it couldn't make up its mind which side it wanted to be.

All you can do if the bike shows this tendency is to SLOW DOWN, but DON'T tighten your grip on the bars. There's quite a lot going on with gyroscopic forces centrifugal forces, tyre drag, and the built-in self-centring provided by the trail—so leave them to get on with it without the complication of extra heave-ho from the bars.

A few further points on the high-speed handling or otherwise of the Commando. Initially a disclaimer; I have only ridden a Commando for about half a mile, therefore I do not know the problem at first hand, but the following are facts that I have picked up from years of associating with Norton owners:

A run down of the facts affecting Commando wobbles not covered by Mr. Stevens' oration. All points on the Commando have to be set correctly, the bike is critical to any maladjustments. Tyres must be to the correct pressures, balanced, and in line with each other. Tyres must be of the same breed; do not mix Avon and Dunlop. A 3.60 front tyre is recommended for better steering and "the racer's edge". The rear tyre of 4.10 section should be on a

WM3 rim as per Dunlop recommendations; this gives a greater road tread contact area.

Correct shimming is essential. Rear springs are 126lb standard wear, 150lb springs have been known to improve matters. Weight should be kept as far forward as possible by using low or flat bars; a tank top bag or Swagman pannier bag is ideal for touring. Tri-point screens have an adverse effect while a small handlebar fairing has been known to improve matters. That is about all I have come across (VIVE LA FEATHERBED).

Commandos are not the only bikes to show this phenomenon, but a little attention to the above details could improve your situation. You can fit a steering damper.

Finally, overheard at a Tim and Mary Stevens coffee evening: "Does your Quackersicki weave at high speeds?" "No, but it is quite good at knitting around town."

**SWINGING ARM:** The later 850 type is reinforced around the junction tube but the real problem is the very poor location of the spindle in the gearbox cradle. The spindle is held by one  $\frac{1}{4}$ in screw—in fact this one screw holds the back wheel in. I know because I once lost that miserable little screw at speed and the spindle came out. Don't ask me what happened—we managed to stay between the Armco barriers—and if you look in the hedge about 20 miles this side of Vienna you'll see an ash tree with a branch missing. The repair held till we got to the long suffering German Norton distributor in Darmstadt. An oversize spindle is available—Part No: 064077. It is 0.005in oversize (0.13mm) and by the time you find the hole is too big, five thou is usually about right—although you may have to ream the centre of the cradle as the wear occurs mainly at the ends. If you can't get an oversize spindle have the old one hard chromium plated and ground down to the size you want. When it fits the centre tube properly you can hold it in place more firmly using a good strong pair of car exhaust clamps—the type which are made of a thick U bolt and a steel pressing. Fit these round the tube and with any luck you will be able to compress the tube onto the spindle and hold it in place. Not a proper engineering job, but then again neither is it to start with. The bronze bushes should be reamed to about 0.0005in (0.013mm) clearance together using a sharp reamer. Then they will be better than new. Possibly a better way is to obtain a new (?) gearbox cradle or to install a second hand one that isn't worn, should you be able to find either of these items.

Any attempt to alter the piddly little 5BA rod which holds the end covers on would be an improvement—exercise your ingenuity but remember the result must be oil tight. Grease will clog the bushes. EP90 is the stuff, or 140 if you can find it.

**JOHN HUDSON:** I do not quite agree with Tim on this although I always respect what he says. The largest bearing area was provided by the original spindle and bushes and there was nothing radically wrong with the piddly little rod retaining the end caps. What was wrong was the fitting of a grease nipple. They did not even stamp the word "OIL" on the outer end cap and naturally anyone seeing a grease nipple is going to use a grease gun and a high pressure one breaks the pin.

From the centre bore of the spindle a  $\frac{1}{16}$ in hole at each end feeds oil downwards to each bush in the rear fork, both spindle and bush is plain—no scroll—so that once grease enters the tiny holes they are blocked until the spindle is withdrawn and thoroughly cleaned out. Anyone finding grease in here should remove the outer end cap with rod, take out the  $\frac{1}{4}$ in UNF locating screw in the centre of the cross tube in the rear engine plate and try and withdraw the spindle to clean it. If it has not already seized it will probably come out fairly easily by screwing in a spare front isolastic mounting bolt