



OVERHAULING FOUR CYLINDER TRACTION GEARBOXES *****

Helas! The traction gearbox is making weirder noises than usual and its only 160,00km since the oil was last changed. Hmm, must be time for an overhaul. If you live with a Traction, fear not, the above situation is going to happen to you, sooner or later.

A gearbox overhaul is well within the scope of the moderately skilled, but attempting it without a workshop manual is something akin to Russian roulette. Finding the gearbox section is easy- it's the fingermarked pages at which the book falls open. The following notes were prepared to help fill in the gaps in the official workshop manual.

Required tools:

With one exception, none of the special Citroën tools listed in the manual are absolutely necessary- they just make the job easier.

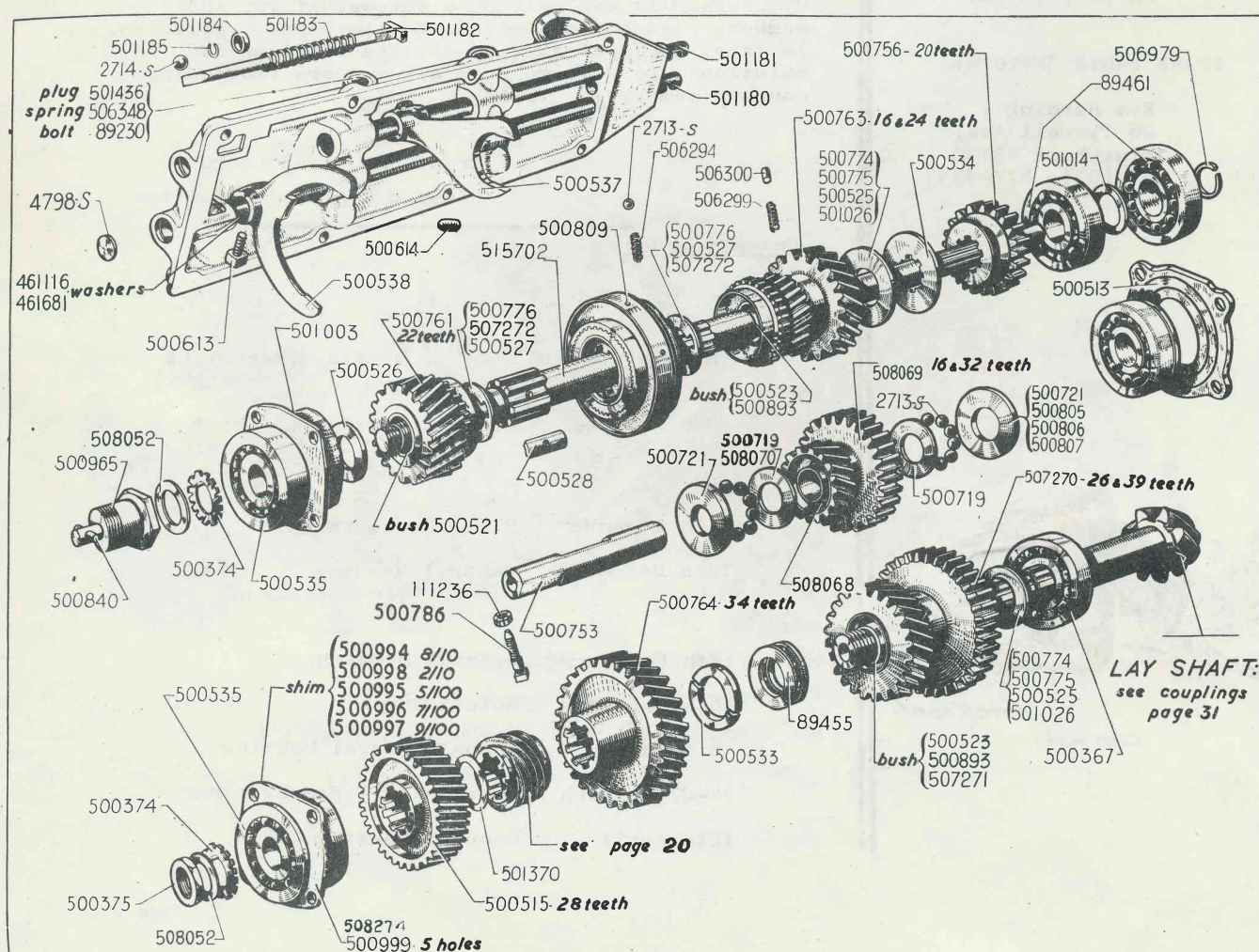
(a) Mainshaft end cap and layshaft nut(508006 and 500375):- 35mm across flats suitable metric spanners not available, use 13/16 Whitworth or 36mm ring spanner.

Note: socket spanner wont fit over mainshaft end cap, but tube spanner will.

(b) Output flanges(508354) dont require extractor- they just slide off.

(c) A normal two-legged puller can be used to remove Timken bearing cones (408451) from differential casing and crown wheel.

(d) If synchromesh hub(500809) is disassembled, then toolMR3025 is essential for re-assembly- paranoia is the inevitable result if not available.



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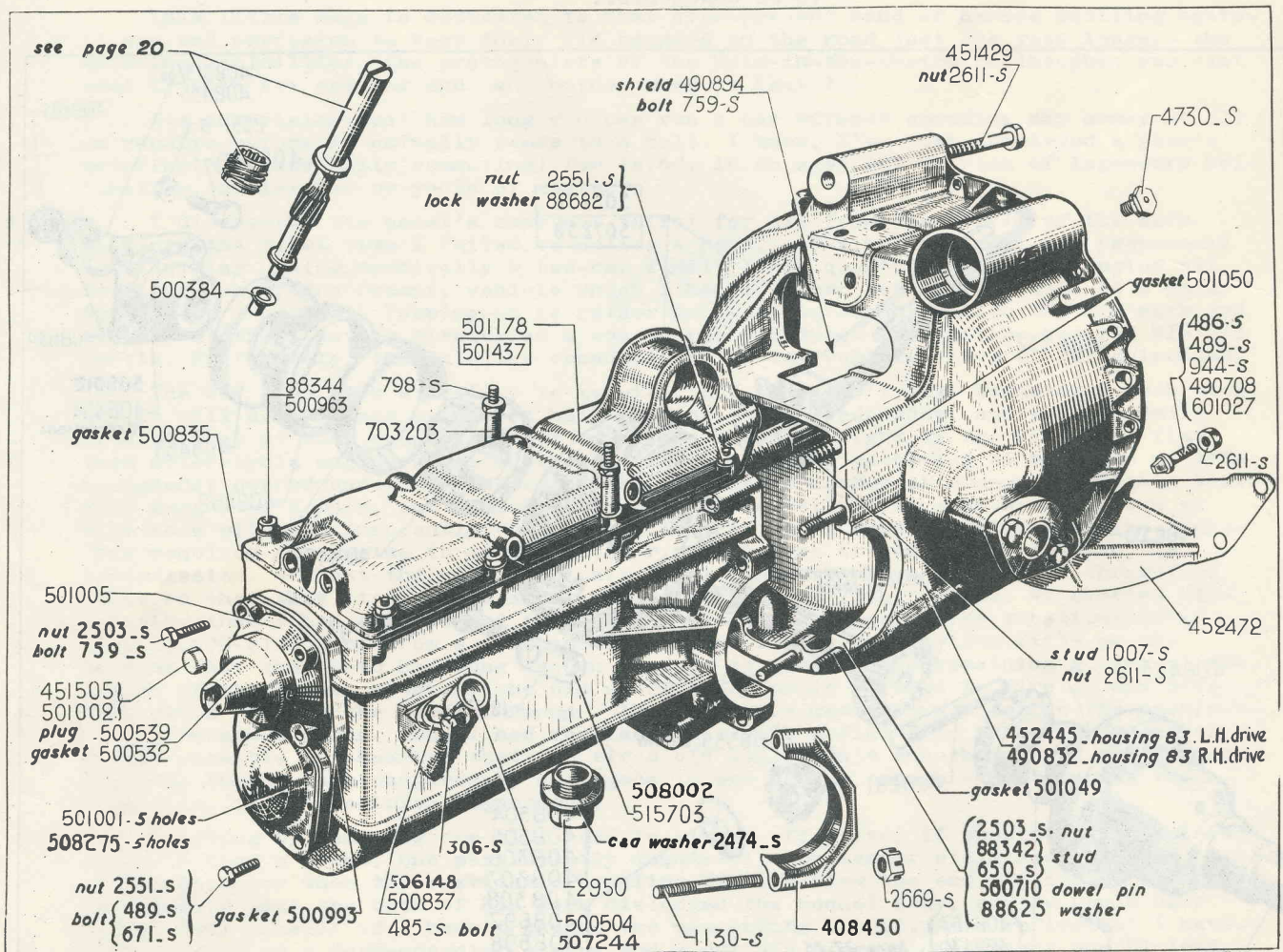
(e) Without stop tool MR3139 to allow the layshaft nut to be tightened, it will be necessary to temporarily fit the mainshaft assembly and bearings into the casing and select two gears to lock the layshaft, in order to tighten the layshaft nut.

(f) It is highly unlikely that apparatus 2044T would be available for positioning the bevel pinion- use simplified method described in the workshop manual, but check that the differential housing diameter being used as a measuring face is true and free from burrs or flats.

(g) A clock gauge(similar to apparatus 2041T) ideally should be used to set up crown wheel and pinion meshing clearance as described in the manual. It is possible however, to use a strip of medium weight brown paper run through the gears, setting the clearance so that the paper is just not cut on the way through. Fiddly and subject to error, unless extreme care is taken.

(h) Spanner 1751T is not necessary to adjust differential bearing ring nuts (408452)- back off bearing cap nuts(508471) temporarily and adjust ring nuts by hand.

(i) The various ball and roller bearings can be removed/refitted with mild steel drifters instead of the mandrels recommended. Dont use bronze drifters as these can chip, leaving bits in the bearings. Mild steel will not harm the hardened steel bearing sleeves.



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Disassembly:

In general the procedure in the workshop manual should be followed. However, when removing second gear idler gear(500763) from the mainshaft, care should be taken that plunger(506300) doesn't fly to the darkest regions of the garage and ensure in any case, that this plunger is removed before it is attempted to slide the gear off the shaft. If removal of the gear is attempted with the plunger in place, it will trap itself in the lubrication groove halfway along the gear bronze bushes, making removal without damage to the bushes impossible.

Dismantling of the synchromesh hub must only be done when wrapped in a cloth or plastic bag- the six balls fly everywhere otherwise.

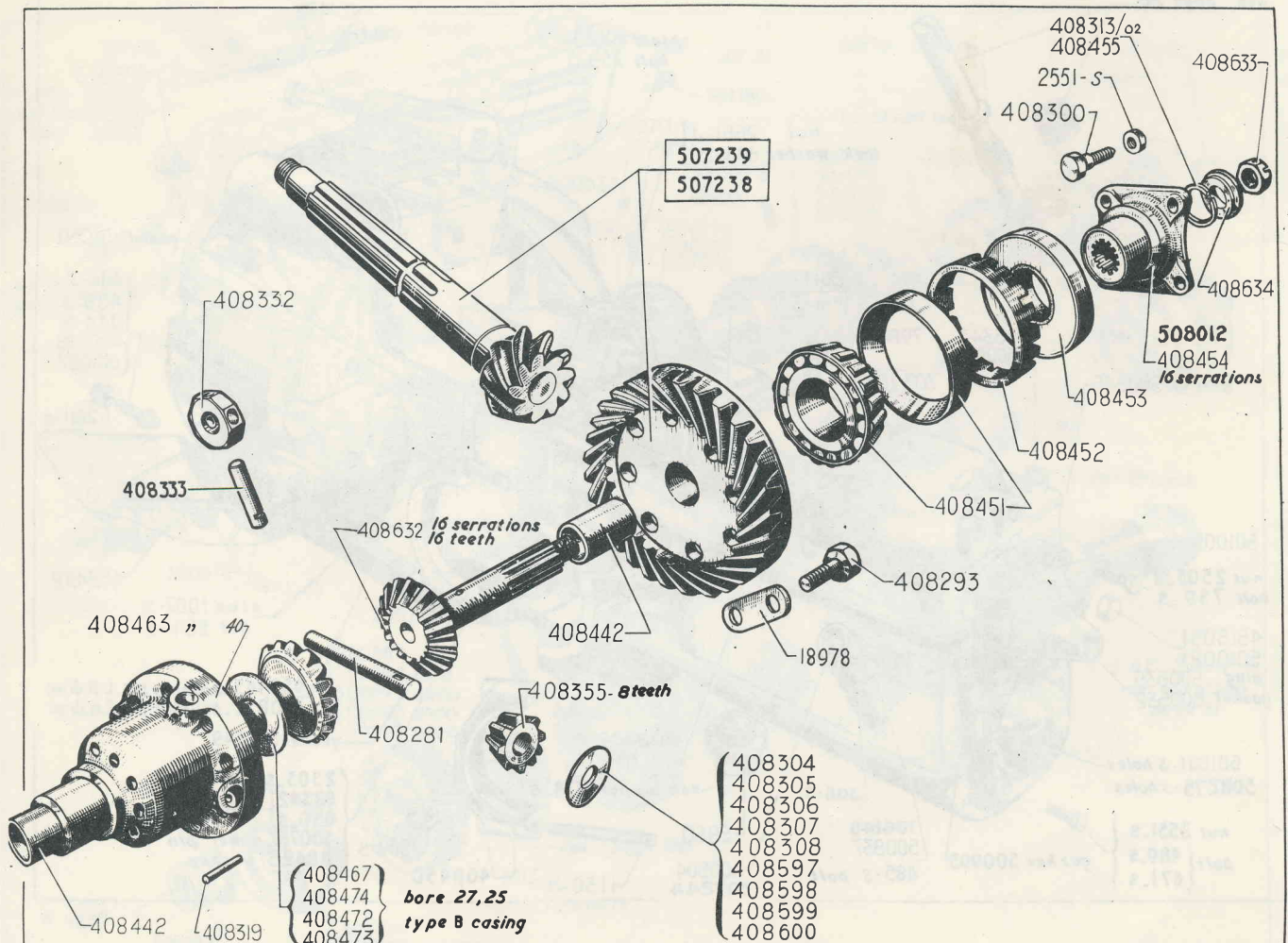
Clean all parts thoroughly(not in petrol, please!) so that they can be examined carefully for wear, cracks and other catastrophies.

Incidentally, because a good clean well lit area is required to lay out parts for examination it is not recommended to do this on the lounge room carpet- kitchen table is OK, though.

Examination:

Missing gear teeth should be obvious to even the most incompetent. After all, there must have been some reason for all that drama when outdragging the 2CV at the lights. However all sound teeth should be examined for pitting, scoring and cracks. The latter applies particularly to the second gear mainshaft pinion(500763) teeth adjacent to the synchro dog teeth and bevel pinion(508460). Cracks originate at the junction of the base(root fillet) of the tooth and the gear side face and run in a curved line to around the midpoint of the tooth tip. If cracks can be seen with the naked eye, the part should be scrapped.

TO BE CONCLUDED..





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[Continued from last issue]

Apologies to those readers confused by some of the part numbers referred to in the first issue. The correct numbers for the illustrations finally printed are:—

Mainshaft end cap nut	500965
Output flanges	508012
Bearing cap nuts	2669-S
Bevel pinion	507239

Examination (continued)

Apart from cracking of the second gear mainshaft pinion teeth, the helical gears don't seem to wear too much. The straight-cut first/reverse mainshaft pinion(500756*) teeth however, can show surface pitting due to metal fatigue at high mileages. This pinion also suffers from burring of the ends of the teeth due to shifting into first or reverse before the gears are stationary (Motorkhanas?) so check for either condition.

The crown wheel and pinion teeth should be evenly polished over the tooth contact areas and should be free from ripple or score marks. Such signs of abnormal wear will mean that they will be impossible to set up correctly and will be noisy in use.

Although the differential planet gears(408632) generally last well, the satellite gears(408355) almost always show tooth surface pitting after considerable use. Replacement with less worn gears is the only cure.

All the ball and roller bearings are quite reliable, but check all ball and roller tracks for excessive wear, pitting and corrosion. If the box has done a lot of work, it is worth replacing all the available bearings while it is apart. This particularly applies to the pinion shaft rear roller bearing(500367) and differential taper roller bearings(2x 408451), especially if a new crown wheel and pinion is being fitted.

Following is a list of the bearings:

	Citroën Part No.	SKF No.
Main shaft, front	500535	3305/C3 Available as 3305.
Main shaft, rear(2 off)	89461 (30x62x11mm)	98206 and 99206 No longer available but could use one 4206 (30x62x20) with 2mm approx. spacer.
Pinion shaft, front	500535	3305/C3 As for mainshaft front.
Pinion shaft, centre (thrust)	89455	No longer available but rarely needs replacing.
Pinion shaft, rear	500367	F-UC 1306TM Available as 5F-UC 5F-UC 1306TM
Differential, side (right and left)	408451	30208 Available.
Reverse idler, thrust	2713-S	¼" balls. 26 required.
Clutch throwout	89971 (35x72x17/14mm)	306629 No longer available but can use 7207C or 7207B (35x72x17) and modify shroud to fit over wider outer sleeve.

(*See Front Drive Vol. 1 No. 1 for illustrations.)

The bronze bush in reverse gear idler pinion(508069) and the floating bush in the first/second pinion shaft gear(507270) are not prone to excessive wear. Those in the top gear mainshaft pinion and the first/second mainshaft pinion are however but this does not seem to cause problems other than an increase in the noise level. Replacement is tricky, as the bushes have to be line-bored in place using the imaginary pitch line diameter as the concentricity datum. In practise, the worn bush inside diameter is used as the setting up datum on the assumption that it was right in the first place and that subsequent wear has been evenly distributed. The other complicating factor is that the mainshaft journals wear and should be ground true and the bushes bored to suit. This is OK for top gear, but the second gear journal diameter is the same as the splined section of the shaft where the ball-races sit, and grinding the journal and splined section undersize would allow the shaft to flop about on the bearing bores. The correct method would be to build the journal up by short arc welding, hard chrome plating or metal spraying and grinding back to the original size — probably not worth the effort!

If bush replacement is attempted, allow a minimum diametral clearance of 0.04mm otherwise the bush will seize, and don't forget to machine the oil grooves and drill oil holes.

Other wear prone points are synchromesh splines, dog teeth and synchromesh bronze rings. These synchro rings are also prone to becoming loose. Check that they are solidly located and note the depth of the oil breaker grooves to gauge the amount of wear. If the grooves are almost non-existent and the synchro cones have been chewing away at the rear face of the recess, it explains why the gears crunched at every change and means you will have to hunt around for some bits that aren't so worn. The dog teeth can even wear down to half their thickness without seriously affecting their function, but this degree of wear adds to the "sloppiness" and noise of a well used gearbox.

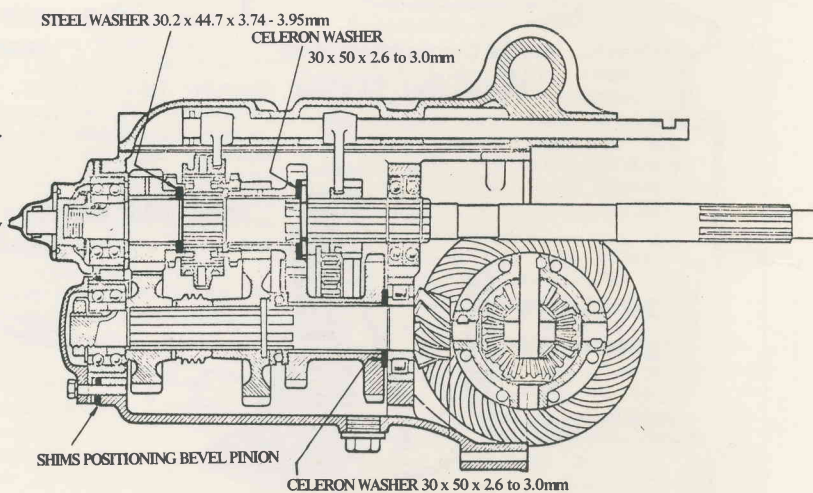


FIG. 1. CROSS-SECTION ON LONGITUDINAL CENTRE-LINE SHOWING WASHERS CONTROLLING END PLAY AND POSITIONING.

With the synchromesh hub dismantled, check that springs (506294) are not broken and that the six balls(2713-S) have not worn excessive tracks in the hub face. Both conditions can cause poor synchromesh action.

The selectors do not seem to wear much, but again check for broken springs and ball tracking. The T-shaped interlock rod(501182) wears on the contacting faces.

End play of the first/second pinion shaft and main shaft gears(507270 and 500763) is controlled by a non-metallic (Celeron) thrust washers. These **DO** wear and on occasion can break-up due to old age. Tractionistes seem to collect a selection of washers out of boxes that have expired, but there is no reason why they cannot be machined from a similar cloth re-inforced resin or even bronze and finally finished to the thickness required by rubbing on a sheet of fine emery laid on a surface plate or a sheet of plate glass. Don't forget the oil grooves.

Overhauling Four Cylinder Traction Gearboxes (Contd.)

Check the split locking collars(500533) on the pinion shaft, and the mating groove in the pinion shaft for chipping and other signs of distress. It is essential that these faces are sound, as they take the load of tightening the pinion shaft nut to the specified torque (110 lb/ft).

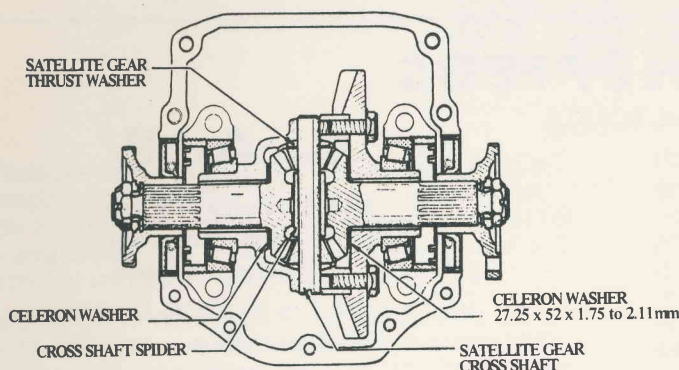


FIG. 2. CROSS SECTION OF DIFFERENTIAL

Turning to the differential, apart from the satellite gears mentioned earlier, the wear points are the cross shafts (40828 and 408333), the satellite gear thrust washers (408304) and the thrust washer mating surfaces in the differential housing(408463). Wear of the shafts doesn't matter too much unless obviously excessive. A method of taking up the thrust washer wear was given in the Classic Register Restorer's Guide of 1976 and copies of this article are available from the Technical Officer. The Celeron thrust washers(408467) and output shaft bushes(408442) show little wear.

The output shaft oil seals(408453) have a habit of weeping oil and wearing grooves in output flanges(508012). These seals are spring loaded leather lip seals (TypeA1) 83 x 36 x 12mm, and the Super Seals (Repcos) part no. is P3074. There seems to be no stock of them in Melbourne and it is unlikely that another batch will be run off. Have the output flange journals ground and polished to 35mm diameter and use P6147 seals(63.5 x 35 x 13 T2) together with an aluminium spacer ring to make up the outside diameter. The P6147 seal is a rubber dual lip seal with metal case.

Reassembly:

In general the workshop manual should be faithfully followed. Reprints of the workshop manual gearbox overhaul section are available from the Classic Register Technical Officer.

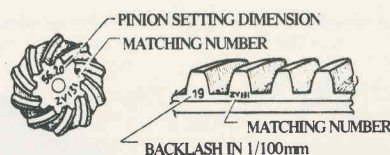
All locking tab washers should **never** be reused. These are fitted to the mainshaft and cap nut, pinion shaft nut, crown wheel retaining set screws and diff. bearing saddle nuts. In all cases these can be dispensed with entirely, as long as LOCTITE 242 is used on assembly. When using LOCTITE, ensure surfaces are free from oil and grease by cleaning with a solvent such as trichloroethylene, or lacquer thinners.

Similarly all paper gaskets can be dispensed with by using DOW CORNING SILASTIC RTV 732 as a sealing medium. This is a viscous liquid rubber in a tube which cures at room temperature when exposed to humidity. Incidentally, although RTV732 is not attacked by oil, petrol causes it to soften and loosen.

When assembling the mainshaft don't forget the locking key(500528) which spaces the washers retaining the synchromesh hub and ensure that the key engages in both washers. End play, 0.05 - 0.10mm, of the second gear idler(500763) is controlled by the thickness of the Celeron washer(500774 etc., - 30 x 50 x 2.6 - 3.0mm) and that of the top gear pinion, 0.10 - 0.20mm, by the synchro hub steel washer (500776 etc., - 30.2 x 44.7 x 3.75 - 3.95mm). Try to achieve these clearances by selective assembly, as excessive end play affects the synchromesh operation.

Check that the synchrohub travel doesn't exceed 4.2mm - it probably will if the synchro rings are badly worn, so back to the spare parts box for a hub that is less worn. Selective assembly at its best!

Setting up the pinion shaft and crown wheel backlash was covered by an excellent article by Gerald Propsting in the Sept. 77 issue of the CCCV Newsletter, so we will not repeat (to be reprinted in a future edition - Ed.), other to say that it is quicker with clock gauge than feeler gauges.



NOTE: FIGURES ON CROWN WHEEL MAY BE ON BACK FACE

FIG. 3. CROWN WHEEL AND PINION SETTINGS

Without Stop Tool MR3139, it will be necessary to alter the official assembly sequence and fit the main shaft assembly and select two gears to enable the pinion shaft nut to be tightened during the pinion shaft positioning procedure. It is still possible to insert feeler gauges to check the pinion position with the mainshaft in position.

End play of the first/reverse pinion shaft gear(507270) is controlled by yet another Celeron washer which is identical with the second gear idler washer. If there is appreciable wear in the pinion shaft front bearing it will be impossible to accurately set the position of the pinion shaft.

Regarding the crown wheel backlash, it's useful to note that with a 9 x 31 crown wheel and pinion there are 270 odd meshing positions. Obviously it is impractical to check the backlash of all, but select a few at random. With a well-used CWP it is surprising what variation can be observed.

For those who decide to adopt the use of LOCTITE, use the 242 grade for the main shaft end cap nut, pinion shaft nut, differential retaining set screws, differential bearing saddle nuts, output shaft nuts(408633), and reverse idler shaft retaining set screw(500786). LOCTITE grade 601 can be used for retaining the differential bearing inner sleeves (408451) where the journals have worn.

If after all this care and 'selective' assembly your gearbox crunches, rattles and howls, don't despair - c'est la vie (et 'Traction')!

Roger Brundle