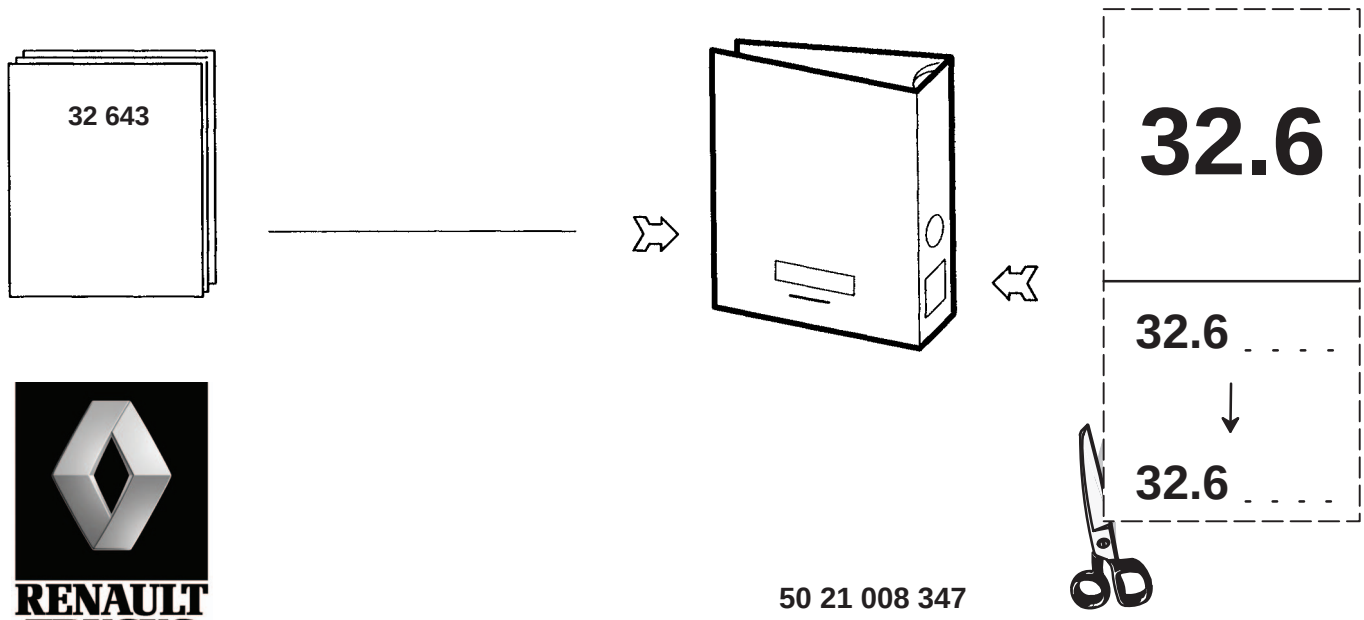
32 643 - AN - 02.2002

GEARBOX

GEARBOX	VEHICLE
EATON 4106 / 5206	MIDLINER 4x2 / 4x4 MIDLUM 4x2 / 4x4 PA 210 TRM 180 TRM 200 GBC 180 PREMIUM

NOTE
The above information may change in the course of time.
Only the "Consult" section of the workshop manuals directory in standard N° 10320 serves as reference.



RENAULT TRUCKS

Generalities

Model designation

Example: FSO - 4106 A

FS	Standard prefix
O	Overdrive
4	Rated torque in ft.lbs
1	Series 1
06	Number of forward gears
A	Standard ratio set
B, C	Other ratio sets

Gearbox identification

All gearboxes are fitted with an identification plate on the left-hand side of the front half-casing, showing:

1. Gearbox serial number.
2. Gearbox model.
3. Manufacturing date code number.
4. Gearbox specification number.

The gearbox specification number is unique to each customer and gives precise details of the gearbox design level. This number must be quoted when ordering spare parts.

There are currently two design levels of the 4106 gearbox. Each level is identified by the specification number:

Y 04000
Y 04100

The middle digit denotes the design level.

Generalities

Technical data

MODEL			4106
Max. input torque	FS-4106A FS-4106B	640 Nm 650 Nm*	65 ft. lbs 66 ft. lb
for engine performance up to		134 kW	182 hp
Weight (1)		117 kg	
Length (2)		555 mm	
Oil capacity (4) Horizontal mounting Vertical mounting		 6.5 litres 7.5 litres	
Clutch housing		SAE Standard	
Power take-off ports		Left side (vertical mounting) Bottom right (horizontal mounting) SAE 6 bolt facing plus extended layshaft for Eaton PTO	

PTO driving gears (3)		Rotation to engine
driven from the reverse idler gear at :	Engine speed x	
FS-4106A (standard ratio)	0.226	same
FS-4106B (alternative ratio)	0.271	same
FSO-4106B (overdrive ratio)	0.336	same
driven from layshaft front gear at :	Engine speed x	
FS-4106A (standard ratio)	0.434	opposite
FS-4106B (alternative ratio)	0.519	opposite
FSO-4106B (overdrive ratio)	0.644	opposite

Gear	Standard ratio	% staging	Standard ratio	% staging	Overdrive ratio	% staging
6	1.00		1.00		0.79	
	—	38	—	30	—	26
5	1.38		1.30		1.00	
	—	45	—	44	—	35
4	2.00		1.87		1.35	
	—	55	—	50	—	55
3	3.10		2.80		2.09	
	—	69	—	57	—	69
2	5.25		4.38		3.53	
	—	72	—	72	—	72
1	9.03		7.54		6.08	
	—		—		—	
Bak	8.07		6.74		5.43	

(1) Including output coupling, low remote control; excluding clutch housing.
(2) Front face of gearbox casing to rear face of output flange.
(3) Recommended backlash: from 0.15 to 0.25 mm.
(4) Oil capacity without PTO.
* Higher torques: subject to approval by Eaton.

Generalities

Lubrication

Correct oil level

Before checking the oil level or refilling, the vehicle should be on level ground.
Make sure the oil level is flush with the filler port.

Draining the oil

Drain the gearbox while the oil is hot.
To drain the oil, remove the drain plug at the bottom of the casing.
Clean the drain plug before refitting.

Refilling with oil

Clean the surrounds of the filler plug.
Fill the gearbox until the oil is flush with the filler port.
The exact amount of oil depends on the inclination of the gearbox.
In every instance, fill until the oil is flush with the filler port.
Do not overfill - this causes oil to be forced out of the casing past the main shaft and input shaft seals.

Adding oil

It is recommended that different types and brands are not intermixed because of possible incompatibility.

Operating temperature

It is important that the gearbox operating temperature does not exceed 120 °C (250 °F) for an extended period of time. Operating temperatures above 120 °C cause breakdown of the oil and shorten gearbox service life.

Any combination of the following conditions can cause operating temperatures in excess of 120 °C:

1. Consistent operation at road speeds below 32 km/h (20 mph).
2. High engine speeds.
3. High ambient temperature.
4. Restricted air flow around gearbox.
5. Exhaust system too close to gearbox.
6. Engine operation at maximum power in overdrive.
7. High power PTO operation for extensive periods while stationary.

High operating temperatures may require more frequent oil changes.

Towing

When towing the vehicle, the propeller shaft must be disconnected between the gearbox and the drive axle.

Generalities

Recommended lubricants

Oils

Choice of lubricants according to operating temperature:

Renault Trucks Oils

Oil	Temperature range
MV3 20 W 30	da – 20° C to + 30° C
MV3 25 W 40	da – 10° C to + 40° C
EP 90	da – 10° C to + 30° C
EP 80 W	da – 20° C to + 20° C
SUPERTRANS EPX	da – 10° C to + 50° C

International standards

Oil	Mil-L	API	Temperature range
SAE 30	2104 E	CE/SF	da – 20° C to + 30° C
SAE 40	2104 E	CE/SF	da – 10° C to + 40° C
SAE 90	2104 D	GL 4	da – 10° C to + 30° C
SAE 80 W	2104 D	GL 4	da – 20° C to + 20° C
SAE 80 W 90	2104 D	GL 4	da – 10° C to + 30° C
SAE 80 W 85 W	2104 D	GL 4	da – 20° C to + 25° C

DO NOT use oil additives, friction modifiers or synthetic lubricants.

CONSUMABLE PRODUCTS

Industrial reference	Automotive reference	Bottle	RENAULT TRUCKS ref N°
Loctite 242	Thread locking compound	24 ml 60 ml	50 00 336 949 50 00 336 950
Loctite 270	Adhesive sealant	24 ml 60 ml	50 00 336 947 50 00 336 948
Loctite 518	Joint sealant	25 ml	50 00 630 985
Loctite 648	Flange sealant	240 ml	50 00 630 037
Activator T 747	Activator	165 ml	50 00 630 036

Generalities

Recommended tightening torques

Screws and nuts

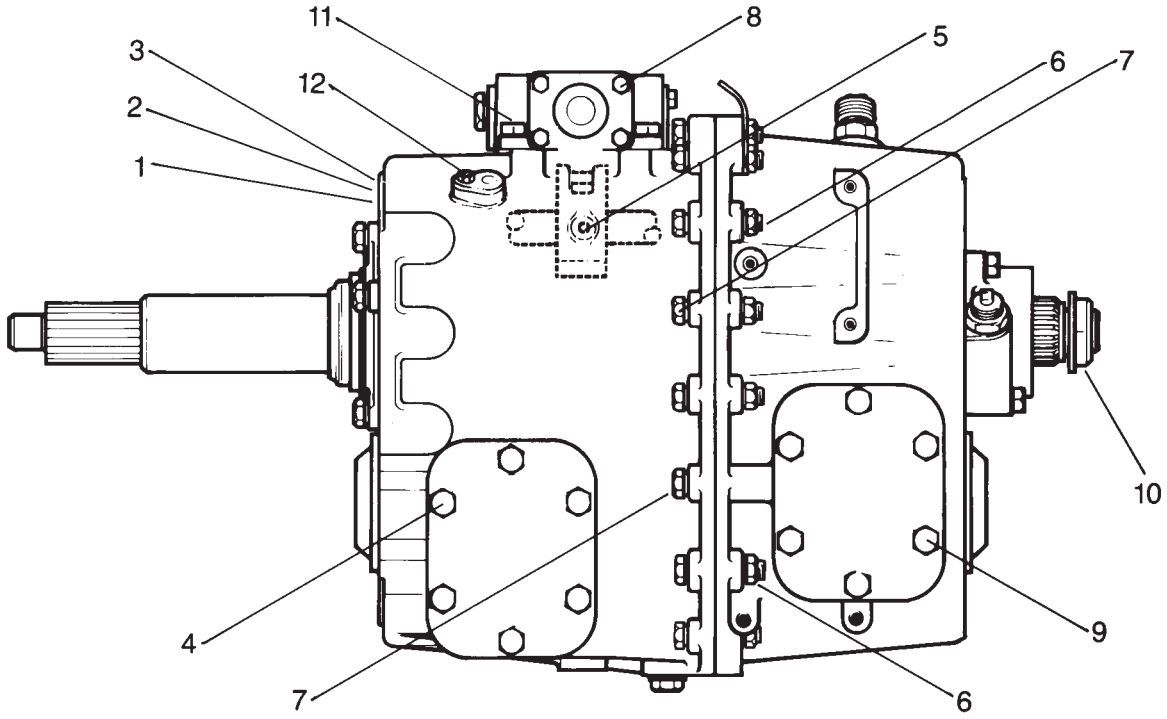
1. Clutch housing
12 studs - M12 screw-thread - 59 Nm (43 ft.lbs) minimum. Installed with Loctite 242.

2. Clutch housing
12 nuts - M12 screw-thread - 69 to 78 Nm (51 to 58 ft.lbs). With plain washers and spring washers.

3. Clutch housing
12 cap screws - M12 screw-thread - 69 to 78 Nm (51 to 58 ft.lbs). With plain washers and spring washers.

4. Front PTO cover
06 cap screws - M10 screw-thread - 35 to 39 Nm (25 to 29 ft.lbs).

5. Selector block tapered lockscrew
1 screw - M10 screw-thread - 35 to 39 Nm (25 to 29 ft.lbs). “Patchlock” or screw-threads coated with Loctite 242.



6. Main half-casings
15 cap screws with plain nuts - M10 screw-thread - 51 to 58 Nm (38 to 43 ft.lbs). With plain washers under cap screws and nuts.

7. Main half-casings
3 cap screws - M10 screw-thread - 51 to 58 Nm (38 to 43 ft.lbs). Plain washers.

8. Remote control housing end cover
4 cap screws - M8 screw-thread - 20 to 24 Nm (15 to 18 ft.lbs). Spring washers.

9. PTO/reverse idler gear cover
6 cap screws - M10 screw-thread - 35 to 39 Nm (25 to 29 ft.lbs).

10. Output shaft
Locknut - M33 screw-thread - 490 to 588 Nm (362 to 434 ft.lbs). With nylon locking insert.

11. Remote control housing
4/6/8 cap screws - M10 screw-thread - 35 to 39 Nm (25 to 29 ft.lbs). Plain washers and spring washers.

12. Overdrive selector fork pivot
2 cap screws - M10 screw-thread (with spring washers) - 20 to 24 Nm (15 to 18 ft.lbs).

Generalities

Recommended tightening torques (continued)

Screws and nuts

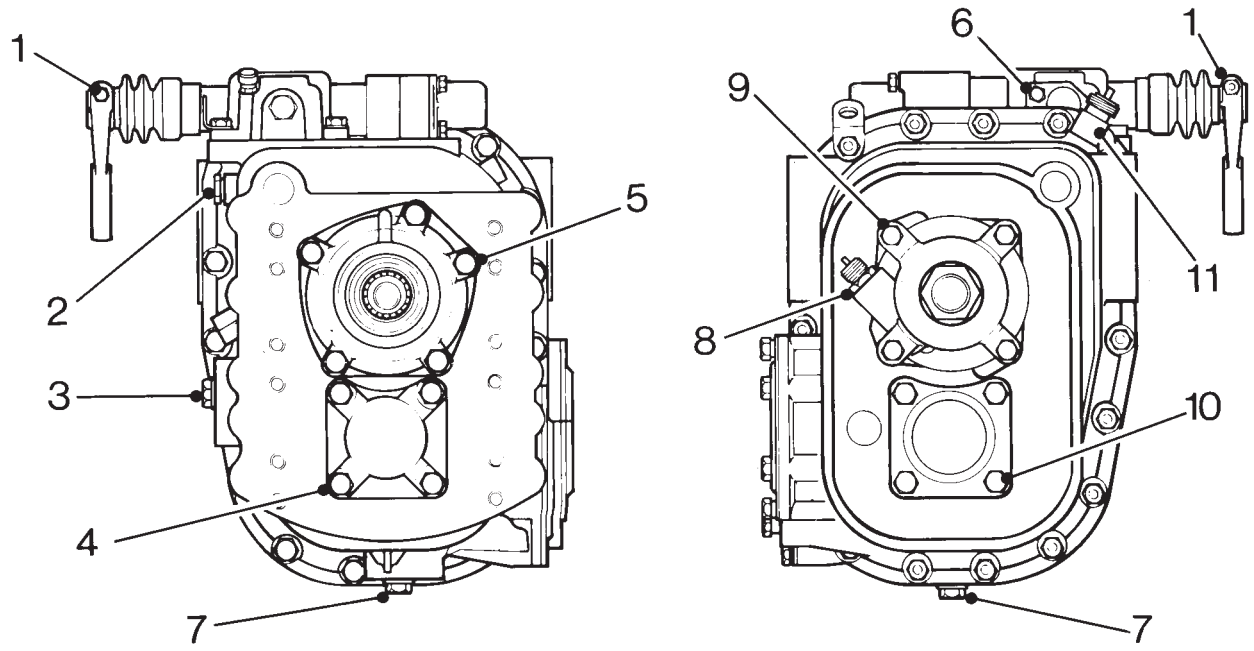
1. Remote control shaft lever
1 cap screw and nut - M8 screw-thread - 20 to 27 Nm (15 to 20 ft.lbs). With spring washer.
or
1 cap screw and nut - M10 screw-thread - 35 to 39 Nm (55 to 29 ft.lbs). With spring washer.

2. Selector shaft detent cover
2 cap screws - M8 screw-thread - 20 to 24 Nm (15 to 18 ft.lbs). With spring washer.

3. Oil filler plug
M24 screw-thread - 32 to 37 Nm (24 to 27 ft.lbs).

4. Layshaft front bearing cover
4 cap screws - M12 screw-thread - 69 to 78 Nm (51 to 58 ft.lbs). With spring washer.

5. Input shaft front bearing cover
5 cap screws - M10 screw-thread - 35 to 39 Nm (25 to 29 ft.lbs). With spring washer.



6. Remote control housing detent cover
2 cap screws - M8 screw-thread - 20 to 24 Nm (15 to 18 ft.lbs). With lockwasher.

7. Oil drain plug (magnetic)
M24 screw-thread - 32 to 37 Nm (24 to 27 ft.lbs).

8. Speedometer drive pinion adapter
M22 screw-thread - 20 to 27 Nm (15 to 20 ft.lbs). With copper washer.

9. Speedometer housing
4 cap screws - M10 screw-thread - 35 to 39 Nm (25 to 29 ft.lbs). With plain washer and spring washer.

10. Layshaft rear bearing cover (rear PTO)
4 cap screws - M12 screw-thread - 69 to 78 Nm (51 to 58 ft.lbs). With spring washer.

11. Reverse lamp switch
M16 screw-thread - 16 to 22 Nm (12 to 17 ft.lbs).

Generalities

Disassembly precautions

It is assumed in the detailed disassembly instructions that the lubricant has been drained and the necessary linkages and air lines (if fitted) have been removed from the chassis.
Removal of the gearshift remote control housing assembly is included in the detailed instructions. However, this assembly may also be removed from the gearbox before removing the unit from the vehicle.
Follow each procedure closely in each section, making use of both the text and the pictures.

1. Bearings - Carefully wash and relubricate all bearings as removed and protectively wrap until ready for use. Remove bearings with pullers designed for that purpose.

2. Assemblies - When disassembling the various assemblies, such as main shaft, layshaft and remote control housing, lay all parts on a clean bench in the same sequence as removal. This procedure will simplify reassembly and reduce the possibility of losing parts. When pulling off synchronizer hubs, follow the procedures detailed in “Disassembly”, using a suitable puller of adequate capacity. Failure to adhere to the recommended procedures may cause irreparable damage.

3. Circlips - Remove circlips and snap rings with pliers designed for that purpose. New selective circlips must be fitted as specified in “Reassembly”.

4. Input shaft - The input shaft can be removed without removing the layshaft or the main shaft. Take care not to misplace or lose the main shaft spigot bearing.

5. Cleanliness - Provide a clean place in which to work. It is important that no dirt or foreign matter enters into the unit during repairs. The outside of the unit should be carefully cleaned before commencing disassembly. Dirt is abrasive and can damage bearings.

6. Press fitting - Apply force to shafts, housings, etc… with restraint. Movement of some parts is restricted. Do not apply force after the part being driven stops solidly. Use soft hammers for all disassembly work.
Do not use pry bars or chisels to separate half-casings or irreparable damage may be caused.

Inspection of fast wearing parts

Before reassembling the gearbox, individual parts should be carefully checked and damaged parts discarded. They must be replaced. This inspection procedure should be carefully followed to ensure maximum service life from the rebuilt unit.
The cost of a new part is generally a small fraction of the total cost of downtime and labour, should the use of a questionable part make additional repairs necessary before the next regularly scheduled overhaul.
Recommended inspection procedures are set out in the following checklist:

A. Bearings

1. Wash all bearings in clean solvent. Check rollers and races for pitting and crumbling. Replace damaged bearings.

2. Lubricate undamaged bearings and check end play and radial play. Replace bearings presenting excessive play.

3. Check the fits of bearings in housing bores. If the outer races turn too freely in the bores, the housing should be replaced. Check housing bores for signs of wear prior to taking such action. Only replace the housing if wear is due to bearing spin.

B. Gears

1. Check gear teeth for tooth face pitting. Gearwheels with pitted teeth should be replaced. Check the reverse gear dog clutch engagement teeth for freedom from damage.

2. Check internal bearing surfaces for wear and effects of overheating.

3. Check gear end play. Where excessive play is found, check both gearwheel and hub for excessive wear.
Maintain the specified end play on main shaft forward gears.

C. Bearing sleeves - Main shaft

1. Sleeves presenting scoring, pitting or signs of overheating or wear must be replaced.

Generalities

Inspection of fast wearing parts (continued)

D. Synchronizer assemblies

1. Check to ensure that all splines are free from excessive wear.

2. Check that the dog clutch engagement teeth on sliding sleeves, synchronizer flanges and synchronizer rings are free from flaking and burrs.

3. Check that synchronizer cone rings are not excessively worn or show signs of overheating. Check that the clearance between synchronizer ring and synchronizer flange is between 1.9 mm maximum and 0.5 mm minimum.

4. Replace springs, plungers and rollers.

E. Splines

1. Check splines on all shafts for wear. If synchronizer hubs, output drive flange or clutch hub have worn into the sides of the splines, shafts in such condition must be replaced.

F. Thrust washers

1. Check the surfaces of all thrust washers. Washers presenting scoring or reduction in thickness should be replaced.

G. Reverse idler gear

1. Check bearings and shaft for wear due to the action of roller bearings.

H. Clutch release parts

1. Check clutch release parts, yoke and bearing carrier. Check pedal shafts. Replace worn shafts and bearings.

I. Gear selector shaft assembly

1. Check forks and keys for wear at points of contact. Replace worn parts.

2. Check forks for excessive and uneven wear. Replace worn forks.

3. Check selector block lockscrews. Lockscrews with worn taper must be replaced.

4. Check condition and fit of selector key and interlock key in gearshift shaft. Worn or damaged keys must be replaced.

J. Gearshift remote control

1. Check spring tension on cross shaft. Replace tension springs if the shaft moves too freely.

2. If the housing is dismantled, check cross shaft, inner lever and bearing bushes for wear. Replace worn parts.

3. Check all seals and locating journals. Replace worn parts.

K. Bearing covers

1. Check covers for wear due to bearing thrust. Replace covers worn or scored by thrust due to bearing outer races.

2. Check cover bores for wear. Replace excessively worn covers.

L. Oil return seals

1. Check oil seal in front bearing cover for damage and wear. Replace if necessary.

2. Check oil seal in speedometer housing for damage or wear. Replace if necessary. Replace grit shield if worn or loose on flange.

3. Check oil seal journals for wear and replace if worn or grooved.

M. O-rings

1. Replace all O-rings.

Generalities
Reassembly precautions

Make sure that the interiors of all housings are clean. It is important that dirt be kept out of the gearbox during reassembly. Dirt is abrasive and can damage the polished surfaces of bearings and washers. Observe certain precautions, as listed below, during reassembly.

1. Gaskets - Use new gaskets only where indicated (neutral detent cover and remote control housing covers). In all other locations, ensure that mating surfaces are clean and undamaged and apply a continuous bead of Loctite 518 Flange Sealant to one face only. Do not apply excessive sealant or allow it to penetrate into the bearings.

2. Threaded hardware - Use thread sealant (Loctite 641) on all screws. The corresponding torque loadings are to be found in "Recommended tightening torques for screws and nuts".

3. O-rings - Lubricate all O-rings lightly with silicone lubricant.

4. Initial lubrication - Lubricate bearings with gearbox oil during reassembly.

5. End play - Maintain the end float of main shaft gears as detailed in the chart on the following page.

6. Bearings - The use of flanged bearing mandrels is recommended for the installation of bearings. Such drivers apply equal force to both bearing races, preventing damage to balls and races and maintain correct bearing alignment with shaft and bore. Tubular type mandrels, if used, will apply force to the inner race only. Heating the bearing inner tracks will aid installation.

7. Output shaft drive flange - Tighten the nut at the correct torque.

8. Synchronizer hubs - All synchronizer hubs are an interference fit on the main shaft splines and must be heated at approximately 85 °C (180 °F) before installation.

9. Layshaft - The layshaft gears are a shrink and press fit on the layshaft body. The gearwheels must be heated to 150 °C (300 °F) before assembly.

10. Prior to fitting a flange (or yoke), ensure that the seal track is not grooved, scored or pitted. If in doubt, it must be replaced.

11. All synchronizer flanges are now fitted to the gears using Loctite. Loctite 648 + Loctite "T 747" Activator are used. It is recommended to mix the sealant and activator before commencing reassembly to allow sufficient time for the Loctite to cure.

Generalities

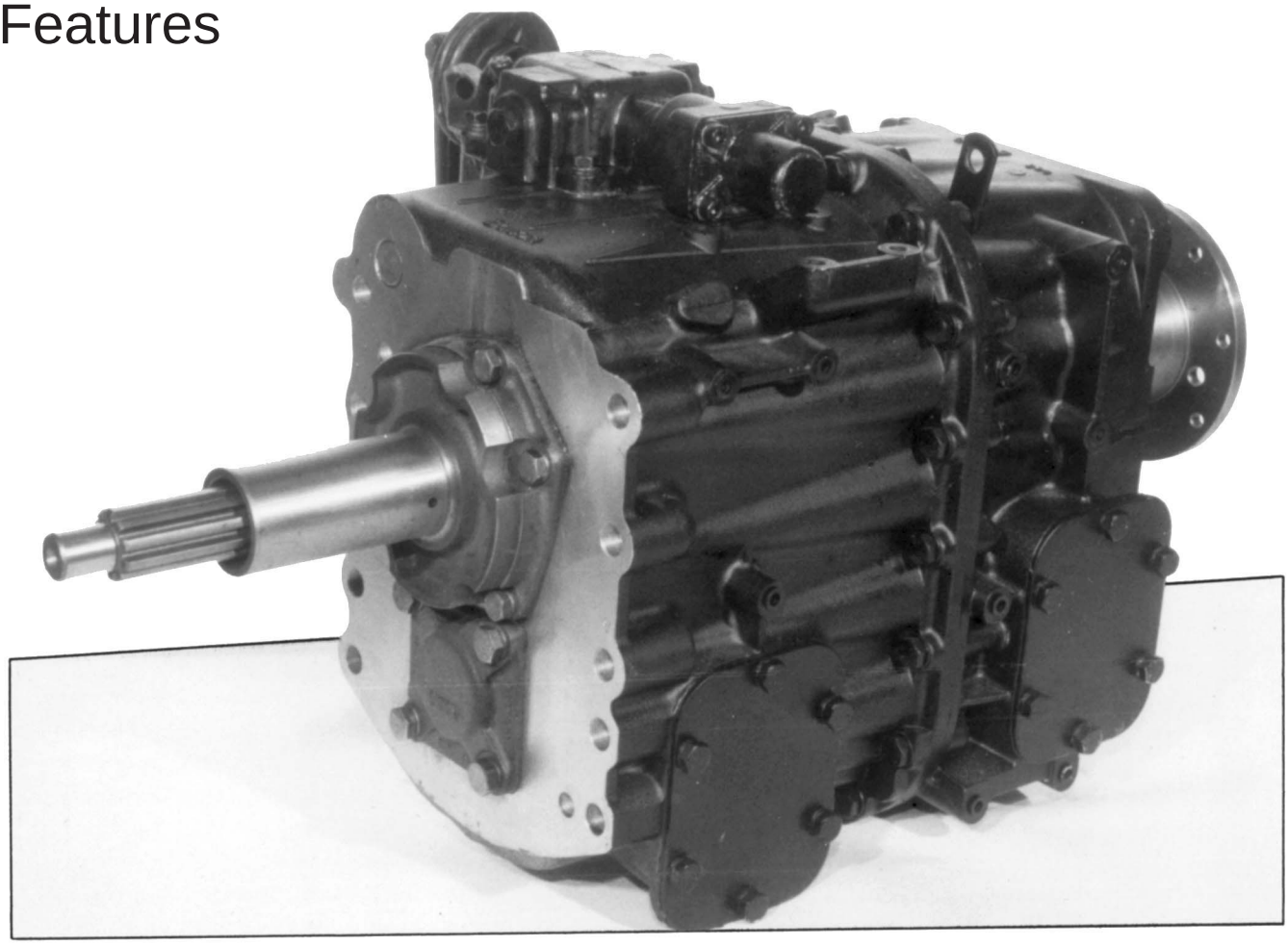
Gear end float

All dimensions in millimetres (mm)

Gear	5th (6th overdrive)	4th	3rd	2nd	1st	Reverse
Low limit High limit Range	0.31 0.53 0.22	0.35 0.48 0.13	0.35 0.48 0.13	0.35 0.48 0.13	0.40 0.57 0.17	Sliding gear

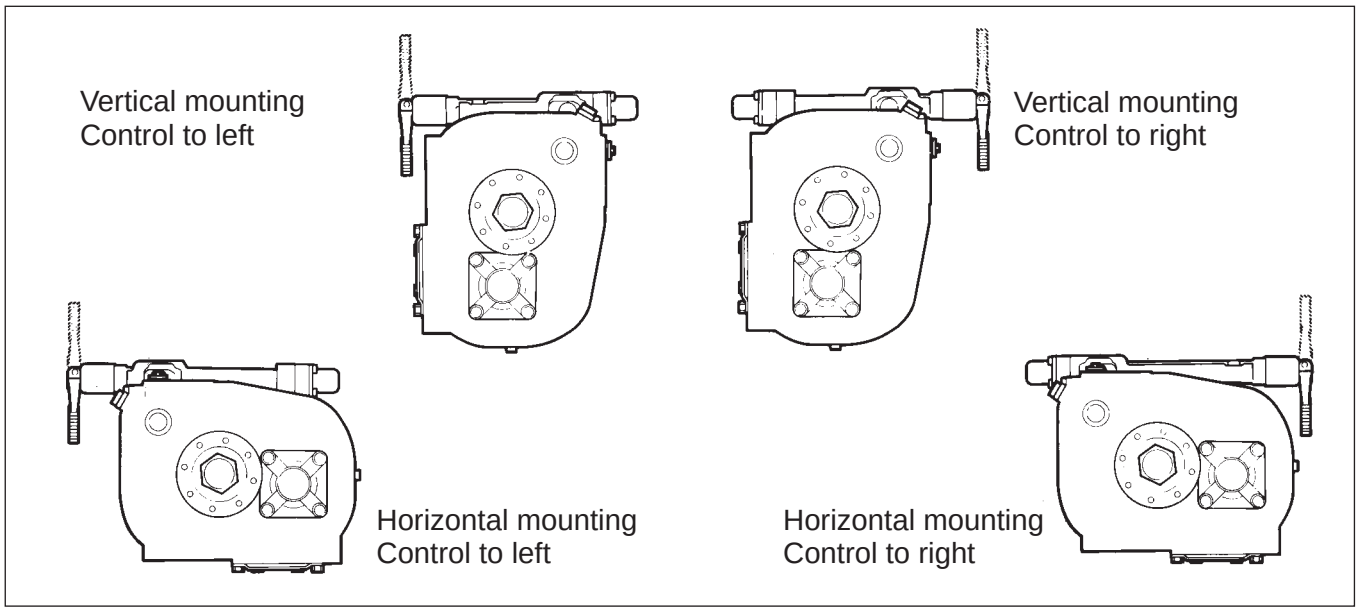
General description

Features



The Eaton 4106 gearbox has six forward speeds and is one of a new family of synchromesh gearboxes. It has a simple shift pattern using a unique single rail selector mechanism.

The gearbox may be mounted vertically or horizontally and in both positions the gear change remote control may be to the right or to the left.

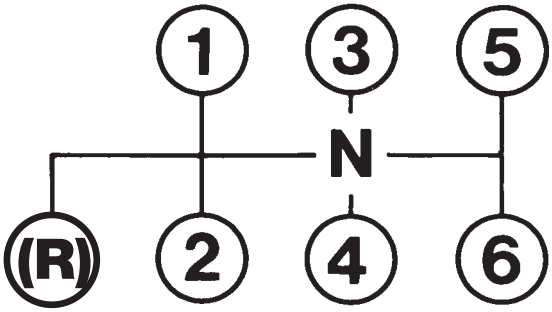


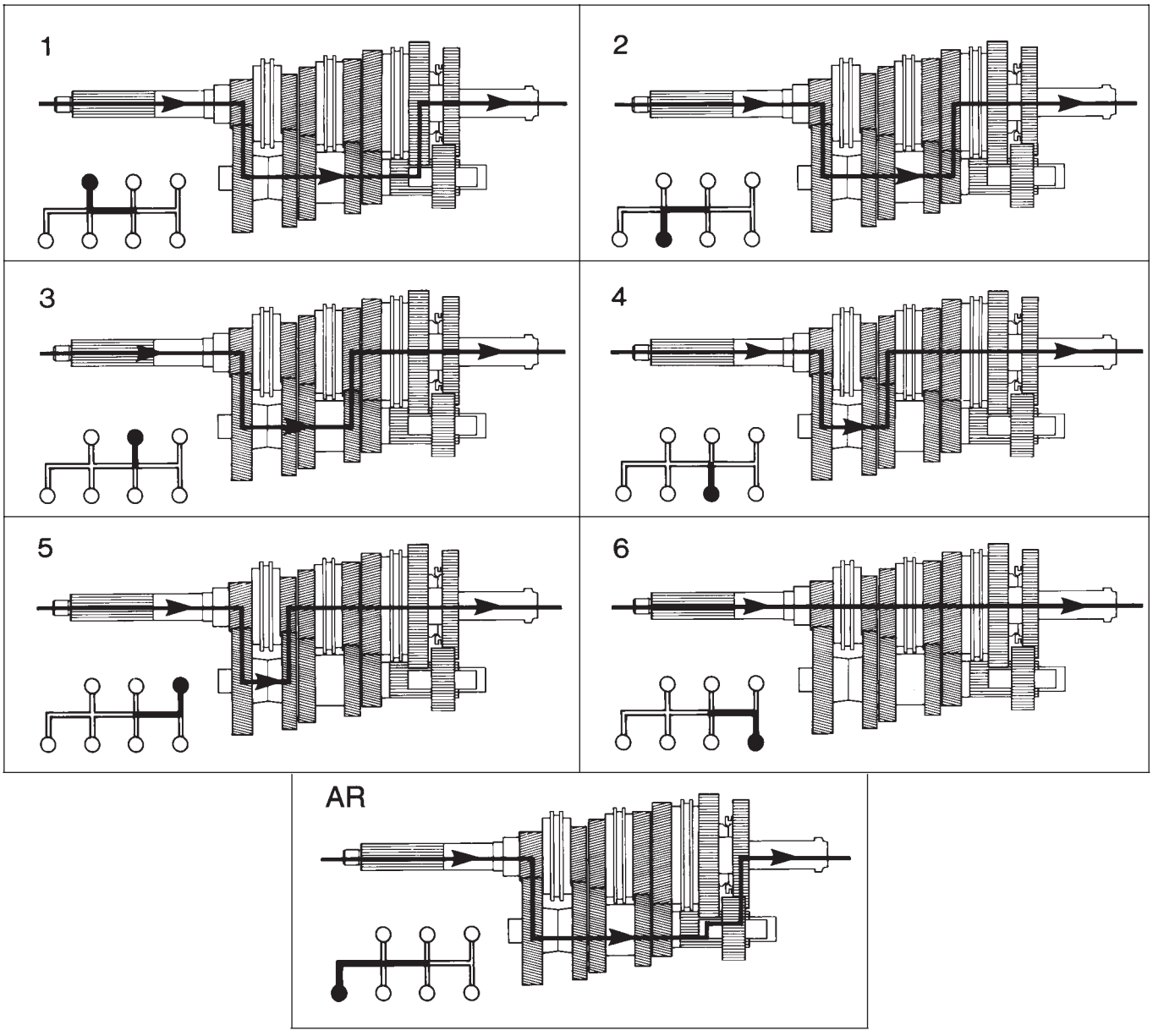
The synchronizer assemblies are of the baulk ring type with the gear ring cones manufactured separately from the gears. This allows the synchronizer rings and flanges to be replaced without need to replace the gears themselves. Reverse gear is engaged by sliding the reverse gear on the main shaft into mesh with a dog clutch ring splined to the main shaft.

General description

Gear change pattern

Simple shift pattern with the mechanism biased in neutral between 3rd and 4th gears.





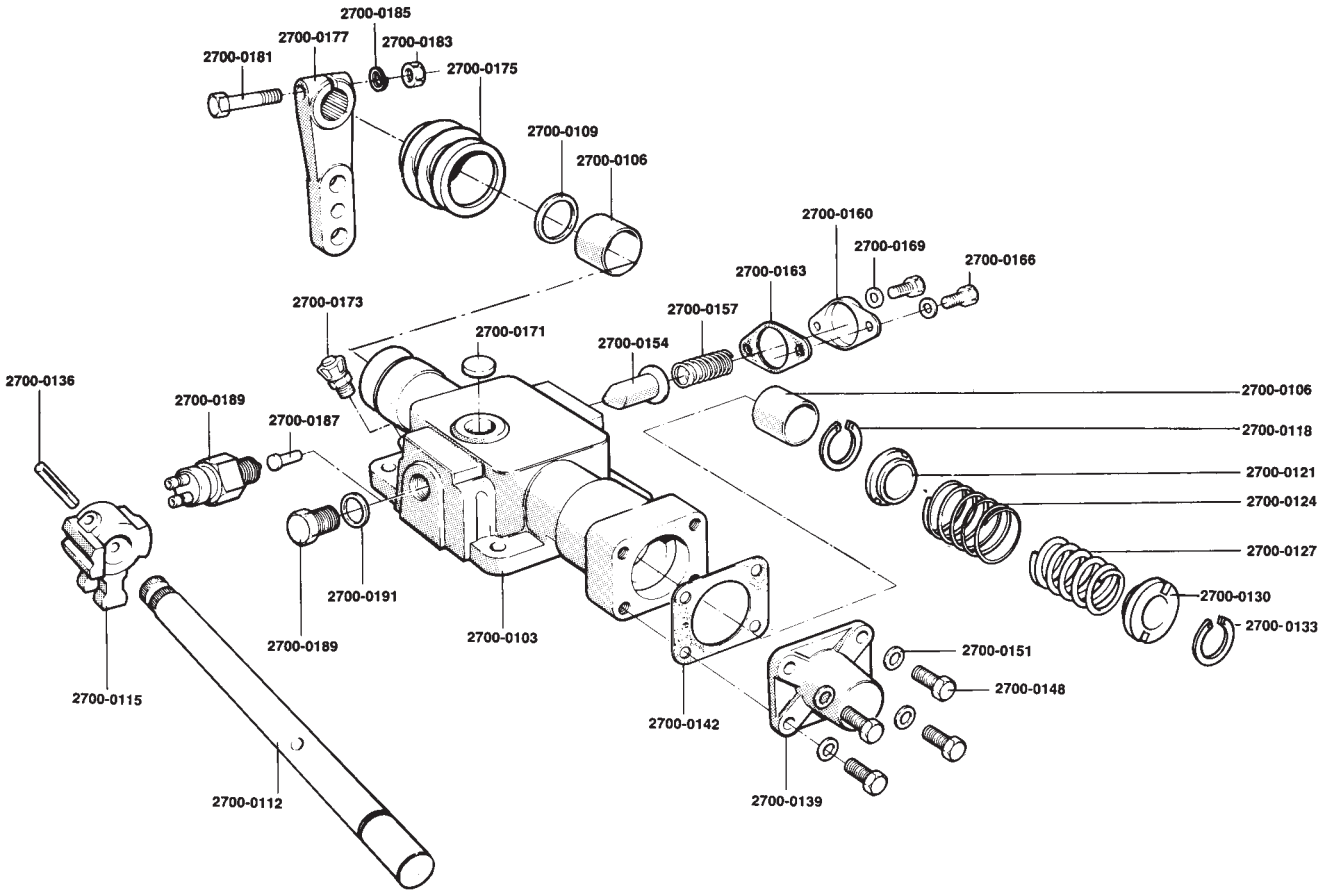
Power flow diagrams - direct drive top gear version

Gearshift control

Remote control

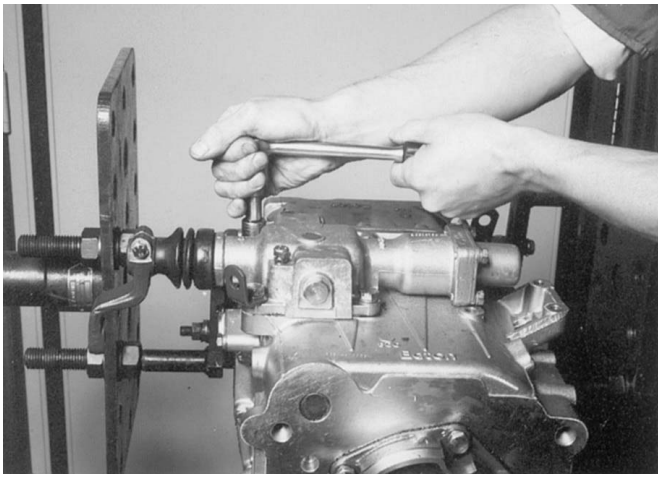
Gearshift control

Remote control - Exploded view

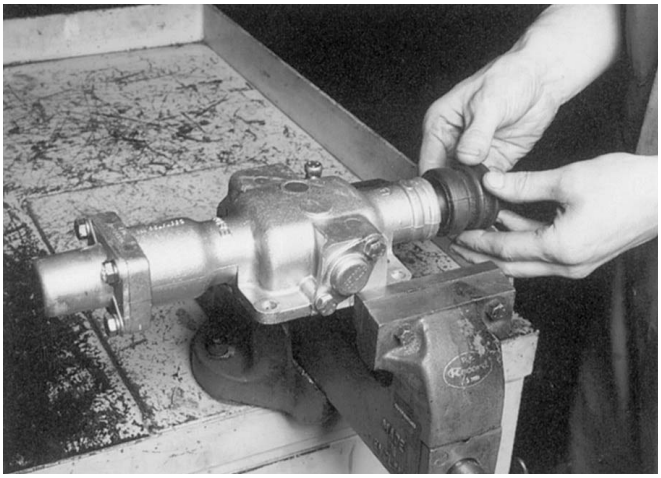


Sequence N°	Description
2700-0103	Housing
2700-0106	Bush
2700-0109	Oil seal
2700-0112	Cross shaft
2700-0115	Inner striking lever
2700-0136	Grooved pin
2700-0121	Spring retainer
2700-0124	Spring
2700-0127	Spring (LH only)
2700-0130	Spring retainer
2700-0139	End cover
2700-0142	Gasket
2700-0148	Screw, M8
2700-0151	Spring washer, M8
2700-0154	Plunger-reverse
2700-0157	Spring-reverse detent
2700-0160	Detent cover
2700-0163	Gasket, detent cover
2700-0166	Screw, M8
2700-0169	Spring washer, M8
2700-0171	Plug
2700-0173	Breather
2700-0175	Rubber boot
2700-0177	Router lever
2700-0181	Bolt, M10 x 50
2700-0183	Nut, M10 x 1.0
2700-0118	Circlip
2700-0133	Circlip
2700-0185	Washer
2700-0187	Pin
2700-0189	Plug or Neutral switch
2700-0191	Washer

A. Remote control disassembly

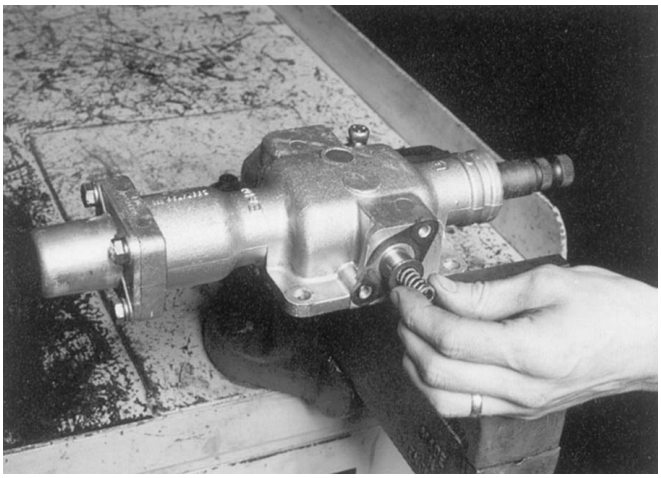


1. Ensure that neutral is selected and remove the remote control assembly from the gearbox.

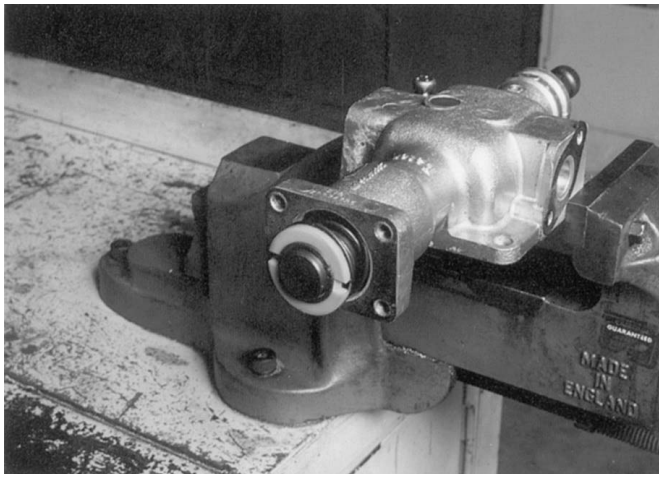


2. Remove the outer gear change lever and the rubber boot. Remove the neutral switch and the pin (if fitted).

Note: The position of the lever is marked on the shaft. Check before removal.



3. Remove the reverse detent plunger cover and pull out the spring and the plunger.

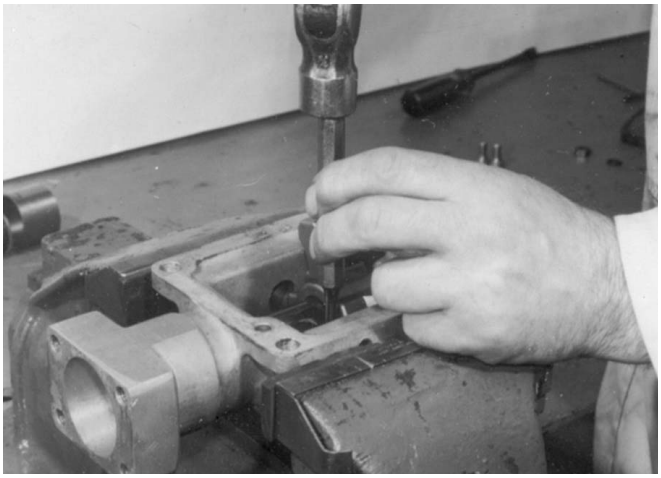


4. Remove the four cap screws and lift off the end cover.

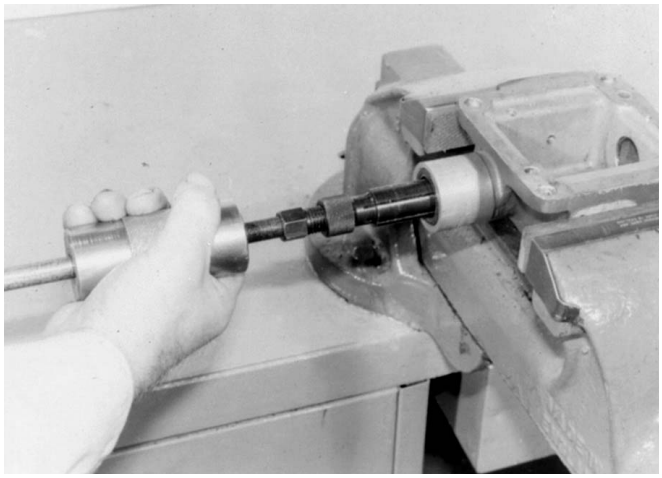
5. Remove the circlip from the shaft and remove the spring retainer.

6. Withdraw the booster spring, bias spring and inner retainer.

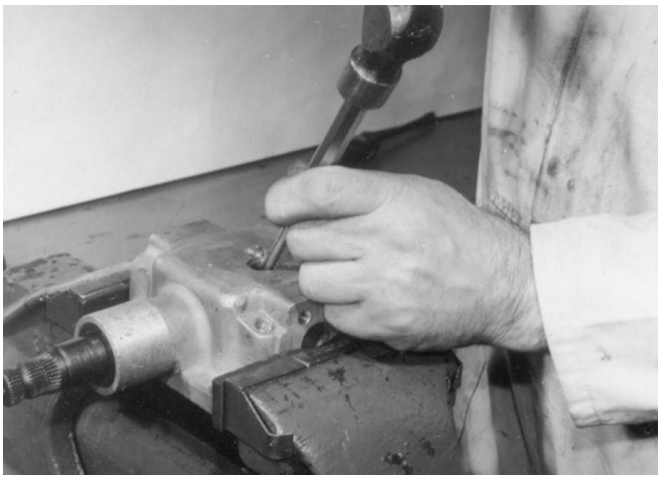
B. Remote control reassembly



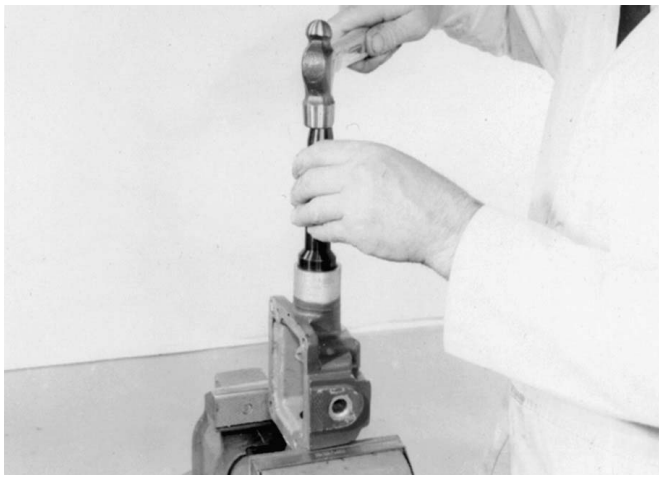
7. Reverse the position of the housing and carefully drive out the expansion plug.



1. If necessary:
Take out the bearing bushes. Use tool **N° 001.**
Press fit new bushes. (Use the removed part as a pusher).

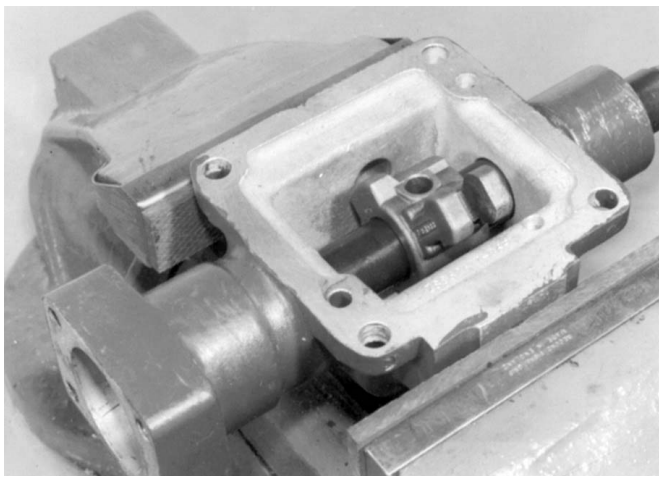


8. Reverse the position of the housing. Align the grooved pin in the inner lever with the expansion plug hole and carefully drive out the pin.



2. Replace the oil seal.
Install the new seal, using a tube.

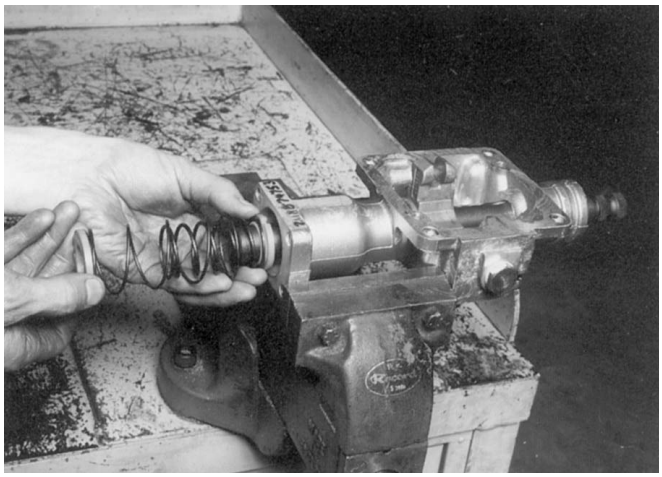
9. Remove the shaft and the inner lever.



3. Install the inner lever, with the long plain groove towards the front of the housing, and install the shaft from the right-hand side of the housing.

4. Align the inner lever on the shaft and install a new grooved pin.

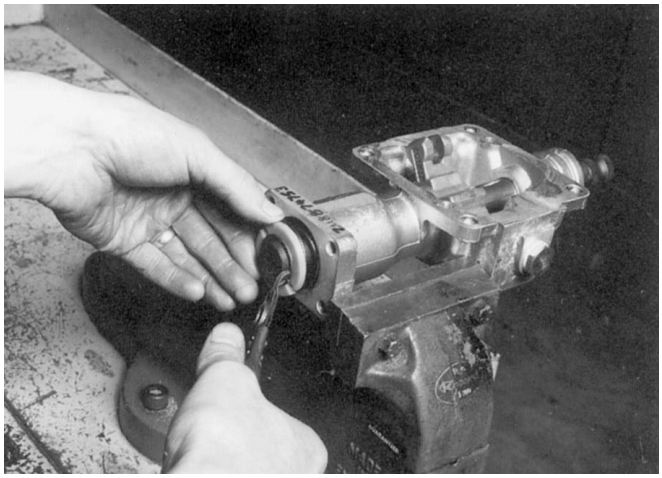
Note: The inner lever should be supported whilst driving the pin, to prevent damage to the bushes.



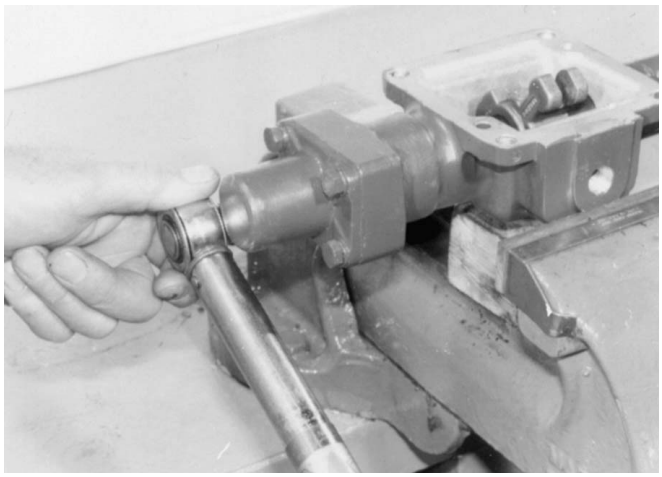
5. Fit the inner circlip on the shaft. Install the smaller spring retainer.

6. Insert the springs and the outer retainer.

Note: Right-hand drive versions need one large retainer whereas left-hand drive versions use one large (outer) and one small (inner) retainer.

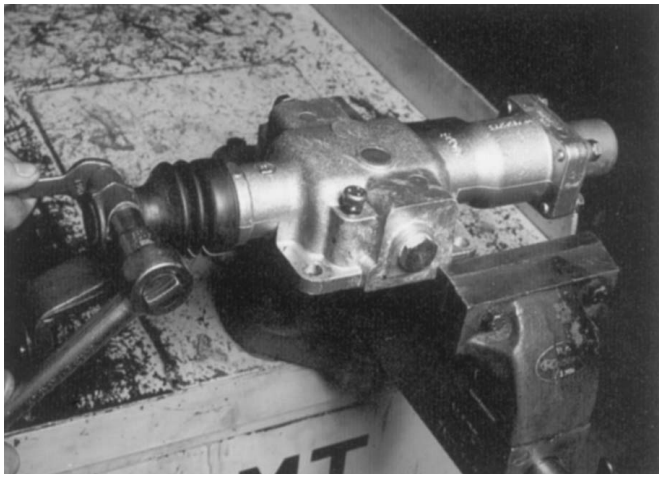


7. Fit the outer circlip on the shaft.

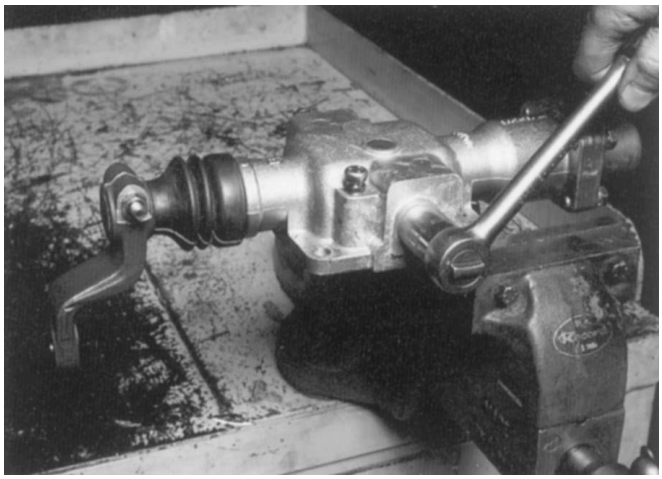


8. Fit a new gasket and secure the end cover to the housing. Tighten at the correct torque (20 to 24 Nm).

9. Install the reverse detent plunger and the spring and fit the cover (using a new gasket). Tighten the cap screws at the correct torque (20 to 24 Nm).



10. Fit the rubber boot on the housing. Align the outer lever with the setting mark on the shaft. Fit the pinch bolt and tighten at a torque of 35 to 39 Nm.

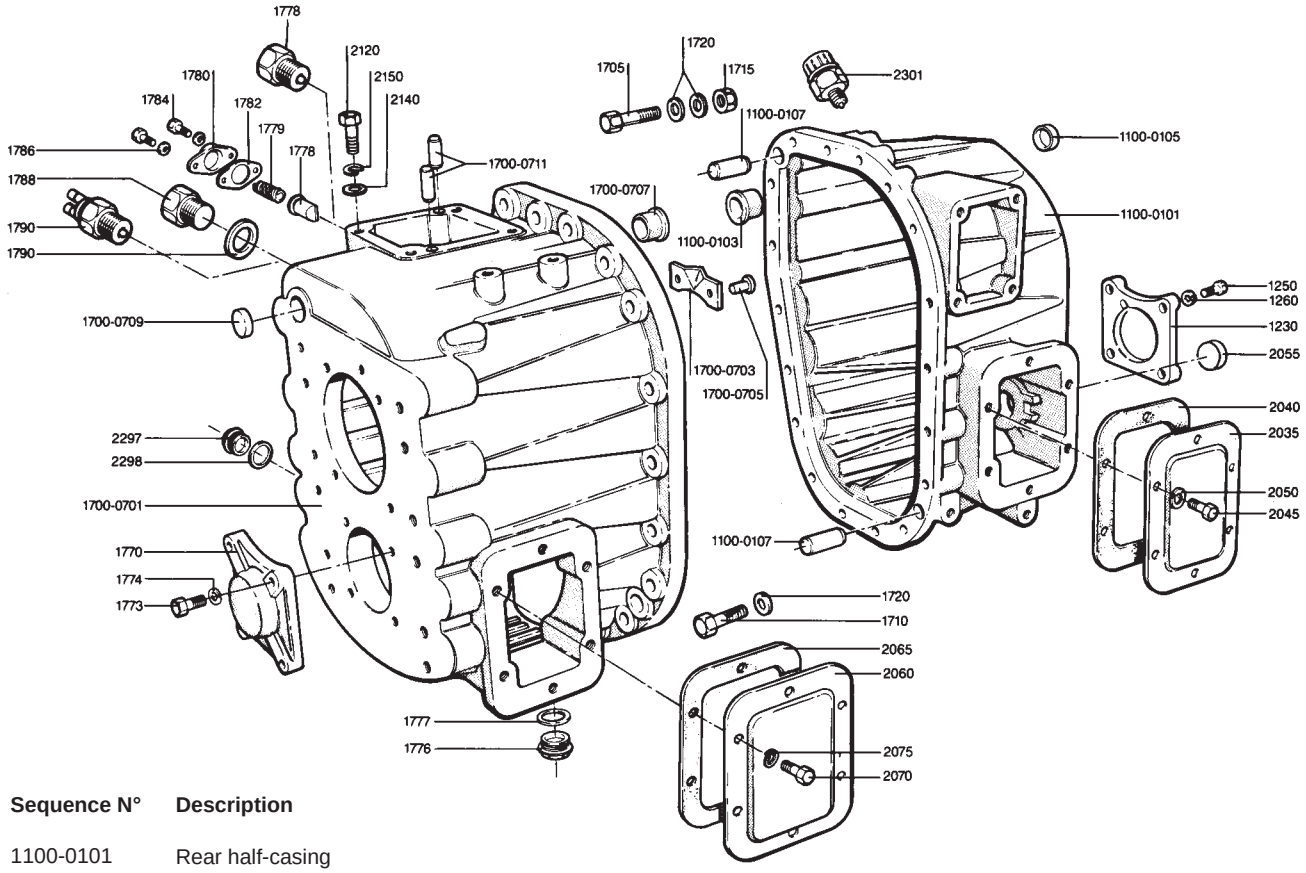


11. Fit the breather. Install the pin and the neutral switch. Tighten at the correct torque (15 to 22 Nm). Apply sealant and install a new expansion plug.

Gearbox overhaul

Gearbox casing

Exploded view

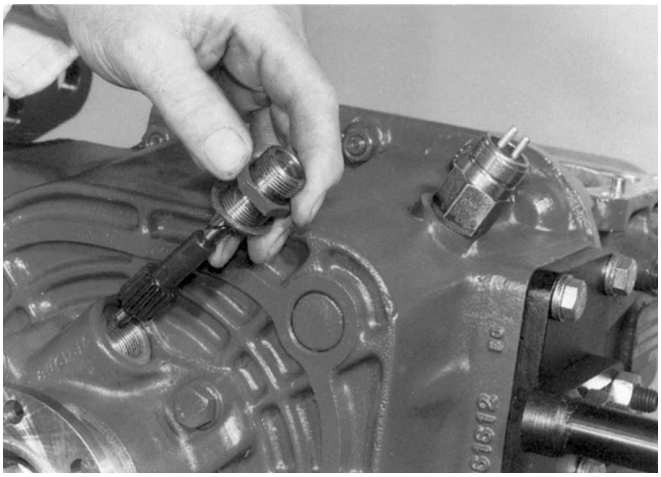


Sequence N°	Description
1100-0101	Rear half-casing
1100-0103	Bush
1100-0105	Core plug
1100-0107	Dowel
2035	Oil trough
2040	Drive screw
2045	Cover
2050	Screw
1230	Spring washer
1250	Cover
1260	Screw
1700-0701	Spring washer
1700-0703	Front half-casing
1700-0705	Oil trough
1700-0707	Drive screw
1700-0709	Bush
1700-0711	Core plug
2060	Dowel
2065	Cover
2070	Screw
2075	Washer
1705	Bolt
1710	Screw
1715	Nut
1720	Washer
1770	Cover
1773	Screw
1774	Washer
1176	Magnetic drain plug
1777	Rotation pin
1778	Screw
1779	Washer
1780	Copper washer
1782	Neutral detent plunger
1784	Spring, detent
1786	Gasket
1788	Screw
1790	Spring washer
	Plug
	Neutral switch or Washer
2055	Cup plug
2120	Screw
2140	Washer
2150	Washer
2297	Oil filler plug
2298	Copper washer
2301	Indicator switch, rev. light

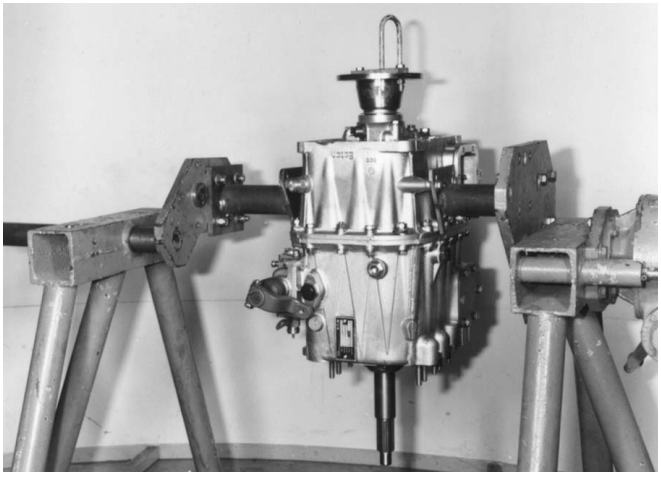
A. Gearbox casing disassembly

Caution: Drain the oil from the gearbox. Clean and refit the drain and filler plugs.

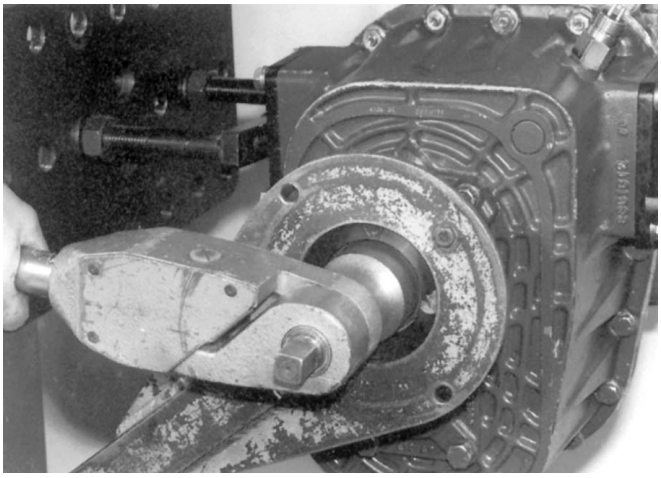
Note: The gearbox illustrated in this section is a standard ratio vertically mounted unit. The procedure is the same for all gearboxes but the physical size and number of teeth on some of the gears will vary from those illustrated on overdrive and alternative ratio models.
Horizontally mounted units have the remote control on the side of the gearbox and different filler and drain plug positions.



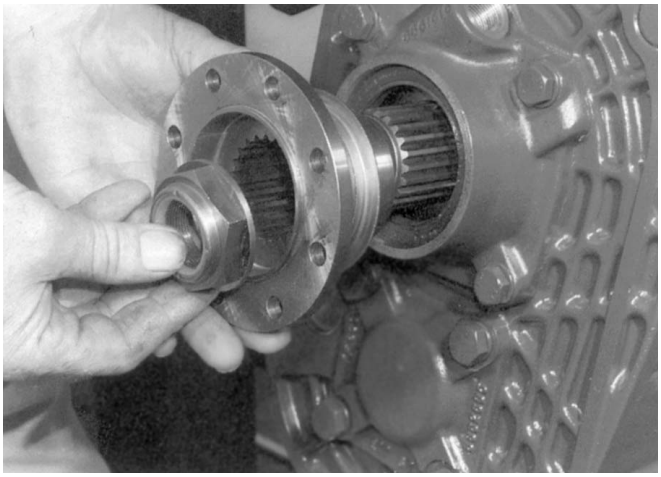
3. Remove the speedometer drive pinion and housing assembly or electronic tachometer sender unit. Remove the reverse lamp switch.



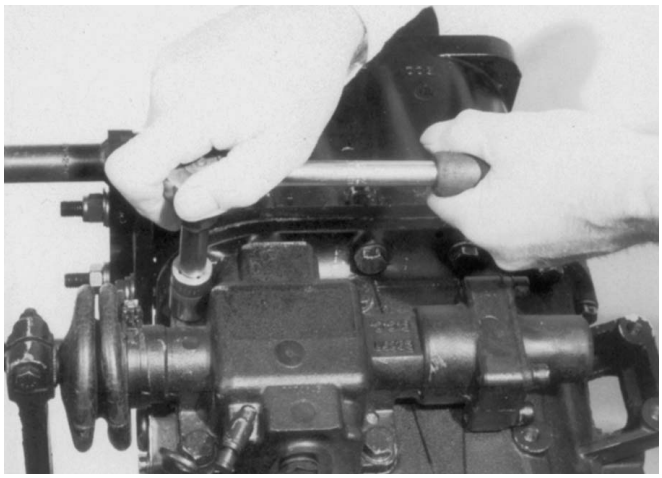
1. Lift up the gearbox using a hoist.
Install the unit on stand **N° 002.**
Use tool **N° 003.**



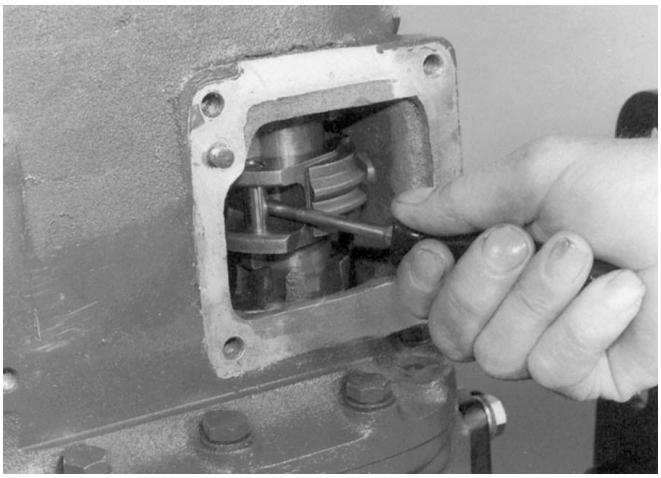
4. Using a flange-holding wrench, remove the output drive flange retaining nut.
Use tool **N° 004.**



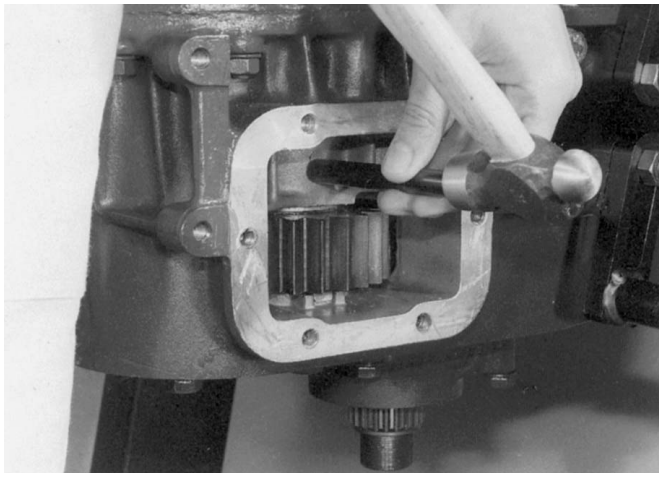
5. Remove the output drive flange, using a suitable puller, if necessary. DO NOT use a hammer as there is risk of damaging the flange.
Use tool **N° 005.**



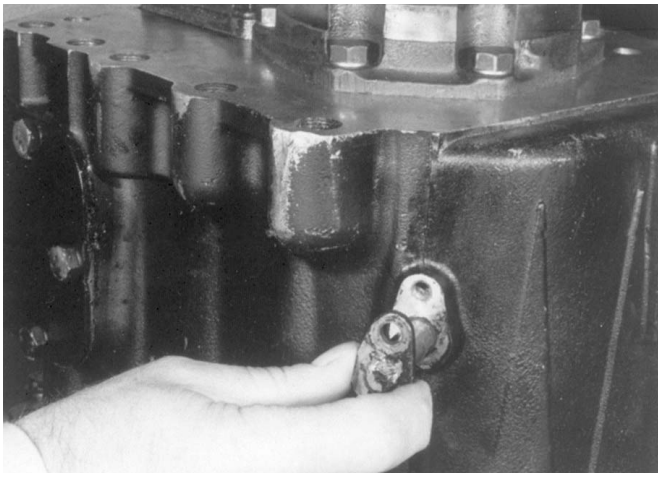
6. Ensure that neutral is engaged, then remove the remote control housing bolts. Use a soft-faced mallet to separate the housing from the gearbox.



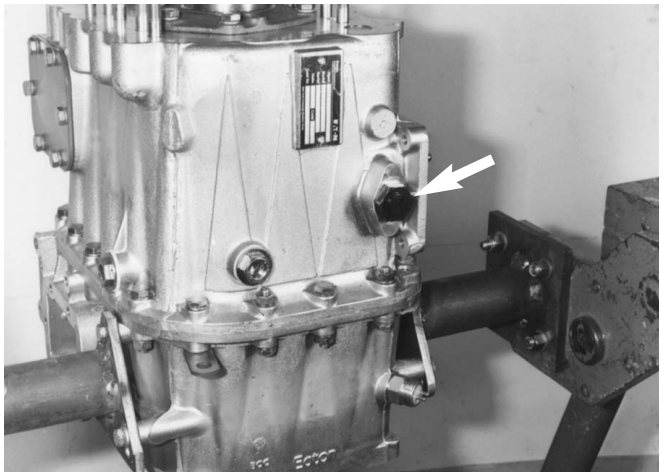
9. Rotate the gear selector shaft anticlockwise (vertical mounting) or clockwise (horizontal mounting) to prevent the casing from fouling the selector block upon removal.



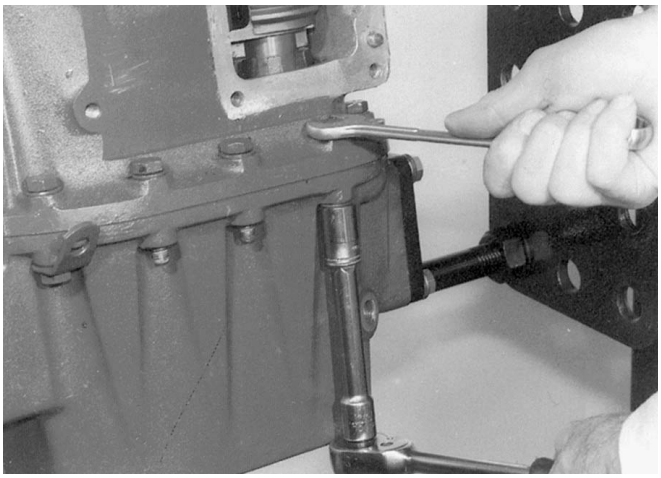
7. Remove the rear PTO cover. Using an 8 mm punch, drive the reverse idler shaft grooved pin INWARDS until the end is approximately 12 mm below the face of the hole. Do not allow the pin to "bottom" against the shaft bore.



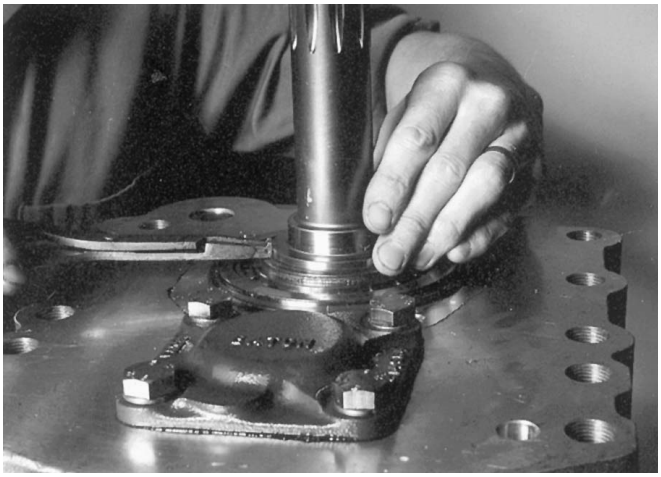
9A. On overdrive models, unscrew the cap screws retaining the two overdrive fork pivot pins and remove the pins.



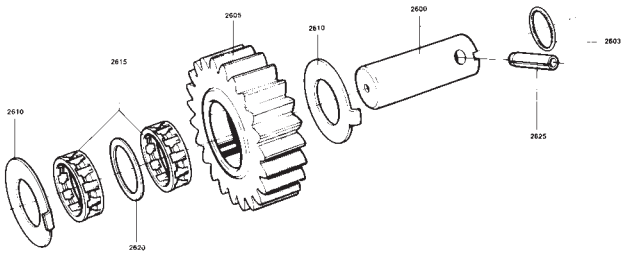
8. Remove the gear selector shaft detent plunger.



10. Remove the half-casing flange cap screws and nuts. Note down the position of the shorter cap screws fitted in the casing.

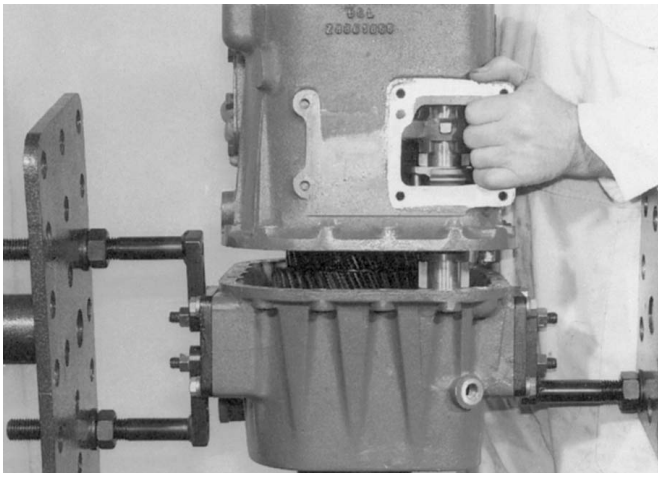


11. Remove the cap screws securing the input shaft cover and remove the cover. Remove the outer circlip from the input shaft bearing.

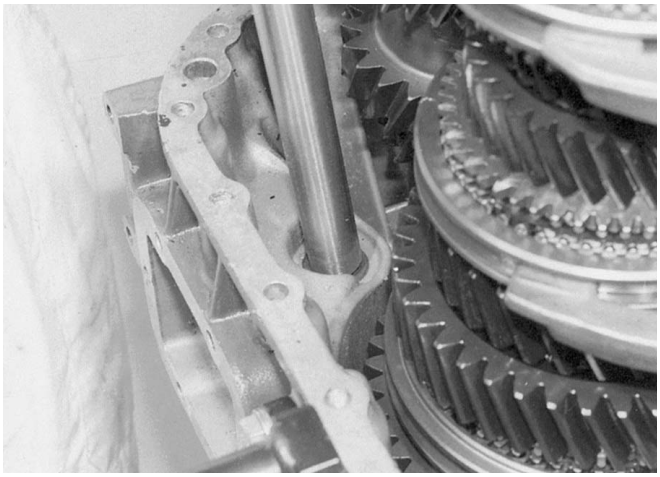


Sequence N°	Description
2600	Reverse idler gear shaft
2603	O-ring
2605	Reverse idler gear
2610	Thrust washer
2615	Needle roller bearing
2620	Spacer
2625	Pin

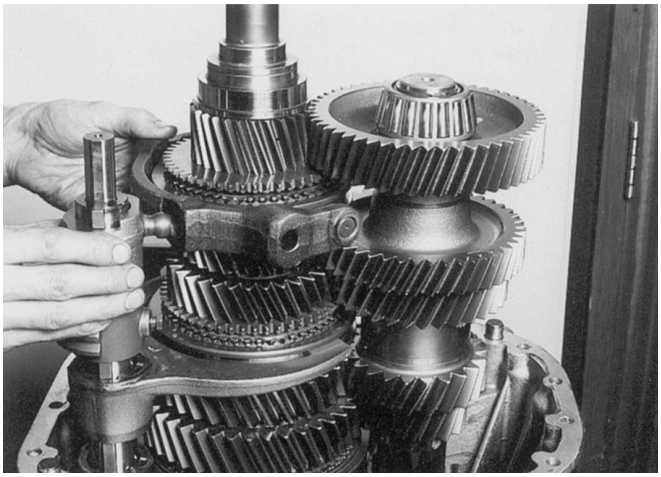
Reverse idler gear assembly.



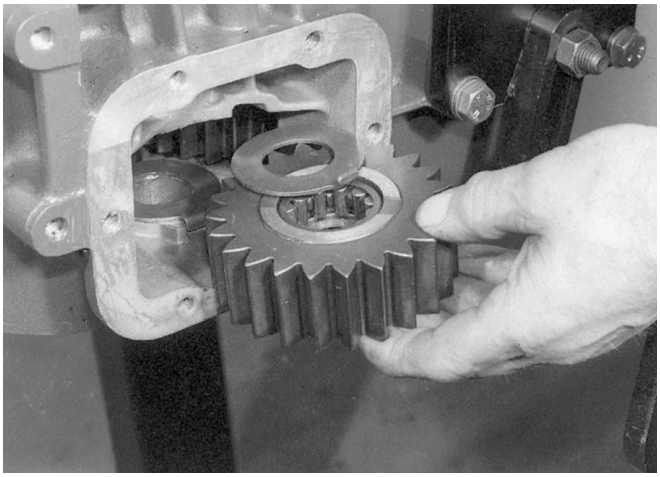
12. Using a soft metal mallet, break the seal and separate the front half-casing from the rear half-casing. DO NOT USE PRY BARS OR CHISELS. Lift off the front half-casing, leaving the input shaft, complete with bearing, in place.



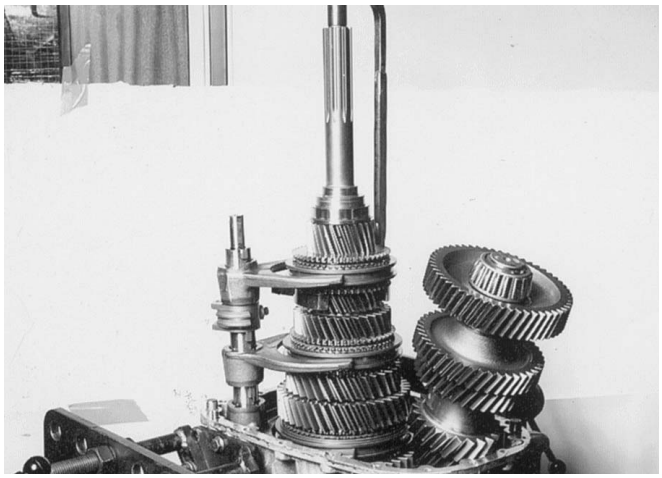
14. Using a sufficiently long drift, drive out the reverse idler gear shaft and expansion plug from the casing.



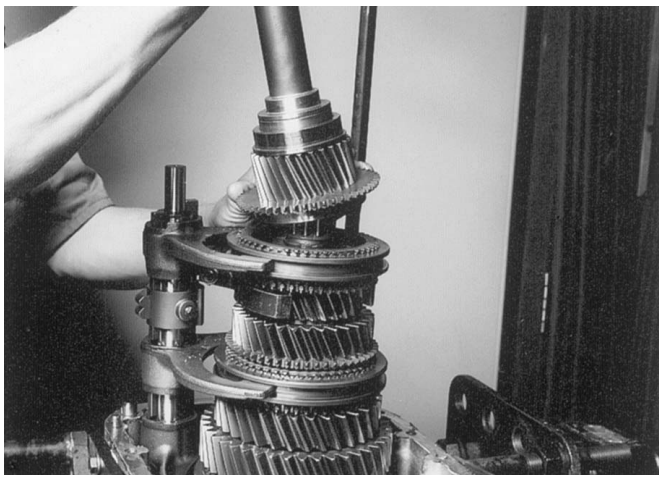
13. On overdrive models, disengage and remove the overdrive fork and pads.



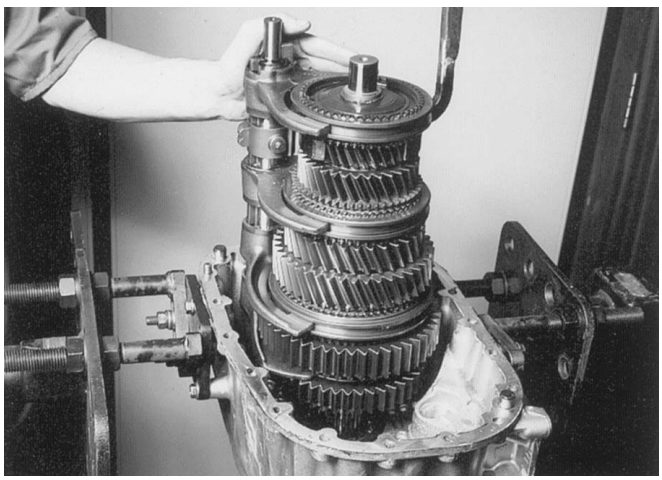
15. Remove the reverse idler gear and the thrust washers. Remove the bearings and spacers from the gear and the O-ring from the shaft.



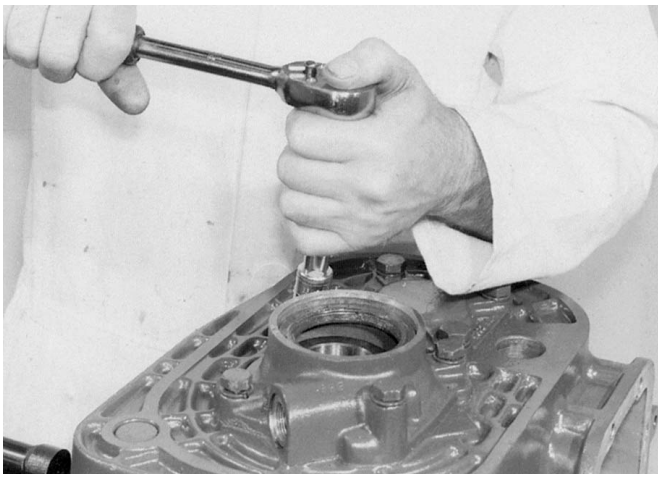
16. Mount the special lifting tool on the main shaft under the 5th/6th speed synchronizer. Lift up the shaft by approximately 20 mm. This allows the layshaft to be lifted clear. Use tool **N° 006.**



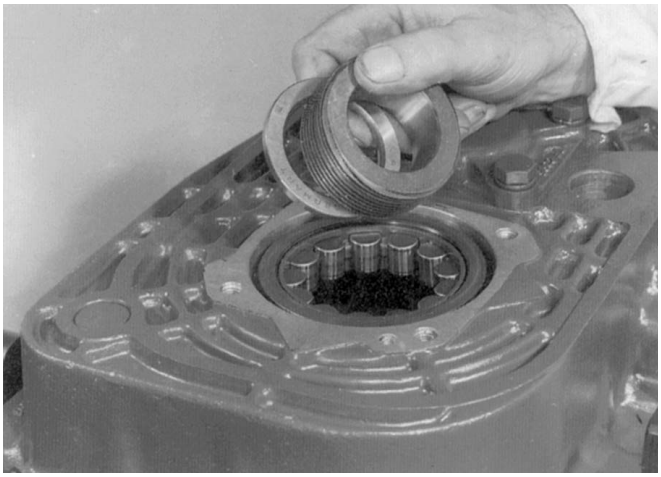
17. Lift off the input shaft complete with the 6th speed flange. Lift out the layshaft. Remove the 6th speed synchronizer ring.



18. Raise the hoist and lift out the main shaft/selector shaft/forks assembly. Carefully lower the assembly onto a clean bench and withdraw the special tool. Separate the selector shaft and forks from the main shaft.

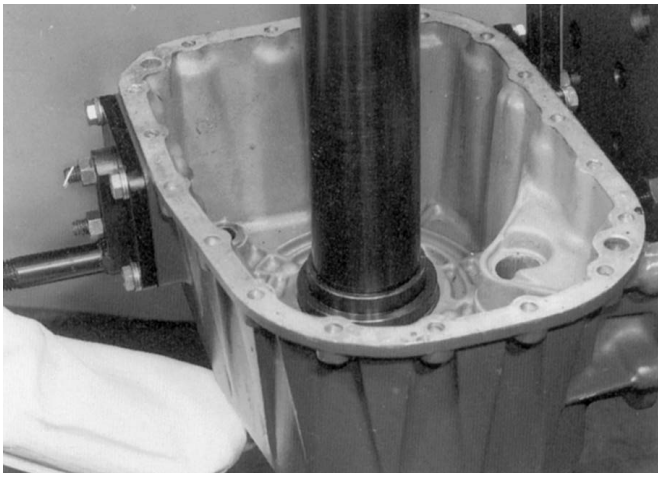


19. Reverse the position of the rear half-casing on the stand and remove the cap screws securing the speedometer housing. Note down the positions of the different length cap screws. Remove the housing. If necessary, drive out the oil seal.

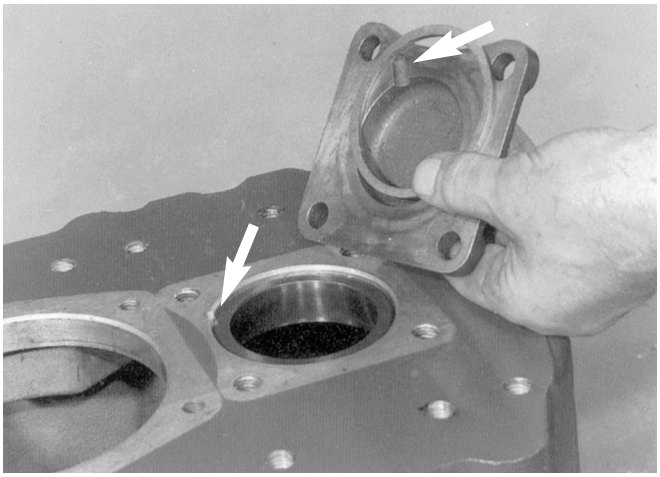


20. Remove the speedometer drive pinion or tachograph rotor and the bearing spacer from the rear half-casing.

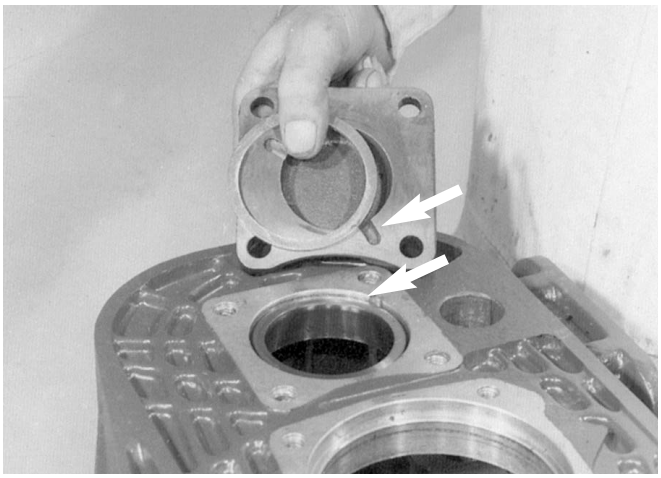
23. Drive out the outer cup from the layshaft rear bearing. Use tool **N° 007.**



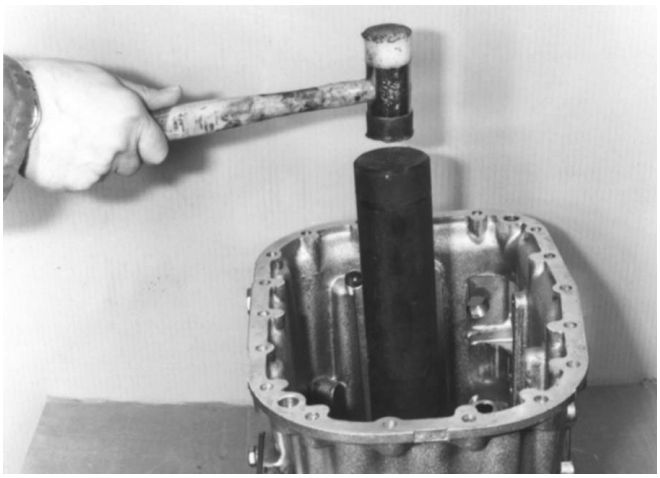
21. Reverse the position of the casing on the stand and, using the special tool, drive out the rear bearing from the main shaft. Do not allow the bearing to fall onto the floor.



24. Remove the front bearing retaining plate from the layshaft and the graded-fit spacer from the front half-casing. Drive out the front bearing from the layshaft, using the special tool.
Use tool **N° 007.**

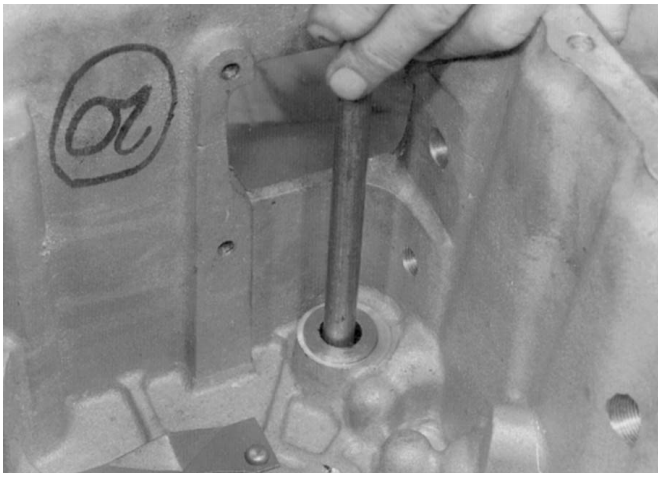


22. Reverse the position of the casing on the stand and remove the layshaft rear bearing cover and bearing spacer.

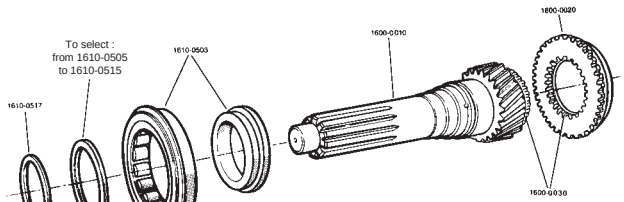


25. Drive out the front bearing from the main shaft. Use a tube.

B. Input shaft disassembly

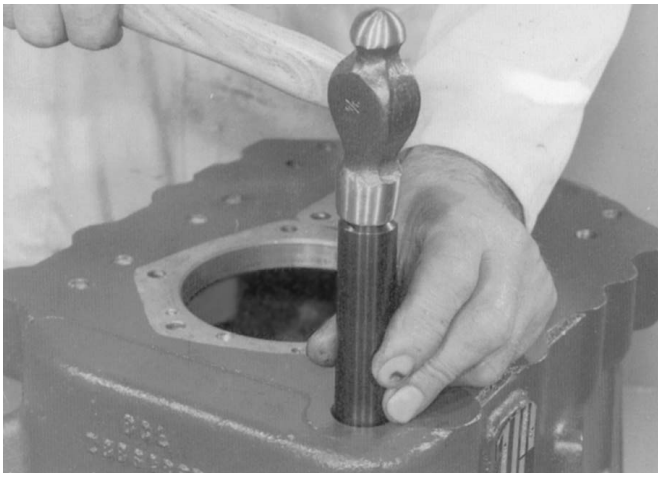


26. If necessary, to replace the selector shaft bushes, drive the selector shaft bore blanking plugs outwards from the half-casings.



Sequence N°	Description	Sequence N°	Description
1600-0010	Input shaft	1610-0509	Spacer 3.80 mm
1600-0020	Synchro flange	1610-0511	Spacer 3.85 mm
1600-0030	Loctite 648	1610-0513	Spacer 3.90 mm
1610-0503	Roller bearing	1610-0515	Spacer 3.95 mm
1610-0505	Spacer 3.70 mm	1610-0517	Circlip
1610-0507	Spacer 3.75 mm		

Input shaft
For replacement only
Remove the synchronizer flange (see page 4/12).



27. Reverse the position of the half-casings and, using the special tool or a suitable mandrel (25 mm in diameter), push the selector shaft bushes out of the casings.

1. If necessary:
Remove the bearing cage.

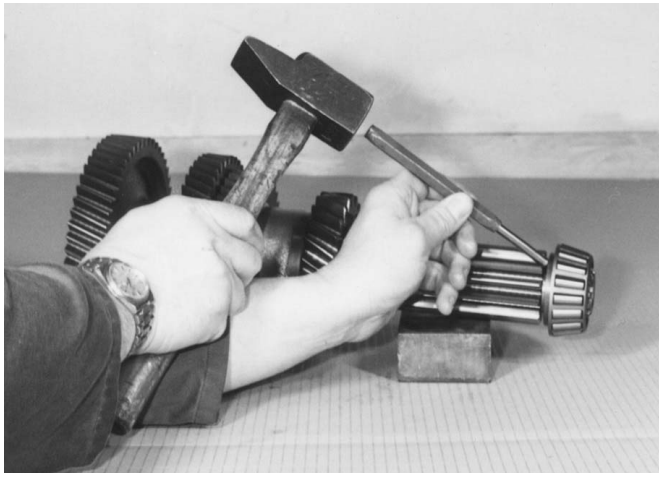
C. Input shaft reassembly

Note: Heat the bearing cage at a uniform temperature of approximately 85 °C (180 °F) prior to assembly. This will greatly ease assembly and, in most cases, the bearing cage will be able to be slid over the shaft without forcing.
In the event of removal:
Install the synchronizer flange (see page 4/12).

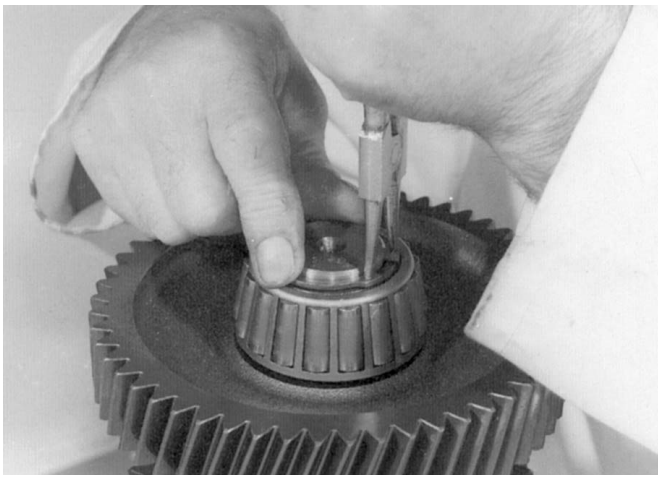
In the event of removal:
Install the bearing cage.

D. Layshaft disassembly

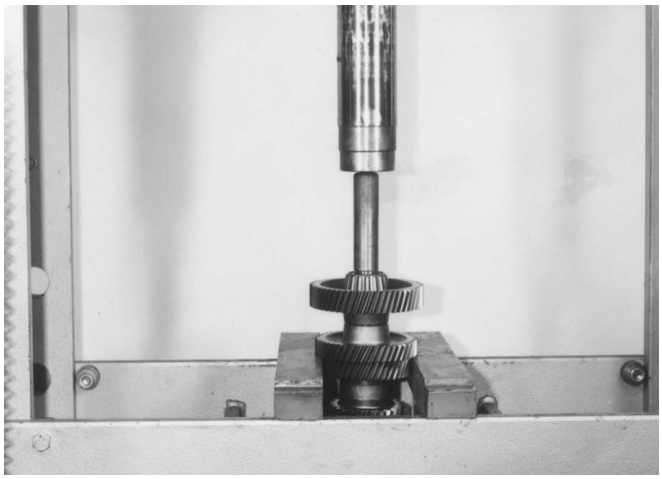
Note: To disassemble the gears on the layshaft, a 30/50 tonne hydraulic press will be required. In-service, it is only possible to replace the driving and 5th speed gears.



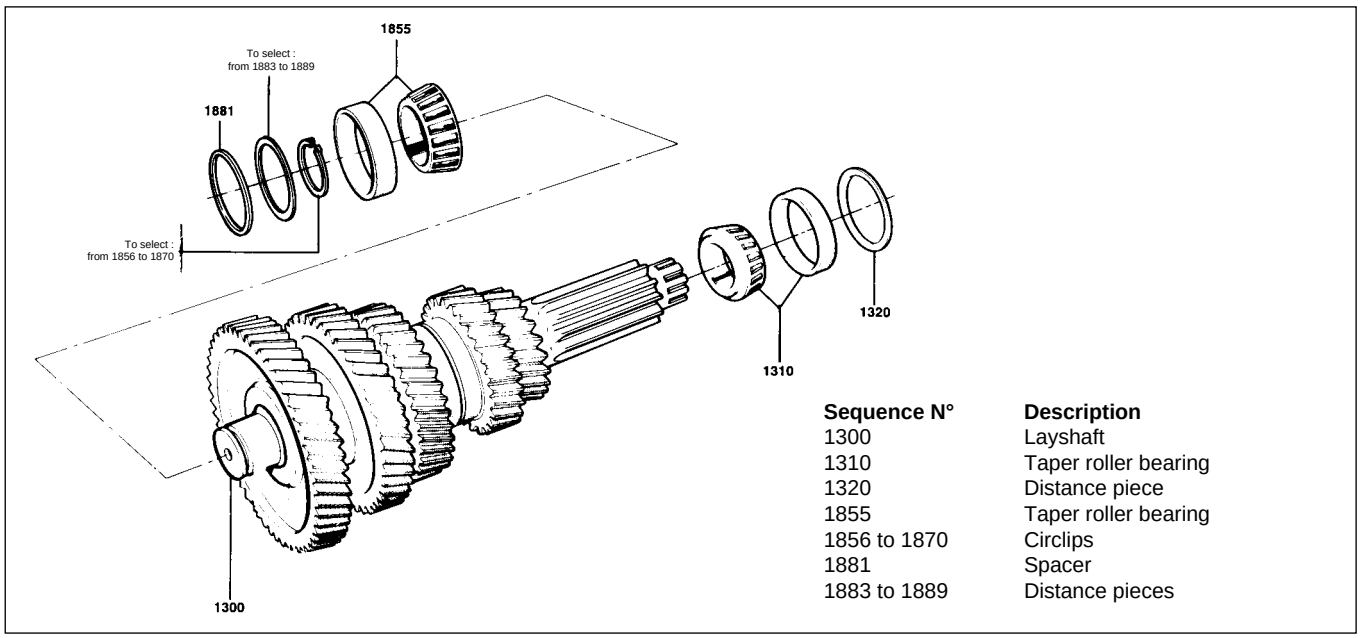
2. If necessary, remove the bearing.



1. Support the shaft assembly and removes the graded-fit circlip retaining the front taper roller bearing.



3. For replacement only:
Remove the 5th speed gear/bearing assembly.

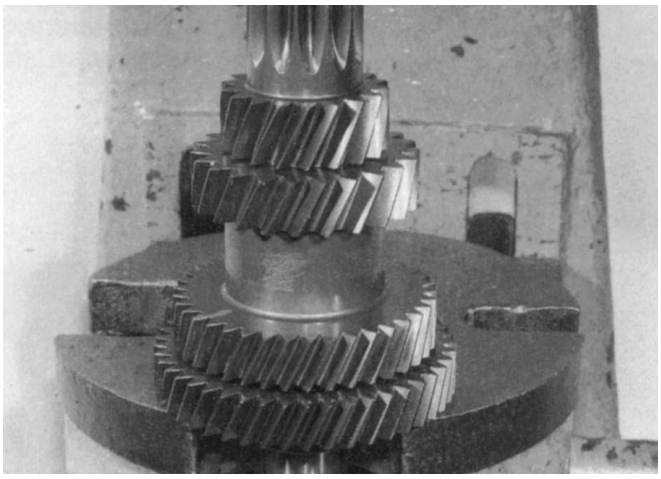


Sequence N°	Description
1300	Layshaft
1310	Taper roller bearing
1320	Distance piece
1855	Taper roller bearing
1856 to 1870	Circlips
1881	Spacer
1883 to 1889	Distance pieces

Layshaft assembly

E. Layshaft reassembly

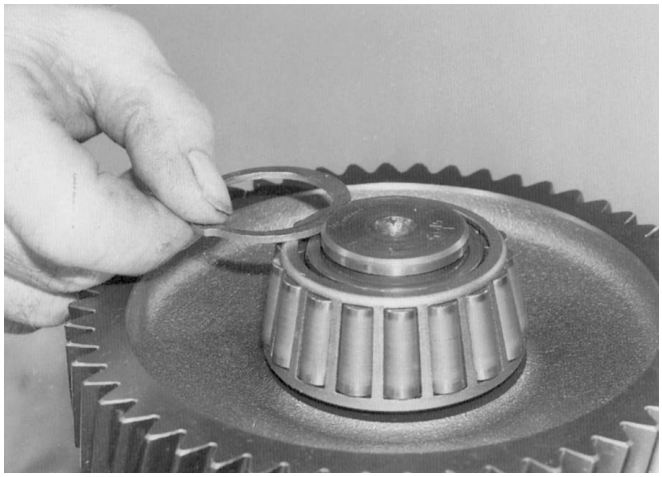
Note: During reassembly, in order to maintain the proper interference fit, it is necessary to chill the shaft body and any gears remaining attached to it at a temperature of - 10 °C (15 °F) and, at the same time, to heat the new gearwheels at a temperature of 150 °C (300 °F) before **quickly** press fitting the shaft. When pressing the shaft into the gears, the pressing operation must not be stopped once it has been begun until the gears are completely and firmly installed on the shaft. If two gears are being fitted, they should be pressed over the shaft separately and as quickly as possible. The assembled shaft and gears must remain under the press, with the appropriate pressure applied, until the temperature has returned to normal (some 10 minutes).



1. Chill the layshaft thoroughly and uniformly in a freezer or suitable refrigerator. Heat the gear(s) thoroughly at a temperature of 150 °C (300 °F). Use a Tempilstick crayon to make sure the gears are at the required temperature.

2. Place the 5th speed gear on the bed of the press. Offer up the layshaft in the gear and press fit the shaft into the gear, without delay. Repeat this operation for the drive pinion. Allow to cool.

3. Heat the layshaft taper roller bearing inner races at a temperature of 85 °C (180 °F). Support the shaft. The forward end facing upwards, and place the heated cone/rollers assembly on the shaft. Use a suitable mandrel to ensure that the bearing is fully home.



4. From the available range of graded-fit circlips, select the one that fits into the groove with the minimum of free play.

Circlips are available in the following sizes:

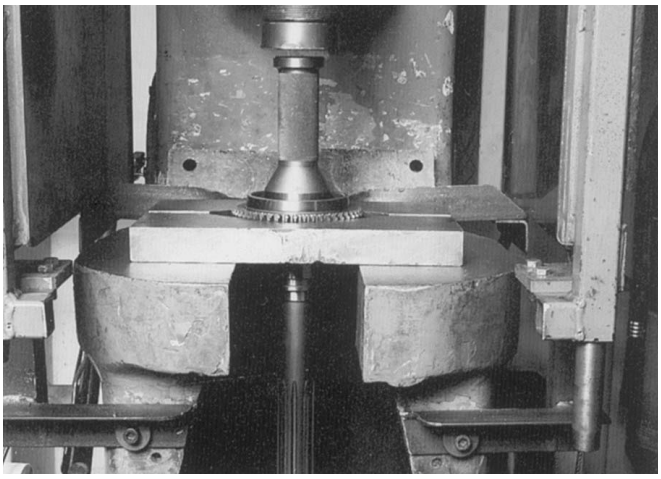
Part N°	Thickness
8870370	2.12
8870371	2.07
8870372	2.02
8871536	1.97
8871537	1.92
8871538	1.87
8871539	1.82
8871540	1.77

Reverse the position of the layshaft and fit the heated rear taper roller bearing inner race on the shaft. Use a suitable mandrel to ensure that the bearing is fully home.

The synchronizer flanges are rendered integral with the gears by the use of Loctite.

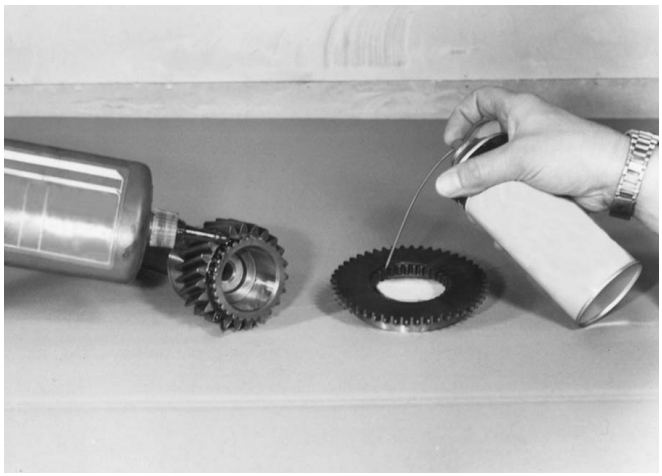
Disassembly

1. Heat the gear/synchronizer flange assembly. This operation softens up the “thread-locking” compound. Remove the flange from the gear.



Note: This also applies to the synchronizer flange of the 6th speed gear on the input shaft. Use a press.

Assembly



1. Apply a thin bead of Loctite 648 to the spline teeth of the gear.
Spray the splines of the synchronizer flange with Loctite T 747 activator.

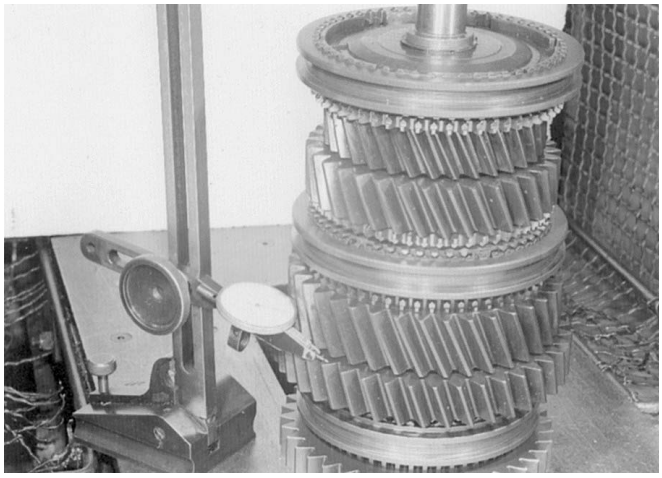
2. Allow the parts to cure for a minimum of two hours.
Note: If the flange is not seated squarely, the procedure must be repeated.

F. Main shaft disassembly

Note: All snap rings and the circlip on the shaft are graded for selective fit. Take care not to score the bearing surfaces of the main shaft when removing the snap rings.
Note: The end float of the gears on the shaft is established during manufacture by machining the components with very tight tolerances. Before disassembly of the main shaft, the end floats should be checked to find out whether they enter within the recommended limits.
Where excessive end float is found, it is necessary to check the gears, main shaft, synchronizer hubs and bearing sleeve for wear. Refer to “Inspection of fast wearing parts” and replace as required.

End float check

End float can be checked with the shaft assembled by using a dial gauge (as shown below).



1. Mount the main shaft assembly vertically on a suitable stand. Position the stylus of the dial gauge on the gear. Zero the gauge. Lift up the gear and record the reading on the dial.

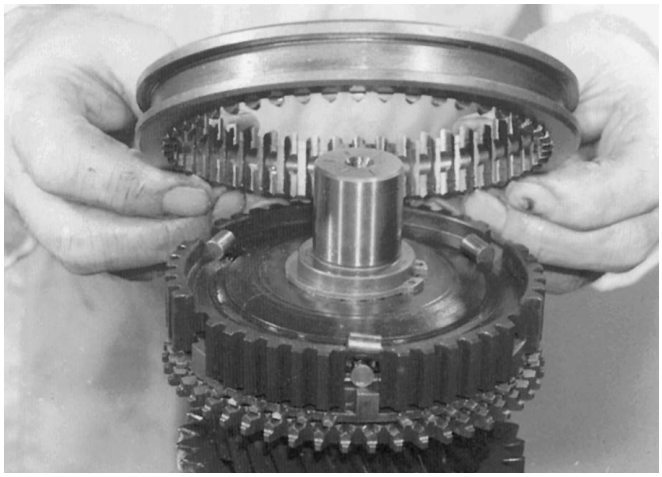
Gear end float

Pinion	5th (6th overdrive)	4th	3rd	2nd	1st
Low limit	0.31	0.35	0.35	0.35	0.40
High limit	0.53	0.48	0.48	0.48	0.57
Range	0.22	0.13	0.13	0.13	0.17

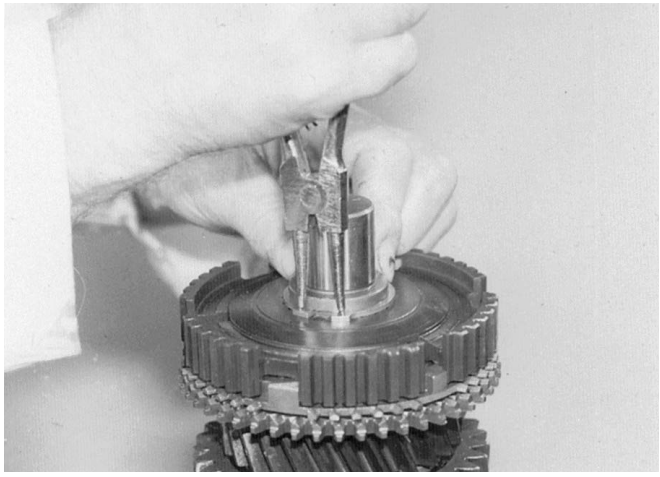
All dimensions in mm.

Note: The reverse gear is a sliding gear.

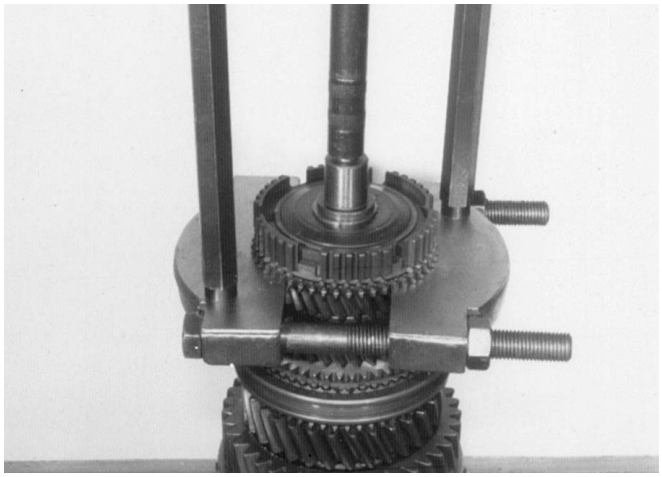
Disassembly



1. Mount the shaft assembly in a vice fitted with soft jaws. Carefully slide the 5th/6th speed synchronizer sleeve upwards until the three rollers are clear of the groove in the sleeve. Remove rollers, sleeve and three plungers and springs from the synchronizer fixed hub.



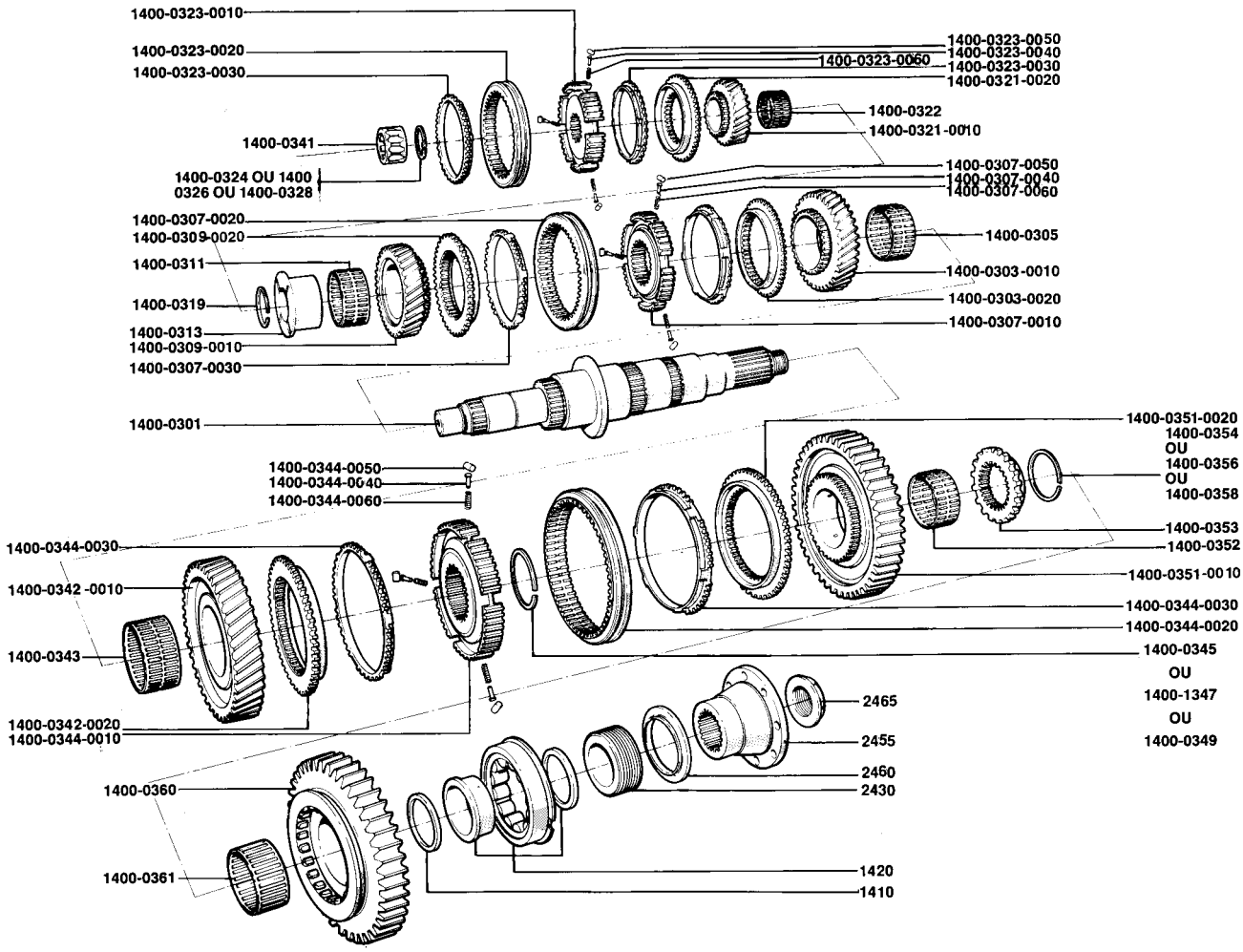
2. Remove the circlip retaining the 5th/6th speed synchronizer hub.



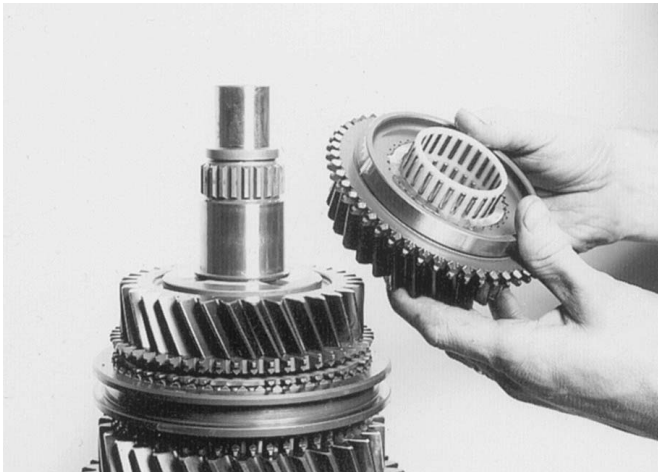
3. Mount the puller over the 5th/6th speed synchronizer hub and the 5th speed synchronizer ring, taking care not to damage the teeth of the ring. Pull off the hub, cone and ring.
(On overdrive models, it may be necessary to engage the puller over the 6th speed gear also).
Use tool **N° 008.**

Main shaft assembly

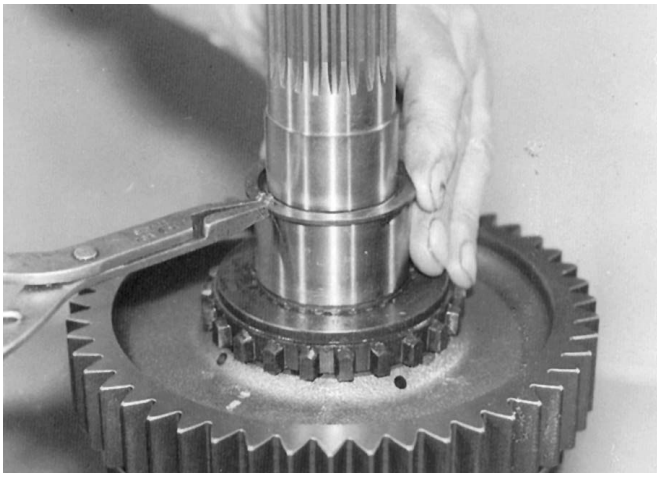
Exploded view



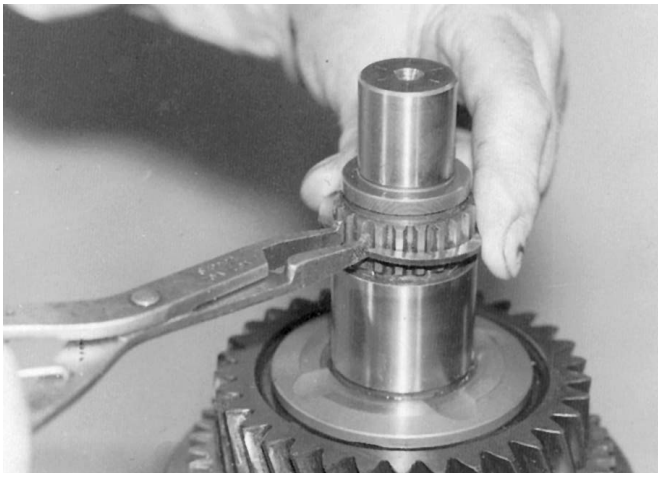
Sequence N°	Description
1400-0301	Main shaft
1400-0303-0010	3rd speed gear
1400-0303-0020	Synchro flange
1400-0303 0010	3rd speed gear (B ratio)
1400-0303-0030	Loctite 648
1400-0305	Needle roller bearing
1400-0307-0010	Fixed hub
1400-0307-0020	Sliding sleeve
1400-0307-0030	Synchro ring
1400-0307-0040	Plunger
1400-0307-0050	Roller
1400-0307 0060	Synchro spring
1400-0309-0010	4th speed gear
1400-0309-0020	Synchro flange
1400-0309-0010	4th speed gear (B ratio)
1400-0309-0030	Loctite 648
1400-0311	Needle roller bearing
1400-0313	4th gear bearing sleeve
1400-0319	Circlip 2.00 mm
1400-0321-0010	5th speed gear
1400-0321-0020	Synchro flange
1400-0321-0010	Overdrive gear
1400-0322	Needle roller bearing
1400-0323-0010	Fixed hub
1400-0323-0020	Sliding sleeve
1400-0323-0030	Synchro ring
1400-0323-0040	Plunger
1400-0323-0050	Roller
1400-0323-0060	Synchro spring
1400-0324	Circlip 2.12 mm
1400-0326	Circlip 2.07 mm
1400-0328	Circlip 2.02 mm
1400-0341	Needle roller bearing
1400-0342-0010	2nd speed gear
1400-0342-0020	Synchro flange
1400-0342-0030	Loctite 648
1400-0343	Needle roller bearing
1400-0344-0010	Fixed hub
1400-0344-0020	Sliding sleeve
1400-0344-0030	Synchro ring
1400-0344-0040	Plunger
1400-0344-0050	Roller
1400-0344-0060	Synchro spring
1400-0345	Circlip 2.10 mm
1400-0347	Circlip 2.05 mm
1400-0349	Circlip 2.00 mm
1400-0351-0020	Synchro flange
1400-0351-0010	1st speed gear
1400-0352	Needle roller bearing
1400-0353	Reverse fixed hub
1400-0354	Circlip 2.10 mm
1400-0356	
1400-0358	Circlip 2.05 mm
1400-0360	Circlip 2.00 mm
1400-0361	Needle roller bearing
1410	Spacer
1420	Roller bearing
2430	Speedometer drive pinion
2455	Coupling flange
2460	Grit shield
2465	Nyloc nut M33



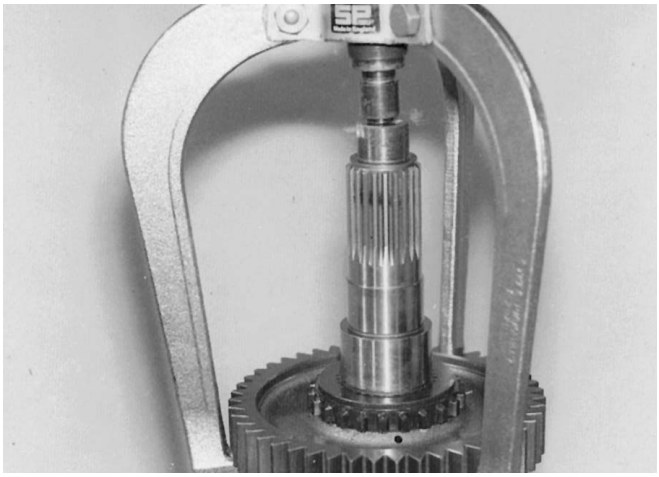
4. Lift off the 5th speed gear and the 5th speed needle roller bearing.
(On overdrive models, this will be the 6th speed gear).



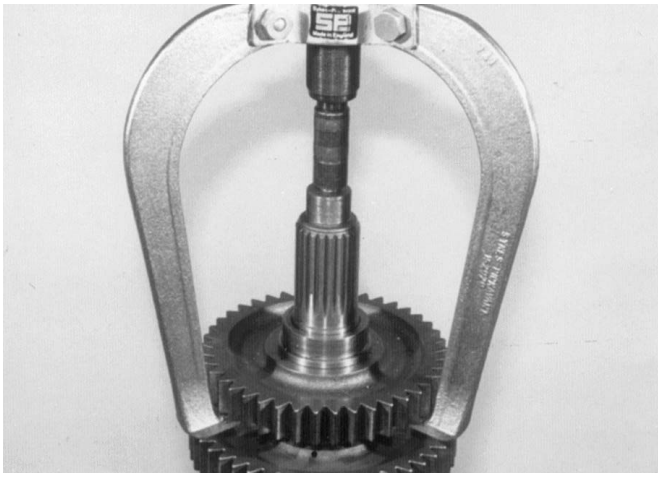
7. Remove the snap ring retaining the reverse gear fixed hub.



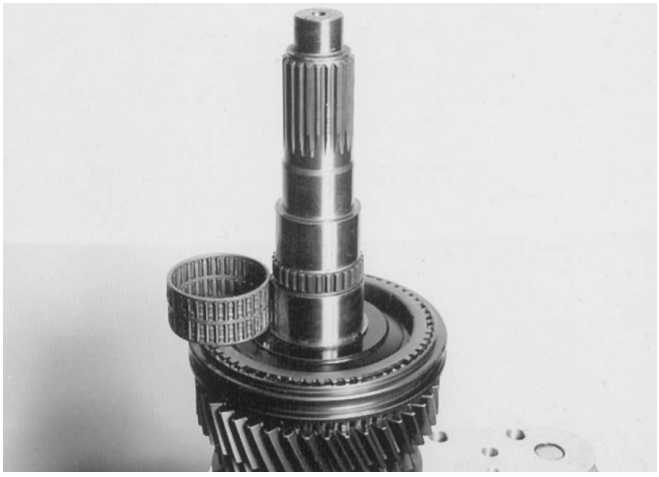
5. Carefully remove the snap ring retaining the 4th speed bearing sleeve.



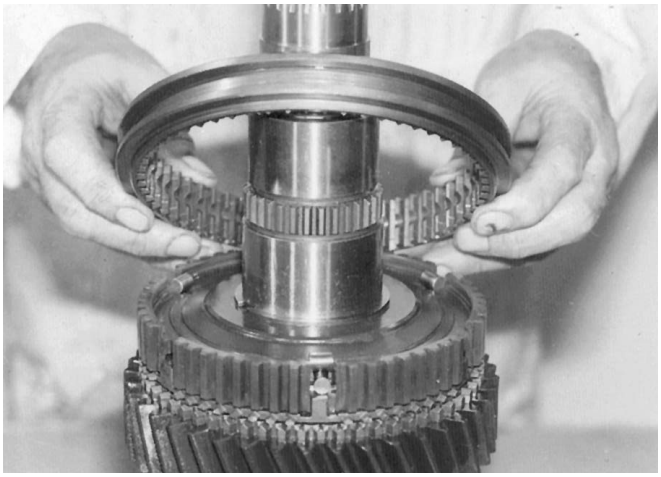
8. Using a vice or a suitable puller, pull off the 1st speed gear and the reverse gear fixed hub. Use tool **N° 009.**



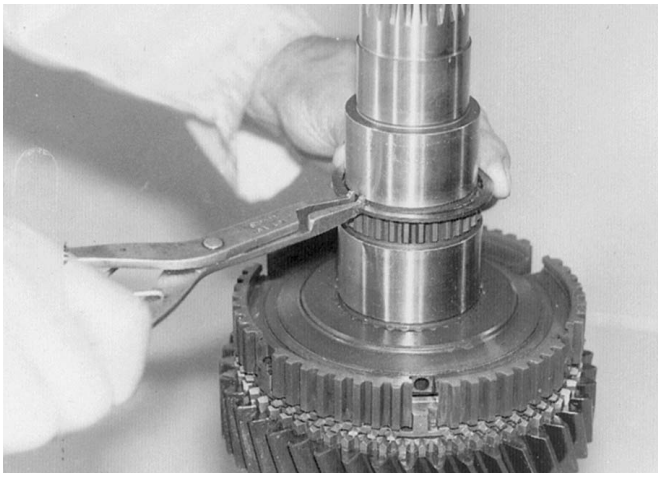
6. Reverse the position of the shaft assembly, hold in a vice and, using a suitable puller placed under the reverse gear, remove the gearwheel, thrust washer and bearing. Remove the reverse gear needle roller bearing. Use tool **N° 009.**



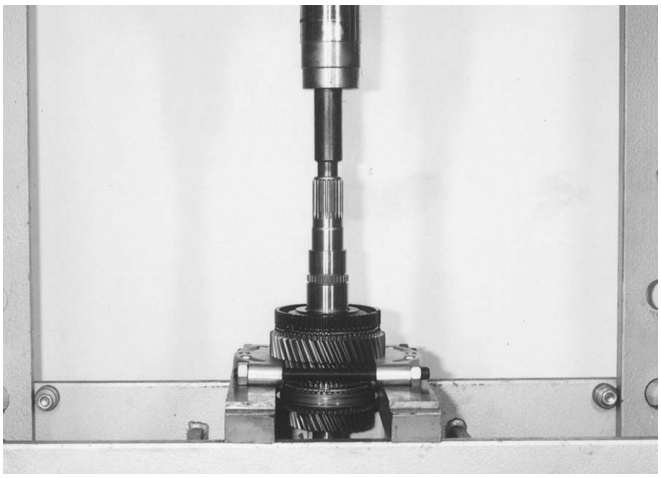
9. Lift out the steel cage bearing and remove the 1st speed synchronizer ring.



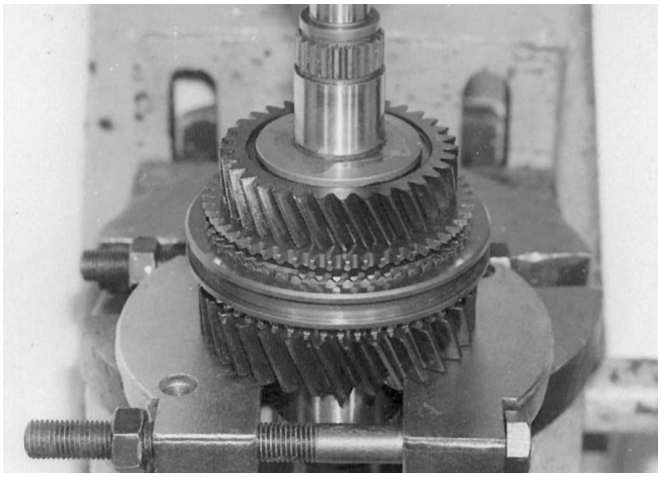
10. Carefully slide the 1st/2nd speed synchronizer ring rearwards until the three rollers are clear of the groove in the sleeve. Remove the rollers, sleeve and three plungers and springs from the synchronizer hub.



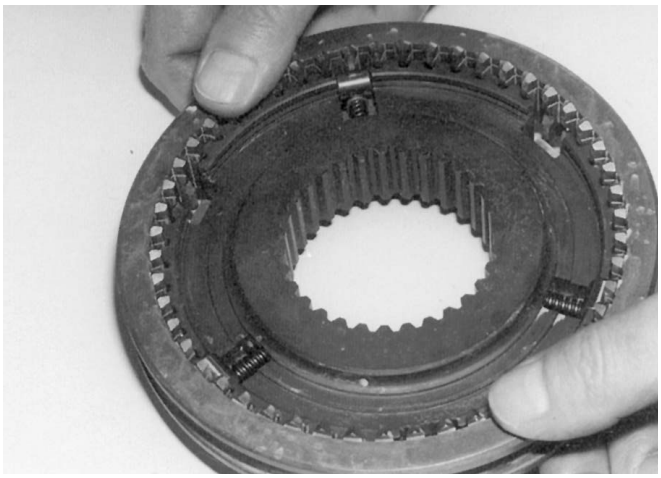
11. Remove the snap ring retaining the 1st/2nd speed synchronizer hub.



12. Mount the puller on the 2nd speed gear and pull off the 2nd speed gear, 2nd speed synchronizer ring and flange, 1st/2nd speed synchronizer hub and bearing.



13. Clamp the shaft in the press, under the 3rd speed gear.
Note: It is vital that the 3rd speed gear is supported and that the flange on the shaft does not foul the supporting blocks or the bed of the press when the shaft is being pushed through. Press or pull the shaft through the 3rd speed gear, 3rd/4th speed synchronizer hub and 4th speed bearing sleeve. Use tool **N° 008.**

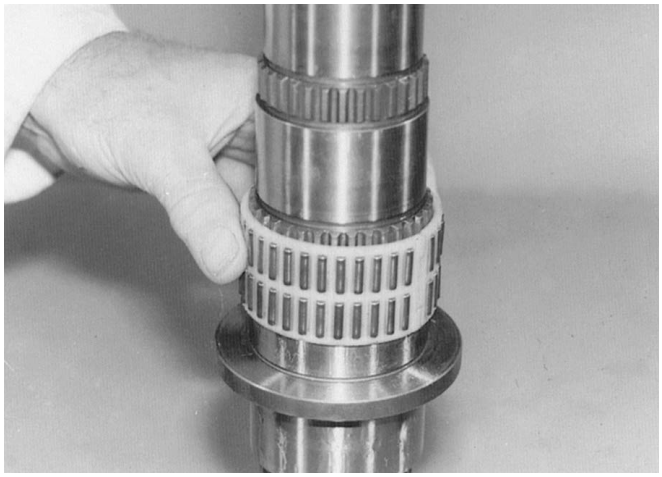


14. Dismantle the 3rd/4th speed synchronizer hub, as previously described in step 1.

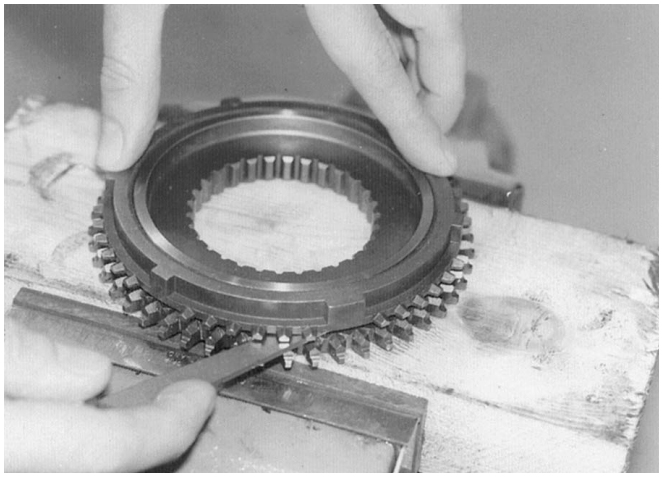
G. Main shaft reassembly

Note: The following parts must be heated at the recommended temperatures prior to assembly. Place the parts on a hotplate or in a temperature-controlled oven for at least 30 minutes to make sure they are thoroughly heated before placing them in position. Once fitted and cooled, the parts will shrink to give an interference fit.

	Sequence N°
4th speed bearing sleeve	1400-0313
Reverse fixed hub	1400-0353
Reverse bearing inner race	1420
Synchronizer hubs (3 off)	1400-0323-0010
	1400-0307-0010
	1400-0344-0010
Recommended temperature	85 °C (180 °F)



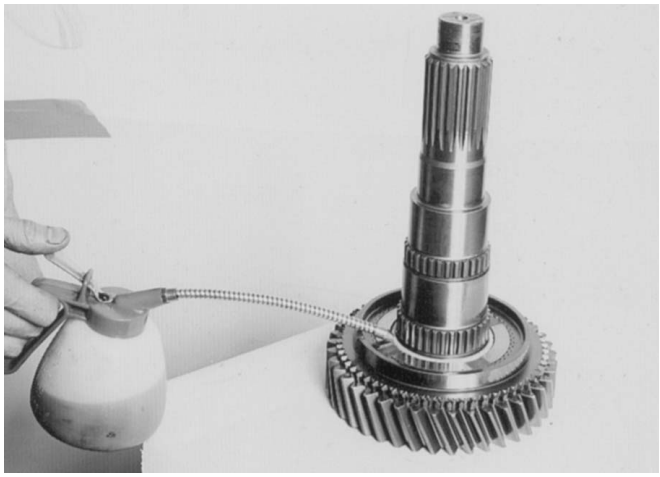
2. Support the main shaft, with the rear end facing upwards. Fit the 2nd speed bearing.



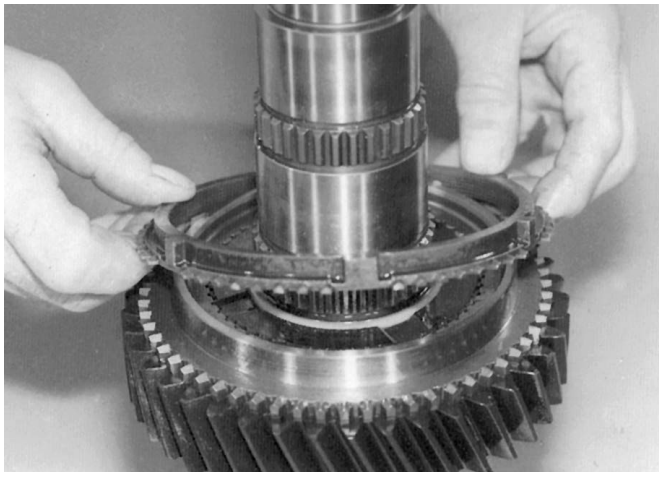
1. Before installing the synchronizer assemblies on the main shaft, check the fit of each synchronizer ring to its synchronizer flange. Place the synchronizer ring on its mating flange and, while holding the two parts firmly together, measure the clearance between the two rings using feeler gauges at several points around the circumference, as shown. The clearance should be between 0.5 and 1.9 mm. Replace both parts if the reading is not within the specified limits. Keep the synchronizer rings and flanges in respective pairs for assembly in the same relative positions.

The synchronizer flanges must be fitted to the gears using Loctite (see page 4/12-1).

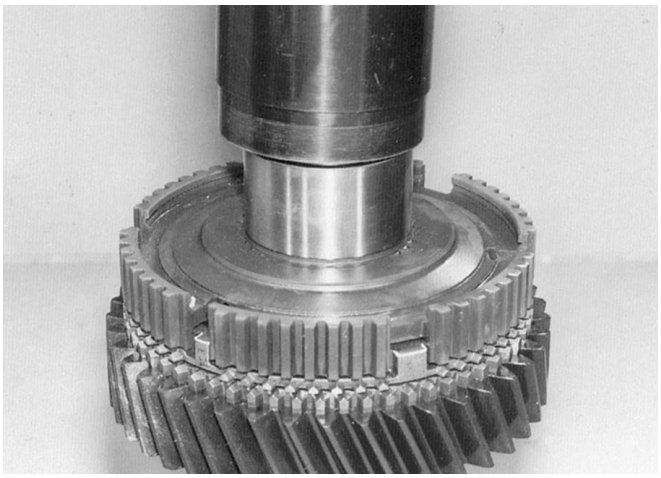
The gearwheel and flange are then treated as a single assembly.



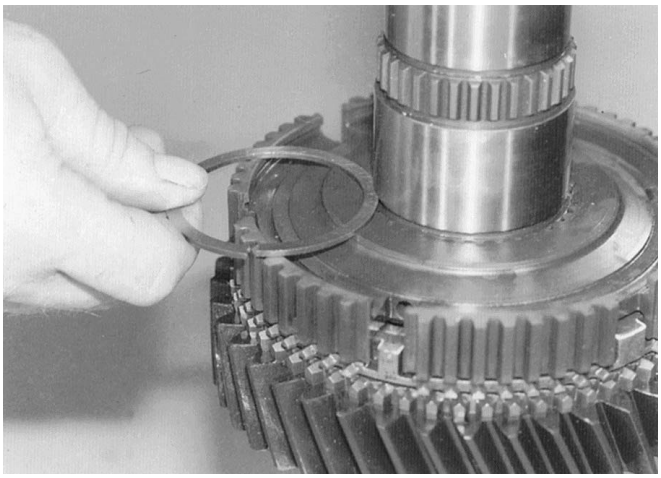
3. Lubricate the bearing with clean oil and slide the 2nd speed gear over the bearing.



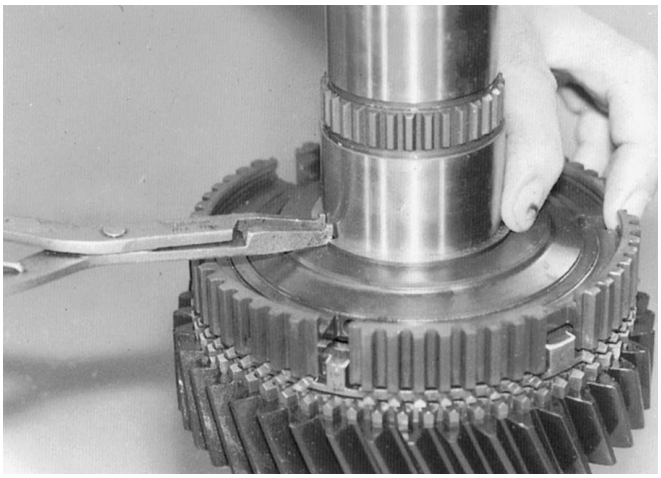
4. Fit the 2nd speed gear/bearing assembly. Then fit the synchronizer ring.



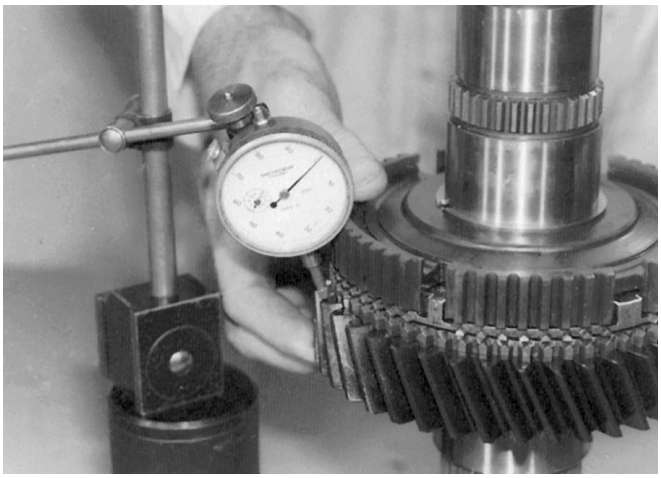
5. Take the heated 1st/2nd speed synchronizer hub and place it over the splines on the main shaft, ensuring that the wide slots in the hub align with the wide shoulders on the synchronizer ring. Allow to cool for 4/5 minutes, then use a soft metal hammer or a suitable mandrel to push the hub fully home.



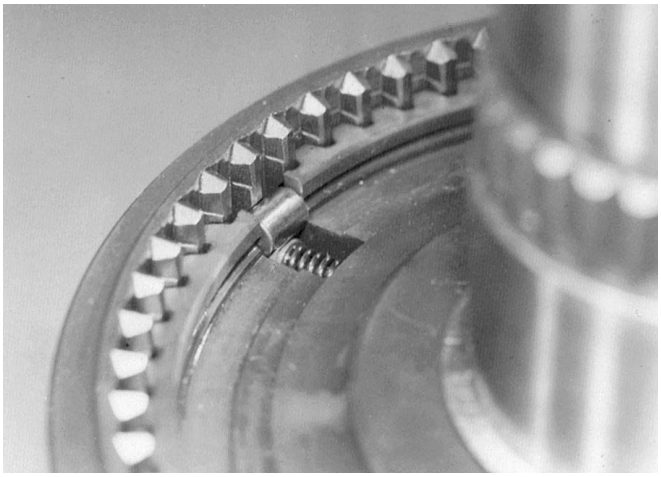
6. From the range of graded-fit snap rings, select the thickest one that fits into the groove with the minimum of free play.



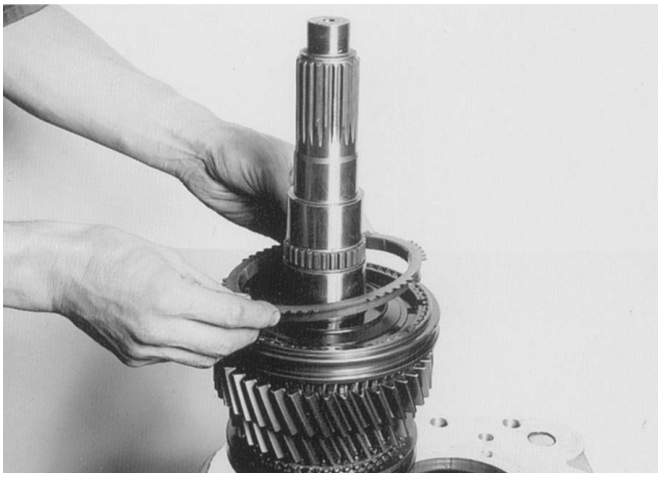
7. Install the snap ring in the groove, taking care not to damage the main shaft bearing surfaces.



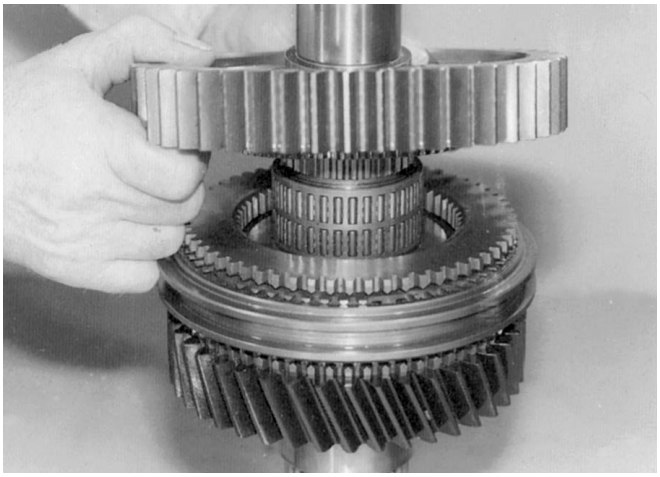
8. Check that the gear end float is within the tolerances stated in the chart.



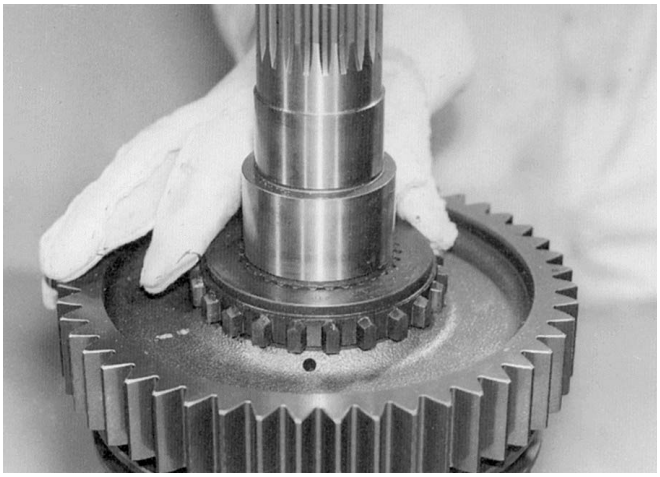
9. Install the three springs and plungers in the synchronizer hub. Place the synchronizer sleeve over the hub and support it, with the internal annular groove just above the hub. Position the three rollers as shown, resting on the heads of the plungers, and press downwards on the sleeve. This compresses the springs, allowing the sleeve to centralize in the neutral position.



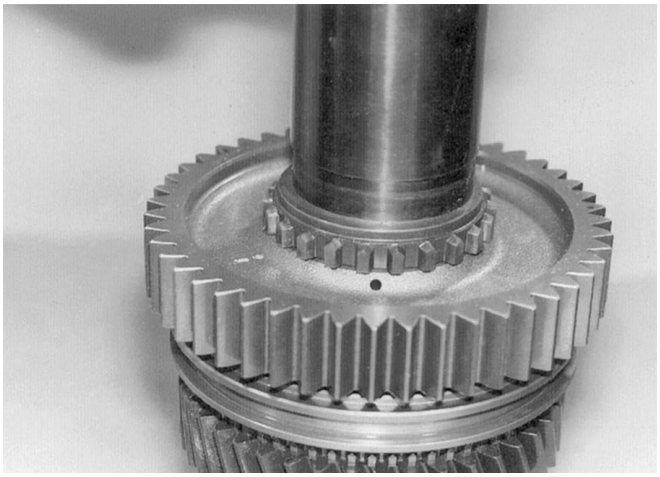
10. Install the 1st speed synchronizer ring on the synchronizer hub.



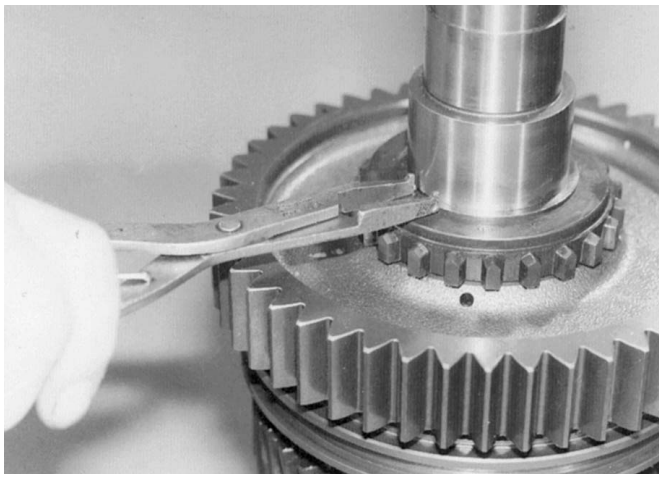
11. Lubricate the 1st speed bearing and install the steel cage bearing in the gear. Place the gear/bearing assembly on the shaft and in the synchronizer ring.



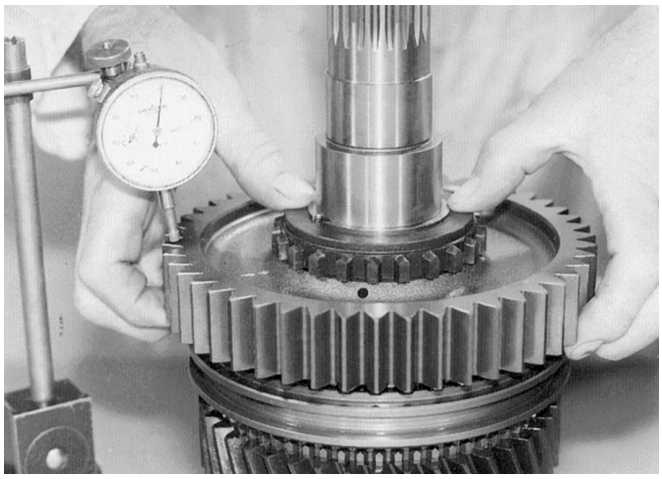
12. Take the heated reverse gear fixed hub and slide it, boss facing upwards, over the splines on the main shaft.



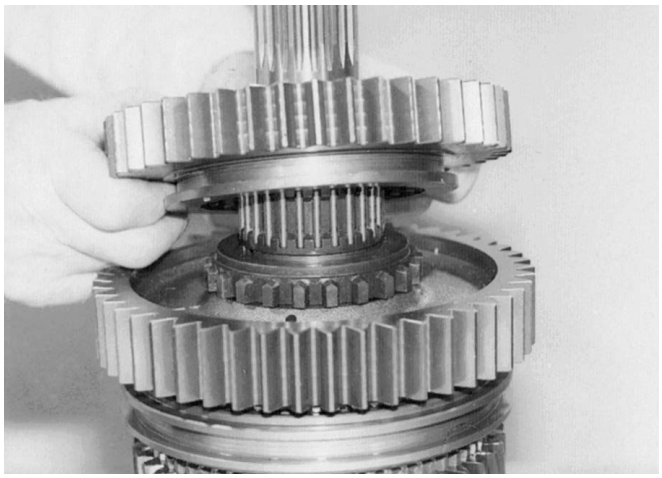
13. Use a soft metal hammer or a suitable flanged mandrel to ensure that the hub is pushed fully home against the shoulder.



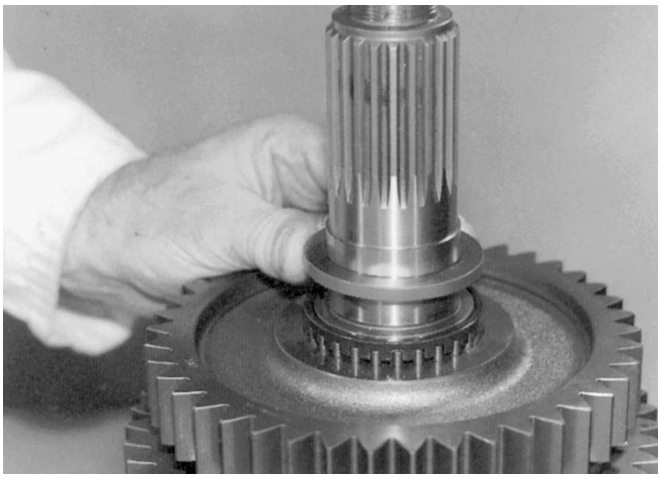
14. From the range of graded-fit snap rings, select the thickest one that fits into the groove with the minimum of free play, taking care not to damage the main shaft bearing surface.



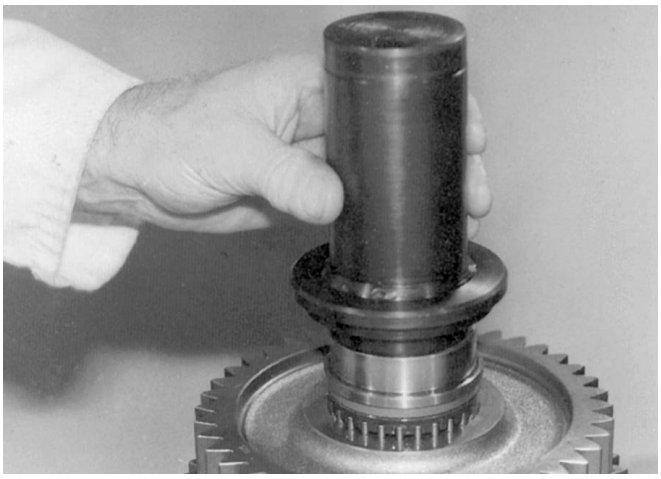
15. Check that the gear end float is within the tolerances stated in the chart.



16. Lubricate the reverse gear bearing and install the bearing and reverse gear on the shaft.

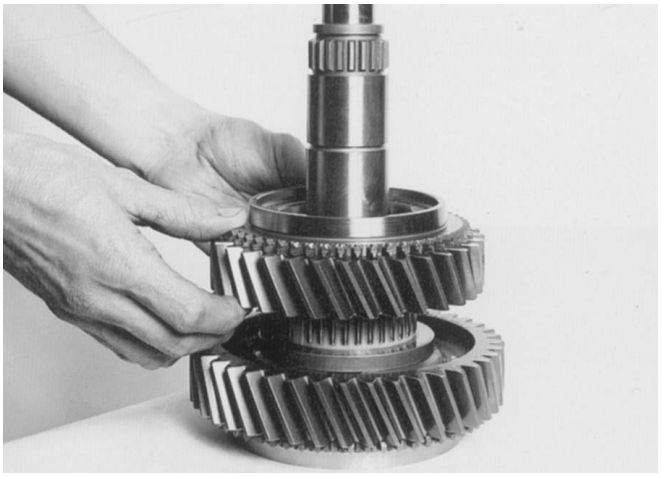


17. Fit the spacer.

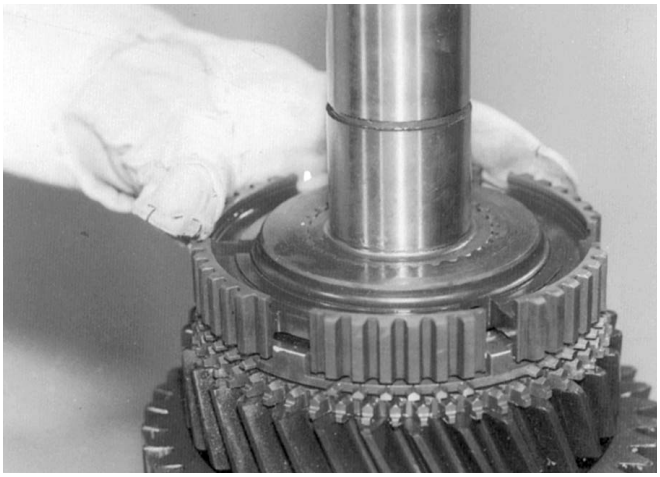


18. Take the heated inner race of the main shaft rear bearing and slide it over the shaft, with the flange facing inwards, against the spacer. Use a soft metal hammer or a suitable flanged mandrel to ensure that bearing hub is pushed fully home against the shoulder.

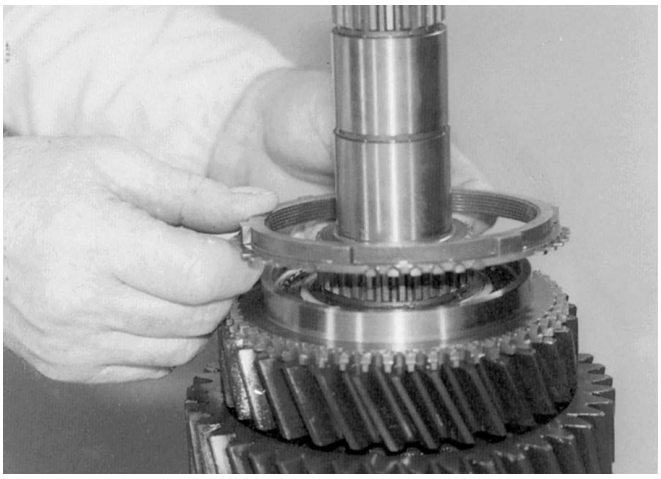
Note: When cooled, the bearing inner race should be sufficiently tight on the shaft to be able to retain the reverse gear on the shaft. Use a tube.



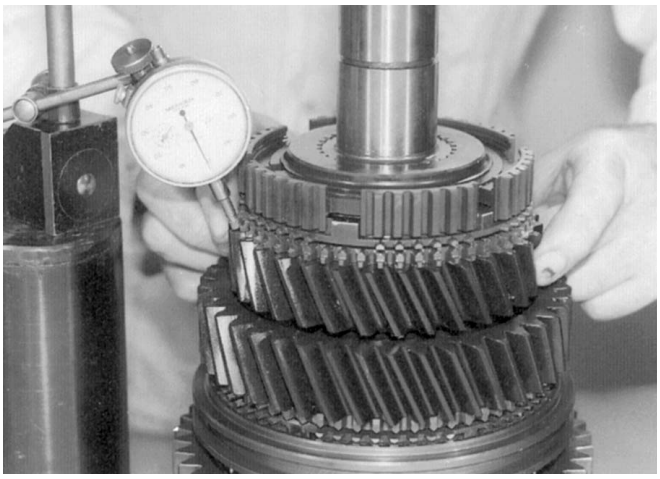
19. Reverse the position of the shaft in a vice. Lubricate and install the 3rd speed bearing and the 3rd speed gear.



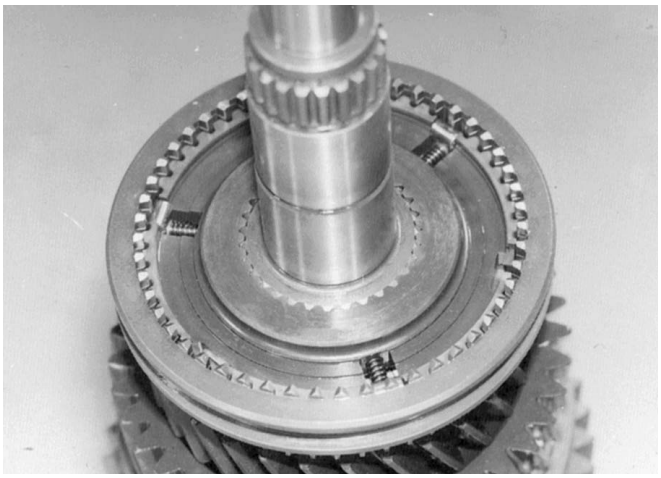
21. Take the heated 3rd/4th speed synchronizer hub and slide it over the splines on the main shaft, ensuring that the wide slots in the hub align with the wide shoulders on the synchronizer ring. Use a soft metal hammer or a suitable mandrel to push the hub fully home. Check again that the shoulders are in the correct slots.



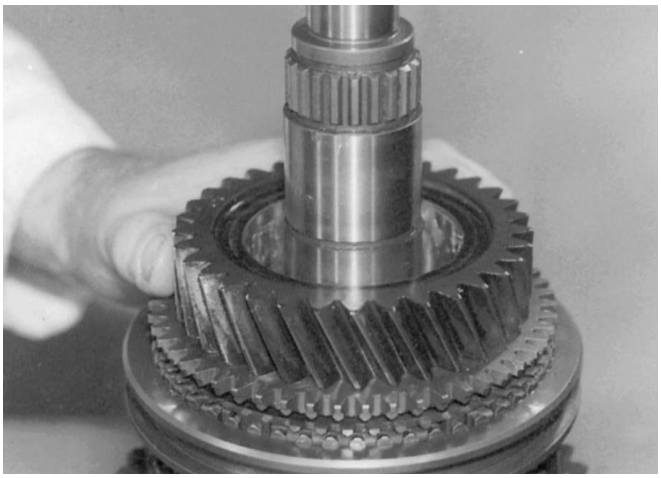
20. Install the 3rd speed synchronizer ring over the flange.



22. Check that the gear end float is within the tolerances stated in the chart.

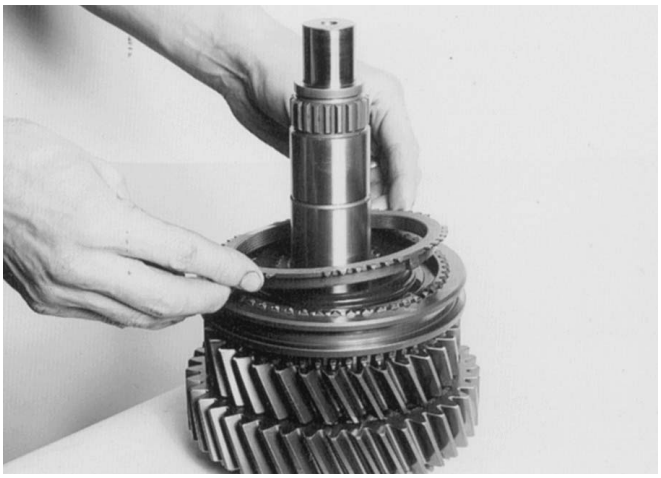


23. Install the three springs and plungers in the synchronizer hub and install the synchronizer sleeve and rollers as described in step 9.

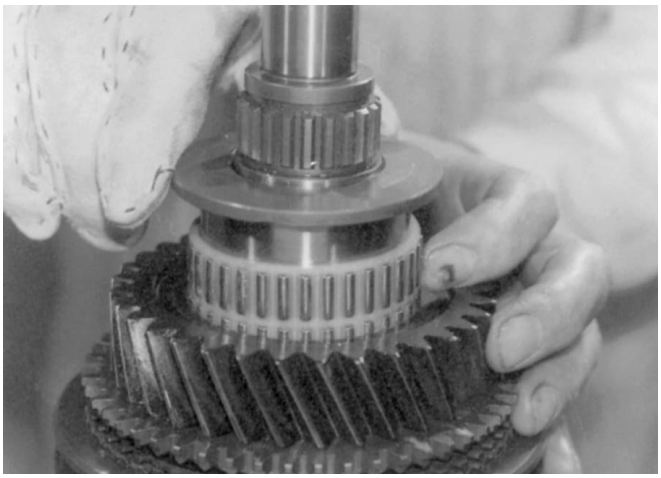


25. Lubricate the 4th speed bearing and position the gear in the synchronizer ring and the bearing in the gear.

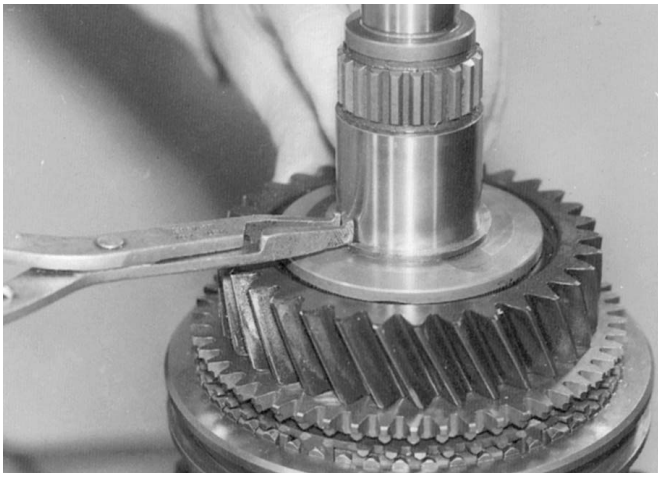
Note: If a smear of petroleum jelly is applied to the outer edge of the bearing, this will support the bearing and it will stand proud of the gear and simplify alignment of the bearing sleeve in the next operation.



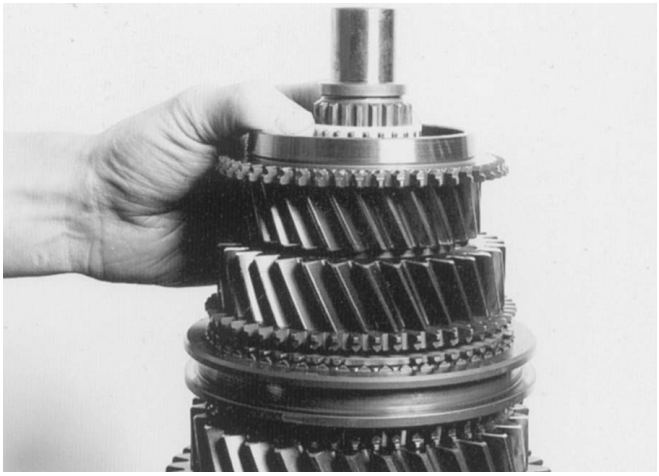
24. Install the 4th speed synchronizer ring on the synchronizer hub.



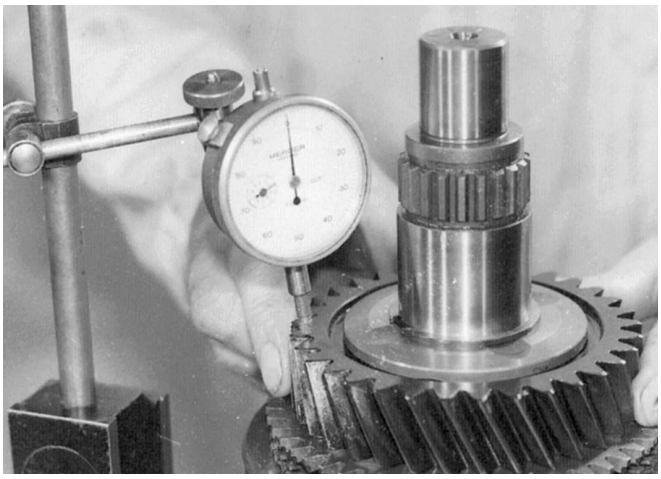
26. Take the heated 4th speed bearing sleeve and place it inside the bearing and over the shaft. Use a soft metal hammer or a suitable flanged mandrel to ensure that the hub is pushed fully home against the synchronizer hub.



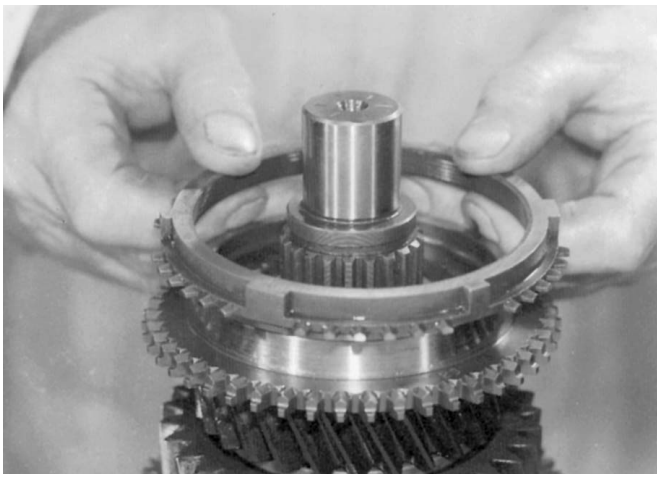
27. Fit a new snap ring in the groove, taking care to not damage the main shaft bearing surface.



29. Lubricate the 5th speed bearing and install the 5th speed bearing and gear on the shaft.

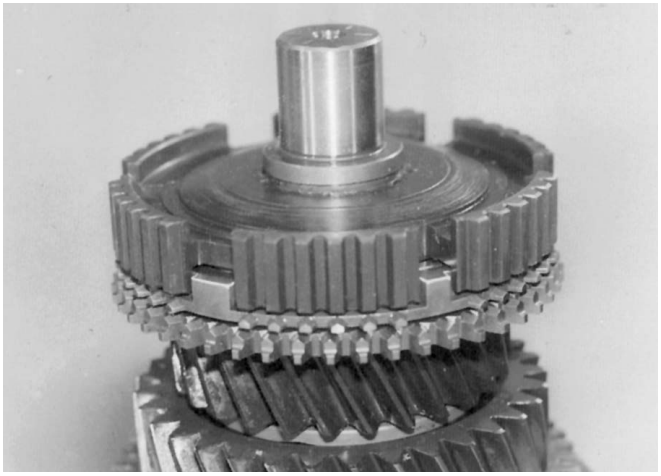


28. Check that the gear end float is within the tolerances stated in the chart.

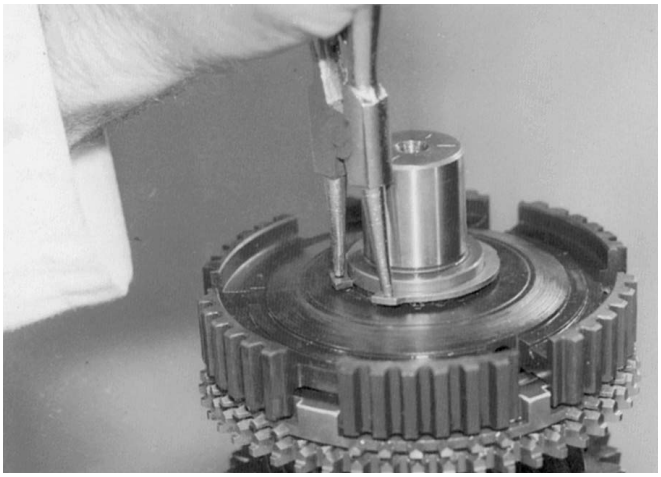


30. Position the 5th speed synchronizer ring on the 5th speed synchronizer flange.

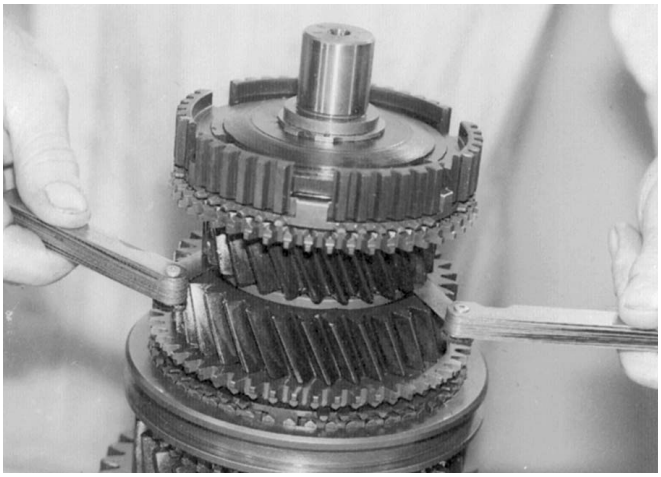
Caution: Take care to use the correct flange when fitting the synchronizer flange to the 5th speed gear. On overdrive models, it is possible to fit the overdrive flange to the 5th speed gear.



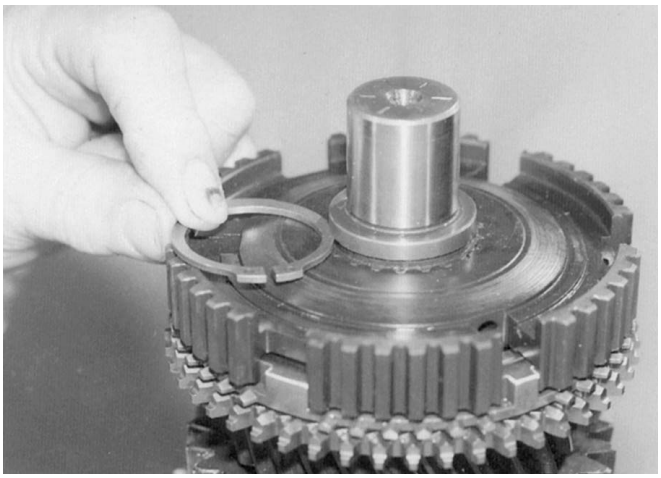
31. Take the heated 5th/6th speed synchronizer hub and slide it, boss facing downwards, over the splines on the main shaft, ensuring that the wide slots in the hub align with the wide shoulders on the synchronizer ring. Use a soft metal hammer or a suitable flanged mandrel, if necessary, to push the hub fully home against the shoulder. Check again that the shoulders are in the correct slots.



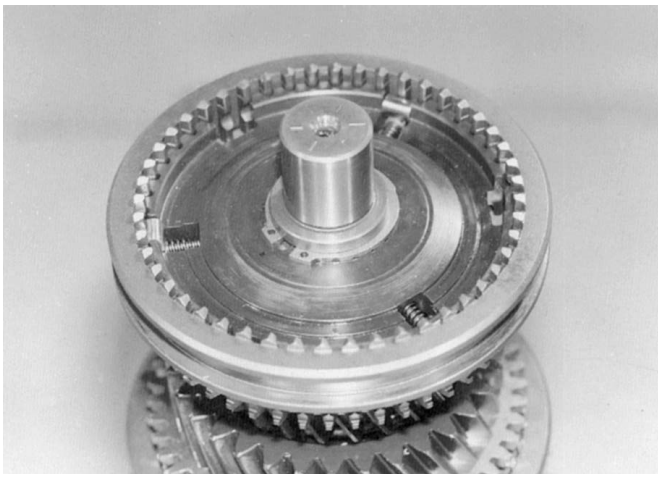
33. Install the circlip in the groove in the main shaft.



34. Check the gear end float using feeler gauges.



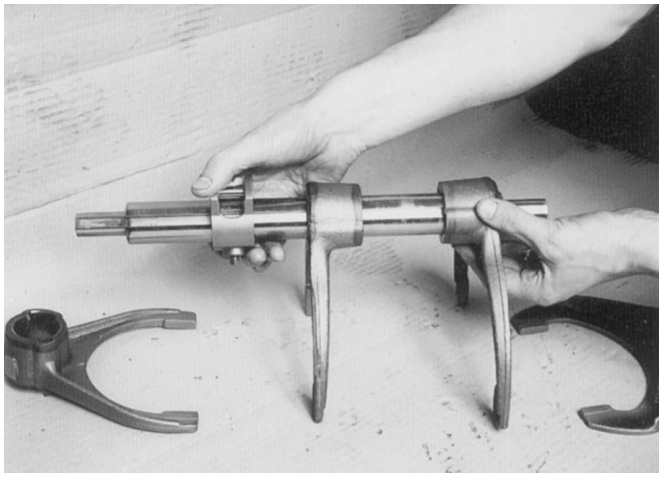
32. From the range of graded-fit circlips, select the thickest one that fits into the groove with the minimum of free play.



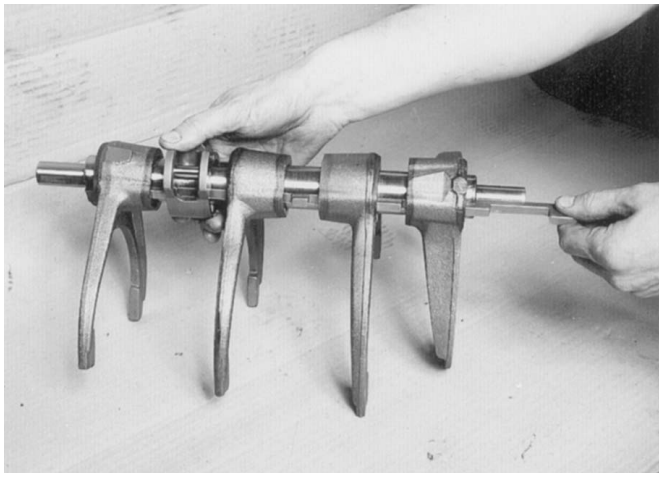
35. Install the three springs and plungers in the synchronizer hub and install the synchronizer sleeve and rollers as described in step 9.

H. Selector shaft disassembly

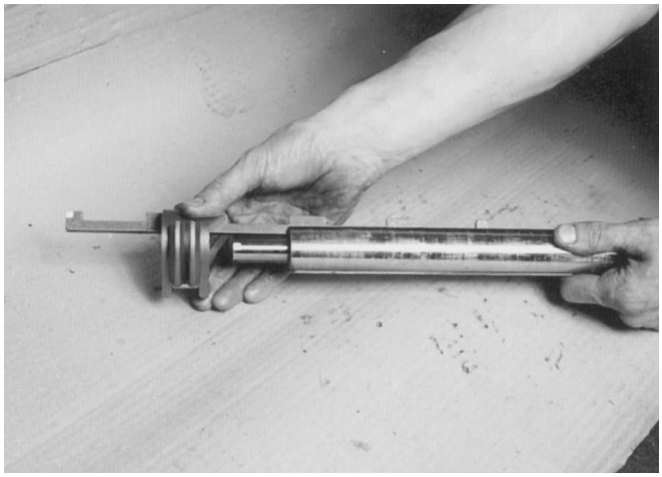
1. Place the selector assembly on the bench with the selector block to the left. Mark the front of the shaft and the keys to aid reassembly.



3. Remove the selector forks from the shaft.

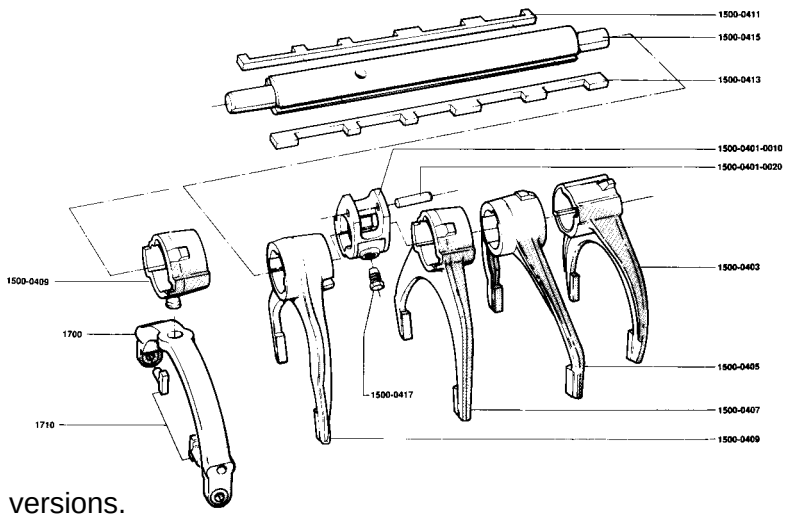


2. Hold the assembly by the selector block and withdraw the interlock key from the rear.



4. Remove the cap screw from the selector block and slide the block off the shaft.

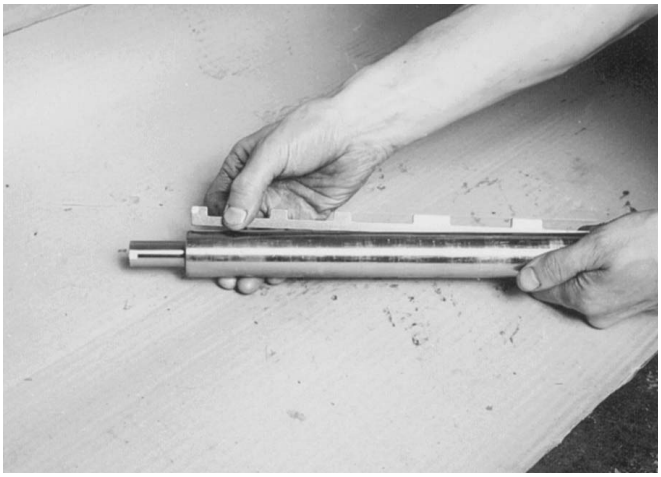
Sequence N°	Description
1500-0401-0010	Selector block
1500-0401-0020	Pin
1500-0403	Reverse shift fork
1500-0405	1st/2nd shift fork
1500-0407	3rd/4th shift fork
1500-0409	5th/6th shift fork
1500-0409	Overdrive selector
1500-0411	Selector key
1500-0413	Interlock key
1500-0415	Selector shaft
1500-0417	Set screw
1700	Overdrive fork
1710	Shift pad



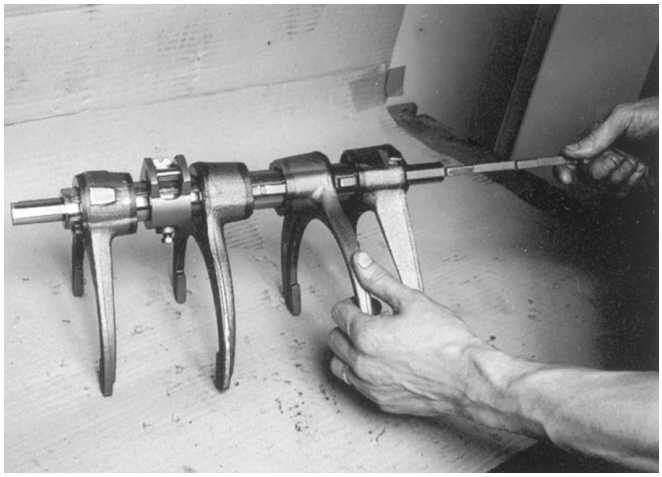
Note: The tapered cap screw is fitted on the opposite side on horizontal mounting versions.

Selector shaft assembly (vertical mounting version)

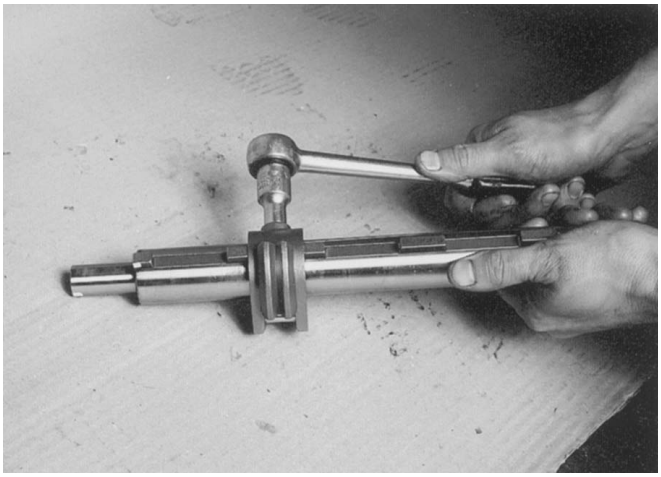
I. Selector shaft reassembly



1. Place the selector key in the keyway on the selector shaft, with the three small bosses towards the front.



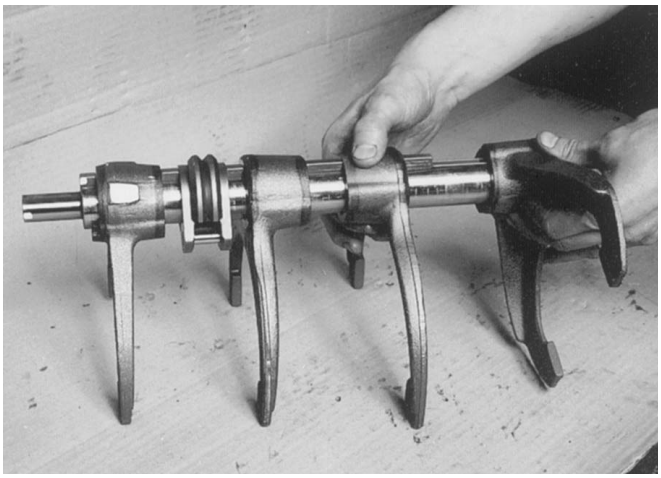
4. Support the selector shaft and slide in the interlock key from the rear.



2. Put the selector block on the shaft and tighten the cap screw at a torque of 35 to 39 Nm.

Note: If re-using the screw, apply Loctite 270 to the screw-thread before fitting.

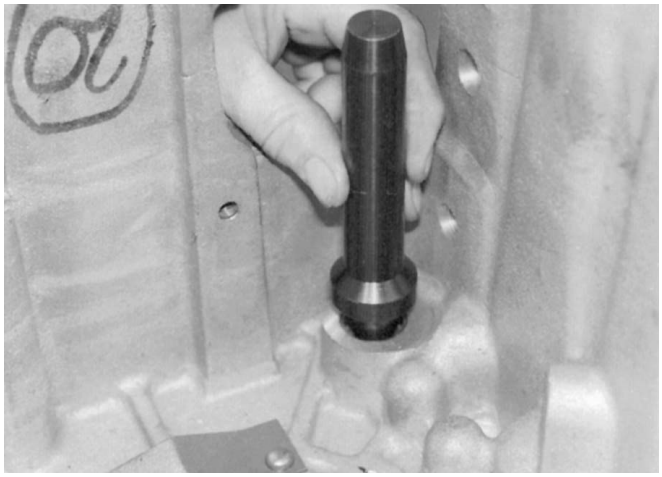
5. On overdrive models, the 5th/6th speed fork is replaced by a selector. Check the fit of the selector before reassembling the gearbox.



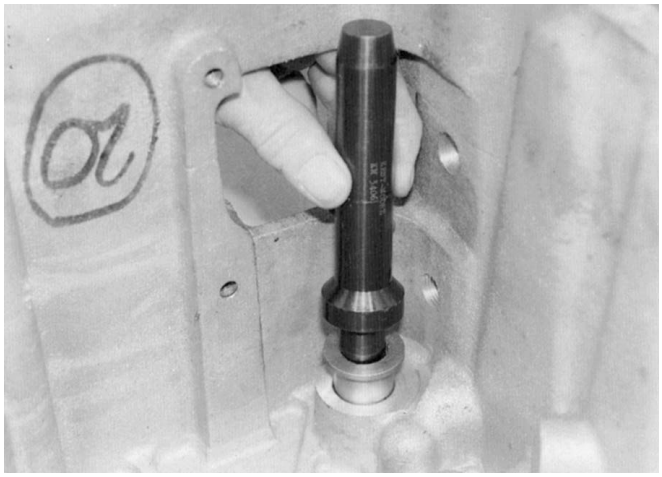
3. Place the selector forks in their respective positions on the selector shaft.

J. Gearbox casing reassembly

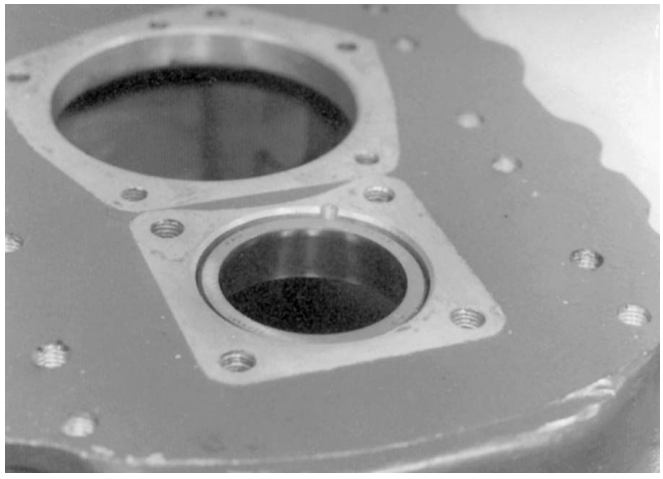
Note: Before reassembling the gearbox casing, ensure that each half-casing and the covers are perfectly clean and that all gaskets and jointing/sealing products are cleaned from the mating faces. When re-using bolts coated with thread locking compound (Patchlock) or when fitting cap screws in through holes, apply the recommended thread locking product or sealant (Loctite 641).



1. Support the front half-casing on wooden blocks. If removed, apply Loctite 518 sealant and install a new selector shaft core plug in the casing, from the inside, with the dished side facing inwards. Use a tube.



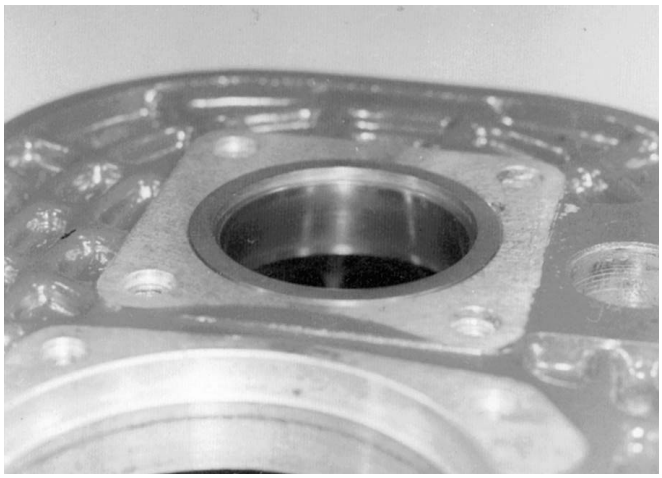
2. Using the special tool, install the selector shaft bush in the casing. Drive in until fully home. Use a tube.



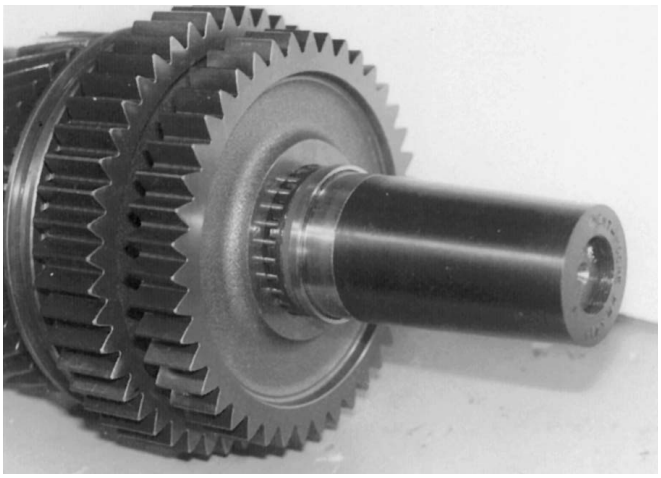
3. Reverse the position of the casing and install the outer cup of the layshaft front bearing in the casing until it is approximately 5 mm below the front face of the casing.

4. Mount the rear half-casing on the stand and, if removed, install new core plugs and rear bushes on the selector shaft, as described in steps 1 and 2.

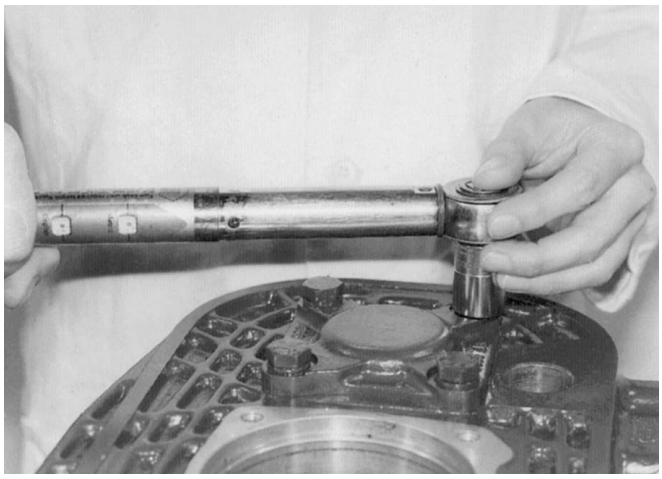
5. Reverse the position of the casing and, using the special tool, install the outer cup of the layshaft rear bearing in the casing until it is just below the rear face of the casing.
Use tool **N° 007.**



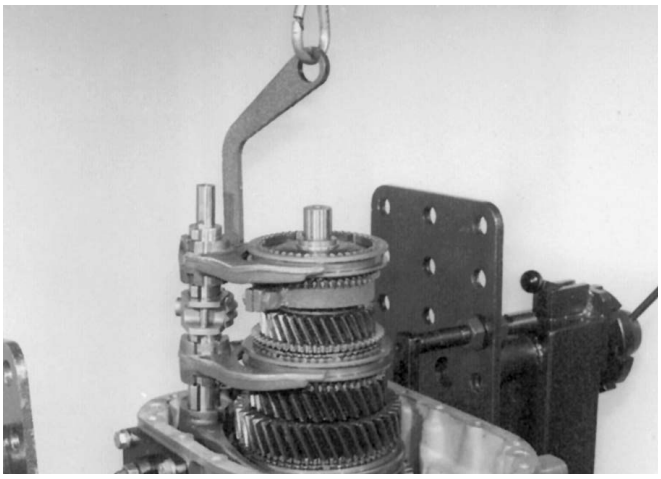
6. Place the spacer on the bearing cup, making sure it is protruding above the rear face of the casing.



9. Install the special locating sleeve over the main shaft. Use tool **N° 010.**

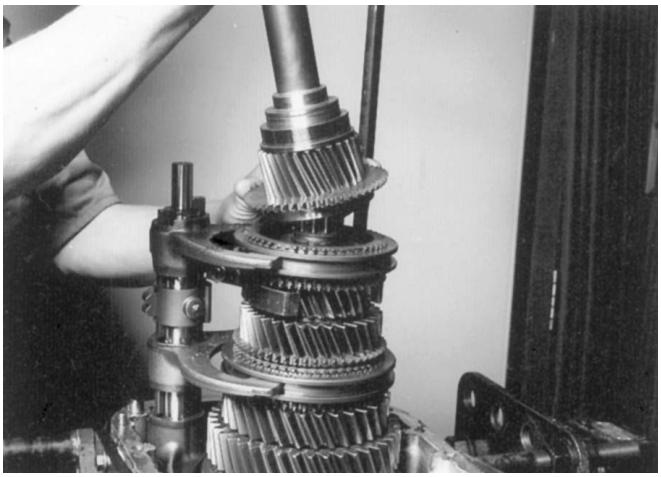


7. Install the layshaft rear bearing cover on the casing. Tighten the cap screws evenly at the correct torque, making sure that the bearing cup is pressed into the casing. Torque = 69 to 78 Nm. **CAUTION:** Take care to not obstruct the lubrication hole. Respect the orientation of the cover plate (see Fig. 22, page 4/7).

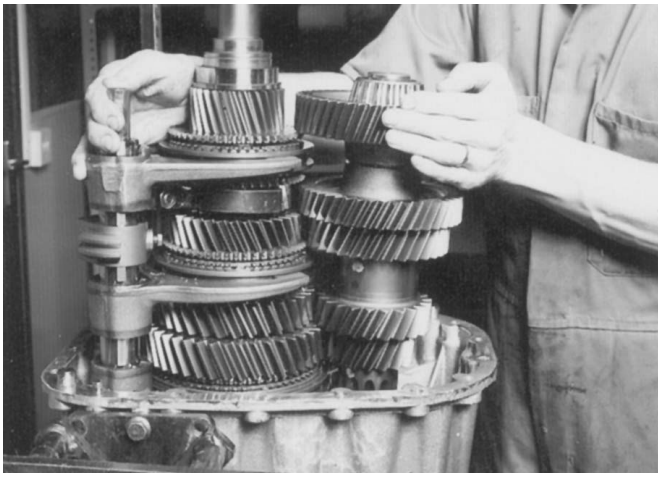


10. Position the selector shaft on the main shaft. Support the main shaft using the special tool and a hoist, and lower the assembly into the casing, making sure that the selector shaft enters into the rear bush. Support the main shaft and the selectors approximately 20 mm above the final installation position.

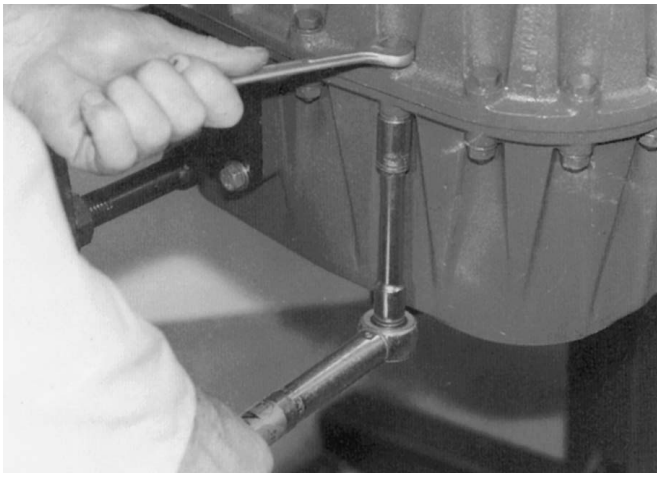
8. Install the main shaft rear bearing outer cage/rollers assembly in the casing, with the snap ring groove facing outwards. Temporarily install the speedometer housing with two or three cap screws. Use a tube.



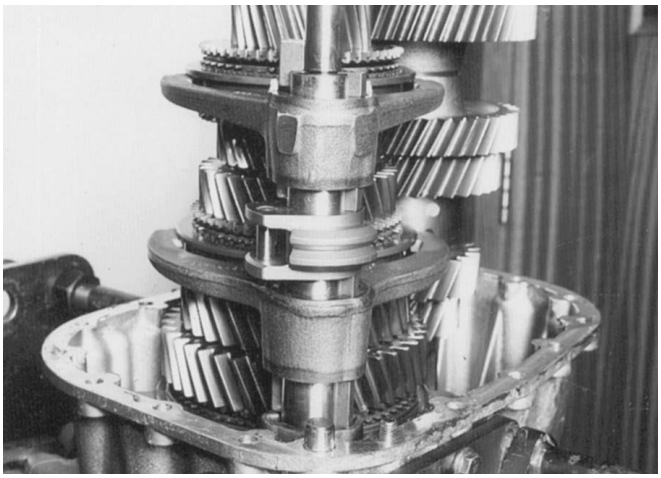
11. Lubricate and install the spigot bearing on the main shaft. Fit the synchronizer ring and install the input shaft assembly.



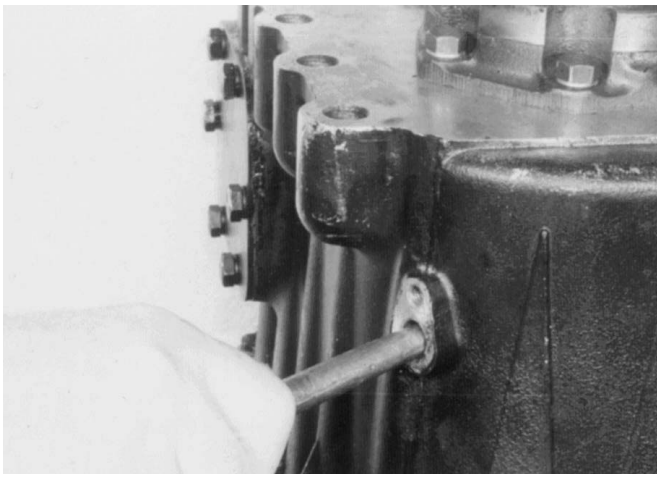
12. Position the layshaft to mesh with the main shaft.



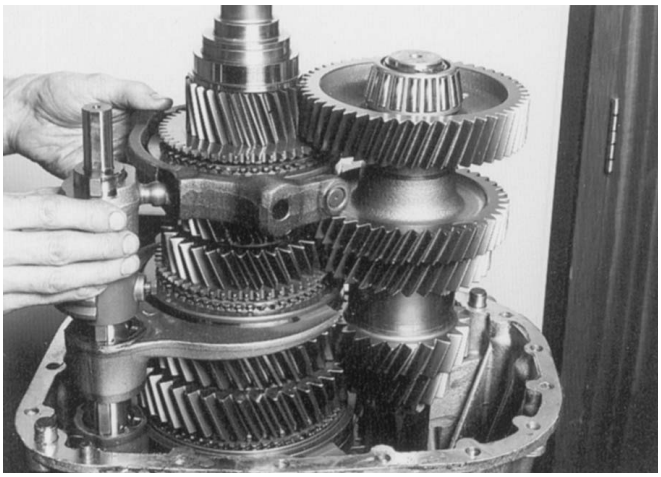
15. Apply sealant to the rear half-casing mating flange and install the front half-casing. Fit the cap screws and nuts. Tighten at a torque of 51 to 58 Nm.



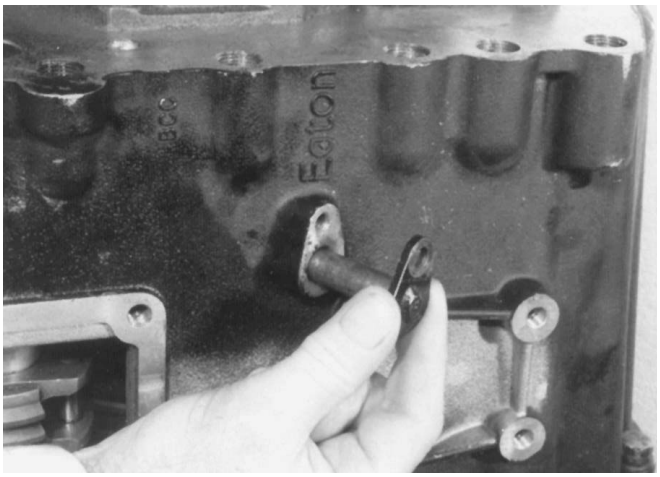
13. Lower the hoist to allow the main shaft, layshaft and selector shaft to seat in their respective bearings and bushes. Remove the special tool. Ensure that the selector block is positioned so that it does not foul the front half-casing.



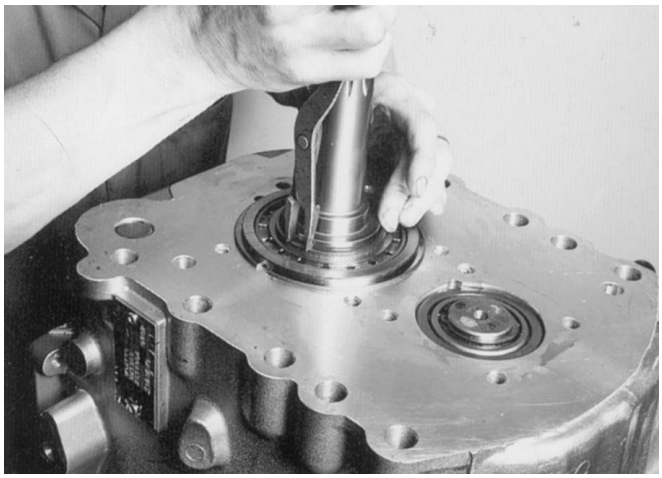
16. On overdrive models, using a suitable probe (as illustrated), align the pivot pins with the holes in the casing. Apply sealant (Loctite 518) to the pivot pin flanges and insert the pins.



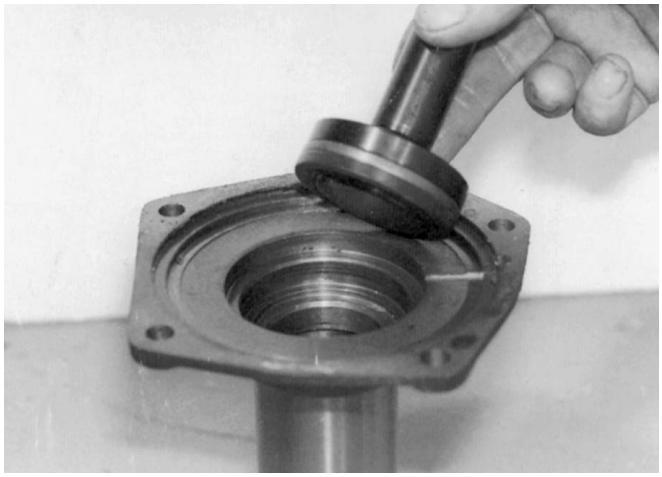
14. On overdrive models, install the fork pads in the 5th/6th overdrive selector fork. Engage the fork and the pads in the synchronizer sleeve.



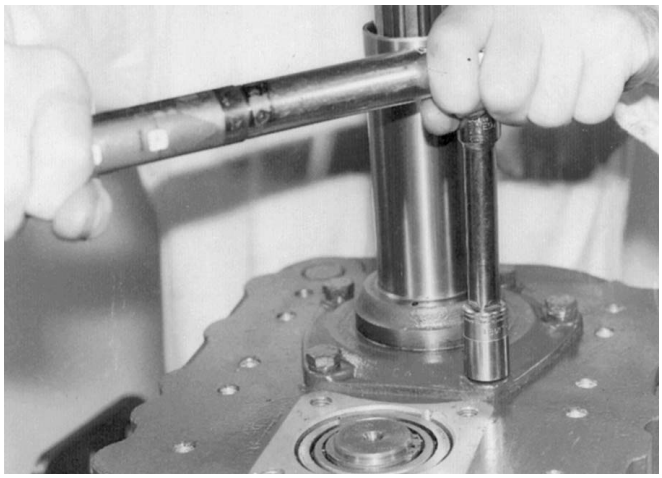
17. When aligning the right-hand pivot pin, lift up the selector using a screwdriver through the remote control aperture. Tighten the cap screws at the correct torque (20 to 40 Nm).



18. Fit the spacer ring and the inner circlip on the input shaft.



19. If removed, install a new oil seal in the front cover of the input shaft bearing, using the special tool. Press the seal firmly down to the shoulder, taking care to not damage the seal.
Use a tube dia. 60.3 x 54.5 mm.



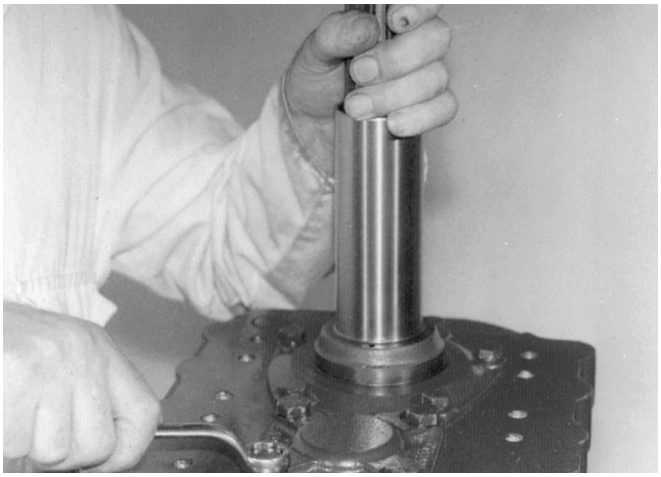
20. Lubricate the shaft seal surface and apply flange sealant to the front cover mating face. Install the front cover and tighten the cap screws at the correct torque (35 to 39 Nm).

21. Select the thickest shim and place it against the layshaft bearing cup. Place the spacer on top of the shim.

Note: The spacer must stand proud of the front face of the casing when the bearing cup is fully seated against the bearing cone/rollers assembly.

Shims are available in the following thicknesses:

Part Nº	Thickness (mm)
F88891	0.051
F88892	0.127
F88893	0.254
F88894	0.508
Spacer	2.40

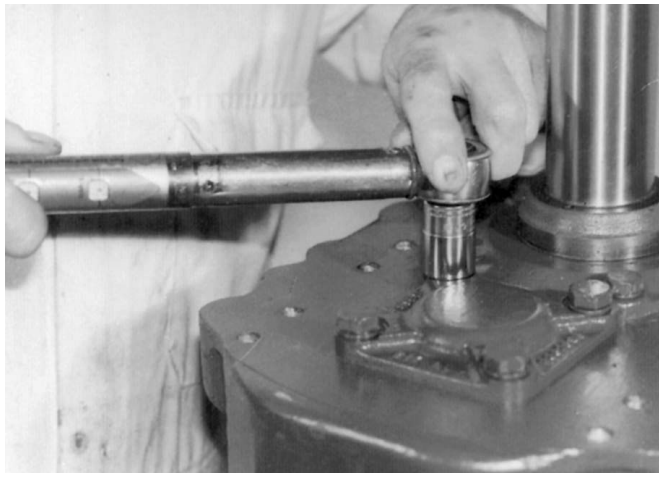


22. Install the layshaft front bearing cover (without sealant). Fit the cap screws without spring washers. Tighten the cap screws tightly and evenly while rotating the input shaft forwards then backwards to settle the bearings. Continue to tighten the cap screws until some resistance can be felt on the input shaft.

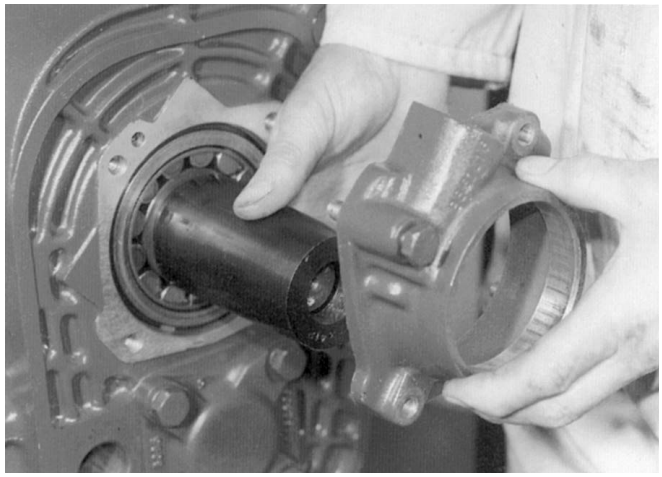
23. Loosen the four cap screws as far as zero torque loading, then retighten just sufficiently to nip the bearing cover plate. Using feeler gauges, measure the clearance between the cover and the casing at several points. From the range of graded-fit spacers, select the thickest one that will give the required preload on the layshaft bearings from 0.075 to 0.125 mm for new bearings and from 0.00 to 0.05 mm for used bearings.

Example

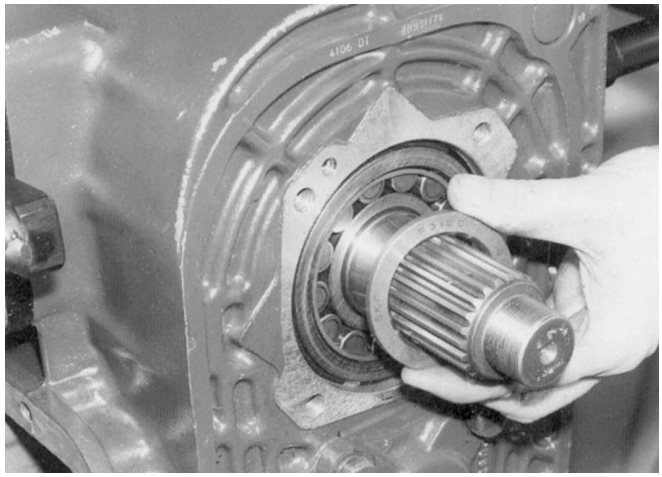
Spacer thickness		2.40 mm
add shim	+	0.508 mm
	=	2.908 mm
subtract clearance	-	0.30 mm
	=	2.608 mm
add preload	+	0.05 mm
	=	2.658 mm
subtract spacer	-	2.40 mm
	=	0.258 mm
Shim required		0 254 mm



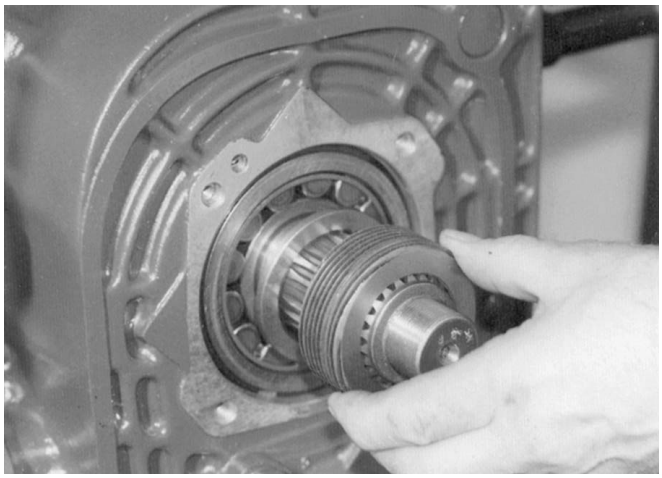
24. Lubricate the layshaft bearing, install the graded spacer of the selected thickness, apply flange sealant and install the cover plate. Apply sealant and tighten the cap screws at the correct torque (69 to 78 Nm).
CAUTION: Take care to not obstruct the lubrication hole. Respect the orientation of the cover plate (see Fig. 24, page 4/7).



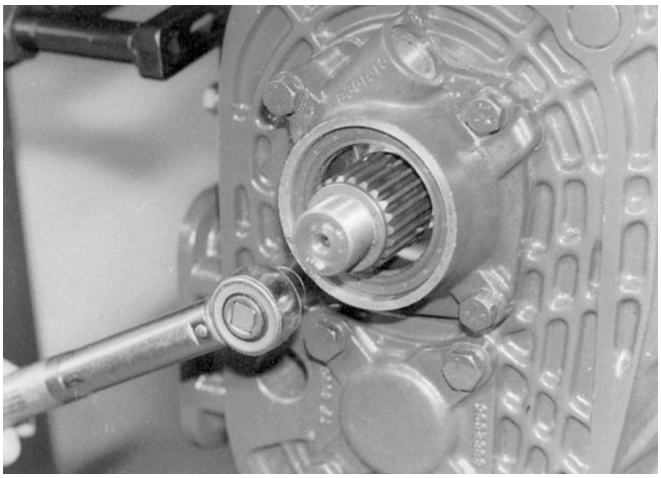
25. Turn the gearbox into the horizontal position and remove the speedometer housing and the locating sleeve from the main shaft.



26. Place the bearing thrust washer on the main shaft, above the shoulder, against the rear bearing. Make sure that the oil groove is against the rollers.



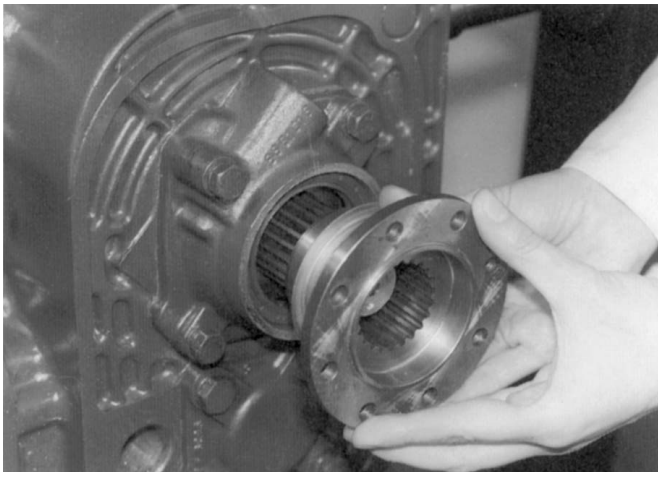
27. Install the speedometer drive pinion or tachograph rotor on the main shaft, against the spacer.



29. Apply flange sealant and install the speedometer housing. Note down the position of the longer cap screw. Tighten the cap screws at the correct torque (35 to 39 Nm).

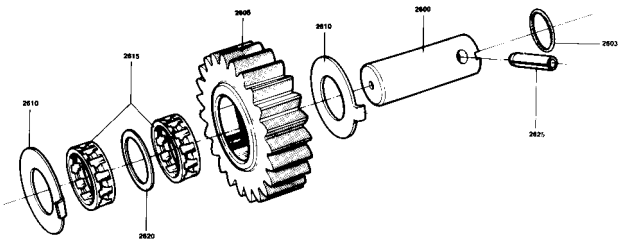
CAUTION: It may be necessary to install the speedometer drive pinion prior to this stage.

28. If removed, install a new oil seal at the correct depth in the speedometer housing, using the special tool. Press the seal firmly down to the shoulder, taking care to not damage the seal. Use tool **N° 011.**



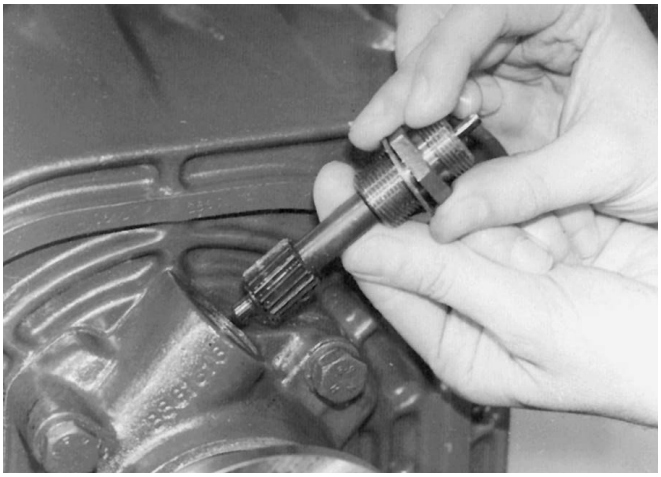
30. Apply a light grease to the lips of the oil seal and install the drive flange. DO NOT hammer the flange onto the shaft as the bearing spacer may be dislodged from its position on the shaft. This could cause serious damage to the spacer, bearing or shaft and/or seriously affect the main shaft end float.

31. Fit and tighten the flange retaining locknut at the correct torque, using a flange-holding wrench (490 to 588 Nm).

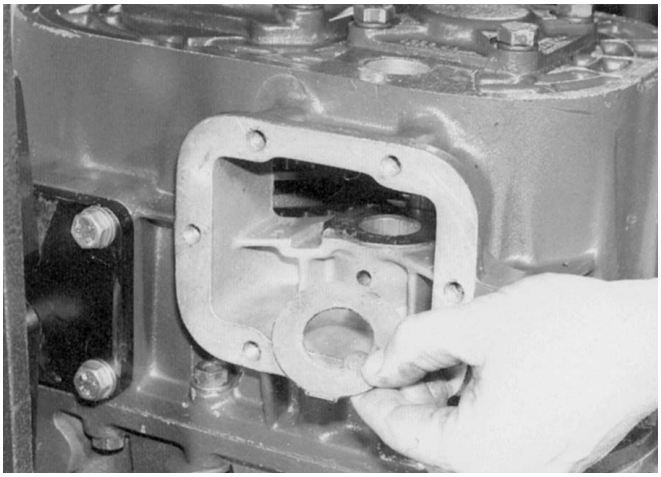


Sequence N°	Description
2600	Reverse idler gear shaft
2603	O-ring
2605	Reverse idler gear
2610	Thrust washer
2615	Needle bearing
2620	Spacer
2625	Pin

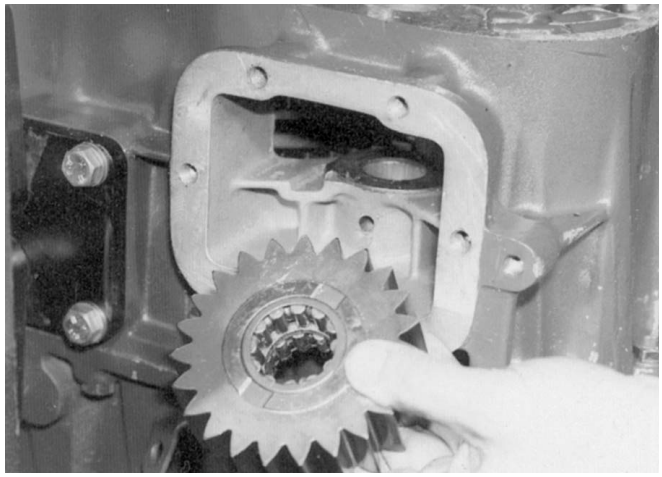
Reverse idler gear assembly



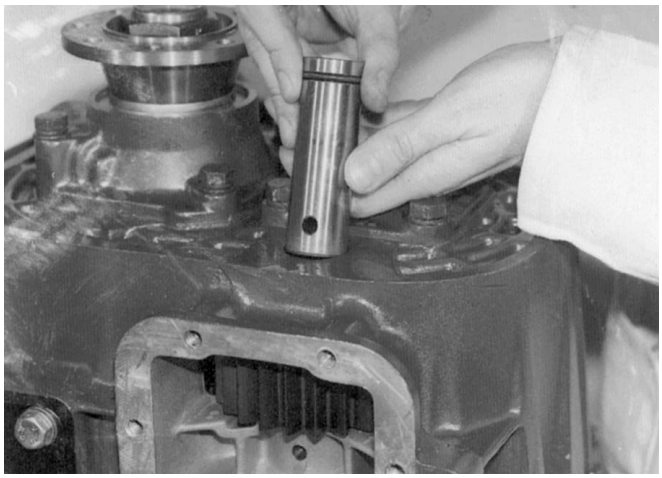
32. Install the tachometer sender unit or the speedometer drive pinion and housing with a new sealing washer. Tighten at the correct torque (20 to 27 Nm).



33. Apply a thick coat of petroleum jelly to the reverse idler gear thrust washers and position them in the gearbox casing.

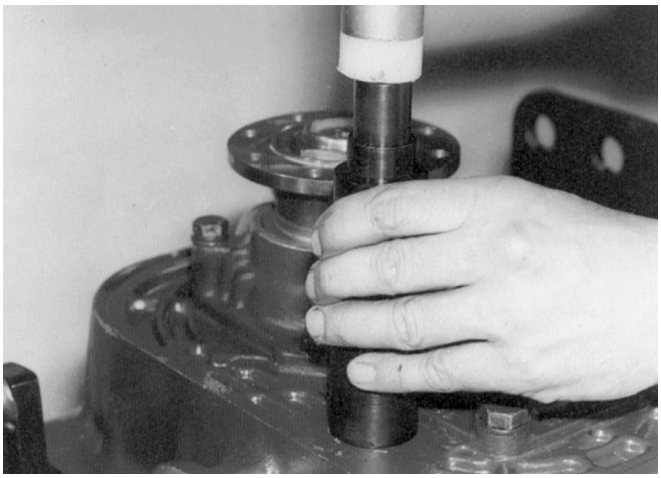


34. Install the bearings and bearing spacer in the reverse idler gear and position the assembled gear between the thrust washers and in mesh with the layshaft and the main shaft reverse gear.

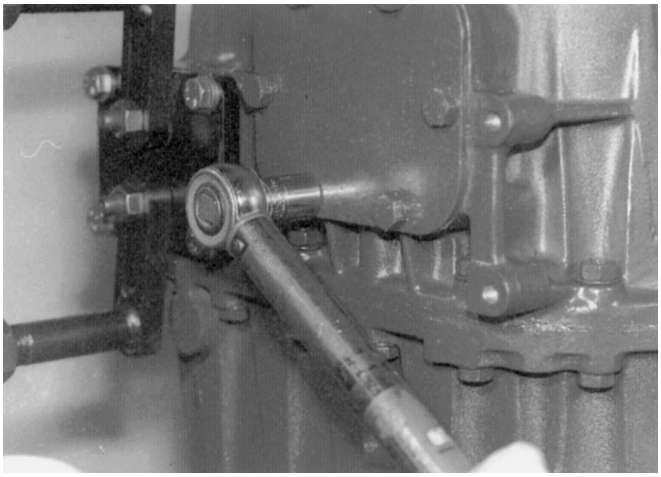


35. Ensure that the thrust washer and the gear are correctly positioned and that the parallel groove pin holes are correctly aligned and install the reverse idler gear shaft with a new O-ring in the casing. Take care not to dislodge the components when the shaft is driven home using a soft metal mallet.

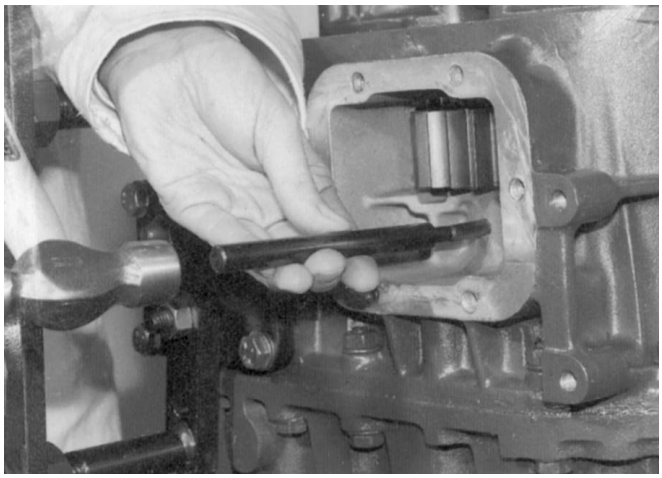
Note: The pin hole in the idler gear shaft is tapered.
The larger diameter must be fitted towards the exterior of the gearbox.



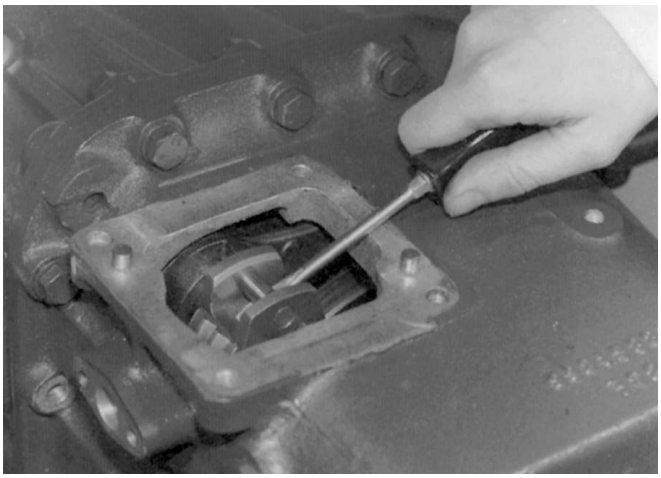
37. Apply the specified sealant and install a new expansion plug in the bore of the reverse idler shaft.



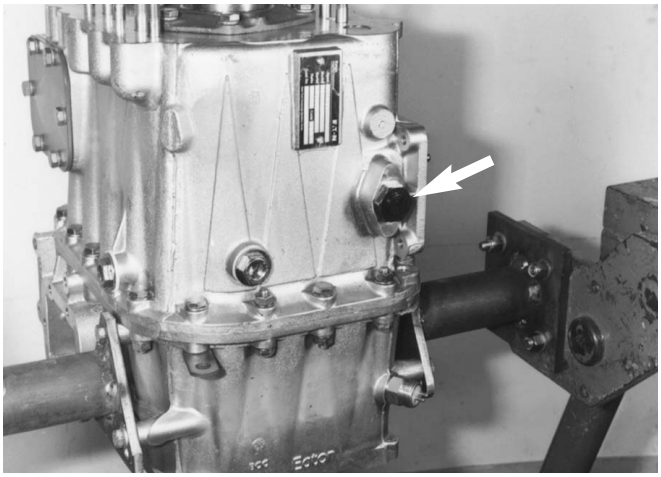
38. Install the reverse idler gear/PTO cover plate with a new gasket. Tighten the cap screws at the correct torque (35 to 39 Nm).



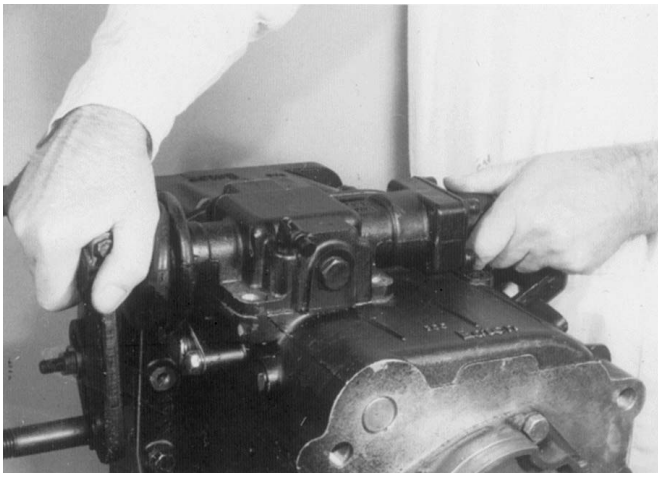
36. Align the pin holes and fit a new parallel groove pin. Drive in until flush.



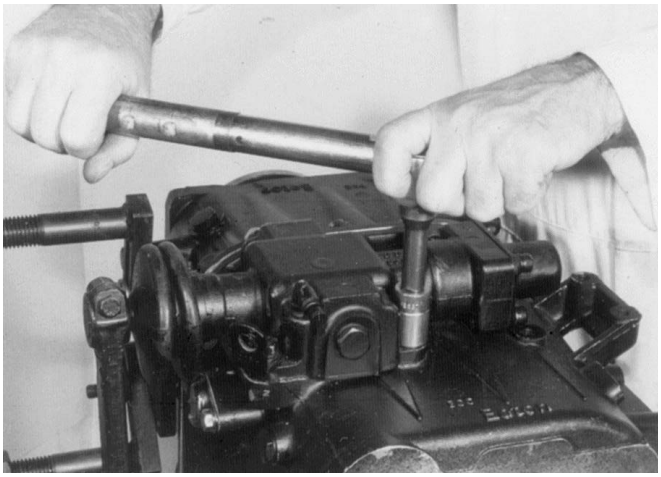
39. Turn the gearbox into the horizontal position. Rotate the selector block until the pin is in the upwards position.



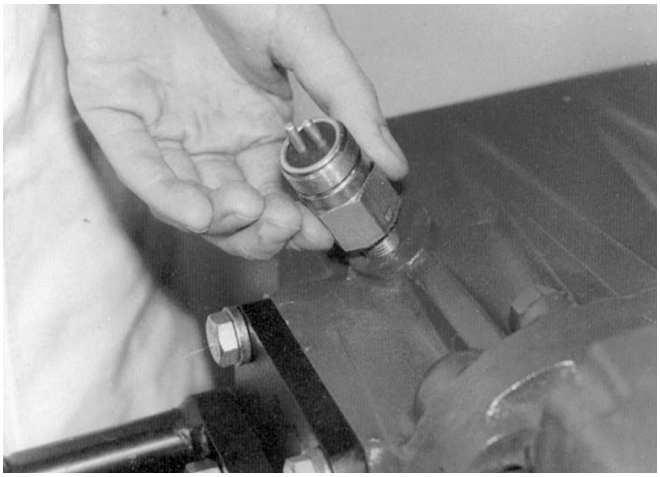
40. Install the selector shaft detent plunger. Apply **Loctite 242** sealant to give an efficient seal.



41. Apply a flange sealant and install the remote control, making sure that the inner lever is located above the selector block.



42. Tighten the cap screws at the correct torque (35 to 39 Nm).

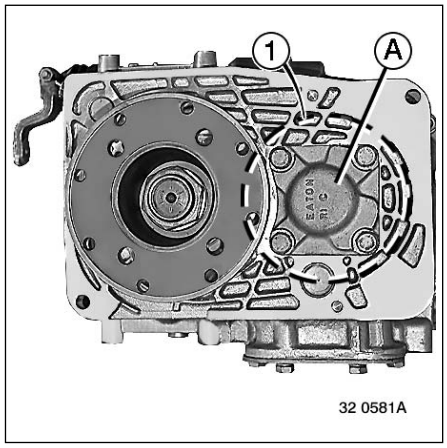


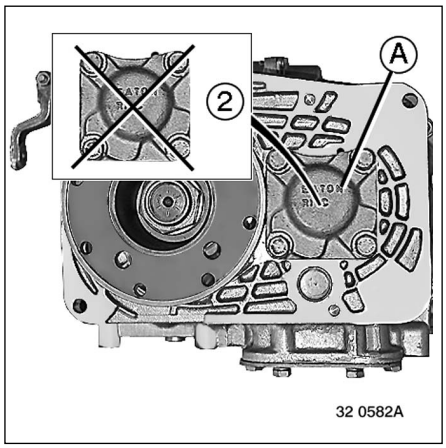
43. Apply sealant and install the reverse lamp switch. Tighten at the correct torque (16 to 22 Nm).

44. Check manually, using the gear change lever, that all the gears can be engaged. It may be necessary to rotate the input shaft in order to fully engage the gears.

WARNING
Rear casing closing plate (A) reassembly (gearbox 4106 A) :

- correct assembly (1)
- wrong assembly (2)





Double Cone Synchronizers

Mainshaft Disassembly

Note: All snap rings and circlips on the mainshaft are graded for selective fit. Take care not to score the bearing surfaces of the mainshaft when removing or fitting the snap rings or circlips.

Note: The end float of the gears on the mainshaft is established in manufacture by machining the components to fine tolerances. Before disassembly of the mainshaft the end floats should be checked to ascertain whether they are within the recommended limits.

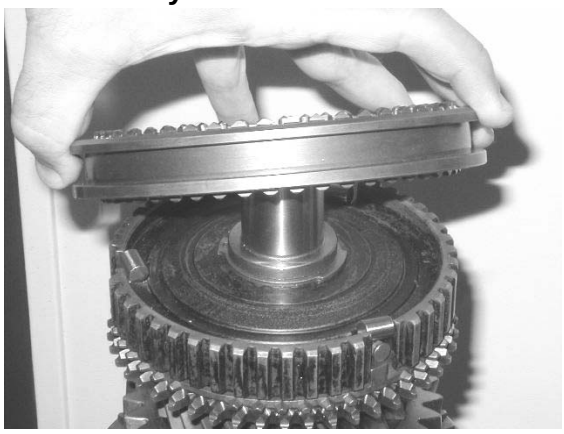
Where end float is found to be excessive it is necessary to check the gears, mainshaft, synchroniser hubs and bearing sleeve for wear.
See **'Inspection of expendable parts'** and renew where necessary.

End float check

Gear	FS – 5th FSO – 6th	4th	3rd	2nd	1st
Minimum	0.31 mm	0.35 mm	0.35 mm	0.35 mm	0.40 mm
Maximum	0.53 mm	0.48 mm	0.48 mm	0.48 mm	0.57 mm
Tolerance	0.22 mm	0.13 mm	0.13 mm	0.13 mm	0.17 mm

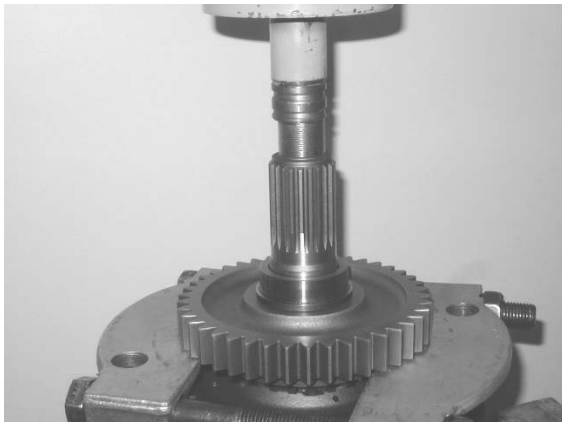
1. End float may be checked with the mainshaft assembled by using a dial gauge, as shown, or feeler gauges. Mount the mainshaft assembly on a suitable stand. Locate the dial gauge on the gear and zero the gauge. Raise the gear and record the reading.

Disassembly

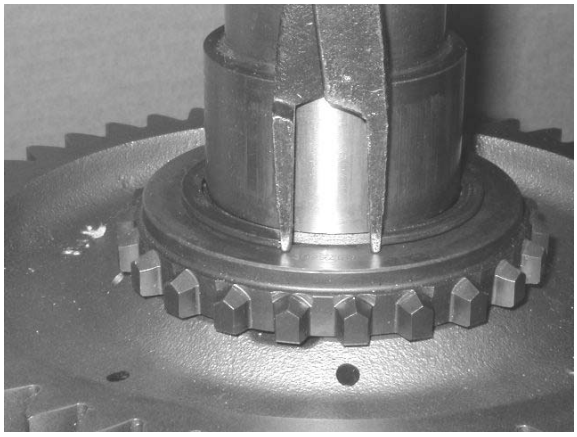


1. Mount the mainshaft assembly, plain end uppermost, in a soft jawed vice. Remove the synchronizer ring. Carefully slide the 5th/6t synchronizer sleeve upwards until the three rollers are clear of the groove in the synchronizer sleeve. Remove the three rollers, the synchronizer sleeve, the three plungers and three springs from the synchronizer hub.

2. Remove the 5th/6th-gear synchronizer hub retaining circlip.

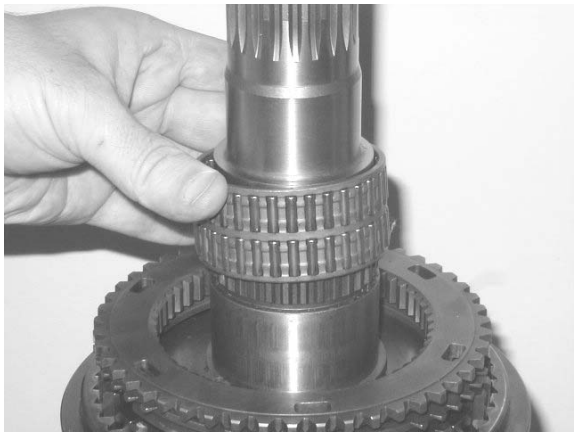


3. Invert the mainshaft assembly. Using a press or suitable puller remove the mainshaft bearing inner, reverse gear and reverse gear needle roller bearing.

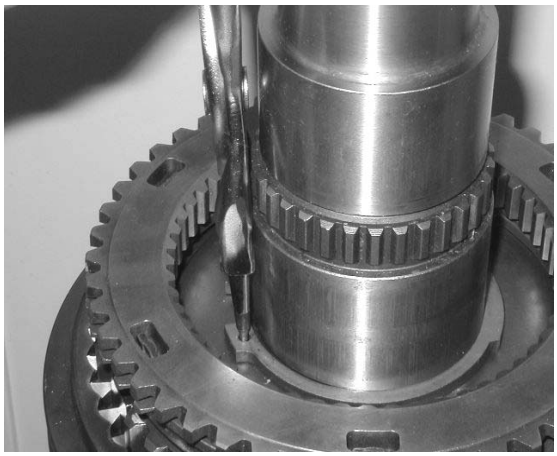


4. Remove the reverse gear fixed hub retaining snap ring.

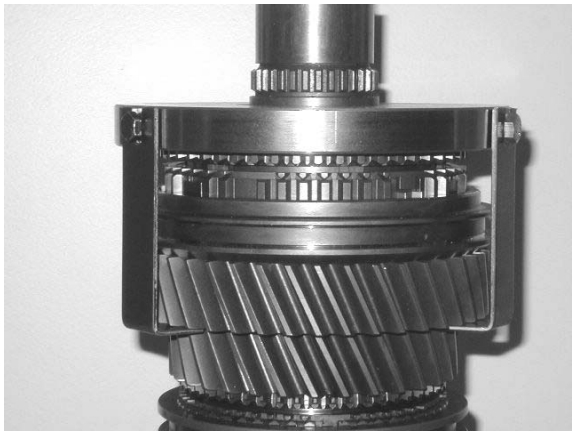
5. Using a press or suitable puller remove the reverse gear fixed hub and 1st speed gear.



6. Remove the 1st speed gear needle roller bearing.

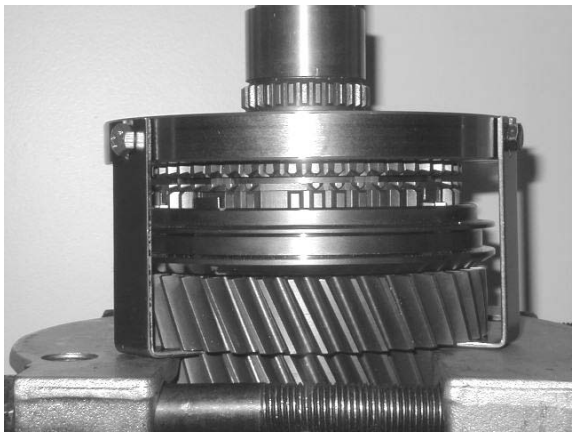


7. Remove the synchronizer assembly retaining circlip.

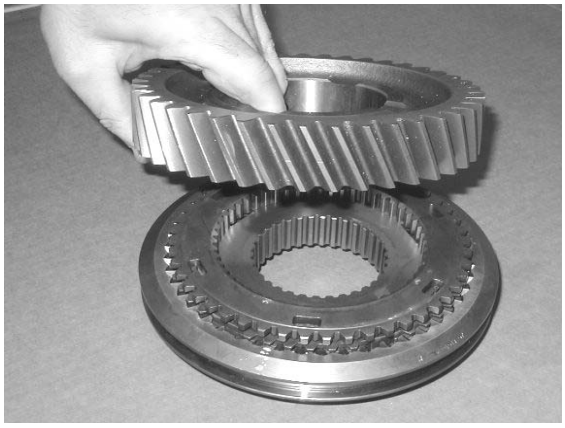


8. To prevent the synchronizer assembly from separating during removal fit the retaining tool. The tool fits onto the mainshaft, boss down, with the three retainers located underneath 2nd speed gear. Adjust the retainers so that there is no free play between 2nd speed gear and synchronizer assembly

Note : Should the synchronizer separate then refer to the relevant section for assembly instructions.

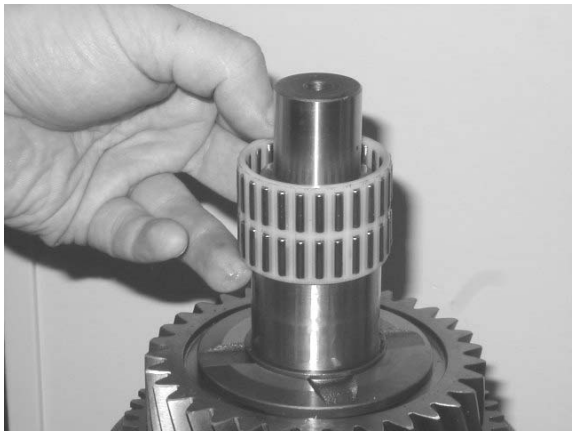


9. Using a press or suitable tool remove the synchronizer assembly and 2nd speed gear. Remove the needle roller bearing

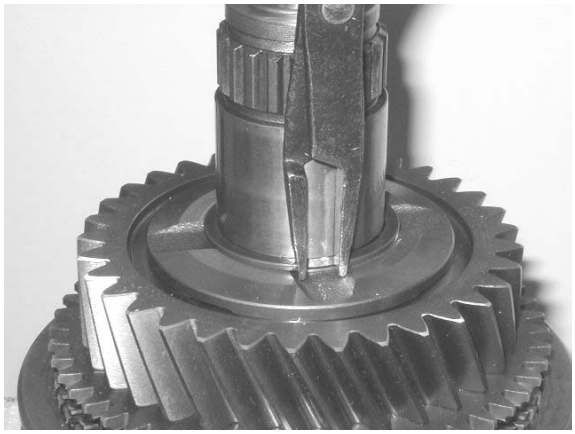


10. Carefully remove the retaining tool and then place the synchronizer assembly and 2nd speed gear onto a suitable work surface. Remove the 2nd speed gear.

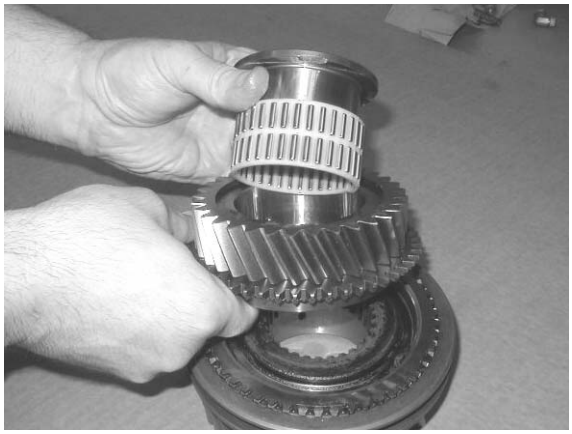
11. Invert the mainshaft. As the 5th/6th-gear synchronizer hub is not symmetrical, identify its orientation. Using a press, or suitable puller, remove the 5th/6th-gear synchronizer hub, synchronizer ring and 5th speed gear assembly. Note: Care must be taken to ensure that damage to the teeth on the synchronizer flange does not occur.
    (On an overdrive transmission it may be necessary to engage the press/puller also over the gear)



12. Remove the 5th gear needle roller bearing. (On overdrive transmissions this will be 6th gear)



13. Carefully remove the 4th gear-bearing sleeve retaining snap ring.

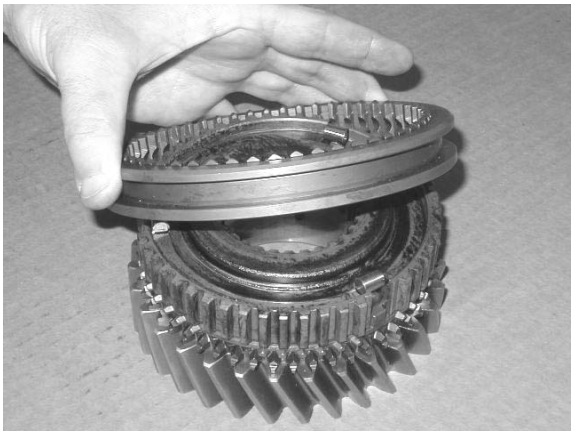


14. Using a suitable press or puller support the mainshaft assembly underneath, 3rd speed gear.

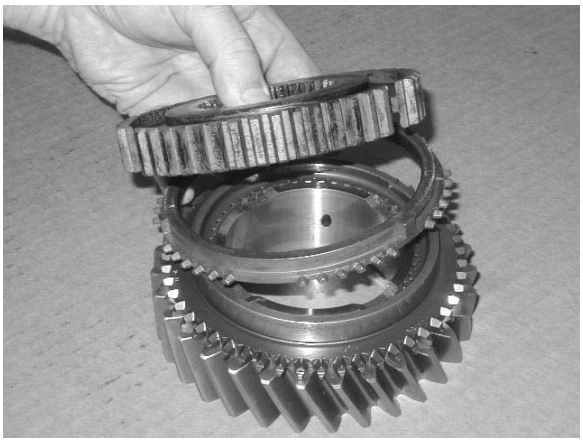
Note : It is imperative that the flange, which is part of the mainshaft, does not foul the press or puller legs as this may result in damage to the mainshaft.

Press or pull the 4th speed gear bearing sleeve, 4th speed needle roller bearing, 4th speed gear assembly, 3rd/4th-speed synchronizer assembly and 3rd speed gear assembly off. Remove the 3rd speed gear needle roller bearing from the mainshaft.

15. Place the assembly on to a suitable work surface, 4th speed gear, uppermost. Remove the bearing sleeve, needle roller bearing and 4th gear assembly.



16. Dismantle the 3rd/4th-speed synchronizer assembly as previously described in paragraph one.

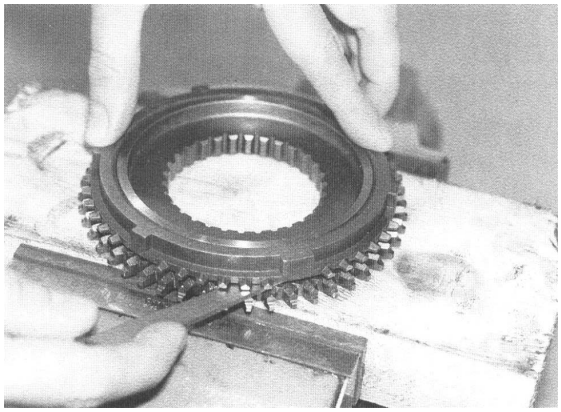


17. Lift off the synchronizer hub and synchronizer ring.

Mainshaft reassembly

Before assembling the synchronizer assemblies on to the mainshaft, check the fit of each synchronizer ring to the relevant synchronizer flange.

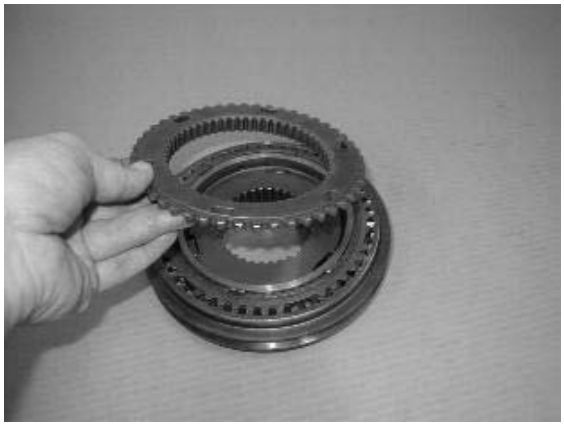
Procedure for 3rd, 4th, 5th and 6th speed synchronisers.



Place the synchronizer ring to the relevant flange and while holding the two parts firmly together, measure the clearance between the two component parts using feeler gauges at several points around the circumference as shown. The clearance should be between 0.5 and 1.9 mm. Renew both parts if the measurement is not within the specified limits. Retain the synchronizer rings and flanges in their respective pairs for assembly in the same relative position.

Procedure for 1st and 2nd speed synchronizers

a) Stand the synchronizer assembly on to a flat surface (Either way up).



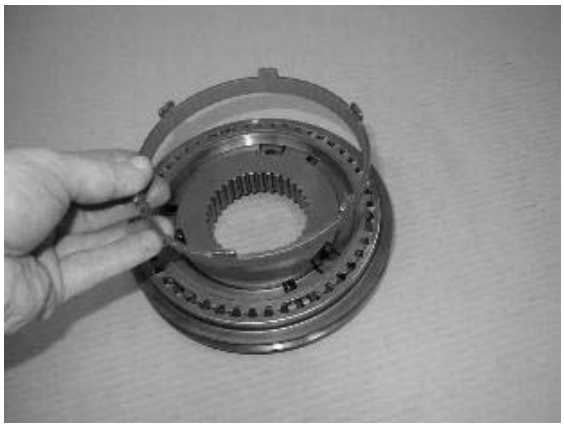
b) Remove the synchronizer flange.

c) Place the synchronizer flange, spigot uppermost onto the bench.

d) Remove the synchronizer inner ring.

e) Fit the synchronizer inner ring, tangs uppermost, on to the synchronizer flange.

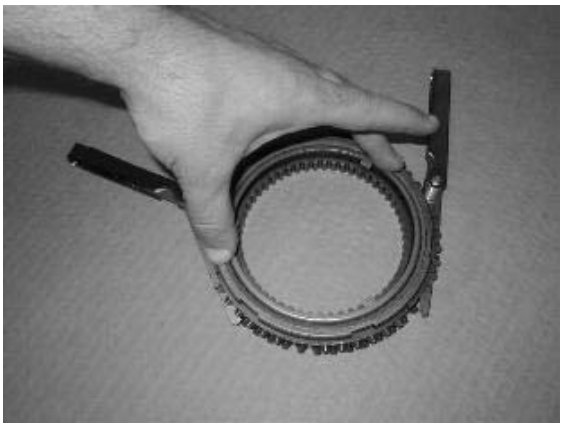
g) Fit the synchronizer friction ring on to the synchronizer flange ensuring that the tabs on the synchronizer friction ring locate into the slots on the synchronizer flange.



f) Remove the synchronizer friction ring.

h) Remove the synchronizer ring.

i) Fit the synchronizer ring onto the assembly.



j) While holding the parts firmly together, measure the clearance between the synchronizer ring and synchronizer flange using feeler gauges at several points around the circumference as shown. The clearance should be between 0.5 and 1.9 mm. If the measured dimension is outside these tolerances then the synchronizer assembly must be changed.

k) Refer to paragraphs twelve to fifteen of the assembly procedure in the section '1st/2nd speed synchronizer assembly'.

l) Invert the synchronizer assembly and repeat the process.

Assembly

Note : The synchronizer flanges, apart from those fitted to the 1st and 2nd speed gears, must be loctited to the gears.

1. Place the retaining tool, boss uppermost, on to a suitable surface.

2. Place the 1st/2nd speed synchronizer assembly onto the retaining tool ensuring that the chamfer on the synchronizer sleeve is uppermost.

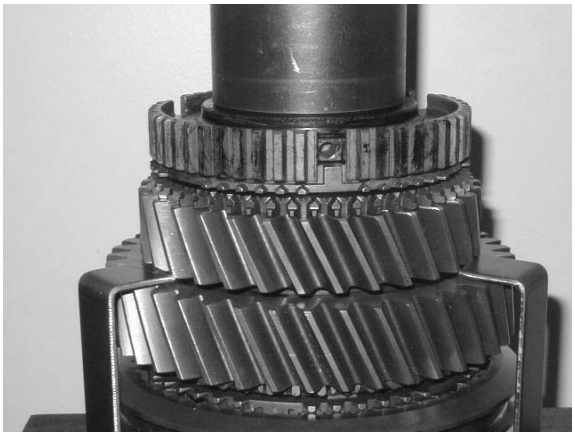
3. Heat the assembly to 85° Centigrade and then place the retaining tool and synchronizer assembly onto the press table.

4. Fit the 2nd speed gear to the synchronizer assembly ensuring that the splines on the gear engage into the splines on the synchronizer assembly. Fit and lubricate the needle roller bearing.

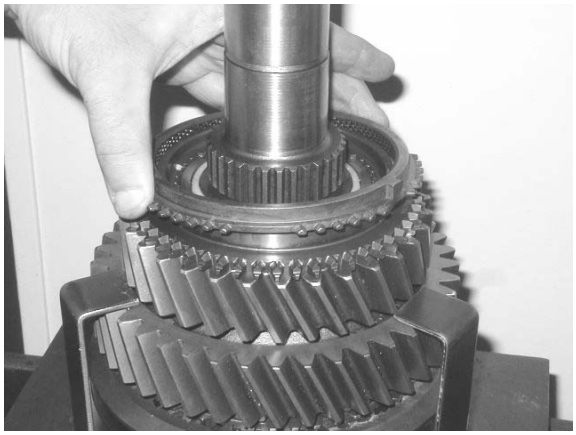
5. Fit the mainshaft, plain end uppermost, into the 2nd speed gear and synchronizer assembly ensuring that the splines on the mainshaft engage into the splines of the synchronizer assembly. Press the mainshaft into the synchronizer assembly.

6. To prevent the synchronizer assembly separating the retainers should be used. Adjust the retainers so that there is no free play between 2nd speed gear and the synchronizer assembly.

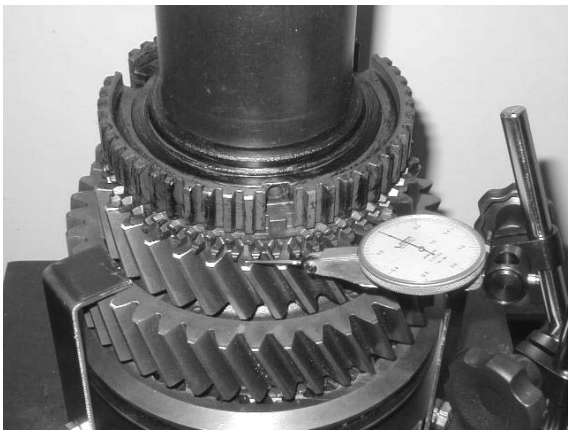
7. Lubricate and install the 3rd gear needle roller bearing and 3rd gear assembly.



9. Heat the 3rd/4th-gear synchronizer hub to 85° Centigrade. Fit the synchronizer hub over the splines on the mainshaft ensuring that the large slots in the synchronizer hub align with the large shoulders on the synchronizer ring. Press the synchronizer fully home.

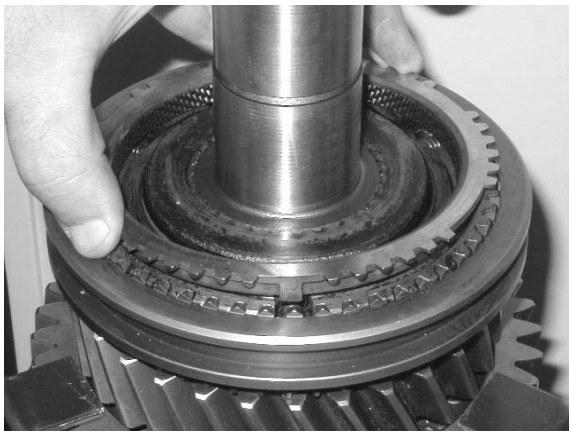


8. Lubricate the 3rd gear synchronizer flange and then fit the synchronizer ring.



10. Check that the 3rd gear end float is within the tolerance stated in the chart.

11. Assemble the three springs and plungers into the synchronizer hub. Place the synchronizer sleeve over the synchronizer hub and support it with the internal groove just above the synchronizer hub. Position the three rollers as shown, resting on the heads of the plungers, and press downward on the synchronizer sleeve. This compress the springs allowing the synchronizer sleeve to centralise in the neutral position.

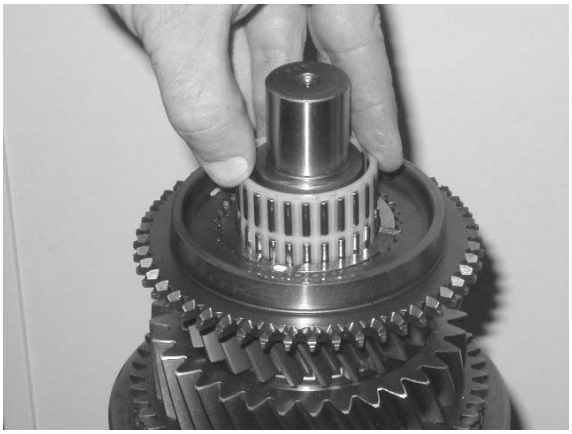


12. Place the 4th gear synchronizer ring onto the synchronizer assembly ensuring that the shoulders on the synchronizer ring locate into the slots of the synchronizer hub. Lubricate the synchronizer ring.

13. Fit the 4th speed gear assembly. Lubricate the needle roller bearing and then install it into the gear.

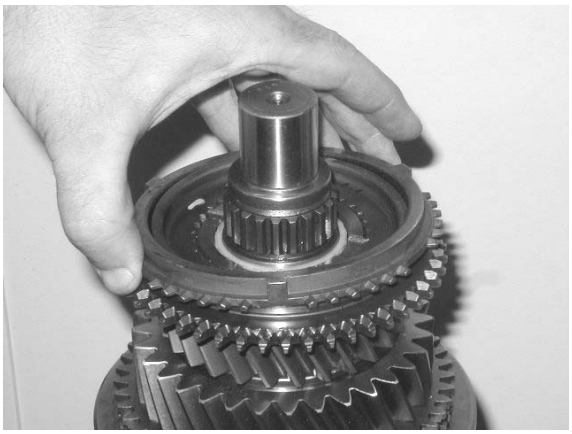
14. Heat the 4th speed gear-bearing sleeve to 85° Centigrade and locate it onto the mainshaft and inside the needle roller bearing. Press the bearing sleeve into position.

15. Fit a new snap ring into the mainshaft groove taking care not to damage the mainshaft-bearing surface.



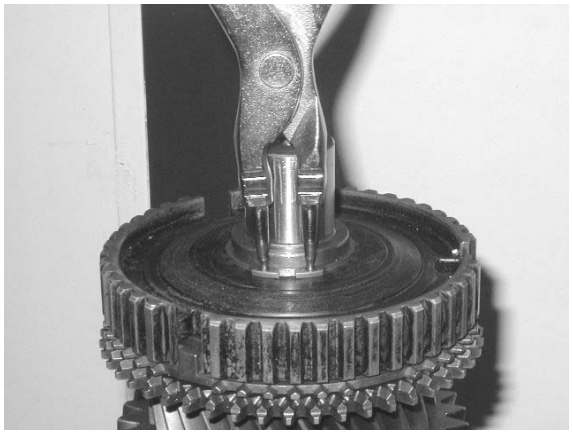
17. Fit the 5th speed gear assembly. Lubricate the needle roller bearing and then install it into the gear.

16. Check that the 4th gear end float is within the tolerance stated in the chart.

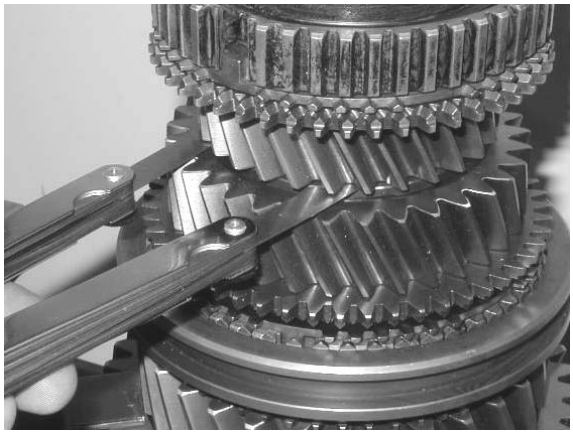


18. Lubricate the 5th gear synchronizer flange. Fit the synchronizer ring.

19. Heat the 5th/6th-speed synchronizer hub to 85° Centigrade and then install it, boss downwards, onto the mainshaft. Ensure that the large slots on the synchronizer hub align with the large shoulders on the synchronizer ring. Press the synchronizer hub until it is fully seated.

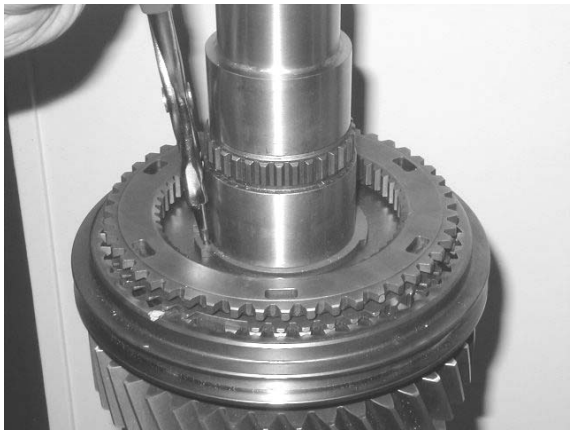


20. From the range of graded circlips select the one which fits into the mainshaft groove with the least amount of free play. Fit the Circlip into the groove.

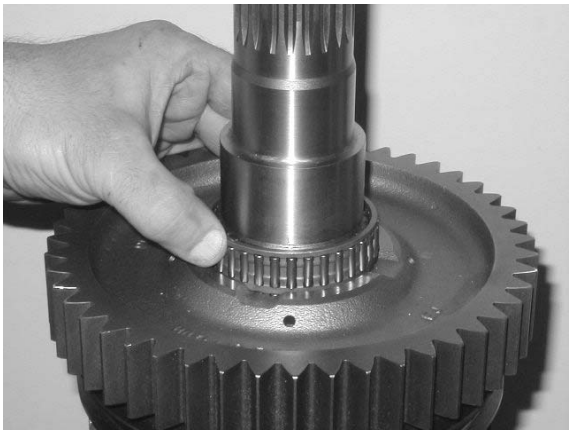


21. Using feeler gauges check that the 5th gear end float is within the tolerance stated in the chart.

22. Invert the mainshaft and then remove the retaining tool.

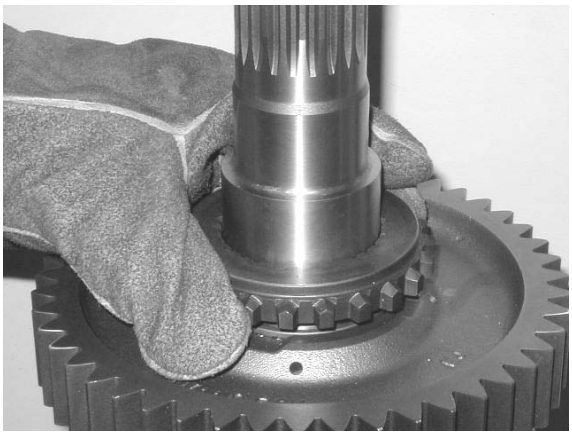


23. Install the circlip into the groove of the mainshaft. Take care not to damage the mainshaft bearing surface.



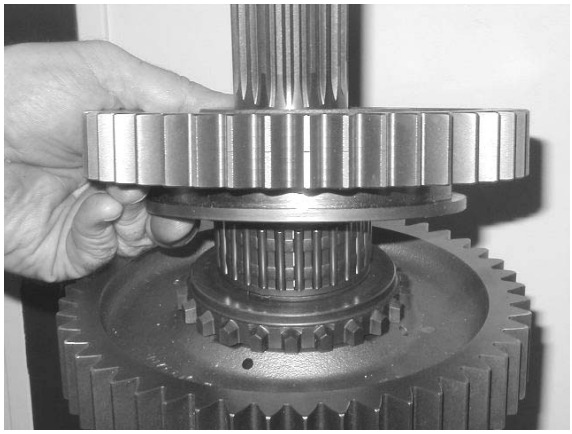
25. Fit and lubricate the needle roller bearing. Fit the 1st speed gear ensuring that the splines on the 1st speed gear engage into the splines of the synchronizer flange.

24. Check that the 2nd speed gear end float is within the tolerances stated in the chart.



26. Heat the reverse gear hub to 85° Centigrade and then, with the boss uppermost, fit it onto the splines of the mainshaft. Press the reverse gear hub until it is fully seated.

27. From the range of graded circlips select the one which fits into the mainshaft groove with the least amount of free play. Fit the Circlip into the groove taking care not to damage the mainshaft needle roller bearing surface.



29. Fit the reverse gear needle roller bearing. Lubricate the bearing and then fit the reverse gear, boss down, onto the mainshaft.

28. Check that the 1st speed gear is within the specified tolerance stated in the chart.

30. Heat the mainshaft bearing inner to 85° Centigrade and then fit it, shoulder down, onto the mainshaft. Use a press, if necessary, to ensure that the bearing is fully home against the shoulder.

31. Invert the mainshaft. Assemble the three springs and plungers into the synchronizer hub and then install the synchronizer sleeve and rollers as described in paragraph eleven.

32. Fit the synchronizer ring ensuring that the three bosses on the synchronizer ring locate into the three slots on the synchronizer hub. Lubricate the synchronizer ring.

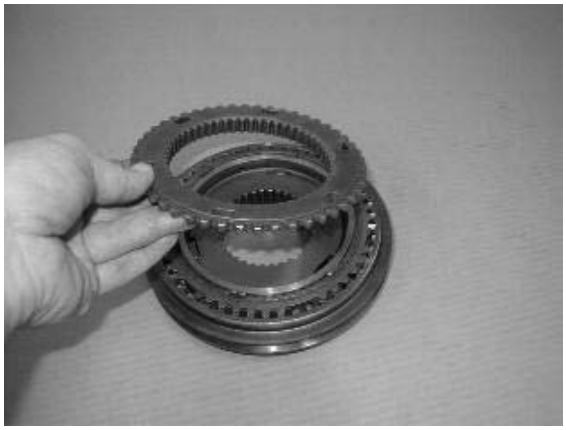
1st/2nd speed synchronizer assembly

Note : The synchronizer is supplied as an assembly. Parts that are used to make the complete assembly are not available separately.

Disassembly

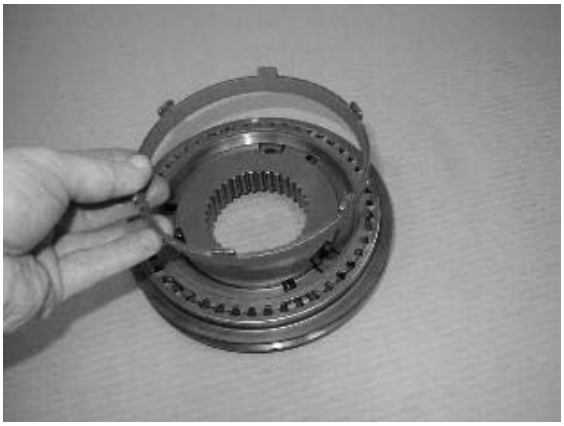
1. Stand the synchronizer assembly on a flat surface with the spigot of the synchronizer sleeve uppermost.

2. Push the synchronizer sleeve downwards.



3. Remove the synchronizer flange.

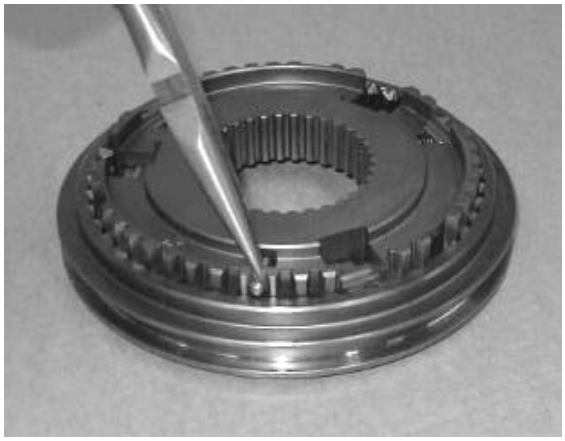
4. Remove the synchronizer inner ring.



5. Remove the synchronizer friction ring.

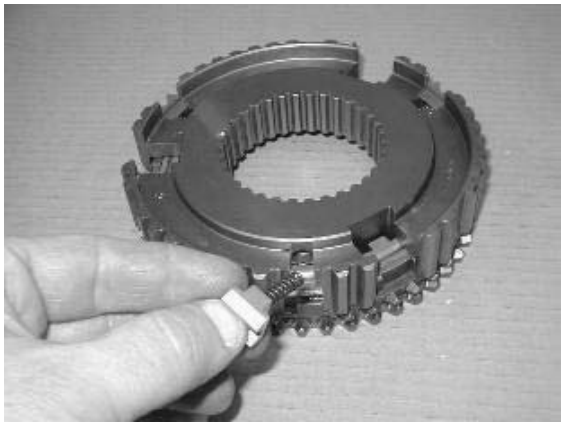
6. Remove the synchronizer ring.

7. Remove the three retainers.



8. Taking care not to lose the balls or springs lift the detent poppets to release the balls. Once the balls have been removed it is possible to remove the detent poppets and springs.

9. Remove the synchronizer sleeve.



10. If not already removed at step eight remove the detent poppets and springs.

11. Remove the synchronizer hub.

12. Remove the synchronizer ring.

13. Remove the synchronizer friction ring.

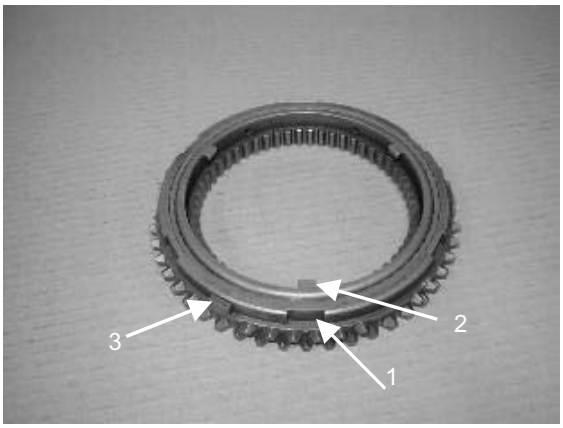
14. Remove the synchronizer inner ring.

Assembly

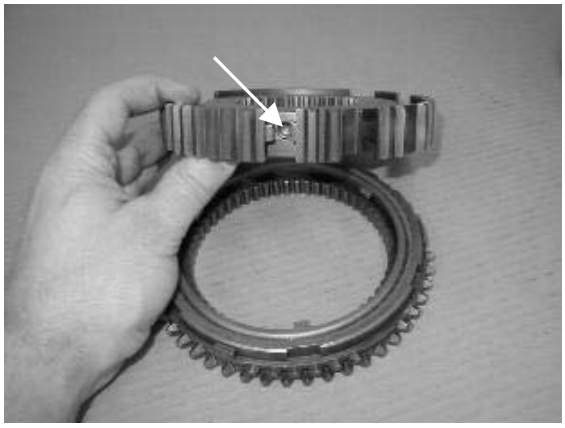
1. Place the synchronizer flange, spigot uppermost onto the bench.

3. Lubricate all surfaces of the synchronizer friction ring. Fit the synchronizer friction ring ensuring that the tabs locate in to the slots of the synchronizer flange.

2. Fit the synchronizer inner ring, tangs uppermost, on to the synchronizer flange.

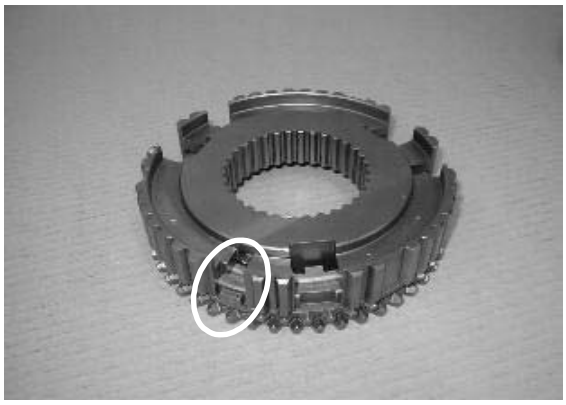


4. Fit the synchronizer ring ensuring that the undercuts (1) line up with the tabs (2) of the synchronizer inner ring and that bosses (3) of the synchronizer ring are to the left hand side of tabs (2) of the synchronizer inner ring as shown.

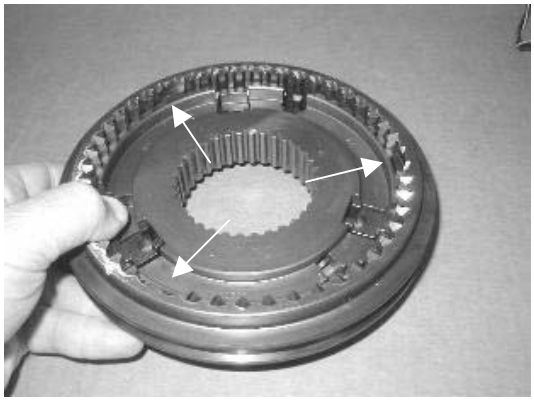


5. With the holes in the synchronizer hub uppermost.

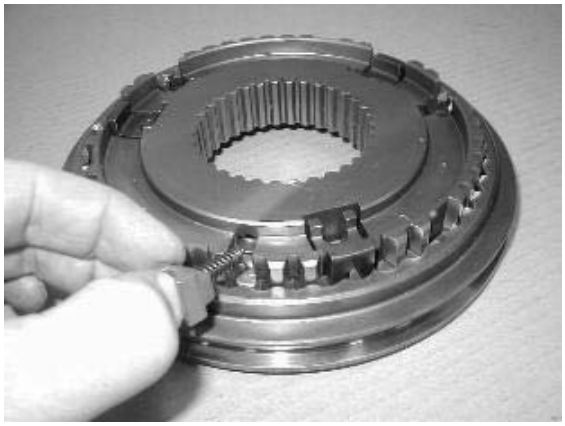
7. Place the three retainers in the large recesses of the synchronizer hub so that the legs of the blocks engage with the tabs of the synchronizer inner ring and the undercuts of the synchronizer ring.



6. Fit the synchronizer hub ensuring that the narrow slots are in line with the bosses of the synchronizer ring.



8. Take the synchronizer sliding sleeve, stepped side uppermost, and fit it on to the synchronizer hub ensuring that the three internal bosses of the synchronizer sleeve locate in the slots of the synchronizer hub.

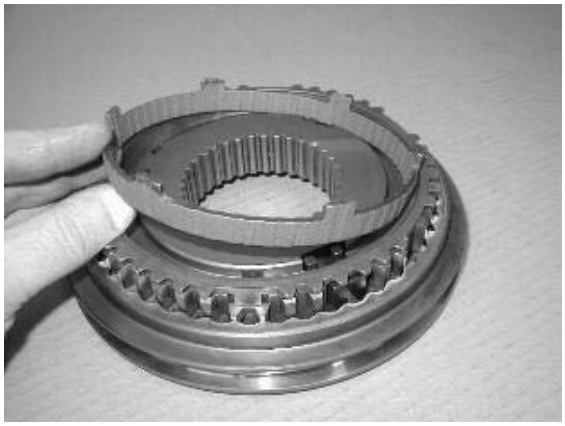


9. Place the detent poppets and springs into the holes of the synchronizer hub.

11. Whilst the spring is compressed push the detent poppet downwards into the synchronizer hub until the ball engages with the annular groove of the sleeve. Fit the remaining detent springs, balls and plungers into position.

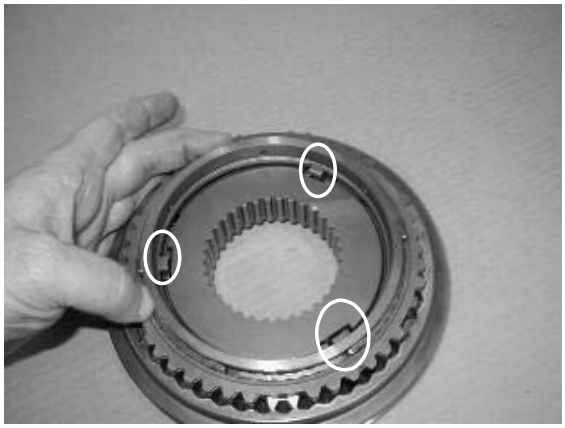
10. Place the detent ball onto the spring and then using a suitable tool push against the detent ball to compress the spring.

12. Place the synchronizer ring on to the synchronizer hub so that the three bosses engage with the three narrow slots on the synchronizer hub.



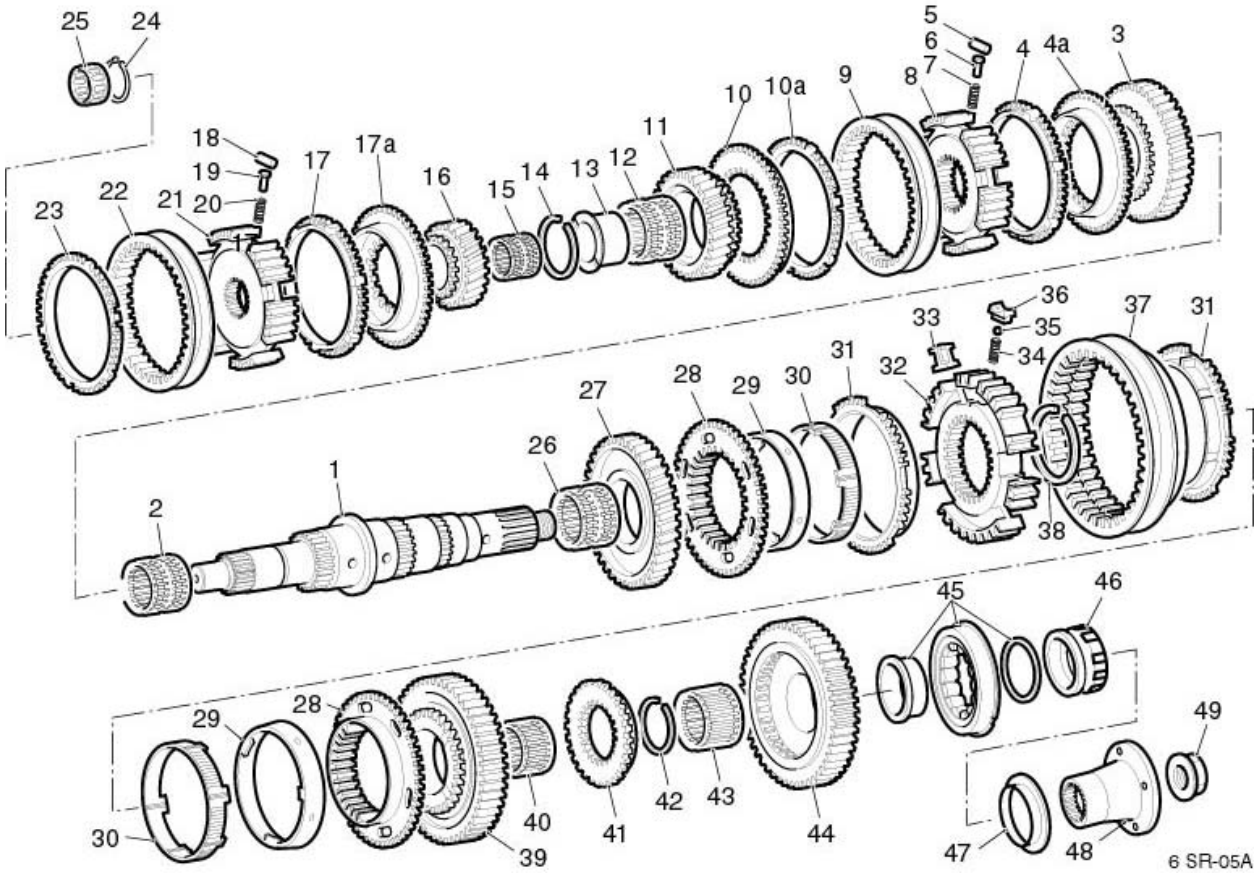
13. Lubricate all surfaces of the synchronizer friction ring. Place the synchronizer friction ring, tabs uppermost, on to the synchronizer hub.

15. Place the synchronizer flange in to position ensuring that the slots of the synchronizer flange align with the tabs of the synchronizer friction ring.



14. Place the synchronizer inner ring in to position ensuring that the three tabs align with the legs of the blocks.

16. Hold the synchronizer assembly down against the bench and at the same time lift the synchronizer sleeve upwards to engage the neutral position.



1. Mainshaft
2. 3rd gear needle roller bearing
3. 3rd speed gear
4. 3rd gear synchronizer ring
4a. 3rd gear synchronizer flange
5. Roller
6. Plunger
7. Spring
8. 3rd/4th speed synchronizer hub
9. 3rd/4th speed synchronizer sleeve
10. 4th gear synchronizer flange
10a. 4th gear synchronizer ring
11 4th gear
12 4th gear needle roller bearing
4th gear sleeve
13. Snap ring
14. 5th gear needle roller bearing (FS)
15. 6th gear needle roller bearing (FSO)
16. 5th speed gear (FS)
6th speed gear (FSO)
17. 5th gear synchronizer ring (FS)
6th gear synchronizer ring (FSO)
17a. 5th gear synchronizer flange (FS)
6th gear synchronizer flange (FSO)
18. Roller
19. Plunger
20. Spring
21. 5th/6th gear synchronizer hub
22. 5th/6th gear synchronizer sleeve
23. 6th gear synchronizer ring (FS)
5th gear synchronizer ring (FSO)
24. Circlip
25. 6th gear needle roller bearing (FS)
5th gear needle roller bearing (FSO)
26. 2nd gear needle roller bearing

27. 2nd gear
28. Synchronizer flange
29. Synchronizer inner ring
30. Synchronizer friction ring
31. Synchroniser ring
32. 1st/2nd gear Synchronizer hub
33. Retainer
34. Spring
35. Ball
36. Detent poppet
37. 1st/2nd speed Synchronizer sleeve
38. Circlip
39. 1st speed gear
40. 1st gear needle roller bearing
41. Reverse gear hub
42. Snap ring
43. Reverse gear needle roller bearing
44. Reverse gear
45. Mainshaft bearing
46. Tachograph
47. Dust shield
48. Coupling flange
49. Nut

Tools

RENAULT TRUCKS divide tools into 3 categories :

— **General-purpose tools :** Commercially available tools.
- **50 00 26… reference number** (possibility of purchasing through the Renault Trucks Spare Parts department).
- **4-figure reference number** (tools with Renault Trucks reference number, but available from the supplier).

— **Special tools :** Specially created tools, distributed by the Renault Trucks spare parts division.

— **Locally manufactured tools :** these tools are classified differently according to their degree of sophistication :

- **4-figure reference number** (represented by a drawing) : tools that are simple to make without need for special qualification.
- **50 00 26 … reference number** (possibility of purchassing through the Renault Trucks Spare Parts department) : a certain skill is needed to make these tools.

Three levels (or echelons) determine their assignment :

— **LEVEL 1 :** Tools for servicing and minor tasks.

— **LEVEL 2 :** Tools for major repairs.

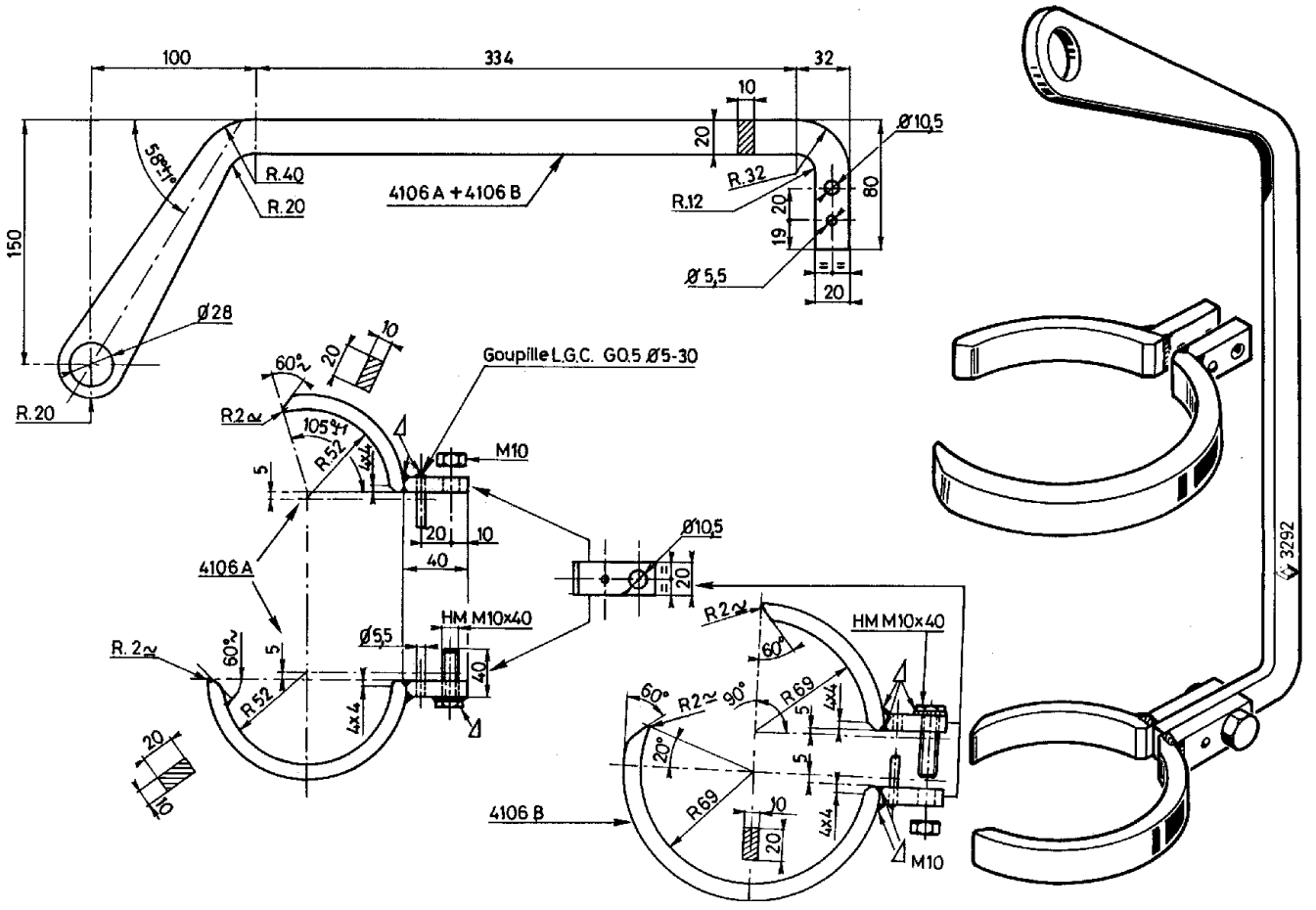
— **LEVEL 3 :** Tools for refurbishment.

General-purpose tools					
Tool ref. N°	**Renault Trucks ref N°**	**Designation**	**Level**	**Qty**	**Page**
009	50 00 26 **0821**	Puller	2	1	4/15
008	50 00 26 **0827**	Puller	2	1	4/13
001	50 00 26 **0832**	Puller	2	1	3/4
005	50 00 26 **0843**	Puller	2	1	4/3
002	50 00 26 **1000**	Universal stand	2	1	4/3

Special or specific tools					
Tool ref. N°	**Renault Trucks ref N°**	**Designation**	**Level**	**Qty**	**Page**
010	50 00 26 **3295**	Guide	2	1	4/28
003	50 00 26 **3296**	Fitting	2	2	4/3
004	50 00 26 **9134**	Holding wrench	3	1	4/3

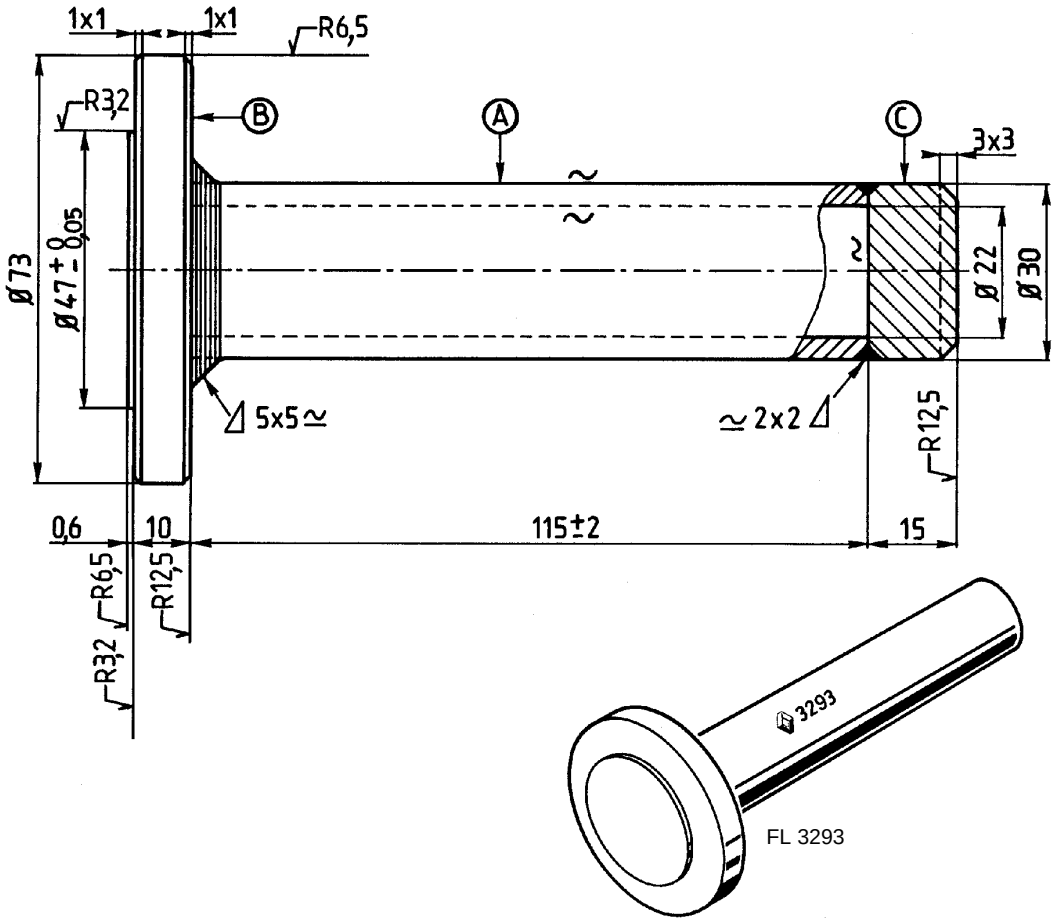
Locally manufactured tools					
Tool ref. N°	**Renault Trucks ref N°**	**Designation**	**Level**	**Qty**	**Page**
006	**3292**	Hook	2	1	4/6
007	**3293**	Pusher	3	1	4/7
011	**3294**	Pusher	1	1	4/32

Locally manufactured tool

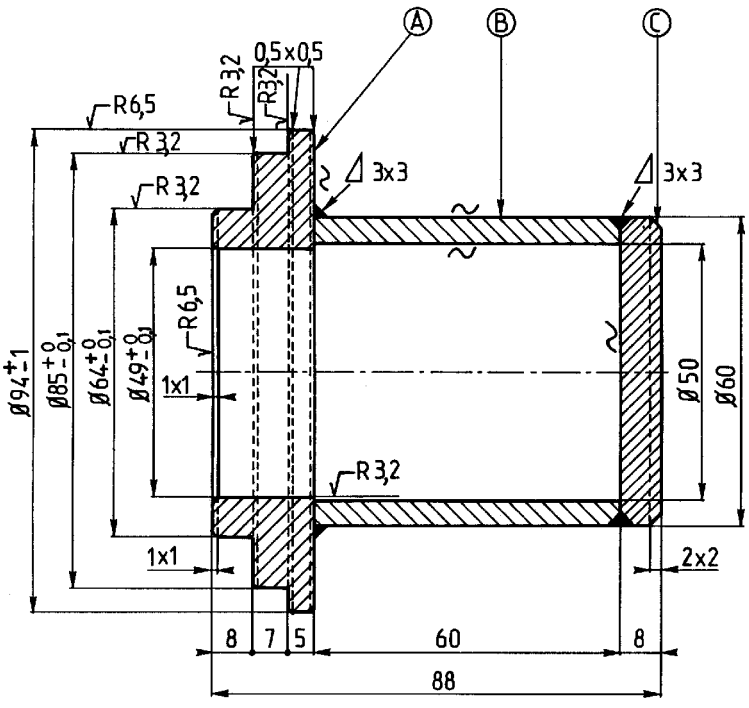


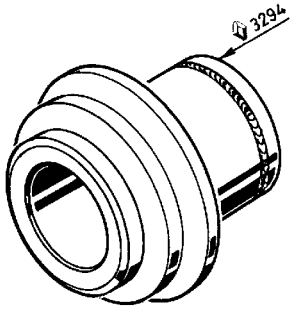
FL 3292

Locally manufactured tool



FL 3293





FL 3294