# WORKSHOP MANUAL

Alfetta

ALFA ROMEO

## CLUTCH
## GEARBOX · DIFFERENTIAL

*The present publication,*
*which is intended for ALFA ROMEO Distributers' workshops, contains instructions*
*for adjusting, repairing and overhauling the clutch,*
*gearbox and differential units.*

*The operations are thoroughly illustrated*
*so as to facilitate identification of the part or assembly being dealt with, the tools or equipment*
*to be used and the correct procedure.*

*Replacement of assemblies or individual parts*
*should be carried out exclusively with* **original ALFA ROMEO equipment:**
*only in this way can interchangeability and perfect working of the various parts be ensured.*

*When ordering parts it is essential to specify,*
*in addition to the type of vehicle, the number of the part taken from the spare parts*
*list together with the chassis number and the engine number.*

*It is also recommended that the appropriate tools and equipment should be used*
*when carrying out repairs and overhauls.*

*Finally, do not fail to keep this manual scrupulously up to date with the information*
*and standards contained in the "Information Sheets" and in the "Modification Instructions"*
*which are issued from time to time by the Technical Service Division.*

*Alfa Romeo* **Service Department**

# INDEX

# WORKSHOP METHODS

*When dismantling and re-assembling always use suitable and not makeshift spanners, extractors and equipment (both general and special) to avoid damaging the parts.*

*Tap lightly to separate parts which stick together firmly using only copper or aluminium hammers for steel parts; but using wooden or synthetic resin mallets for aluminium parts (covers, housings, etc.).*

*Keep the parts of the different assemblies separate and partly screw the nuts back on their respective studs and bolts.*

*When dismantling check whether the parts which should have reference marks are stamped with the reference number or the reference mark. If it is found that any part previously replaced is not so marked it should be stamped.*

*Before washing the parts, clean the rough dirt off them with brushes and rags (so as not to dirty the cleaning fluid) then wash them in paraffin or in hot water and soda and dry them off with a compressed air jet. Dry the parts immediately after washing to prevent them rusting.*

*Straighten bent parts by pressure, using an hydraulic press or other suitable means. Never straighten parts by hammering as this would weaken the material.*

*After emery papering or dressing parts with a stone wash them carefully and clean them off with a jet of compressed air to remove all traces of abrasive dust. During assembly use a compressed air jet or a small clean, dry brush to clean the parts (especially ground parts).*

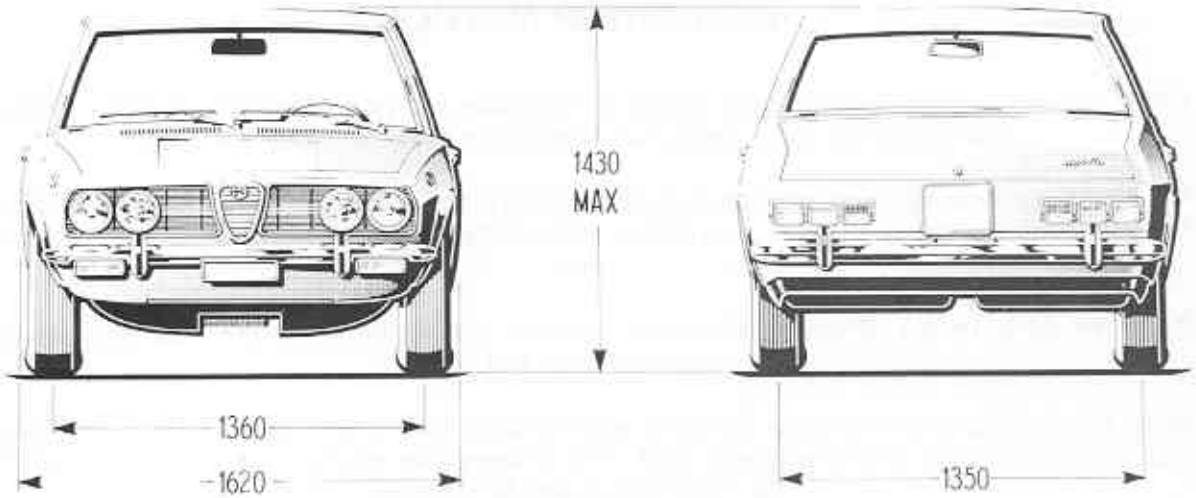
*On assembly, oil the parts well (but not graphited bushes) to avoid seizing during the initial running.*

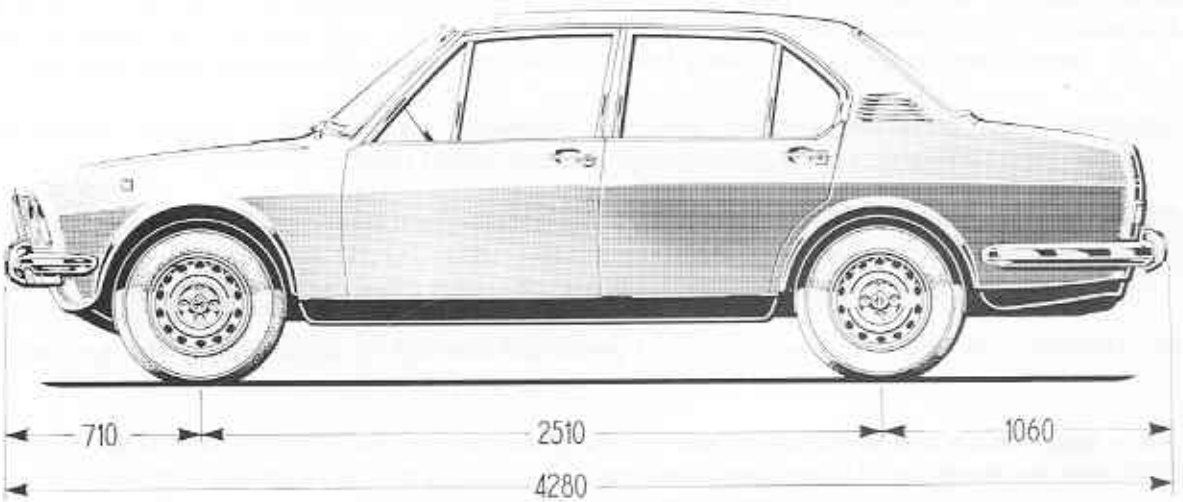
*Use a small brush and extremely clean oil for spreading the oil film on parts which have to be lubricated on assembly. Always keep the brush, the oil and the oil container well away from dust and use them for this purpose only.*

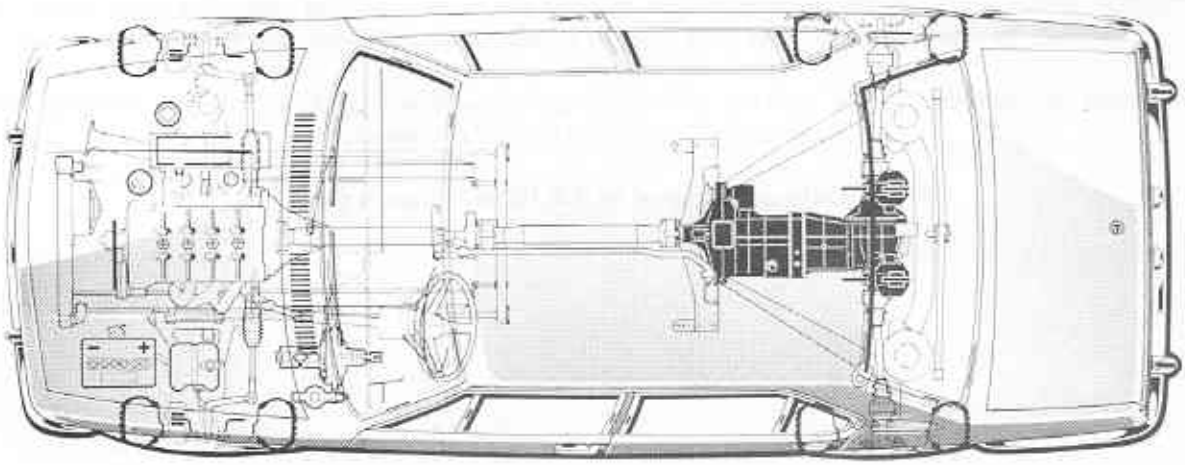
*Protect those parts of the engine which remain uncovered during assembly and which leave opening for the ingress of dust and foreign bodies with adhesive tape or with clean rag.*

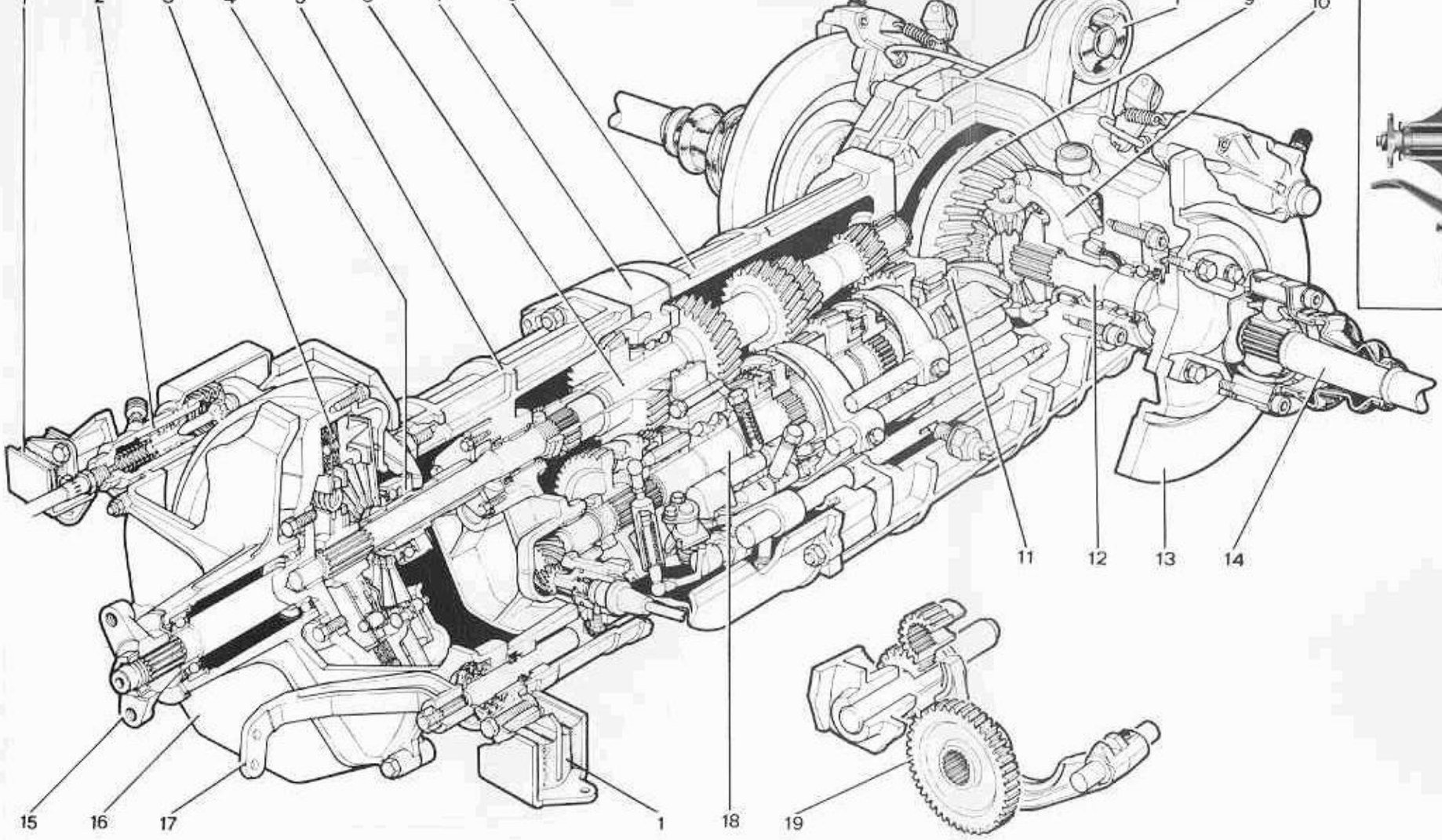
*At each re-assembly renew gaskets, oil seals, spring washers, locking washers, locking plates, "Palmuttern" lock nuts and all damaged parts.*

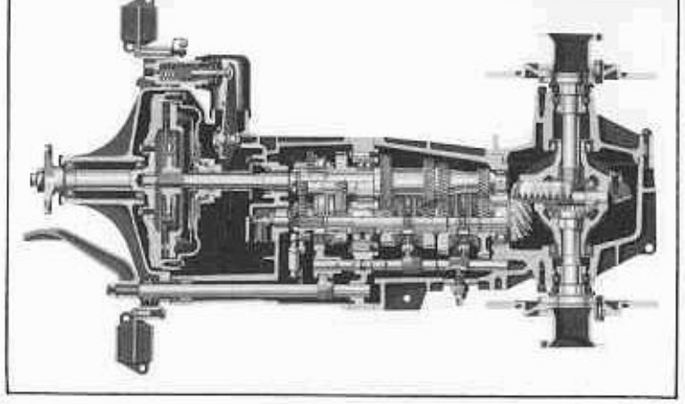
**Only use original ALFA ROMEO spare parts**





1 - Anti-vibration mountings
2 - Clutch slave cylinder
3 - Clutch plate
4 - Release bearing
5 - Clutch - gearbox housing
6 - Main shaft
7 - Intermediate flange
8 - Gearbox - differential housing
9 - Crown wheel

11 - Pinion
12 - Differential output shafts
13 - Brake disc
14 - Drive shafts
15 - Universal joint yoke connecting clutch shaft to propeller shaft
16 - Clutch housing
17 - Rear gear change lever
18 - Pinion shaft



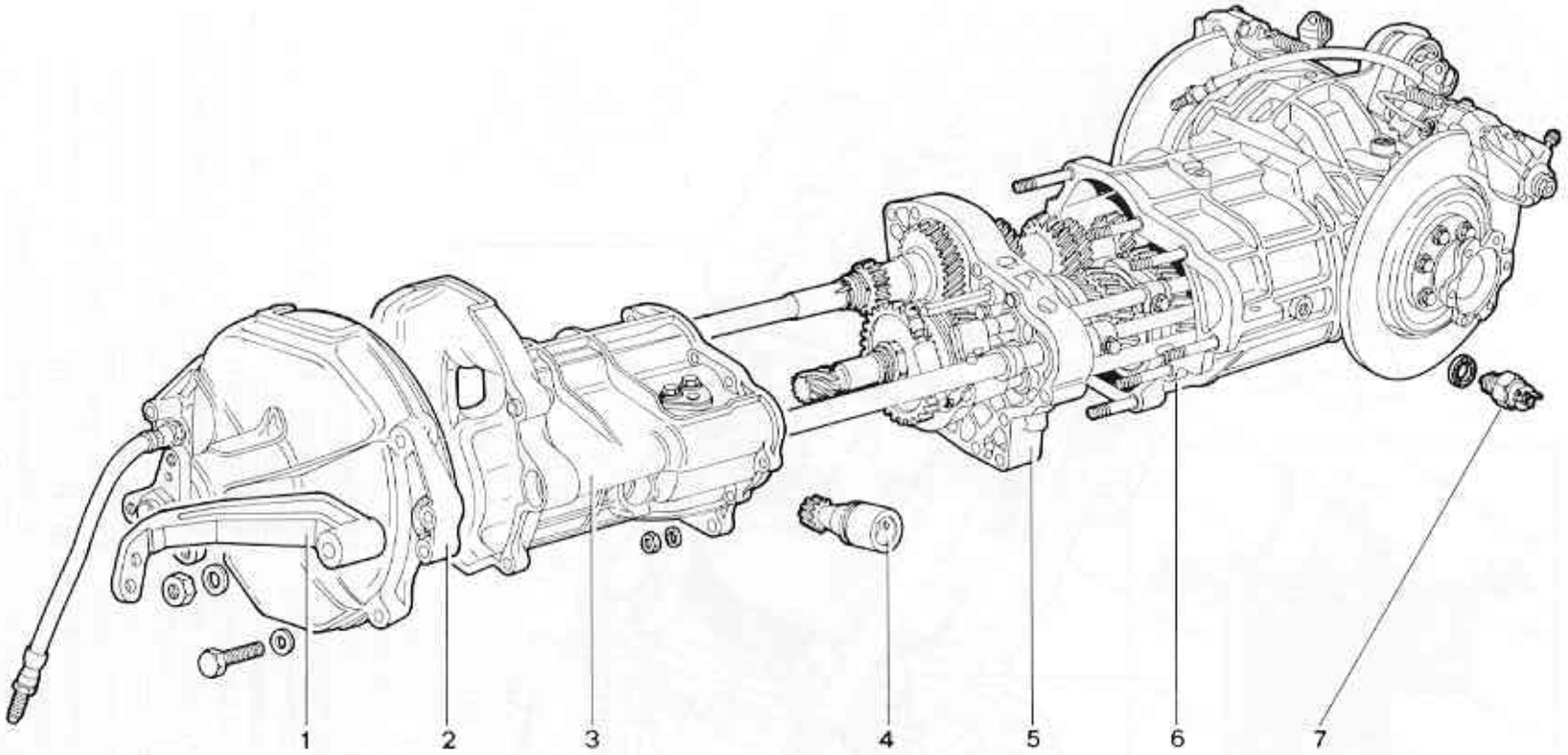
## CLUTCH - GEARBOX - DIFFERENTIAL UNIT

The clutch, gearbox and differential are mounted at the rear of the vehicle within the triangle of the De Dion axle of the rear suspension. They form a single unit directly connected to the body by suitable antivibration mountings.

The clutch, which is fitted at the power input of the gearbox – differential unit, is driven by the propeller shaft direct, to which it is connected by a universal joint.

The gearbox is of the "cascade" type, viz. it is comprised of two shafts only, one of which enters the differential direct and carries the pinion at the end.

Connection to the wheels is by drive shafts of the oscillating type fitted with constant velo-




## EXPLODED VIEW OF THE CLUTCH-GEARBOX-DIFFERENTIAL UNIT

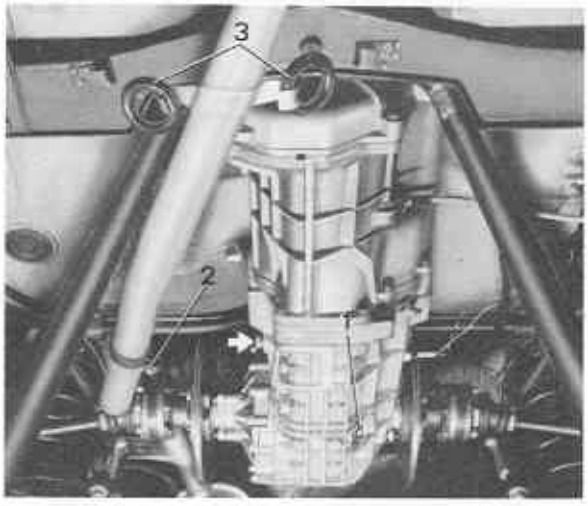
1 - Rear gear selector lever
2 - Housing with clutch assembly
3 - Clutch and gearbox housing
4 - Speedometer driven gear
5 - Intermediate flange complete with shafts and gear change components
6 - Gearbox - differential housing
7 - Reversing light switch

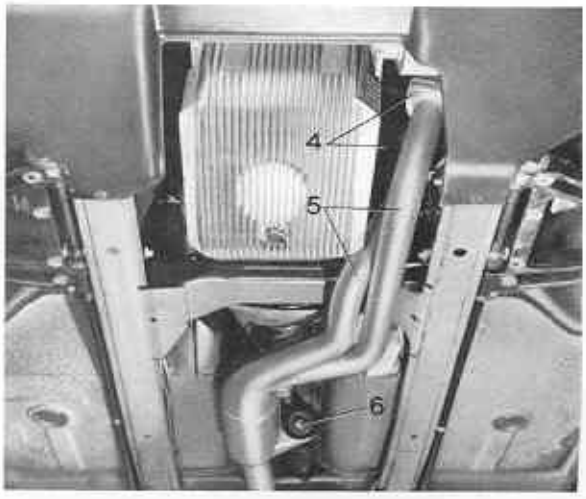
# REMOVAL OF CLUTCH - GEARBOX - DIFFERENTIAL UNIT FROM THE VEHICLE

Raise the vehicle on a lift and drain the oil from the gearbox-differential unit by removing the drain plug. **1**.

**Removing the exhaust pipe**

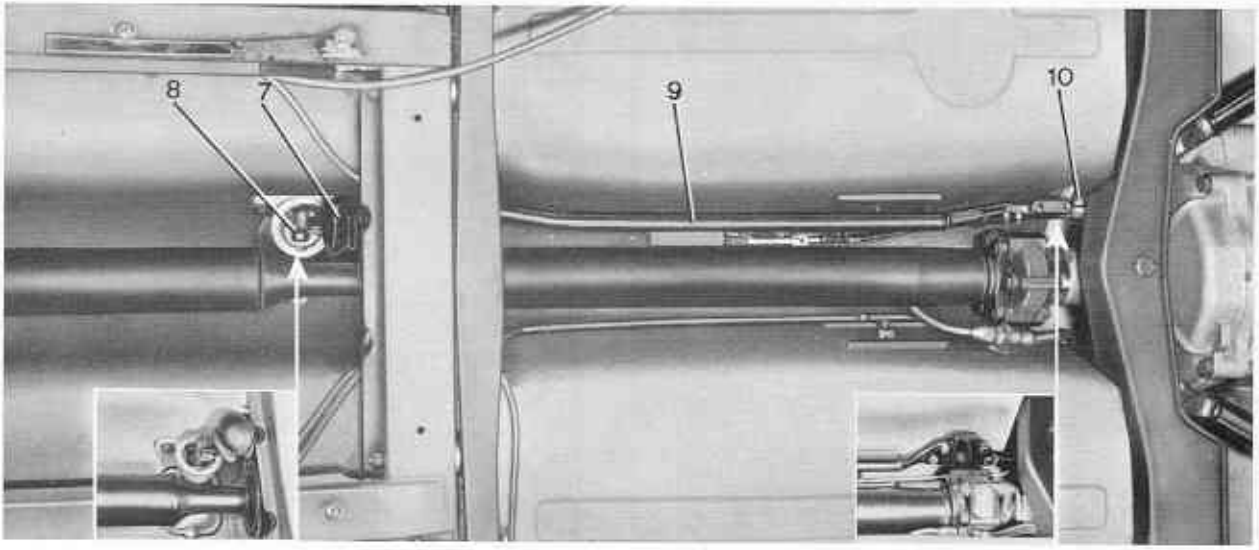
- Slacken clip **2** connecting the front pipe to the tail pipe
- Unhook the rubber rings **3** from the axle front support bracket
- Slacken and remove the flange bolts **4** from the exhaust pipe **5** at the exhaust manifold
- Slacken and remove the exhaust pipe support bolt **6** from the bracket provided on the rear engine mounting and remove the exhaust pipe after sliding it out of the tail pipe.




**Removing the operating rod from the gear lever and the rear lever on the clutch housing**

- Remove the dust boot **7** from the gear lever bracket
- Slacken and remove: the screw and washer **8** connecting the operating rod **9** to the gear lever; the nuts and washers **10** from the operating rod flexible coupling to the rear gear elector lever on the clutch; remove the operating rod itself.



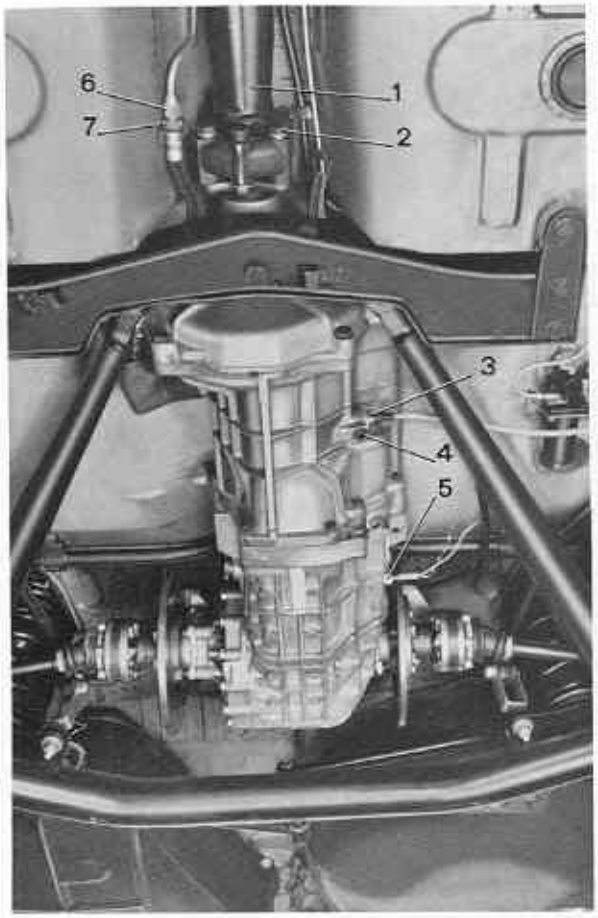
### Dismantling miscellaneous items

Disconnect the propeller shaft **1** from the clutch shaft universal joint yoke by slackening and removing the bolts and washers **2** using spanner, Tool **A.5.0192.**

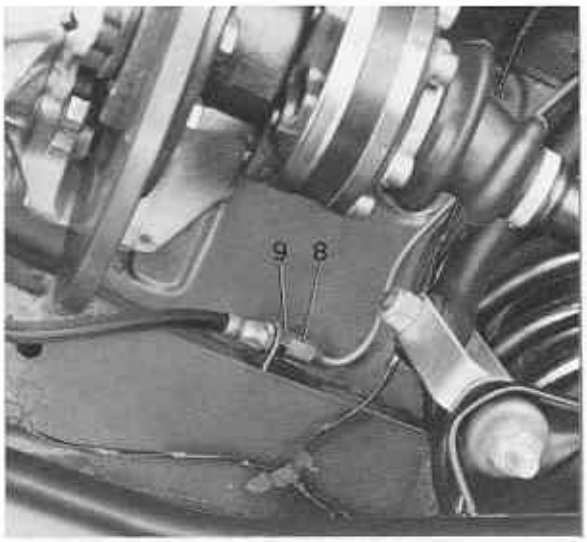
Disconnect the speedometer flexible shaft **3** from the drive spindle by slackening the retaining screw **4.**

Disconnect the electric cables from the reverse lights switch **5.**

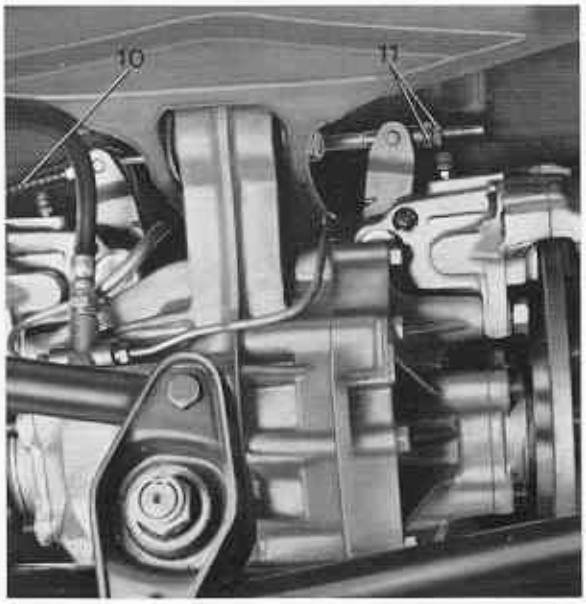
Slacken and disconnect the connection **6** on the pipe from the hose of the clutch slave cylinder, then slacken and remove the nut and washer **7** attaching the hose to the bracket on the body.




Slacken and disconnect the connection **8** on the pipe from the hose of the hydraulic brake system and remove nut and washer **9** attaching the hose to the support bracket.



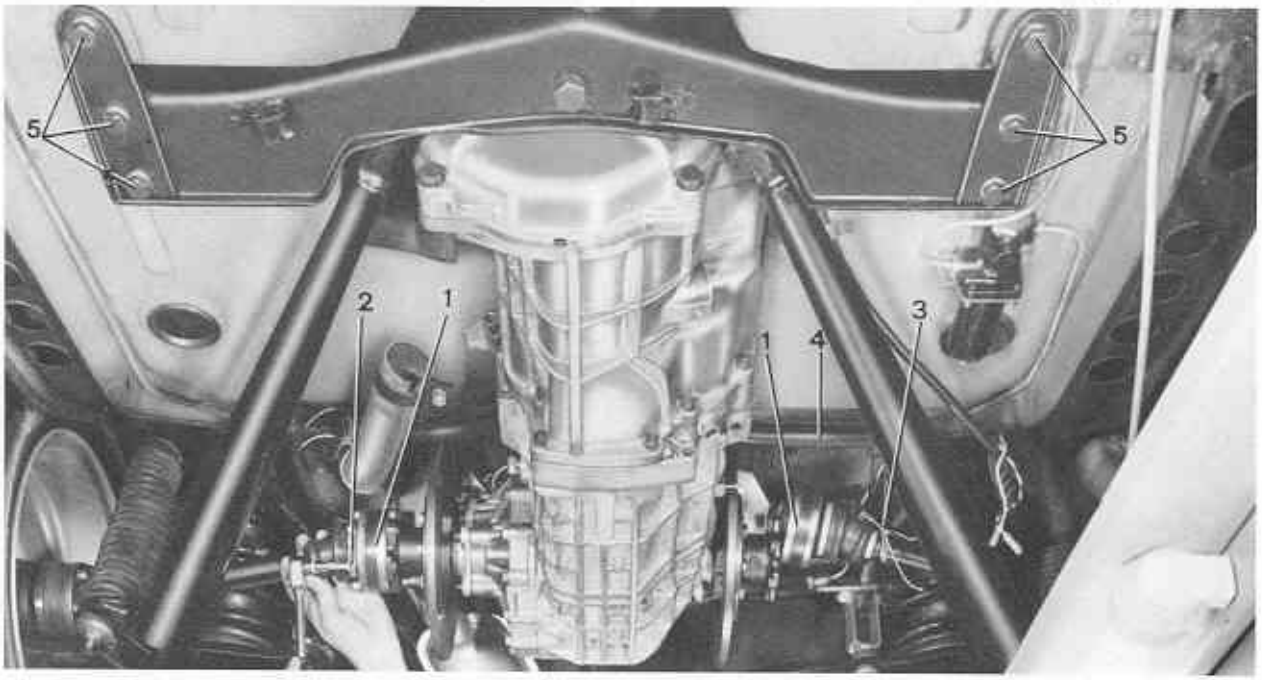

Release the hand brake Bowden cable **10** from the levers on the brake calipers by slackening the locknut and adjusting nut **11.**



Disconnect the drive shafts **1** from the disc brake distance flanges by slackening and removing the bolts and washers **2**.

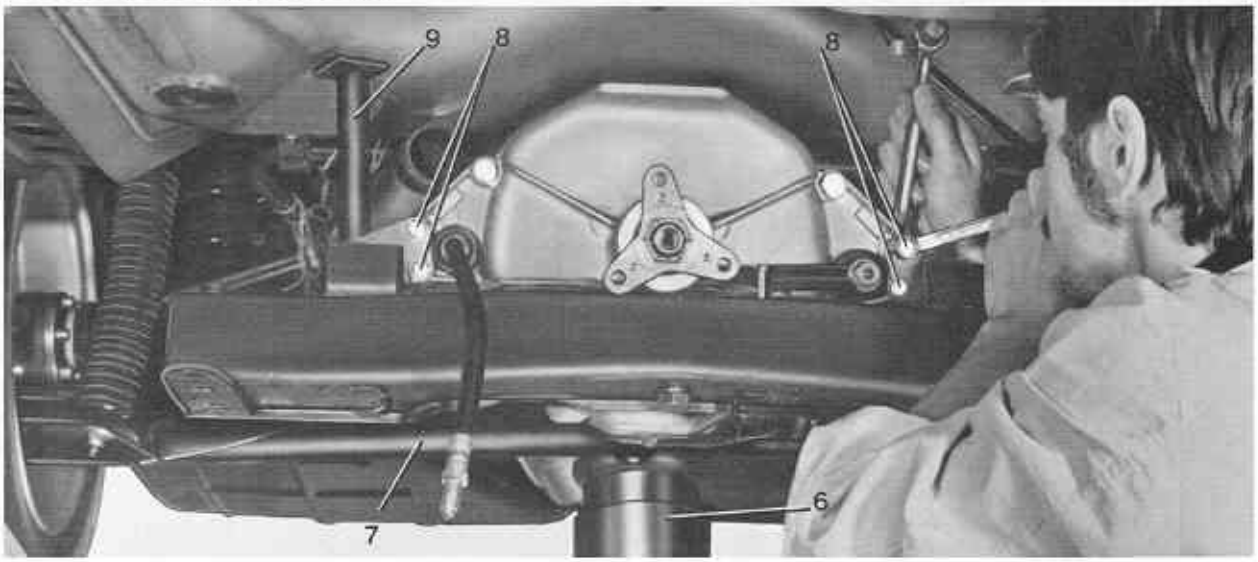
Raise the drive shafts to clear the disc brake distance pieces and support them by tying them with string **3** to the stabilizer bar **4**.

Slacken and remove screws **5** attaching the front bracket of the de-Dion axle to the body.



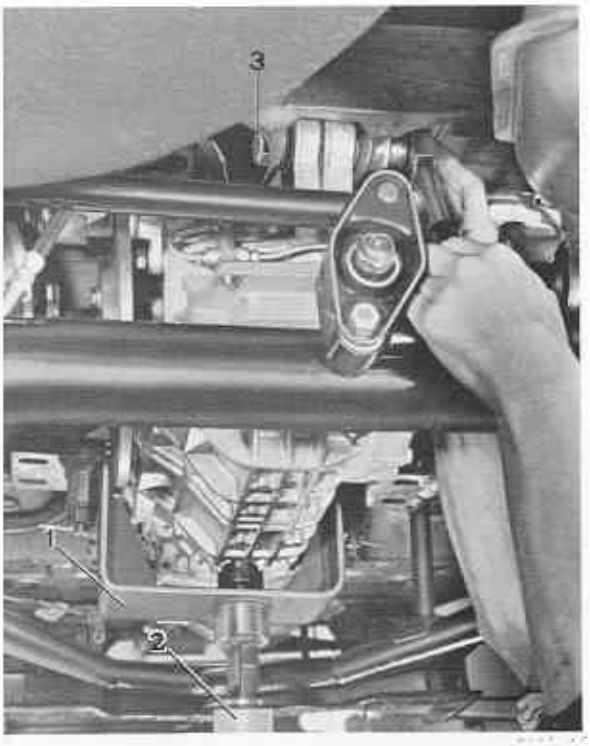

Raise the axle **7** with an hydraulic jack **6** so as to incline the front downwards sufficiently to slacken bolts **8** attaching the clutch - gearbox - differential unit to the flexible mountings fitted on the front support cross-member.

**NOTE - To facilitate the work fit the distance piece 9 (Tool A.2.0268) between the arm of the de-Dion axle and the body and remove the hydraulic jack from the axle.**



With the special tool **1 (R.4.0150)** and a jack **2 (R.7.0010)** support the unit and take out the bolts **8** previously slackened (see page 9).

Raise the unit so that the rear rubber bushing is relieved of the load, then slacken and remove the attaching bolt **3**.




Slant the unit forward.

Lower the unit and remove it from under the axle **4**.

# REMOVING CLUTCH UNIT FROM THE VEHICLE

If it is necessary to overhaul the clutch only, it is removed from the vehicle as follows:

Raise the vehicle on the ramp.

Dismantle the exhaust pipe as described on page 7.

Slacken and remove the bolts and washers 10 from the operating rod flexible coupling attached to the rear gear selector lever fitted on the clutch housing (see page 7).

Disconnect the propeller shaft 1 from the yoke on the clutch shaft by slackening and removing bolts and washers 2 using spanner, Tool **A.5.0192** (see page 8).

Slacken and disconnect the pipe connection 6 from the hose of the clutch hydraulic system, then slacken and remove nut and washer 7 attaching the hose to the bracket on the body (see page 8).

Slacken and remove bolts 5 fastening the front support cross-member of the de-Dion axle to the body (see page 9).

Remove the clutch slave cylinder dirt cover 3 (see page 12).

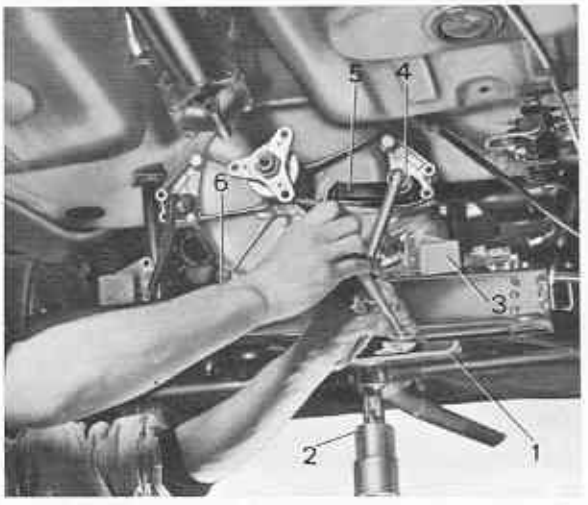
Raise the axle 7 with an hydraulic jack 6 so as to incline the front downwards sufficiently to slacken the bolts 8 attaching the clutch-gearbox-differential unit to the flexible mountings fitted on the front support cross-member (see page 9).

**NOTE - To facilitate the work, fit the distance piece 9 (Tool A.2.0268) between the arm of the de-Dion axle and the body and remove the hydraulic jack from the axle, (see page 9).**

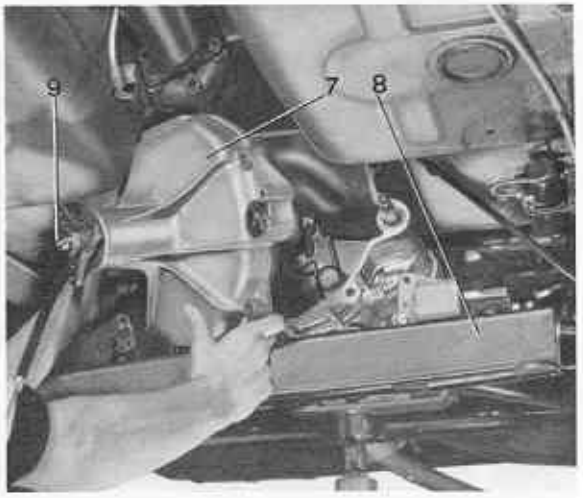
Support the clutch-gearbox-differential with the appropriate cradle **1** (Tool **R.4.0150**) and an hydraulic jack **2** (**R.7.0010**) and remove the bolts, previously slackened, attaching the unit to the flexible mountings **3**.

Slacken and remove the retaining nut and washer **4** from the rear gear selector lever **5** and withdraw the lever.

Raise the unit with the jack positioning it so as to permit the removal of the clutch assy between the body and the cross-member of the axle frame. Then slacken and remove bolts **6** attaching the clutch to the clutch-gearbox housing.




Slide the clutch assy **7** from the main shaft and remove it between the body and the front support cross-member **8** of the axle frame.



# REMOVING GEARBOX UNIT FROM THE VEHICLE

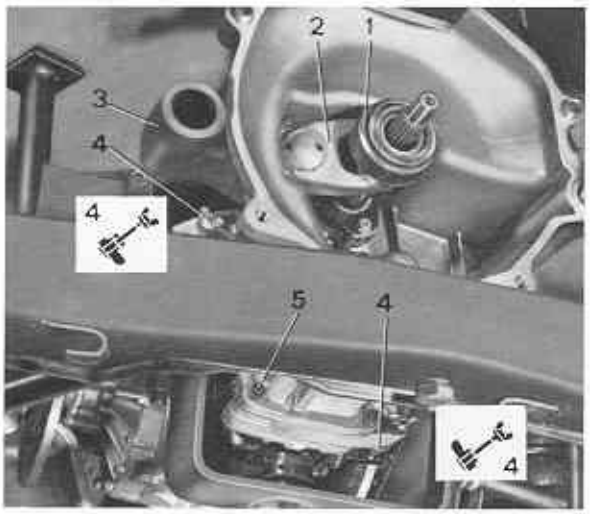
Raise the vehicle on the ramp and drain the oil from the gearbox - differential unit by removing the appropriate plug (see 1, page 7).

Remove the clutch assy as described on page 11.

Remove the reverse light switch 5 and withdraw the speedometer drive 3 by removing the retaining screw 4 (see page 8).

Remove the release bearing **1**, the release lever **2** and the dirt cover **3**.

Clamp the intermediate flange and the gearbox - differential housing together with tools **4** (A.2.0244).



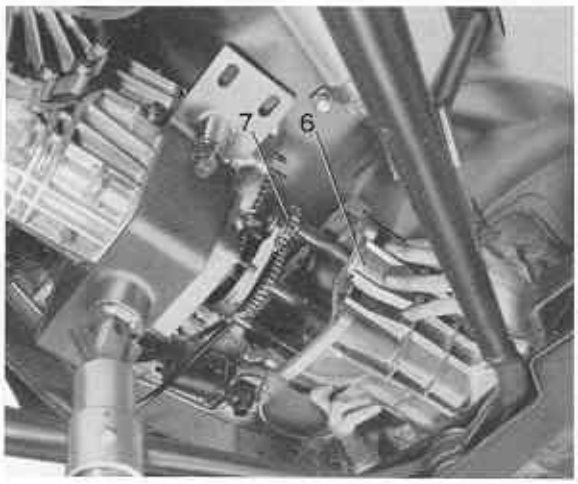

Slacken and remove nuts **5** fastening the clutch - gearbox housing to the gearbox - differential housing.

Remove the clutch-gearbox housing **6**.

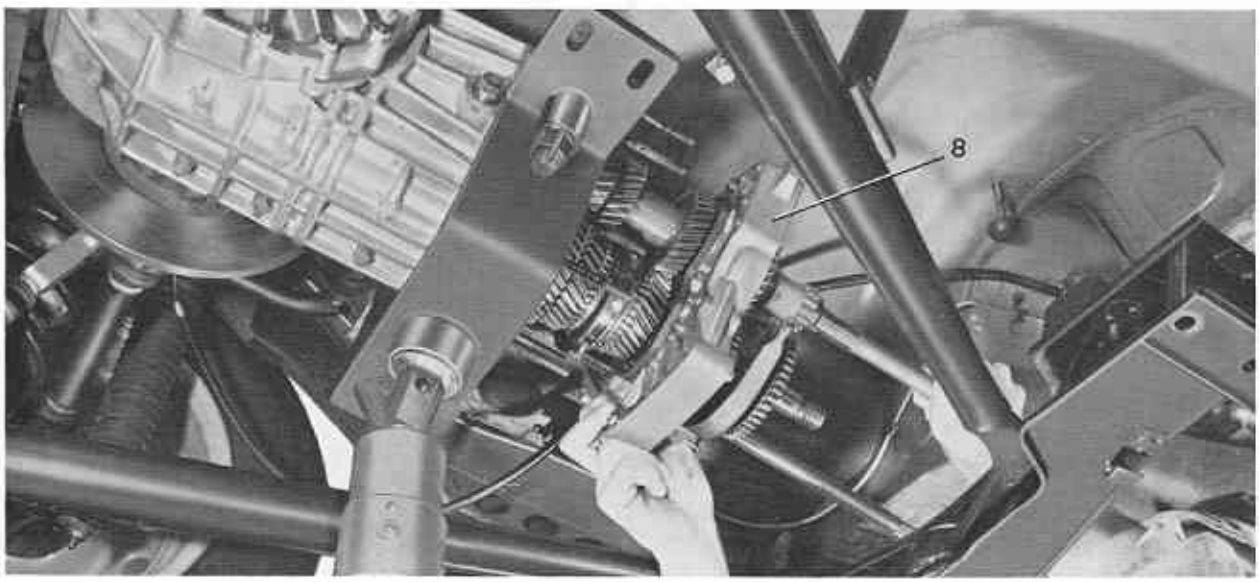
**NOTE - To facilitate the operation tap the end of the gear selector rod lightly with a plastic mallet.**

Withdraw the sliding reverse gear **7**.

Remove the clamps **4** holding the intermediate flange to the gearbox - differential housing.




Withdraw the intermediate flange **8** with the gear shafts and the gear change components.



# RE-INSTALLATION OF THE UNITS

Refitting of the units in the vehicle is carried out by working in the reverse order to the stripping-out operations, paying special attention to the following points:

**Re-installing the clutch-gearbox-differential unit**

Lubricate using the grease specified:
- the seat for centering the propeller shaft on the clutch shaft (see 9, page 11).

- the threaded shank of the bolts connecting the drive shafts to the disc brake distance pieces. Tighten the bolts to a torque of 2.8 to 3 Kgm (see 2, page 9).

Tighten the pipe connection to the hose of the clutch hydraulic system (see 6, page 8) and the connection of the brake hydraulic system (see 8, page 8) with a torque of 0.8 to 1 Kgm.

Tighten the reverse light switch with a torque of 4 to 4.9 Kgm (see 5, page 8).

Tighten the clutch shaft universal joint yoke bolts to a torque as specified on page 19 using spanner, tool **A.5.0192** and the torque spanner.

Check the tightening torque of the propeller shaft universal joint bolts as shown on page 14.

Bleed the air from the hydraulic brake and clutch systems as shown on page 15.

Inspect and re-fill the gearbox - differential unit with oil as shown on page 16.

**Re-installing the gearbox unit**

Coat the joint faces of the intermediate flange and the gearbox - differential housing and the gearbox - clutch housing with the prescribed sealant after having cleaned the joint faces with the prescribed liquid.

Tighten opposite nuts in turn of the clutch gearbox housing to the intermediate flange joint to a torque of 1.2 to 1.4 Kgm.

Lubricate the seat for centering the propeller shaft on the clutch shaft with the prescribed grease (see 9, page 11).

Tighten the rear gear selector lever retaining nut to a torque of 2.9 to 3.6 Kgm (see 4, page 11).

Tighten the pipe connection to the hose of the clutch hydraulic system to a torque of 0.8 to 1 Kgm (see 6, page 8).

Tighten the reverse light switch with a torque of 4 to 4.9 Kgm (see 5, page 8).

Tighten the clutch shaft universal joint yoke bolts to a torque as specified on page 19 using spanner, tool **A.5.0192** and the torque spanner.

Check the tightening torque of the propeller shaft universal joint bolts as shown on page 14.

Bleed the air from the clutch hydraulic system as shown on page 16.

Inspect and re-fill the gearbox - differential unit with oil as directed on page 16.

**Re-installing the clutch unit**

Lubricate the seat for centering the propeller shaft on the clutch shaft with the prescribed grease (see 9, page 11).

Tighten the rear gear selector lever retaining nut to a torque of 2.9 to 3.6 Kgm.

Tighten the pipe connection to the hose of the clutch hydraulic system to a torque of 0.8 to 1 Kgm (see 6, page 8).

Tighten the clutch shaft universal joint yoke bolts to a torque as specified on page 19 using spanner, tool **A.5.0192**, and the torque spanner.

Check the tightening torque of the propeller shaft universal joint bolts as shown below.

Bleed the air from the clutch hydraulic system as shown on page 16.

Carry out the inspection and checks as described on page 16.

**Checking the tightening of the propeller shaft universal joint bolts**

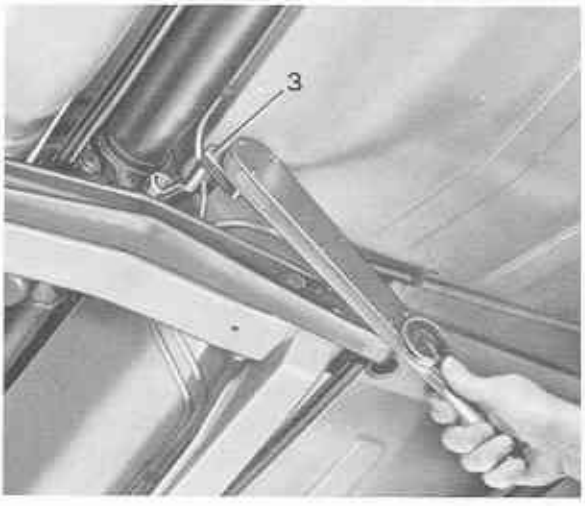
Check, using the appropriate spanner, that the tightening torque of the bolts in all the universal joints in the propeller shaft is 4.1 to 4.5 Kgm in the following manner:

- Check the tightening torque of the rear universal joint bolts with spanner **1** (Tool **A.5.0192**) and the torque spanner


- Check the tightening torque of the centre joint bolts.

• Front bolts: Use spanner **2** (Tool **A.5.0190**) and torque spanner

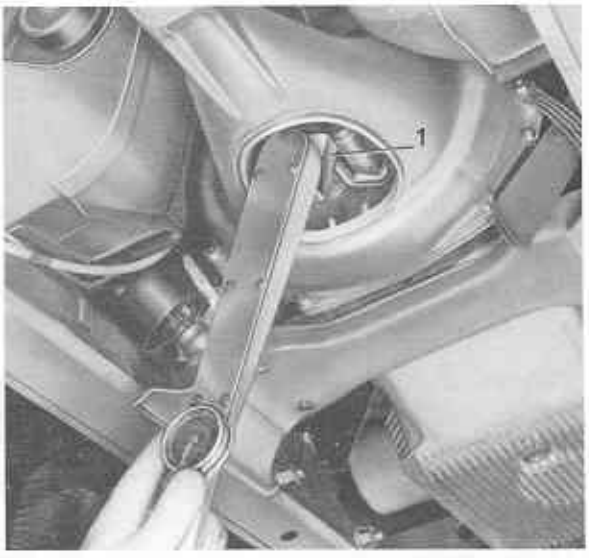

• Rear bolts: Use spanner **3** (Tool **A.5.0191**) and torque spanner.



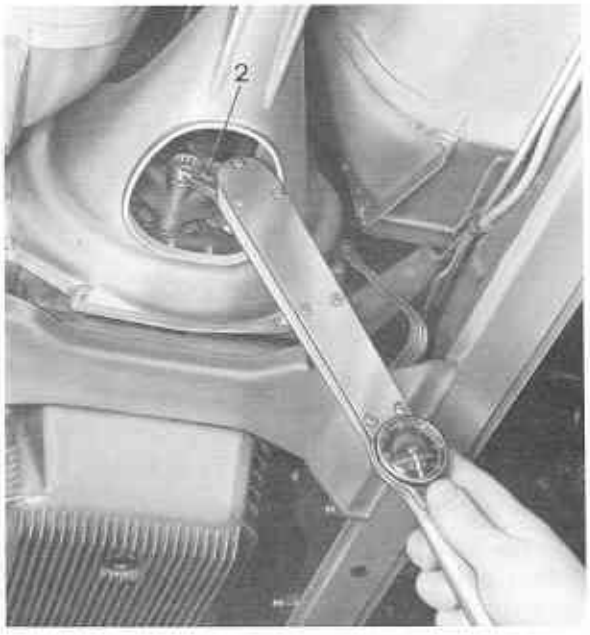
# BLEEDING BRAKE AND CLUTCH HYDRAULIC SYSTEMS

- Check the tightening torque of the front universal joint bolts.

• Front bolts: use spanner **1** (Tool **A.5.0191**) and torque spanner



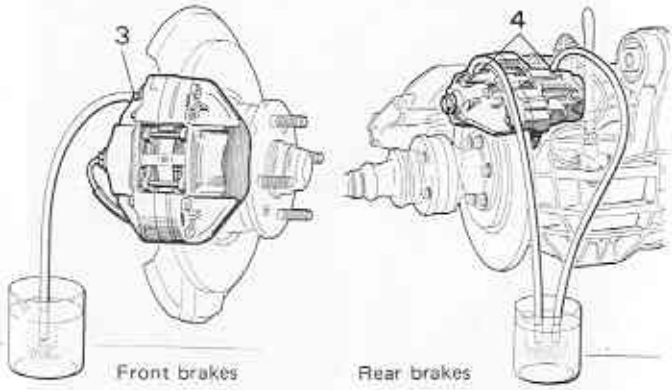

• Rear bolts: use spanner **2** (Tool **A.5.0192**) and torque spanner.




Bleed the air with the utmost care paying attention to the following points:

**Brakes**

- if necessary refill the reservoirs with the prescribed fluid taking it from new sealed tins which should only be opened at the moment they are about to be used. Take care that during bleeding the fluid does not fall below the minimum level.




- remove the dust caps and fit flexible tubing on the bleed screw **3** of one front caliper and on the bleed screws **4** of one rear caliper (the two right hand wheels or the two left hand wheels) with the tube ends immersed in transparent jars already partly filled with the prescribed brake fluid

- slacken the front and rear caliper bleed screws simultaneously; depress the brake pedal several times taking care to let it return slowly and wait a few seconds before depressing it again

- repeat the operation until fluid comes out free from air bubles

- keeping the brake pedal pressed hard down, shut the bleeder screws, remove the flexible tubes and replace the dust caps.

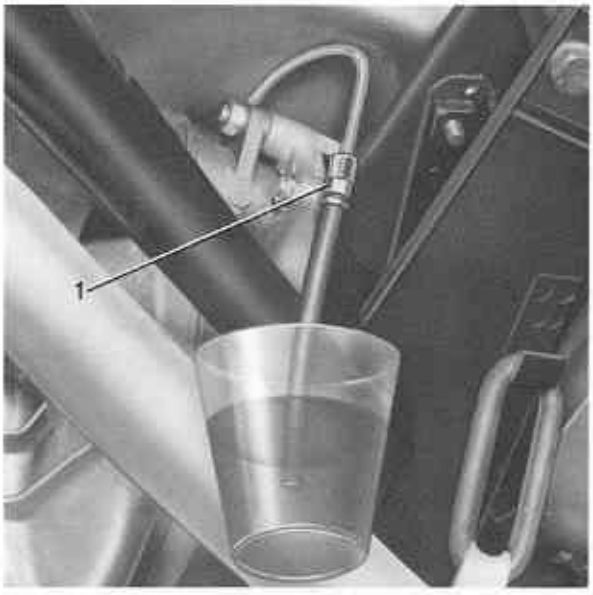
Repeat the operation described for the other pair of brake calipers and then top up the level of the fluid in the reservoirs.

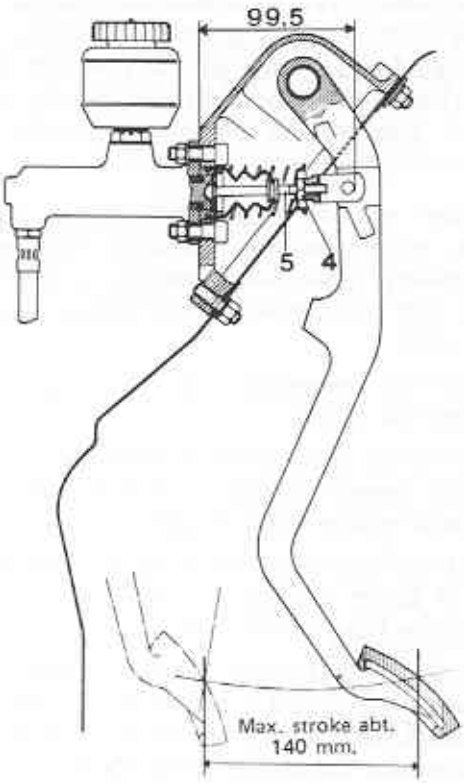
If the bleeding is done carefully, soon after the pedal free travel a direct action without sponginess will be felt on the fluid. If this is not so, repeat the bleeding procedure.

# ADJUSTMENT AND FILLING

## Clutch

Proceed in a similar way to that described for bleeding the air from the hydraulic brake system by putting the flexible tube on the bleed screw which is on the connecting pipe **1** to the clutch slave cylinder.




Adjust the hand brake by turning the locknut and nut on the Bowden cable (see 11, page 8) then fully engage the brake lever and check that the rear wheels are locked at half the total movement.

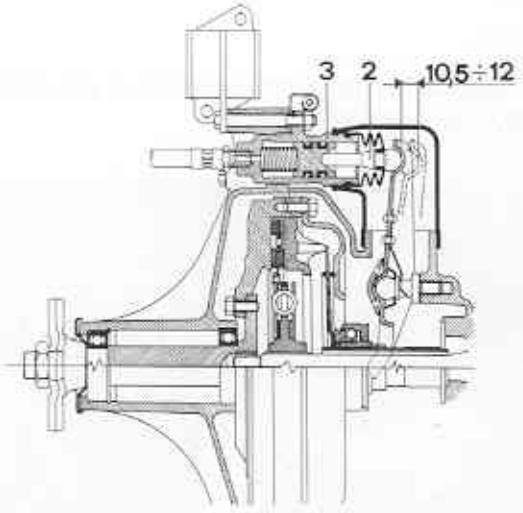
If necessary check that the clutch slave cylinder spindle **2** in the cylinder **3** is working properly, by pressing the clutch pedal right down, and has a stroke of 10.5 to 12 mm.

To adjust the slave cylinder stroke proceed as follows:

Slacken the locknut **4** on the master cylinder push rod clevis.

Tighten or slacken the push rod **5** of the master cylinder so as to increase or reduce the stroke on the master cylinder until the stroke of the slave cylinder spindle **2** is between the values stated.

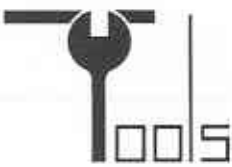
Under these conditions the stroke of the master cylinder push rod **5** should be between 22 and 25 mm.




Fill the gearbox - differential unit with new oil of the quality and in the quantity specified, after having tightened the drain plug to the required torque of 1.5 to 1.8 Kgm.

When filling has been completed the oil should come up to the bottom edge of the filling hole; then tighten the plug (see arrow on page 7) to a torque of 1.5 to 1.8 Kgm.


Prescriptions

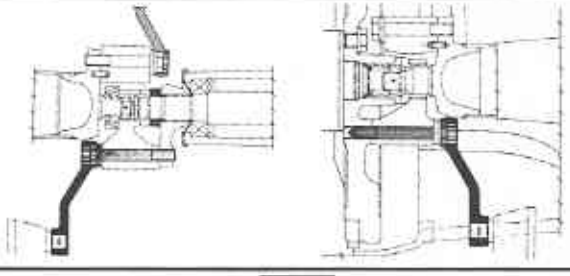

Tools


Tightening
torques


Lubricants


fluids and sealants

# Tools



## A.5.0192

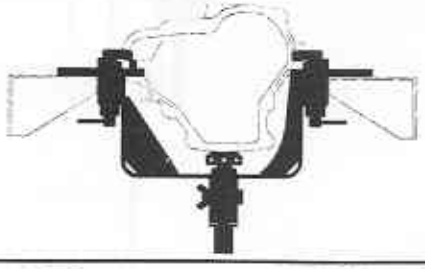
**SPANNER**
17 mm hexagon, for propeller shaft rear universal joint bolts and rear bolts of front universal joint

## A.2.0268

**DISTANCE PIECE**
for holding de-Dion axle arms clear of body

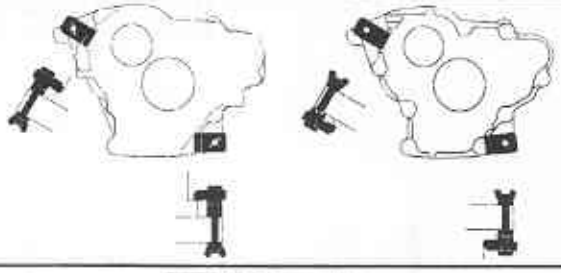
## R.7.0010

**PEDESTAL LIFT**
for removing refitting-clutch-gearbox-differential unit



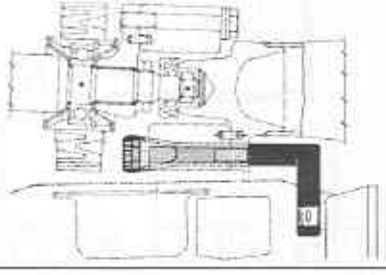
## R.4.0150

**CRADLE**
for clutch-gearbox-differential unit



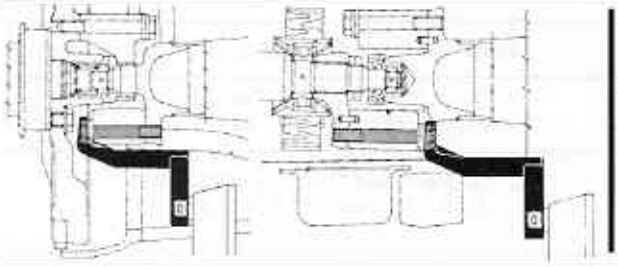
## A.2.0244

**CLAMPS**
for clamping intermediate flange to clutch-gearbox housing and gearbox-differential housing



## A.5.0190

**SPANNER**
17 mm hexagon crowfoot, for front bolts of propeller shaft centre U-joint



# A.5.0191

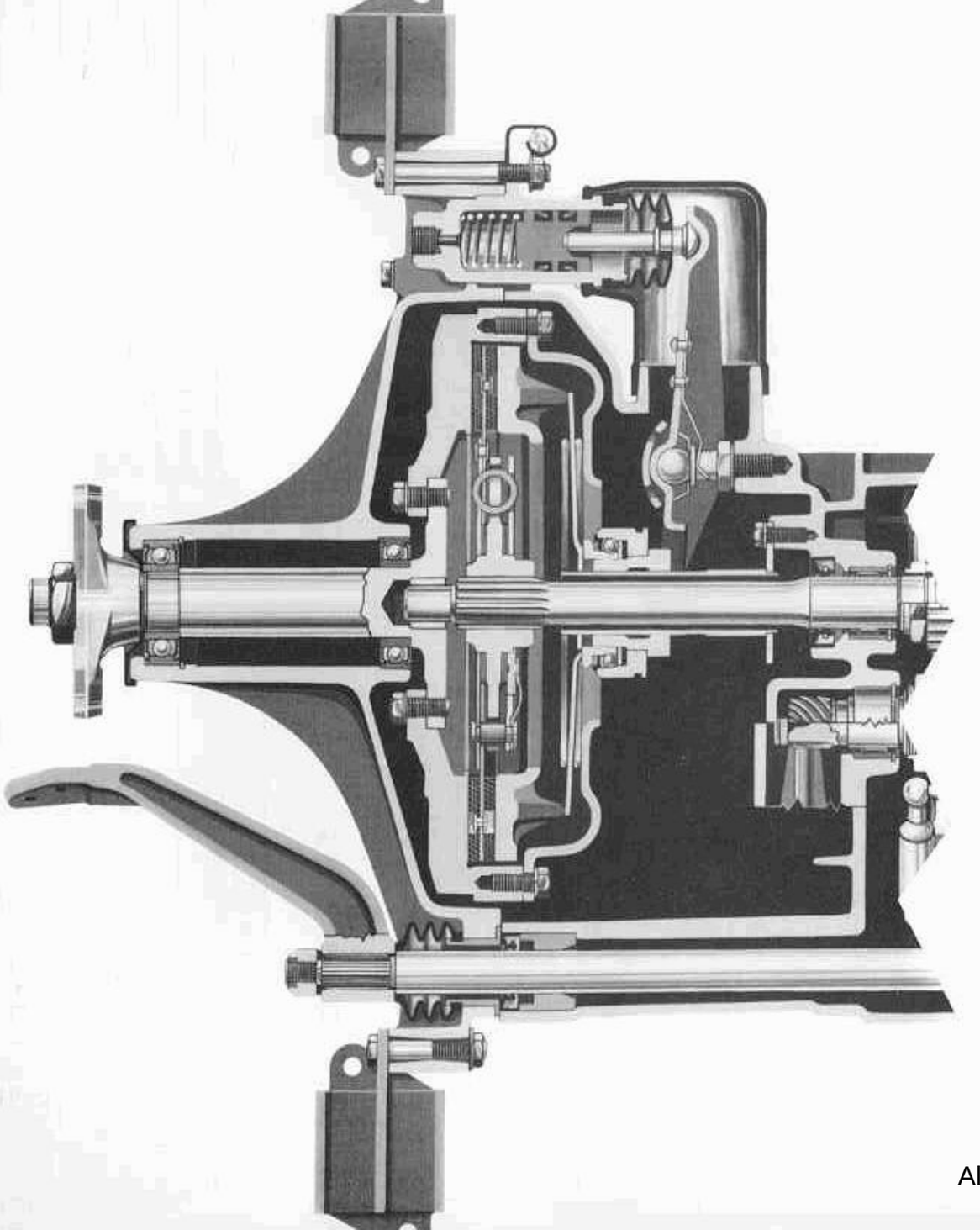
**SPANNER**
17 mm crowfoot, for front bolts of front U-joint and rear bolts of centre propeller shaft U-joint,

## Tightening torques

| ITEM | Kg.m. | TIGHTEN |
|---|---|---|
| Screws securing propeller shaft joints to flywheel, to prop.shaft sections and clutch yoke. | | |
| A) Using a torque spanner directly applied to screws: | | |
| – conventional screws | 4.85 – 5.35 | Dry |
| – interference fit screws and safety nuts | 4.4 – 4.9 | Dry |
| B) Using extensions A.5.0190/91/92 and 300-400 mm lever arm torque spanner: | | |
| – conventional screws | 4.1 – 4.5 | Dry |
| – interference fit screws and safety nuts | 3.8 – 4.2 | Dry |
| Nuts, clutch - gearbox housing to intermediate flange | 1.2 – 1.4 | Dry |
| Nut, securing rear gear selector lever | 2.9 – 3.6 | Dry |
| Connection, hoses to pipes of clutch and brake hydraulic systems | 0.8 – 1.0 | Dry |
| Switch, reverse light | 4.0 – 4.9 | Dry |
| Bolts, drive shafts to disc brake distance pieces | 2.8 – 3.0 | With grease |

# Lubricants fluids and sealants

| ITEM | RECOMMENDED COMMERCIAL PRODUCTS |
|---|---|
| Oil for:<br>- Gearbox-differential 2.57 Kg (2.79 litres) | AGIP F1 ROTRA MP SAE 85 W/90<br>SHELL SPIRAX 90 HD |
| Brake and clutch system fluid. Use only: | ALFA ROMEO std. no. 3681-69903<br>AGIP F1 BRAKE FLUID SUPER HD<br>ATE "BLAU S" |
| Sealant for:<br>- Contact faces of intermediate flange with gearbox-differential and gearbox-clutch castings<br>**NB** - To clean the faces use methylated spirit or trichloroethano | LOWAC PERFECT SEAL |
| Grease for:<br>- Threads, drive shaft to disc brake distance piece bolts.<br>- Centralizing bush of propeller shaft to clutch shaft. (2 cc) | ISECO MOLYKOTE BR 2 |



is hydraulically operated and the play is taken up automatically.

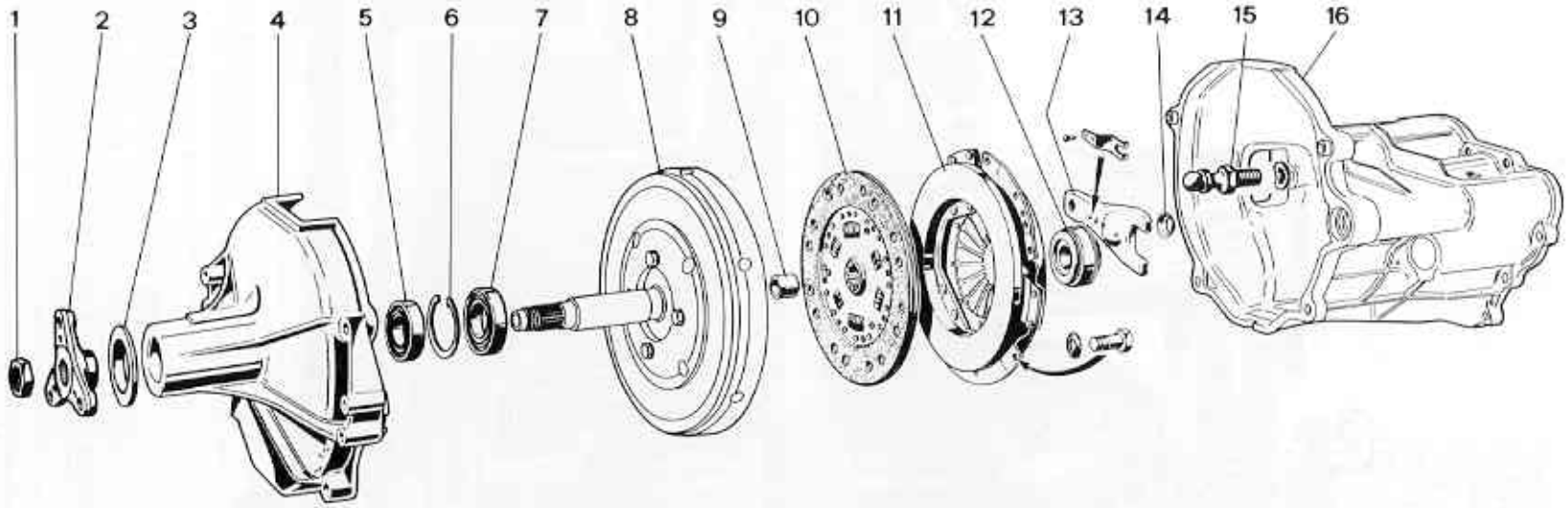
The clutch pedal actuates a master cylinder fed by a reservoir. On depressing the pedal, the fluid pressure actuates the slave cylinder piston which operates the release bearing lever.

Drive of the clutch is that the release bearing is continuously in contact with the diaphragm spring. Consequently there is no clearance between the release bearing and the clutch and the wear is taken up automatically.

Periodic adjustment of the clearance is not necessary.

TECHNICAL DATA

| | |
|---|---|
| Type | Dry single plate |
| Operation | Hydraulic, with automatic wear take-up |
| Engagement and disengagement | By diaphragm spring |
| Clutch plate | Fitted with friction lining |
| Clutch plate diameter | 216 mm |
| Clutch plate thickness when loaded to 480 Kg | 8.7 to 9.1 mm |
| Thickness of clutch plate at maximum allowable wear | 6 mm |
| Stroke of slave cylinder spindle with the pedal fully depressed | 10.5 to 12 mm |
| Stroke of clutch master cylinder spindle | 22 to 25 mm |




## CLUTCH UNIT COMPONENTS

1 - Universal joint yoke securing nut
2 - Yoke connecting to the propeller shaft rear universal joint
3 - Splash shield
4 - Clutch housing
5 - Front bearing
6 - Circlip
7 - Rear bearing
8 - Flywheel with clutch shaft
9 - Centering bush
10 - Clutch plate
11 - Pressure plate
12 - Release bearing
13 - Release lever
14 - Dust cover
15 - Ball stud
16 - Clutch - gearbox housing

## REMOVAL OF CLUTCH UNIT

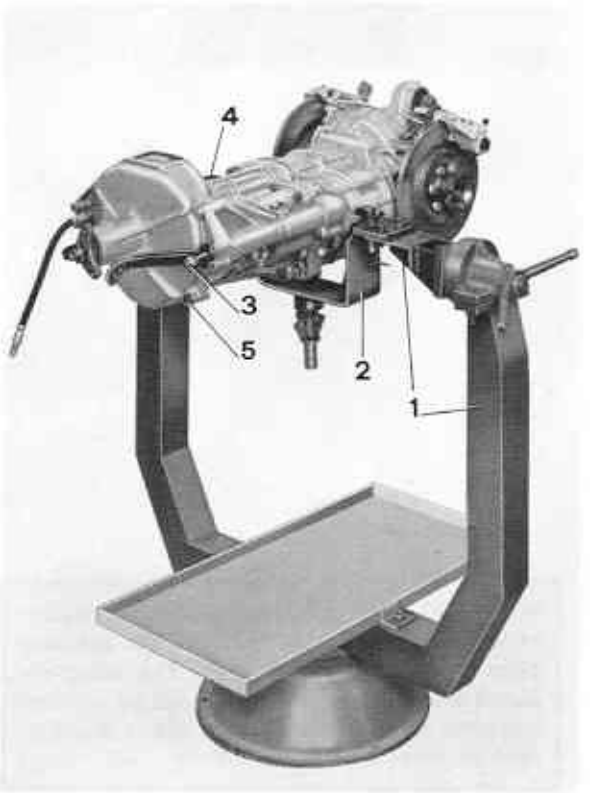
Mount the clutch-gearbox-differential unit on the stand **1** (Tool **R.4.0151** complete with the clamps **R.4.0154**) and fasten it with the cradle **2** (Tool **R.4.0150**).

Slacken and remove nut and washer **3** and withdraw the rear selector lever off the unit.

Remove dust cover **4** from the clutch slave cylinder.

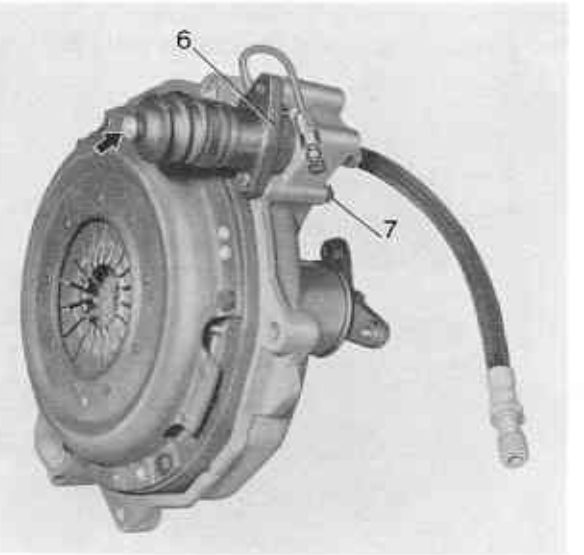
Slacken and remove the clutch unit to gearbox housing bolts **5**.

Withdraw the clutch unit from the main shaft.

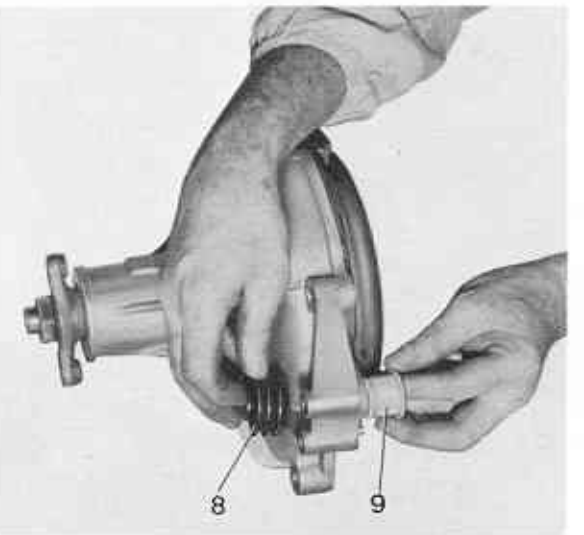



## DISMANTLING CLUTCH UNIT

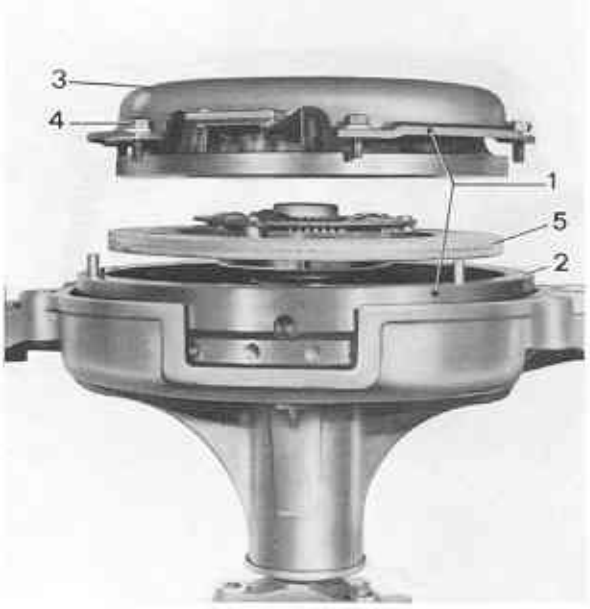
Remove clutch slave cylinder **6** by slackening and removing bolt **7** attaching it to the clutch housing.



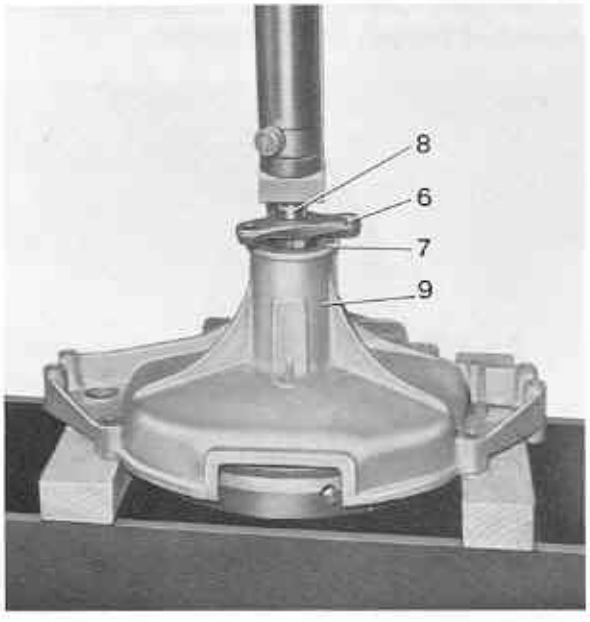

If necessary remove the dust boot **8** and the bush **9** of the gear selector spindle.



**If the reference marks 1 for assembling the flywheel 2 and the pressure plate 3 are missing, mark the two parts** then slacken and remove the bolts and washers **4** attaching the pressure plate to the clutch flywheel. Remove the pressure plate and the clutch plate **5**.




Extract the shaft **8** with the flywheel from the housing **9** by means of a press and remove the universal joint yoke **6** and the splash shield **7**.

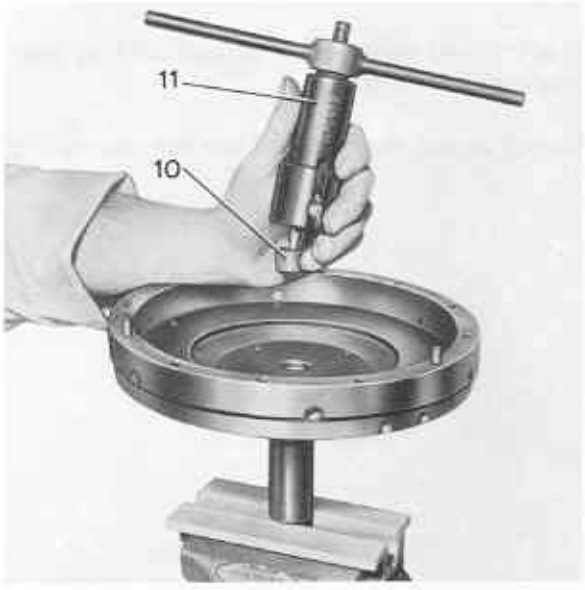



Slacken and remove the nut securing the yoke **6** which connects to the propeller shaft.

If necessary extract:

- the rear clutch shaft bearing with suitable equipment.

- bush **10** (for centering the main shaft) from the clutch shaft using tool **11** (A.3.0402).




**WARNING.** *If it is found necessary to replace or do work on the* **flywheel** *or the* **pressure plate** *or on the* **clutch shaft, the complete clutch assembly should be replaced by another complete clutch assembly** *so as not to interfere with the balance.*

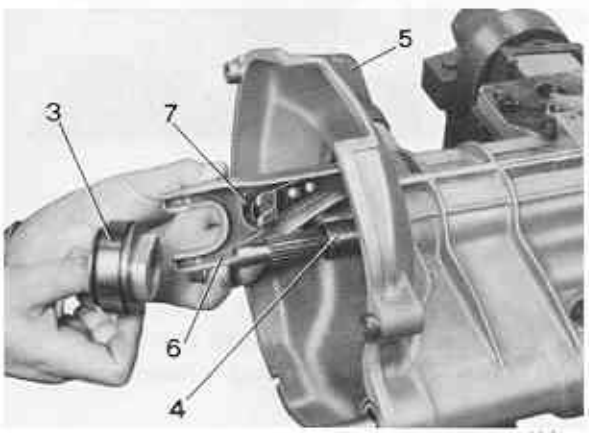
Remove the circlip **1** with circlip pliers and using tool **2** (**A.3.0401**) tap out the front bearing from the clutch housing.


Remove from the clutch-gearbox housing:

- the clutch release bearing **3** from the guide sleeve **4**

- the dust cover **5** from the clutch release lever housing

- the clutch release lever **6** by disconnecting it from the ball stud and removing the dust seal **7**, then slacken and remove the guide sleeve.




## CHECKING AND INSPECTION

### Clutch plate

Check the wear of the clutch plate and see that:

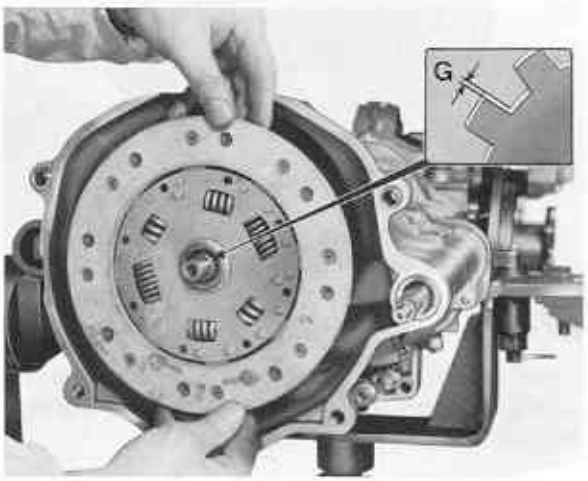
- the linings are not burnt or oily

- that the wear is uniform and not patchy

- that the thickness of the clutch plate with new linings when loaded to 480 Kg is 8.7 to 9.1 mm. The thickness at the maximum allowed wear is 6 mm.

- the hub the clutch plate is in good condition and the working surfaces are solidly attached

- there is no excessive clearance or hard spots between the plate and main shaft splines. The clearante "G" should be 0.07 to 0.13 mm.




### Release bearing

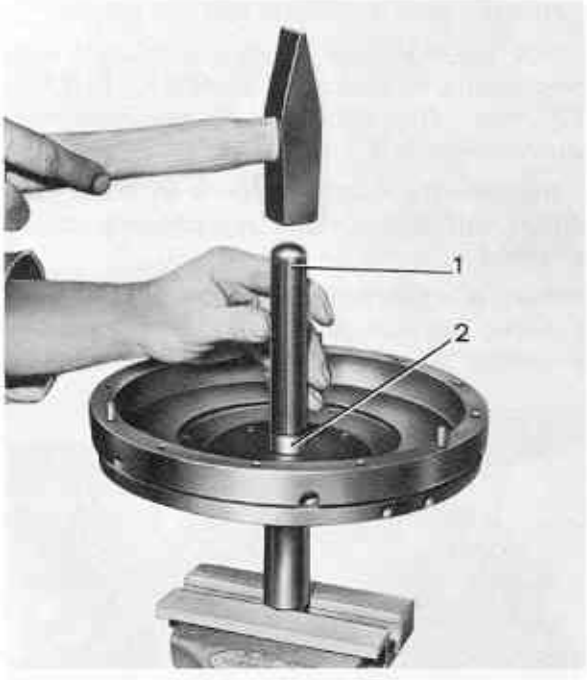
Check that the release bearing **3** is in good condition, that it is not noisy, that it does not have excessive play and that it slides freely on the guide sleeve.

### Centering bush

Check that there are no signs of seizing or hammering or of excessive wear in the centering bush (see 10 page 24) fitted in the flywheel-clutch shaft for centering the main shaft. Replace the bush if necessary.

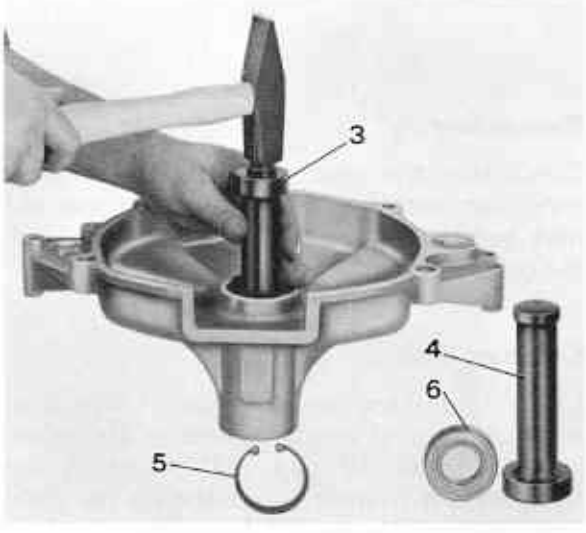
# RE-ASSEMBLY OF CLUTCH UNIT

If previously extracted, fit bush **2** to the flywheel-clutch shaft using tool **1 (A.3.0405)** after having impregnated it with hot oil.




Fit in the clutch housing:

- the front bearing with the corresponding circlip **5** using tool **3 (A.3.0401)** and the rear bearing **6** using tool **4 (A.3.0404)**.

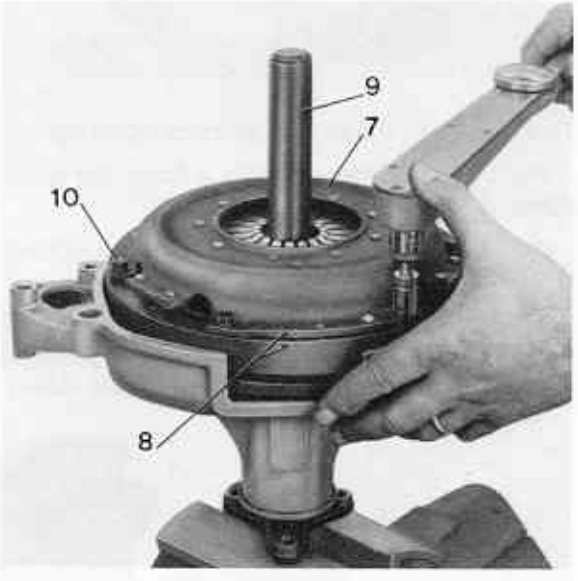



Apply the prescribed locking fluid at three points on the circumference of the rear bearing location, then fit the flywheel and shaft, viz the rotating parts, in the clutch housing.

Fit the splash shield 7 (see page 24) and the universal joint yoke 6 for connecting to the propeller shaft after having applied the prescribed locking fluid to the splines, then tighten the yoke retaining nut with a torque of 9.5 to 10.5 Kgm.

Proceed re-assembling the original unit by fitting the clutch plate and the pressure plate **7** to the flywheel taking care to match the reference marks **8** put on them when stripping.

Centre the clutch plate with the tool **9 (A.4.0139)** and tighten the bolts **10** crosswise, to fasten the pressure plate to the flywheel, with a torque of 1.3 to 1.6 Kgm.




Fit the release lever slave cylinder 6 (see page 23) and attach it with bolt 7. Insert the gear selector spindle plastic guide bush 9 and the dust boot 8 if they have previously been removed.

# RE-ASSEMBLING OF THE CLUTCH UNIT TO THE GEARBOX - DIFFERENTIAL UNIT

If previously removed, fit the dust cap 7 (see page 25) on the ball stud and fill the space with the prescribed grease.

Lubricate the ball spindle on the clutch slave cylinder with the prescribed grease.

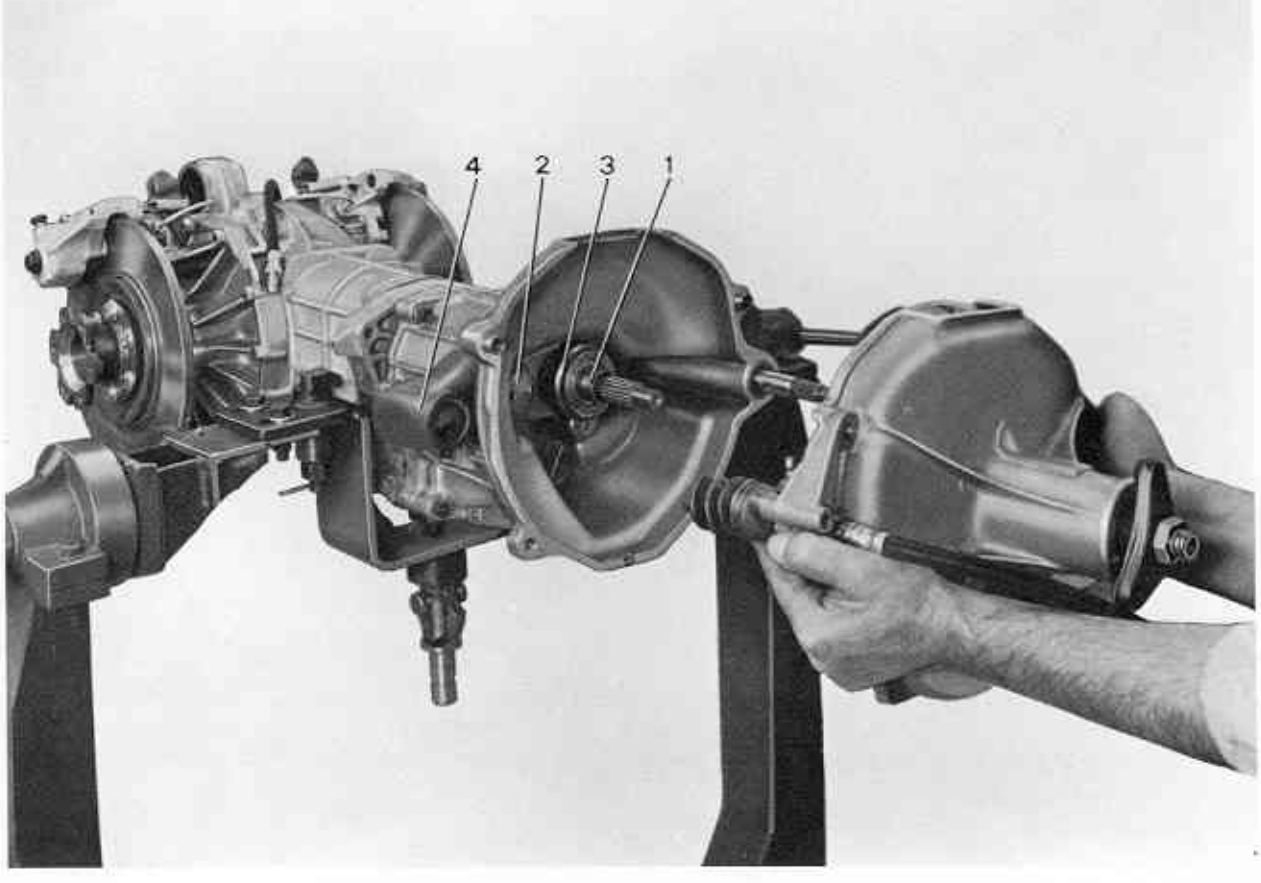
Fit the guide sleeve **1** for the clutch release bearing.

Fit the clutch release lever **2** for the release bearing **3** with the dust cover **4** then fit the release bearing itself after having previously filled the space provided in the sliding component with the prescribed grease.

Lubricate the flywheel-clutch shaft bush 2 (see page 26) with the prescribed grease.

Re-attach the clutch unit to the clutch-gearbox housing working in the reverse order to the "removal instructions" (see page 23) and tighten nut 3 retaining the rear gear operating lever to a torque of 2.9 to a 3.6 Kgm.

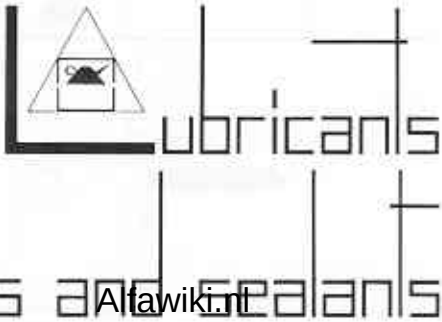
**NOTE - If previously disconnected, reconnect the end of the clutch hydraulic system flexible pipe to the slave cylinder 6 (see page 23) and tighten the nut to a torque of 0.8 to 1 Kgm.**



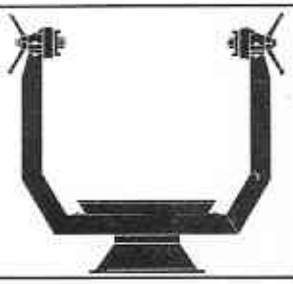

Prescriptions


Tools


Tightening
Torques

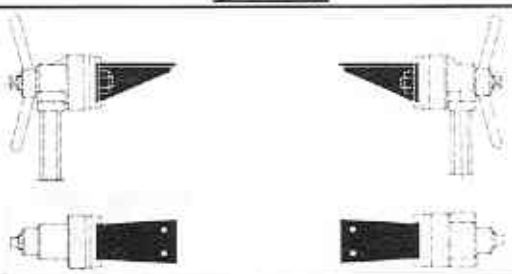

Lubricants
fluids and sealants

# Tools



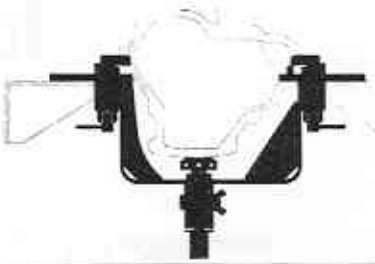
## R.4.0151

**STAND**
for holding units



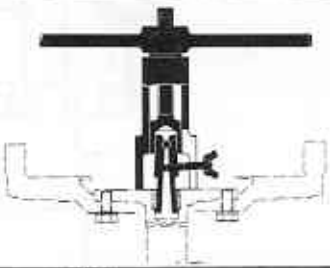
## R.4.0154

**CLAMP**
for attaching cradle for clutch - gearbox - differential unit to the stand



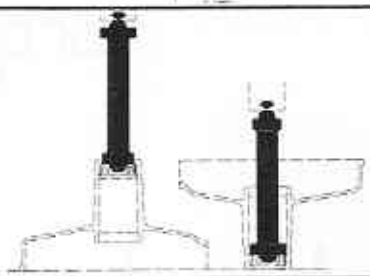
## R.4.0150

**CRADLE**
for clutch - gearbox - differential unit



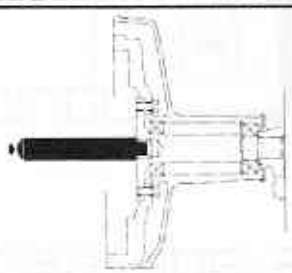
## A.3.0402

**EXTRACTOR**
For bush for centering the main shaft from the flywheel-clutch shaft



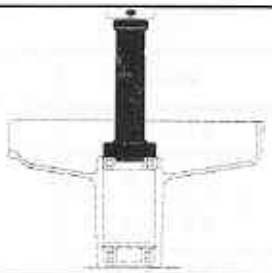
## A.3.0401

**EXTRACTOR-ASSEMBLY TOOL**
for clutch housing front bearing



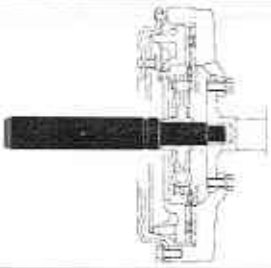
## A.3.0405

**ASSEMBLY TOOL**
for clutch housing rear bearing



## A.3.0404

**ASSEMBLY TOOL**
for centering bush in flywheel-clutch shaft



## A.4.0139

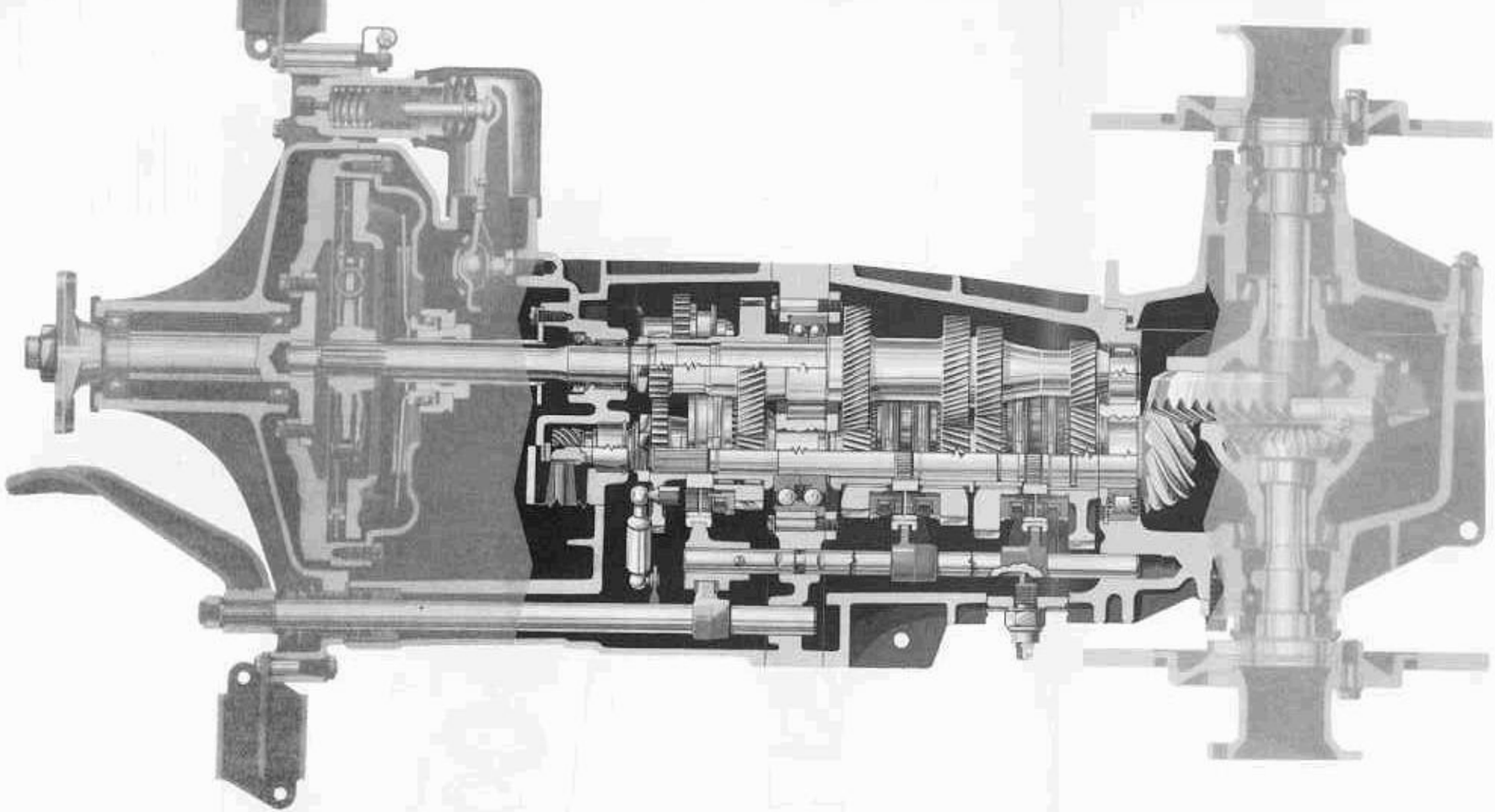
**MANDRIL**
for centering clutch plate

# Tightening torques

| ITEM | Kg.m. | TIGHTEN |
|---|---|---|
| Nut, securing yoke to flywheel - clutch shaft | 9.5 – 10.5 | Dry |
| Bolts, securing pressure plate to flywheel | 1.3 – 1.6 | Dry |
| Nut, securing rear gear change lever | 2.9 – 3.6 | Dry |
| Coupling, attaching flexible pipe to clutch slave cylinder | 0.8 – 1 | Dry |

# Lubricants fluids and sealants

| ITEM | RECOMMENDED COMMERCIAL PRODUCTS |
|---|---|
| Grease for:<br>- ball stud, clutch operating mechanism fulcrum<br>- release bearing<br>- ball spindle, clutch slave cylinder<br>- bush, flywheel - clutch shaft | AGIP F1 GREASE 33 FD<br>SHELL RETINAX AX |
| Locking fluids for:<br>- rear bearing, flywheel-clutch shaft<br>**NB** - To clean the surfaces use commercial trichloroethylene | STA–LOK 1000<br>LOCTITE A–A |
| - teeth, engagement fork-clutch | STA–LOK 400<br>LOCTITE NUT–LOCK |

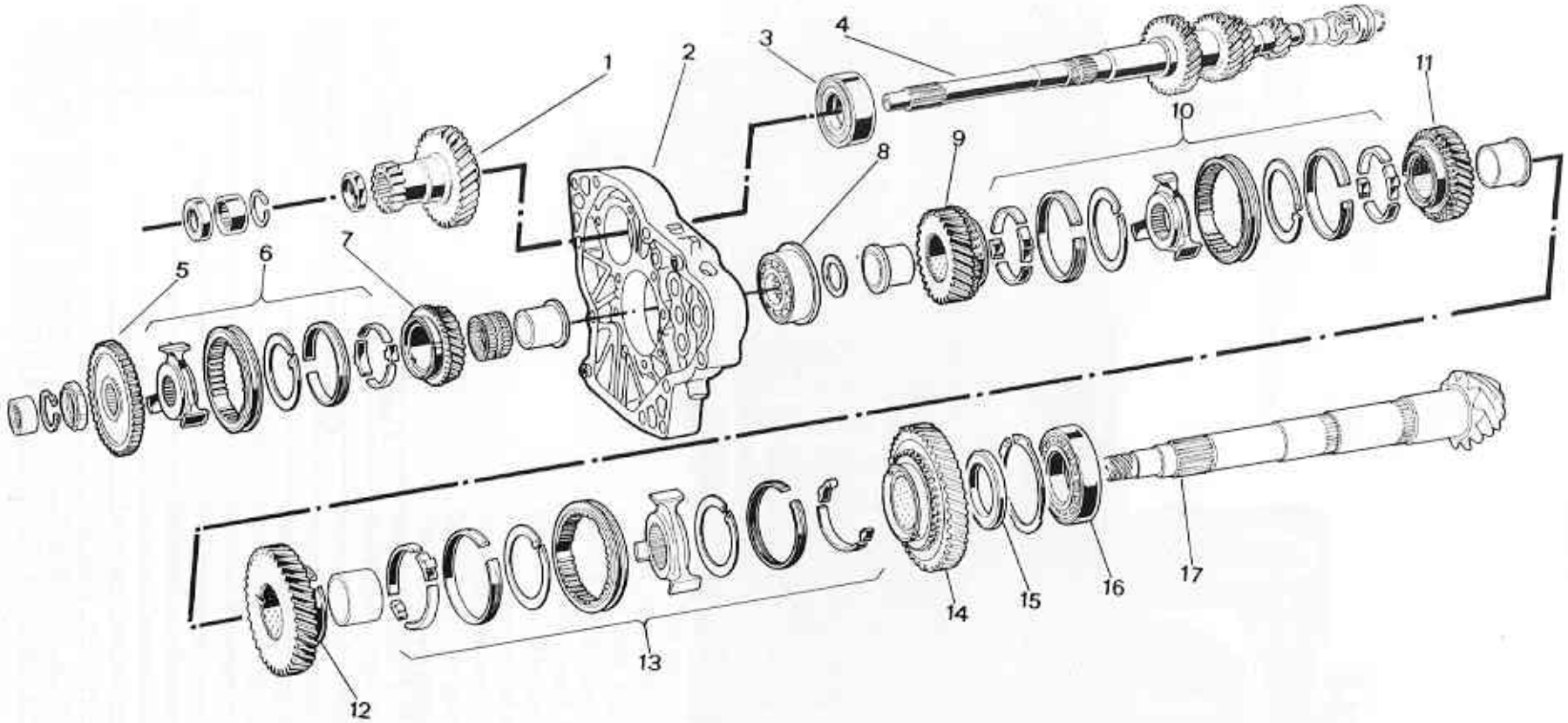


## GEARBOX

The gearbox has five forward speeds and reverse. The constant mesh forward gears have helical teeth to ensure maximum silence in operation and they are fitted with synchromesh for each speed.
The reverse gears have straight teeth. Engagement is effected by moving an idler gear which reverses the direction of rotation of the main shaft to the pinion shaft.
Control of the gearbox is by lever located in the centre console and connected to the gearbox housing by operating rod and lever.
The housing can be split into three parts. The forward part contains the clutch, the clutch release bearing, and the gear selector lever. It also supports the ends of the mainshaft and pinion shaft. The intermediate part consists of a flange in which the gear shafts are mounted and secured lengthwise with the relevant selector spindles and forks. This unit forms a compact assembly which can be withdrawn from the rear housing in which the gear shafts are also supported. In addition the rear housing acts as the differential housing and

TECHNICAL INFORMATION AND DATA

| | |
|---|---|
| Speeds | 4 speeds with synchromesh and reverse |
| Type of gears: | |
| Forward gears: | Constant mesh gears with helical teeth |
| Reverse gears: | Straight teeth |
| Gear ratios: | |
| 1 st. | 1 : 3.3 |
| 2 nd. | 1 : 2 |
| 3 rd. | 1 : 1.37 |
| 4 th. | 1 : 1.04 |
| 5 th. | 1 : 0.83 |
| Reverse | 1 : 2.86 |
| Mainshaft bearings | 3 in number (one ball - two roller) |




## GEARS & SHAFTS EXPLODED VIEW

1 - 5th. speed and reverse gear
2 - Intermediate flange
3 - Mainshaft intermediate bearing
4 - Main shaft
5 - Reverse gear
6 - 5th. speed synchronizing components
7 - 5th. speed gear
8 - Pinion shaft intermediate bearing
9 - 4th. speed gear
10 - 4th. and 3rd. speed synchronizing components
11 - 3rd. speed gear
12 - 2nd. speed gear
13 - 2nd. and 1st. speed synchronizing components
14 - 1st. speed gear
15 - Spacer for rear roller bearing
16 - Rear roller bearing
17 - Pinion shaft

# REMOVAL OF GEARBOX UNIT

Remove the clutch unit as described on page 23.

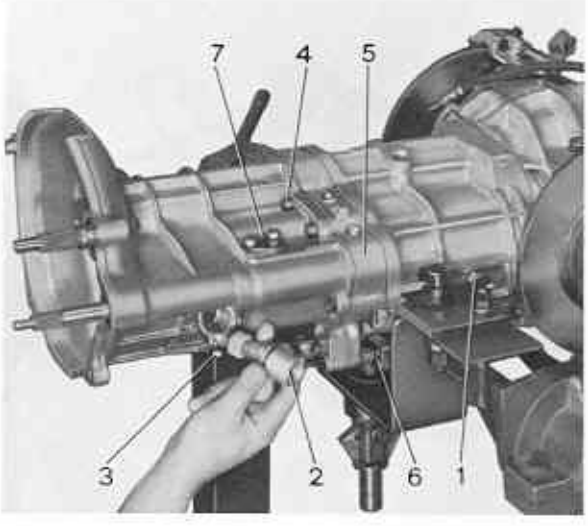
Withdraw the clutch release bearing (see 3, page 25) from the guide bush 4 and the release lever 6 from the ball stud with the corresponding dust cover 5.

Remove the reverse light switch **1**.

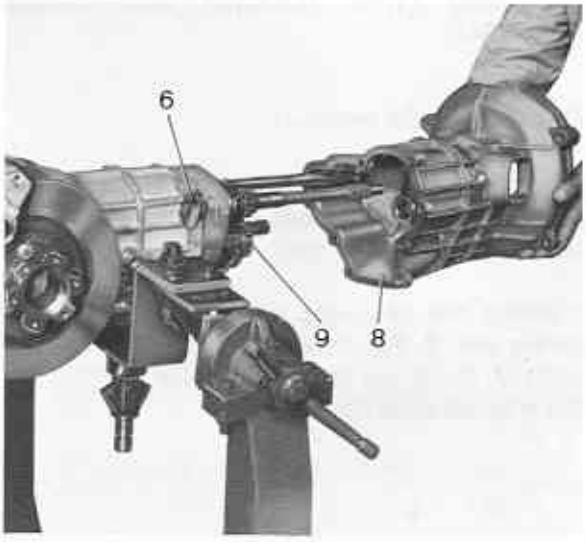
Remove the speedometer drive **2** by unscrewing the retaining screw **3** completely.

Slaken and remove nuts and washers **4** attaching the clutch-gearbox housing to the intermediate flange 5.

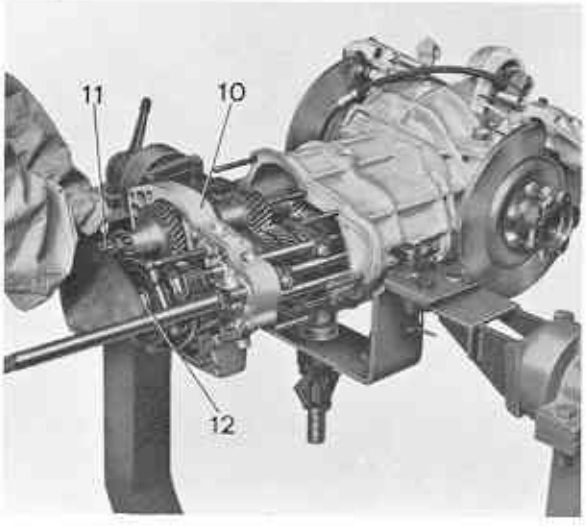
**NOTE - The joint surfaces of the intermediate flange with the gearbox-clutch and gearbox-differential housings have been coated with sealant compound. When the joint is to be broken at one side only of the intermediate flange, the opposite housing can be clamped to the intermediate flange by the tool 6 (A.2.0244).**




Remove the clutch-gearbox housing **8** and withdraw the sliding reverse pinion **9**.




Remove the intermediate flange **10** from the gearbox-differential housing with the mainshaft **11** and the pinion shaft assemblies **12** after having removed the clamp **6** from the intermediate flange and the gearbox-differential housing if it has been fitted previously.



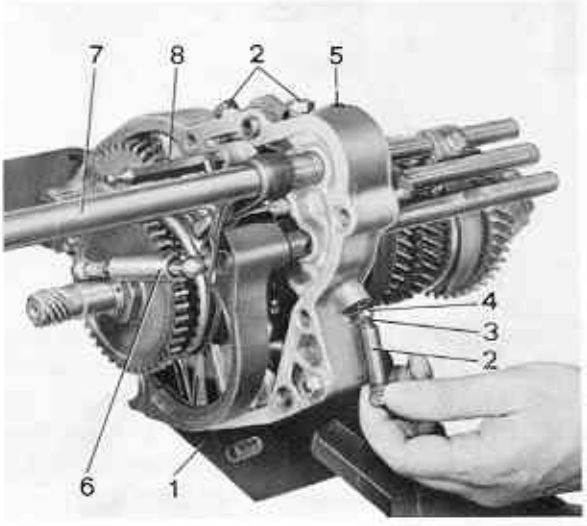
# DISMANTLING GEARBOX UNIT

Fit bracket **1** (Tool **R.4.0149**) to the intermediate flange complete with the shafts and selectors, then grip it in a vice or clamp it on the stand (Tool **R.4.0151** with clamps **R.4.0154**).

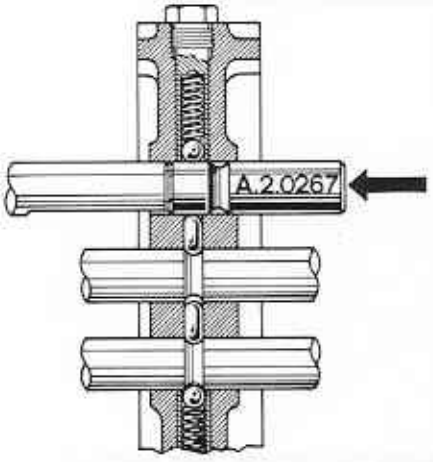
### Dismantling the selectors

Remove the detent spring guide **2**, the springs **3** and the selector shaft detent balls **4** from the intermediate flange.

Remove the retaining spring **5**; unhook the spring link **6**, for centralising the gear selector shaft **7**, from the hexagonal pillar **8** fitted to the intermediate flange.

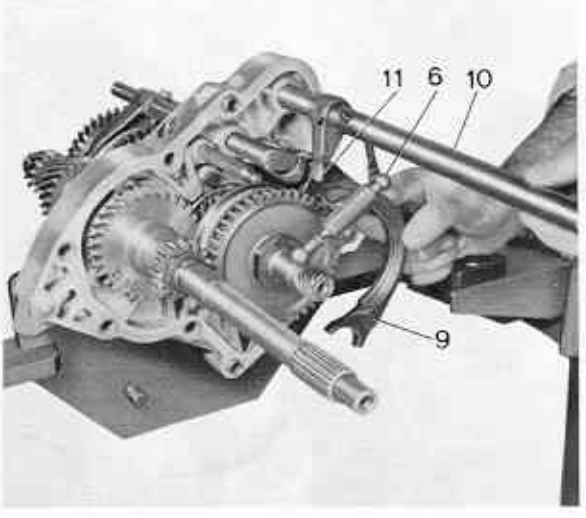



NOTE - If it is only necessary to remove a gear selector shaft, or if it is not required to examine the detent ball assembly, which positions the gear selector shaft, and the gear 'inter lock' plungers, these components can be held in place by means of the dummy spindle (Tool A.2.0267) which has to be inserted from the opposite side at the same time as the selector shaft is being withdrawn.



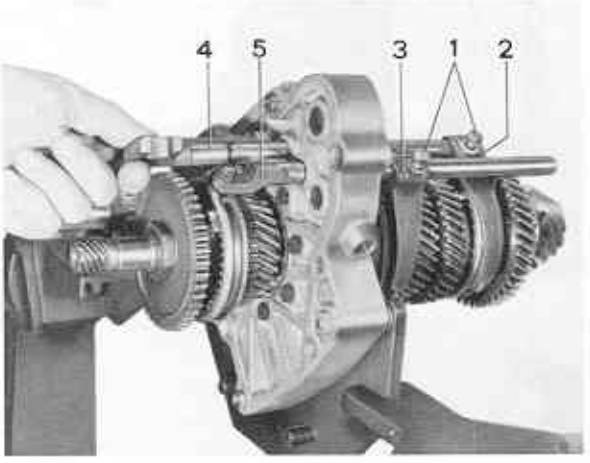

Withdraw the gear selector shaft **10**, rotating the finger **11** and the 5th. speed and reverse gear change fork **9** to the right. Then withdraw the 5th. speed and reverse gear selector shaft.

If necessary unhook the spring return link **6** for returning the gear selector shaft by releasing the retaining device.

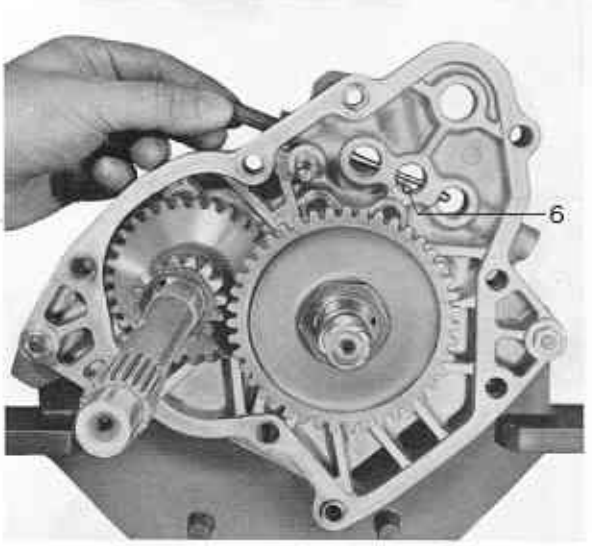


Slacken and remove the set screws **1** and washers securing the gear selector forks **2** and **3** for the 1st./2nd. and 3rd./4th. speeds respectively.

Remove the selector shaft **4** for the 1st./2nd. speed and the selector shaft **5** for the 3rd./4th. speed.




Remove the gear interlock plungers **6** from the intermediate flange.

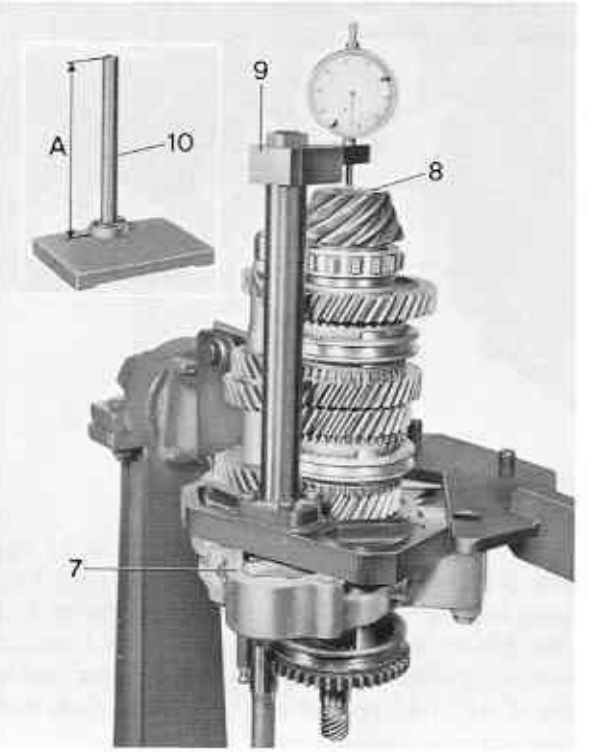



**Recording dimensions for re-assembly of the pinion shaft**

Record the dimension —A— between the inside face **7** of the intermediate flange and the end face of the pinion **8** as follows:

Fasten a dial gauge on the appropriate pillar gauge **9** (Tool **A.4.0145**) and set the dial gauge to zero at the nominal height —A— of 226.7 mm on the master gauge **10** (Tool **C.6.0166**).

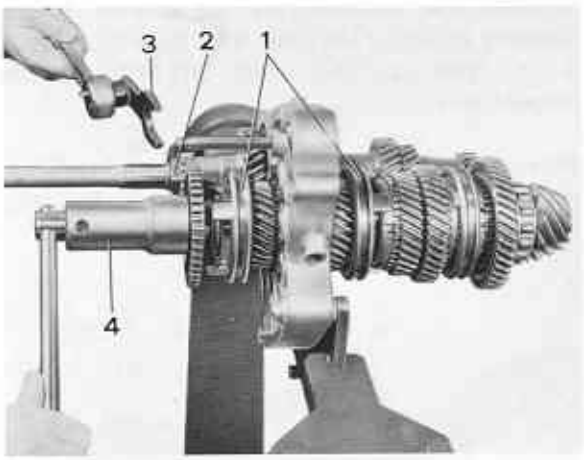
Rest the dial gauge pillar in the manner shown on the inside face of the flange with the dial gauge stylus on the pinion end face and record the reading.
This recorded dimension will be used to reset the bevel pinion in its original working position when only the gearbox has to be overhauled.



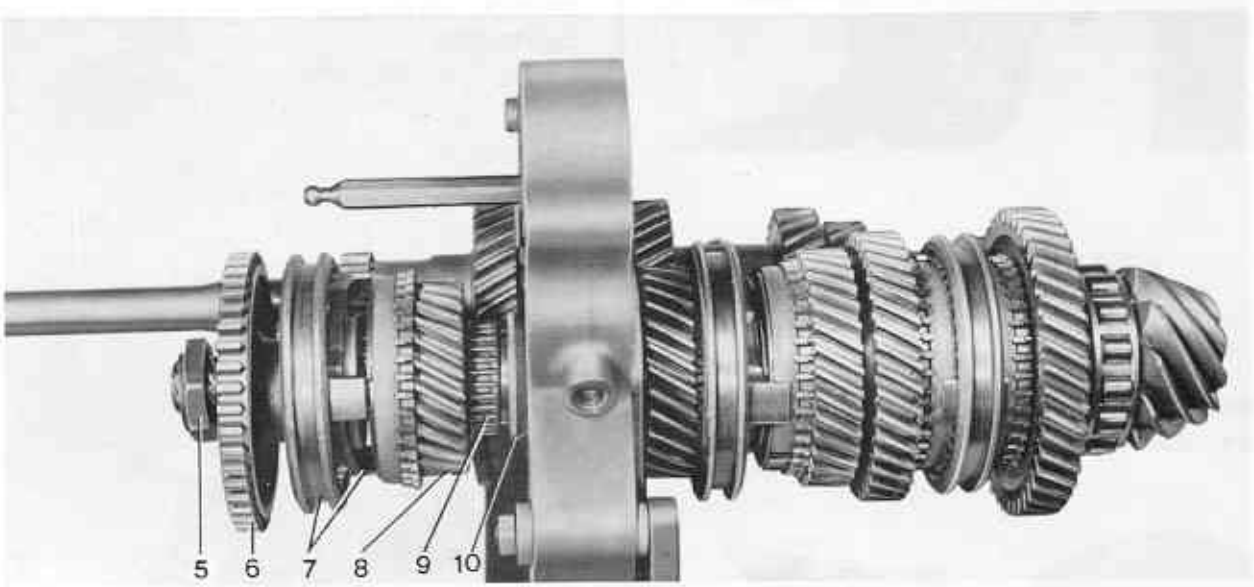
### Dismantling the pinion shaft

Remove the pinion shaft from the intermediate flange as follows:

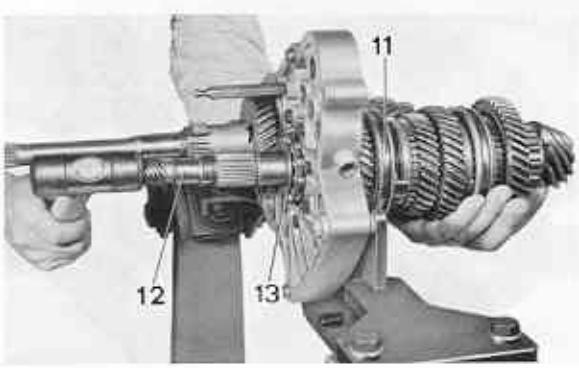
- slide the synchronizer sleeves **1** along to engage two speeds
- slacken nut **2** on the mainshaft using the appropriate spanner **3** (Tool **A.5.0181**) or a wrench and socket spanner after having deburred the rivetted portion.
- remove the rivetted portion from the pinion shaft nut and using the appropriate spanner **4** (Tool **A.5.0126**) slacken and remove nut **5**.




Remove from the pinion shaft: - the reverse gear **6**; - the synchronizer hub and the corresponding sleeve **7**; - the 5th. speed gear **8** with the roller cage **9** and the corresponding bush **10**.

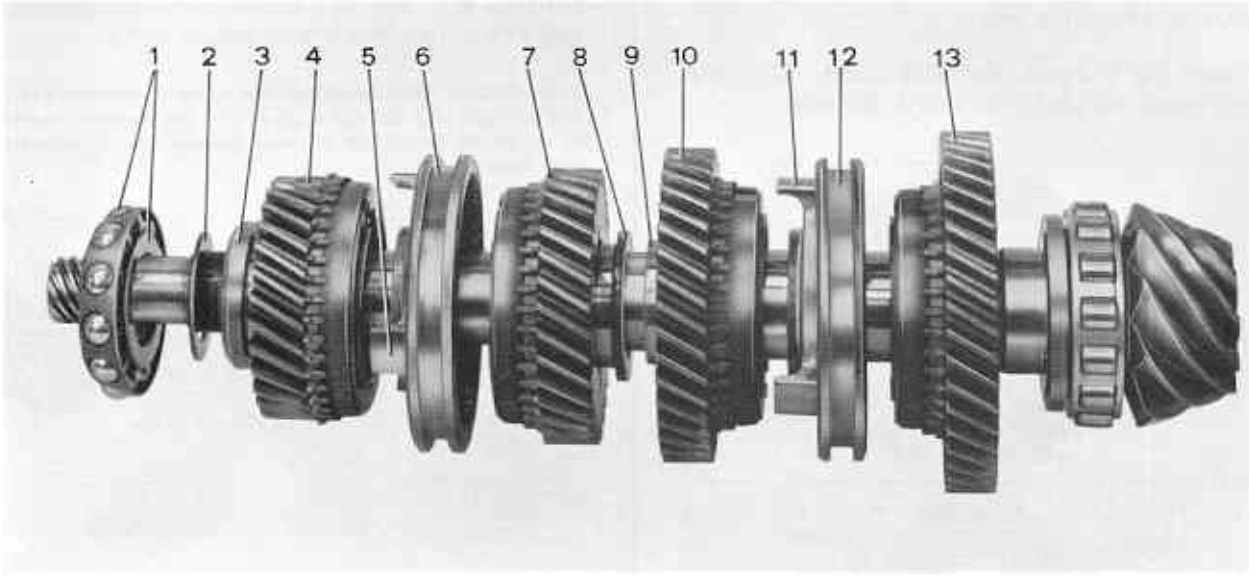



Make certain the synchronizer sleeve **11** for the 3rd. and **4**th. speeds is engaged into 4th. gear and using a plastic mallet tap the end of the pinion shaft **12** and withdraw it through the intermediate flange, removing the inside front half ballrace **13** of the intermediate ball bearing at the same time.

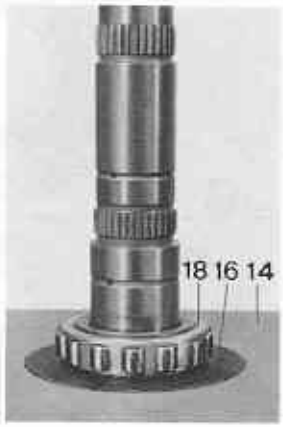


Dismantle the pinion shaft by removing:

- the ballcage **1** with the corresponding rear inside half ballrace of the intermediate flange ball bearing, taking care when re-assembling, if the ball bearing is not renewed, to follow the same order as on dismantling and mate the same pairs of parts together,
- Distance piece **2** for adjusting the height of the pinion from the crown wheel axis,
- bush **3** and gear **4** for the 4th. speed
- the synchronizer hub **5** of the 5th. and 3rd. speeds with the corresponding sleeve **6**
- gear **7** for the 3rd. speed with the corresponding bush **8**
- gear **10** for the 2nd. speed with bush **9**
- synchronizer hub **11** with the corresponding sleeve **12** for the 2nd. and 1st. speeds.
- gear **13** for the 1st.




Using plate **14** (Tool **A.2.0259**) and by varying the half rings **15** to suit (Tool **A.2.0236**) and **16** (Tool **A.2.0235**) remove, with the help of a press, the distance piece **17** for the rear roller bearing on the pinion shaft and the inner race **18** of the same roller bearing.

### Dismantling the synchronizer

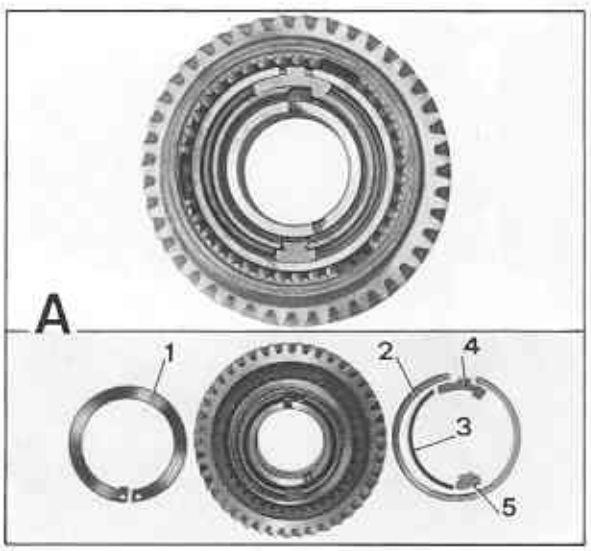
Remove the circlip **1** from the particular gear in question with special circlip pliers (Tool **G.2.0051**) or with suitable commercial pliers.

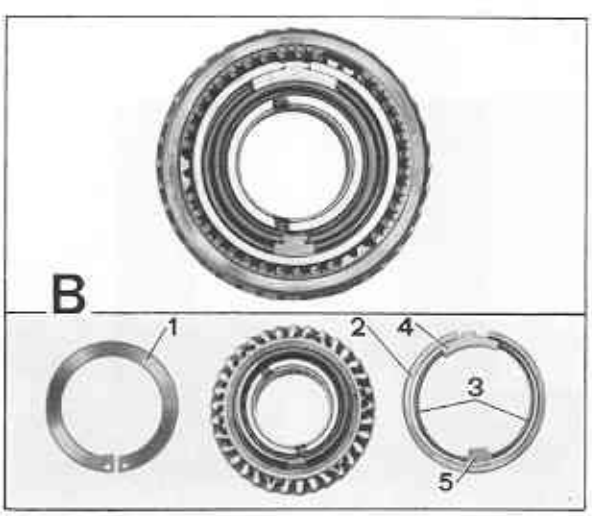
Remove the synchronizing ring **2** from the corresponding gear.

Remove the limit strips **3** with the respective segments **4** and **5**.

Figure "A" shows the 1st. speed synchronizer with its respective gear.

Figure "B" shows the 2nd., 3rd., 4th. and 5th. speed synchronizers with the gear.



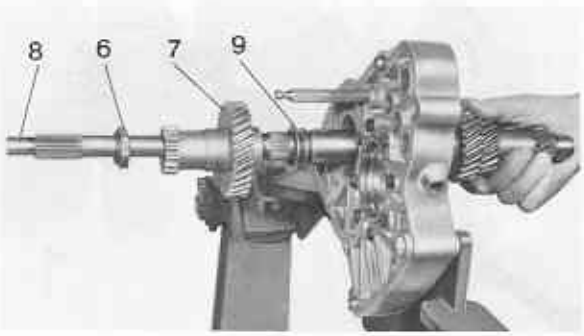

### Dismantling the mainshaft

Remove nut **6**, which has already been slackened, from the mainshaft.

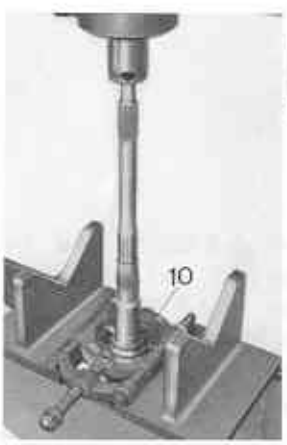
Remove the 5th. speed gear and reverse gear **7**.

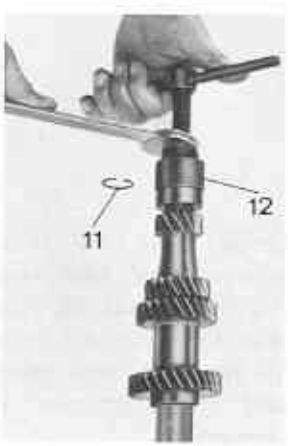
Using a plastic mallet, tap the end of the shaft **8** and remove the shaft from the intermediate flange, taking with it the forward inner half ballrace **9** of the ball bearing, also remove the ball cages from the intermediate flange.

WARNING – *Take particular care when re-assembling the half ballraces and half ball cages of the intermediate bearing to follow the same order as when dismantling and mate the same pairs.*



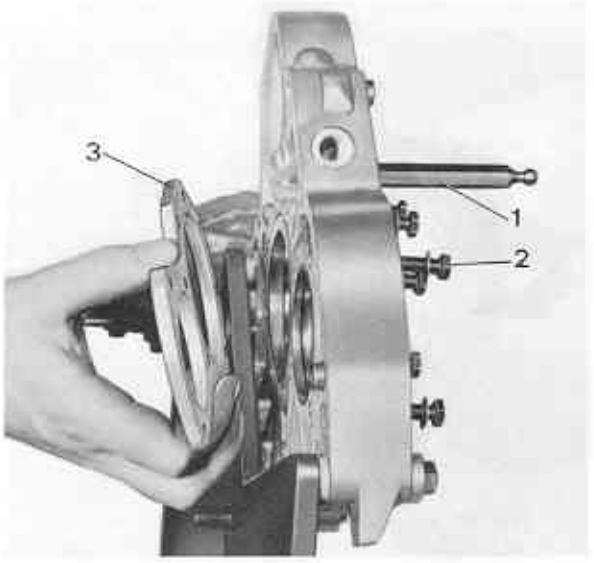

Using a press and a suitable extractor withdraw the other rear inner half ballrace **10** and if necessary remove the locking circlip **11** and the inner roller race of the rear roller bearing using tool **12** (**A.30361**).



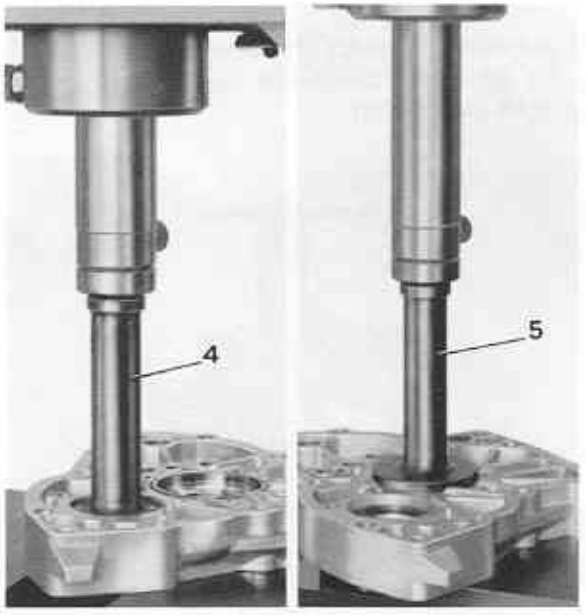



**Removal of the outer ball races from the intermediate flange**

Remove the hexagonal pillar **1**; slacken and remove the bolts and washers **2** holding the bearing back plate **3** to the intermediate flange.

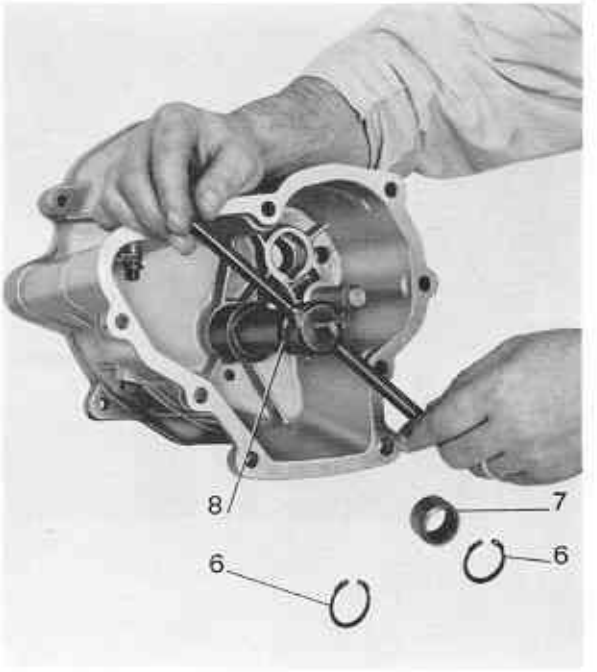



Using a press and the appropriate special tools extract the mainshaft outer ball races (ref. **4**-Tool **A.3.0407**) and the pinion shaft outer ball race (ref. **5**-Tool **A.3.0408**).



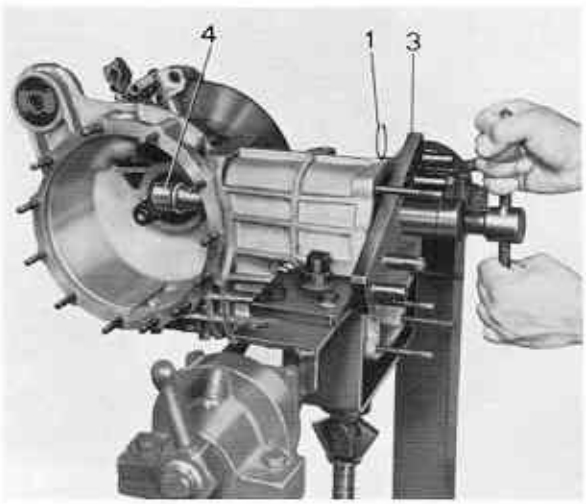

**Removal of the front roller bearings from clutch - gearbox housing**

Remove the circlips **6** from the clutch-gearbox housing, which secure the mainshaft and the pinion shaft roller bearings **7**, then extract the bearings from their locations, using tool **8** (**A.3.0345**).

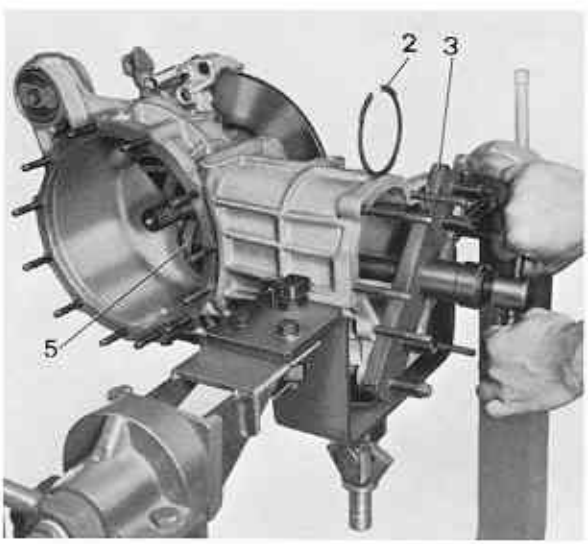


### Removal of the rear roller bearing outer roller races from the gearbox-differential housing

Remove the differential housing from the gearbox-differential housing as described on page 62 then remove the circlips **1** and **2** and extract the outer roller races of the mainshaft rear roller bearing. using tools **3 (A.3.0348)** and **4 (A.3.0363)**

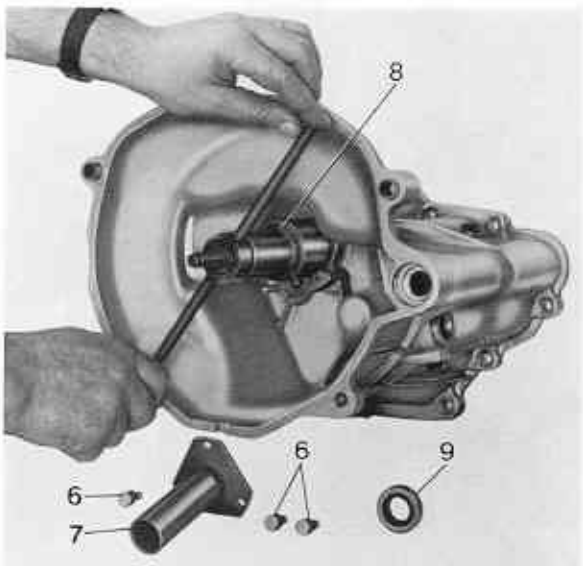



and of the pinion shaft rear roller bearing using tools **3 (A.3.0348)** and **5 (A.3.0364).**




### Removing the oil seals from the clutch-gearbox housing

Slacken and remove the set bolts and washers **6** holding the release bearing sleeve **7**, withdraw the guide bush and then, using tool **8 (A.3.0291)**, extract the oil seals **9** for the mainshaft and the gear selector shaft.




### Removing the gear selector shaft guide bush

If necessary, extract the selector shaft guide bush from the clutch-gearbox housing using tool **10 (A.3.0433)**.

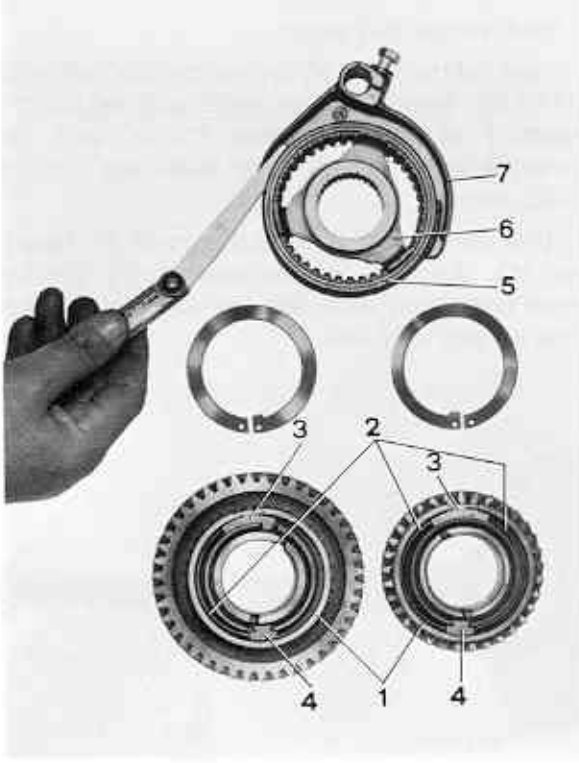
# CHECKING AND INSPECTION

### Synchronizers

Check that all the synchronizer components are in good condition and that:

- the synchronizer rings **1** are not excessively worn
- there are no signs of overheating on the points of engagement of the limiting strips **2**
- the segments **3** and the segments **4** are not excessively marked on the points of engagement
- the synchronizing sleeves **5** slide freely on their respective hubs **6**
- there are no signs of seizing or of detrimental wear on the engagement dogs on the sleeves and on the gears.

Check the working surfaces of the gear selector forks **7** and of the sleeves **5** to see that there are no signs of seizing and check that the axial clearance is within the prescribed amount viz. 0.2 to 0.5 mm.

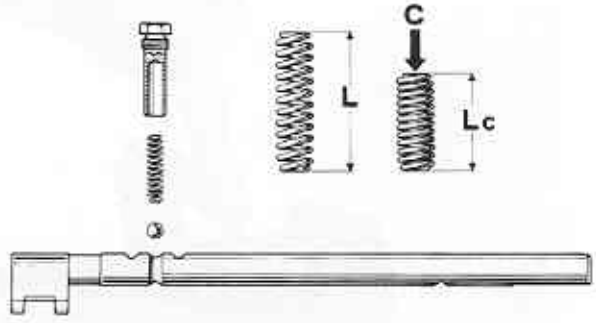



### Components for positioning the gear selector shaft

Check that the detent ball springs are in good condition and that their lengths at the prescribed loads are as follows:

Free length of spring **L = 30.6 mm**

Length of spring **Lc = 18.8 mm** with a load **C = 9.18 to 9.95 Kg.**




Check that the balls and their locations in the spindles are in good condition.

Check that the gear interlock plungers, the detent balls and the gear selector fork shaft slide freely in their locations and that the working surfaces are perfectly smooth.

### Bearings

Check that there are no signs of excessive wear or seizing on the bearings

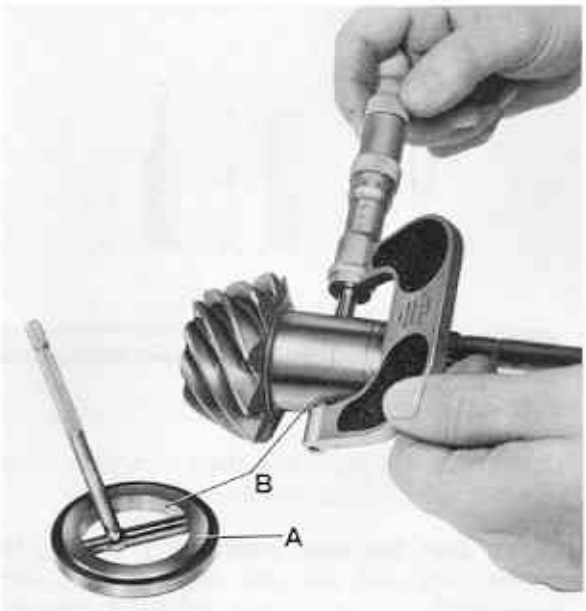
### Gears

Check the condition of the gears and that there are no signs of seizing or of excessive wear in the gear bushes or on the pinion shaft.

The axial and radial clearance of the gears is 0.10 to 0.15 mm.

### Pinion shaft rear bearing distance piece

Check that the deviation from square of the thrust face A of the rear pinion shaft bearing distance piece does not exceed 0.02 mm and that the interference fit between the seat B on the pinion shaft and the distance piece is the specified amount, viz. 0.019 to 0.060 mm.

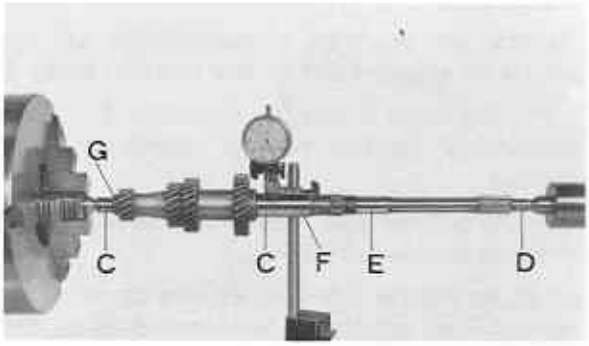



### Mainshaft

Check with a dial gauge:

- that the run-out of the mainshaft at the bearing seats C in the line of the gearbox-differential housing bearing and the intermediate flange bearing, compared with the centering spigot D for the clutch shaft, the seat E for the clutch-gearbox housing bearing and the seat F of the 5th. speed gear does not exceed 0.03 mm.

- the deviation from square of the face G of the shoulder for the inner roller race of the roller bearing with respect to the seats C of the ball and roller bearings does not exceed 0.03 mm.

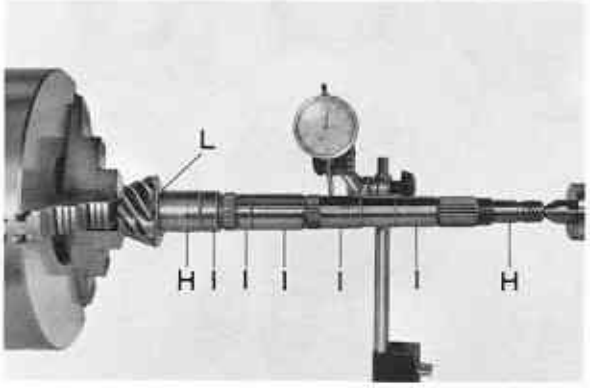



### Pinion shaft

Check with a dial gauge:

- that the run-out of the pinion shaft at seats H of the front and rear roller bearings, at the seats I of the gearwheel bushes and the intermediate ball bearing does not exceed 0.02 mm.

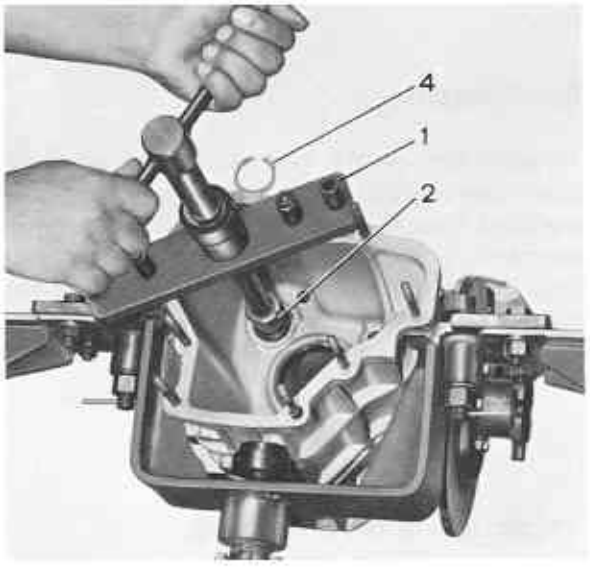
- that the deviation from square of the face L on the shoulder for the inner roller bearing race compared with the bearing seat H does not exceed 0.02 mm.



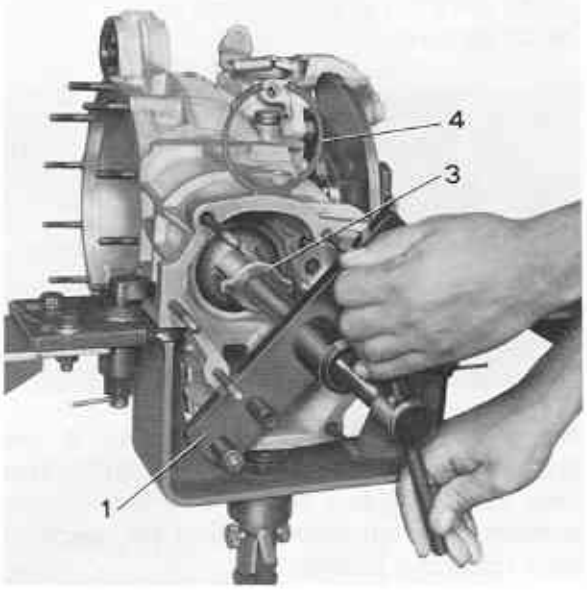
# RE-ASSEMBLING GEARBOX UNIT

**Gearbox-differential housing rear bearing outer roller races**

Fit the rear roller bearing roller races in the gearbox-differential housing using tools **1 (A.30348)** and **2 (A.3.0363)**

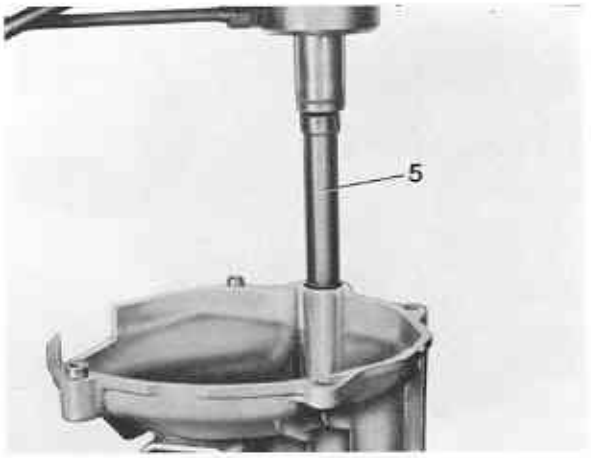



for the mainshaft and tools **1 (A.3.0348)** and **3 (A.3.0364)** for the pinion shaft and fit the corresponding circlips **4.**




**Gear selector shaft guide sleeve**

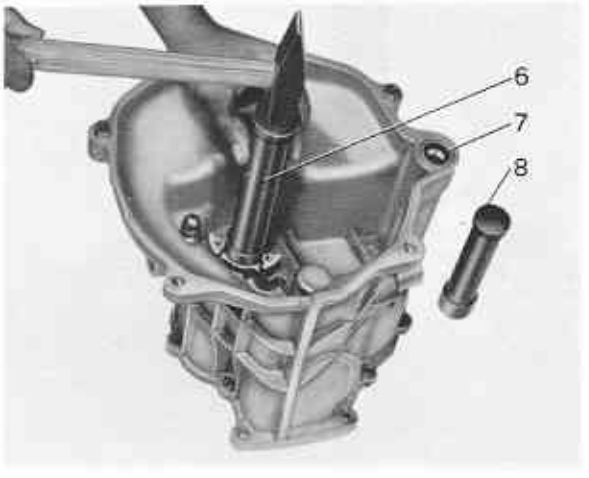
If previously removed fit the selector shaft guide bush in the clutch-gearbox housing which has previously been heated to 140° to 160°C, using tool **5 (A.3.0434)**. Load for inserting bush: 350 to 400 Kg.




**Clutch-gearbox housing oil seals**

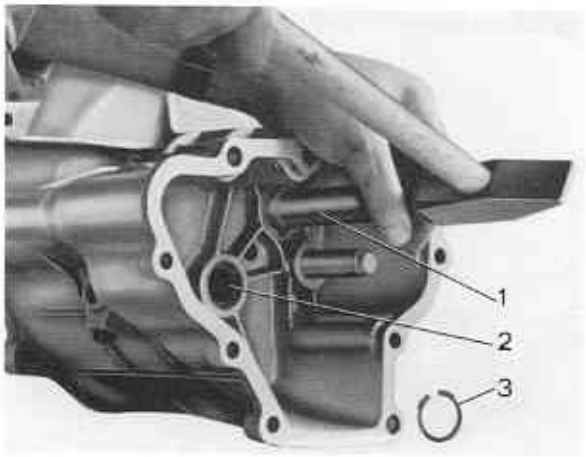
Fit the mainshaft oil seal in the clutch-gearbox housing using tool **6 (A.3.0343)** and the oil seal **7** for the gear selector spindle using tool **8 (A.3.0342)** after first moistening the outside surfaces with oil.

Lubricate the oil sealing lip of the seals with the prescribed grease.



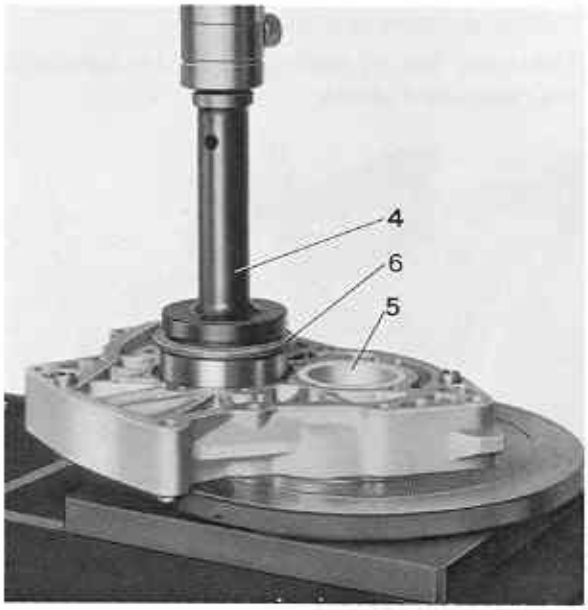
### Clutch-gearbox housing bearings

Fit the mainshaft and pinion shaft roller bearings 2 in the clutch-gearbox housing using the appropriate tool 1 (A.3.0346): fit the corresponding circlips 3 and lubricate the bearing rollers with the prescribed grease.




### Bearing outer ballraces in the intermediate flange

Fit the bearing outer ballraces for the mainshaft 5 and the pinion shaft 6 to the intermediate flange using tool 4 (A.3.0408).



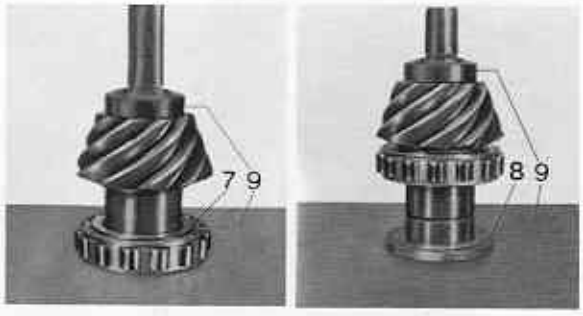

Fit the back plate (see 3, page 41) and tighten the bolts 2 diagonally, then fit the hexagonal pillar 1 for the gear selector spindle spring return link.

### Synchronizers

Re-assemble on the gearwheels the synchronizer assemblies and fit the stop segments in position (see 4, page 40) with the reference segments 5, the limit strips 3 the synchronizer ring 2 and the circlip 1, then check that the synchronizer ring rotates freely.

### Preparation of the pinion shaft

Re-assemble the pinion shaft by fitting the inner race 7 of the rear roller bearing in position and also the relevant distance piece 8, previously heated to 140°C, using a press and the appropriate platten and the plate 9 (A.2.0237) taking care to cool it with air while the parts are subjected to pressure under the press so as to ensure perfect contact of all the faces.

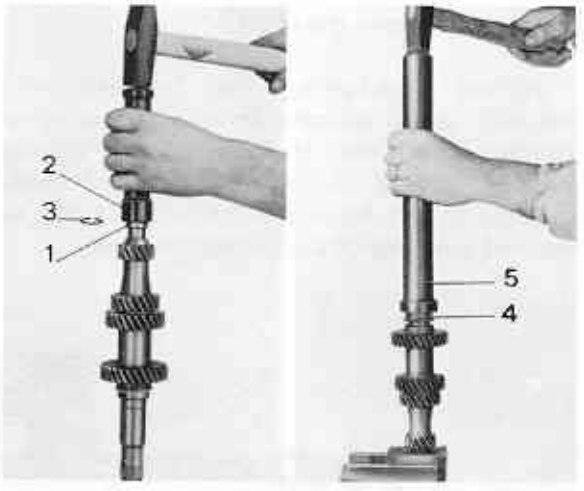



Repeat the operations of assembly in the opposite sequence to that of dismantling (see page 39) taking care to lubricate the working surfaces with oil before fitting the gears on their respective bushes.

### Preparation of the mainshaft

If previously removed, fit the rear bearing inner roller race **1** on the mainshaft using the appropriate tool **2 (A.3.0406)** and then fit circlip **3**.

Also fit the intermediate bearing half ball race **4** using the tool for the purpose **5, (A.3.0125)**.




### Assembly of main shaft

Fit the ball cages in the intermediate flange taking care not to reverse them with respect to their own half ballraces, then fit the mainshaft 8 (see page 40) with the front half ballrace 9 of the intermediate ball bearing, the 5th, speed gear and reverse gear 7 and screw on nut 6 but do not tighten fully.

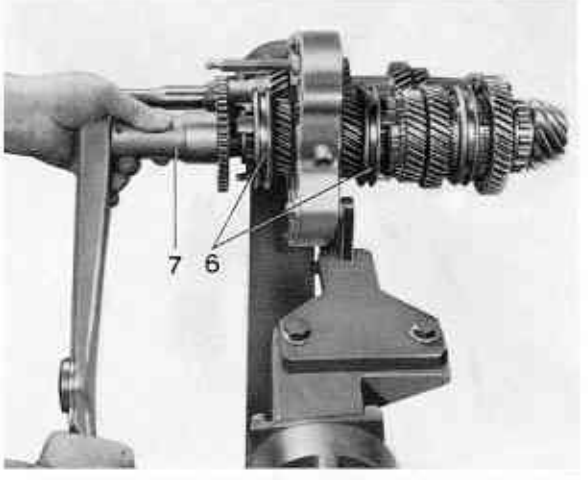
### Fitting the pinion shaft

Slide the synchronizing sleeve of the 3rd. and 4th. speeds along to engage 4th. gear (see 11, page 38).

Fit the pinion shaft assembly 12 in the pinion flange.

Fit the ball cage with the corresponding rear inner half ballrace 13 of the intermediate bearing, the bush 10; the roller cage 9 after having lubricated it with the prescribed grease, the 5th. speed gear 8, the synchronizer hub 7 of the 5th. speed and reverse gear with the corresponding sleeve and the reverse gear 6, then fit the nut 5 on to the pinion shaft.

Slide the synchronizer sleeves **6** to engage two speeds (in the event the 4th speed has come out of gear inadvertently); then, tighten the pinion shaft nut to the prescribed torque, viz. 11.4 to 12.6 Kgm, using spanner **7 (A.5.0126)**.

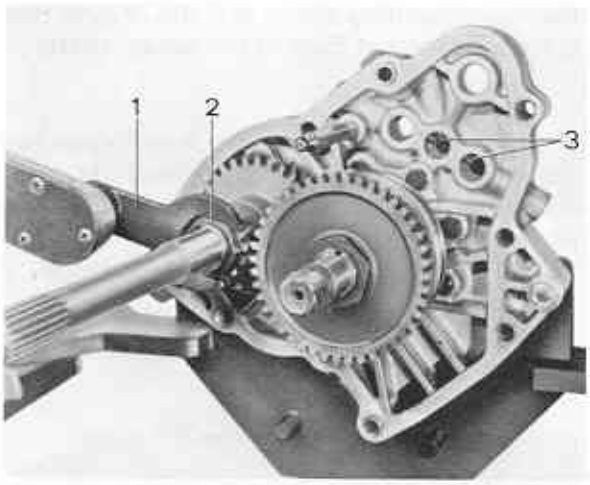



Check, using tool 9 (see page 37), that the dimension —A— between the inside face 7 of the intermediate flange and the end face of the pinion 8 corresponds with the dimension recorded prior to dismantling the pinion.

To make any necessary correction, vary the thickness of the distance piece (see 2, page 39) fitted between bush 3 of the 4th. speed gearwheel and the front inner half ball race 1 of the intermediate bearing.

As the final operation, rivet the nut on one flat only.

Tighten the mainshaft nut **2** to a torque of 8.1 to 8.9 Kgm. with the special spanner **1**, (Tool **A.5.0181**) and rivet it over on one side only also, then disengage the two speeds **6** (see page 47) which were previously engaged.




**Assembly of the gear selector components**

Fit the gear change interlock plungers **3** into their respective locations in the intermediate flange, lubricating them with the prescribed grease.

Re-assemble the gear selector components in the intermediate flange proceeding in the reverse sequence to the order of dismantling (see page 36), namely:

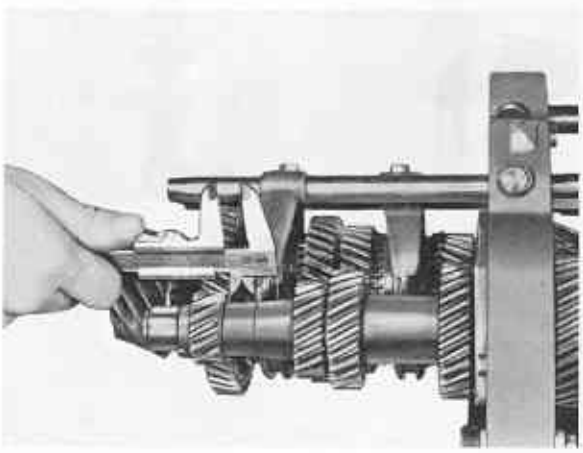
- fit the selector fork for the 3rd. and 4th. speeds to the corresponding synchro sleeve, then, having oiled the working surfaces, partly enter the selector shaft into the intermediate flange and insert it into the selector fork.

- fit the appropriate fork to the 1st. and 2nd. speed synchro sleeve.

- finish sliding the 3rd. and 4th. speed selector shaft into place; then, after having oiled the working surfaces, enter the 1st. and 2nd. speed selector shaft into the intermediate flange and insert it into its selector fork.

- insert the 5th. forward speed and reverse speed selector shaft and rotate it so that when it enters its location the interlock catch fits in the space between the shaft.

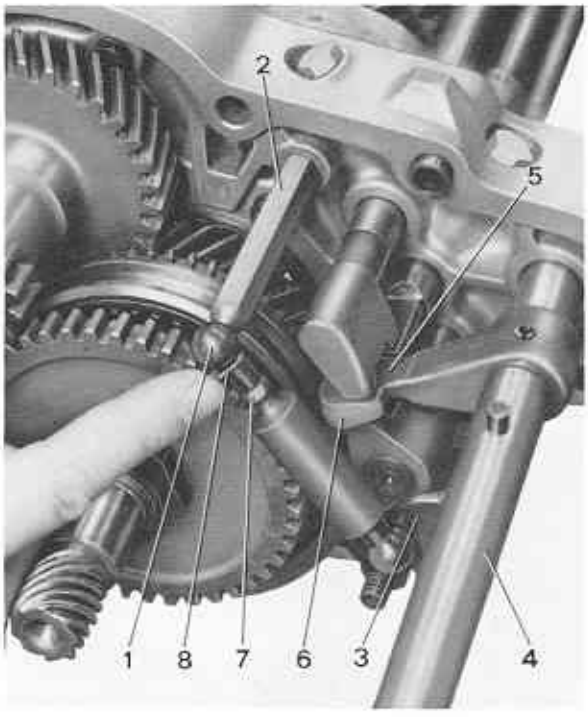
- before tightening the 1st./2nd. and 3rd./4th. speed selector forks on the selector spindles, check that the synchronizer sleeves for these speeds, in the disengaged position, are equidistant from the inside faces of the toothed portions of the respective gears.



- hook the sheath end of the return spring link **1** on to the ball end of the hexagonal pillar **2** attached to the intermediate flange and, if previously disconnected, re-hook the other end of the spring return link to the hook on the return lever **3** on the gear selector shaft **4** and check that the interlock catch **5** on the gear selector shaft is centered in the nose **6** of the 3rd./4th. speed selector spindle.

- if necessary, adjust the spring link by screwing it in the required direction and to the required tension after having slackened back the lock nut **7**. Re-tighten the lock nut and close the locking tabs **8** of the ball head.

- lock the selector forks to the selector shafts with the set screw.




- lubricate with the prescribed grease and fit the detent balls (see 4, page 36) for positioning the selector shaft together with the corresponding springs 3 and spring carriers 2 which should be tightened to a torque of 1.4 to 1.6 Kgm.

# REASSEMBLY OF THE GEARBOX UNIT

Coat the joint faces of the intermediate flange and the gearbox-differential and gearbox-clutch housings with the prescribed sealant after having cleaned them with the prescribed liquid.

Assemble the intermediate flange complete with the shaft assemblies and the operating components on the gearbox-differential housing (see 10, pag 35).

Insert the reverse idler gear 9 into the 5th. speed and reverse gear selector fork and lubricate the gear pin which is mounted on the clutch-gearbox housing.

Fit the clutch-gearbox housing 8 to the intermediate flange, taking care to put the reverse gear on its pin, then tighten the nuts diagonally to a torque of 1.9 to 2.3 Kgm.

Fit the differential housing in position, then fit the cover to the gearbox-differential housing. Tighten the nuts diagonally and proceed with the operations of assembly as described on page 73.

**NOTE - If it is necessary to re-assemble the safety interlock for engaging reverse (see 7, page 35) smear the bracket joint faces with the prescribed sealant on re-assembly.**

Fit the speedometer drive pinion (see 2, page 35) lock it in place with setscrew 3 and fit the reverse light switch 1 and tighten it to a torque of 4 to 4.9 Kgm.

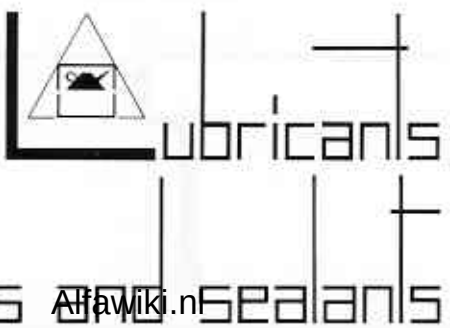
**Re-assembly of clutch unit**

Re-assemble the clutch unit to the gearbox-differential unit as described on page 27.

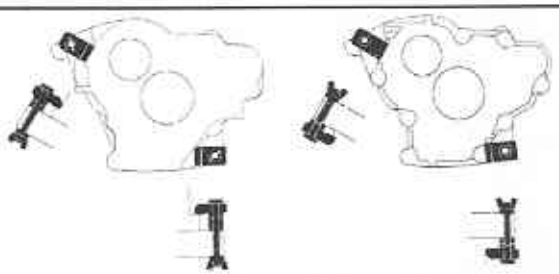

Prescriptions


Tools


Tightening
torques

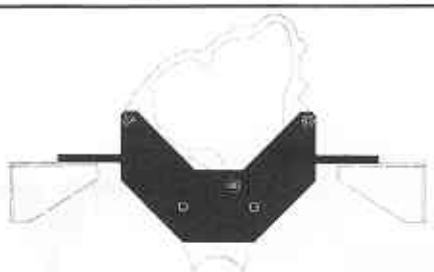

Lubricants
fluids and sealants

# Tools



## A.2.0244

**CLAMPS**
for clamping the intermediate flange to the clutch-gearbox and gearbox-differential housing

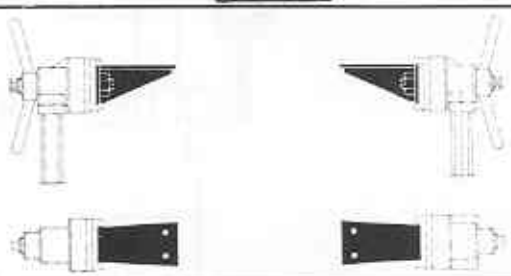


## R.4.0149

**CRADLE**
intermediate flange (use on stand R.4.0151 with brackets R.4.0154 or in a vice)

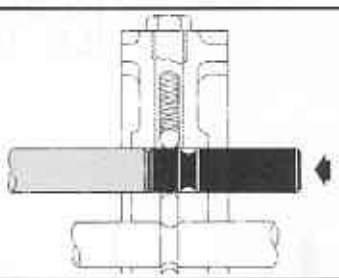
## R.4.0151

**STAND**
for supporting units



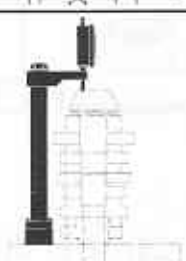
## R.4.0154

**BRACKETS**
for assembling the stand R.4.0151 and cradle R.4.0149



## A.2.0267

**DUMMY SPINDLES**
for retaining the detent balls for positioning the gear selector spindles and the gear engagement safety plungers in their locations

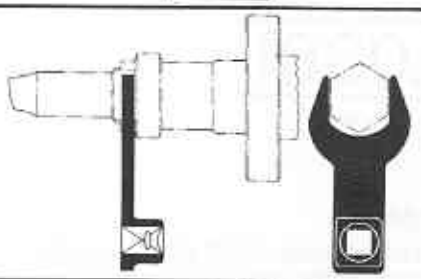


## A.4.0145

**DIAL GAUGE PILLAR**
for mounting dial gauge to determine pinion setting

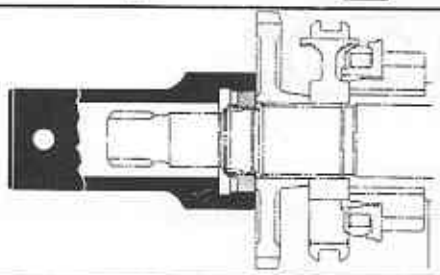
## C.6.0166

**PILLAR GAUGE**
for setting dial gauge to determine the pinion setting



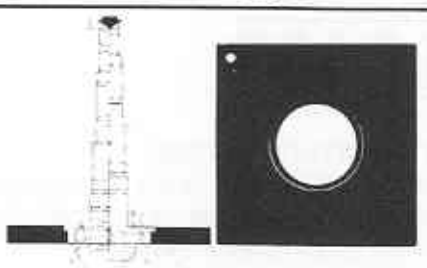
## A.5.0181

**SPANNER**
30 mm for mainshaft nut



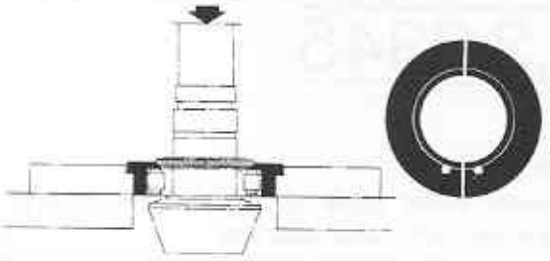
## A.5.0126

**SPANNER**
36 mm box spanner for pinion shaft nut



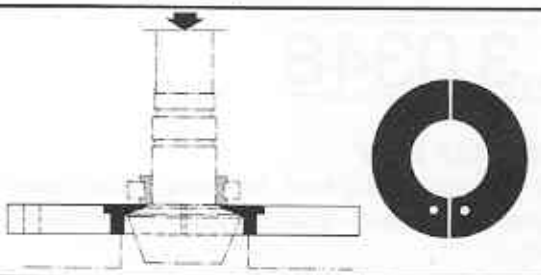
## A.2.0249 *

**PLATE**
for removing pinion shaft distance piece and roller bearing inner roller race. To be used with A.2.0235 and A.2.0236



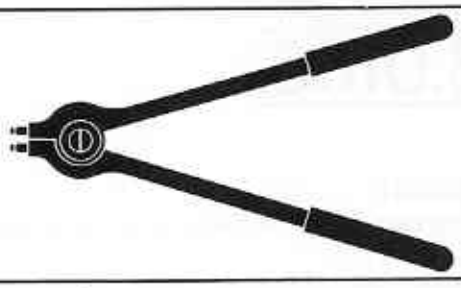
## A.2.0236 *

**HALF RINGS**
for removing the pinion shaft rear bearing distance piece. To be used with A.2.0249



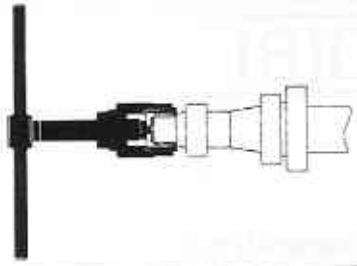
## A.2.0235 *

**HALF RINGS**
for removing pinion shaft rear roller bearing roller race. To be used with A.2.0249



## G.2.0051 *

**PLIERS**
for external circlips securing the synchronizers

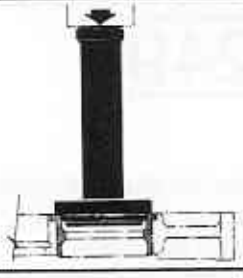


## A.3.0361

**EXTRACTOR**
for inner race of mainshaft rear bearing

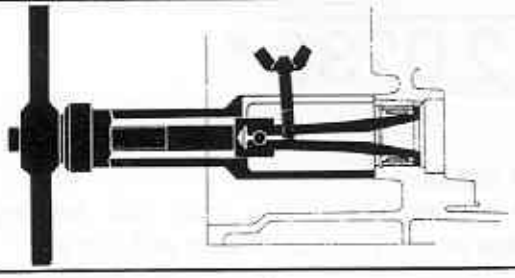
## A.3.0407

**EXTRACTOR**
for outer race of mainshaft intermediate bearing



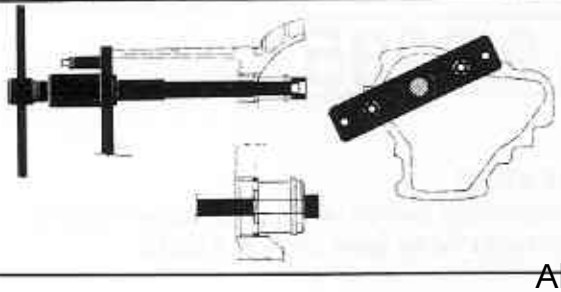
## A.3.0408

**EXTRACTOR-FITTING MANDREL**
for outer race of pinion shaft intermediate bearing and for fitting outer race of mainshaft bearing in the intermediate flange



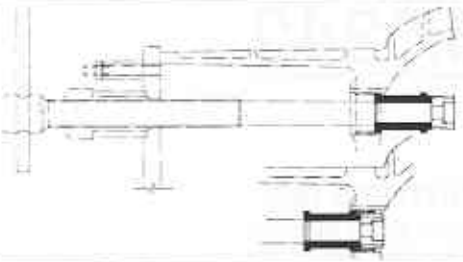
## A.3.0345

**EXTRACTOR**
for outer roller races of forward mainshaft and pinion shaft roller bearings



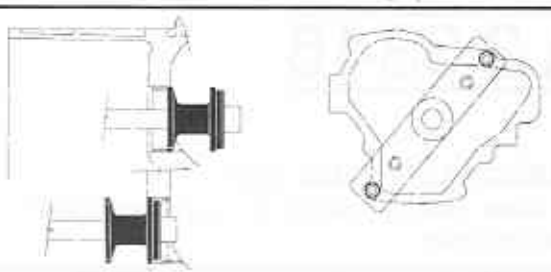
## A.3.0348

**EXTRACTOR BODY**
for extractor-fitting tool, for outer roller races of mainshaft and pinion shaft rear roller bearings



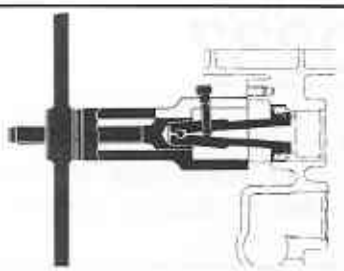
## A.3.0363

**BUSH**
for extracting and fitting outer roller race of pinion shaft rear roller bearing (use with A.3.0348



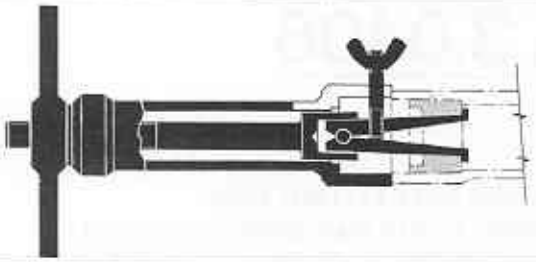
## A.3.0364

**BUSH**
for extracting and fitting outer roller race of mainshaft rear roller bearing (use with A.3.0348)



## A.3.0291

**EXTRACTOR**
for selector shaft guide bush



## A.3.0433

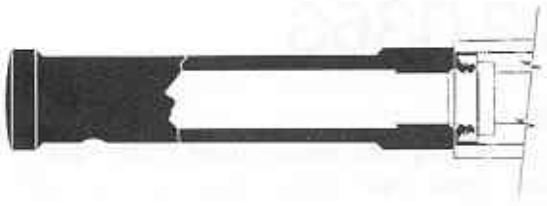
**EXTRACTOR**
for mainshaft and selector shaft oil seals

## A.3.0434

**BUSH FITTING MANDREL**
for selector shaft guide bush

## A.3.0343

**OIL SEAL FITTING TOOL**
for main shaft oil seal

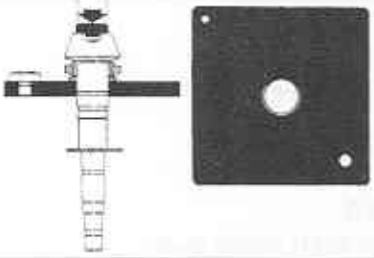


## A.3.0342

**OIL SEAL FITTING TOOL**
for selector shaft oil seal

## A.3.0346

**BEARING RACE FITTING TOOL**
for outer race of mainshaft and pinion shaft roller bearings

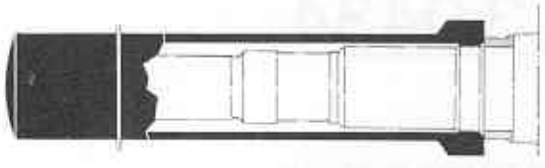


## A.2.0237

**PLATE ASSY**
for fitting inner roller race of rear roller bearing and bearing distance piece on pinion shaft

## A.3.0406

**BEARING RACE FITTING TOOL**
for inner race of main shaft rear bearing



## A.3.0125 *

**BEARING RACE FITTING TOOL**
for rear semi-inner race of intermediate bearing on main shaft

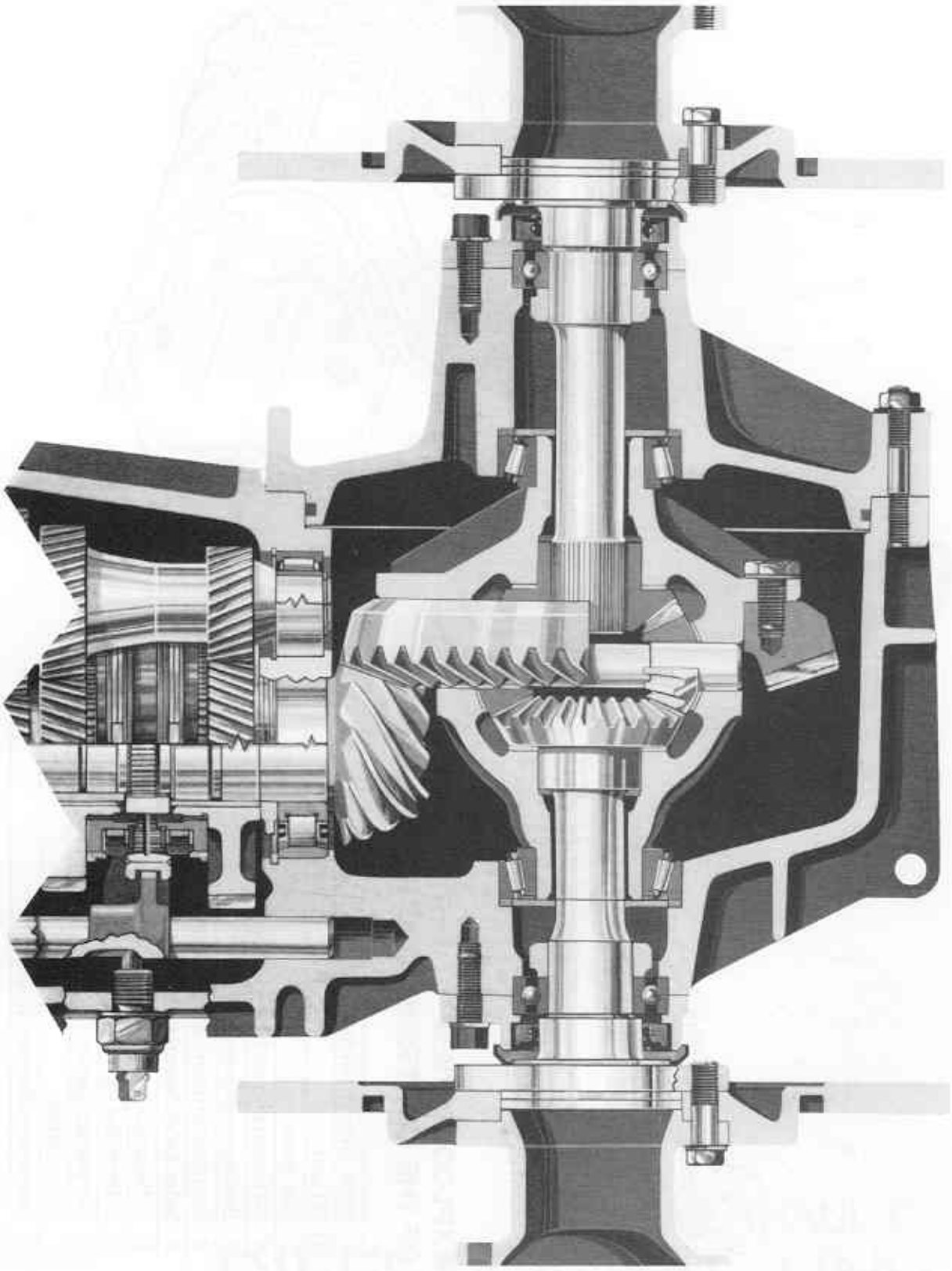
* Tools common to other types of vehicle

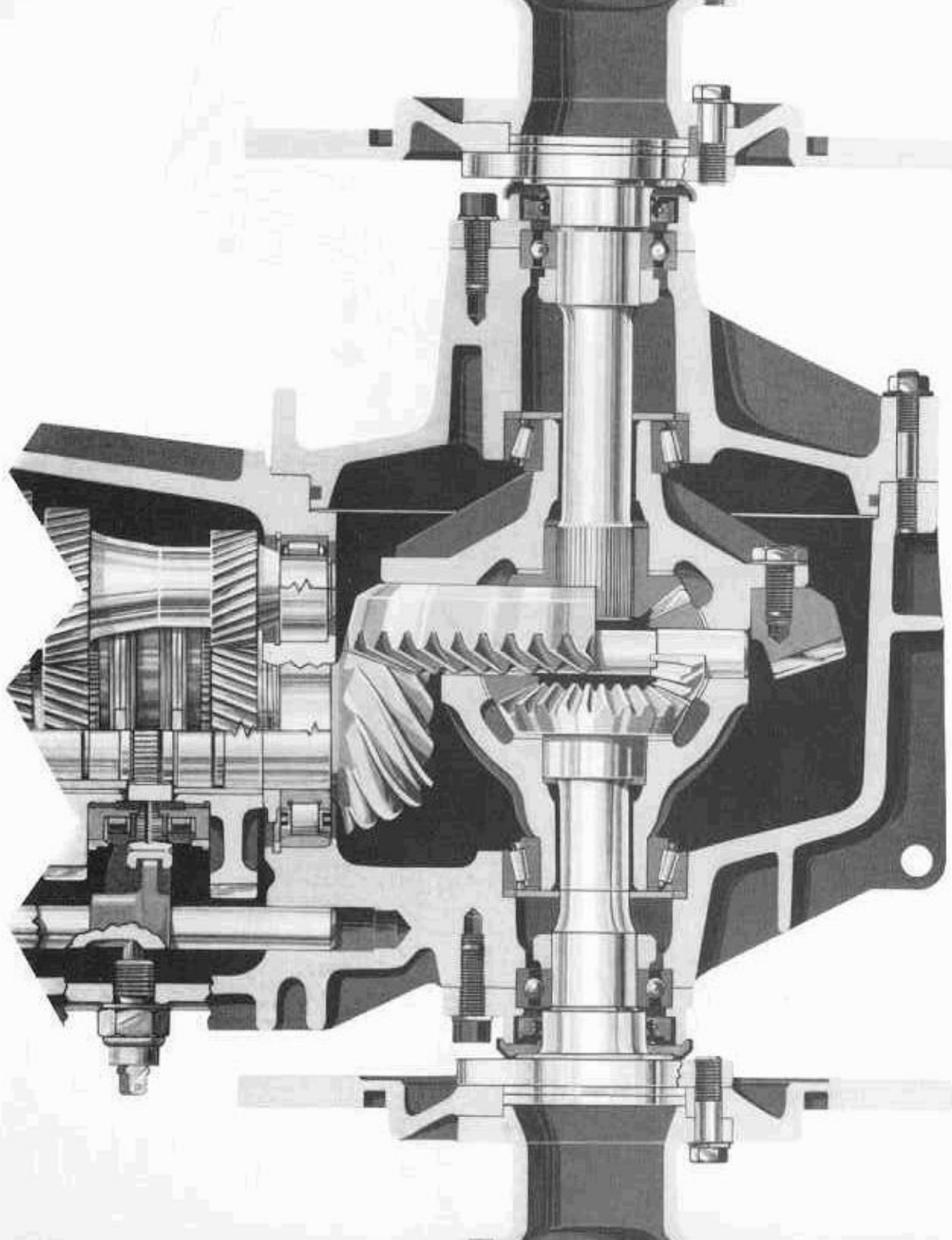
# Tightening torques

| ITEM | Kg.m. | TIGHTEN |
|---|---|---|
| Pinion shaft nut | 11.4 – 12.6 | Dry |
| Main shaft nut { without special spanner | 9.5 – 10.5 | Dry |
| Main shaft nut { with spanner A.5.0181 | 8.1 – 8.9 | Dry |
| Selector shaft detent ball carrier | 1.4 – 1.6 | Dry |
| Nuts securing clutch-gearbox housing and intermediate flange to gearbox-differential housing | 1.9 – 2.3 | Dry |
| Reverse light switch | 4 – 4.9 | Dry |

# Lubricants fluids and sealants

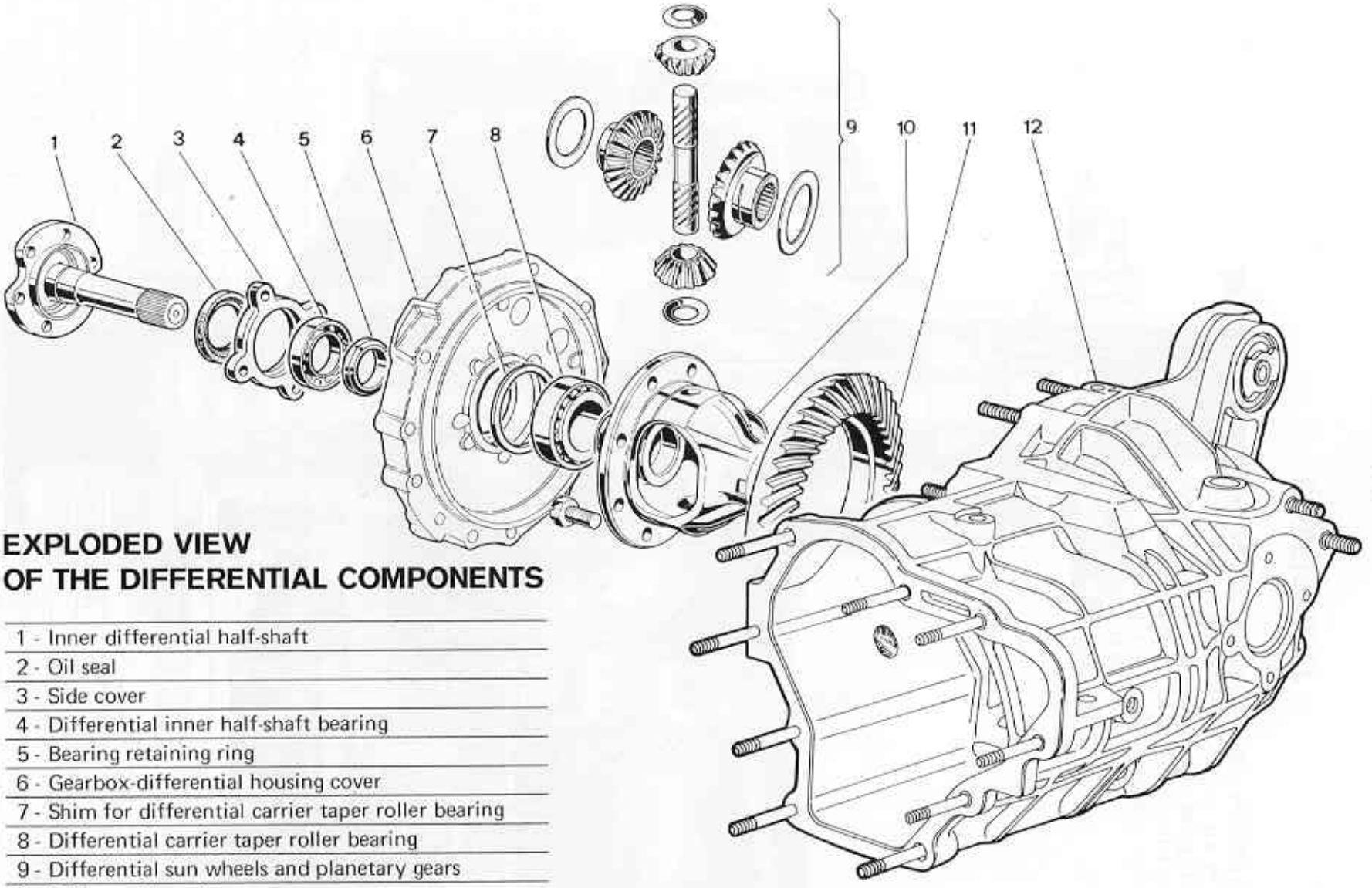
| ITEM | RECOMMENDED COMMERCIAL PRODUCTS |
|---|---|
| Oil for:<br>- Outside surfaces of mainshaft and pinion shaft oil seals | AGIP F1 ROTRA MP SAE 85 W/90<br>SHELL SPIRAX 90 HD |
| Sealant for:<br>- Contact surfaces of intermediate flange<br>NB - To clean the faces use methylated spirit or trichloroethane<br><br>- Joint face of reverse gear safety device support plate | LOWAC PERFECT SEAL |
| Grease for:<br>- 5th speed roller cage and rollers<br>- Speed engagement safety plungers<br>- Selector spindle positioning balls<br>- Mainshaft and pinion shaft front roller bearings | AGIP F1 GREASE 33 FD<br>SHELL RETINAX AX |
| - Oil seal lips and working surfaces of same on mainshaft and pinion shaft | ISECO MOLYKOTE BR 2 |





box. The crownwheel and pinion are of the hypoid type, the reduction ratio being 10/41. The outer half-shafts of the differential are of the oscillating type with constant velocity universal joints at each end.

| TECHNICAL INFORMATION AND DATA | |
|---|---|
| Crownwheel and pinion teeth | Hypoid |
| Reduction ratio | 10/41 |
| Overall gear ratios of gearbox and differential: | |
| 1st. gear | 1 : 13.53 |
| 2nd. gear | 1 : 8.20 |
| 3rd. gear | 1 : 5.62 |
| 4th. gear | 1 : 4.26 |
| 5th. gear | 1 : 3.40 |
| Reverse | 1 : 11.73 |
| Adjustment of distance between pinion and crownwheel axis | by shims |
| Differential carrier bearings | 2 off taper roller bearings |
| Preloading adjustment of differential bearings | by shims |
| Torque to rotate differential bearings | 10 to 20 Kg cm |
| Differential inner half-shaft bearings | 2 off ball bearings |
| Distance between pinion and crownwheel axis | 56.500 mm |
| Distance between pinion and outer surface of setting pin (C.6.0164) | 66.500 mm |
| Backlash between crownwheel and pinion teeth on assembly | 0.13 to 0.18 mm |
| Backlash between sun wheels and planetary gear teeth on assembly | 0 to 0.05 mm |
| Clearance between brake pads and rear brake discs on assembly | 0.1 mm on each side |
| Thickness of brake pads when new | 15 mm |




## EXPLODED VIEW OF THE DIFFERENTIAL COMPONENTS

1 - Inner differential half-shaft
2 - Oil seal
3 - Side cover
4 - Differential inner half-shaft bearing
5 - Bearing retaining ring
6 - Gearbox-differential housing cover
7 - Shim for differential carrier taper roller bearing
8 - Differential carrier taper roller bearing
9 - Differential sun wheels and planetary gears
10 - Differential carrier
11 - Crownwheel
12 - Gearbox-differential housing

# DISMANTLING THE DIFFERENTIAL UNIT

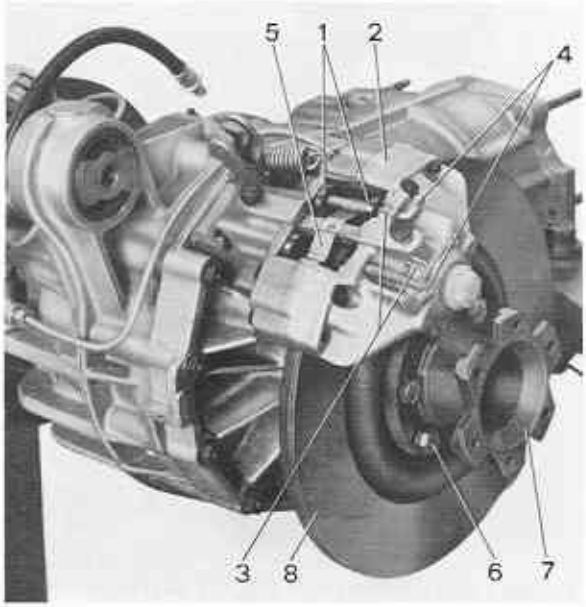
### Removing the brake calipers

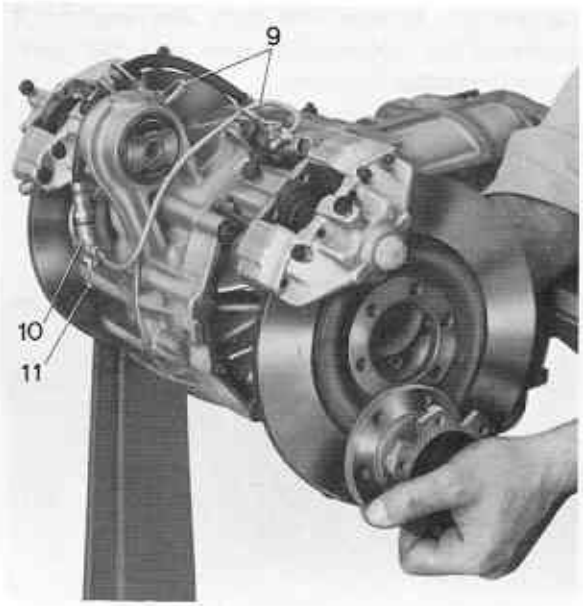
Remove the brake pads **1** from the caliper **2**, by removing the locking clips **3** from the pad retaining pins **4**, the retaining pins themselves and the retaining spring **5**.

Slacken and remove bolts and washers **6** attaching the brake disc **8** and the distance piece **7**.

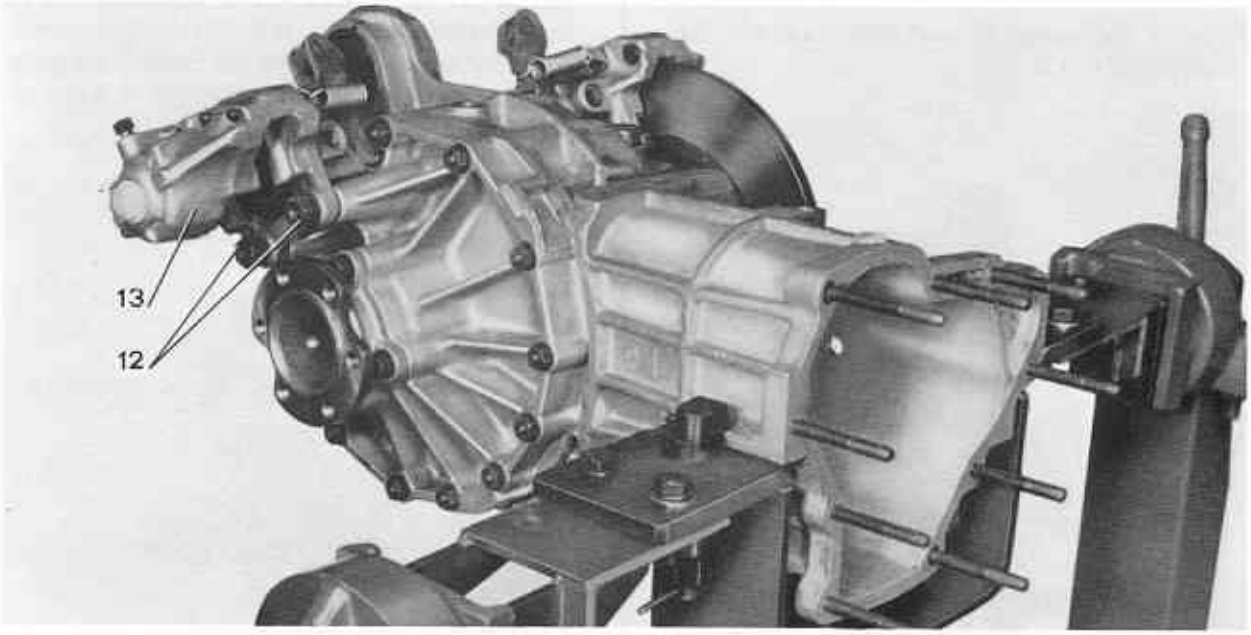
Remove the distance piece and the brake disc.

Disconnect the hydraulic brake piping **9** from the calipers and remove the threeway connection **10** from the gearbox-differential housing by slackening and removing screw **11**.



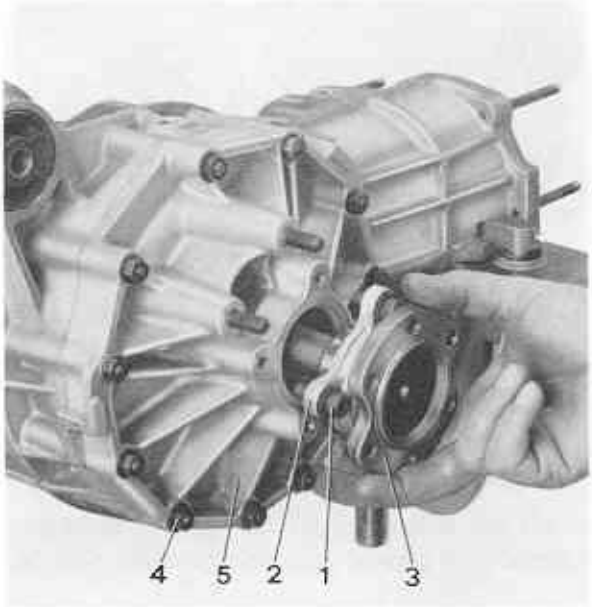

Slacken and remove the nuts and washers **12** attaching the brake caliper **13** to the gearbox-differential housing and remove the caliper itself. Proceed in a similar way on the other side to dismantle the other brake caliper.



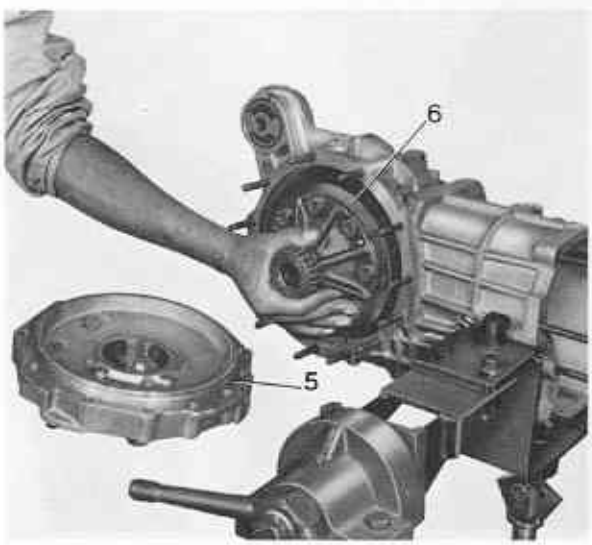
**Removal of the inner differential half-shafts and the differential carrier.**

Slacken and remove from both sides, the bolts and washers **1** attaching the side covers **2** of the differential inner half-shafts **3** to the gearbox-differential housing and withdraw the half-shafts.

Slacken and remove the nuts and washers **4** attaching the differential cover **5** to the gearbox-differential housing.

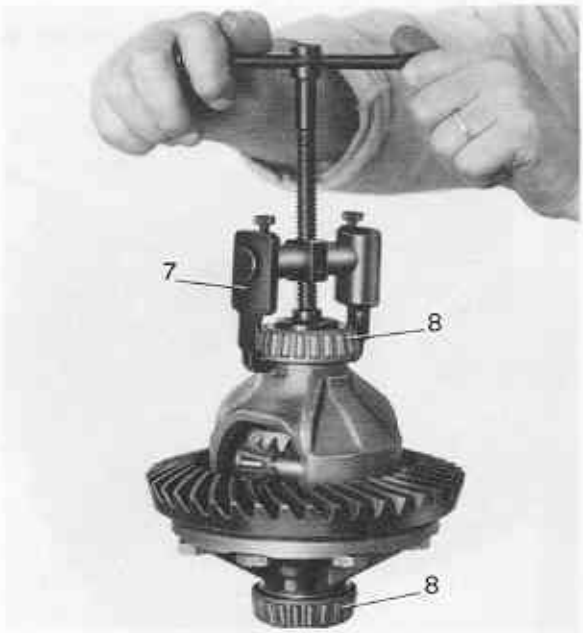



Remove the cover **5** and withdraw the differential carrier **6**.



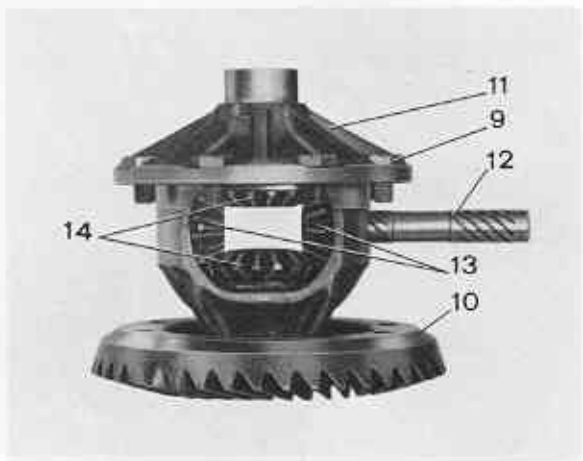

**Dismantling the differential carrier**

Using the special tool **7** (A.3.0287) extract the inner race of the tapered roller bearing **8** from the differential carrier.



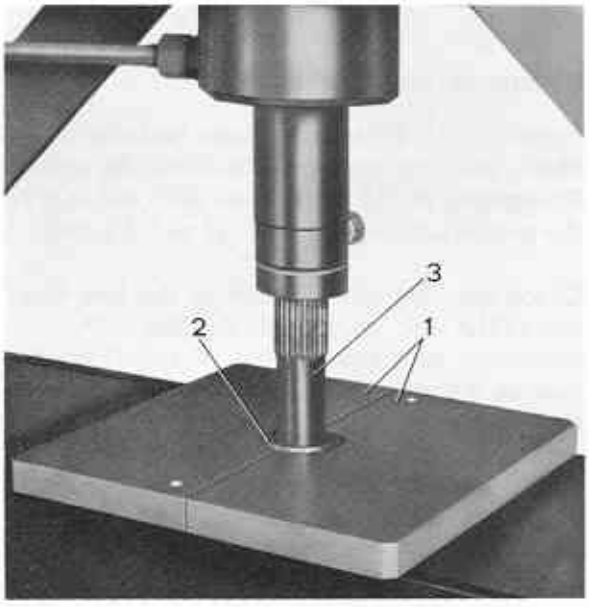

Extract the differential pin **12** and remove the sun wheels **13** from the differential carrier with the corresponding washers, also remove the planetary gears **14** with their spacer rings.

Put reference marks for re-assembly on the crownwheel and on the differential carrier, then slacken and remove the bolts **9** attaching the crownwheel **10** and remove it from the differential carrier **11**.



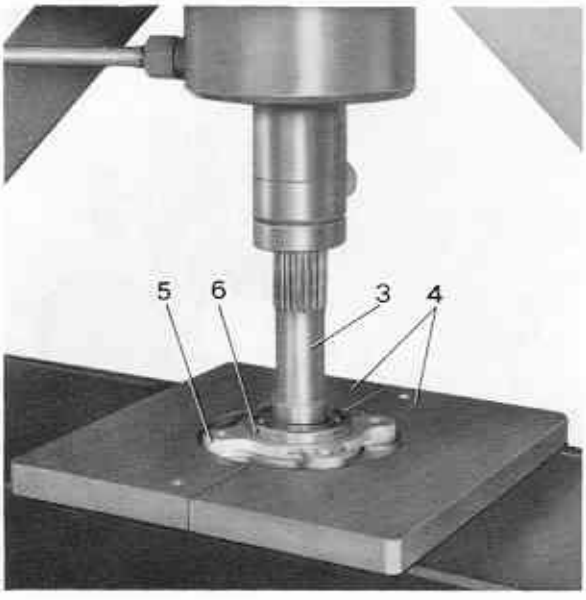
### Dismantling the differential inner half-shafts

Using a press and the half plates, tool **1** (A.2.0247), remove the bearing retainer ring **2** from the differential inner half-shaft **3**;



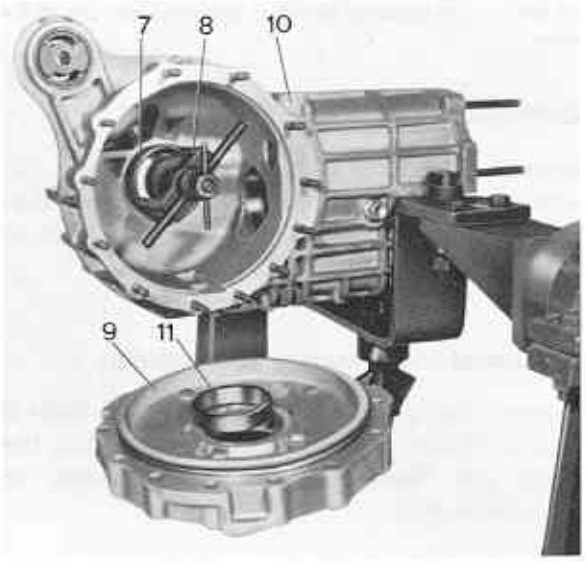

then, using the half plates **4** (Tool A.2.0248) withdraw the side cover **5**.

Remove the oil seal and bearing **6** from the side cover.




### Removal of the outer races of the differential carrier, taper roller bearings

Using tools **7** (A.3.0411) and **8** (A.3.0390) extract the races **11** of the taper roller bearings with their respective adjusting shims from the gearbox-differential housing **10** and the housing cover **9**.




### Dismantling pinion shaft

Remove the pinion shaft from the intermediate flange.

NOTE - Refer to the gearbox unit for the instructions for removing and dismantling the pinion shaft (see page 38).

# CHECKING AND INSPECTION

### Crownwheel and pinion

Check that there are no signs of seizure or excessive wear on the teeth of the crownwheel and pinion **1**.

If necessary replace the crownwheel and pinion

NOTE - The crownwheel and pinion are supplied as a matched pair. It is not possible therefore to replace only one of the gears.

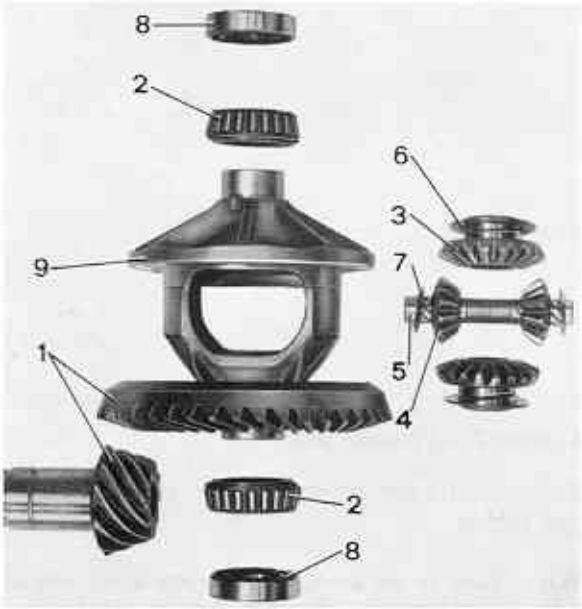
### Differential carrier bearings

Inspect the condition of the differential carrier taper roller bearings **2** and check that the surfaces are free from score marks, seizure or signs of wear.

### Sun wheel and planetary gear assembly

Inspect the sun wheels and planetary gears **3** and **4** of the differential and check that the teeth are free from seizure, breakage, or excessive wear.

Examine the differential pin **5**, the spacer rings **6** and the spherical washers **7** and check that they are complete and free from excessive wear.




### Differential inner half-shaft bearings

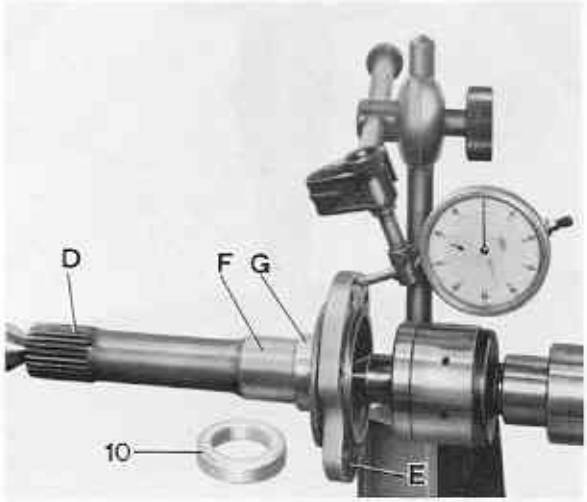
Inspect the condition of the differential inner half-shaft bearings **8** and check that they rotate freely without tight spots, that they are not noisy and that there is no excessive play.

### Differential inner half-shafts

Examine the differential inner half-shafts and check that the clearance between the splines **D** engaging in the sun wheels does not exceed the prescribed amount of 0.07 to 0.13 mm.

Check that the out of truth of the face **E** for the brake disc on the differential half-shaft, compared with the journals **F** and **G** for the bearing and the oil seal does not exceed 0.05 mm.

Check that the interference fit between the bearing retaining ring **10** and its register **F** on the differential inner half-shaft is the prescribed amount, viz. 0.023 – 0.057 mm.



# PRELIMINARY OPERATIONS FOR THE ASSEMBLY

### Preparation of the differential carrier

- Lubricate the working surfaces of the gears and wheels 3 (see page 64), the spacer rings 6, the spherical washers 7 and the pin 5 with oil

- fit the spacer rings to the sun wheels; fit them in the differential carrier

- fit the planetary gears 4 with the spherical washers 7 and rotate them until they register with the pin locations in the differential carrier and then insert the pin

- check that the clearance between the teeth of the gears and wheels is not greater than 0.05 mm.

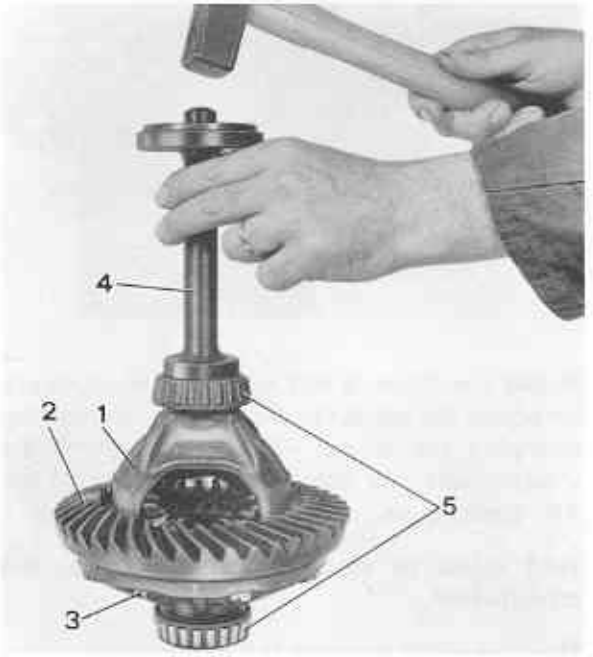
NOTE - when this unit is assembled there should be a certain amount of resistance to rotation in the gears.

To adjust the clearance between the teeth alter the thickness of the spacer rings 6:

- fit the crownwheel **2** to the differential carrier **1** aligning with the reference marks made on dismantling (in the case of the original crownwheel and pinion);

Lubricate the bolts **3** with oil and tighten them diagonally to a torque of 6.8 to 7.5 Kgm.

- fit the inner races **5** of the taper roller bearings to the differential carrier using tool **4** (A.3.0208).




### Preparation of the intermediate flange

Fit the pinion shaft assembly in the intermediate flange.

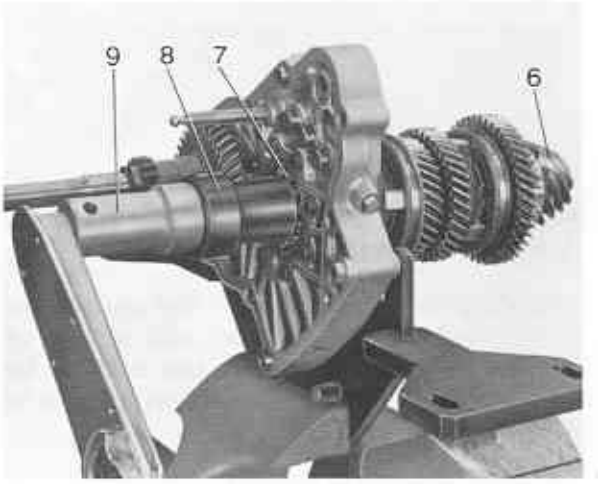
NOTE - For the re-assembly of the pinion shaft see gearbox unit, page 47.

Fit on the pinion shaft **6**:

- the forward half ball race of the intermediate bearing **7**.

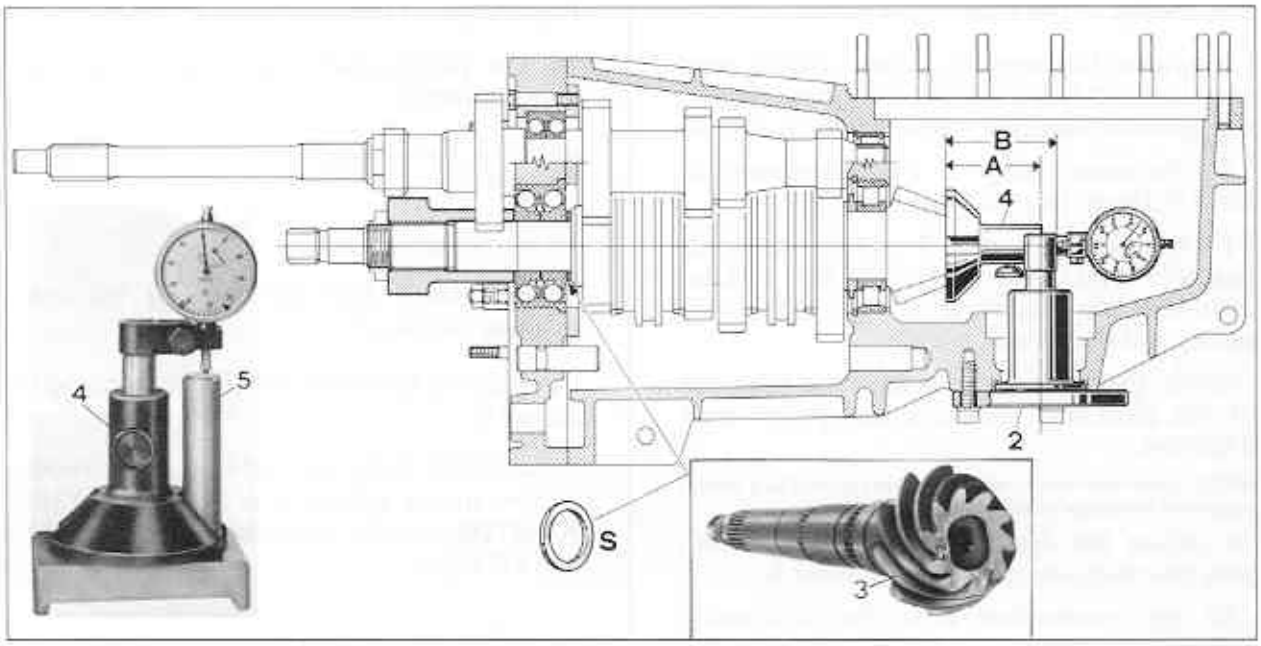
- the sleeve, tool **8** (A.2.0175) for locking the pinion 6.

- the pinion shaft nut and after having engaged two speeds tighten it with spanner **9** (tool A.5.0126), to the prescribed torque of 11.4 to 12.6 Kgm.




Disengage the two speeds previously engaged and fit the intermediate flange complete with the shafts to the gearbox-differential housing. Fit the distance pieces **1** (Tool A.2.0234) - (See page 66) at four points on the intermediate flange and tighten the nuts diagonally to a torque of 1.7 to 2.4 Kgm.

# ADJUSTMENT OF THE DISTANCE BETWEEN THE PINION AND CROWNWHEEL AXIS




Fit gauge **2 (C.6.0164)** to the bearing location in the gearbox-differential housing.

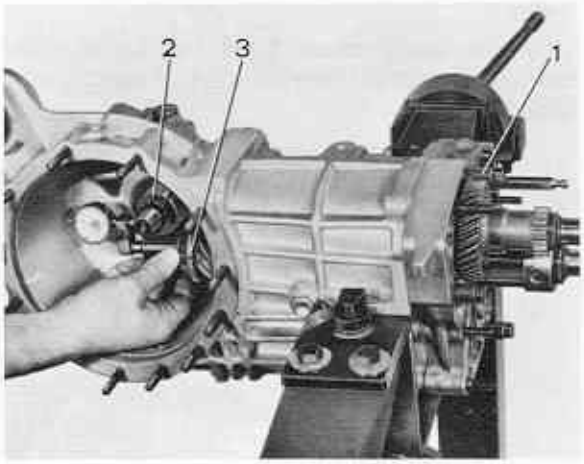
The distance –A– between the end of the pinion and the crownwheel axis should be 56.500 mm plus or minus the amount (in hundredths of a mm) stamped on the end of the pinion **3**.

To check proceed as follows:

Fit a dial gauge on the pillar tool **4 (A.4.0136)** and set the dial gauge to the nominal dimension of 66.500 mm using the distance gauge **5 (C.6.0163)**.

Dimension –B– (66.500 mm) corresponds to the nominal distance between the end of the pinion and the external diameter face of the pin on the checking gauge.

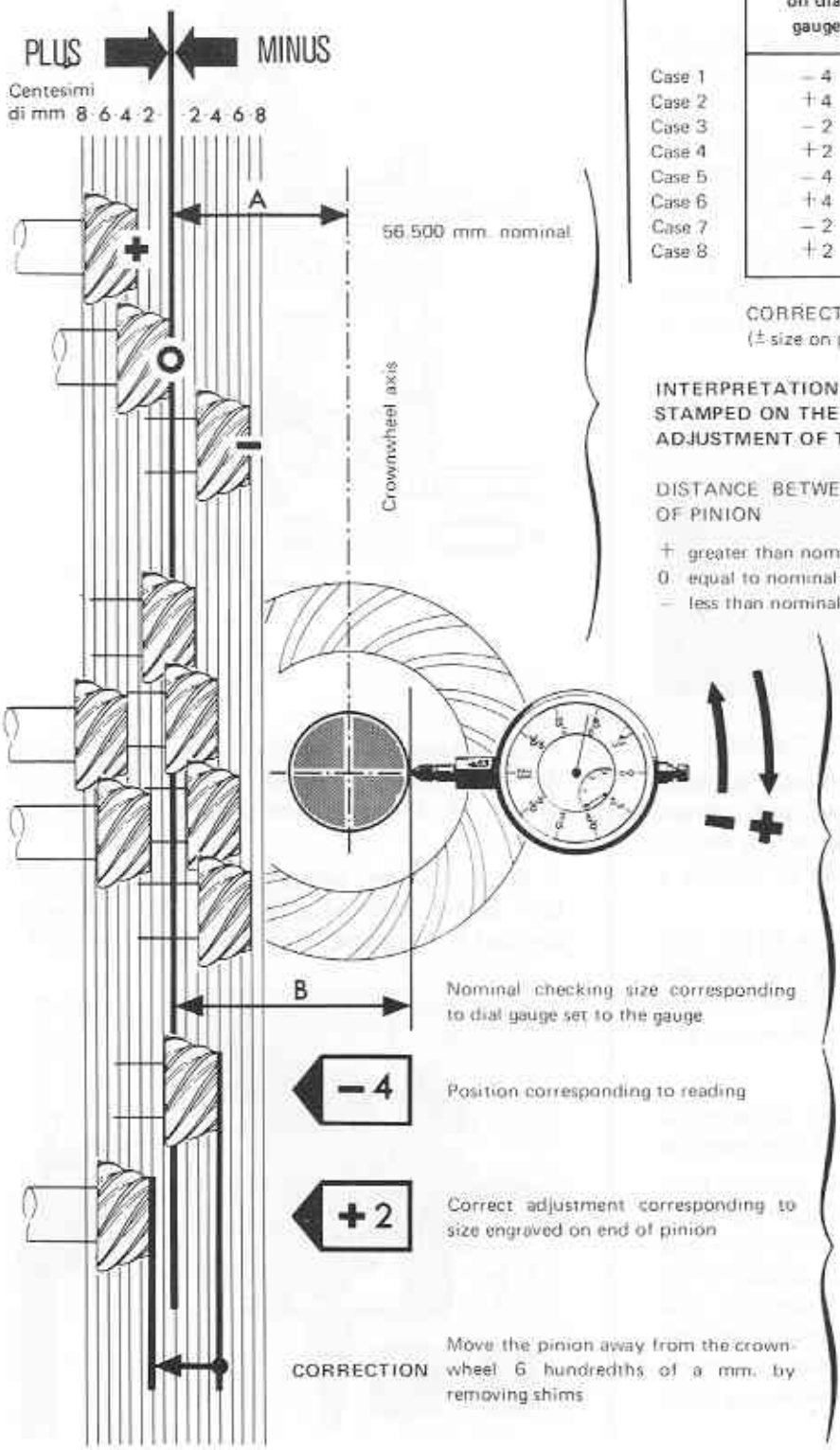
Rest the adjusted pillar tool assembly on the face of the pinion and take the reading, positive or negative, for the dimension –B–. This reading should correspond in value and quality with the dimension stamped on the end of the pinion.




If this condition is not fulfilled it is necessary to adjust the pinion to the correct position by changing the shims –S– fitted behind the intermediate ball bearing race and against the 4th. speed bush.

**Add shims to close the pinion up to the crownwheel.**

**Remove shims to move the pinion away.**




PRACTICAL EXAMPLE

| | Reading on dial gauge | Size on pinion | Correction to be made |
|---|---|---|---|
| Case 1 | − 4 | + 2 | − 6 (remove) |
| Case 2 | + 4 | − 2 | + 6 (add) |
| Case 3 | − 2 | + 4 | − 6 (remove) |
| Case 4 | + 2 | − 4 | + 6 (add) |
| Case 5 | − 4 | − 2 | − 2 (remove) |
| Case 6 | + 4 | + 2 | + 2 (add) |
| Case 7 | − 2 | − 4 | + 2 (add) |
| Case 8 | + 2 | + 4 | − 2 (remove) |

CORRECTION to spacer **S** = (± dial reading) minus (± size on pinion)

**INTERPRETATION OF THE SIZE (in hundredths of a mm.) STAMPED ON THE END OF THE PINION FOR CORRECT ADJUSTMENT OF THE PINION.**

DISTANCE BETWEEN CROWNWHEEL AXIS AND END OF PINION

\+ greater than nominal size
0 equal to nominal size
− less than nominal size

CHECKING

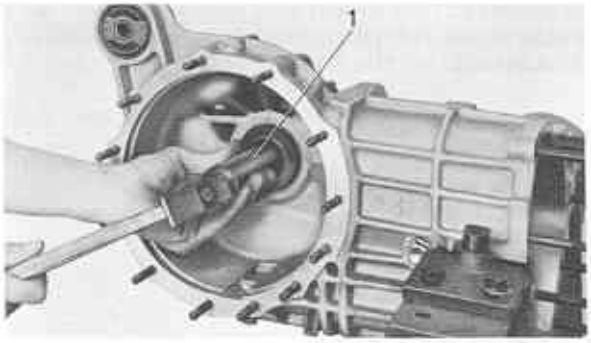
EXAMPLE OF CORRECTION

# ADJUSTING THE PRELOAD OF THE DIFFERENTIAL CARRIER BEARINGS

Having completed the adjustment of the distance of the pinion from the crownwheel axis, remove:

- the intermediate flange with the shafts and the gauge (see 2, page 66) fitted in the bearing location in the gearbox-differential housing.

- fit the spacer "S" previously removed, (initial size 1.7 to 1.8 mm) to the location in the gearbox-differential housing and fit the outer race of the differential carrier taper roller bearing using tool **1 (A.3.0292)**; then, fit the outer race of the opposite side taper roller bearing in the appropriate Tool **A (C.6.0171)**.



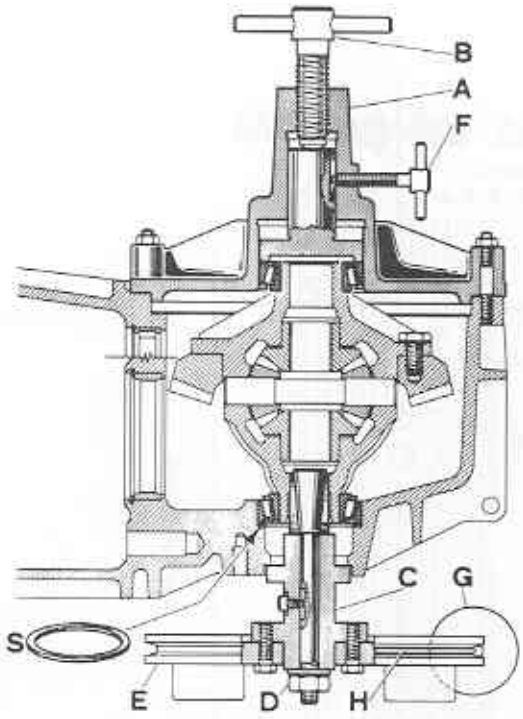

- locate differential carrier in this housing.

- fit tool **A** to the gearbox-differential housing in the position of the cover and tighten the nuts diagonally to a torque of 1.9 to 2.3 Kgm then tighten the screw **B** to obtain a measure of preloading

- fit the spindle assembly **C (C.5.0123)** and disc **E (C.5.0124)** for measuring the preloading into the left hand side differential shaft and using drawbolt **D** secure it firmly to the differential carrier

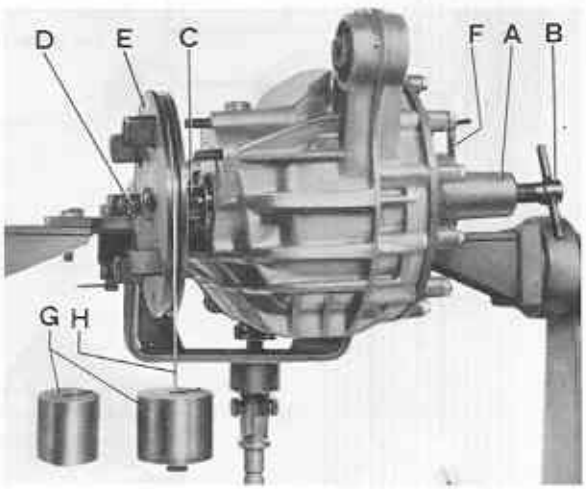
- using the disc **E** rotate the differential carrier in both directions to bed the bearings

- fit and wind the cable **H** round the disc **E** of the special tool and apply a weight **G** (tool **C.2.0037**) of 2 Kg to the end of the cable and check that in this condition on releasing the disc the weight falls rapidly. Substitute this weight by a 1 Kg weight; after rewinding the cable on the disc, release it again and check that the weight falls slowly (if necessary start the motion with a slight push).




By checking the conditions as stated above the required torque to turn the bearings should be the prescribed values of 10-20 Kg cm.

If the conditions prescribed are not fulfilled, turn screw **B** of tool **A** until the necessary preload is obtained, then tighten the screw **F**.



# ADJUSTING THE BACKLASH OF THE CROWNWHEEL AND PINION TEETH

Having obtained the preload prescribed for the differential carrier bearings, **do not remove the special tools.**

Refit the intermediate flange **1** with shafts to the gearbox-differential housing; after having fitted the distance pieces **2 (A.2.0234)**, fasten it at four points and tighten the nuts diagonally to a torque of 1.7 to 2.4 Kgm.

Fit the special clamp **3 (A.2.0250)** on the intermediate flange and lock the sleeve of tool **4** (previously fitted to lock the pinion shaft) by screwing the clamping screw **5** into one of the centering holes.

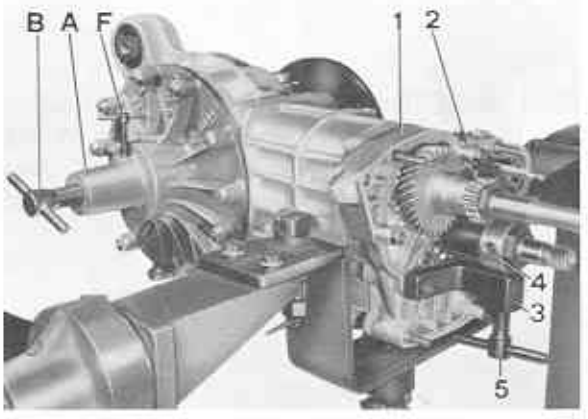
Rest the stylus of a dial gauge to one of the lugs **6** on the disc of tool **E**.

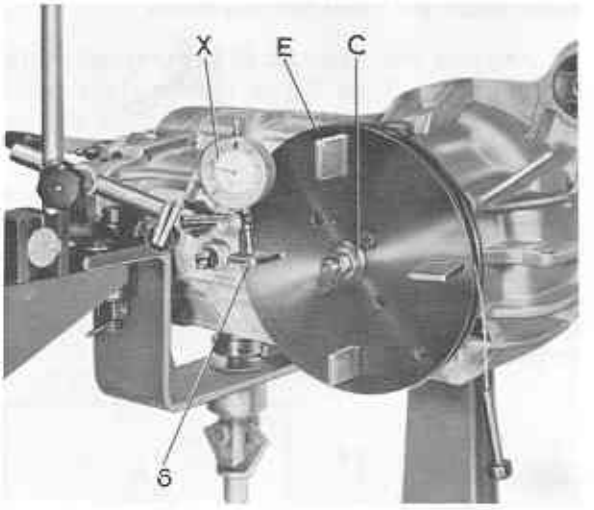
By turning disc **E** move the differential carrier back and forth and record the backlash **X** indicated by the dial gauge.

The position of the lug on the disc corresponds to the mean diameter of the crownwheel so that the dial gauge reading gives the effective backlash of the crownwheel and pinion.

**NOTE - The backlash should be checked in four positions of the cronwheel by rotating the differential carrier with disc E and by releasing the pinion with screw 5 in clamp 3.**

If the backlash **X** read off the crownwheel is not the prescribed amount of: **G = 0.13 to 0.18** mm the shims fitted between the outer races of the differential carrier and their




respective seats should be altered, proceeding as follows (see diagram on page 71):

**Adjusting left hand bearing shims**

- remove tool **A** from the gearbox-differential housing which was fitted for adjusting the preload of the differential carrier bearings, taking care not to alter the setting of screw **B**.
- remove tool **C** for recording the preload of the differential carrier bearings, then, using the special tools **(A.3.0411** ref. 7 and **A.3.0390** ref. 8 see page 63) extract the outer race of the differential carrier bearing from the gearbox-differential housing

- alter the shim **S'** between the external race of the bearing and the seat in the gearbox-differential housing a suitable amount to make the backlash between the crownwheel and pinion teeth the prescribed amount remembering that:

- **adding shims increases the backlash**
- **removing shims reduces the backlash**

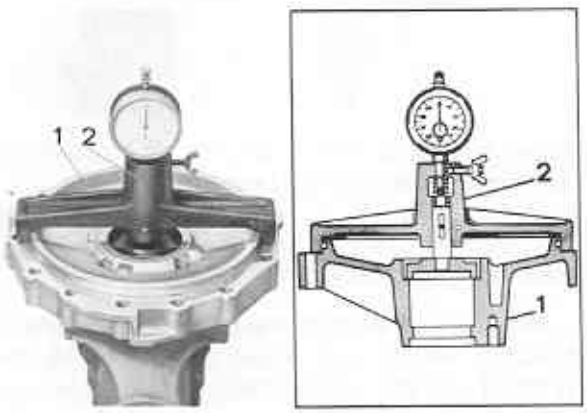
**WARNING:** *So as not to alter the amount of preload of the differential carrier bearings, the same alteration made to shims S' above, must be made at the same time to the shims S'' for the right hand bearing,* **but to the opposite value.**

Fit the outer race of the differential carrier bearing in its location in the gearbox-differential housing using tool **A.3.0292**, (see ref. 1, page 68).

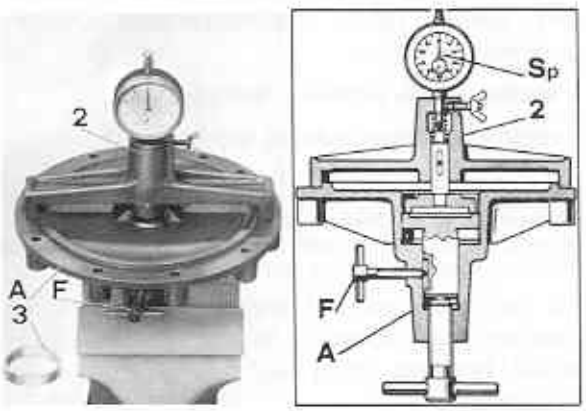
### Adjusting right hand bearing shims

To measure the value **Sp** of the preload shims which have to be fitted in the right hand bearing location for the differential carrier proceed as follows:

- fit the special tool **2 (C.6.0172)** on the differential housing cover **1** with the surface face of the gauge resting on the seat in the differential carrier for the outer race shims, then fit the dial gauge to the tool and set it to zero.



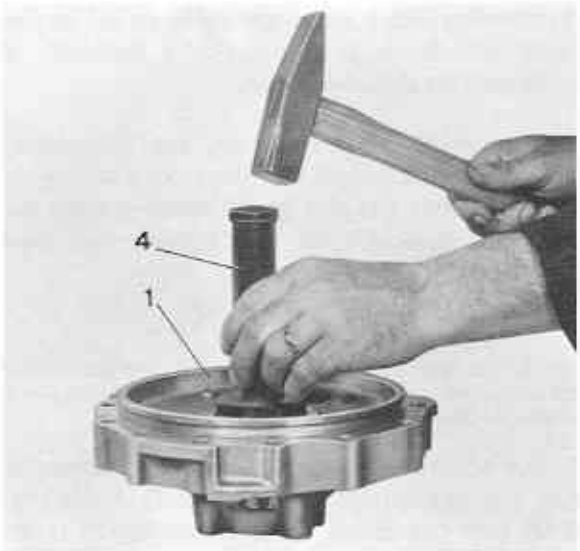

- extract the outer race **3** previously fitted in tool **A** for adjusting the preload of the differential carrier bearings, taking care not to alter the setting of screw **F**, and fit tool **2** to tool **A** without altering the setting of the dial gauge and thus measure the value of the dimension **Sp**.




The dimension **Sp** shown on the dial gauge must be varied by the value of any alteration made to the thickness of the shim in the left hand side during the operation of checking the backlash of the crownwheel and pinion. This figure is the difference between S and S' and must be to the opposite value on the right hand side to that of the alteration of the left hand side-see WARNING on previous page.

The resultant figure is the dimension of the shim to be fitted between the seating in the differential housing side cover and the outer race of the differential carrier bearing.

- fit the outer race of the differential carrier bearing in its location in the differential housing cover **1** using tool **4 (A.3.0292)**.




Refit the differential carrier to the housing and fit the differential housing cover to the gearbox-differential housing using its own nuts and tighten them to a torque of 1.9 to 2.3 Kgm.

**Final check of the backlash of the crownwheel and pinion teeth and of the preload of the differential carrier bearings**

Recheck the backlash "G" of the crownwheel and pinion teeth, using the tool C as described on page 69.

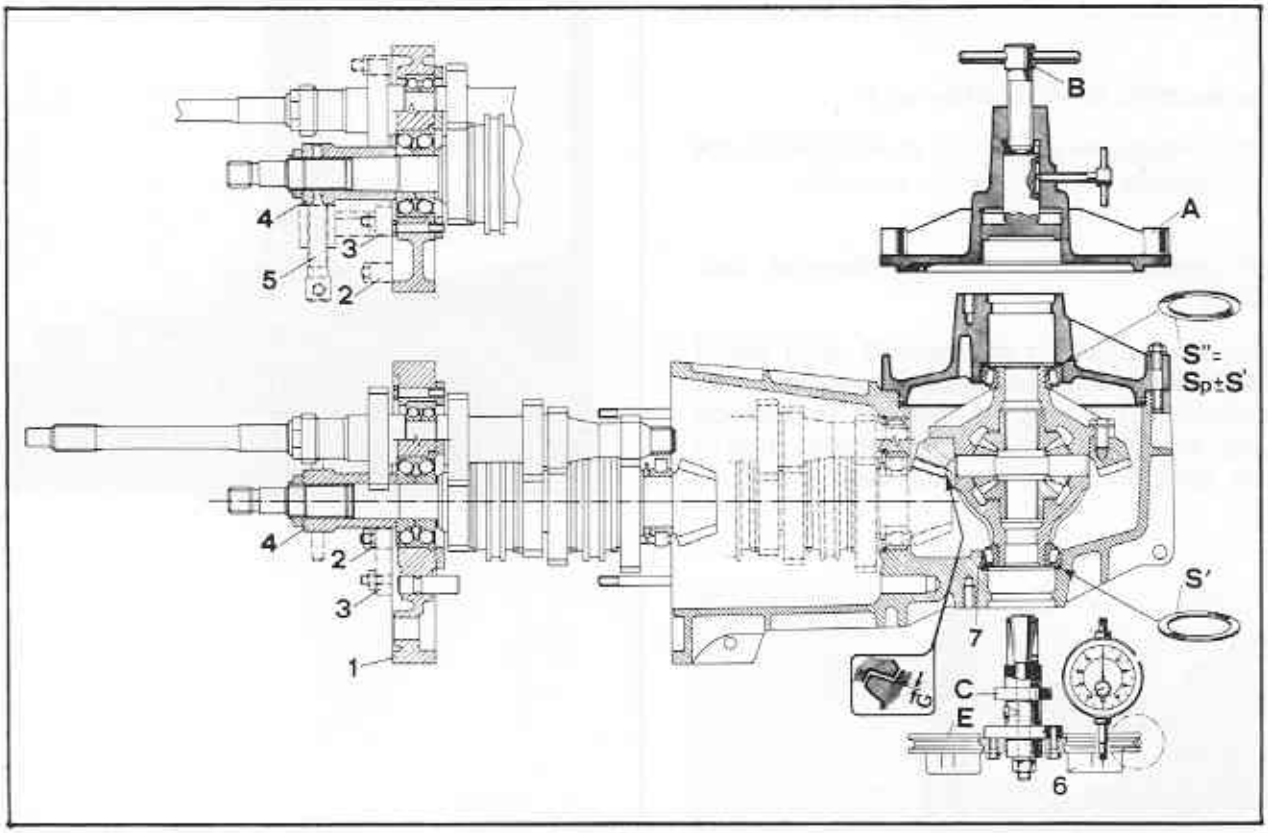
Remove the clamp 3, then remove the intermediate flange 1 with the shafts and check the preload of the differential carrier bearings, using tool C.

If the preload is correct, but the backlash is less than the prescribed amount reduce the shims S'' of the right hand bearing and increase the shims S' of the left hand bearing by the same amount; proceed in the opposite manner if the backlash is greater than prescribed.

If the backlash of the teeth is correct but the preloading is not correct, it is necessary to increase or reduce both shims by the same amount according as to whether the preload has to be increased or reduced.

Remove the nut and the sleeve (see 4, page 99) for locking the pinion, from the pinion shaft.

**Diagram summarising the operations.**




S' = Correction of the left hand bearing shim thickness

G = backlash specified for the crownwheel and pinion, viz. 0.13 to 0.18 mm.

S'' = total thickness of right hand bearing shim

Sp = thickness of right hand bearing shim read off the dial gauge

# RE-ASSEMBLY OF DIFFERENTIAL UNIT

### Re-assembly of pinion shaft

Fit the 5th. speed gear bush on the shaft (see ref. 10, page 38), the roller cage 9 with the gear 8 itself, then the synchroniser hub for the 5th. speed and reverse with the sleeve 7, and reverse gear 6.

Fit a new nut 5 and tighten it to the prescribed torque of 11.4 to 12.6 Kgm and then secure by locking over one flat.

### Re-assembly of the intermediate flange

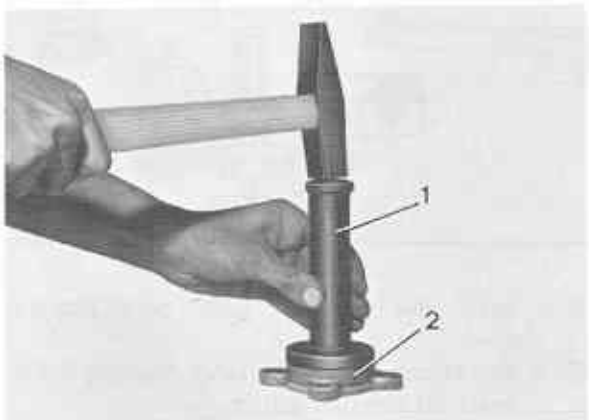
Re-assemble the intermediate flange with the gear selector components (see page 48) and mount the flange complete on the gearbox-differential housing after having cleaned the joint faces with the recommended liquid and coated them with the prescribed sealant.

### Re-assembly of the gearbox unit

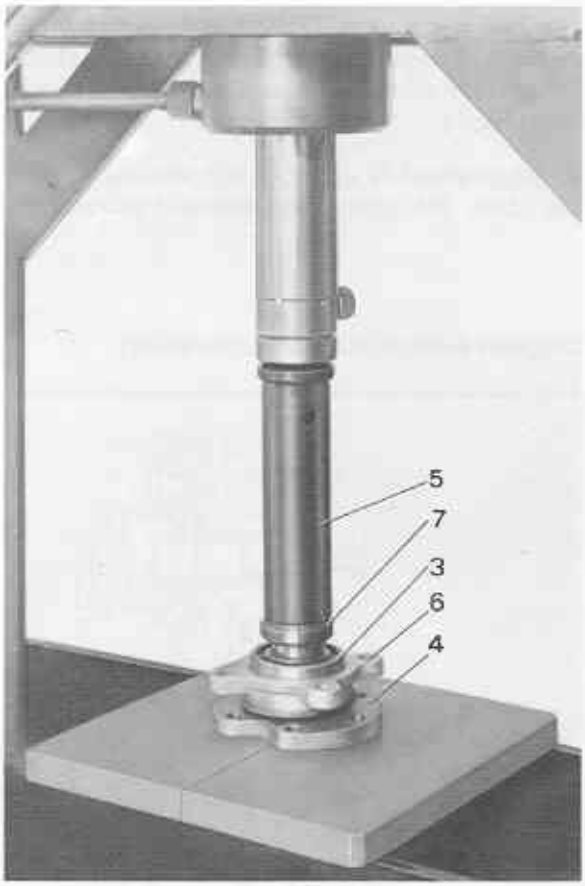
Re-assemble the entire unit as described in the instructions for the unit (see page 49).

### Re-assembly of the inner differential half-shafts

Fit the oil seal to the cover **2** using tool **1** **(A.3.0430)**, after having lubricated the outer surface and the lip of the seal respectively with the recommended oil and grease then fit the cover to the differential inner half-shaft.




Fit bearing **3** on the inner half-shaft **4** using a press and the special tool **5** **(A.3.0412)** centering it on the cover **6**.
Then fit the bearing retaining ring **7** after heating it to a temperature of 190°C, using the press and the same tool **5**.



### Miscellaneous assembly work

On re-assembly proceed in the reverse order to dismantle (see page 61) taking care to:

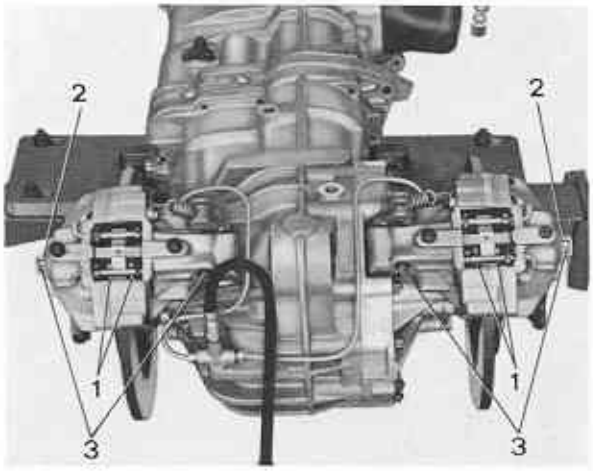
- coat the joint surfaces of the differential outer half-shaft covers with the recommended sealant after cleaning them with the specified liquid.
- fit the differential outer half-shafts, taking care to fit the shortest shaft to the left hand side
- tighten the brake caliper securing nuts to a torque of 4.7 to 5.4 Kgm.
- tighten the brake disc securing screws to a torque of 5.1 to 5.7 Kgm.
- fit the brake pads in position checking the direction of rotation which is indicated by the arrow 1 stamped on the pads
- reconnect the hydraulic brake pipes to the calipers and tighten them to a torque of 0.8 to 1.1 Kgm.

### Adjusting the clearance between the brake pads and brake discs

Remove the dust cover 2, slacken the lock nut and adjust the clearance between the pads and the brake discs by turning the adjusting screws 3. The clearance on assembly between the pads and the disc is 0.1 mm on each side.

The thickness of the new pads is 15 mm (including the metal part). The limit of wear is 7 mm.

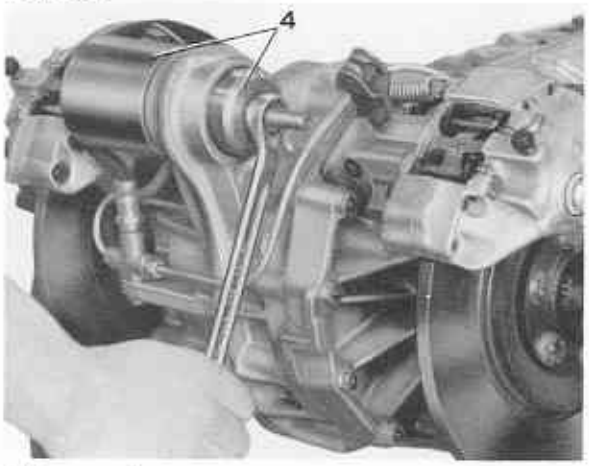
Tighten the lock nut and replace the dust cover 2 when adjustment is completed.



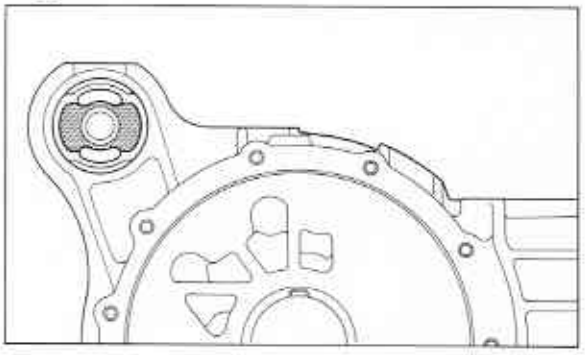

### Replacing silentbloc mounting

If necessary, replace the silentbloc mounting of the clutch-gearbox-differential unit to the body, using tool 4 (A.3.0413).
Insert the mounting from the chamfered side and align it as shown in the illustration.

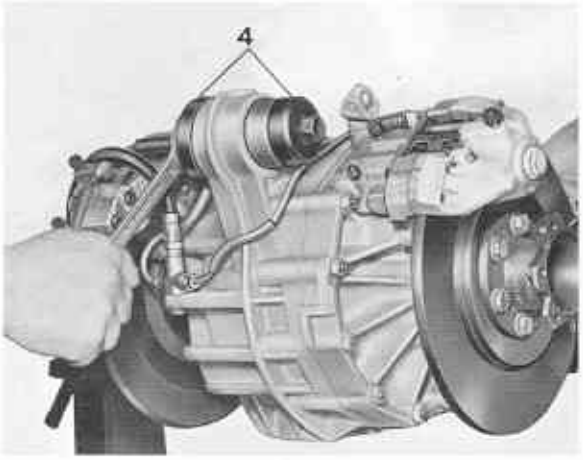
Removal




Alignment



Fitting



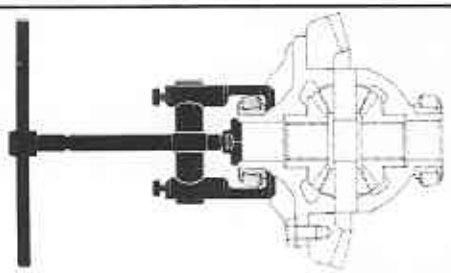
# Prescriptions

# Tools

# Tightening torques

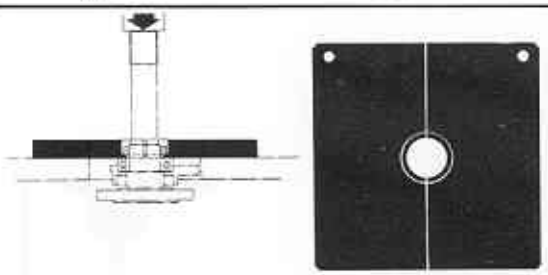
# Lubricants fluids and sealants

# Tools



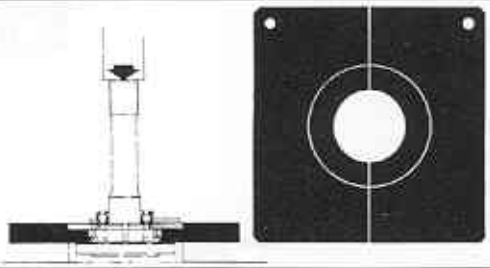
## A.3.0287 *

**EXTRACTOR**
with adjustable claws for differential carrier inner taper roller bearing races



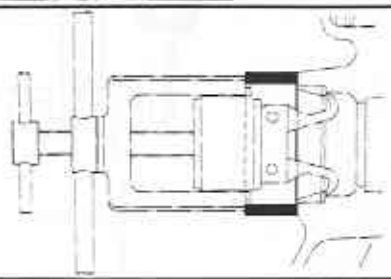
## A.2.0247

**HALF-PLATES**
for removing differential inner half-shaft ball bearing backing ring



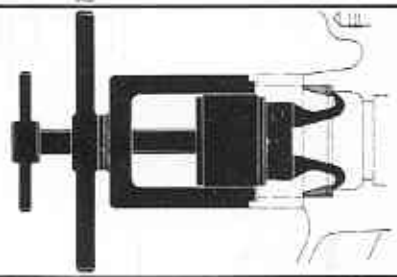
## A.2.0248

**HALF-PLATES**
for removing bearing and cover from differential inner half-shaft



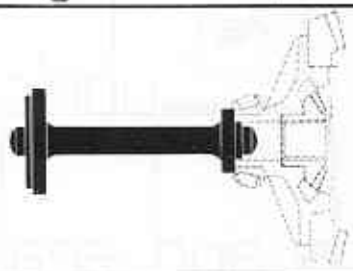
## A.3.0411

**EXTENSION RING**
for extracting outer differential taper roller bearing races, (use with A.3.0390)



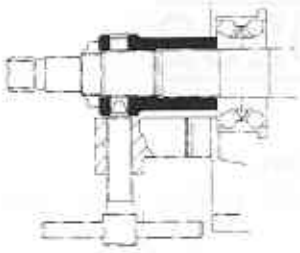
## A.3.0390 *

**EXTRACTOR**
for extracting differential outer races of taper roller bearings from the cover and gearbox-differential housing, (use with A.3.0411)



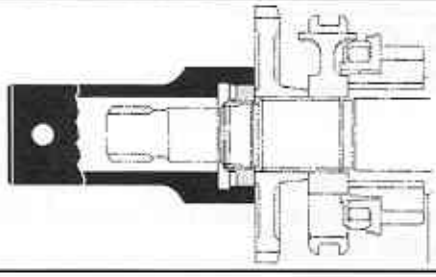
## A.3.0208 *

**ASSEMBLY TOOL**
for fitting taper roller bearing inner races to differential carrier



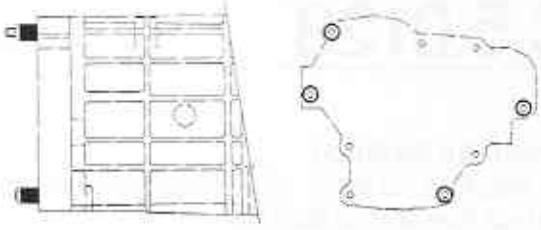
## A.2.0175

**SLEEVE**
for locking pinion shaft to intermediate flange



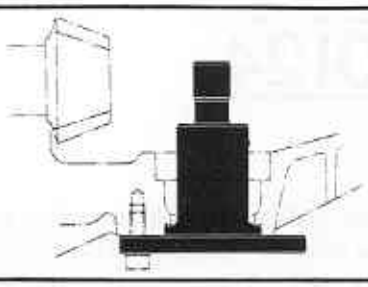
## A.5.0126 *

**SPANNER**
36 mm box spanner for pinion shaft nut



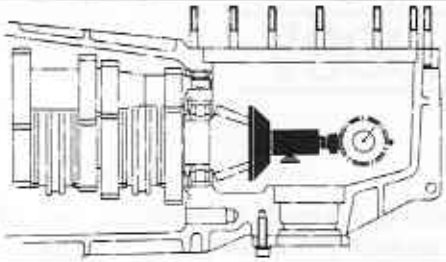
## A.2.0234

**GAUGE**
for checking position of pinion



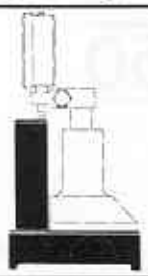
## C.6.0164

**DISTANCE PIECES**
for bolting intermediate flange to the gear-box-differential housing (set of 4 items)



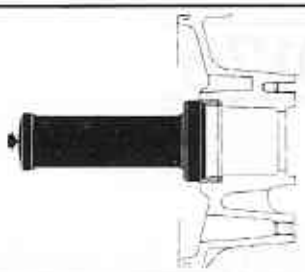
## A.4.0136

**PILLAR TOOL**
for dial gauge for checking position of pinion



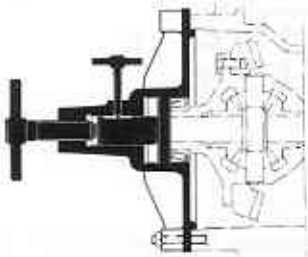
## C.6.0163

**DISTANCE GAUGE**
for setting dial gauge on the pillar tool for checking the position of the pinion



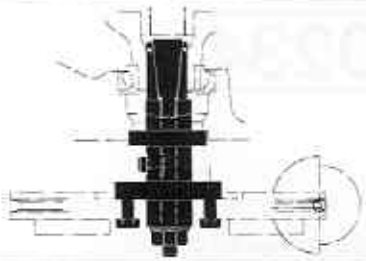
## A.3.0292

**ASSEMBLY TOOL**
for differential carrier taper roller bearing outer races



## C.6.0171

**SIDE COVER TOOL**
for setting backlash and for preload differential carrier bearings



## C.5.0123

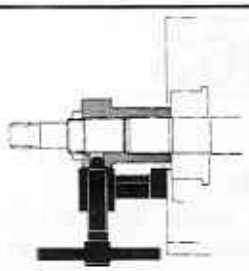
**EXPANDING MANDREL**
for checking preload of differential carrier bearings (use with C.5.0124)

## C.5.0124

**DISC**
for checking preload of differential carrier bearings (use with C.5.0123 and C.2.0037)

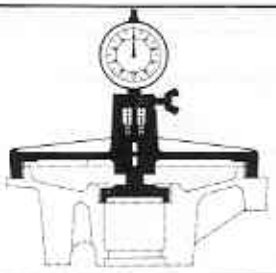
## C.2.0037

**WEIGHT**
for checking preload of bearings (set of 7 items) (use with C.5.0124 and C.5.0123).



## A.2.0250

**CLAMP**
for locking pinion shaft (use with A.2.0175)



## C.6.0172

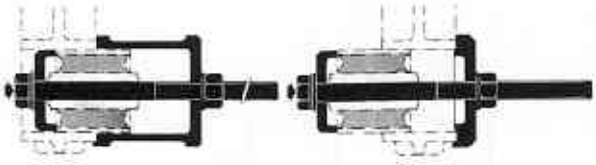
**DIAL GAUGE CARRIER**
for checking the adjustment of the bearing preload shims on the right hand side of the differential carrier

## A.3.0430

**ASSEMBLY TOOL**
for oil sealing ring in small cover for differential inner half-shaft

## A.3.0412

**ASSEMBLY TOOL**
for bearing and bearing retaining ring on differential inner half-shaft



## A.3.0413

**EXTRACTOR AND ASSEMBLY TOOL**
Silentbloc rear mounting for clutch-gearbox-differential unit

* Tools common to other types of vehicle

# Tightening torques

| ITEM | Kg.m. | TIGHTEN |
|---|---|---|
| Bolts, attaching crownwheel to differential carrier | 6.8 — 7.5 | Oiled |
| Pinion shaft nut | 11.4 — 12.6 | Dry |
| Nuts, fixing distance pieces A.2.0234 and intermediate flange to the gearbox-differential housing | 1.7 — 2.4 | Dry |
| Nuts, securing differential cover and side cover, tool C.6.0171 to the gearbox-differential housing | 1.9 — 2.3 | Dry |
| Nuts, fastening brake calipers to differential housing | 4.7 — 5.4 | Dry |
| Bolts, attaching brake discs and distance pieces to differential half-shafts | 5.1 — 5.7 | Dry |
| Hydraulic brake pipe couplings | 0.8 — 1 | Dry |

# Lubricants fluids and sealants

| ITEM | RECOMMENDED COMMERCIAL PRODUCTS |
|---|---|
| Oil for:<br>- External surfaces of oil seals of differential inner half-shafts | AGIP F1 ROTRA MP SAE 85 W/90<br>SHELL SPIRAX 90 HD |
| Sealants for:<br>- Contact faces of intermediate flange<br>**NB** - Use methylated spirit or trichloroethane to clean surfaces<br><br>- Joint faces of differential inner half-shaft covers with gearbox-differential housing and housing cover<br>**NB** - Use methylated spirit or trichloroethane to clean surfaces | LOWAC PERFECT SEAL |
| Grease for:<br>- Lips of oil seals and their working surfaces on the differential inner half-shafts | ISECO MOLYKOTE BR 2 |

Alfa Romeo

DIREZIONE ASSISTENZA TECNICA
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