Workshop Manual

Audi 100 1991 ►

Booklet 5 and 6-Speed Manual
Gearbox 01E

Edition 01.92

Service.

List of Workshop Manual Repair Groups

Audi 100 1991 ▶

Booklet 5 and 6-Speed Manual Gearbox 01E Edition 01.92

When filing a Technical Bulletin enter the Bulletin No. in the adjacent column. When using the Workshop Manual you can then see at a glance whether Technical Bulletins have been published in respect of the particular Repair Group in which you are looking.

Repair Group	Technical Bulletins					
00 Technical data						
30 Clutch						
34 Controls, Housing						
35 Gears, Shafts						
39 Final drive, Differential						

Technical information should always be available to all foremen and mechanics, because their compliance with the instructions given is essential to ensure vehicle roadworthiness and safety.
In addition, the normal safety precautions to be observed when working on motor vehicles are also applicable.

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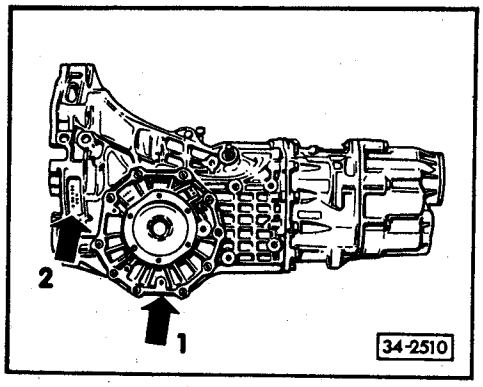
Indice

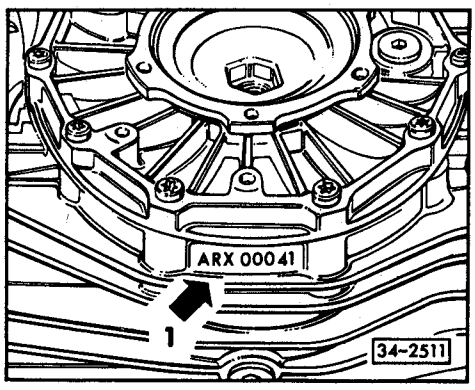
Identification of gearbox

The 5- and 6-speed manual gearbox 01E is fitted to the Audi 100 from 04/91 in combination with the 5-cylinder in-line turbo diesel engine.



◄ **Location on gearbox**

Code letters and serial No. (arrow 1).
Manual gearbox 01E (arrow 2).

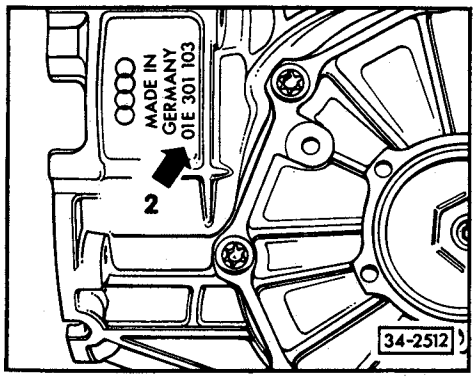


◄ Code letters and consecutive serial number of gearbox (arrow 1).

Example: ARX	000 41
Code letters	Consecutive serial n° of gearbox

Note:

The code letters of the gearbox are also listed in the vehicle data cards.

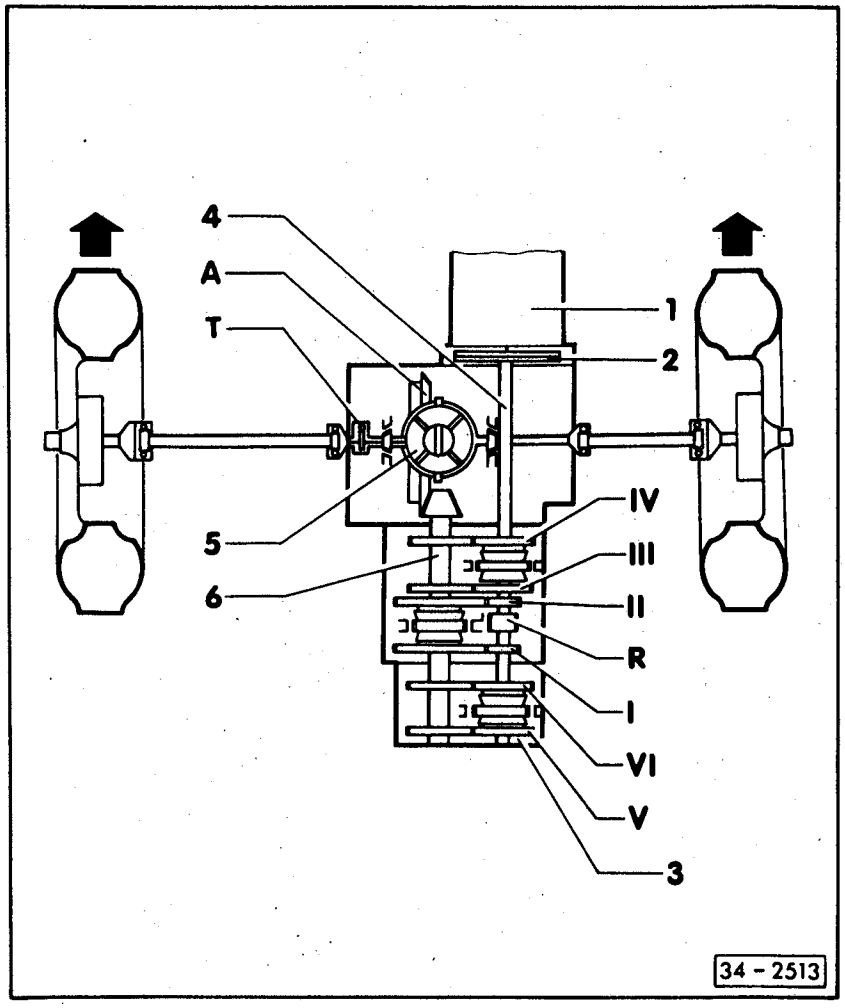


◄ Manual gearbox 01E (arrow 2).

Code letters, assignment, ratios, capacities

Manual gearbox		5- and 6-speed 01E		
Code letters		**ABZ**	**ARX**	**CEP**
Manufacture	from	04.91	04.91	01.92
	to	12.91		
Allocation	Model	Audi 100/Avant 1991 ►		
	Engine	2.5 l Turbo diesel 85 kW	2.5 l Turbo diesel 85 kW	2.5 l Turbo diesel 85 kW
Ratio: Z2 : Z1 = i	Final drive	31: 8 = 3.875	31: 8 = 3.875	31: 8 = 3.875
	1st gear	28: 8 = 3.500	28: 8 = 3.500	28: 8 = 3.500
	2nd gear	34:18 = 1.889	34:18 = 1.889	34:18 = 1.889
	3rd gear	32:26 = 1.231	32:26 = 1.231	32:26 = 1.231
	4th gear	27:31 = 0.871	27:31 = 0.871	27:31 = 0.871
	5th gear	26:39 = 0.667	26:39 = 0.667	26:39 = 0.641
	6th gear	–	23:41 = 0.561	–
	Reverse	38:11 = 3.455	38:11 = 3.455	38:11 = 3.455
	Speedo	electronic	electronic	electronic

Code letters	**ABZ**	**ARX**	**CEP**
Capacity	2.4 l		
Specification	Gear oil G 50 (synthetic oil) SAE 75W90		
Clutch operation	hydraulic		
Clutch plate dia.	240 mm	240 mm	240 mm
Drive shaft flange dia.	130 mm	130 mm	130 mm
Total ratio in top gear	2.583	2.174	2.484



Power transmission table

Designation

1 – Engine
2 – Clutch
3 – Gearbox
4 – Input shaft (main shaft)
5 – Differential
6 – Drive pinion (output shaft)

Ratios

I – 1st gear
II – 2nd gear
III – 3rd gear
IV – 4th gear
V – 5th gear
VI – 6th gear
R – Reverse
A – Final drive
T – Speedo drive (electronic)
(arrows point in direction of travel)

Note:

The 5-speed gearbox is derived from the 6-speed gearbox by eliminating the 6th speed gear pair and installing the disc (shift lock for 6th speed) ⇒ page 34–24 as well as an additional circlip (small taper roller bearing/drive pinion) ⇒ page 34–42 and using the selector cylinder for the 5-speed gearbox ⇒ 34–21.

Calculating the transmission ratio

Example:

	6th speed	Final drive
Driving gea	$ZG_1 = 41$	$ZA_1 = 8$
Driven gear	$ZG_2 = 23$	$ZA_2 = 31$

$$i = \frac{Z_2}{Z_1} = \frac{\text{N° of teeth driven gear}}{\text{N° of teeth driving gear}}$$

$$i_G = \text{Gear ratio} = \frac{ZG_2}{ZG_1} = \frac{23}{41} = 0.561$$

$$i_A = \text{Final drive ratio} = \frac{ZA_2}{ZA_1} = \frac{31}{8} = 3.875$$

$$i_{tot} = \text{Total ratio} = i_G \times i_A$$

$$= 0.561 \times 3.875 = 2.174$$

General repair instructions

The maximum care as well as proper tools are essential for achieving perfect and successful gearbox repairs. The generally valid basic rules of safety naturally also apply when performing repair work.

A number of generally applicable instructions for individual repair operations – otherwise mentioned more than once at various points in the Workshop Manual – are combined here. They apply to this Workshop Manual.

Gearbox

- When renewing the gearbox, fill with gear oil ⇒ Capacity and specification, page 00–4.
- When installing gearbox, ensure dowel sleeves are correctly located.

Gaskets, oil seals

- Thoroughly clean contact surfaces beforehand.
- Renew paper gaskets.
- Renew O-rings.

- Radial shaft seals

  Before installing:
  - Lightly oil at the outer diameter.
  - Pack the space between the sealing lips with grease.

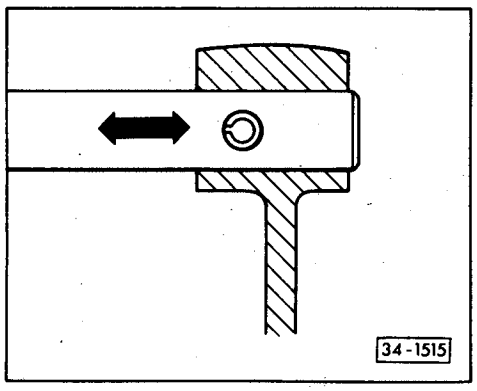
  After installing:
  - Check gear oil level; top up as necessary to bottom edge of filler opening ⇒ Specification, page 00–4.

Sealing compound

- Thoroughly clean contact surfaces and apply sealant AMV 188 000.
- Apply sealant evenly – **not too thick** –.
  - Keep breather holes clear.

Locking elements

- Renew circlips.
- Do not over-tension circlips.
- Circlips must be properly inserted in the base of the groove.



◄ • Renew tensioning sleeves.
Installation position: slot longitudinal to lines of force.

- Roll pins (used from 01/92 in place of tensioning sleeves)
  Installation position: irrespective of lines of force

Note:

Tensioning sleeve or roll pin for attaching 5th/6th speed selector fork/selector rail must only be removed and installed with special tool.

Nuts, bolts

- Slacken and tighten nuts and bolts for attaching covers and housings diagonally.
  - Do not twist particularly sensitive parts – e.g. clutch pressure plates – and slacken and tighten **in stages** diagonally.
- The tightening torques are indicated for unoiled nuts and bolts.
- Renew self-locking nuts and bolts.

Note:

*Tapped holes into which self-locking bolts or bolts coated with sealant are screwed, **must** be cleaned off residues of the microencapsulation. Otherwise, there is a risk of the bolts seizing when being screwed in and shearing off when again removed. The holes can be cleaned with a tap.*

Bearings

- Position bearings with the inscribed side (thicker metal) facing the insertion drift.
- Grease needle bearings for the input shaft in the crankshaft.
- Insert all bearings in the gearbox with gear oil. Oil especially carefully for measuring friction torque.
- Heat inner races of taper roller bearings to approx. 100°C for installing. Press in when fitting until they abut axially free of play.
- Do not mix up outer and inner races of bearings of the same size. Bearings are matched.
- Always renew all the taper roller bearings on a shaft and use the same makes.

Shims

- Re-gauge shims at several points with a micrometer. Different tolerances enable the required shim thickness to be precisely gauged.
- Check for signs of burrs or damage.
- Install only shims which are in proper condition.

Synchronizer rings

- Do not mix up.
  When re-using, allocate again to the same gearwheel.
- Check for signs of wear, renew if necessary.
- Insert with gear oil.

Clutch mechanism

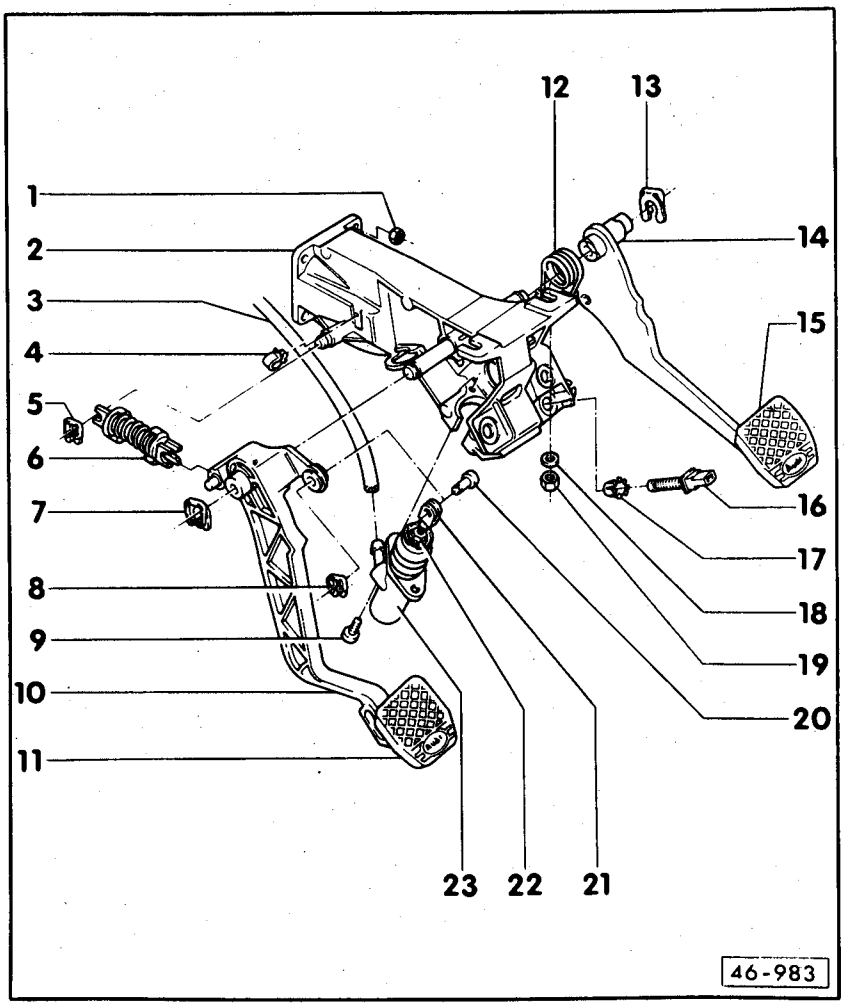
When removing gearbox, take off clutch slave cylinder without separating the line system. Do not operate clutch pedal any more after removing slave cylinder. Otherwise, the piston will be pushed out of the slave cylinder and will thus be unusable.

Gearwheels, synchronizer bodies, inner races for selector gears

- When installing, press in until they abut axially free of play.
- Heat gearwheels to approx. 120°C before pressing on.
- Heat inner races for selector gears to approx. 80°C before pressing on.

Selector gears

After fitting
- 1st to 4th speed selector gears
  check for axial play of 0.15 to 0.35 mm.
- 5th and 6th speed selector gears
  check that they operate freely when rotated.



Servicing clutch mechanism

Servicing pedal cluster, clutch mechanism

Note:

Grease all bearing points with white solid lubricating paste, Part No. AOS 126 000 05, before installing.

Important!

The travel of the brake pedal must not be shortened by additional floor coverings.

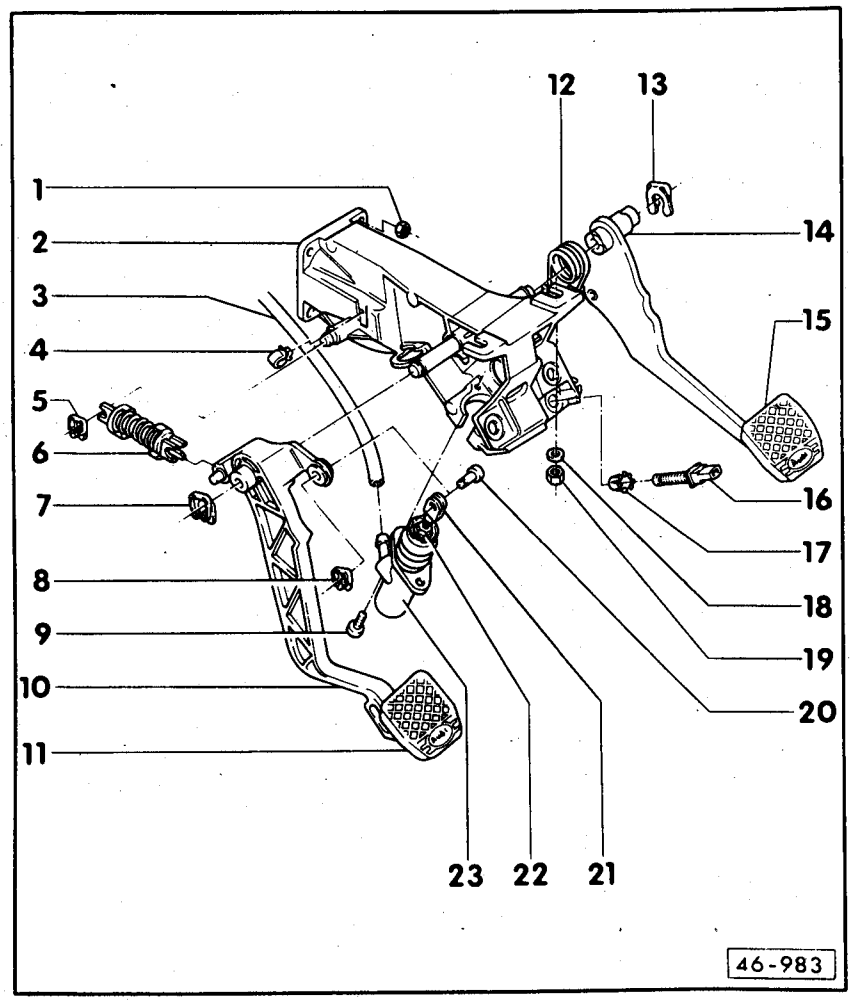
1 – Self-locking nut, 25 Nm
- Always renew

2 – Pedal bracket
- Do not remove in order to take out clutch pedal

3 – Hose line
- Lay appropriately at pedal bracket and secure with cable clip

Important!

Hose line must not touch over-centre spring.



4 – Cable clip
- Fit onto hose line and then insert into pedal bracket

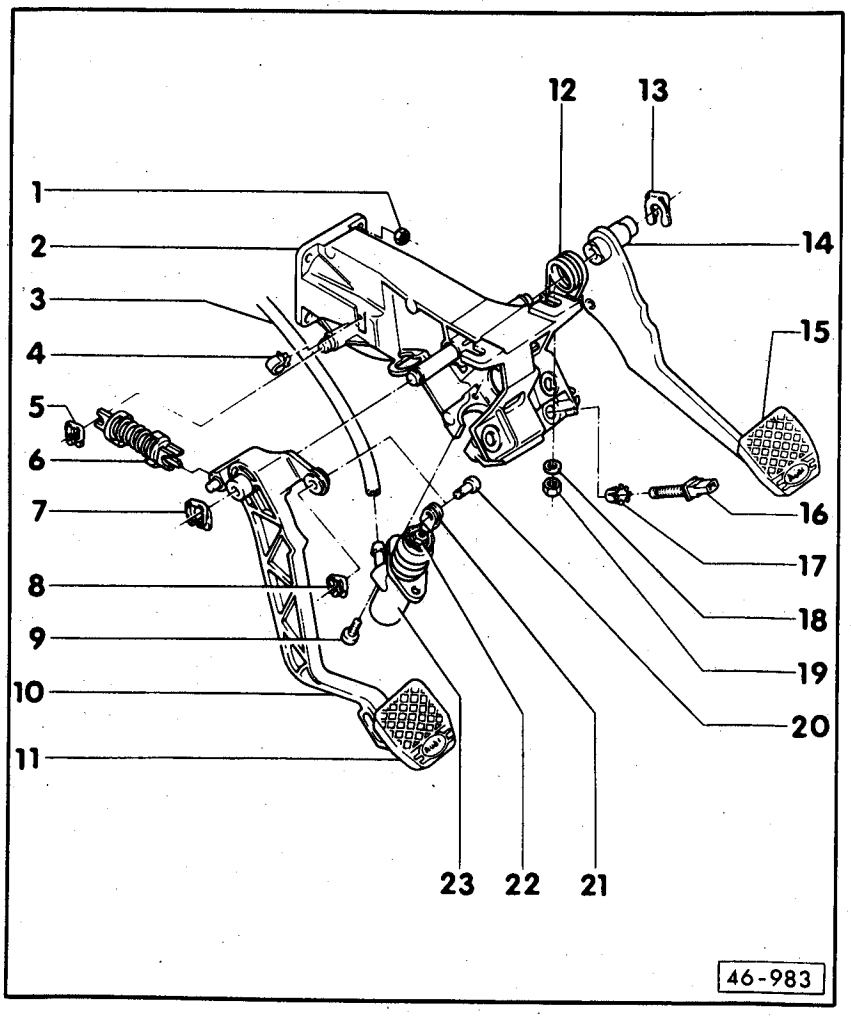
5 – Locking plate
- Renew
- Fit onto bearing pin

6 – Over-centre spring
- Grease with white solid lubricating paste before assembling
- Insert into bearing pin of pedal bracket and clutch pedal
- Removing and installing ⇒ page 30–6
- Lay hose line to master cylinder so that it does not chafe at the over-centre spring
- Pay attention to different versions
- Can be removed and installed with pedal bracket in place

7 – Locking plate
- Renew
- Fit onto shaft of pedal bracket

8 – Locking plate
- Renew
- Insert pin

9 – Cheese-head screw, 20 Nm
- Screw master cylinder to pedal bracket



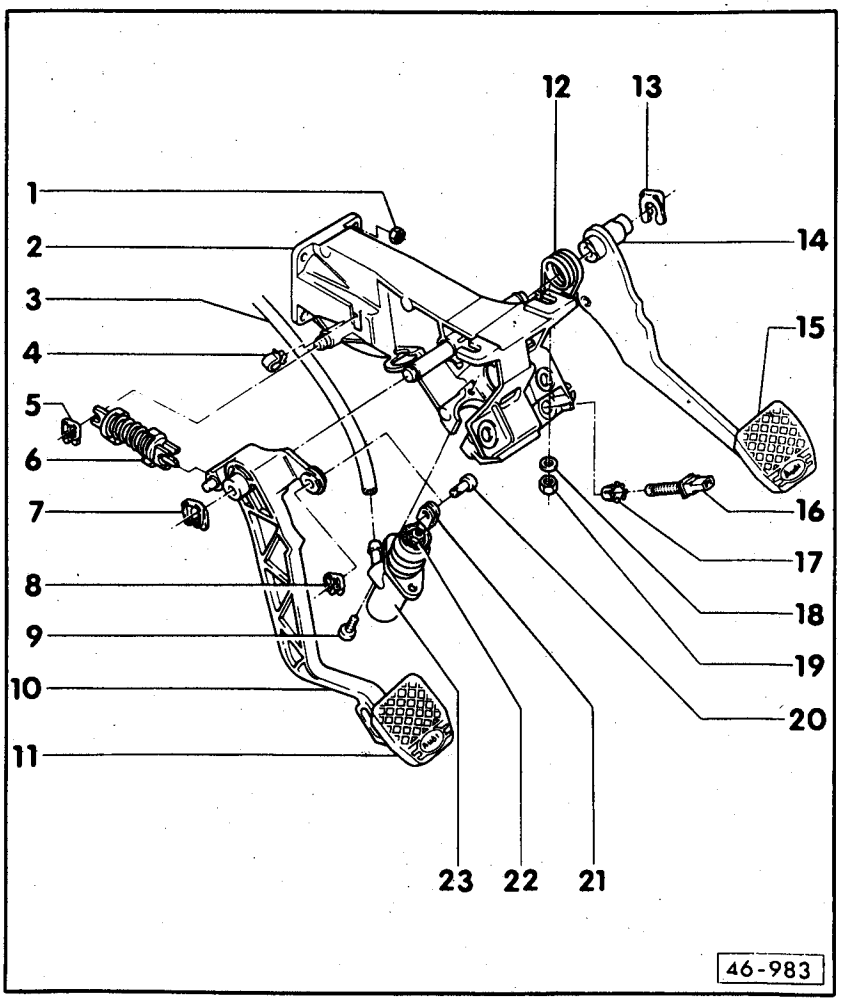
10 – Clutch pedal
- Is fixed in place by adjusting clevis
- Fit onto shaft of pedal bracket
- Is supplied as service part with injection-moulded bearing bush. Bearing bush cannot be renewed
- Can be renewed with pedal bracket in place

11 – Pedal pad
- Can be renewed if required

12 – Return spring for brake pedal
- Attach long leg to pedal bracket and short leg to brake pedal

13 – Locking plate
- Renew
- Fit onto shaft of pedal bracket

14 – Brake pedal
- Fit onto shaft of pedal bracket
- Is supplied as service part with injection-moulded bearing bush. Bearing bush cannot be renewed
- Remove and install in order to remove and install pedal bracket



15 – Pedal pad
- Can be renewed if necessary

16 – Brake light switch
- Adjusting:
  - Operate brake pedal
  - Press in brake light switch as far as the stop
  - Pull brake pedal back as far as the stop by hand

17 – Clip for brake light switch
- Insert into pedal bracket

18 – Washer

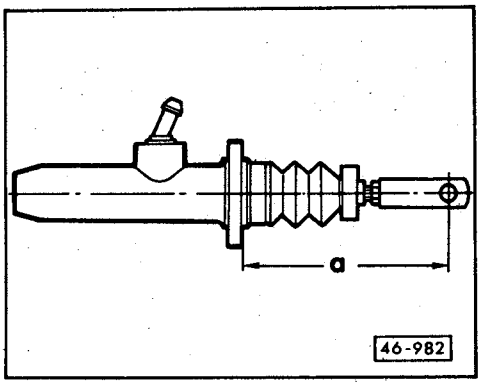
19 – Self-locking nut, 25 Nm
- Always renew

20 – Pin
- Secure clevis to clutch pedal

21 – Clevis
- Adjusting ⇒ Fig. 1

22 – Lock nut
- Tighten after adjusting clevis

23 – Master cylinder
- Service or renew if leaking



◄ **Fig. 1 Adjusting clevis**

"a" = 109.5 ± 0.5 mm

- Turn clevis accordingly in order to adjust.

Note:

When measuring, the clevis must be at right angles to the contact surface of the clutch master cylinder.

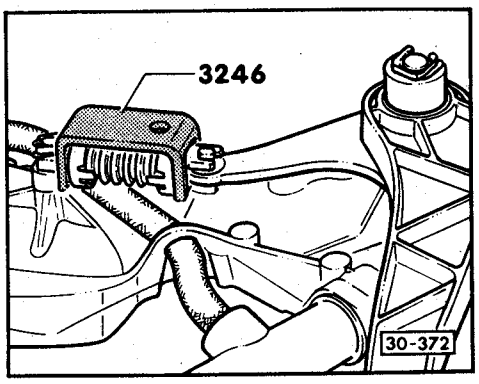
Important!

If the clutch pedal does not return by itself when the clevis is correctly adjusted, this may be caused by:

- ***Air in the hydraulic system.***
- ***The pedal in its mounting or the over-centre spring not moving freely.***

Removing and installing over-centre spring

- Remove left stowage tray ⇒ General Body Repairs, Repair Group 70.
- Remove left footwell air vent ⇒ General Body Repairs, Repair Group 80.
- Remove guard plate between plug connection for wiring and pedal cluster.
- Take locking plate off pedal bracket bearing pin.

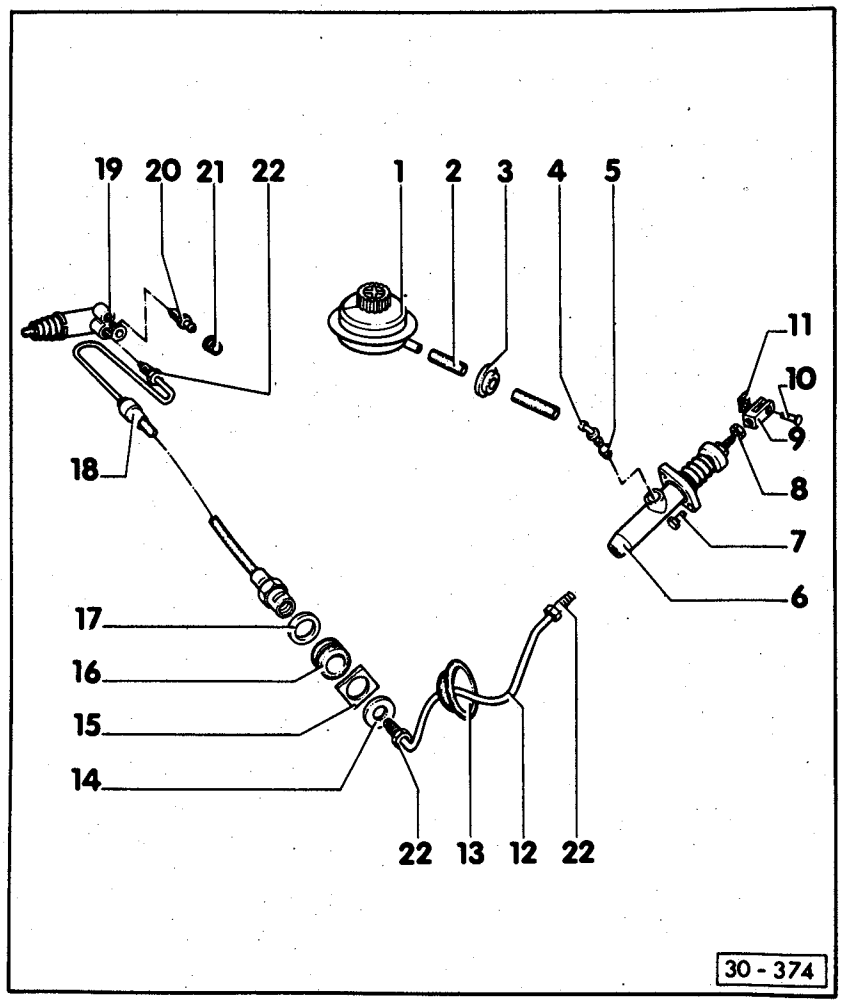


◄ – Push retaining clip 3246 sidewards over the over-centre spring.

Note:

The retaining clip is shown with the pedal bracket removed to simplify the illustration.

- Operate clutch pedal and take out over-centre spring together with retaining clip.
- Installation is performed in the reverse order.



Servicing hydraulic clutch mechanism

1 – **Brake fluid reservoir**

2 – **Supply hose**

3 – **Grommet**

4 – **Angled connector**

5 – **Sealing plug**
- Moisten with brake fluid for inserting

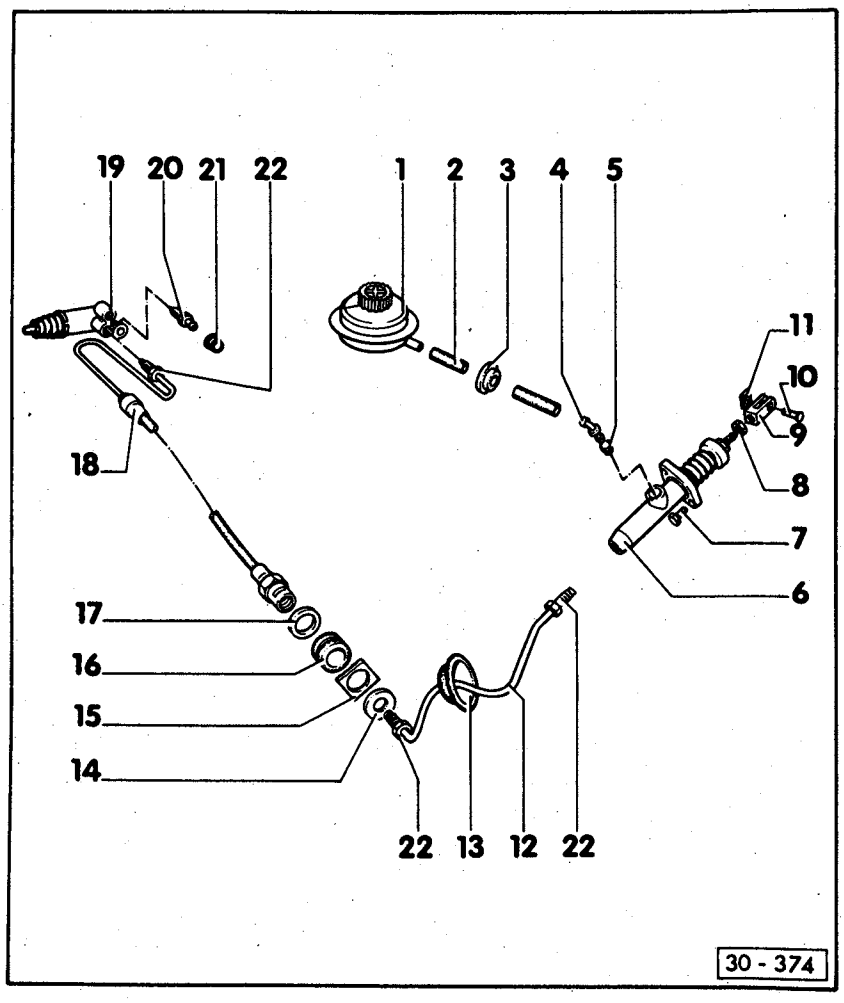
6 – **Master cylinder**

7 – **Bolt, 20 Nm**

8 – **Lock nut**

9 – **Clevis**
- Adjusting ⇒ page 30–5

10 – **Pin**



11 – **Locking plate**

12 – **Pipe**

13 – **Grommet**

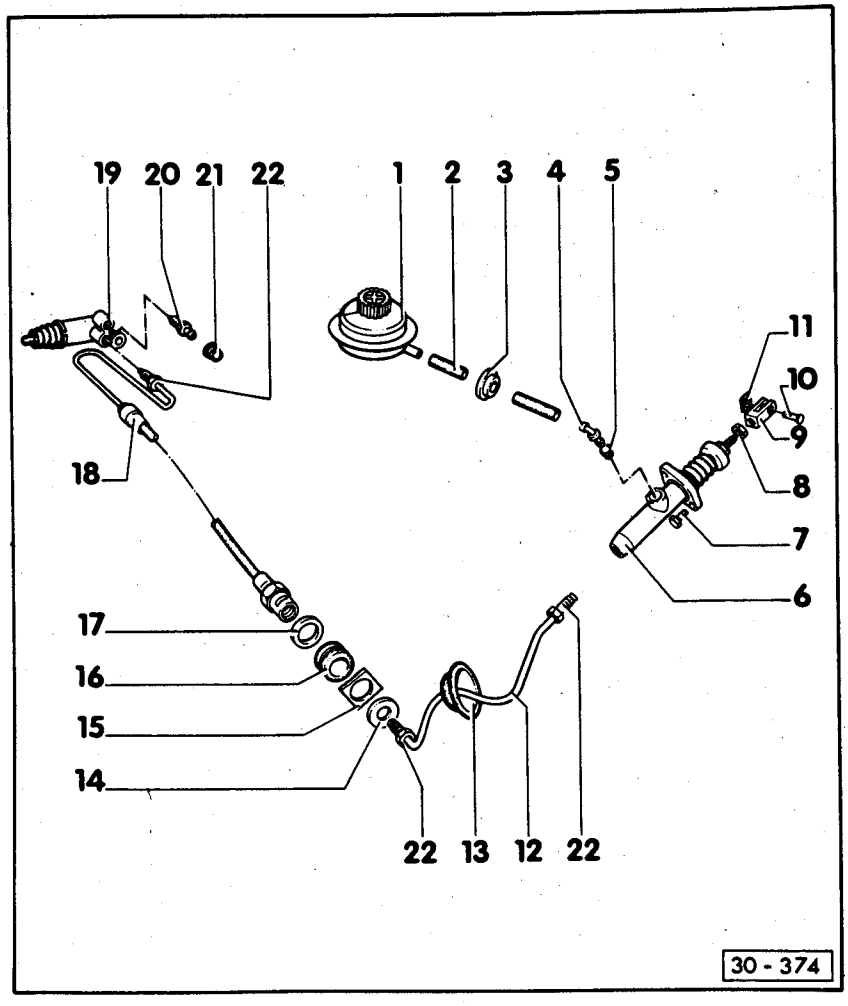
14 – **Washer**
- Small inner diameter

15 – **Holder**

16 – **Bush**

17 – **Washer**
- Large inner diameter

18 – **Pressure hose**
- Must not touch gearbox or surrounding parts
- Allocate to engine fitted with parts catalogue



19 – Slave cylinder
- Installing ⇒ page 30–13
- After installing, bleed clutch mechanism at slave cylinder

Important!

Do not operate clutch pedal any more after removing slave cylinder.

20 – Bleeder valve
- Bleeding ⇒ page 30–11

21 – Dust cap

22 – Pipe connection nut, 15 Nm

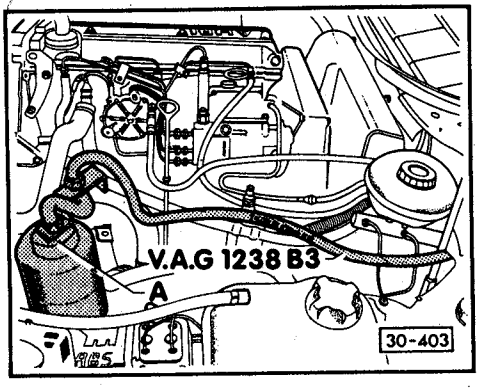
Bleeding clutch system

The clutch system must be bled after performing work on the hydraulic clutch mechanism.

Important!

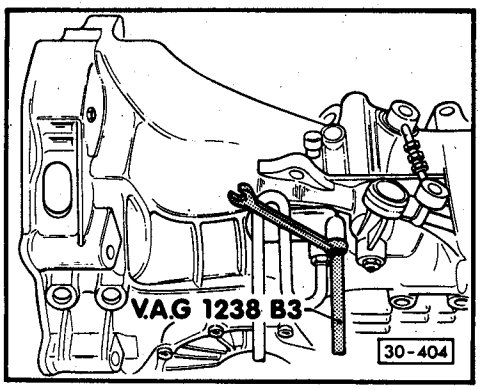
Top up brake fluid reservoir to the "max" marking before bleeding clutch system.

– Bleed clutch system only with a brake bleeder. Max. operating pressure 2.5 bar.



◄ – Use the bleeder hose V.A.G 1238 B3 – 670 mm long for bleeding.

– Connect bleeder hose to the pressure hose of the bottle –A– of the brake bleeder.

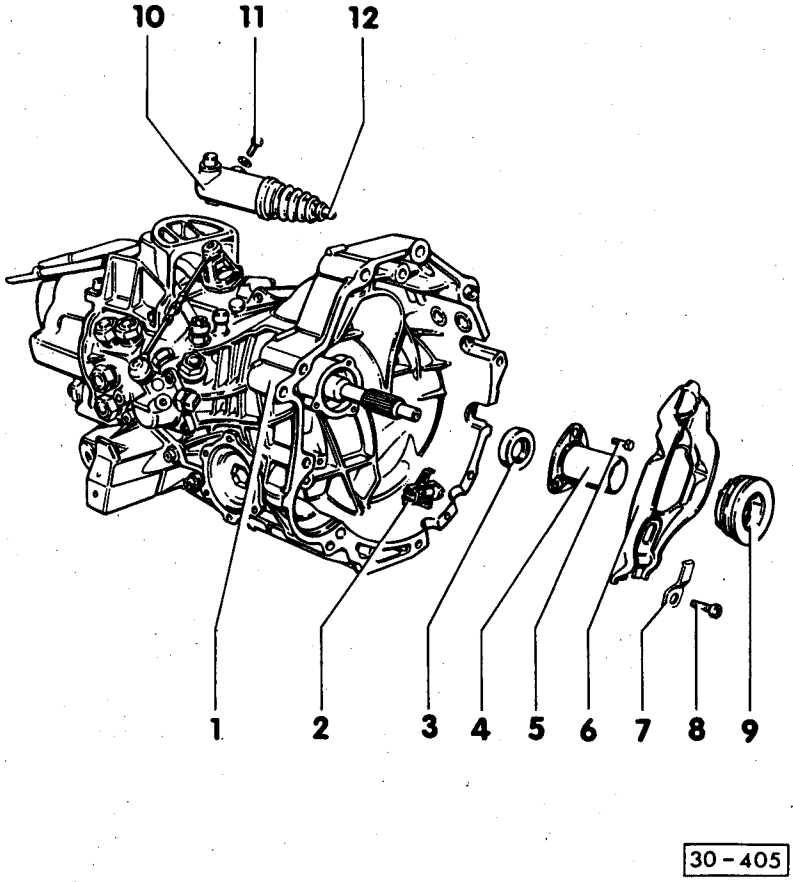


◄ – Fit open-end wrench and hose V.A.G 1238 B3 onto bleeder valve and open valve.

Important!

Ensure the bleeder hose is correctly fitted during the bleeding operation.

– After completing the bleeding operation, depress clutch pedal several times.



Servicing clutch release mechanism

1 – Gearbox

2 – Intermediate fitting

3 – Shaft seal for input shaft
- Removing and installing
⇒ page 34–52

4 – Guide sleeve

5 – Bolt, 15 Nm

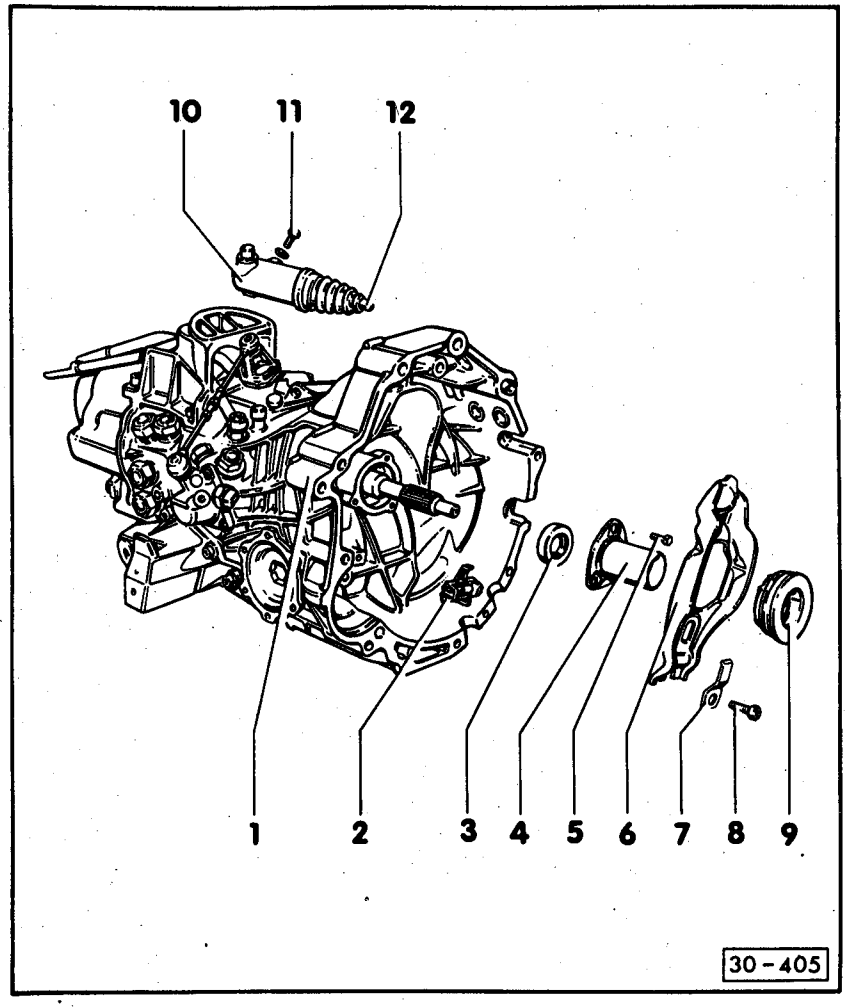
6 – Clutch release lever

Important!

Release lever must engage in the lugs of the intermediate fitting when installed ⇒ Fig. 1.

Note:

Each time before installing, lubricate dome for clutch slave cylinder tappet end with Dow Corning copper paste Cu-7439 plus.



7 – Leaf spring

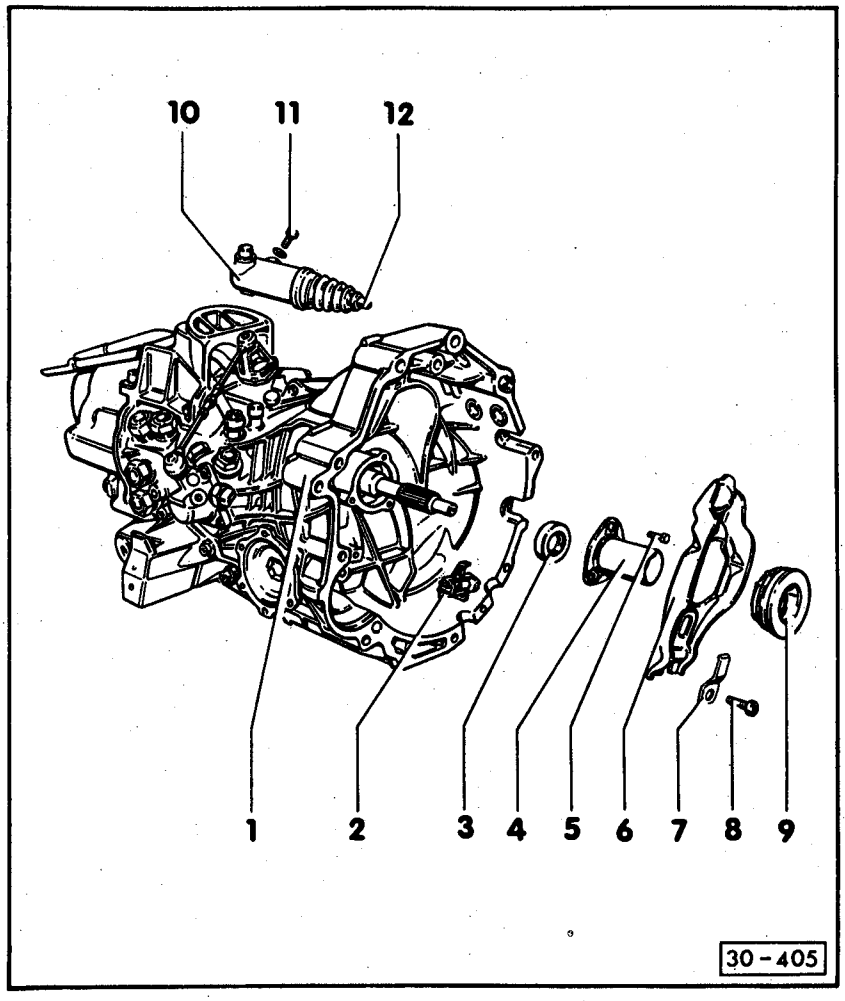
8 – Torx screw, 25 Nm

9 – Release bearing
- Do not wash out bearing, wipe clean only
- Renew noisy bearings
- Fit bearing onto release lever approx. 45° offset to installation position and engage with a twisting movement

10 – Clutch slave cylinder
- Bleeding clutch system ⇒ page 30–10
- Installing ⇒ Fig. 2
- When inserting, push on far enough to fit the securing bolt

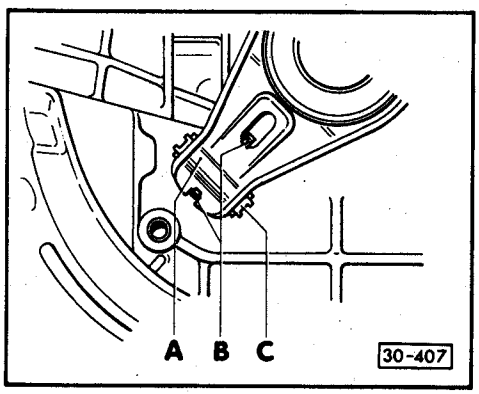
Note:

The securing bolt with pointed tip listed in the parts catalogue can be used to facilitate installation.



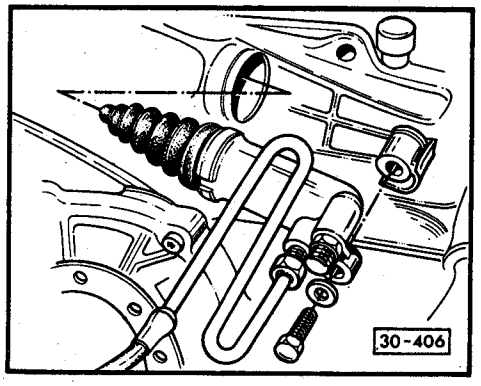
11 – Bolt, 25 Nm
- Always renew

12 – Tappet



◄ **Fig. 1 Installing clutch release lever**

A – Clutch release lever
B – Detents on intermediate fitting
C – Intermediate fitting



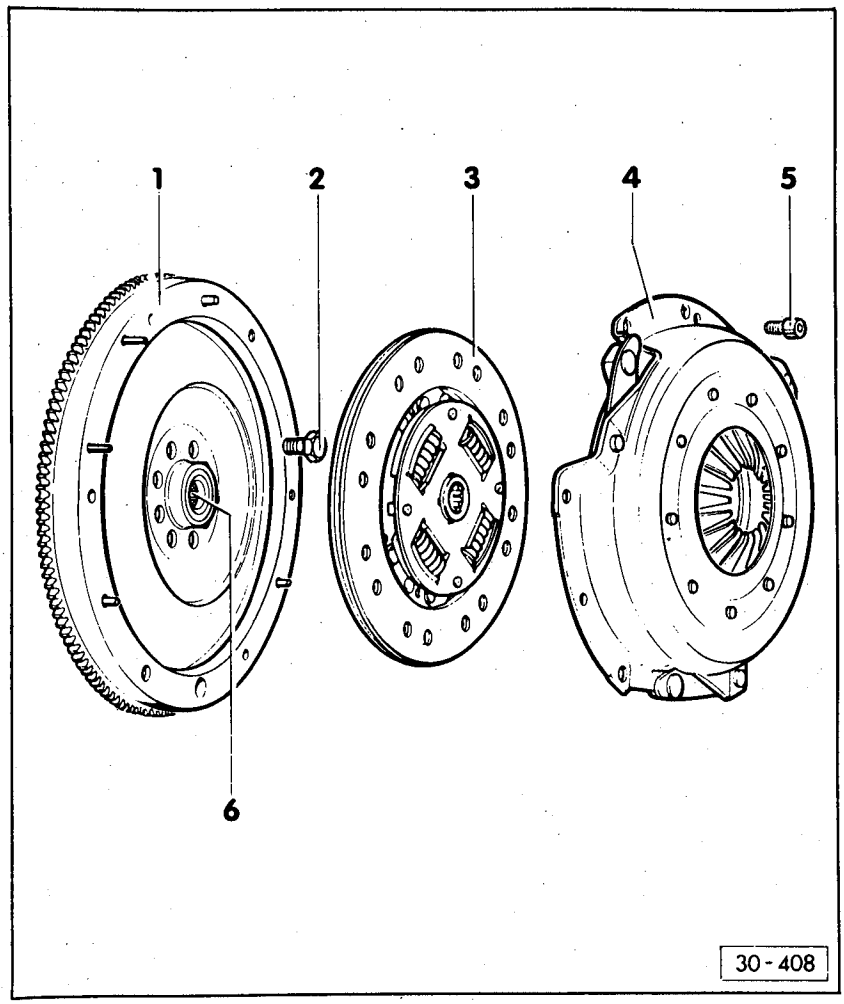
◄ **Fig. 2 Installing clutch slave cylinder**

The clutch slave cylinder must be inserted into the mounting hole of the gearbox housing without any major lateral deviation from the direction of operation of the tappet.

Important!

If the clutch slave cylinder is introduced twisted, there is a risk that the tappet will not connect with the clutch release lever.

- To facilitate installation, engage 6th gear of the 6-speed gearbox and 4th gear of the 5-speed gearbox before installing the slave cylinder.
- Pre-tension clutch slave cylinder far enough for the securing bolt to be easily inserted.
- Always renew securing bolt (microencapsulation).



Servicing clutch

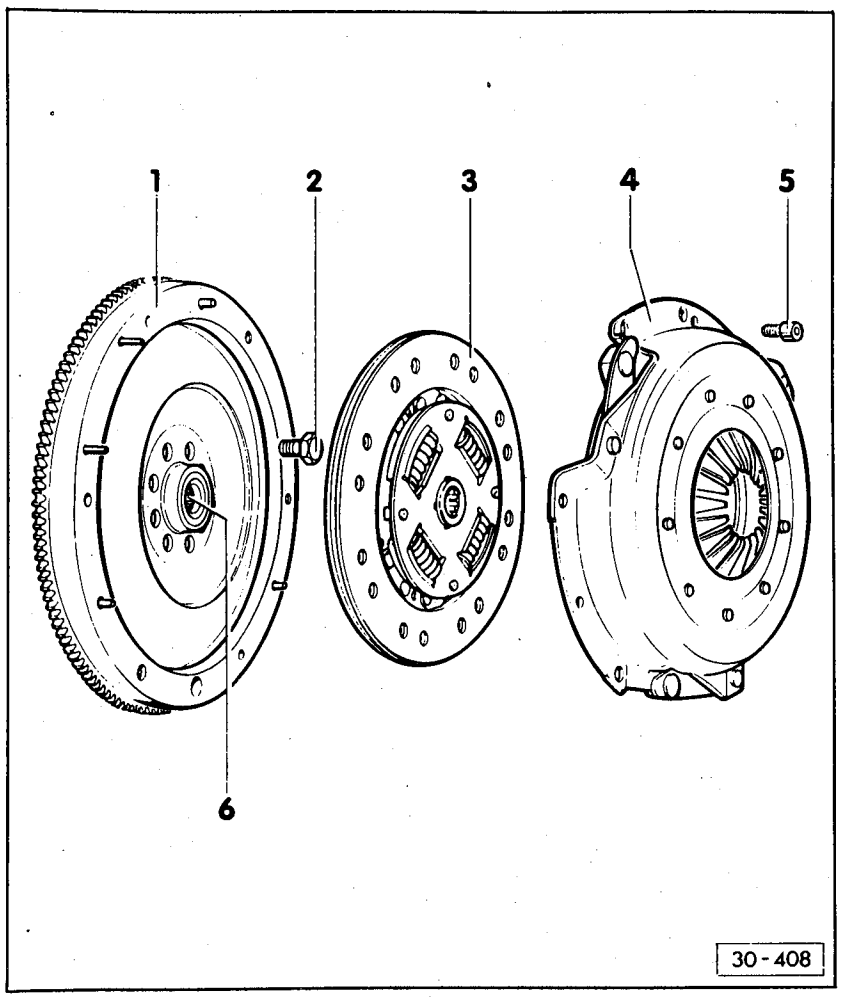
Pay attention to general repair instructions ⇒ page 00–8.

Note:

Remove gearbox for performing work on the clutch.

1 – Flywheel
- Ensure the centering pins are tightly seated
- Contact surface for clutch lining must be free of grooves, oil and grease
- Use counter-holder 10-201 for attaching and removing

2 – Bolt for securing flywheel to crankshaft
- Removing and installing ⇒ Workshop Manual Audi 100 1991► 5-Cyl. Diesel Engine (Mechanics 2.5 l Engine) Repair Group 13 Crankshaft Group



3 – Clutch plate
- Centering ⇒ Fig. 1
- Pay attention to installation position, spring cage faces pressure plate
- Do not grease

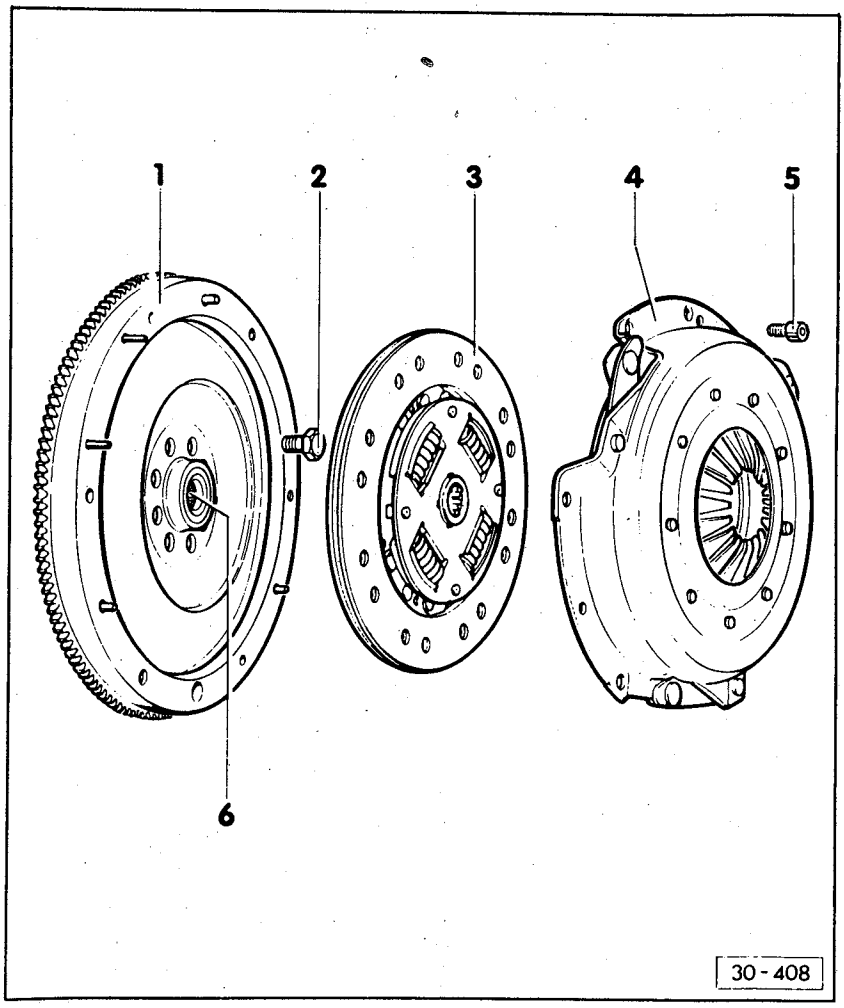
Note:

Clean teeth of input shaft and, if clutch plate is used, also teeth of hub, remove corrosion and apply only a ***very thin coat of grease G 000 100*** *to the teeth of the input shaft. After this, move clutch plate back and forward on the input shaft until the hub moves freely on the shaft.*
Always *remove excess grease.*

- Diameter of clutch plate ⇒ Technical data, page 00–4

Important!

Before renewing the clutch plate, pay attention to fault finding No. 9 – Faults at clutch and clutch mechanism.



4 – Pressure plate
- Removing and installing ⇒ Fig. 1
- Checking ends of diaphragm spring ⇒ Fig. 2

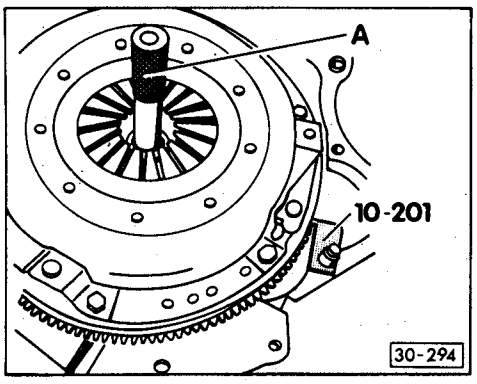
Important!

Pressure plates are corrosion-protected and greased. They may only be cleaned at the contact surface otherwise the life of the clutch will be considerably shortened.

Before renewing the pressure plate, pay attention to fault finding No. 9 – Faults at clutch and clutch mechanism.

5 – Screw, 25 Nm

6 – Needle bush
- Removing and inserting ⇒ Workshop Manual Audi 100 1991► 5-Cyl. Diesel Engine (Mechanics 2.5 l Engine) Repair Group 13 Crankshaft Group



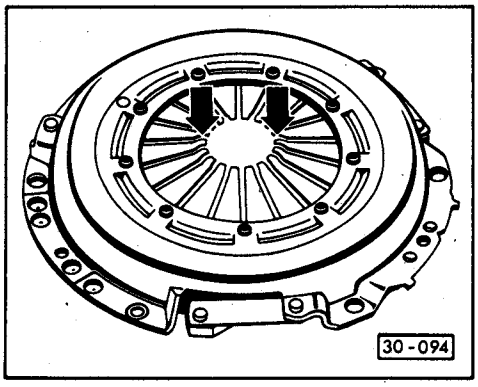
◄ **Fig. 1 Removing and installing clutch**

Slacken and tighten bolts in stages crosswise, **25 Nm.** Switch over counter-holder 10-201 when removing.

A – Centering drift 3176

Important!

Pressure plate must make contact all round with flywheel. Only then insert securing bolts. On no account pull on pressure plate otherwise the centering holes of the pressure plate and the centering pins of the flywheel will be damaged.

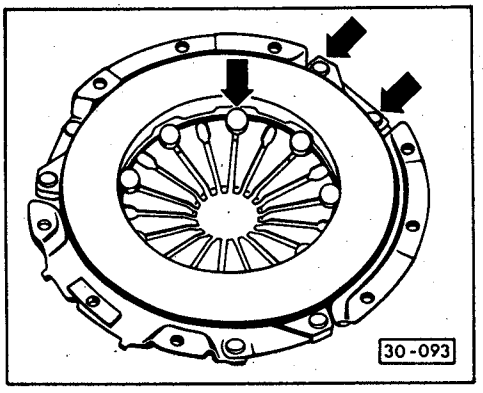


◄ **Fig. 2 Checking ends of diaphragm spring**

Wear is permissible up to half the thickness of the diaphragm spring.

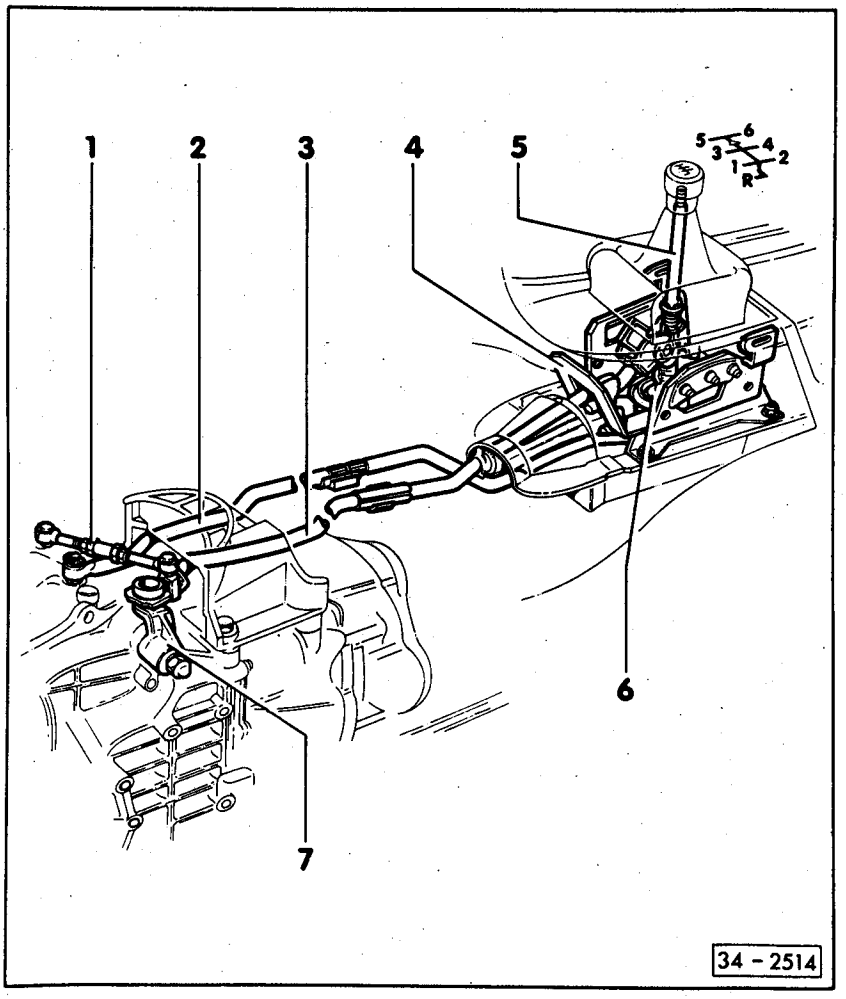
Important!

When performing repairs, always match clutch pressure plate and clutch plate from engine code letter using the parts catalogue.



◄ **Fig. 3 Examining spring connection between pressure plate and cover for cracking, and checking that rivet fastenings are tightly seated**

Clutches with damaged or loose riveted connections (arrows) must be renewed.



Servicing selector mechanism

1 – Connecting rod

2 – Torque rod

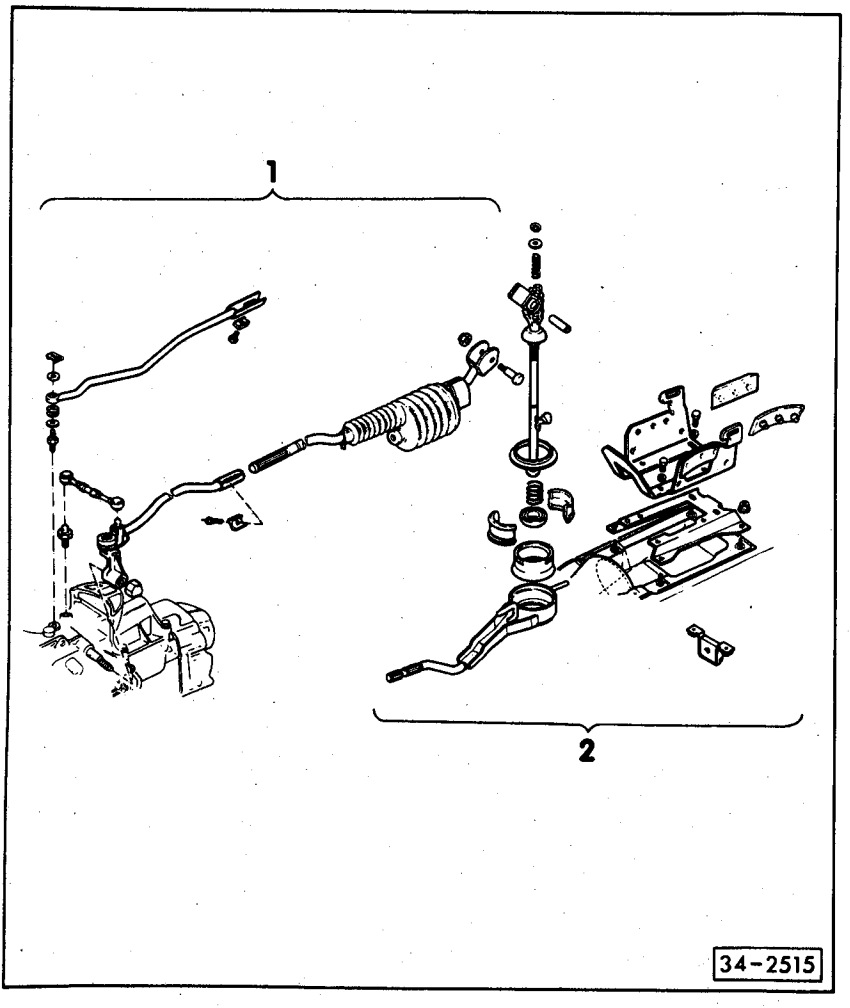
3 – Selector rod

4 – Stop

5 – Gearshift lever

6 – Gearshift lever bearing

7 – Selector lever at gearbox



Dismantling and assembling selector mechanism

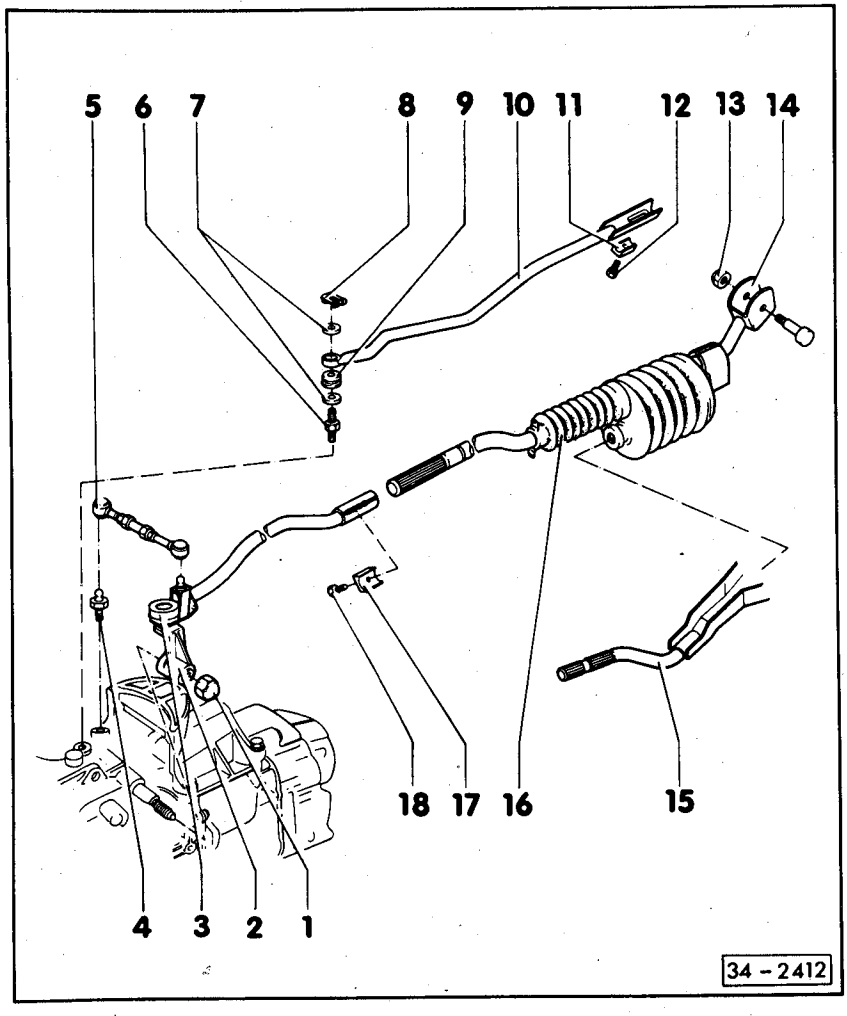
Pay attention to general repairs
⇒ page 00–8.
Removing and installing selector rods
⇒ page 34–8.
Removing and installing torque rods
⇒ page 34–9.
Adjusting and checking selector mechanism
⇒ page 34–11.

Important!

Grease all joints and sliding surfaces with white solid lubricating paste, Part No. AOS 126 000 05.

1 – Servicing selector rods and front torque rod
⇒ page 34–3

2 – Servicing gearshift lever and rear torque rod
⇒ page 34–5



Servicing selector rods with front torque rod

1 – Cap nut, 25 Nm

2 – Selector lever at gearbox
- Remove together with front selector rod

3 – Front selector rod
- Remove together with selector lever –2–

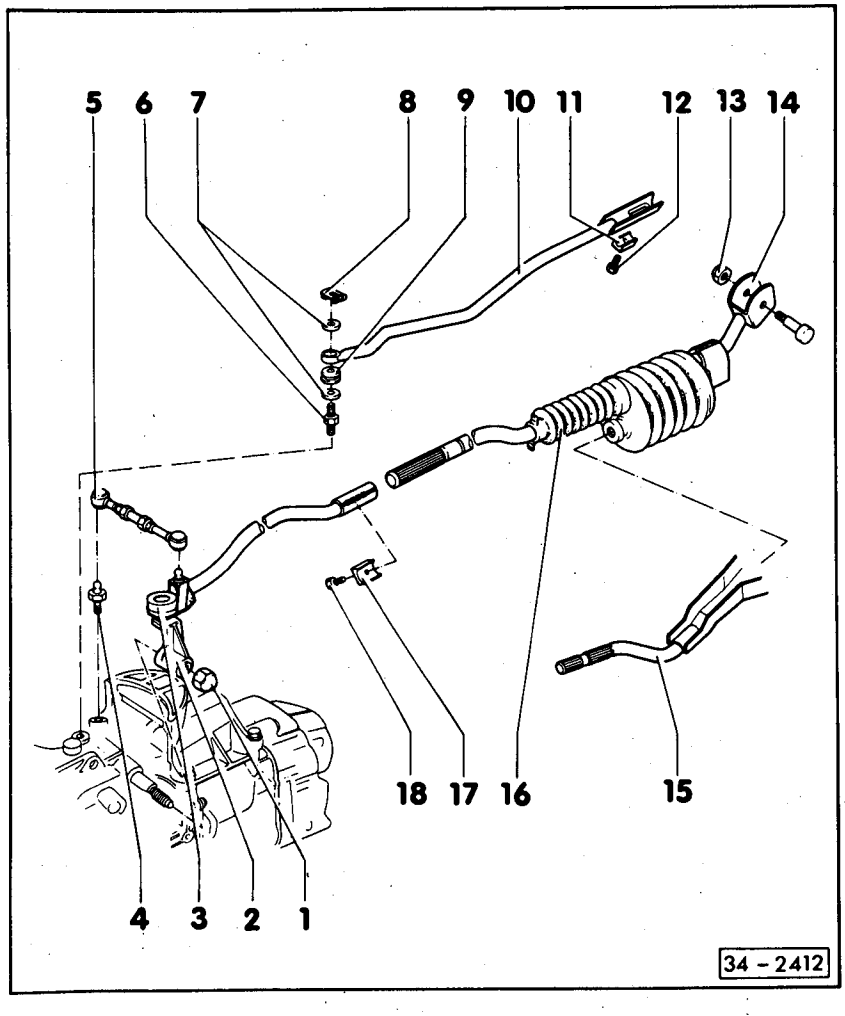
Important!

Do not lever selector rod –3– off selector lever –2–.

4 – Ball stud, 15 Nm

5 – Connecting rod
- Adjusting ⇒ page 34–11

6 – Slotted screw, 40 Nm



7 – Washer

8 – Locking plate

9 – Bearing

10 – Front torque rod
- Removing and installing ⇒ page 34–9

11 – Clamping piece

12 – Bolt, 25 Nm

13 – Locking nut, 15 Nm

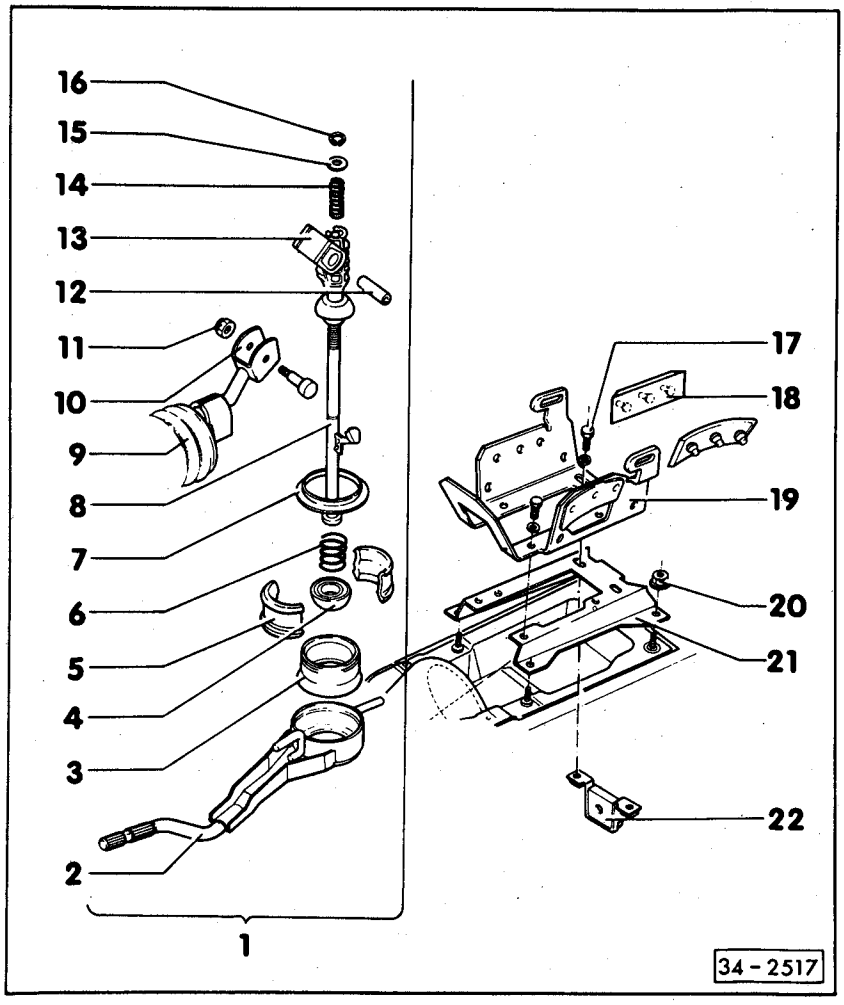
14 – Rear selector rod
- Removing and installing ⇒ page 34–8

15 – Rear torque rod
- Removing and installing ⇒ page 34–9

16 – Boot
- Install boot so that marking lug is facing up on top marking

17 – Clamping piece

18 – Screw, 25 Nm



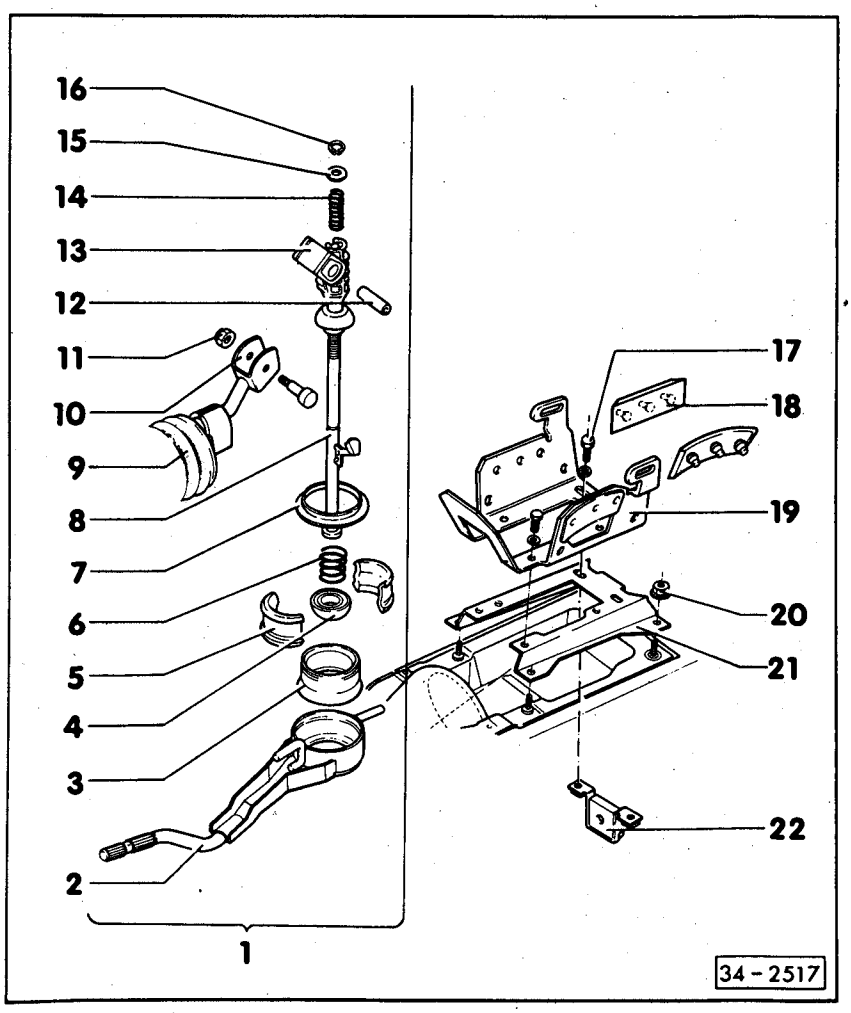
Servicing gearshift lever and rear torque rod

1 – Gearshift lever complete
- Dismantle only for greasing
- Assembling: Pre-assemble rubber guide, spherical shells and bottom hemispherical ball. Insert gearshift lever with spring, intermediate plate and top hemispherical ball into the spherical shells. Press rubber guide into gearshift lever bearing. Fit on intermediate plate and caulk gearshift lever bearing at three points so that the intermediate plate is tightly located ⇒ Fig. 1
- Adjusting ⇒ page 34–11

2 – Rear torque rod with gearshift lever bearing, bearing pin and locking pin
- Adjusting ⇒ page 34–13

3 – Rubber guide
- Installation position: shoulder faces up

4 – Bottom hemispherical ball



5 – Spherical shell

6 – Compression spring

7 – Intermediate plate

8 – Gearshift lever

9 – Boot

10 – Rear selector rod

11 – Locking nut, 10 Nm

12 – Tube

13 – Guide for gearshift lever

14 – Compression spring

15 – Spacer bush

16 – Circlip

17 – Bolt, 10 Nm

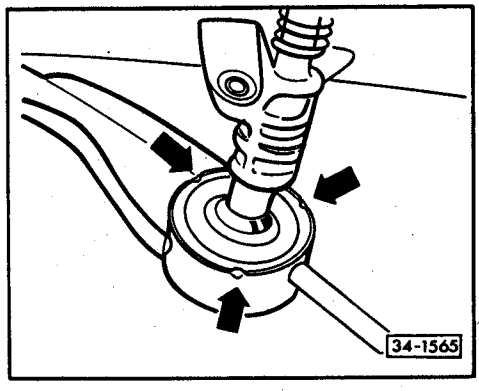
18 – Left and right rubber pads
- When renewing, after installing pads, shorten 6 studs by approx. 7 mm

19 – Top part of stop

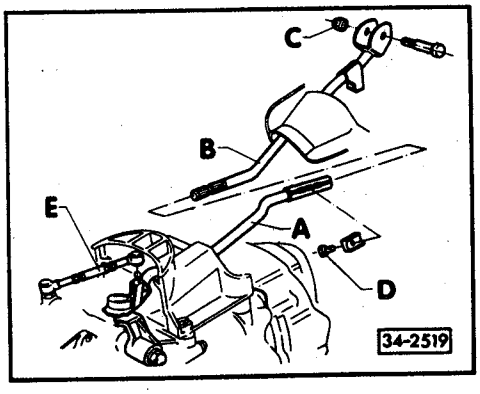
20 – Nut and washer, 10 Nm

21 – Bottom part of stop

22 – Bearing bracket



◄ **Fig. 1 Caulking gearshift lever bearing**



Removing and installing selector rods

◄ – Slacken clamping piece "D".

– Unscrew rear selector rod "B" from gearshift lever and push forward over the locking pin of the torque rod.
– Take out selector rod upward.

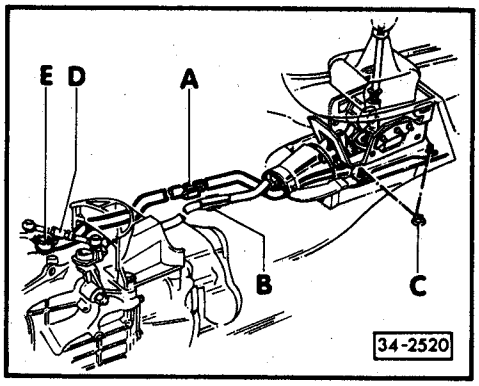
– Front selector rod "A"
  • Lever connecting rod "E" off selector rod.
  • Remove selector lever at gearbox and pull out selector rod below the cable clip for procon-ten system.

Note:

– *When installing the selector rods, first of all attach front selector rod "A" with selector lever to gearbox, connect to rear selector rod "B" and bolt to gearshift lever.*
– *"C" – 10 Nm.*
– *"D" – 25 Nm.*
– *When installing front and rear selector rods, ensure the boot is correctly seated.*
– *Press on connecting rod with assembly lever.*
– *Re-adjust selector mechanism ⇒ page 34–11.*

Removing and installing torque rods

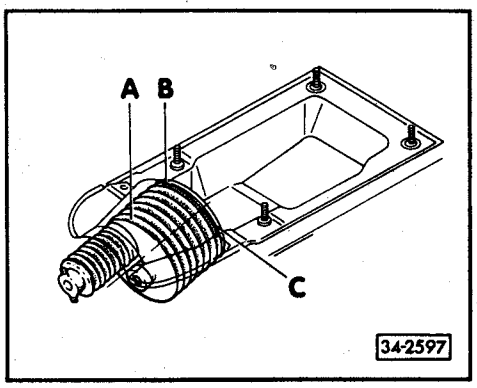
The rear torque rod should be removed complete with the gearshift lever and the rear selector rod.



◄ – Unscrew clamping piece "A" and "B".
– Remove rear and front centre console
⇒ Workshop Manual
Audi 100 1991►
General Body Repairs Repair Group 70.
– Unscrew stop "C".
– Take out rear torque rod, gearshift lever, selector rod and boot upward.
– After levering off connecting rod "D" and removing circlip "E", take off front torque rod. When installing, renew circlip and ensure it is correctly seated ⇒ Fig. 34-2412 on page 34–3.
Installation is performed in the reverse order. Ensure the boot is correctly seated ⇒ Fig. 34-2597 on page 34–10.
– Re-adjust selector mechanism ⇒ page 34–11.

Removing and installing only boot

– Unscrew clamping piece "A" and "B"
⇒ Fig. 34-2520 on page 34–9.
– Remove handle and trim cover for gearshift lever
⇒ Workshop Manual
Audi 100 1991►
General Body Repairs, Repair Group 70.
– Unscrew rear selector rod and gearshift lever and push forward over the catch pin.
– Take out selector rod upward.
◄ – Pull boot "A" down over the torque rod.



Installation is performed in the reverse order.

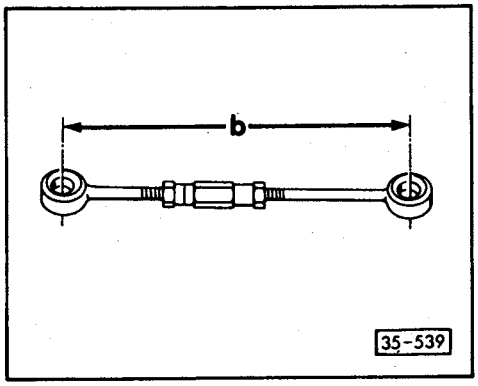
Note:

When installing, ensure that the marking lug "B" is facing up and that the boot edge "C" is correctly inserted.

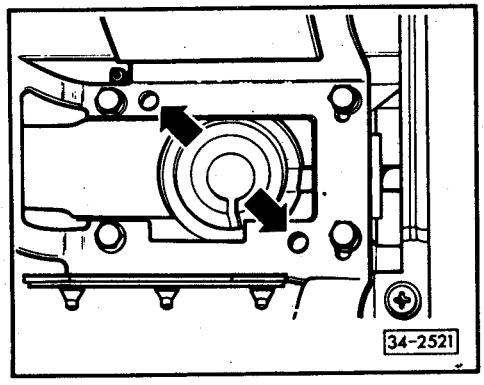
Adjusting and checking selector mechanism

Basic adjustment (adjustment intructions)

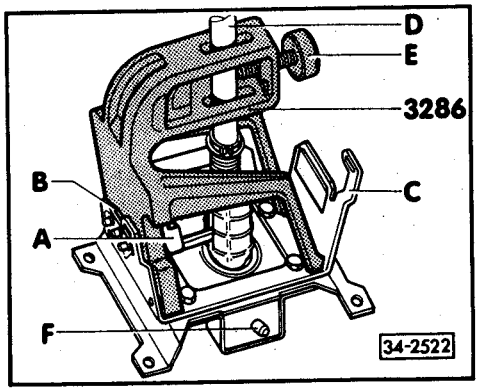
The basic adjustment should be performed if the fine adjustment is not adequate or if clamping pieces have been detached when performing repairs.



◄ – Adjust connecting rod, b = 168.5 mm, permissible deviation of ball socket axes ± 2°. Removal and installation ⇒ page 34–8 and page 34–9.
– Unscrew handle for gearshift lever and unclip trim cover for gearshift lever ⇒ Workshop Manual Audi 100 1991► Repair Group 70, Removing and installing centre console.



◄ – Position centering holes –arrows– of top and bottom parts of stop over each other, then tighten bolts.
– Move gearshift lever into Neutral of gate 3/4.
– Install clamp connection of selector and torque rods so that they can still be turned and moved relative to each other free of force.
– Adjust gearshift lever and rear torque rod ⇒ Fig. 1 and Fig. 2.

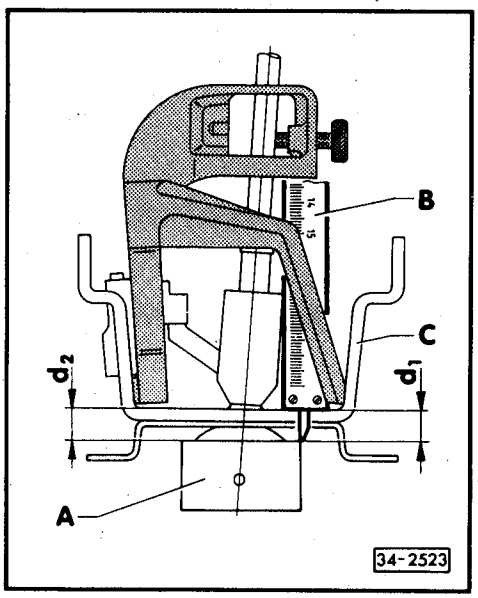


◄ **Fig. 1 Adjusting gearshift lever**

A – Stop knob
B – Left rubber stop pad
C – Top stop
D – Gearshift lever
E – Knurled screw
F – Bearing pin

Note:

– *Fit gauge 3286 onto gearshift lever "D", then insert on the left-hand side into the free holes of the stop "C" and after this into the right-hand holes of the stop "C".*
– *Slightly tighten knurled screw "E" until stop knob "A" is touching the gauge 3286.*



◄ **Fig. 2 Adjusting rear torque rod**

A – Gearshift lever bearing (rear torque rod)
B – Caliper gauge with depth gauge
C – Top stop

Note:

Determine the clearance d_1 and d_2 with caliper gauge "B" – align gearshift lever bearing "A" to a permissible difference of 1 mm between d_1 and d_2.

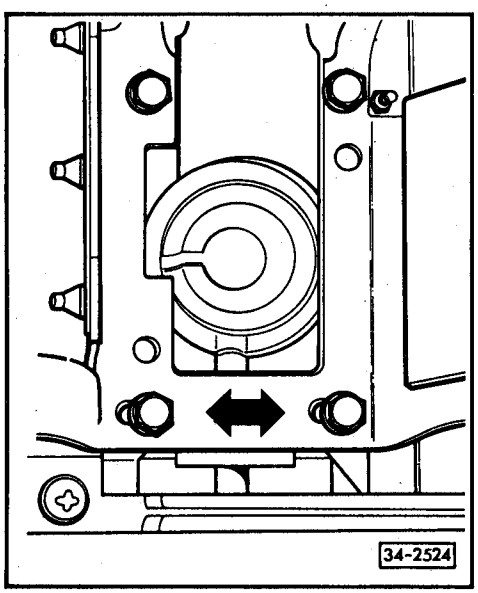
- Tighten clamp joint of selector and torque rods ⇒ page 34–9, Fig. 34-2520.
- After turning back knurled screw "E", take gauge 3286 out of stop "C" ⇒ Fig. 34-3522 and also install handle for gearshift lever and trim cover for gearshift lever.

Checking adjustment and fine adjustment instructions

- Engage 2nd gear and push gearshift lever to the left against the stop. Then, allow gearshift lever to move back with reduced force to the pressure point.
  The return spring travel must be 3 ... 9 mm (measured at the gearshift handle).
- Check that all gears can be engaged.
- Check operation of reverse gear lock.
- It must be possible to move the gearshift lever without pushing it and without power assistance in the preselect direction from the reverse gear plane to the 3/4 selector plane.

Note:

◄ *If the return spring travel is not correct, perform a correction in the preselect direction by moving the top stop sideways in the slots (arrow).*



Removing and installing gearbox

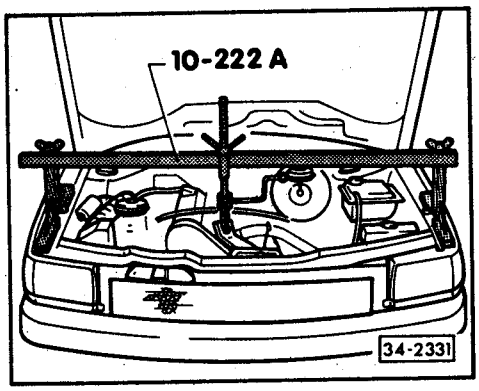
Removal

Note:

Before disconnecting the battery, determine the code number of radio sets equipped with anti-theft coding.

- Disconnect earth strap from battery.
- Unscrew top bolts connecting engine and gearbox ⇒ page 34–19, turn steering if necessary for performing this step.
- Unplug connector from switch for reversing lights and from speedometer sender (press down clip for this purpose).

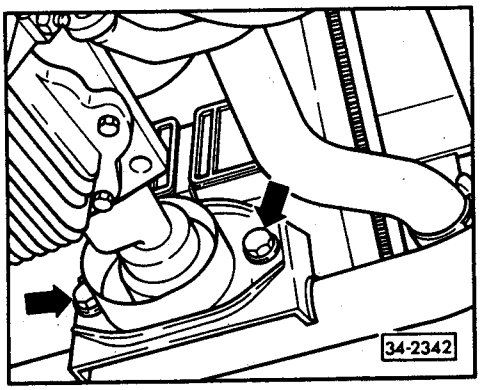
◄ – Install supporting device 10-222 A and take up weight of engine via spindle.



- Remove noise insulation (2 parts) and unbolt bracket for noise insulation
  ⇒ Workshop Manual
  Audi 100 1991► Diesel Engine
  (Mechanics 2.5 l Engine)
  Repair Group 10, Removing and installing engine.
- Unbolt front exhaust pipe at manifold.
- Separate exhaust system upstream of catalytic converter and unbolt at gearbox.
- Remove starter and place down to the side in engine compartment.
- Engage 3rd gear, unbolt clamp for torque and selector rod.

Note:

The selector rod is separated by pulling the gearshift lever back in the direction of 4th gear.

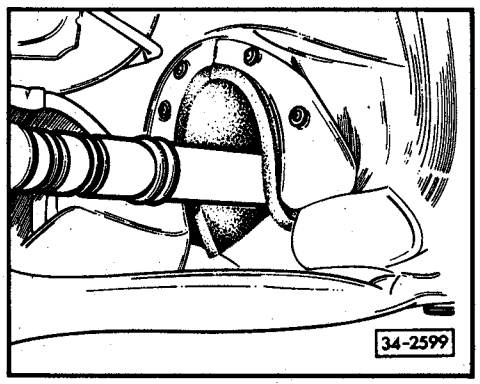


◄ – Slacken securing bolts for torque support (arrows).
- Remove heat shield for inner right joint of gearbox.
- Remove left and right drive shafts and tie up.
- Remove securing bolts for right and left gearbox support/subframe.

– Remove cable guide for procon-ten system from gearbox ⇒ Workshop Manual Audi 100 1991► Repair Group 68 General Body Repairs.

Note:

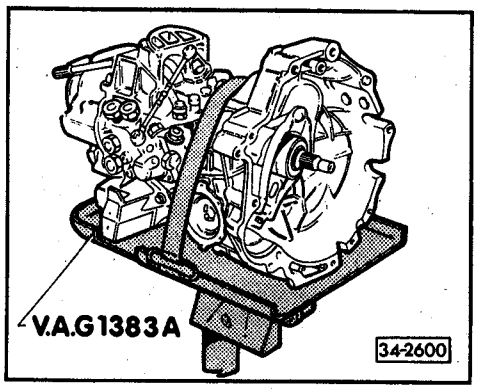
In order to detach the procon-ten cables from the cable guide at the gearbox, they have to be further pre-tensioned ⇒ Fig. 34-2331, page 34–15, in order to lower the gearbox.



◄ – Remove noise cover above left drive shaft to facilitate removal of the slave cylinder.
– Remove clutch slave cylinder. Do not open line system.

Important!

Do not operate clutch pedal any more after removing the slave cylinder.



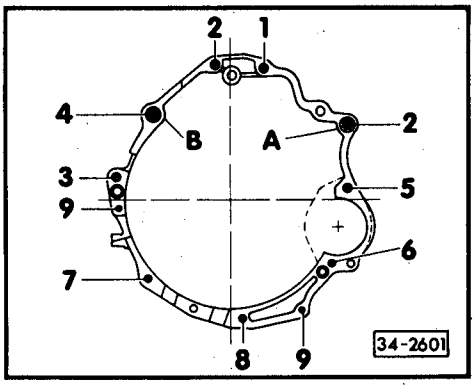
◄ – Support gearbox with gearbox jack V.A.G 1383 A.
– Unscrew bottom bolts connecting engine and gearbox ⇒ page 34–19.
– Press gearbox off dowel sleeves and carefully lower.

Installing

– Installation of the gearbox is performed in the reverse order.

Note:

– *Check whether dowel sleeves for centering engine/gearbox are fitted in engine block, renew if necessary.*
– *Before installing the clutch slave cylinder, the gearbox must be bolted to the engine.*
– *Installation of clutch slave cylinder ⇒ Fig. 2, page 30–15.*



◄ **Tightening torques**

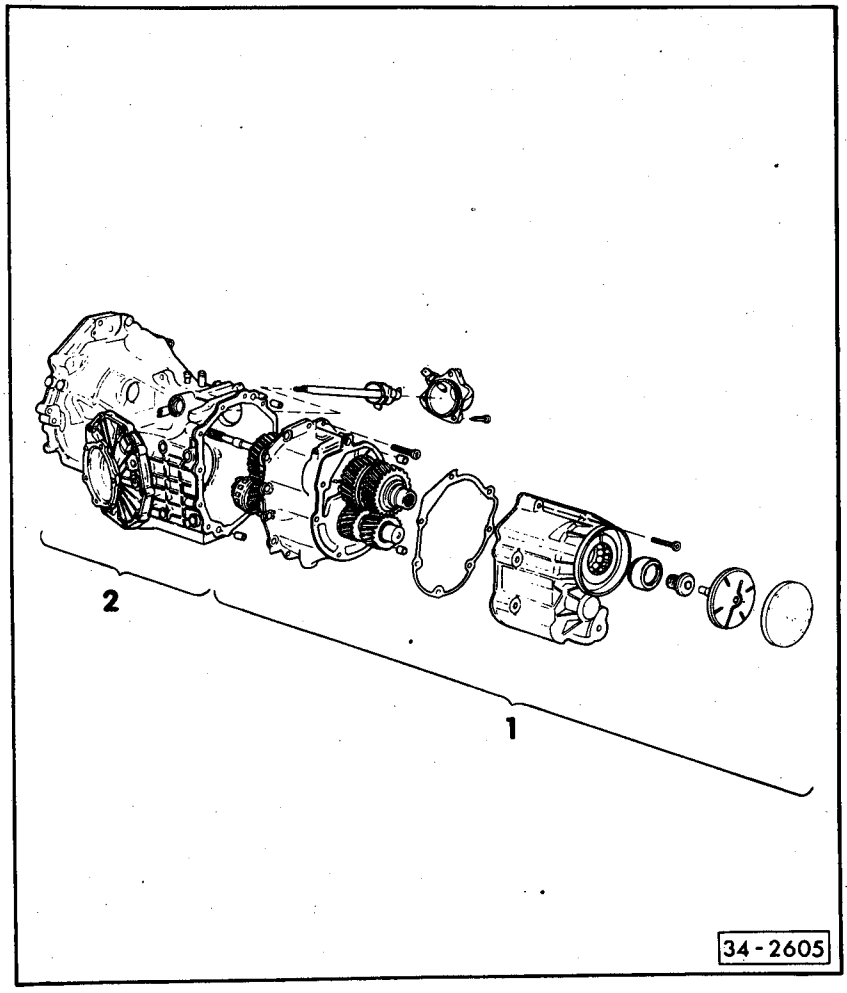
Engine/gearbox attachment (flange illustration engine)

Item	Bolt	Qty.	Nm
1	M12 x 67	1	65
2	M12 x 75	2	65
3	M12 x 80	1	65
4	M12 x 90	1	65
5	M12 x 100	1	65
6	M10 x 120	1	65
7	M10 x 50	1	45
8	M10 x 38	1	45
9	M 8 x 40	2	25

Dowel sleeves for centering, items –A– and –B–

Drive shaft to flanged shaft

M8 ..... 45 Nm
M10 ..... 80 Nm
Selector rod to gearbox ..... 20 Nm
Torque support to body ..... 45 Nm
Clutch slave cylinder to gearbox ..... 25 Nm
Gearbox support to subframe ..... 45 Nm
Crossmember to body ..... 45 Nm
Flanged shaft securing bolt + 90° (1/4 turns) ..... 10 Nm



Dismantling and assembling gearbox

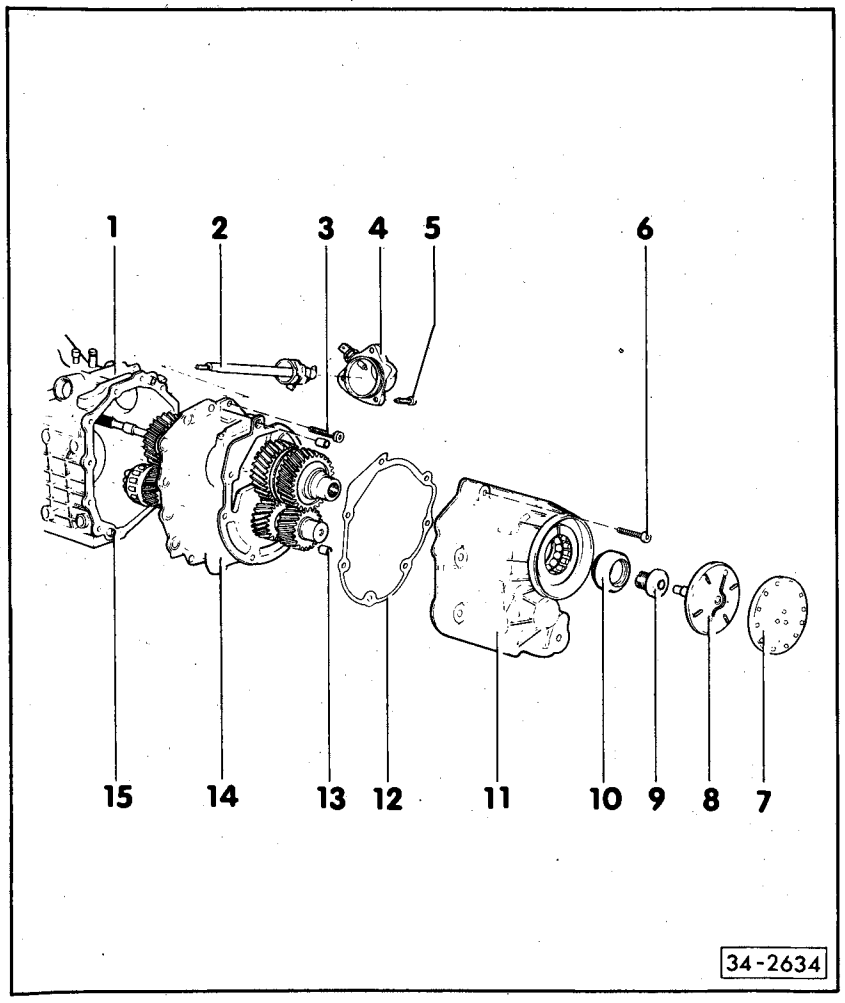
Sequence of operations ⇒ page 34–29

Important!

If gearbox housing or taper roller bearings for drive pinion are to be replaced and deviation "r" is not stated on the crown wheel, the position of the drive pinion must be determined before removing the gearbox (actual measurement) ⇒ Repair Group 39.

1 – Removing and installing gearbox and end cover
– ⇒ page 34–21
- Removing and installing 5th and 6th gear ⇒ page 34–23
- Removing and installing input shaft, drive pinion and inner selector mechanism from bearing plate ⇒ page 34–27

2 – Gearbox housing with differential
- Removing and installing differential ⇒ page 39–4
- Servicing gearbox housing ⇒ page 34–50



Removing and installing gearbox and end cover

1 – Gearbox housing

2 – Selector shaft with selector cylinder
- Removing ⇒ page 34–31

3 – Screw M8 x 36, 25 Nm
without washer (12 screws)

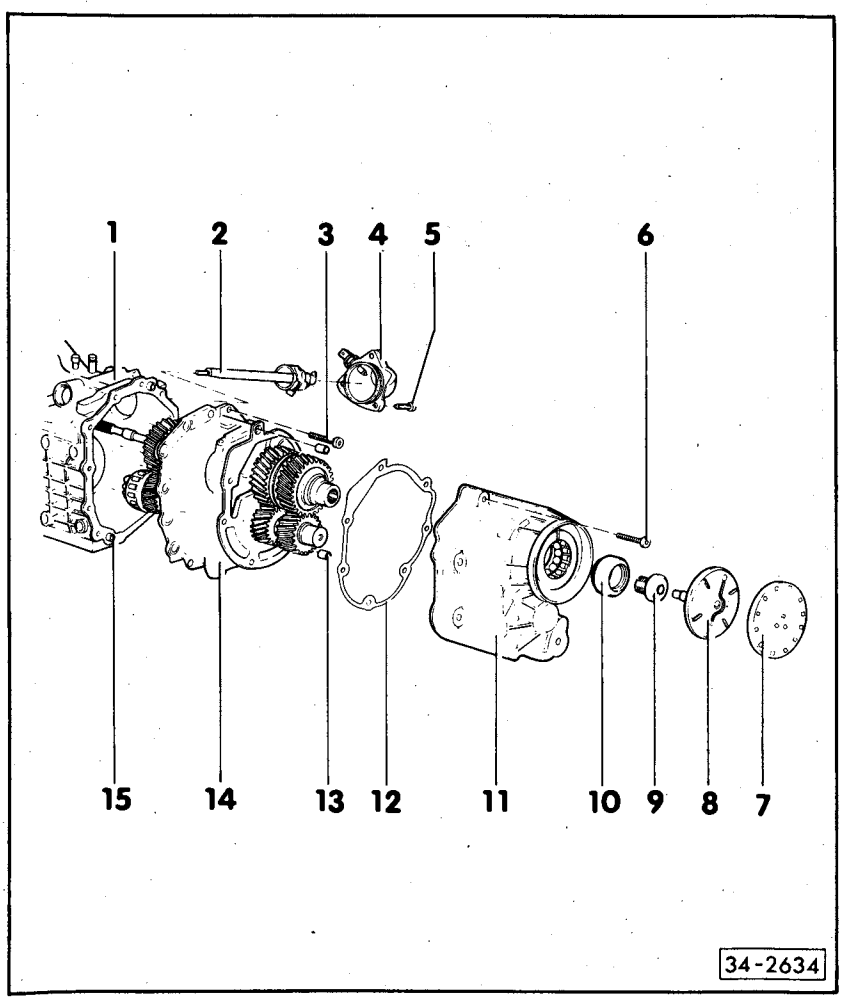
4 – Cover for selector shaft
- Detaching ⇒ page 34–31

5 – Screw M8 x 22, 25 Nm
without washer (3 screws)

6 – Screw M8 x 60, 25 Nm
(7 screws)

Important!

If the bolt hole casting height of the end cover is insufficient, approx. 35 mm, the washer
N 011 525.8 or
N 011 525.2, respectively
must be fitted to both bottommost bolts.



7 – End cover
- Removing ⇒ page 34–30

8 – Oil collecting plate
- Removing ⇒ page 34–30

9 – Screw, 150 Nm

10 – 2nd inner race/four-point bearing
- Removing ⇒ page 34–32
- Installing ⇒ page 34–48

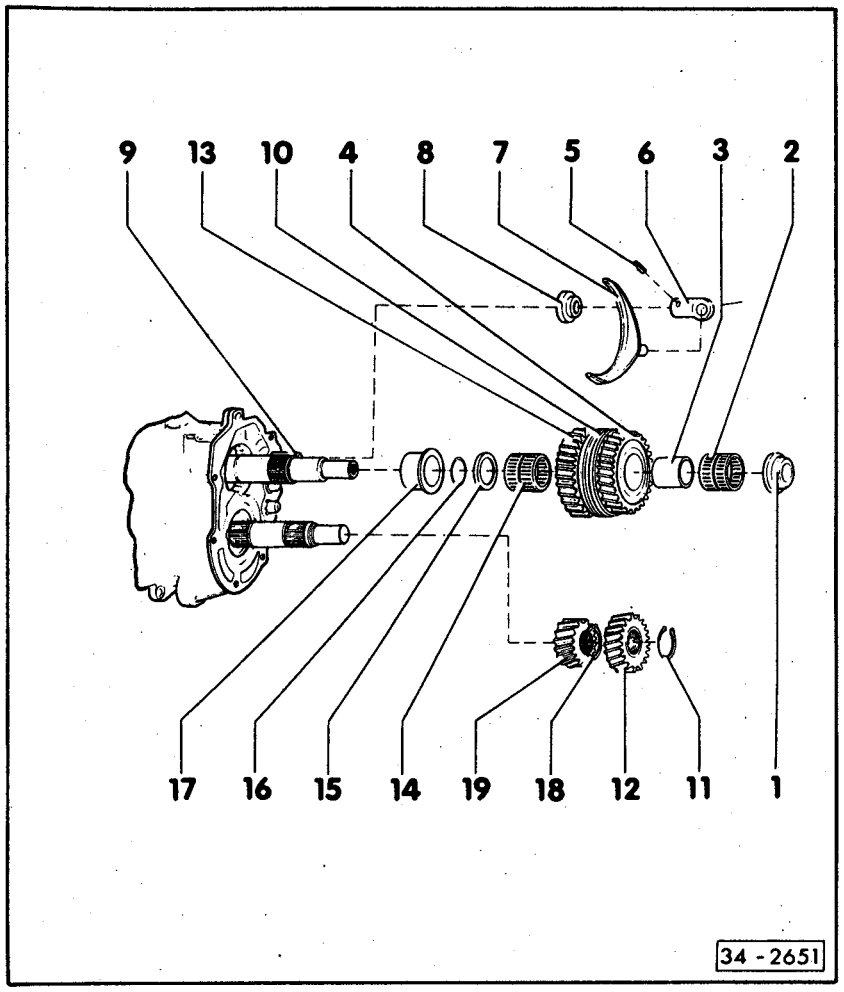
11 – End cover
- Removing – possible without removing gearbox
- Servicing ⇒ page 34–77

12 – Gasket

13 – Dowel sleeves
(2 each)

14 – Gearbox
- Removing and installing 5th and 6th gear ⇒ page 34–23

15 – Dowel sleeve
(2 pieces)



Removing and installing 5th and 6th gear

1 – 1st inner race/four-point bearing
- Pulling off ⇒ page 34–33
- Pressing on ⇒ page 34–47

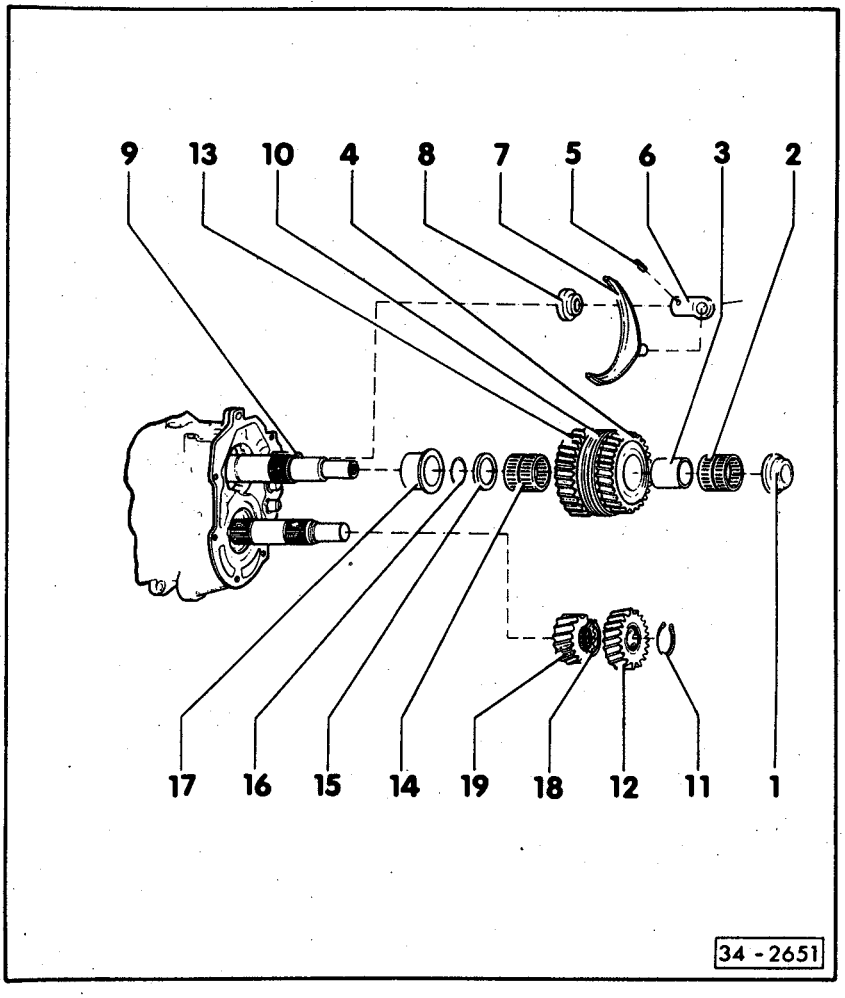
2 – Needle bearing for 5th gear

3 – Inner race for 5th speed selector gear
- Pulling off ⇒ page 34–35
- Fitting on ⇒ page 34–47

4 – Selector gear for 5th speed
- Pulling off ⇒ page 34–33
- Installing ⇒ page 34–47

5 – Tensioning sleeve, roll pin from 01/92
- Removing ⇒ page 34–34
- Inserting ⇒ page 34–46

6 – Driver
- Replace only complete with selector rod for 5th and 6th gear, item 9 ⇒ page 34–35
- Pulling off ⇒ page 34–34



7 – 5th and 6th gear selector fork
- Can be renewed individually

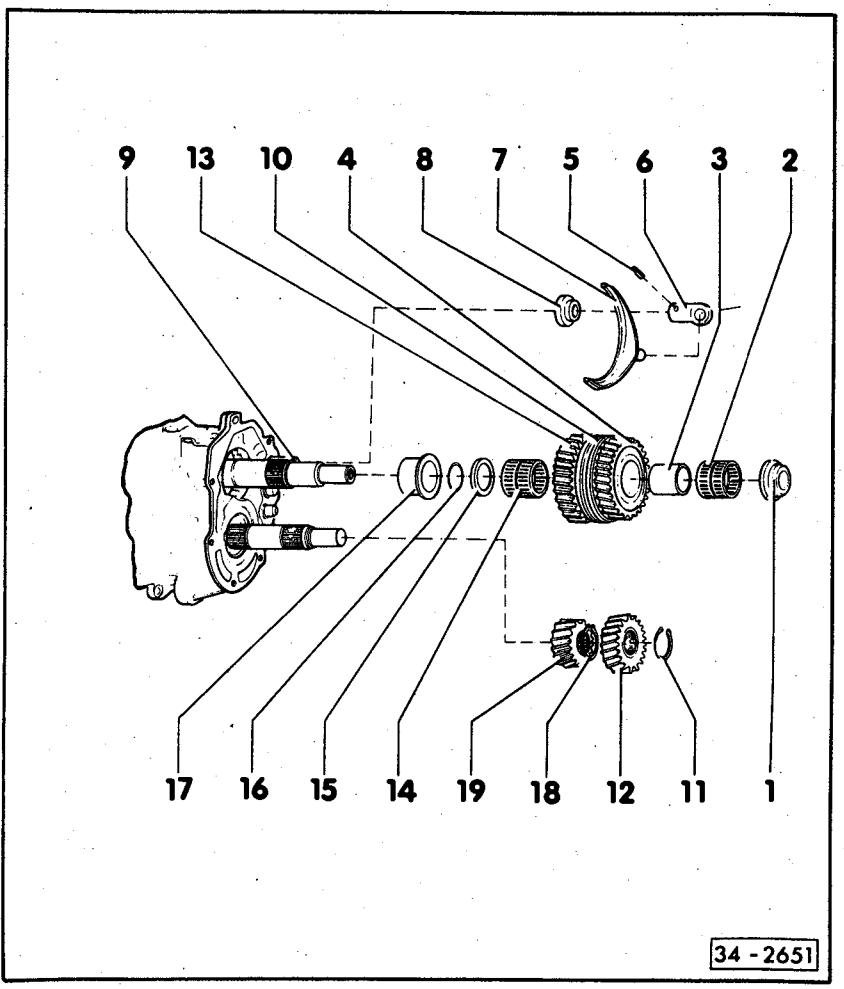
8 – Disc – for 5-speed gearbox only
- Installing ⇒ page 34–45

9 – Selector rod for 5th and 6th gear
- Renew only complete with driver, item 6 ⇒ page 34–35 and page 34–66

10 – Sliding sleeves/synchronizer body for 5th and 6th gear

11 – Circlip

12 – 5th speed gearwheel
- Pulling off ⇒ page 34–33
- Pressing on ⇒ page 34–46



13 – 6th speed selector gear – not applicable to 5-speed gearbox
- Pulling off together with synchronizer body and 5th gear inner race ⇒ page 34–35
- Installing ⇒ page 34–44

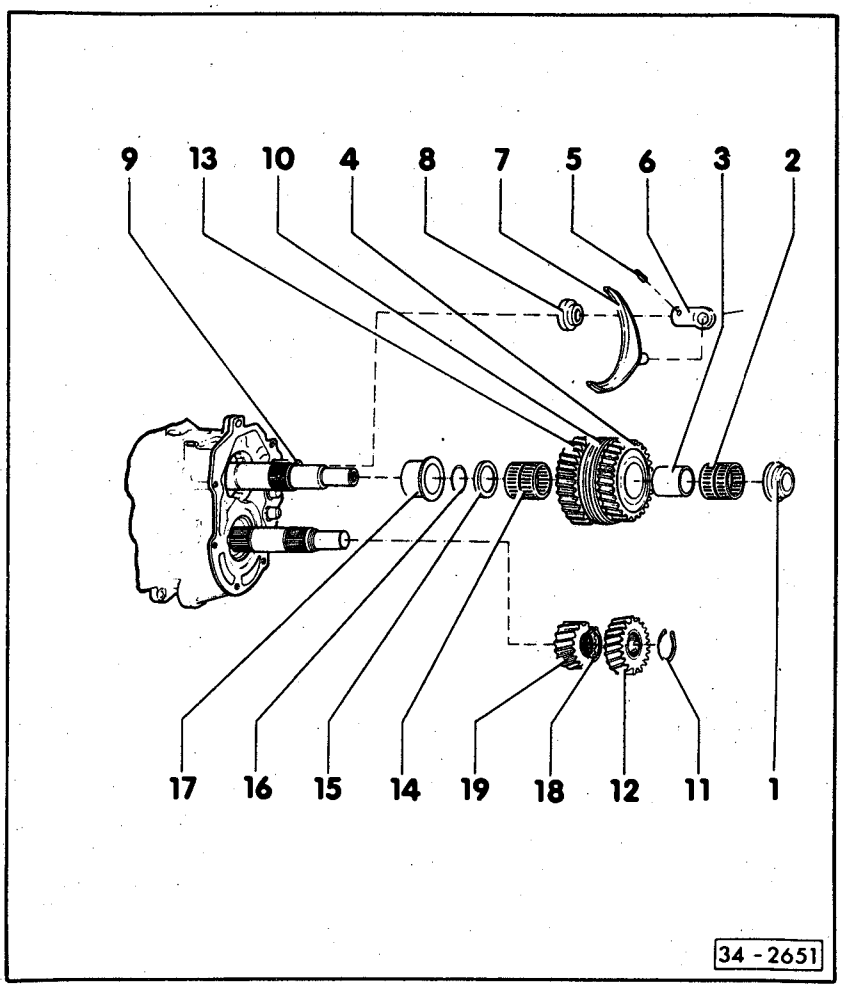
14 – Needle bearing for 6th gear – not applicable to 5-speed gearbox

15 – Thrust washer for 6th gear needle bearing – not applicable to 5- speed gearbox

Note:

Recess of thrust washer must face toward snap ring.

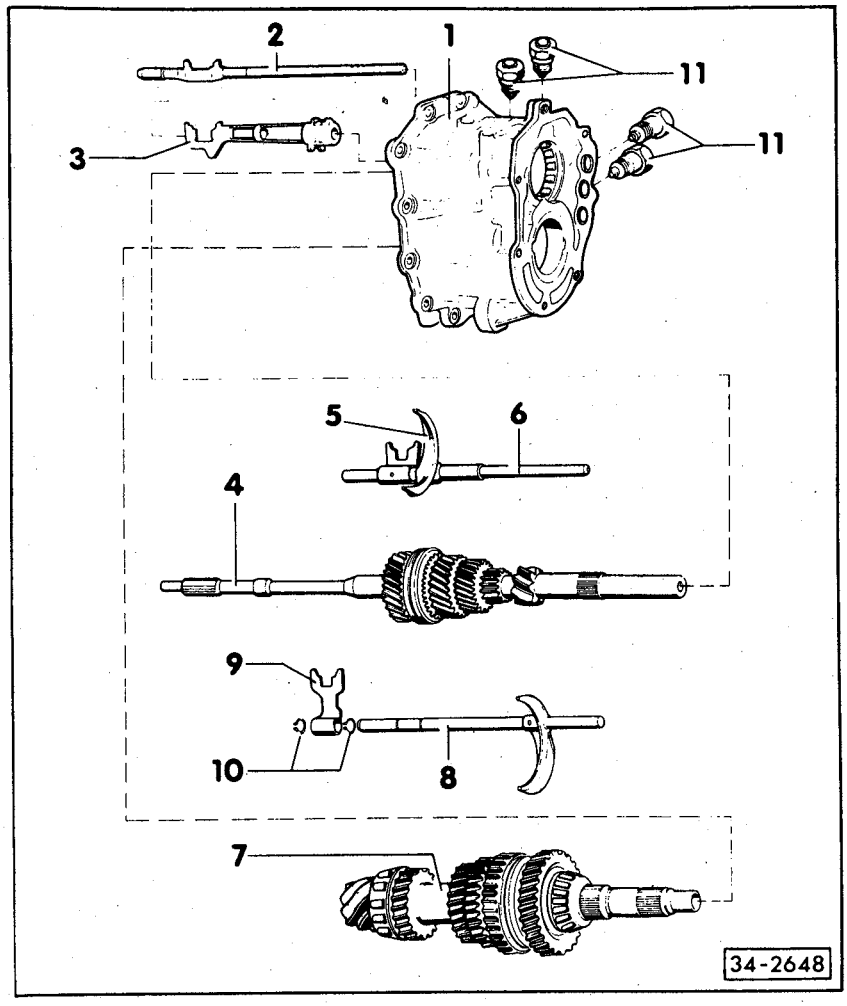
16 – Snap ring



17 – Cylinder roller bearing inner race
- Take off by hand

18 – Circlip – not applicable to 5-speed gearbox
- Re-determining thickness ⇒ page 34–40

19 – 6th speed gearwheel – not applicable to 5-speed gearbox
- Pressing off ⇒ page 34–36
  Remove bearing plate first ⇒ page 34–35
- Pressing on ⇒ page 34–37

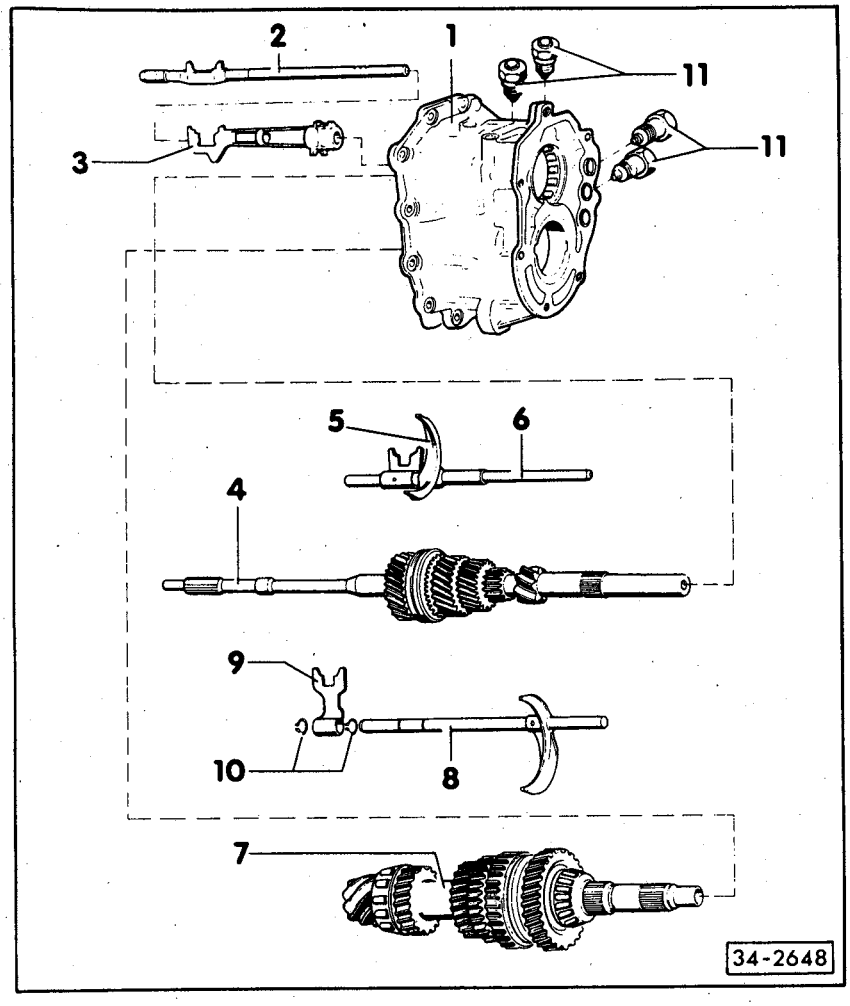


Removing and installing input shaft, drive pinion and inner selector mechanism from bearing plate

1 – Bearing plate
- Servicing ⇒ page 34–63

2 – Selector rod for 5th and 6th gear
- Renew only complete with driver for 5th and 6th gear ⇒ page 34–23

3 – Driver for reverse gear
- Removing and inserting ball sleeve ⇒ page 34–69 and page 34–70



4 – Input shaft
- Dismantling and assembling ⇒ page 35–1

5 – Selector fork for 3rd and 4th gear
- Can be replaced individually

6 – Selector rod for 3rd and 4th gear
- Renew only complete with driver for 3rd and 4th gear

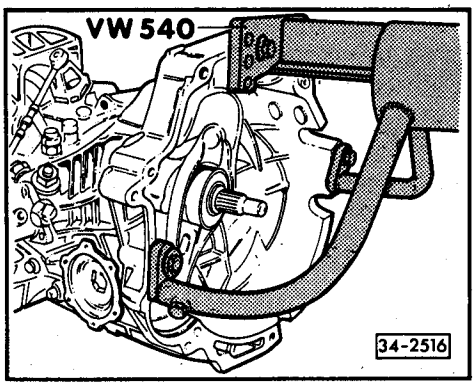
7 – Drive pinion
- Dismantling and assembling ⇒ page 35–11

8 – Selector rod for 1st and 2nd gear
- Renew only complete with pinned 1st and 2nd gear selector fork

9 – 1st and 2nd gear driver
- Can be renewed individually

10 – Circlip

11 – Selector rod lock, 80 Nm



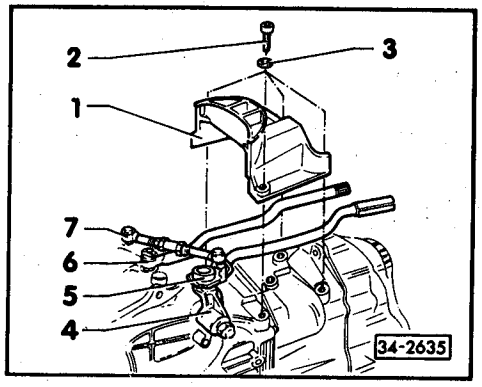
Removing and installing end cover, input shaft and drive pinion (sequence of operations)

Pay attention to general repair instructions ⇒ page 00–8.

Removal

◄ – Clamp gearbox in repair stand.

– Drain gear oil.



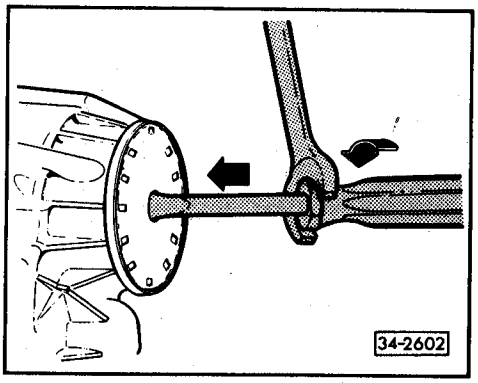
◄ – Unscrew cable guide for procon-ten system.

1 – Cable guide

2 – Cheese-head screw, 40 Nm

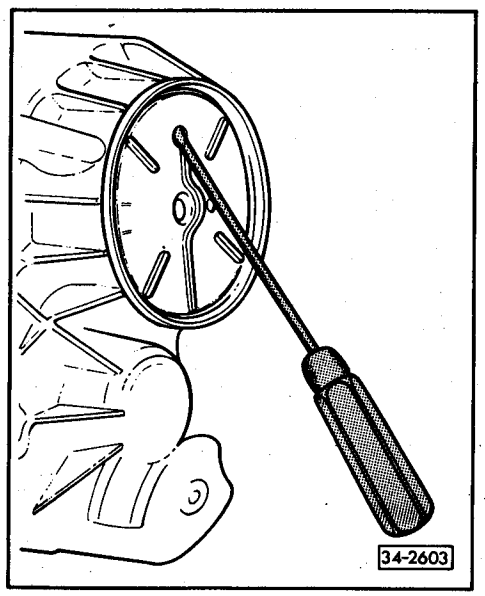
3 – Washer

– Detach connecting rod –7– and front torque rod –6– and pull front selector rod –5– together with selector lever –4– off the selector shaft ⇒ page 34–3.

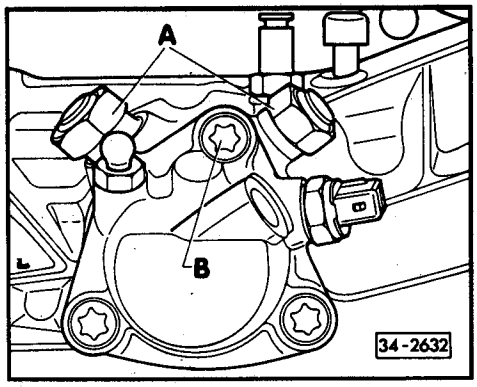


◄ – Remove end cover; pierce rubber in the middle with a large screwdriver for this purpose.

– Push screwdriver from the side between cover and oil collecting plate up to the edge and lever of cover by turning.



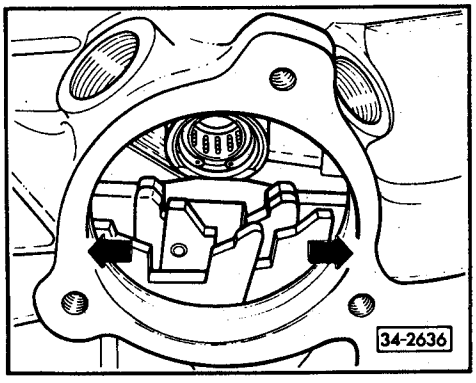
◄ – Remove oil collecting plate by inserting screwdriver into hole and levering off oil collecting plate.



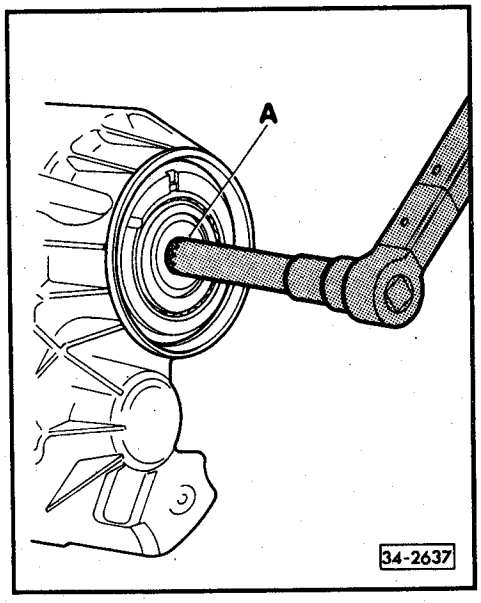
◄ – Remove locking bolts –A– for selector shaft.

– Detach cover for selector shaft by unscrewing bolts –B–.

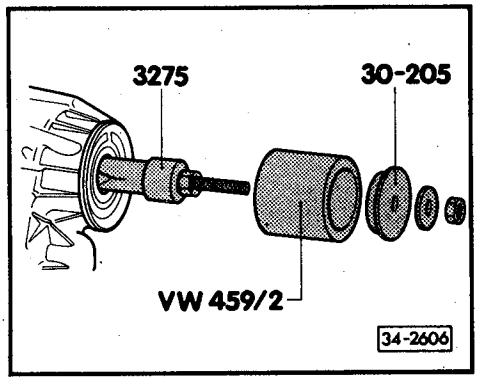
– Pull out selector shaft.
- Changing selector cylinder:
  For changing the selector cylinder (version for 5- **or** 6-speed gearbox ⇒ page 00–6), remove and install clamping sleeve or roll pin with a suitable drift pin.



◄ – Lock input shaft by engaging 2 gears by moving 2 selector rails (arrows).



◄ – Unscrew internal multi-toothed screw –A– for input shaft.



◄ – Pull off 2nd inner race for four-point bearing on input shaft.

Note:

The internal extractor 3275 grips the surrounding groove of the inner race during pulling.

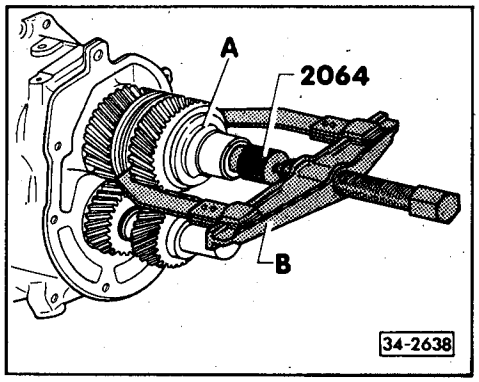
– Unscrew bolts securing end cover/bearing plate ⇒ page 34–21.

– Take end cover off bearing plate.

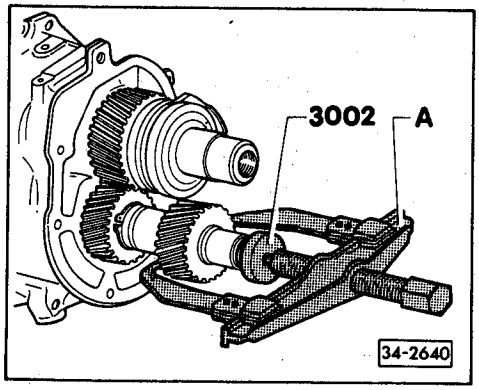
– Remove gasket of end cover/bearing plate.

Note:

Servicing end cover ⇒ page 34–77.

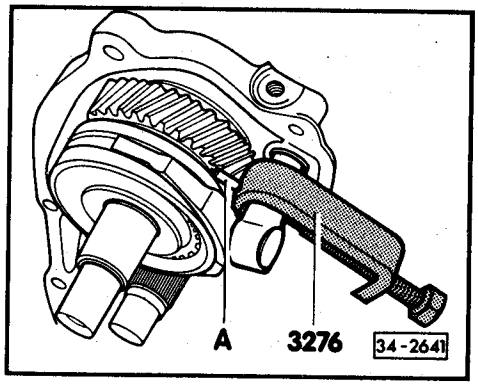


◄ – Pull off 5th speed selector gear together with 1st inner race –A– for four-point bearing/input shaft.
B – Two-legged puller (commercially available), e.g. Kukko 20/10



– Take off circlip for 5th speed gearwheel.

◄ – Pull off 5th speed gearwheel by engaging 2 gears ⇒ page 34–31.
A – Two-legged puller (commercially available), e.g. Kukko 20/10

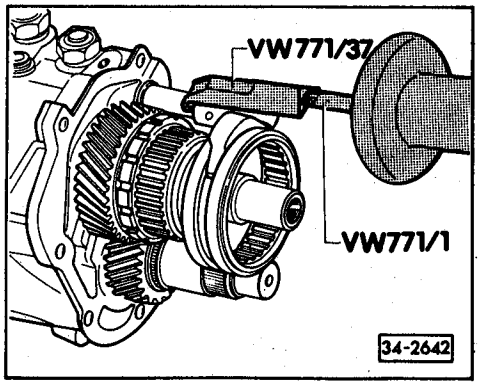


◄ – Press out clamping sleeve, or from 01/92 roll pins –A– for 5th/6th speed selector fork.

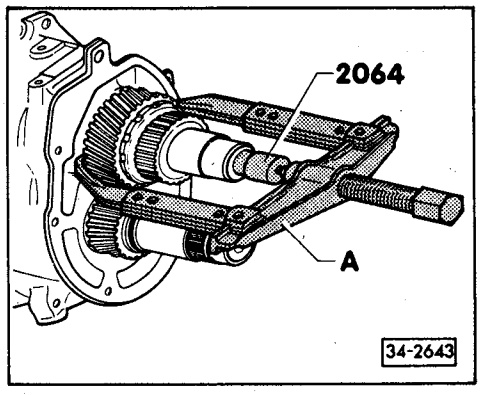
Note:

Do not knock out clamping sleeve otherwise mounting of selector rod will be damaged.

– Pull selector rod together with 5th/6th speed selector fork as far as possible out of the bearing plate.



◄ – Pull 5th/6th speed selector fork together with sliding sleeve and driver off the selector rod.



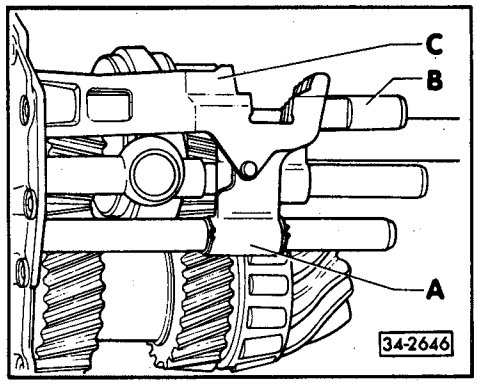
◄ – Pull off 6th speed selector gear, 5th/6th speed synchronizer body and inner race for 5th speed selector gear.

A – Two-legged puller (commercially available), e.g. Kukko 20/10, with 200 mm long legs

– Knock out dowel sleeves and unscrew bearing plate.

– Take off bearing plate with input shaft and drive pinion.

– Unscrew selector rod locking bolts ⇒ page 34–28.



◄ – Remove circlip from 1st/2nd speed selector rod and take off driver –A–.

– Pull out selector rod –B– for 5th/6th gear.

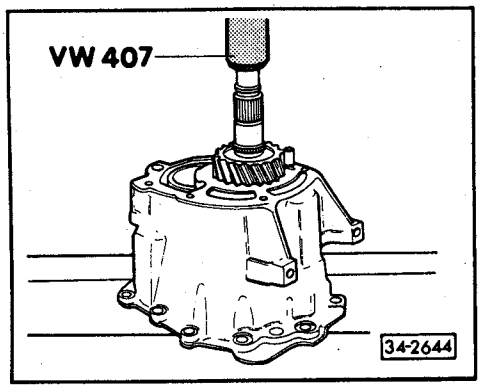
– Remove reverse gear driver –C–.

– Take off thrust washer for 6th speed needle bearing and snap ring for inner race of cylinder roller bearing ⇒ page 34–25.

– Take out inner race (not tightly seated).

– Remove input shaft with 3rd/4th speed selector rod and selector fork from bearing plate.

– Take off snap ring for 6th speed gearwheel; renew if necessary when fitting.



◄ – Press off 6th speed gearwheel.
Take drive pinion with 1st/2nd gear selector rod and selector fork out of bearing plate.

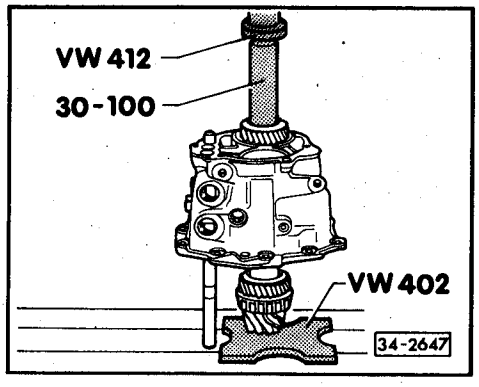
Note:

It is not necessary to remove reverse gear when working solely on drive pinion and input shaft.

– Take off reverse gear relay lever.

– Unscrew hex. bolt with collar, take off spring clasp and retaining plate, pull out reverse idler gear shaft. Take out reverse idler gear, synchronizer ring and compression spring.

– Removing and installing reverse gear ⇒ also page 34–63 "Servicing bearing plate".



Installation

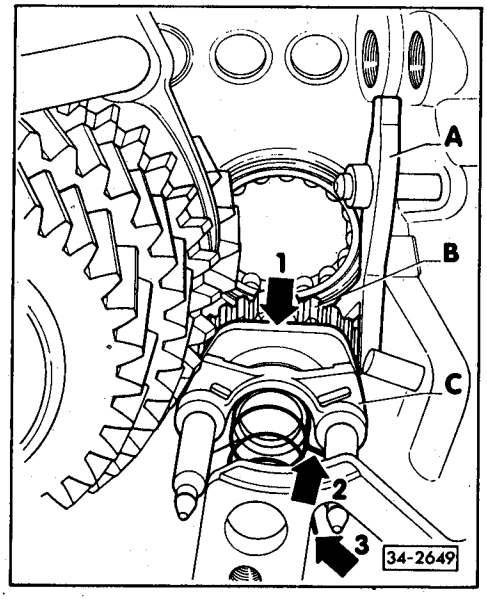
- Determining circlips for 6-speed gearbox ⇒ page 34–40.
- Determining circlips for 5-speed gearbox ⇒ page 34–42.
- Insert drive pinion with 1st/2nd gear selector fork and selector rod without driver into the bearing plate.

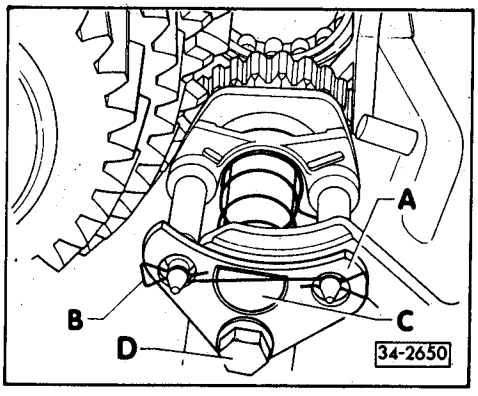
◄ – Heat 6th speed gearwheel to approx. 120°C and fit on; press home as far as the stop with inserting sleeve 30–100.
Installation position: Collar faces taper roller bearing.

- Fit on circlip.

◄ – Fit on reverse gear relay lever –A–.

- Insert selector gear B– and mesh relay lever with groove at selector gear.
- Insert synchronizer ring –C–.
Installation position: Position flat side at circumference of synchronizer ring facing input shaft (arrow 1).
- Insert compression spring.
Installation position: Attach single angled end into the recess at the synchronizer ring (arrow 2). Turn double angled end to the left and attach in the opening in the bearing plate (arrow 3).

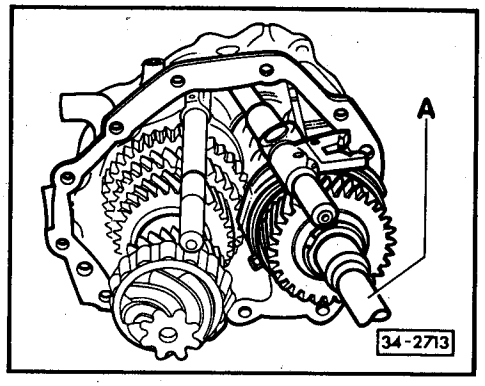




◄ – Insert the shaft –C–.

- Fit on retaining plate –A–.
Installation position: The radii of the holes for the locking pins of the synchronizer ring face the bearing plate.
- Insert spring clasp –B– into the locking pins of the synchronizer ring ⇒ page 34–65.
- Bolt –D– tightening torque **25 Nm.**

> ***Important!***
>
> ***Always renew bolt because of microencapsulation.***



◄ – Insert input shaft –A– with 3rd/4th speed selector rod and selector fork ⇒ page 34–27, into the bearing plate **at an angle.**

- Fit on cylinder roller bearing inner race.
- Fit on snap ring for inner race.
- Insert reverse gear driver with the recess into reverse gear relay lever ⇒ page 34–66.
- Push 5th/6th speed selector rod through driver for reverse gear.
- Push 1st/2nd gear driver onto selector rod and fit on circlip ⇒ page 34–28.

– Oil bearing points for input shaft roller bearings, drive pinion taper roller bearings and selector rods with gear oil.

– Apply a thin coat of sealant AMV 188 000 to the bearing plate/gearbox housing sealing surface and insert the complete bearing plate into the gearbox housing.

Note:

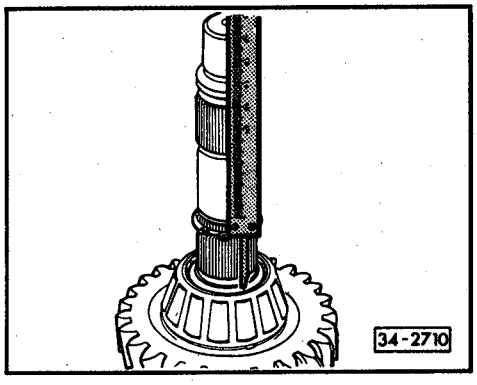
When inserting, ensure that the selector rods are aligned with the ball sleeves.

– Insert dowel sleeves and tighten bolts to **25 Nm**.

– Screw in selector rod locking bolts and tighten to **80 Nm** ⇒ page 34–28.

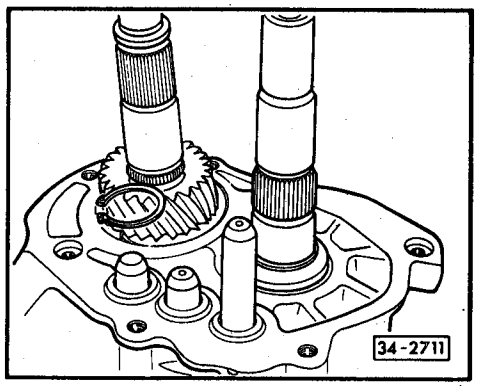
Determining circlips for taper roller bearings and 6th speed gearwheel

– Press on taper roller bearing as far as stop.



◄ – Measure size between inner race of taper roller bearing and fitted circlip (push up) with depth gauge and determine thickness of circlip from the table.

Range (mm)	Circlip	
	Thickness (mm)	Part N°
32.44 ... 32.53	1.66	N 905 130 01
32.54 ... 32.62	1.75	N 905 130 02
32.63 ... 32.71	1.84	N 905 130 03
32.72 ... 32.80	1.93	N 905 130 04
32.81 ... 32.89	2.02	N 905 130 05
32.90 ... 32.98	2.11	N 905 130 06
32.99 ... 33.07	2.20	N 905 130 09
33.08 ... 33.16	2.29	N 905 130 12



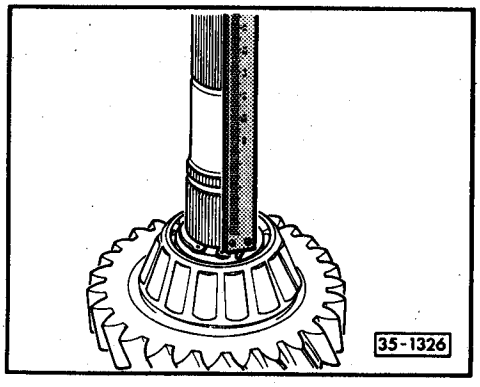
– Press on 6th speed gearwheel as far as the stop.

◄ – Calculate the thickest circlip which can still just be inserted and fit on. The axial play must be not more than 0.05 mm.

– Determine circlip from the table.

Thickness (mm)	Part n°
2.11	N 905 130 06
2.14	N 905 130 07
2.17	N 905 130 08
2.20	N 905 130 09
2.23	N 905 130 10
2.26	N 905 130 11
2.29	N 905 130 12

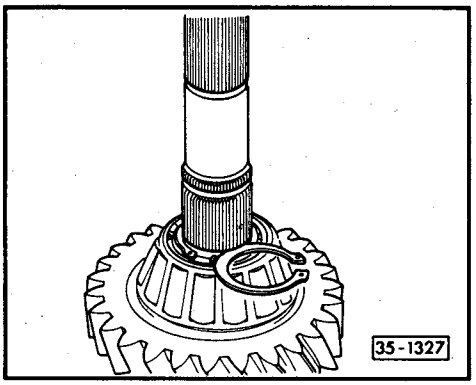
Determining circlips for taper roller bearings of 5-speed gearbox



– Press on taper roller bearing as far as the stop.

◄ – Measure size between inner race of taper roller bearing and fitted circlip (push up) with depth gauge and determine thickness of circlip from the table.

Range (mm)	Circlip	
	Thickness (mm)	Part N°
3.84 ... 3.93	1.66	N 905 130 01
3.94 ... 4.02	1.75	N 905 130 02
4.03 ... 4.11	1.84	N 905 130 03
4.12 ... 4.20	1.93	N 905 130 04
4.21 ... 4.29	2.02	N 905 130 05
4.30 ... 4.38	2.11	N 905 130 06
4.39 ... 4.47	2.20	N 905 130 09
4.48 ... 4.56	2.29	N 905 130 12



◄ – Determine the thickest be inserted and fit on.

– Determine circlip from the table.

Thickness (mm)	Part n°
2.14	N 905 130 07
2.17	N 905 130 08
2.20	N 905 130 09
2.23	N 905 130 10
2.26	N 905 130 11
2.29	N 905 130 12

Installation (continued)

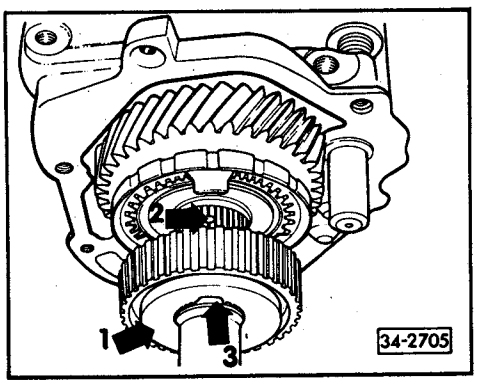
– Fit snap ring onto input shaft behind cylinder roller bearing inner race.

– Push on thrust washer for 6th gear needle bearing.

– Oil needle bearing with gear oil and fit on.

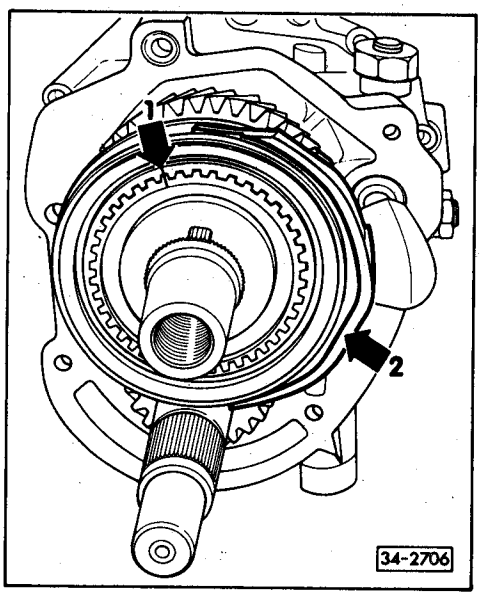
– Push on 6th speed selector gear together with spring and synchronizer ring.

– Heat synchronizer body for 5th and 6th gear to approx. 120°C; drive on as far as the stop, if necessary with insertion sleeve 30 – 100.



◄ ***Note:***

The projecting face (arrow 1) of the synchronizer body points toward the 5th speed selector gear and the oil drilling of the input shaft (arrow 2) must be aligned with the oil groove of the synchronizer body (arrow 3).



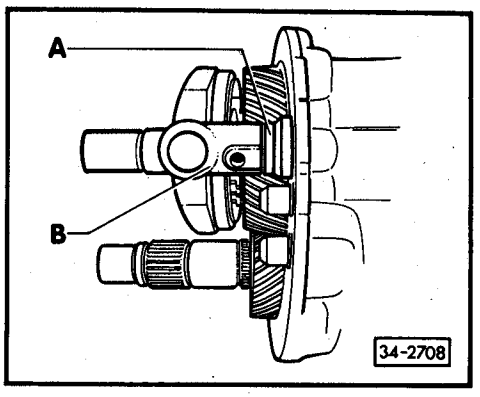
◄ – Fit on 5th and 6th gear sliding sleeve together with selector fork and driver.

Note:

– Align markings of synchronizer body and sliding sleeve (arrow 1).

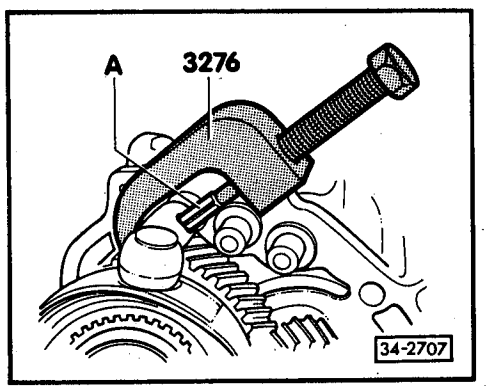
– Rib of selector fork (arrow 2) must be facing 5th speed selector gear.

– Fit driver onto 5th and 6th gear selector rod, ensuring that the hole for the tensioning sleeve is aligned.

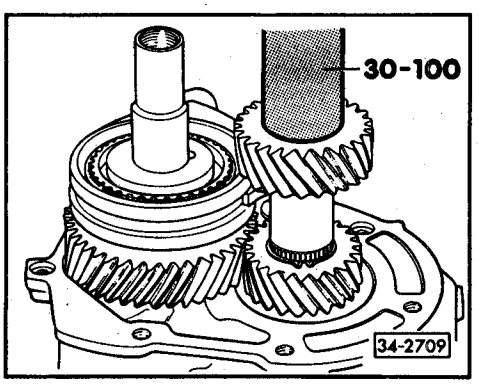


◄ – On **5-speed gearbox**, engaging of 6th gear is prevented by installing the disc –A–.

– The disc is fitted before fitting on the sliding sleeve and pushing on the driver –B–.

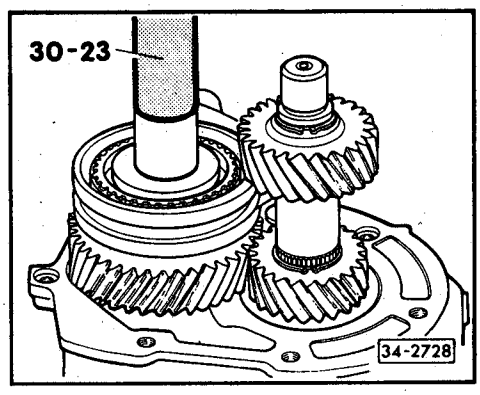


◄ – Press in tensioning sleeve, from 01/92 roll pin –A– with tool 3276.

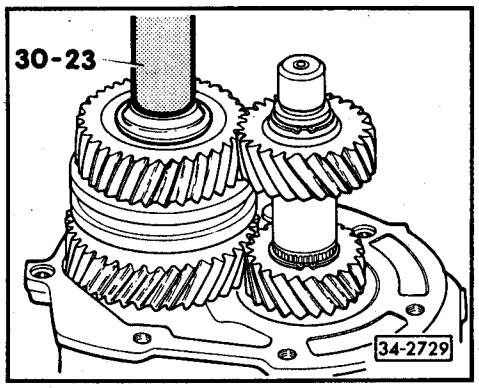


◄ – Heat 5th speed gearwheel to approx. 120°C and fit on; drive home if necessary with inserting sleeve 30 – 100.
Installation position: Shoulder faces 6th speed gearwheel.

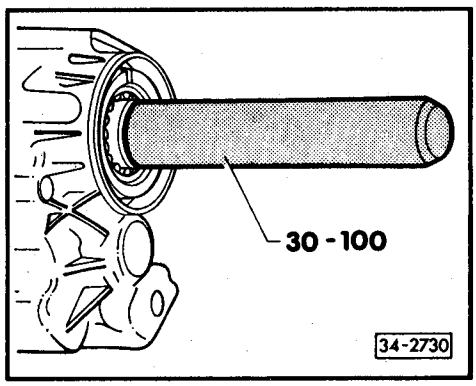
– Fit on circlip.



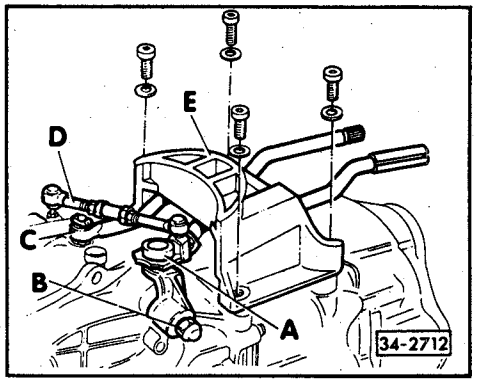
- Drive on inner race for 5th speed selector gear with tool 30–23.
- Oil needle bearing with gear oil and fit on.
- Push on 5th speed selector gear together with spring and synchronizer ring.



- Heat 1st inner race for 4-point bearing to 100°C and fit onto input shaft; drive home if necessary with tool 30–23.
- Insert dowel sleeves into the bearing plate; drive in if necessary.
- Fit on gasket for end cover; always replace.
- Fit on end cover.
  - Servicing end cover ⇒ page 34–77
- Tighten bolt for end cover to **25 Nm**.



- Drive on 2nd inner race for four-point bearing with tool 30–100.
- Tighten internal multi-toothed screw to **150 Nm**; lock input shaft as shown on page 34–31 for this step.
- Press on new oil collecting plate; the large oil drilling ⇒ page 34–30 Fig. 34-2603, and cam must be aligned with the groove in the end cover.
- Press in new closing cover.
- Install complete selector shaft; push on assembly sleeve first of all ⇒ page 34–59.
- Screw in 2 locking bolts for selector shaft and tighten to **25 Nm**.
- Fit on cover for selector shaft; examine rubber ring beforehand and insert bolts with sealant AMV 188 001.2 and tighten to **25 Nm**.
- Check that input and output shaft rotate freely; new parts rotate less freely.
- Check that gears can be shifted freely.

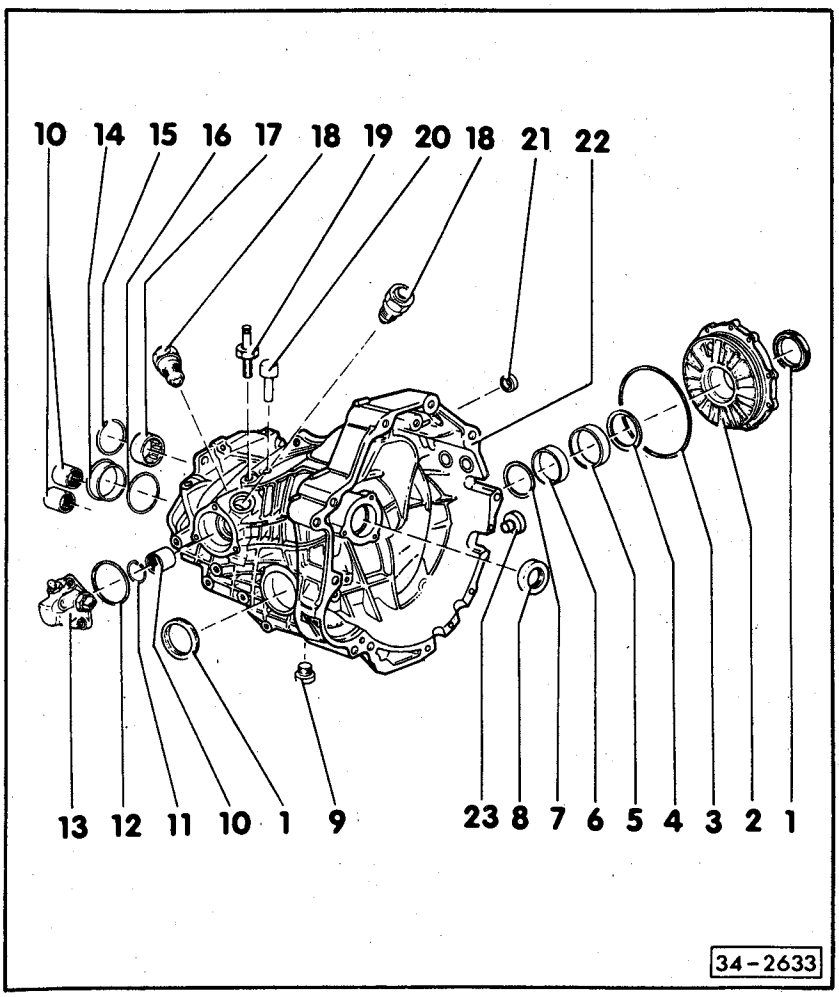


◄ – Fit on selector rod –A– and tighten cap nut –B– to **25 Nm**.

– Install torque rod –C–.

– Fit on connecting rod –D–; check adjustment beforehand ⇒ page 34–11.

– Fit on cable guide –E– for procon-ten system and tighten screws to **40 Nm**.



Servicing gearbox housing

Pay attention to general repair instructions ⇒ page 00–8.

Note:

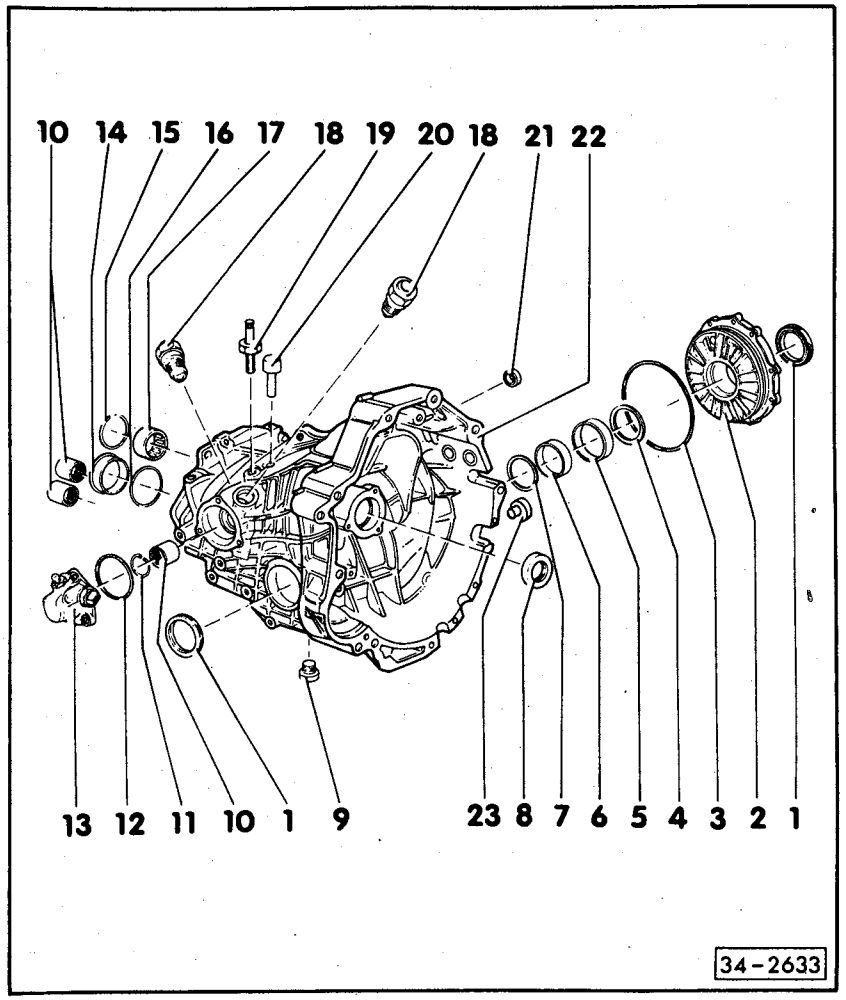
Servicing clutch release mechanism (not shown here) ⇒ page 30–12.

1 – Oil seal for flanged shafts
- Removing ⇒ Fig. 1
- Inserting ⇒ Fig. 2
- Pack space between sealing lips with multi-purpose grease
- Renewing with gearbox installed ⇒ page 39–1

2 – Cover for final drive
- When replacing, adjust crown wheel ⇒ page 39–37

3 – O-ring for final drive cover
- Renew

4 – Shim "S1"
- Note thickness
- List of adjustments ⇒ page 39–22



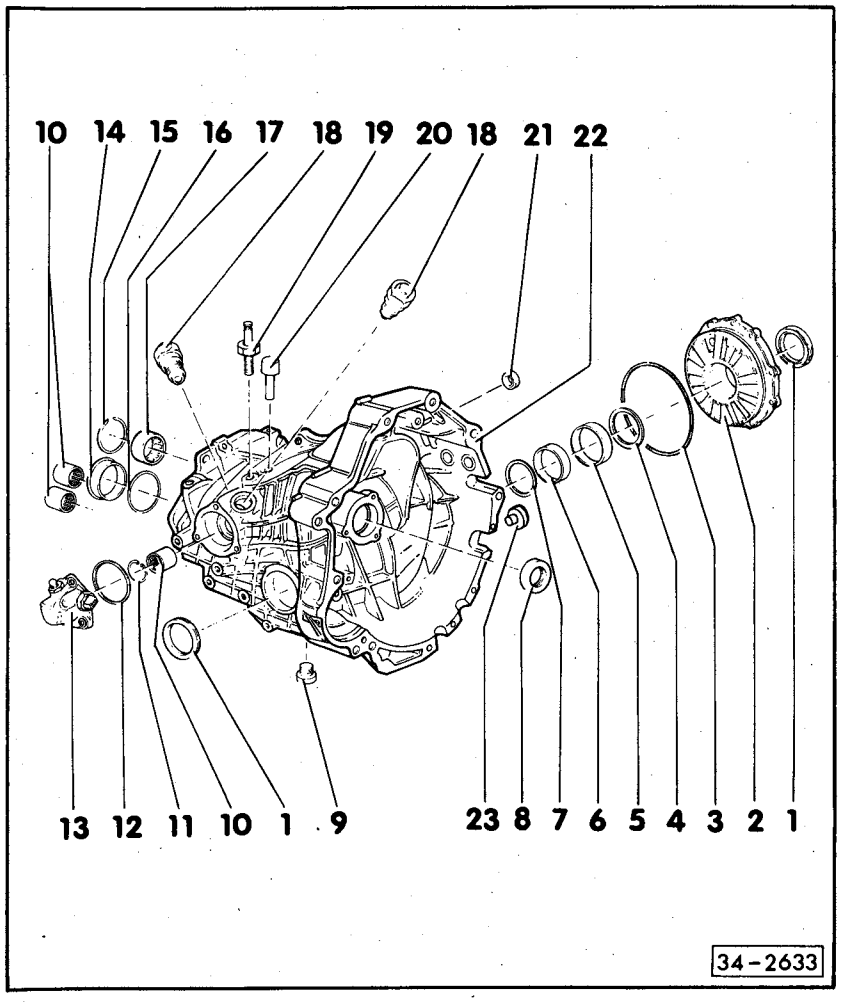
5 – Outer race for large taper roller bearing/differential
- Removing and inserting ⇒ page 39-8
- When replacing, adjust crown wheel ⇒ page 39–37

6 – Outer race for small taper roller bearing/differential
- Removing and inserting ⇒ page 39–6
- When replacing, adjust crown wheel ⇒ page 39–37

7 – Shim "S2"
- Note thickness
- List of adjustments ⇒ page 39–22

8 – Oil seal for input shaft
- Levering out ⇒ Fig. 3
- Inserting ⇒ Fig. 5
- Pack space between sealing lips with multi-purpose grease
- Replacing when gearbox not dismantled ⇒ Fig. 4 and Fig. 5

9 – Oil drain plug, 35 Nm



10 – Spherical sleeve
- Always renew

for selector shaft:
- Removing ⇒ Fig. 6
- Inserting ⇒ Fig. 7

for selector rods:
Same tools as for spherical sleeve for selector shaft
- Knock in sleeve flush

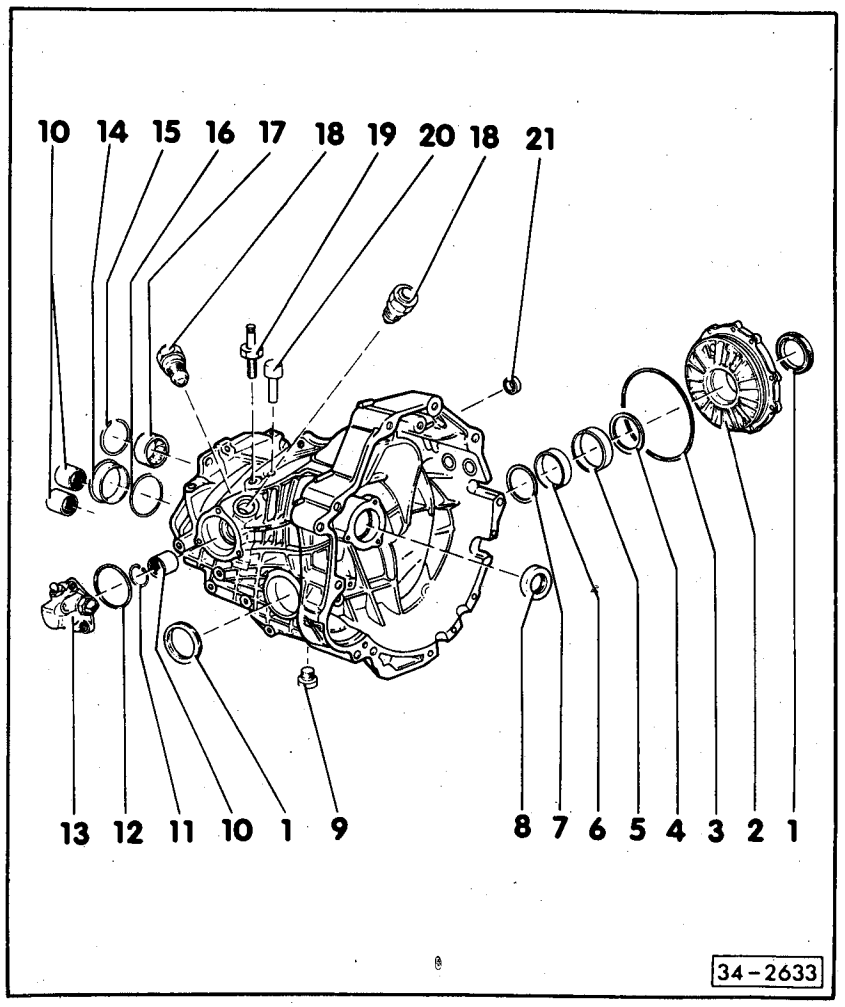
11 – Circlip

12 – O-ring for selector shaft cover
- Renew

13 – Cover for selector shaft
- Removing ⇒ page 34–31
- Installing ⇒ page 34–48
- Removing and installing reverse gear switch ⇒ Fig. 12

14 – Taper roller bearing outer race
- For drive pinion, removing and inserting ⇒ page 35–11
- When replacing: Before removing, determine installation position of drive pinion (actual measurement) ⇒ page 39–24

15 – Circlip
- Removing ⇒ Fig. 16



16 – Shim "S3"
- Note thickness
- List of adjustments ⇒ page 39–22

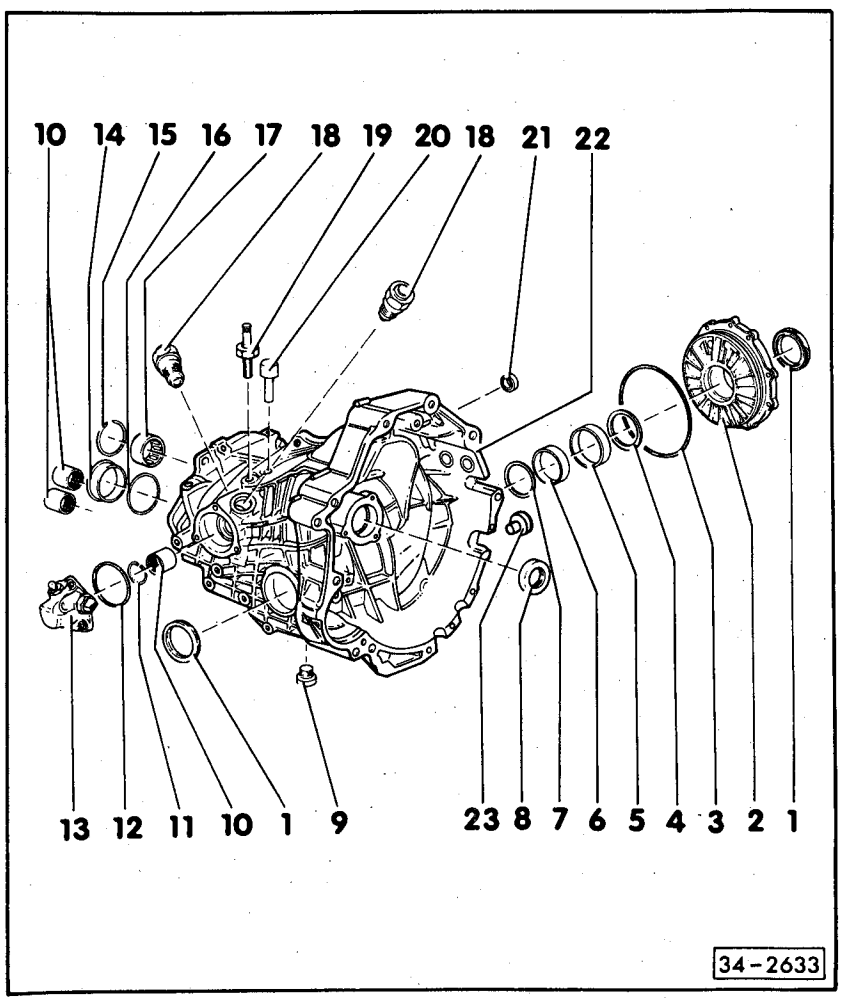
17 – Needle bearing for input shaft
- Removing ⇒ Fig. 13
- Inserting ⇒ Fig. 14
- Insertion depth of needle bearing ⇒ Fig. 15

18 – Locking screw for selector shaft
- Removing ⇒ page 34–31
- Inserting ⇒ page 34–48

19 – Shoulder screw
- Tightening torque – **40 Nm**

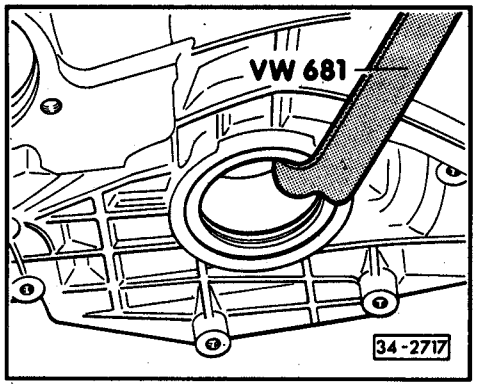
20 – Breather
- Pay attention to insertion depth ⇒ Fig. 11

21 – Oil seal for selector shaft
- Removing ⇒ Fig. 8
- Inserting ⇒ Fig. 9
- Renewing seal when gearbox removed but not dismantled ⇒ Fig. 10



22 – Gearbox housing
- When replacing, pay attention to list of adjustments ⇒ page 39–22

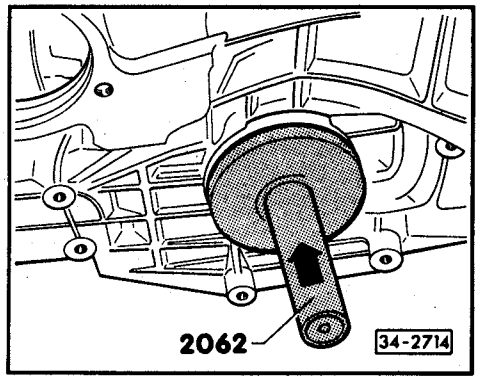
23 – Magnet
- Clean
- When replacing gearbox housing, insert by analogy ⇒ page 34–78



◄ **Fig. 1 Removing oil seal for flanged shaft**

Note:

Oil seal on right side of gearbox (illustrated) and left side removed in the same manner.

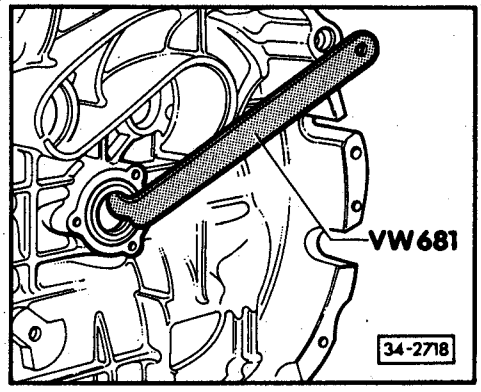


◄ **Fig. 2 Inserting oil seal for flanged shaft**

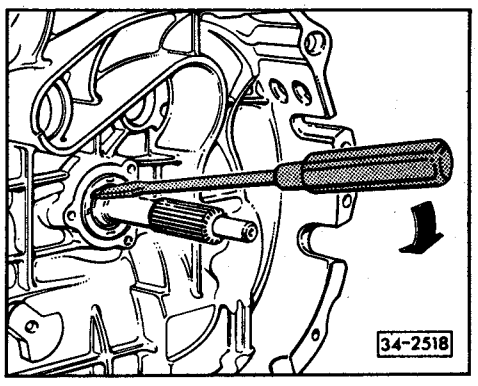
– Insertion depth = 5.5 mm

Note:

Oil seal on right side of gearbox (illustrated) and on left side inserted in the same manner.



◄ **Fig. 3 Levering out oil seal for input shaft**



◄ **Fig. 4 Removing oil seal for input shaft when gearbox not dismantled**

– Carefully lever out seal with screwdriver.

Important!

Do not damage running surface for shaft seal on input shaft.

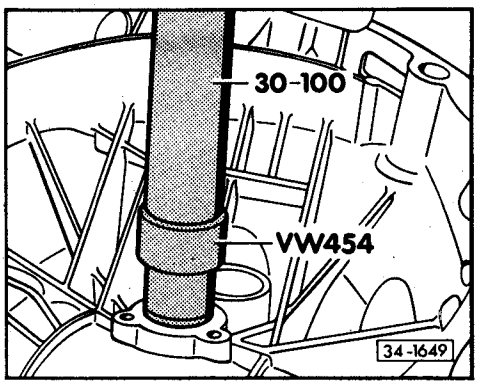


Fig. 5 Inserting oil seal for input shaft

- Pack space between sealing and dust lips with multi-purpose grease.
- Insertion depth 3.5 mm

Note:

If gearbox not dismantled, fit an insulating hose tightly onto input shaft and then press in oil seal.

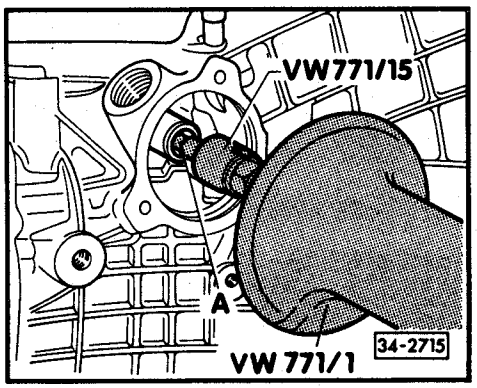


Fig. 6 Removing spherical sleeve for selector shaft

- Take off circlip.

A – Internal extractor (commercially available), e.g. Kukko 21/2

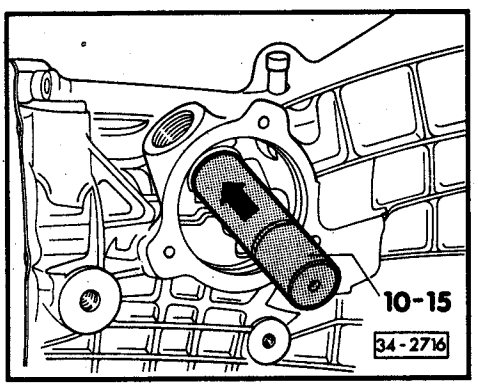


Fig. 7 Inserting spherical sleeve for selector shaft

- Drive in as far as the stop.
- Insert circlip.

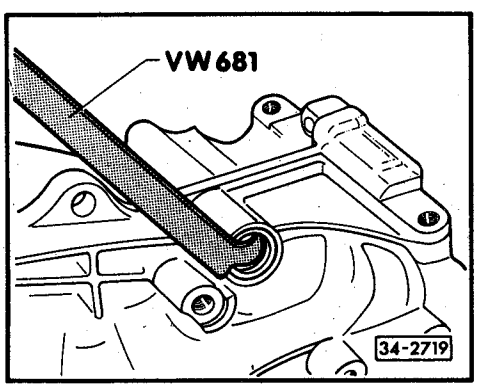
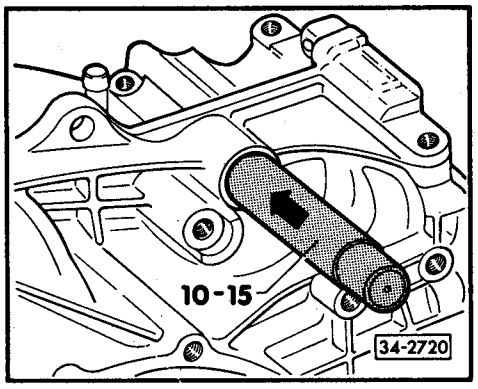
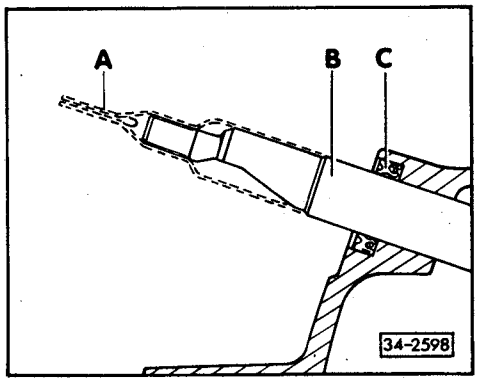


Fig. 8 Removing oil seal for selector shaft



◄ **Fig. 9 Inserting oil seal for selector shaft**

– Drive into housing as far as the stop.



◄ **Fig. 10 Replacing oil seal for selector shaft when gearbox removed but not dismantled**

– Carefully lever out shaft seal –C– with small screwdriver.

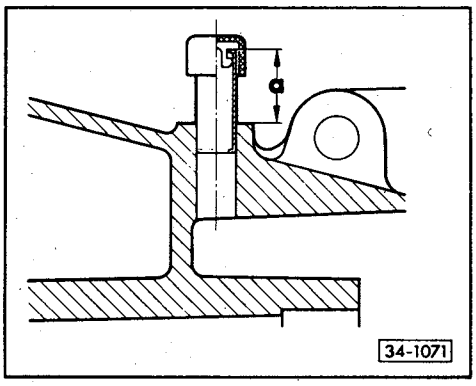
– Push assembly sleeve –A– Part N° 01E 311 120 over selector shaft –B–.

– Pack space between sealing and dust lips with multi-purpose grease.

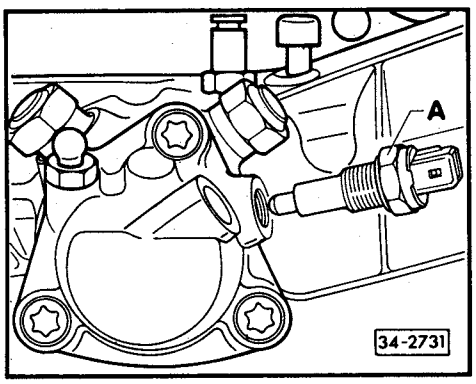
– Drive new shaft seal into housing as far as the stop with tube section VW 423.

Note:

Always use assembly sleeve –A– for installing shaft seal –C–.

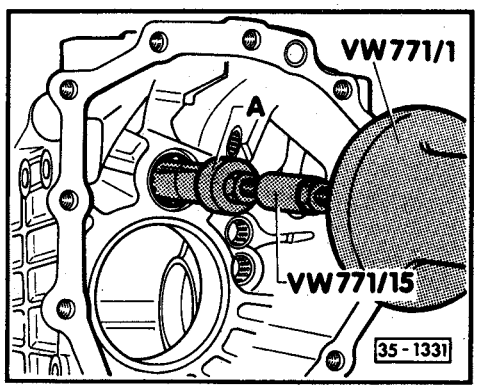


◄ **Fig. 11 Insertion depth of breather sleeve "a" = 21 mm**



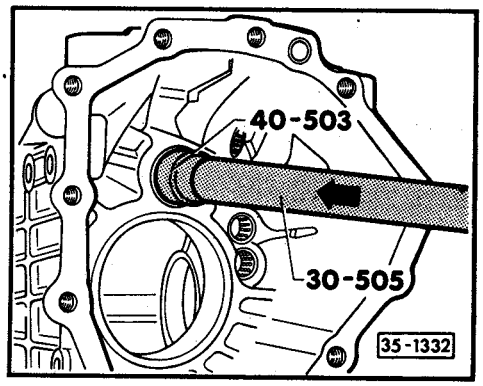
◄ **Fig. 12 Removing and installing reversing light switch**

A – Switch, **20 Nm**



◄ **Fig. 13 Removing needle bearing from gearbox housing**

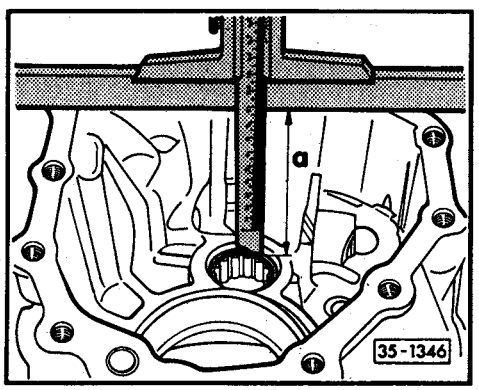
A – Internal extractor 30 – 37 mm, e.g. Kukko 21/5.



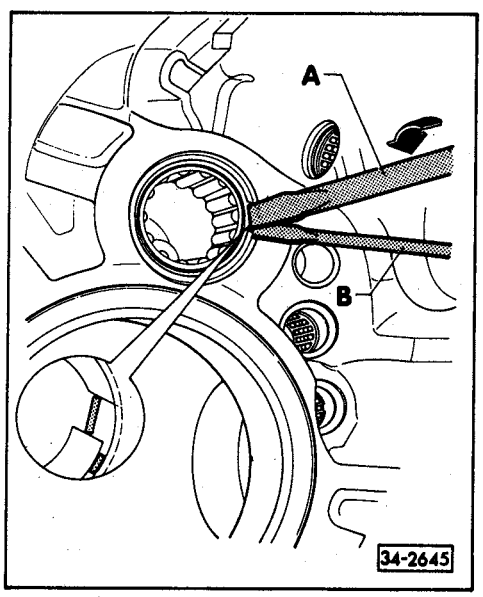
◄ **Fig. 14 Inserting needle bearing into gearbox housing**

Installation position:
The inscription on the bearing faces the insertion drift.

Insertion depth ⇒ Fig. 15.

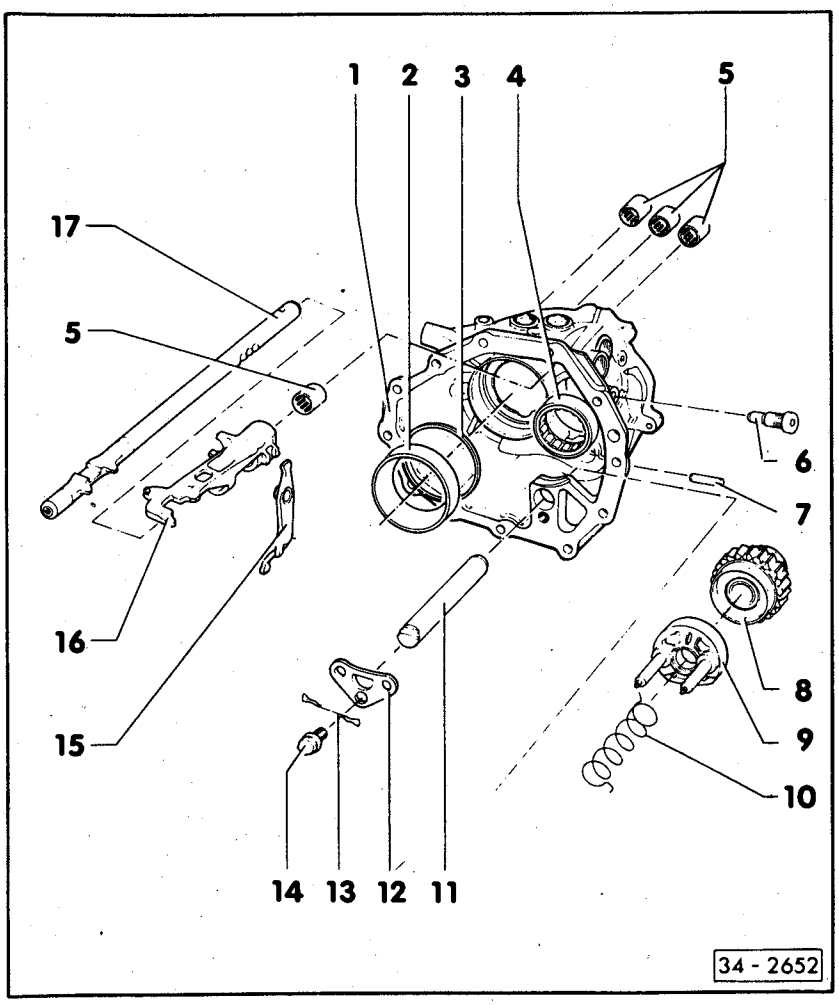


◄ **Fig. 15 Insertion depth of needle bearing "a" = 105 mm**



◄ **Fig. 16 Removing circlip**

- Lift circlip out of the groove by turning one end of circlip with screwdriver –A–.
- Fix this end with screwdriver –B–.
- Lever ring out further by gripping with screwdriver –A–.



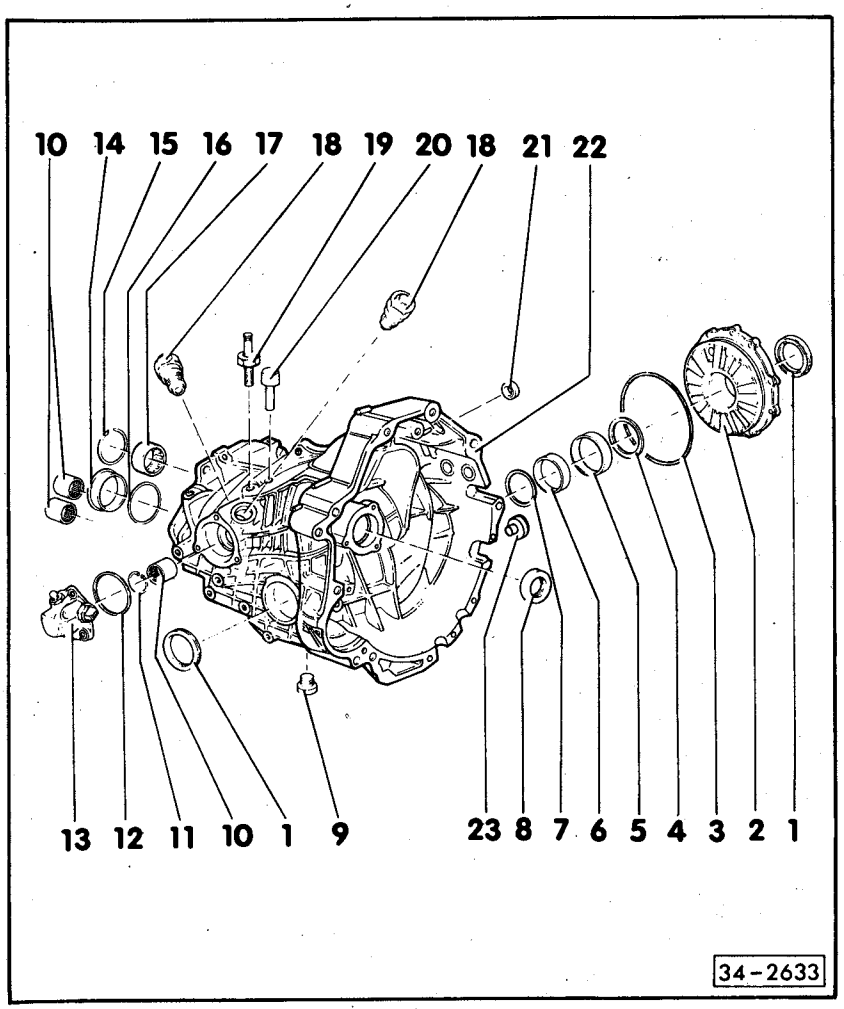
Servicing bearing plate

1 – Bearing plate
- When replacing, re-determine shim "S4" ⇒ page 34–72

2 – Taper roller bearing outer race for drive pinion
- Removing ⇒ page 35–11
- Inserting ⇒ page 35–11

3 – Shim "S4"
- List of adjustments ⇒ page 39–22
- Re-determining ⇒ page 34–72

4 – Cylinder roller bearing for input shaft
- Removing ⇒ Fig. 5
- Inserting ⇒ Fig. 6



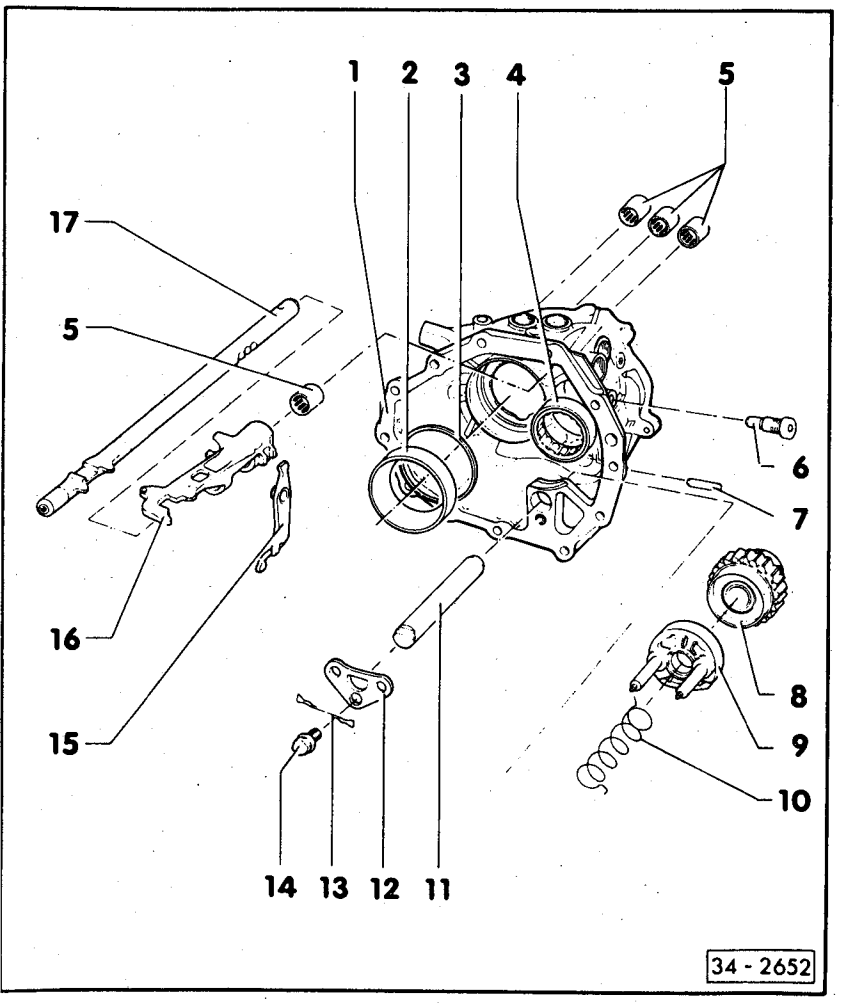
5 – Spherical sleeves for selector rods
- Removing and inserting ⇒ Fig. 1
- Always renew

6 – Relay lever screw, 35 Nm

7 – Straight pin 7 x 28
- Press in flush

8 – Reverse selector gear
- Replace complete
- Removing ⇒ page 34–36
- Installing ⇒ page 34–37

9 – Synchronizer ring for reverse gear with locking pins
- Check for wear ⇒ Fig. 2
- **Installation position:** Position flat side on synchronizer ring to face input shaft ⇒ page 34–37



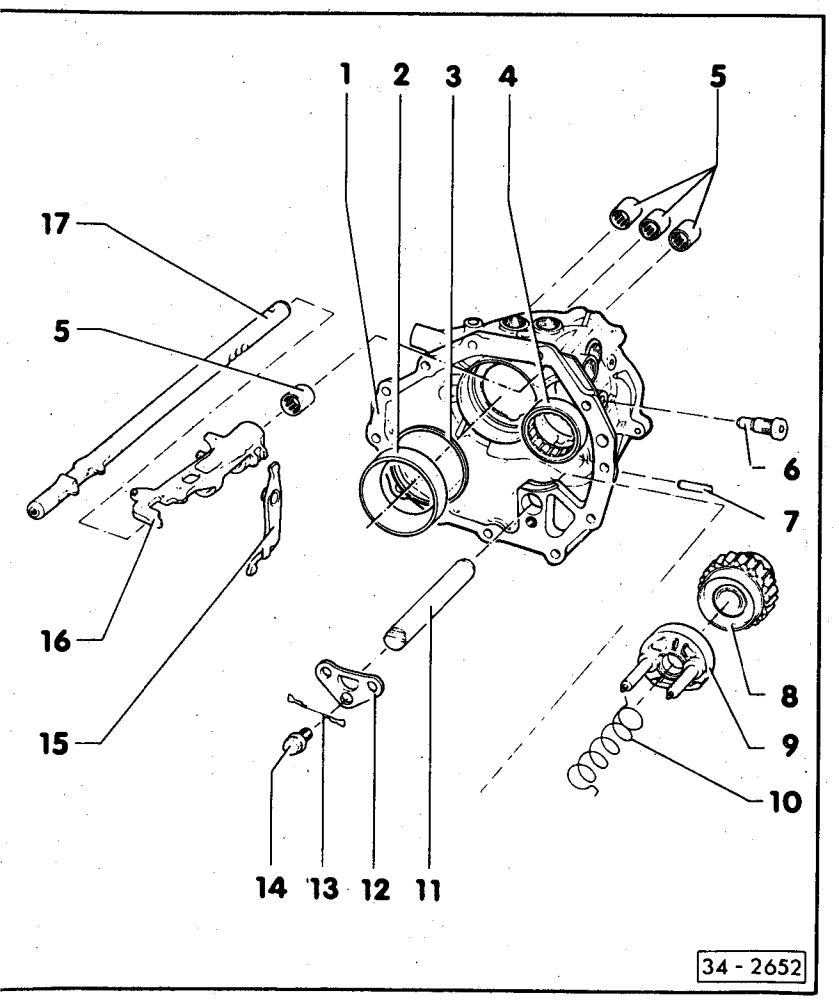
10 – Compression spring
- **Installation position:** Attach single angled end into recess on synchronizer ring. Turn double angled end to the left and insert into the opening in the bearing plate ⇒ page 34–38

11 – Shaft for reverse selector gear
- Removing ⇒ page 34–36
- Inserting ⇒ page 34–38

12 – Retaining plate
- **Installation position:** The radii of the holes for the locking pins of the synchronizer ring face the bearing plate ⇒ page 34–38

13 – Spring clasp

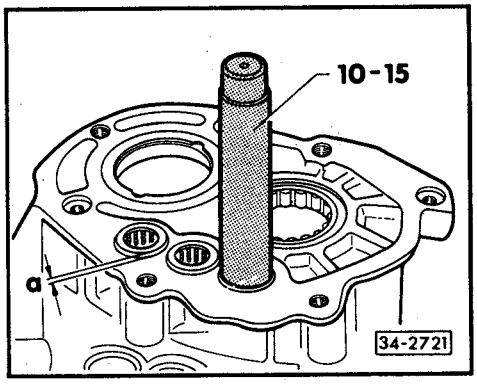
14 – Hexagon bolt with collar, 25 Nm
- Always renew



15 – Reverse gear relay lever
- Removing ⇒ page 34–36
- Installing ⇒ page 34–37

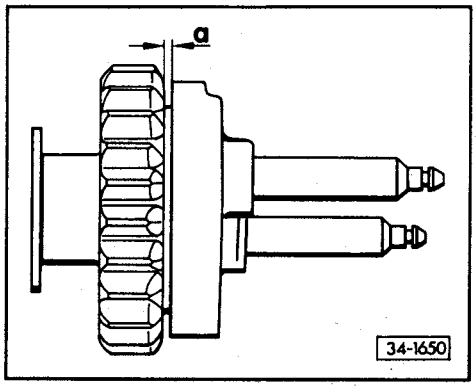
16 – Reverse gear driver
- Removing spherical sleeve ⇒ Fig. 3
- Inserting spherical sleeve ⇒ Fig. 4

17 – 5th and 6th gear selector rod
- Renew only complete with driver ⇒ page 34–24



◄ **Fig. 1 Removing and inserting spherical sleeves for selector rods**

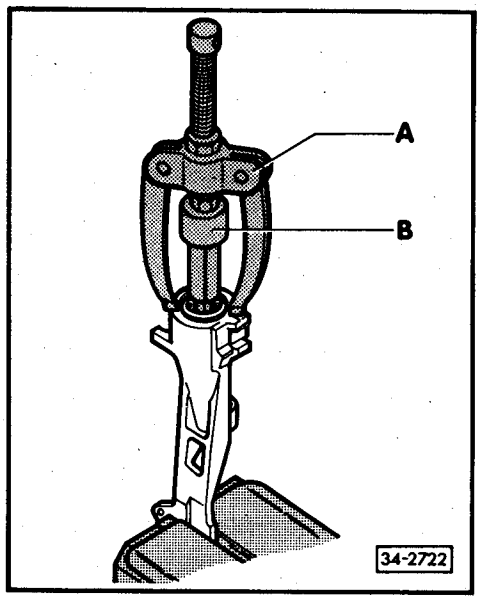
Insertion depth "a" = 2.5 mm



◄ **Fig. 2 Checking synchronizer ring**

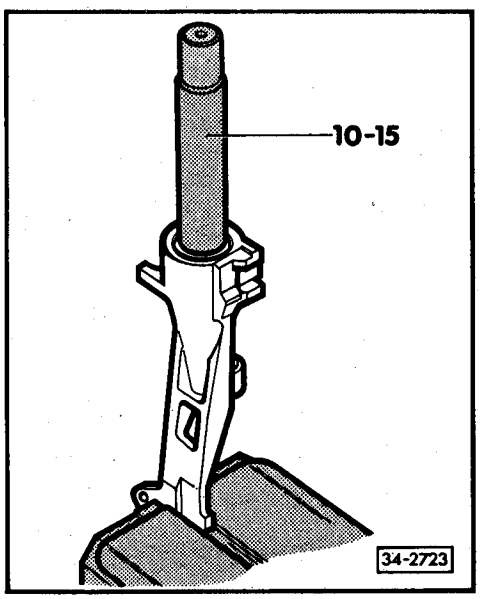
Press synchronizer ring onto the taper of the gear-wheel and measure gap "a" with a feeler gauge.

Gap "a"	Installed size (new)	Wear limit
Reverse gear	0.75 – 2.3 mm	0.2 mm

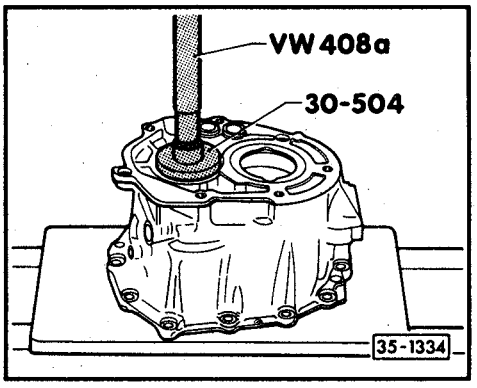


◄ **Fig. 3 Removing spherical sleeve from reverse gear driver**

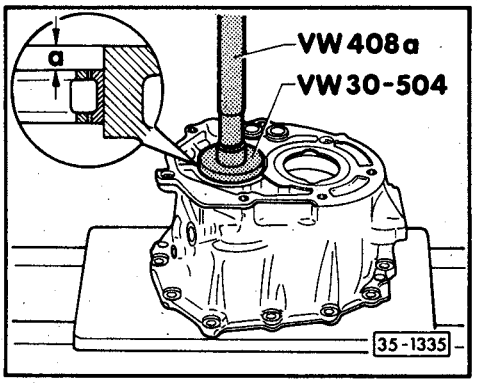
A – Counter-support, e.g. Kukko 22/1
B – Internal extractor, e.g. Kukko 21/3



◄ **Fig. 4 Inserting spherical sleeve flush into reverse gear driver**

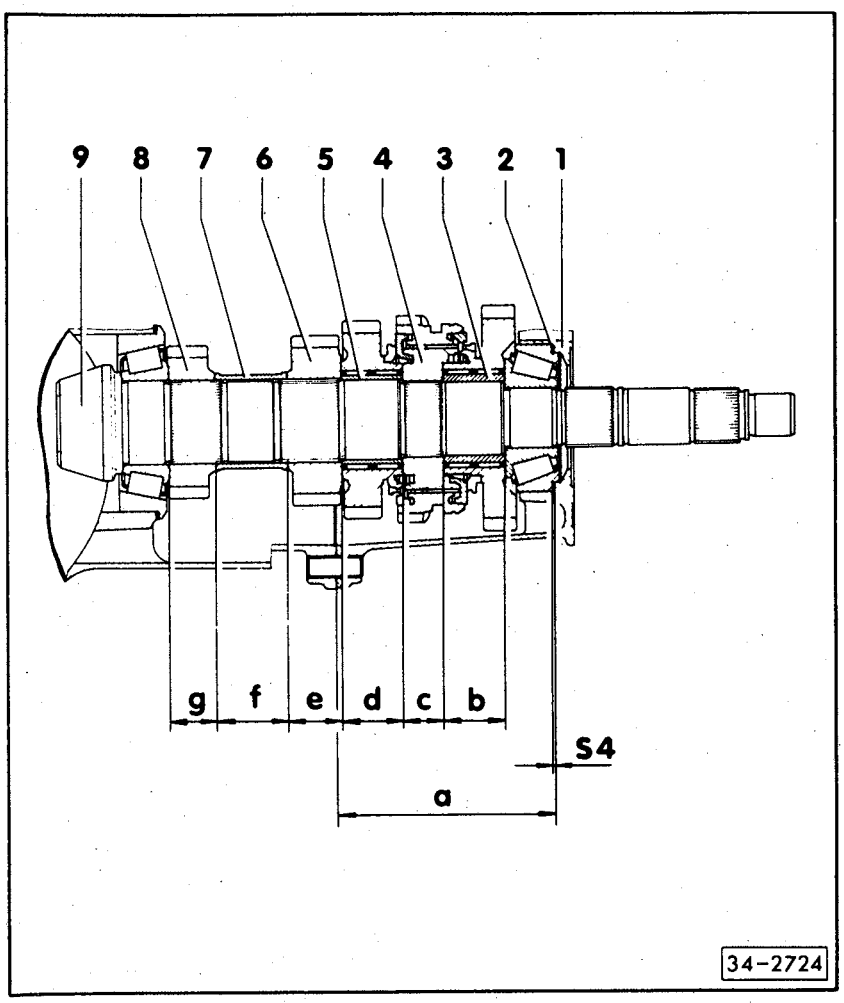


◄ Fig. 5 Pressing cylinder roller bearing outer race out of bearing plate



◄ Fig. 6 Pressing cylinder roller bearing outer race into bearing plate

Insertion depth "a" = 9 mm



Re-determining shim "S4"

This adjustment is necessary if bearing plate, inner race for needle bearing of 1st speed selector gear, synchronizer body for 1st and 2nd gear, inner race for needle bearing of 2nd speed selector gear, 3rd speed gearwheel, spacer sleeve, 4th speed gearwheel are replaced.

This adjustment re-creates the preload of the taper roller bearings for the drive pinion.

1 – Bearing plate

2 – Shim "S4"

3 – Inner race for needle bearing of 1st speed selector gear

4 – 1st and 2nd gear synchronizer body

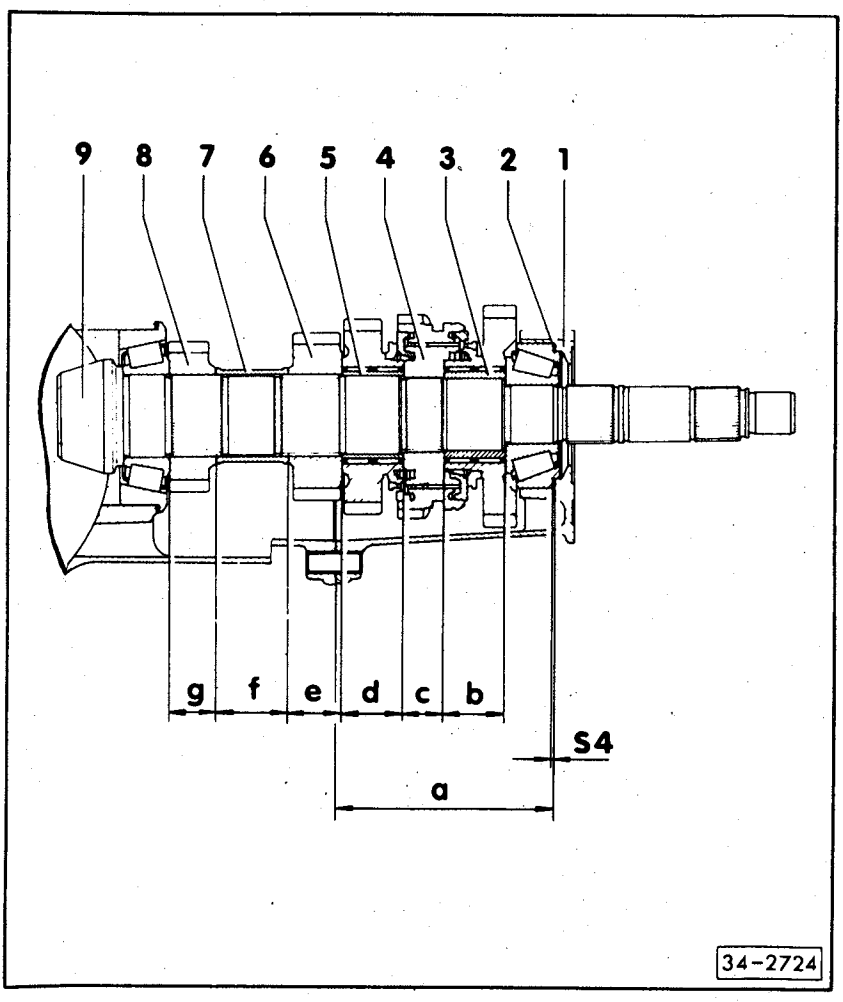
5 – Inner race for needle bearing of 2nd speed selector gear

6 – 3rd speed gearwheel

7 – Spacer sleeve

8 – 4th speed gearwheel

9 – Drive pinion



Size "a" = Housing depth of bearing plate

Size "b" = Length of inner race of needle bearing for 1st speed selector gear

Size "c" = Length of hub of 1st and 2nd gear synchronizer body

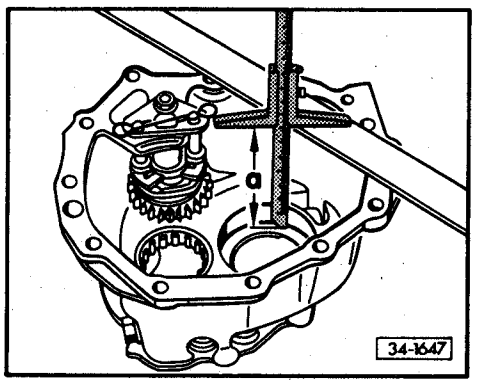
Size "d" = Length of inner race of needle bearing for 2nd speed selector gear

Size "e" = Length of 3rd speed selector gear

Size "f" = Length of spacer sleeve

Size "g" = Length of 4th speed gear-wheel

Size "S4" = Thickness of shim S4



A – Replacing bearing plate

◄ – Measure the housing depth "a" of the old and new bearing plate and calculate the difference.

Example:

Old bearing plate	
Housing depth "a" =	118.40 mm
New bearing plate	
Housing depth "a" =	118.65 mm
Difference =	0.25 mm

If the **new** bearing plate is deeper – install **thicker** "S4".

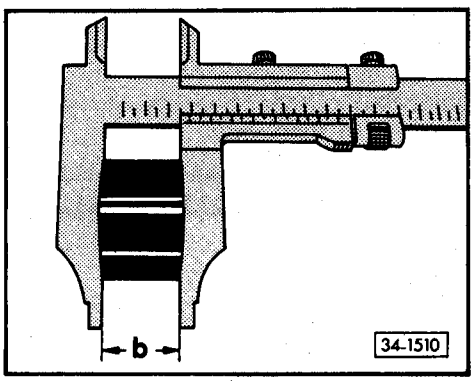
If the **old** bearing plate is deeper – install **thinner** "S4".

Example:

Previous shim	0.95 mm
Difference	+ 0.25 mm
New shim "S4"	1.20 mm

Shims available as service parts:

Part N°	Thickness (mm)
01 E 311 393	0.45
01 E 311 393 A	0.50
01 E 311 393 B	0.55
01 E 311 393 C	0.60
01 E 311 393 D	0.65
01 E 311 393 E	0.70
01 E 311 393 F	0.75
01 E 311 393 G	0.80
01 E 311 393 H	0.85
01 E 311 393 I	1.25



B – Replacing needle bearing for 1st gear

◄ – Measure length "b" of inner race of old and new needle bearing and calculate difference.

Example:

Old inner race:	"b" = 33.35 mm
New inner race:	"b" = 33.40 mm
Difference	= 0.05 mm

If the **new** inner race is longer – install appropriately **thinner** "S4".

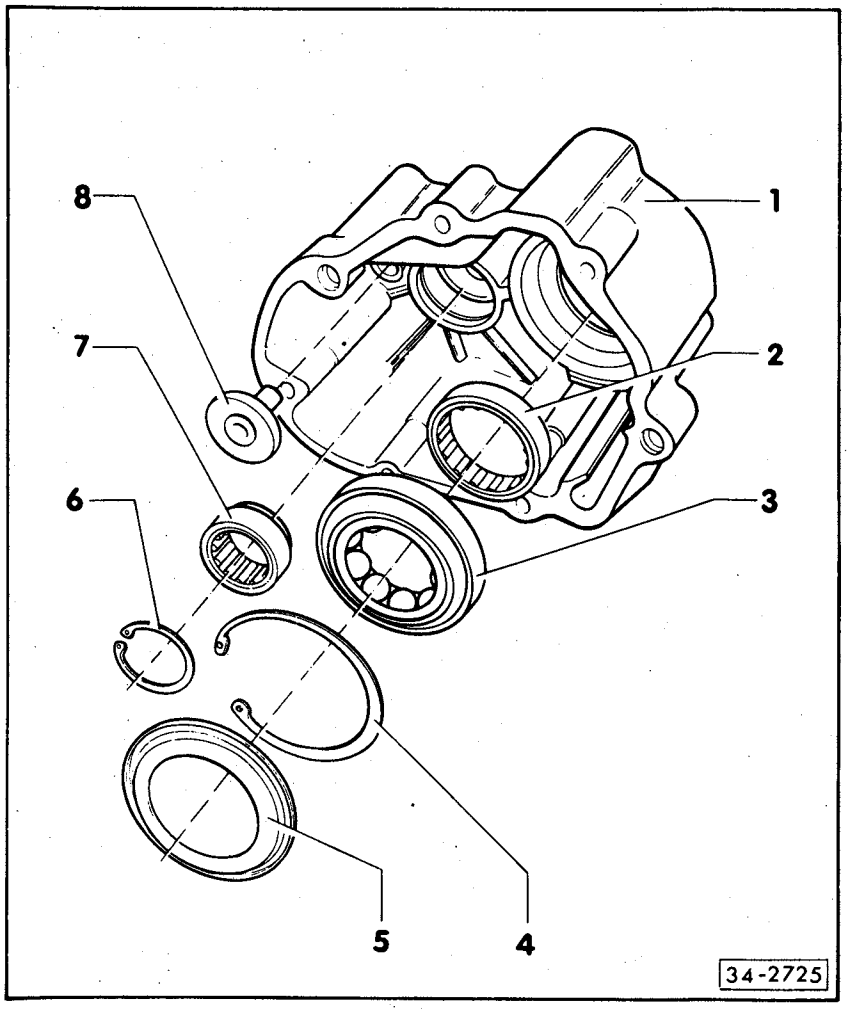
If the **old** inner race is longer – install appropriately **thicker** "S4".

Shims available as service parts ⇒ page 34–72.

C – Replacement of parts 4 to 8 ⇒ page 34–72

– Calculate the difference in size between new and old part in the same manner for the sizes "c" to "g" ⇒ page 34–73, and determine the shim "S4".

D – Replacing only drive pinion (drive set) ⇒ page 39–22



Servicing end cover

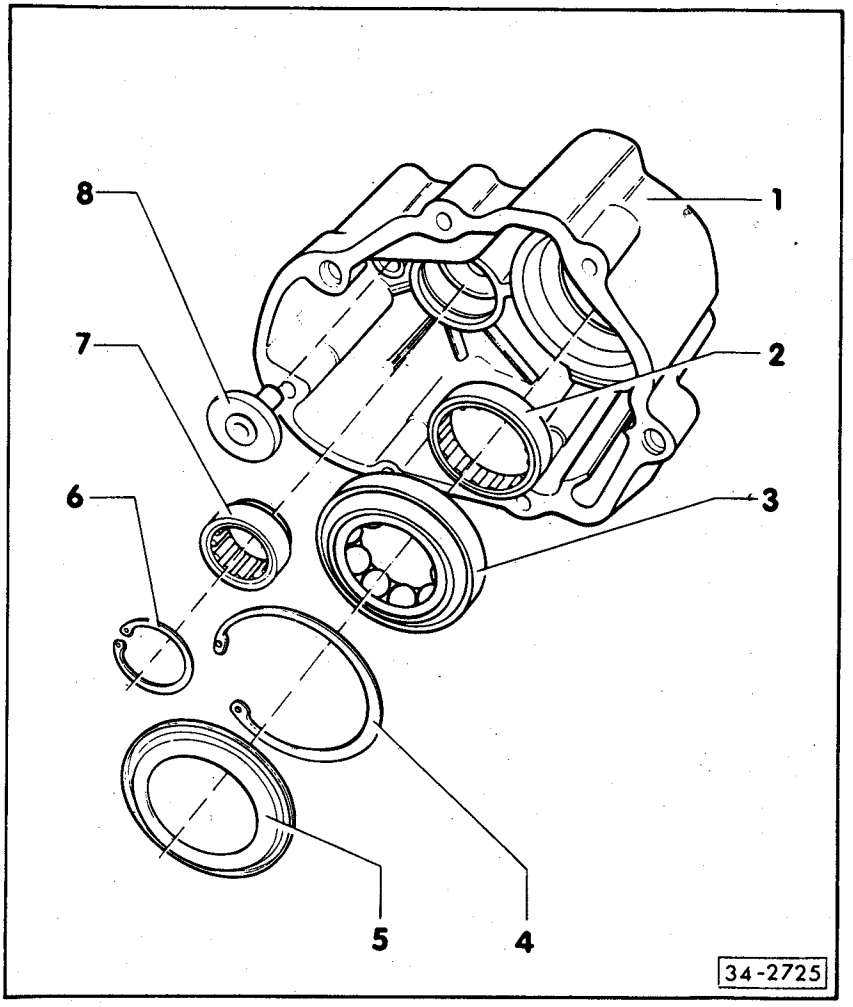
1 – End cover

2 – Cylinder roller bearing/input shaft
- Removing ⇒ Fig. 1
- Inserting ⇒ Fig. 2

3 – Four-point bearing/input shaft
- Removing ⇒ Fig. 3
- Installing ⇒ Fig. 4

4 – Circlip
- Determining circlip ⇒ page 34–80
- Installation position ⇒ Fig. 4

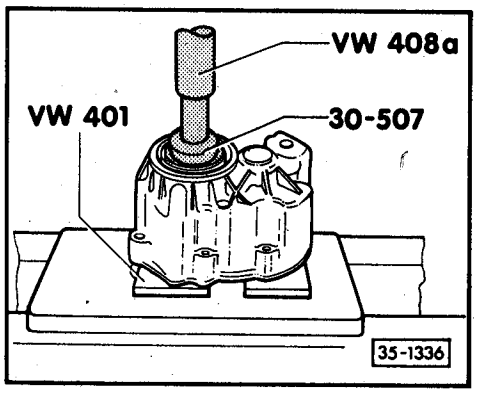
5 – Baffle plate
- Always renew
- Removing ⇒ Fig. 3
- Caulking when replacing four-point bearing ⇒ Fig. 5
- Caulking when replacing end cover ⇒ Fig. 6



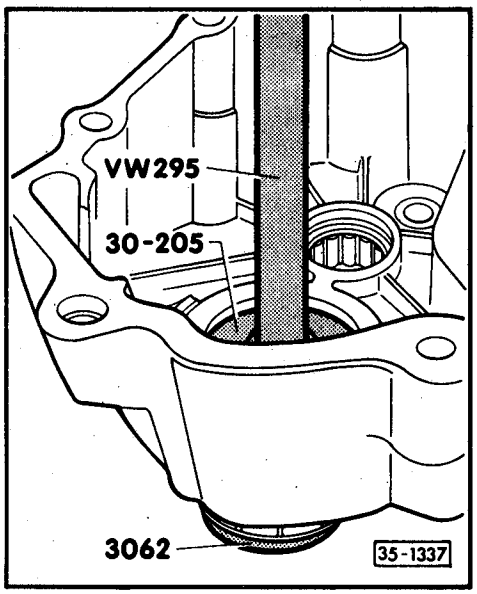
6 – Circlip

7 – Drive pinion roller sleeve
- Is damaged when removed
- Always replace
- Removing ⇒ Fig. 7
- Inserting ⇒ Fig. 8
- Installation position ⇒ Fig. 9

8 – Magnet
- Clean
- Knock in, e.g. with tool VW 408 a



◄ **Fig. 1 Pressing cylinder roller bearing out of end cover**

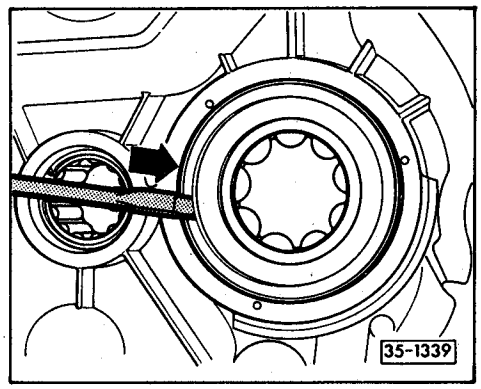


◄ **Fig. 2 Pressing cylinder roller bearing into end cover**

– Fit tool 30-205 onto the bearing with recess facing up.

Important!

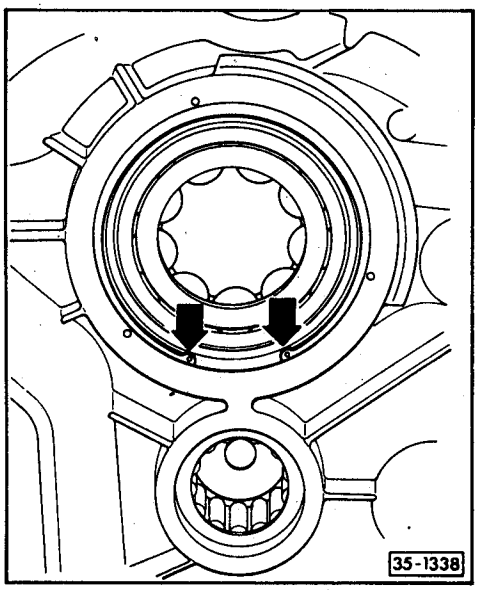
Always place thrust washer 3062 below cylinder roller bearing at collar/stop.



◄ **Fig. 3 Removing input shaft four-point bearing from end cover**

– Position screwdriver as shown, knock into baffle plate (arrow) and lever out.

– Take off circlip and remove bearing; mark off caulking indentations if necessary.



◄ **Fig. 4 Installing input shaft four-point bearing into end cover**

– Position of circlip ends in end cover (arrows).

Determining circlip for four-point bearing

Note:

The thickness of the circlip must be re-determined when replacing the bearing or the end cover.

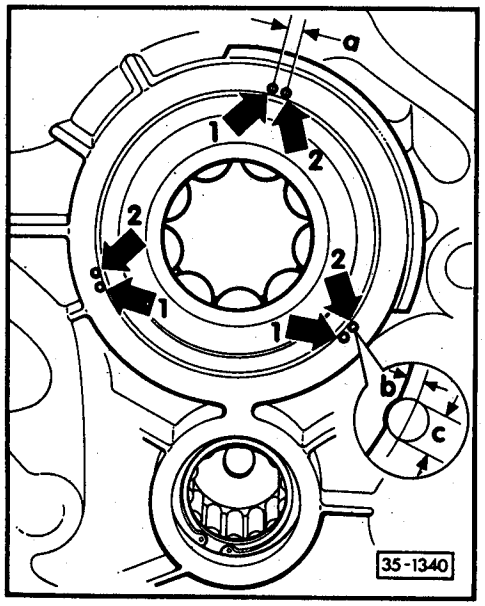
Calculate size of circlip as follows:

– Press outer race of four-point bearing against stop.

– Calculate the thickest circlip which can still just be inserted. The end play must not be more than 0.08 mm.

– Determine circlip from table.

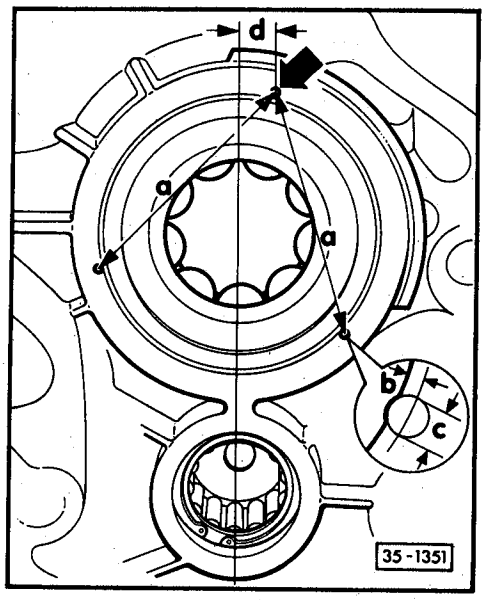
Thickness (mm)	Part n°
2.55	N 905 140.01
2.60	N 905 140.02
2.65	N 905 140.03
2.70	N 905 140.04



◄ **Fig. 5 Caulking baffle plate when replacing four-point bearing**

– Insert baffle plate and perform second caulking (arrows 2) at a distance "a" = 5 mm to initial caulking (arrows 1) with drift (ball diameter = 5 mm).

"b" = 2 mm
"c" = 3 mm



◄ **Fig. 6 Caulking baffle plate when replacing end cover**

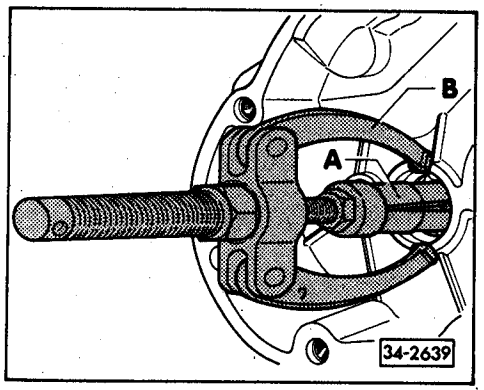
– Insert baffle plate.

– Use drift with spherical end (ball diameter = 5 mm) for caulking.

– Caulk first point (arrow) at a distance "d" = 10 mm from the connecting line of the shaft centres, noting

"b" = 2 mm
"c" = 3 mm.

– Caulk second and third point likewise at a distance "a" = 70 mm.

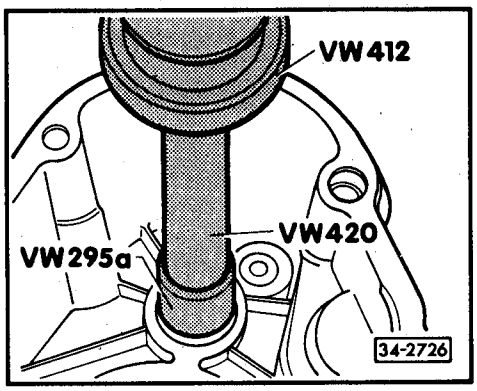


◄ **Fig. 7 Removing drive pinion roller sleeve from end cover**

– Take off circlip.

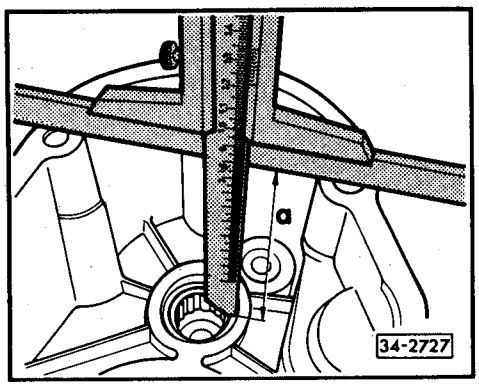
A – Internal extractor 22 – 28 mm
e.g. Kukko 21/4

B – Counter-support
e.g. Kukko 22/1



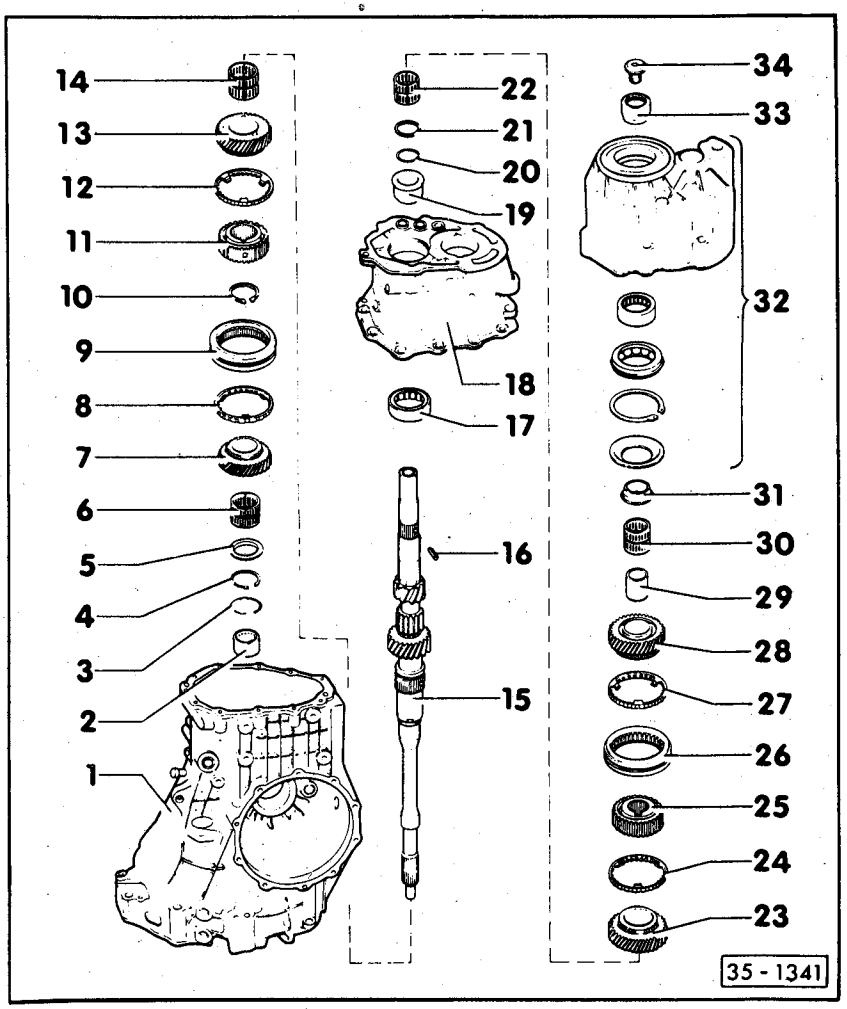
◄ **Fig. 8 Inserting drive pinion roller sleeve into end cover**

– Pay attention to insertion depth ⇒ Fig. 9.



◄ **Fig. 9 Installation position of drive pinion roller sleeve "a" = 98.6 mm**

– Insert circlip.



Dismantling and assembling input shaft

Note:

Pay attention to Technical Data when installing new gearwheels.
Pay attention to repair instructions ⇒ page 00–8.

1 – Gearbox housing

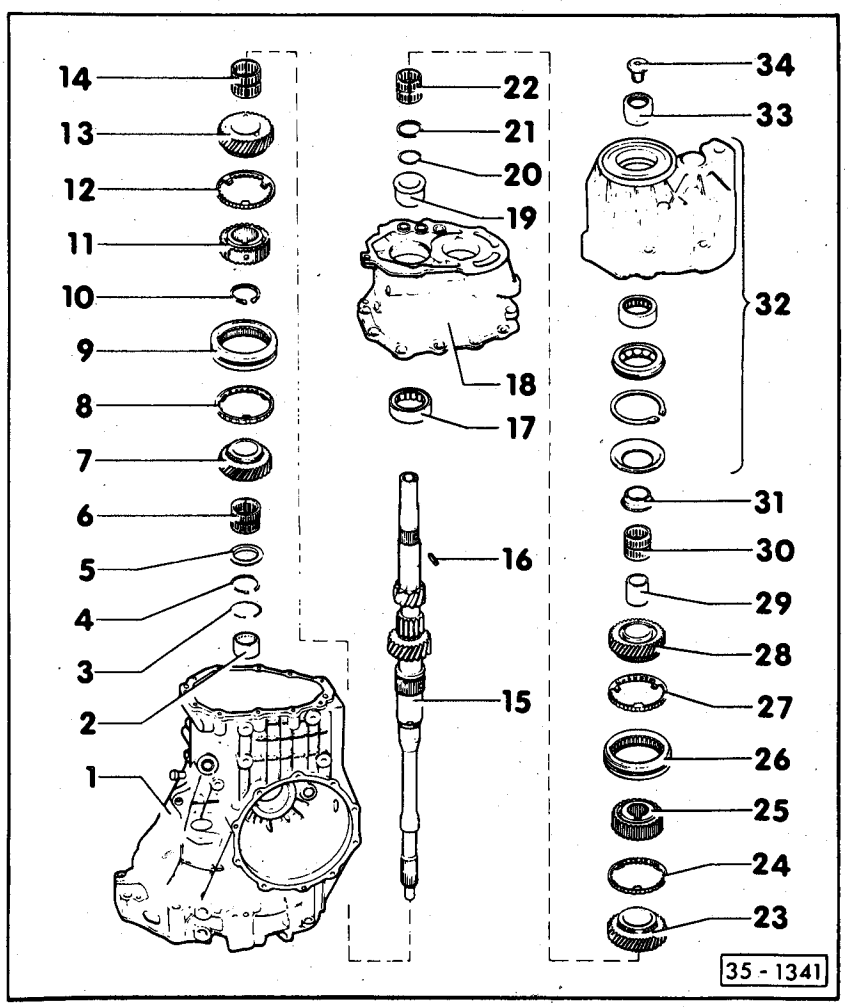
2 – Needle bearing for input shaft
- Removing and installing ⇒ page 34–54

3 – Needle bearing circlip
⇒ page 34–53

4 – Input shaft circlip

5 – Thrust washer

6 – 4th gear needle bearing
- Lubricate with gear oil before installing



7 – 4th speed selector gear
- Insert spring before installing ⇒ Fig. 1

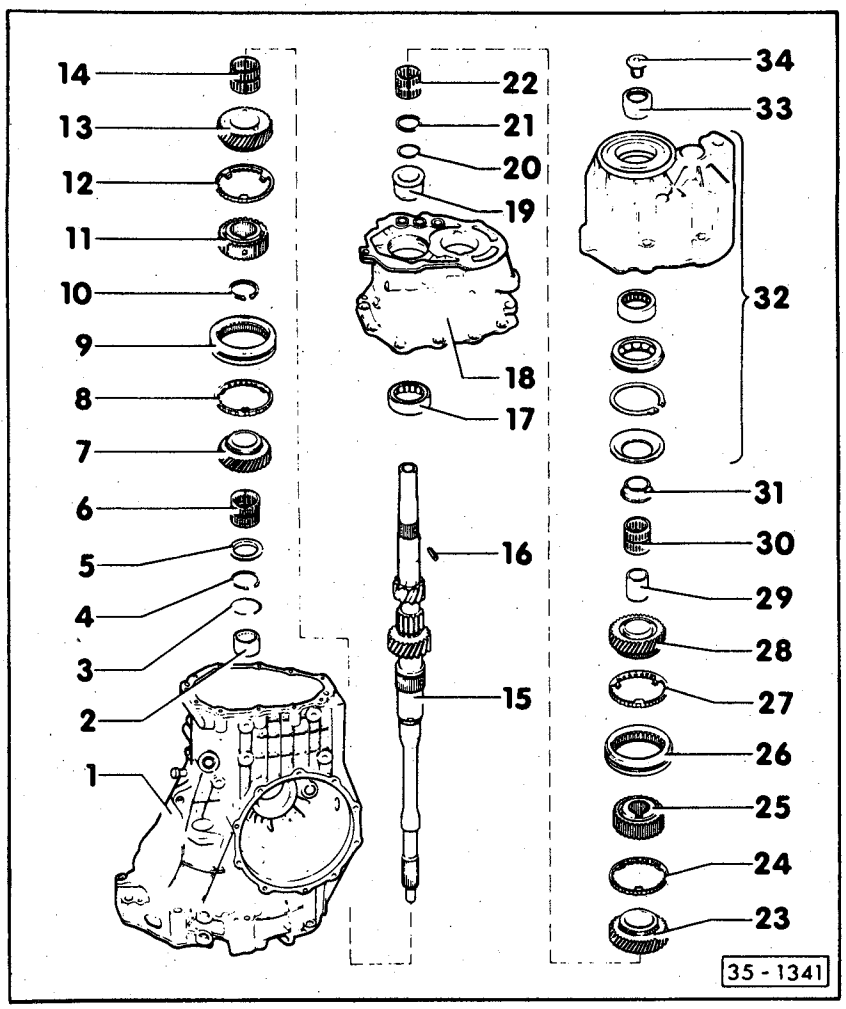
8 – 4th gear synchronizer ring
- Check for wear ⇒ Fig. 2

9 – Sliding sleeve

10 – Circlip
- Re-determine thickness when replacing synchronizer body ⇒ Fig. 3

11 – 3rd and 4th gear synchronizer body
- Installation position of synchronizer body ⇒ Fig. 4
- Pressing off ⇒ Fig. 5
- Pressing on ⇒ Fig. 6

12 – 3rd gear synchronizer ring
- Check for wear ⇒ Fig. 2



13 – 3rd speed selector gear
- Insert spring before installing ⇒ Fig. 1

14 – Needle bearing for 3rd gear
- Lubricate with gear oil before installing

15 – Input shaft

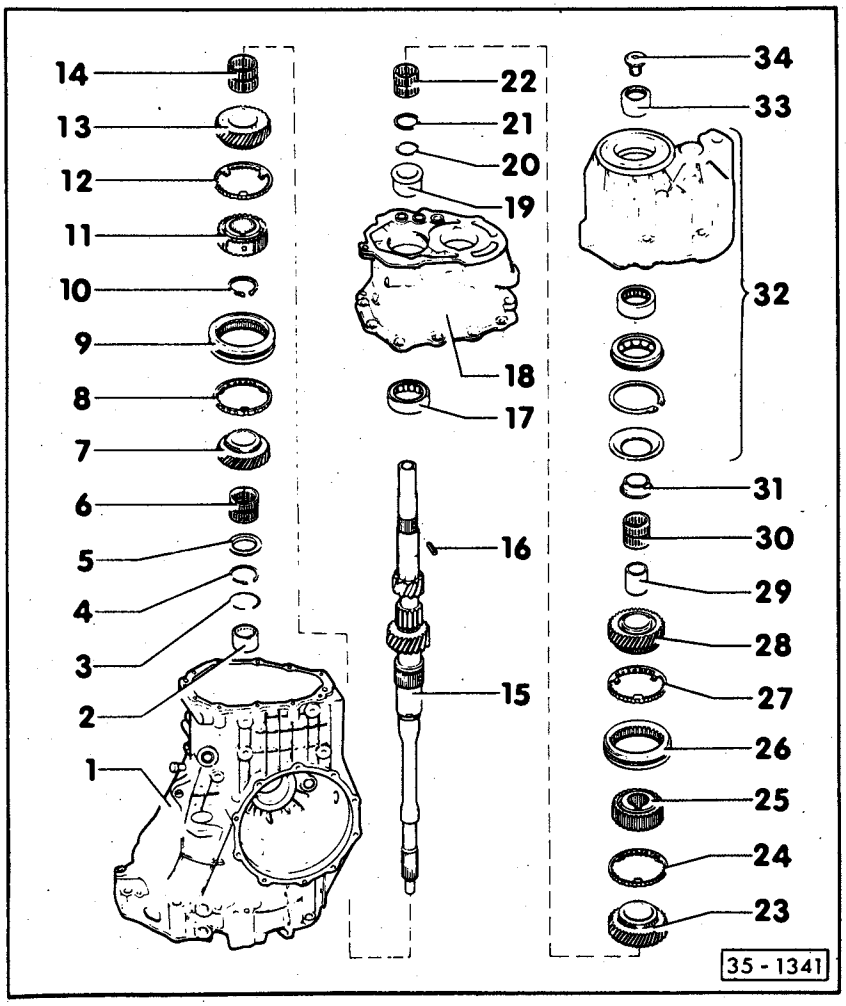
16 – Tensioning sleeve
- Insert when replacing input shaft ⇒ Fig. 7

17 – Cylinder roller bearing for input shaft
⇒ page 34–63

18 – Bearing plate
⇒ page 34–63

19 – Inner race for cylinder roller bearing

20 – Snap ring



21 – Thrust washer for needle bearing of 6th gear – not fitted to 5-speed gearbox

Note:

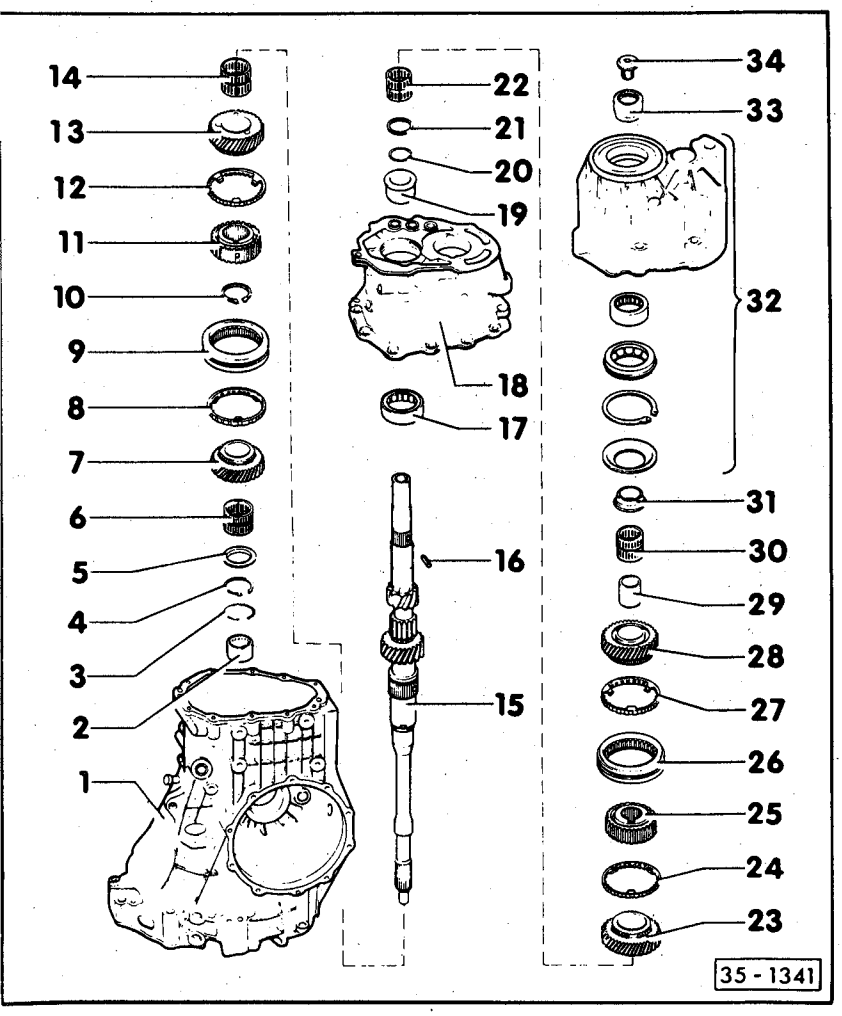
Recess of thrust washer must face snap ring.

22 – Needle bearing for 6th gear – not fitted to 5-speed gearbox
- Lubricate with gear oil before installing

23 – 6th speed selector gear – not fitted to 5-speed gearbox
- Insert spring before installing ⇒ Fig. 1

24 – Synchronizer ring for 6th gear – not fitted to 5-speed gearbox
- Check for wear ⇒ Fig. 2

25 – Synchronizer body for 5th and 6th gear
- Pulling off ⇒ page 34–35
- Fitting on ⇒ page 34–44



26 – Sliding sleeve

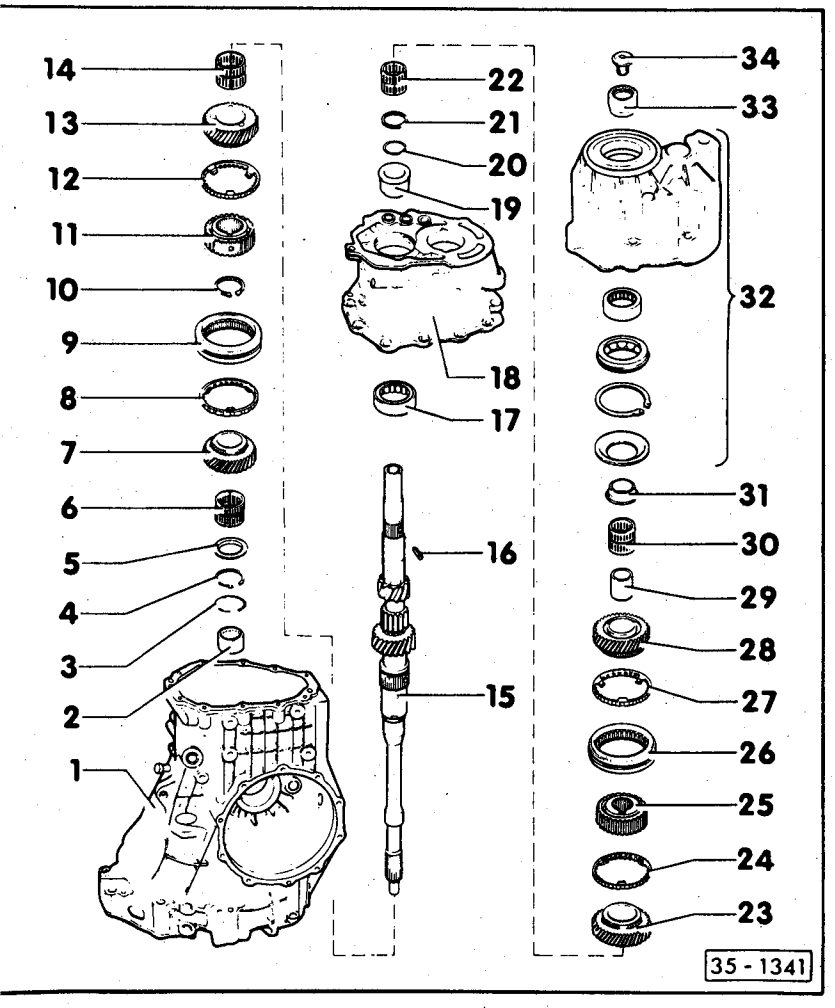
27 – 5th gear synchronizer ring
- Check for wear ⇒ Fig. 2

28 – 5th speed selector gear
- Insert spring before installing ⇒ Fig. 1

29 – Inner race for 5th speed selector gear
- Pulling off ⇒ page 34–35
- Fitting on ⇒ page 34–47

30 – 5th gear needle bearing
- Lubricate with gear oil before installing

31 – 1st inner race of four-point bearing
- Removing ⇒ page 34–33
- Fitting on ⇒ page 34–47



32 – End cover
- Servicing ⇒ page 34–77

33 – 2nd inner race of four-point bearing
- Removing ⇒ page 34–32
- Fitting on ⇒ page 34–48

34 – Inner multi-toothed screw
- Tightening ⇒ page 34–48

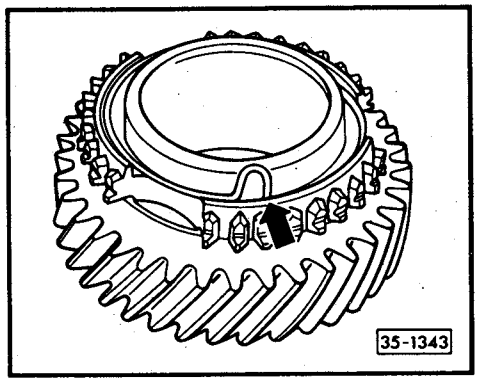


Fig. 1 Inserting spring in selector gear

- Insert spring (arrow) in selector gear by hooking angled end into the hole.

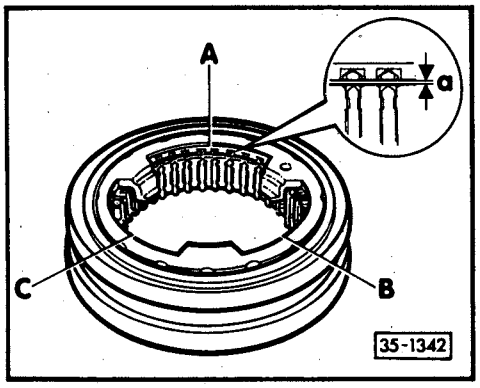


Fig. 2 Checking synchronizer ring for wear

- Push synchronizer ring into the sliding sleeve and measure gap "a" with a feeler gauge in positions A, B and C.
- Add together results obtained and divide by 3.
- The figure calculated must not be less than 0.5 mm.

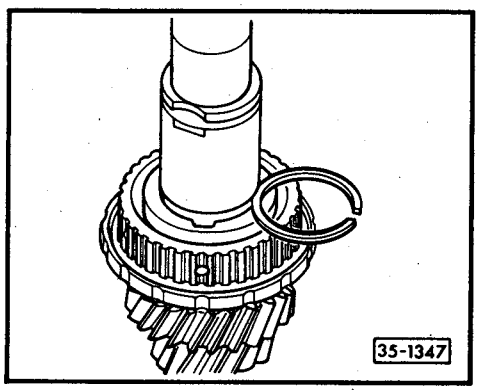


Fig. 3 Re-determining thickness of circlip

- Press synchronizer body against stop.

Note:

Pay attention to installation position when pressing on ⇒ Fig. 4.

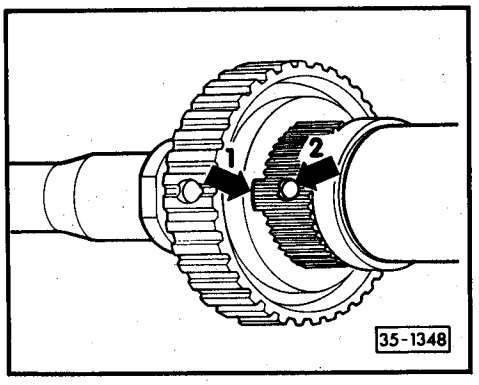
- Calculate the thickest circlip which can still just be inserted and fit on.

Note:

The opening of the circlip must be matched up with the slot in the synchronizer body.

The following circlips are available:

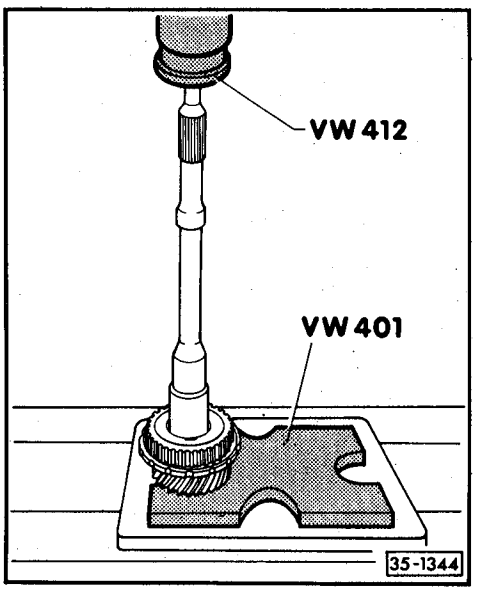
Thickness (mm)	Part n°
1.90	N 902 944.01
1.93	N 902 944.02
1.96	N 902 944.03
1.99	N 902 944.04
2.02	N 902 944.05
2.05	N 902 944.06



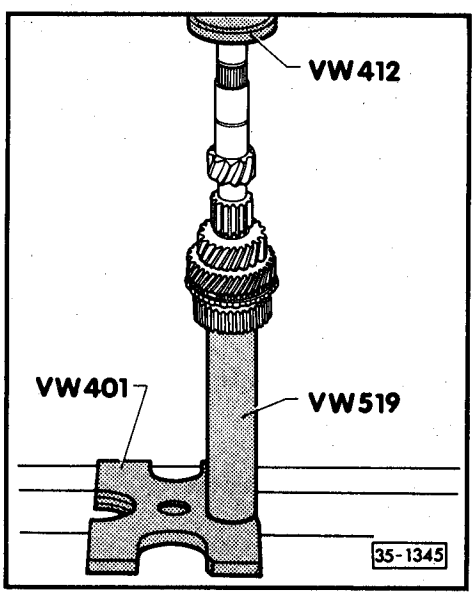
◄ **Fig. 4 Installation position of synchronizer body**

Important!

Oil groove in synchronizer body (arrow 1) must be aligned with the oil drilling (arrow 2) of the input shaft.

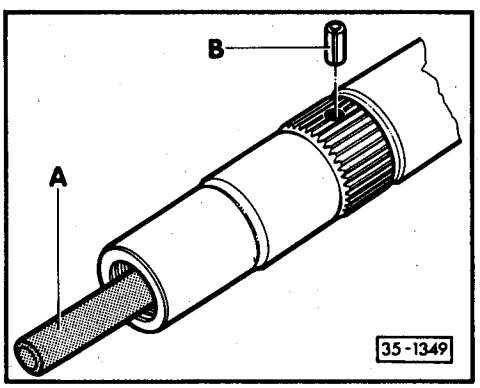


◄ **Fig. 5 Pressing off 3rd and 4th gear synchronizer body**



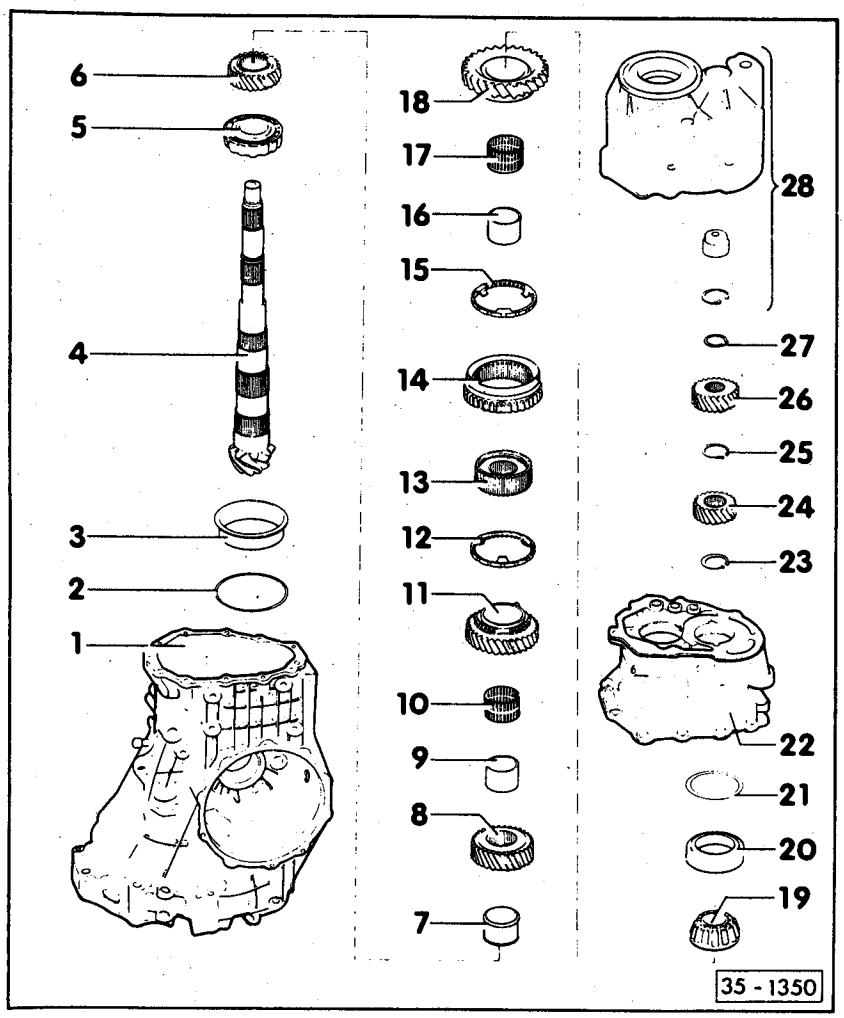
◄ **Fig. 6 Pressing on 3rd and 4th gear synchronizer body**

– Fit on circlip.



◄ **Fig. 7 Inserting clamping sleeve into input shaft**

A – Introduce dia. 9 drift into oil drilling and drive in clamping sleeve –B– until it touches the drift.



Dismantling and assembling drive pinion

Note:

When installing new gearwheels or the drive set, pay attention to Technical Data ⇒ Repair Group 00.

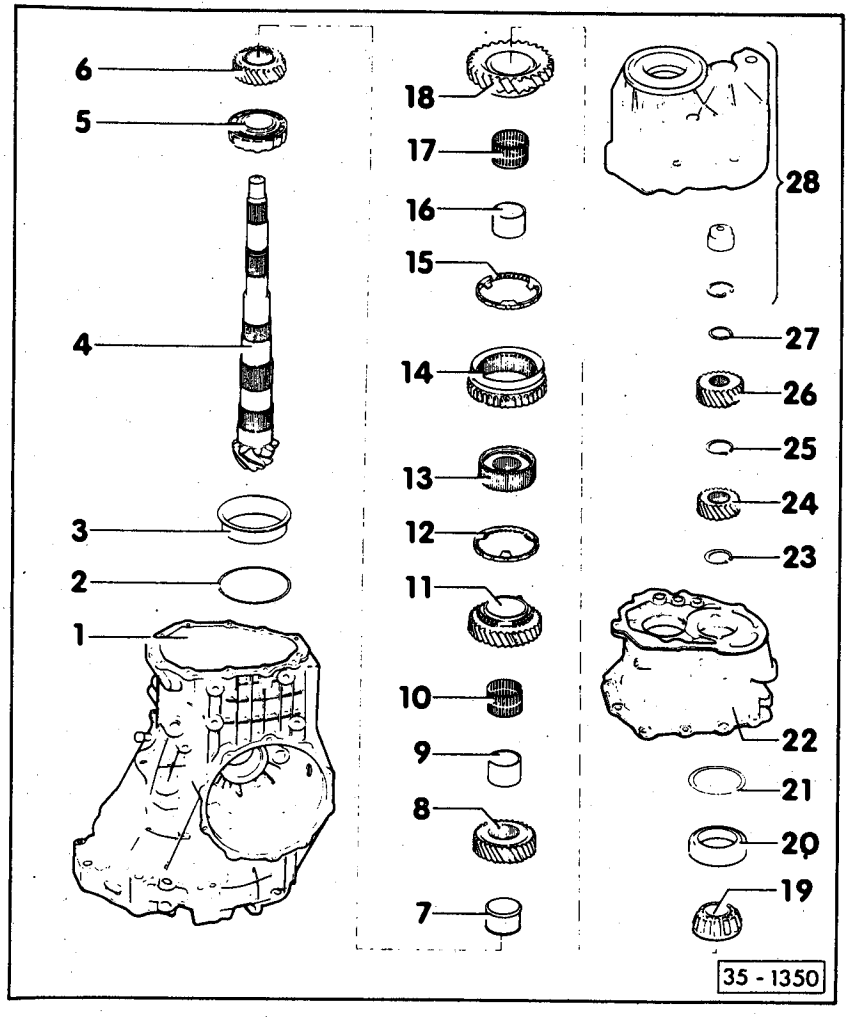
Important!

When replacing the taper roller bearings, determine the installation position (actual measurement) before removing the drive pinion ⇒ Repair Group 39, Calculating installation position of drive pinion.

1 – Gearbox housing

2 – Shim "S3"
- List of adjustments ⇒ Repair Group 39

3 – Outer race for large taper roller bearing
- Removing ⇒ Fig. 1
- Inserting ⇒ Figs. 2 and 3



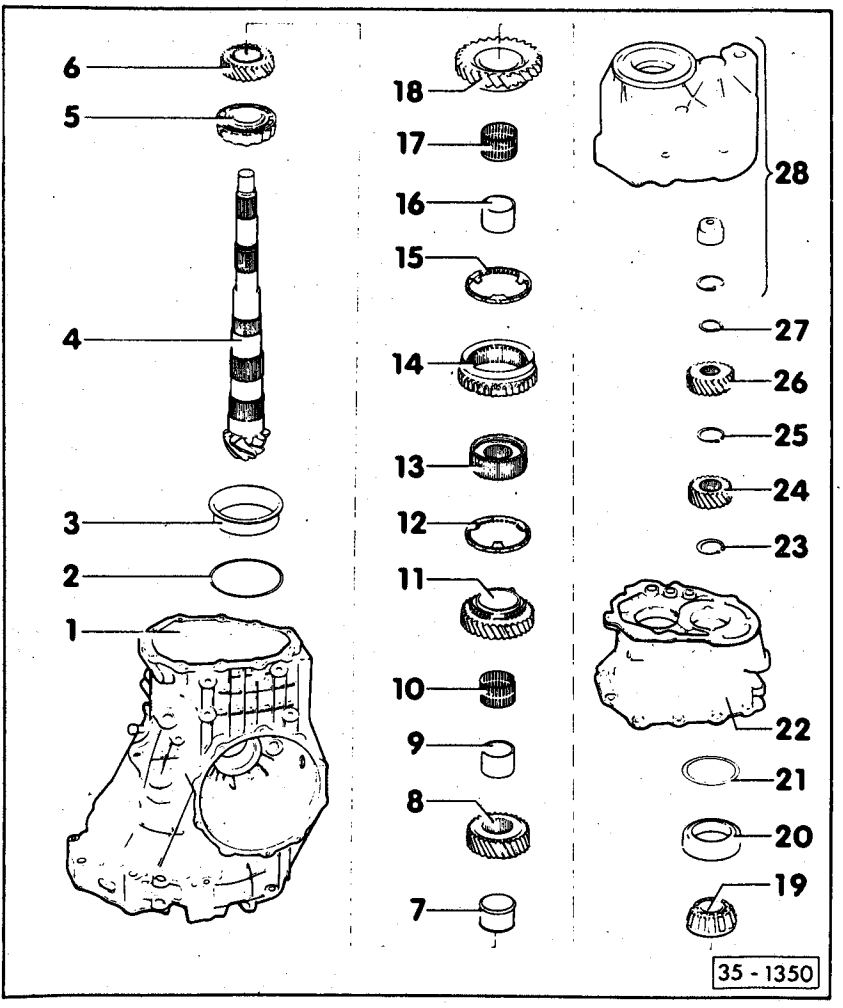
4 – Drive pinion
- Is matched with crown wheel (drive set)
- When replacing drive set, the drive pinion and crown wheel must be adjusted ⇒ Repair Group 39

5 – Inner race for large taper roller bearing
- Removing ⇒ Fig. 8
- Fitting on ⇒ Fig. 9

6 – 4th speed gearwheel
- Pressing off ⇒ Fig. 7
- Pressing on ⇒ Fig. 10

7 – Spacer sleeve

8 – 3rd speed gearwheel
- Pressing off ⇒ Fig. 6
- Pressing on ⇒ Fig. 11



9 – Inner race for 2nd speed selector gear
- Pressing off ⇒ Fig. 6, together with 3rd speed gearwheel
- Pressing on ⇒ Fig. 12

10 – Needle bearing for 2nd speed selector gear
- Lubricate with gear oil before installing

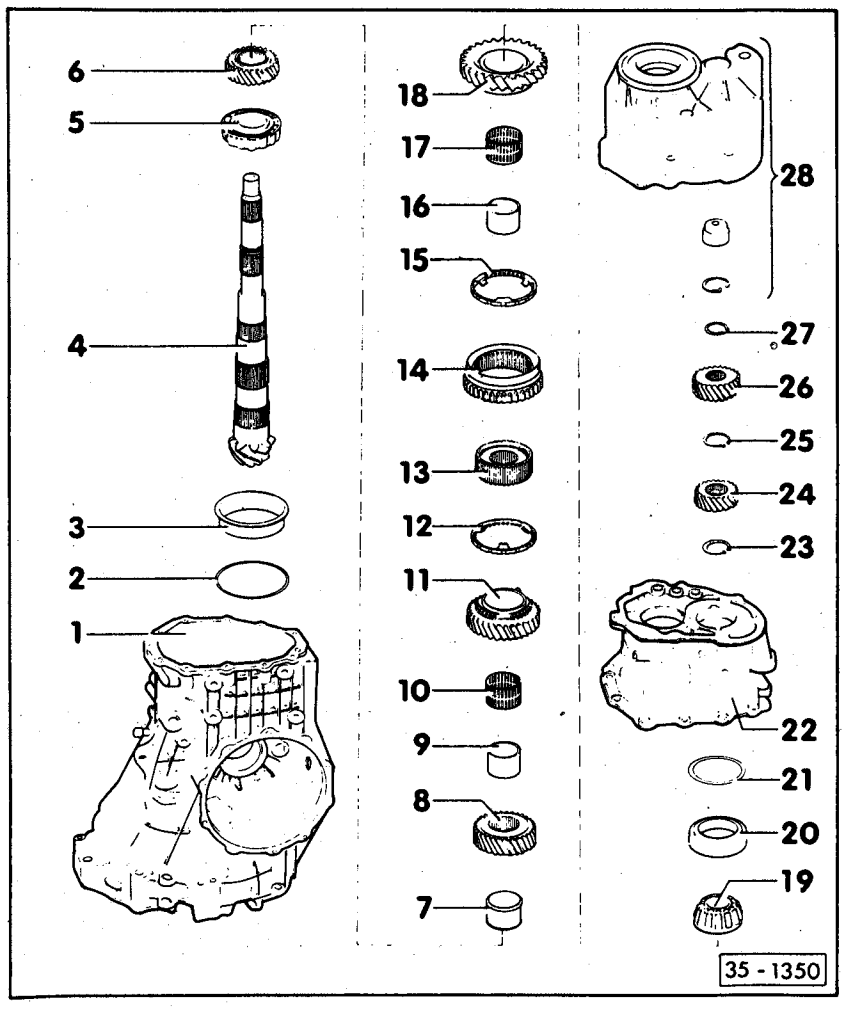
11 – 2nd speed selector gear
- Insert spring before installing ⇒ page 35–7

12 – 2nd gear synchronizer ring
- Check for wear ⇒ page 35–7

13 – 1st and 2nd gear synchronizer body
- Removing ⇒ Fig. 5
- Fitting on ⇒ Fig. 13

14 – 1st and 2nd gear sliding sleeve

15 – 1st gear synchronizer ring
- Check for wear ⇒ page 35–7



16 – Inner race for 1st speed selector gear
- Removing ⇒ Fig. 5
- Fitting on ⇒ Fig. 14

17 – Needle bearing for 1st speed selector gear
- Lubricate with gear oil before installing

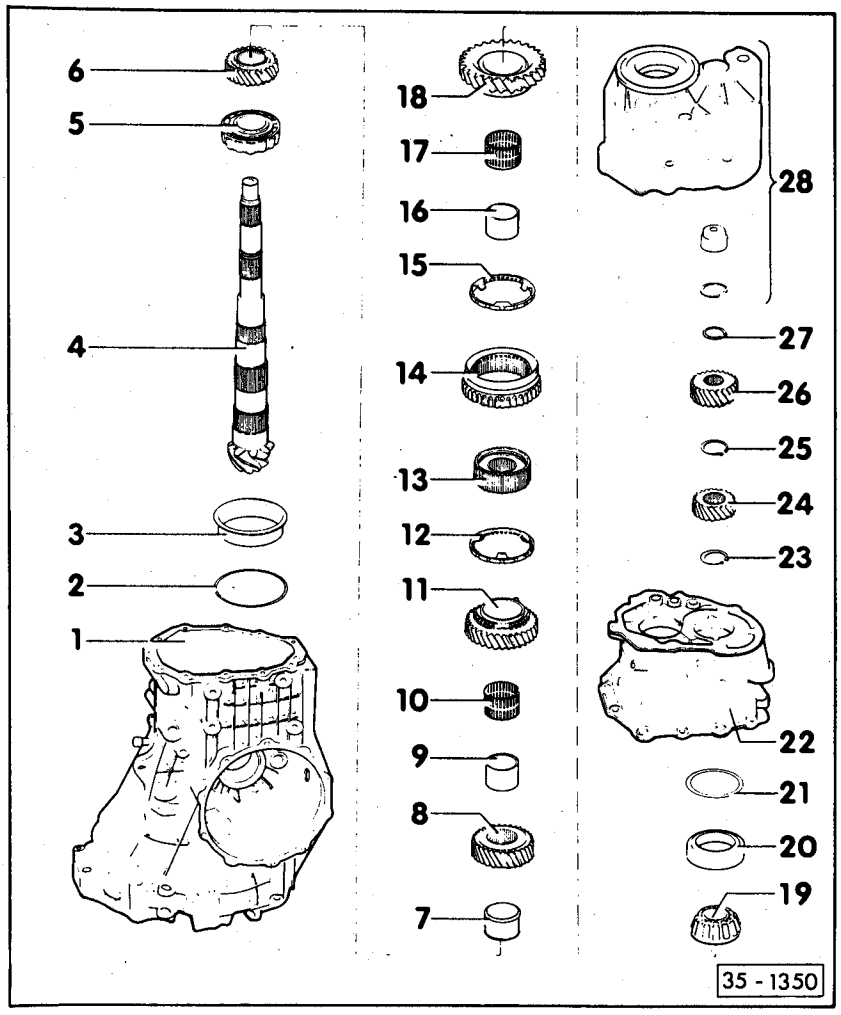
18 – 1st speed selector gear
- Insert spring before installing ⇒ page 35–7

19 – Inner race for small taper roller bearing
- Removing ⇒ Fig. 4
- Fitting on ⇒ Fig. 15

20 – Outer race for small taper roller bearing
- Removing ⇒ Fig. 16
- Inserting ⇒ Fig. 17

21 – Shim "S4"
- List of adjustments ⇒ Repair Group 39

22 – Bearing plate



23 – Circlip
Determining thickness:
- 6-speed gearbox ⇒ page 34–40
- 5-speed gearbox ⇒ page 34–42

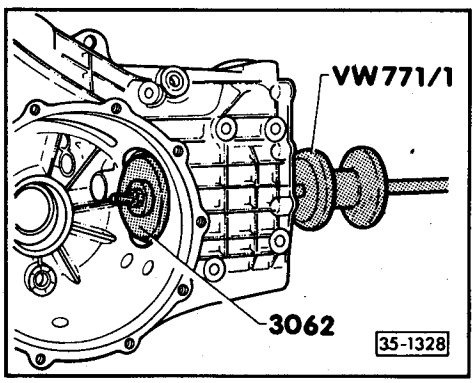
24 – 6th speed gearwheel – not fitted to 5-speed gearbox
- Removing ⇒ page 34–36
- Fitting on ⇒ page 34–37

25 – Circlip
- Determining thickness ⇒ page 34–40
- Install behind item 23 on 5-speed gearbox ⇒ page 34–42

26 – 5th speed gearwheel
- Removing ⇒ page 34–33
- Fitting on ⇒ page 34–46

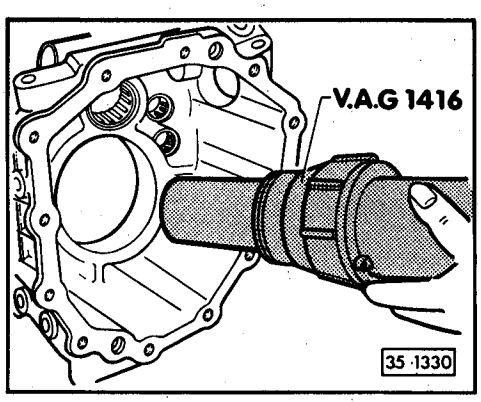
27 – Circlip

28 – End cover
- Servicing ⇒ page 34–77



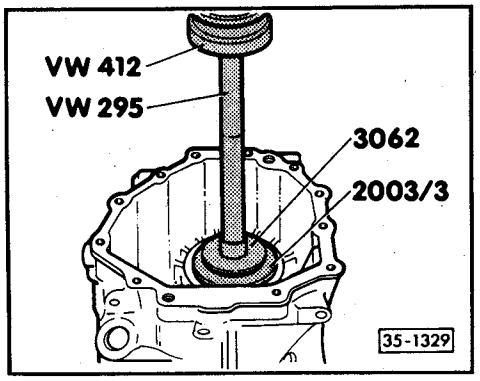
◄ **Fig. 1 Removing outer race for large taper roller bearing**

The thrust washer 3062 is resting against the outer race with the shouldered side.



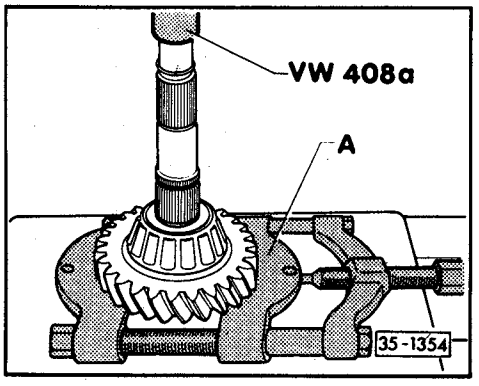
◄ **Fig. 2 Heating gearbox housing in the area of bearing seat to approx. 100°C for inserting taper roller bearing outer race**

Heat for approx. 15 minutes with hot air fan V.A.G 1416.



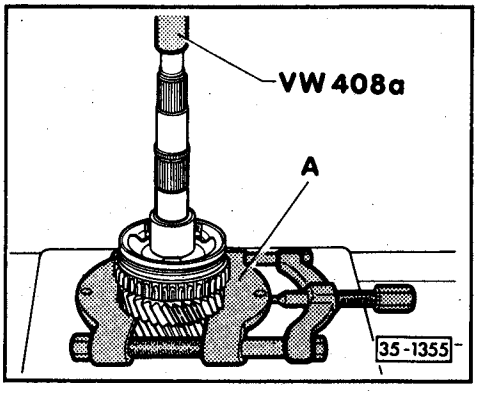
◄ **Fig. 3 Inserting outer race for large taper roller bearing in gearbox housing and pressing home**

– Insert outer race only after heating housing and press home for 1 – 2 minutes under the repair press until a heat exchange has taken place.



◄ **Fig. 4 Removing inner race for small taper roller bearing with 1st speed selector gear**

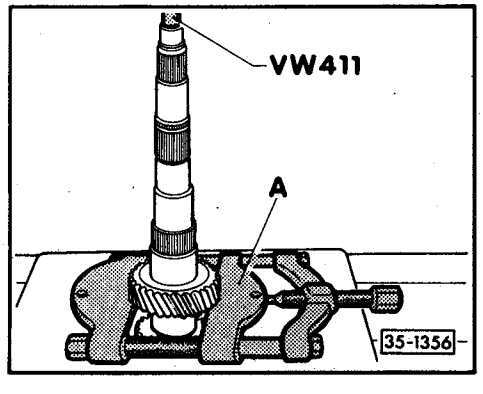
A – Separating device 22–115 mm, e.g. Kukko 17/2



◄ **Fig. 5 Removing 2nd speed selector gear sliding sleeve/1st and 2nd gear synchronizer body with inner race for 1st speed selector gear**

Note:

1st and 2nd gear synchronizer body, 1st speed selector gear inner race can also be removed together with the inner race for the small taper roller bearing.



◄ **Fig. 6 Removing 3rd speed gearwheel with 2nd speed selector gear inner race**

A – Separating device 22–115 mm, e.g. Kukko 17/2

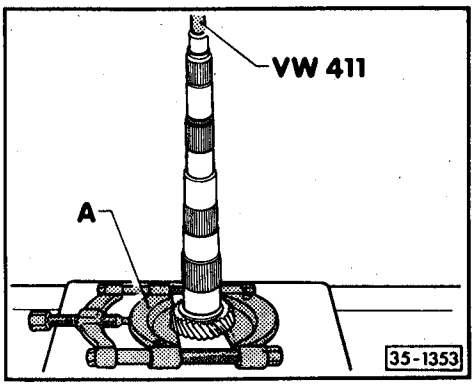


Fig. 7 Removing 4th speed gearwheel

A – Separating device 22–115 mm, e.g. Kukko 17/2

Note:

4th speed gearwheel can also be removed together with 3rd speed gearwheel and inner race for 3rd speed selector gear.

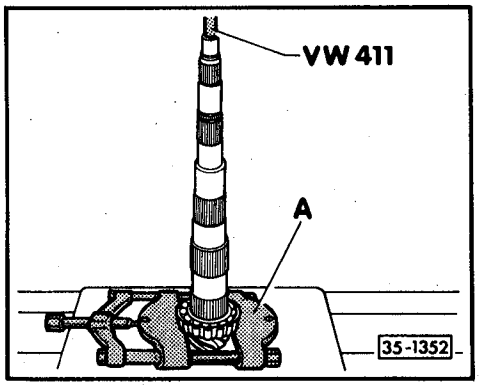


Fig. 8 Removing inner race for large taper roller bearing

A – Separating device 22–115 mm, e.g. Kukko 17/2

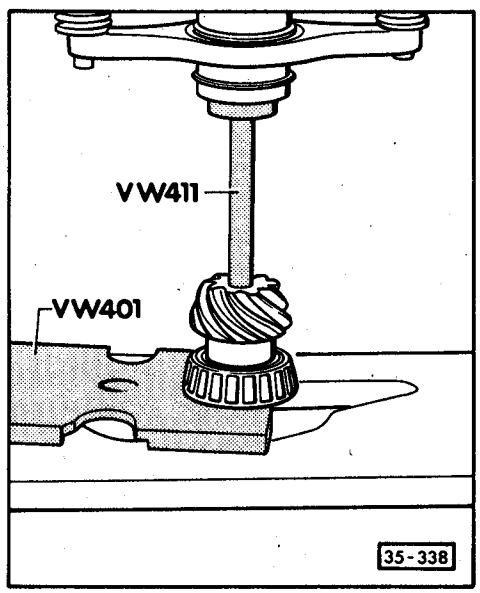
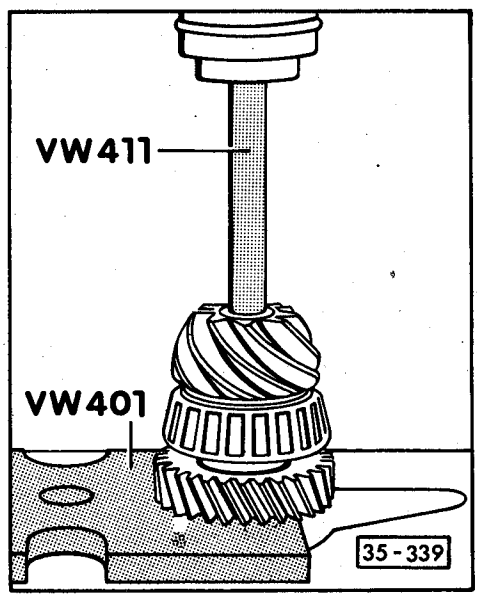
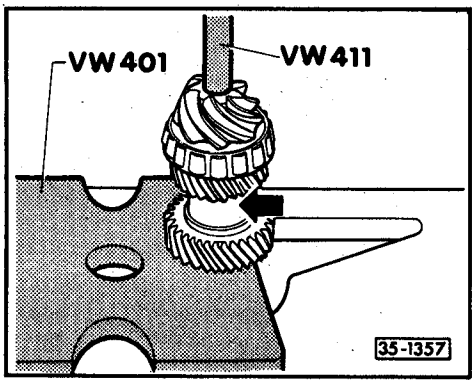


Fig. 9 Pressing on inner race for large taper roller bearing



◄ **Fig. 10 Heating 4th speed gearwheel to approx. 120°C and pressing on**

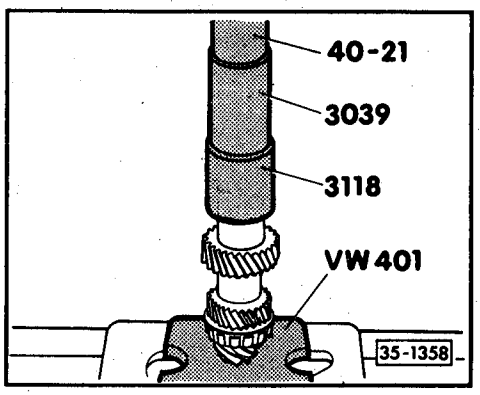
Installation position:
Shoulder faces 3rd speed gearwheel



◄ **Fig. 11 Heating 3rd speed gearwheel to approx. 120°C and pressing on**

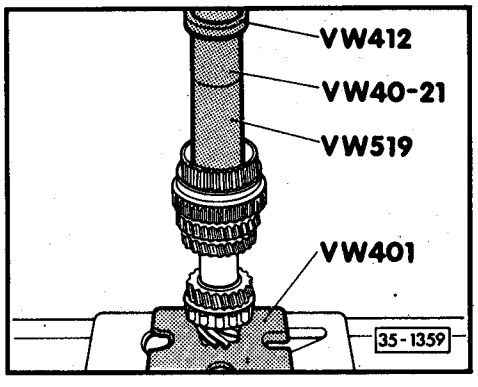
Installation position:
Shoulder faces 4th speed gearwheel

Firstly: Fit on spacer sleeve (arrow).



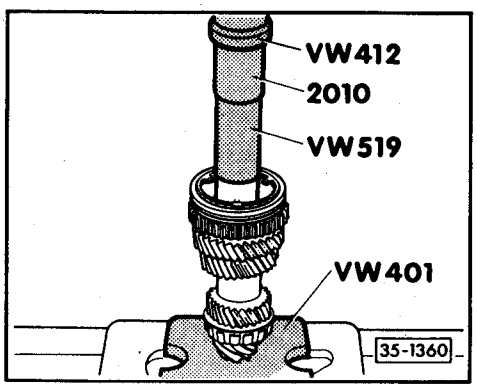
◄ **Fig. 12 Pressing on inner race for 2nd speed selector gear**

Firstly: Heat race to 80°C.



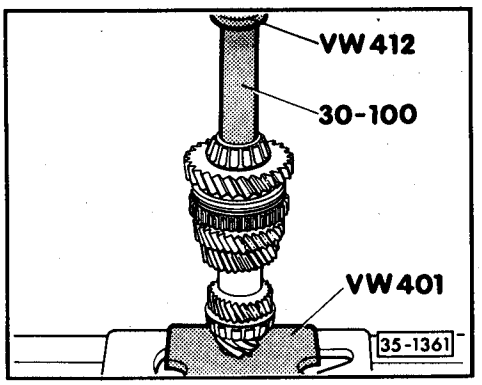
◄ **Fig. 13 Pressing on 1st and 2nd gear synchronizer body**

Firstly: Fit on 2nd speed selector gear needle bearing and 2nd speed selector gear with synchronizer ring. Heat synchronizer body to 100°C.



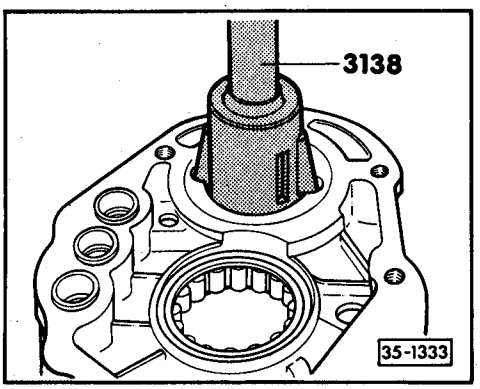
◄ **Fig. 14 Pressing on inner race for 1st speed selector gear**

Firstly: Heat race to 80°C.

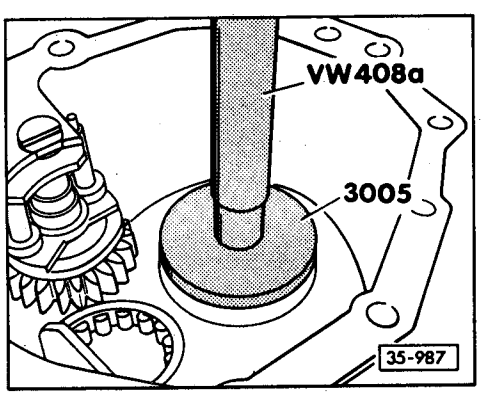


◄ **Fig. 15 Pressing on inner race for small taper roller bearing**

Firstly: Fit on 1st speed selector gear needle bearing and 1st speed selector gear with synchronizer ring.



◄ **Fig. 16 Removing outer race for small taper roller bearing**

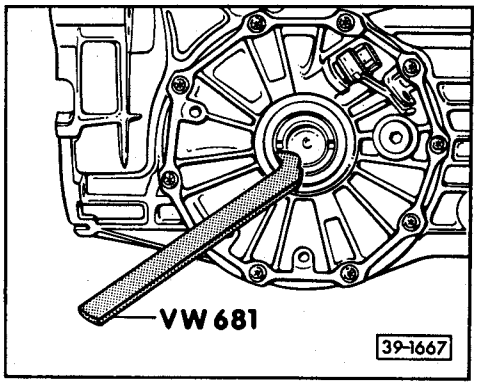


◄ **Fig. 17 Pressing in outer race for small taper roller bearing**

Renewing oil seal for flanged shaft

Notes:

- *Oil seal can be renewed with gearbox installed.*
- *The procedure for removing and installing the oil seal on the left side of the gearbox (illustrated) and on the right side (not illustrated) is identical.*

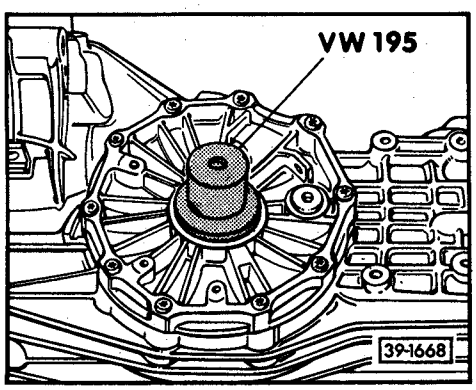


– Unflange drive shaft.

– Place drip tray below oil sump.

– Remove flanged shaft; secure with drift to prevent it rotating.

◄ – Remove oil seal with the forcing lever VW 681.



◄ – Insert oil seal for flanged shaft.

Insertion depth = 5.5 mm.

– Pack space between sealing and dust lips with multi-purpose grease.

– Install flanged shaft, tighten screw to 10 Nm + 90° (1/4 turns).

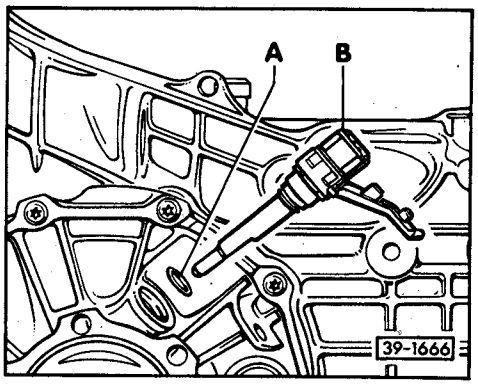
– Install drive shaft, tighten screws to 80 Nm.

– Top up gear oil.

Renewing speedometer sender and speedometer gear for electronic speedometer

Note:

The above-mentioned parts can be renewed with the gearbox installed.

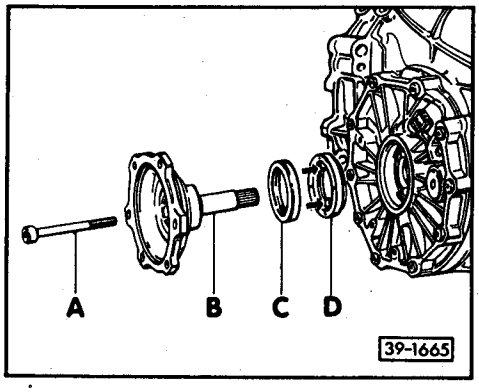


◄ **Renewing speedometer sender –B–**

– Unplug connector from sender –B–.

– Push down retaining bar and carefully remove speedometer sender by turning without damaging, otherwise the speed may no longer be exactly indicated.

– Check seal –A– before installing; replace if necessary.



Renewing speedometer gear –D–

- Unscrew drive shaft from left flanged shaft.
- Remove screw –A–. Secure flanged shaft with drift to prevent it rotating.
- Remove flanged shaft –B– and seal –C– for flanged shaft.
- Remove speedometer gear –D– by alternately levering out with a screwdriver at the drive studs (arrows).

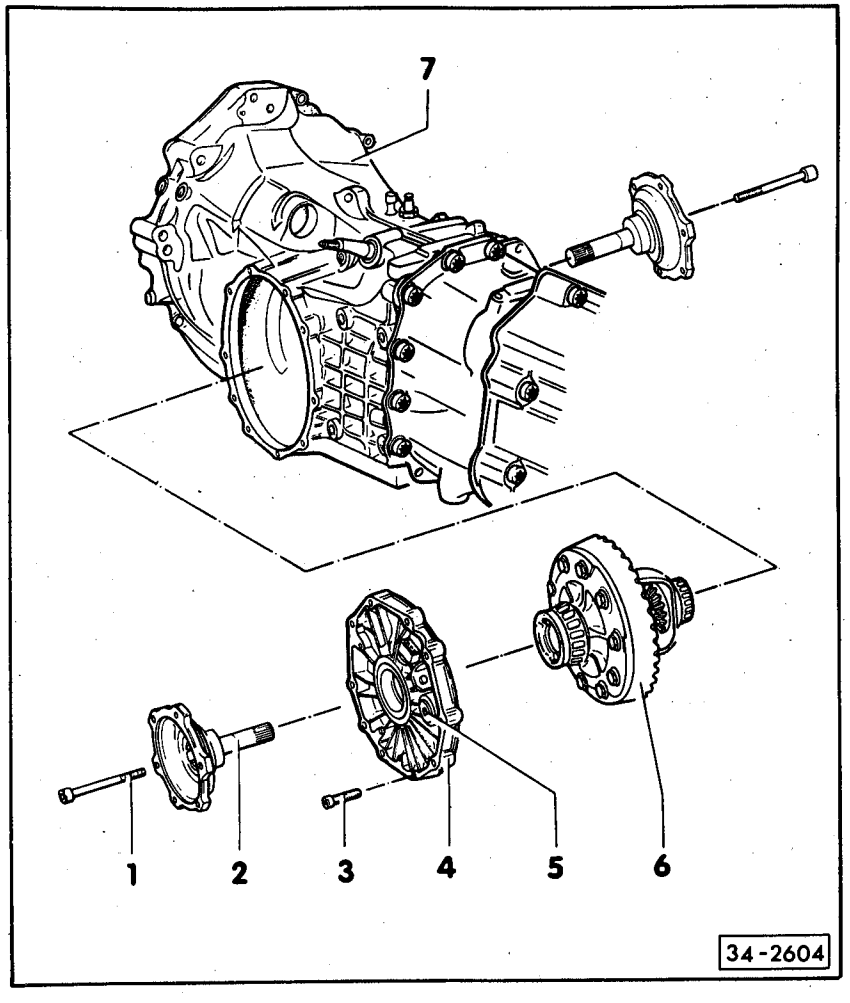
When **Installing**, pay attention to the following:

- Press speedometer gear –D– onto the differential as far as the stop.

Note:

The drive studs of the speedometer gear (arrows) face toward the seal –C– and engage in the slots of the differential.

- Renew oil seal –C– for flanged shaft ⇒ page 39–1.
- Install flanged shaft ⇒ page 39–1.
- Top up gear oil.



Removing and installing differential

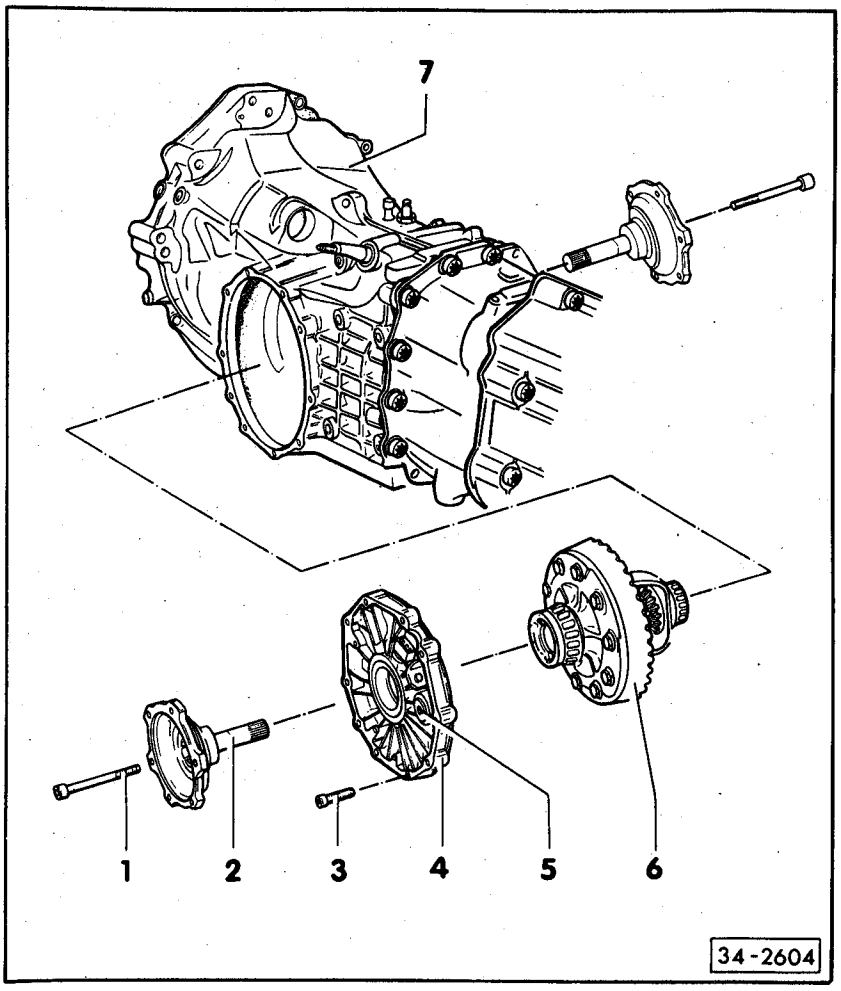
Note:

The differential can be removed and installed without removing the selector shaft complete and taking off the gearbox.
The above-mentioned parts must be removed if the differential is to be set.

1 – Screw – tighten to 10 Nm + 90° (1/4 turns)

2 – Flanged shaft
- When unscrewing, secure with drift to prevent it rotating

3 – Screw, 25 Nm
Without washer (10 screws)

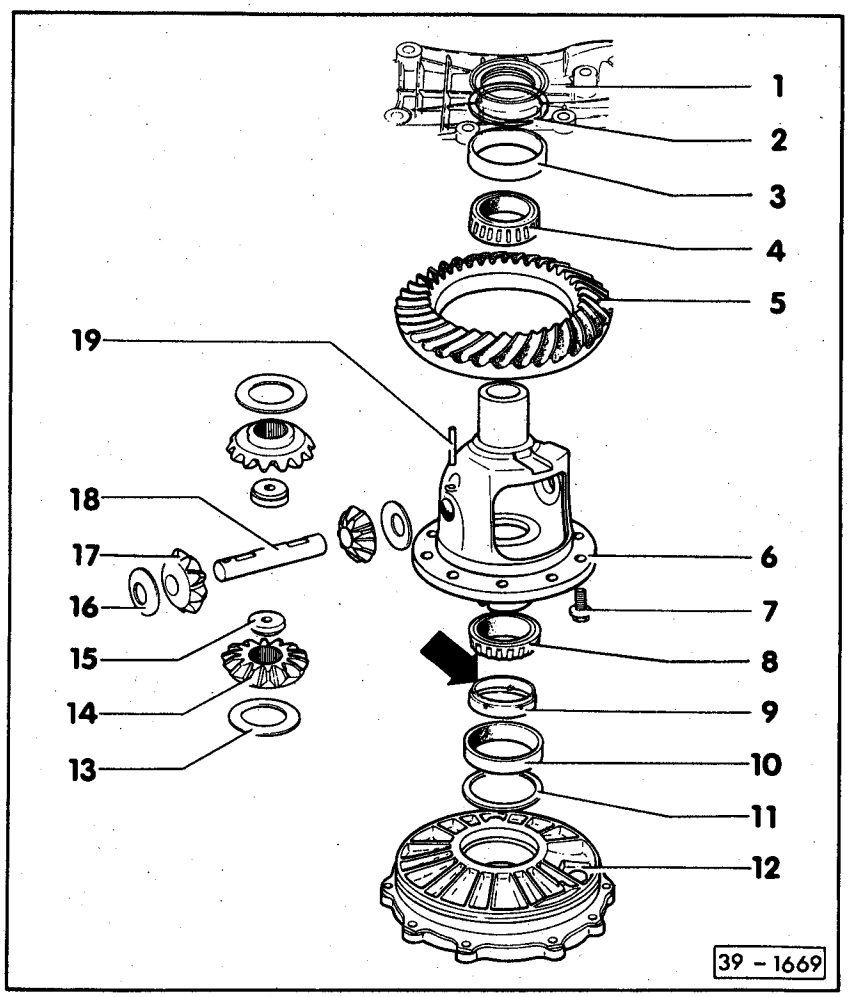


4 – Final drive cover
- Renewing speedometer gear
  ⇒ page 39–3

5 – Oil filler plug, 35 Nm
- Capacity, specification
  ⇒ page 00–4

6 – Differential
- Dismantling and assembling
  ⇒ page 39–6

7 – Gearbox housing
- Servicing ⇒ page 34–50



Dismantling and assembling differential

Note:

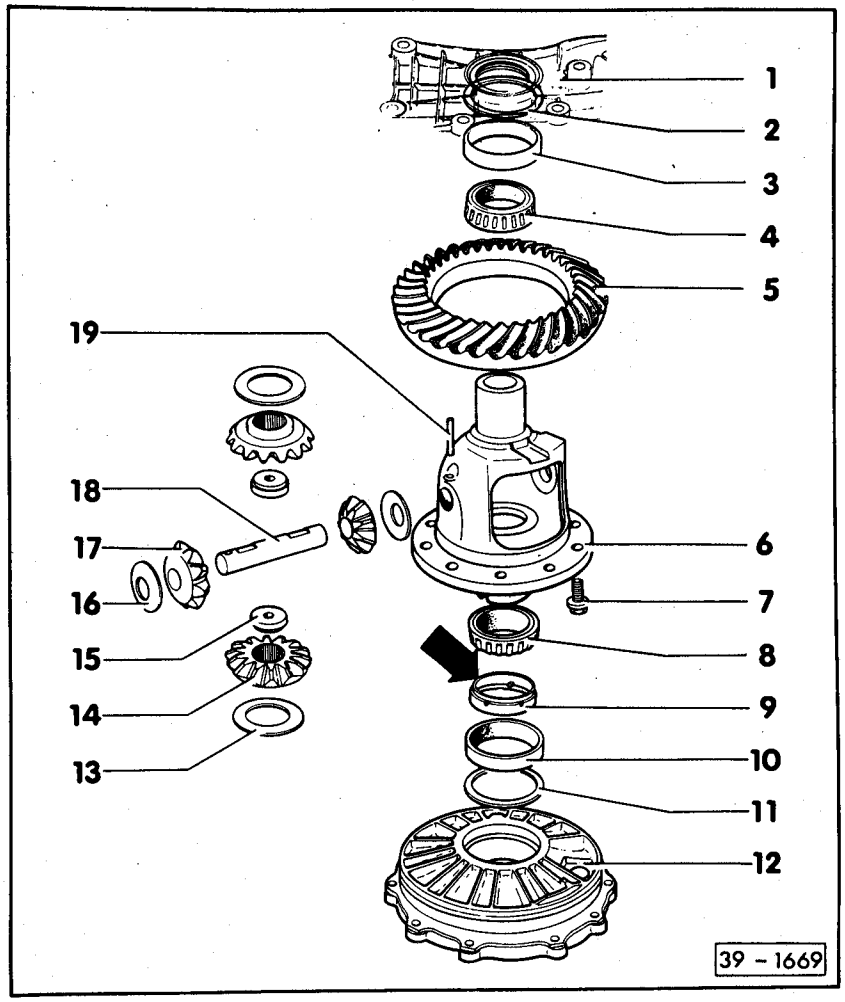
Removing and installing differential ⇒ page 39–4.

1 – Gearbox housing

2 – Shim "S2"
- Note thickness
- List of adjustments ⇒ page 39–22

3 – Outer race for small taper roller bearing
- Removing ⇒ Fig. 9
- Inserting ⇒ Fig. 10

4 – Inner race for small taper roller bearing
- Removing ⇒ Fig. 1
- Fitting on ⇒ Fig. 3

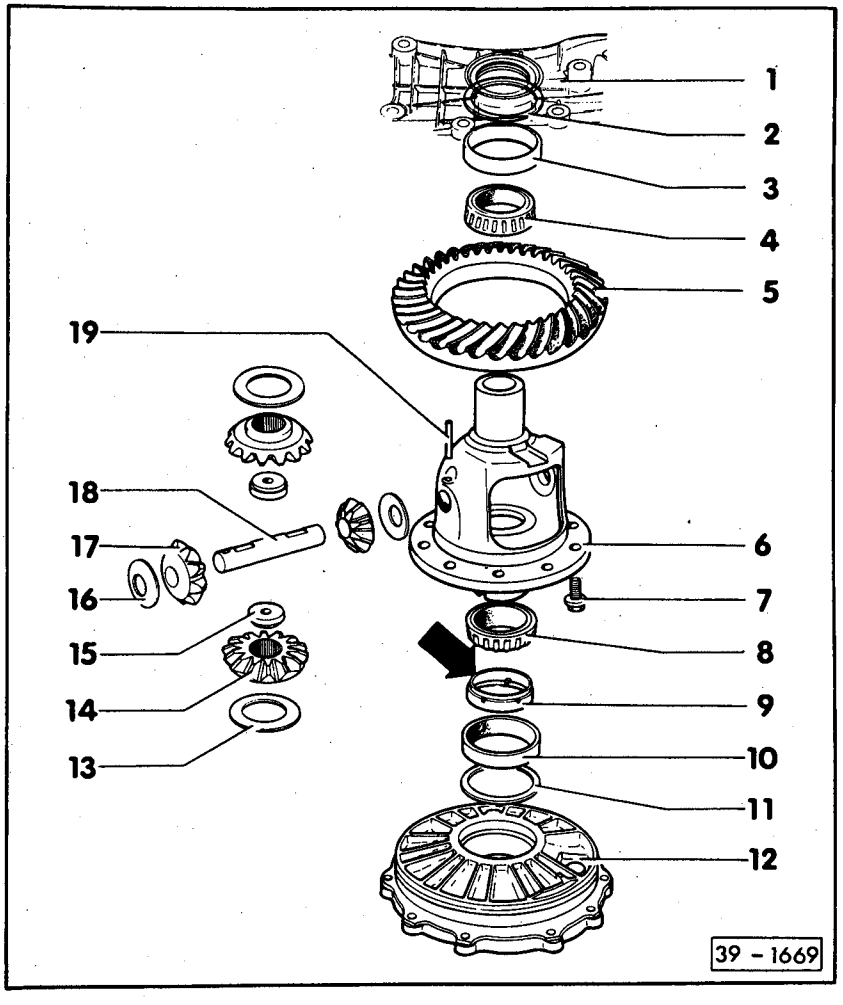


5 – Crown wheel
- Is matched with drive pinion (drive set)
- When replacing drive set, drive pinion and crown wheel must be adjusted ⇒ List of adjustments, page 39–22
- Drive off differential housing with drift ⇒ Fig. 5
- Heat to 80°C
- Use centering pins (shop-made) for guiding

6 – Differential housing
- When renewing, adjust crown wheel ⇒ page 39–37

7 – Crown wheel bolt
- Always renew
- Use only genuine bolts
- Tighten bolts alternately, then tighten diagonally to **90 Nm**

8 – Inner race for large taper roller bearing
- Removing ⇒ Fig. 2
- Fitting on ⇒ Fig. 4



9 – Speedometer gear
- For electronic speedometer
- Removing and installing ⇒ page 39–3
- The web (arrow) faces the differential housing

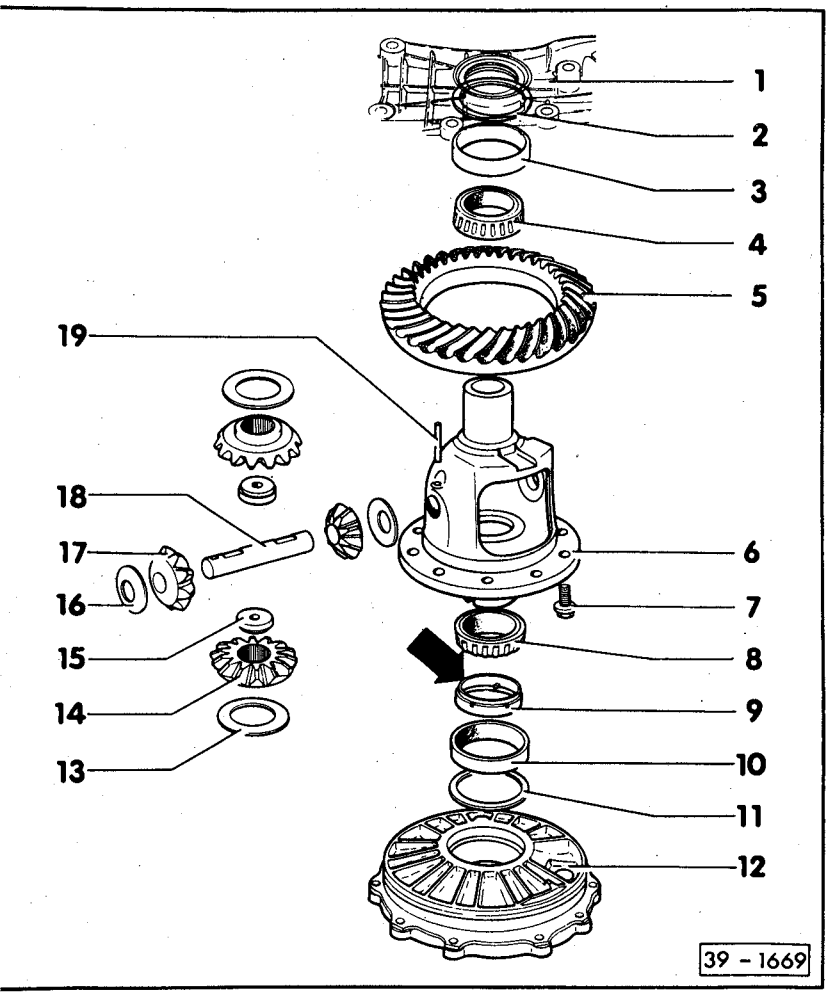
10 – Outer race for large taper roller bearing
- Removing ⇒ Fig. 11
- Inserting ⇒ Fig. 12

11 – Shim "S1"
- Note thickness
- List of adjustments ⇒ page 39–22

12 – Final drive cover

13 – Shims
- Re-determining thickness ⇒ Figs. 7 and 8

14 – Large bevel gears
- Adjusting ⇒ Figs. 7 and 8



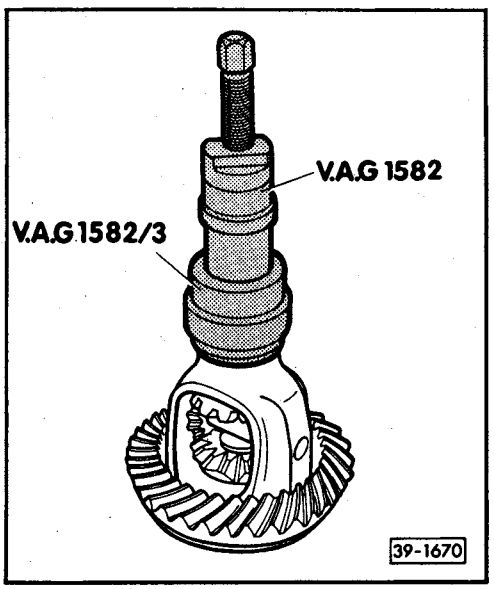
15 – Threaded connector

16 – Thrust washer
- Check for cracking and chipping

17 – Small bevel gears
- Installing ⇒ Figs. 7 and 8

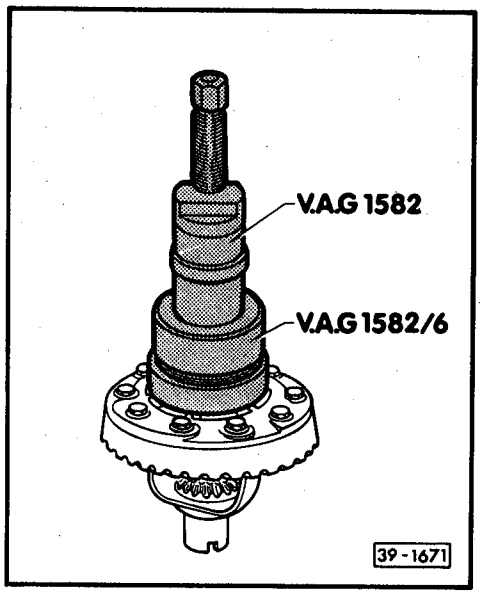
18 – Shaft for bevel gears
- Knock out with drift after removing roll pin
- Align thrust washers before inserting

19 – Roll pin
- Insert flush



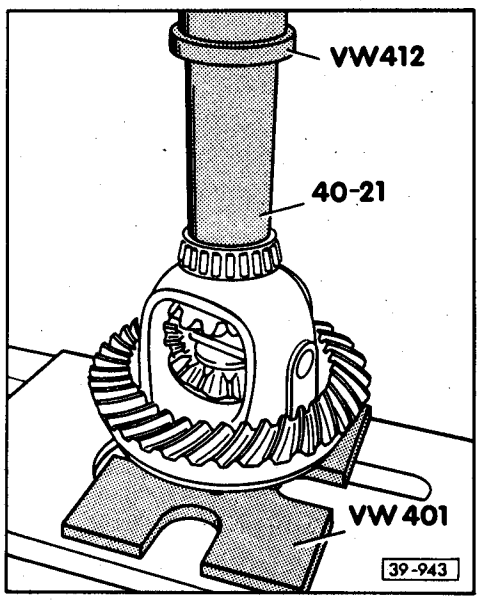
◄ **Fig. 1 Pulling inner race for small taper roller bearing off housing**

– Fit pressure plate 40-105 before fitting on pulling device.

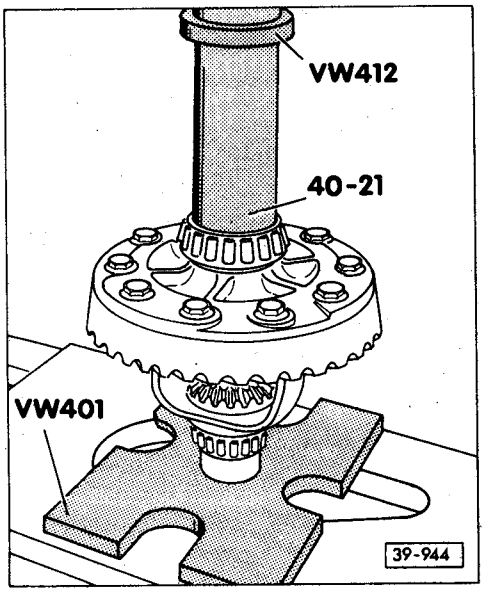


◄ **Fig. 2 Pulling inner race for large taper roller bearing off housing**

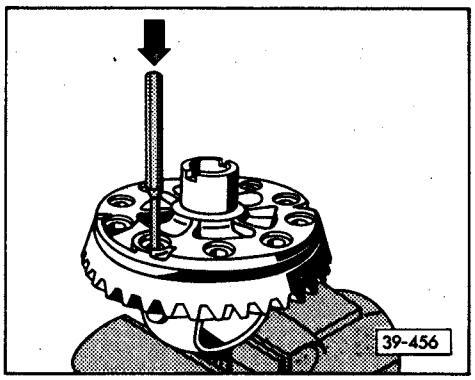
– Fit pressure plate 40-105 before fitting on pulling device.



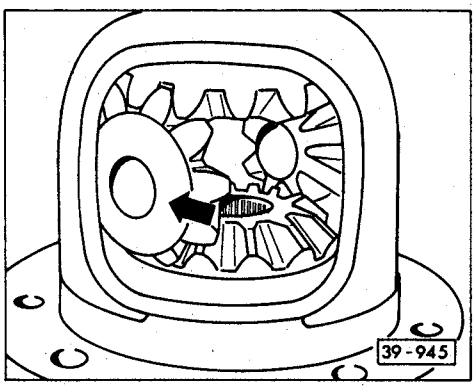
◄ **Fig. 3 Heating inner race for small taper roller bearing to approx. 100°C, fitting on and pressing home**



◄ **Fig. 4 Heating inner race for large taper roller bearing to approx. 100°C, fitting on and pressing home**



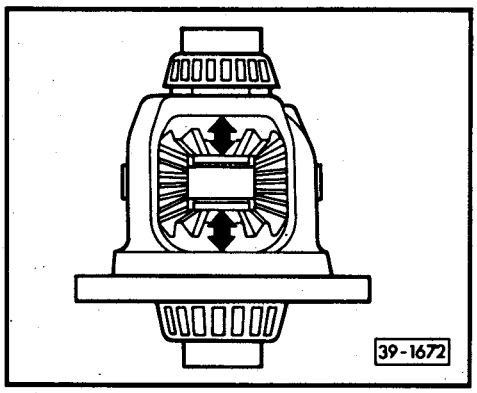
◄ **Fig. 5 Driving crown wheel off housing**



◄ **Fig. 6 Installing bevel gears**

Beforehand: Remove speedometer gear ⇒ page 39–3.

- Insert one-piece thrust washer with gear oil.
- Insert large bevel gears with selected shims (Figs. 7 and 8).
- Insert small bevel gears offset by 180° and swing into place (arrow).
- Fit on threaded pieces (shoulder faces large bevel gear).
- Align thrust washers so that they are matched up with the hole.
- Insert shaft and secure.



◄ **Fig. 7 Adjusting bevel gears**

- Insert large bevel gears with the **thinnest** shims **(0.5 mm)**.
- Insert small bevel gears with thrust washers and press in shaft.

Note:

Do not now interchange bevel gears and thrust washers!

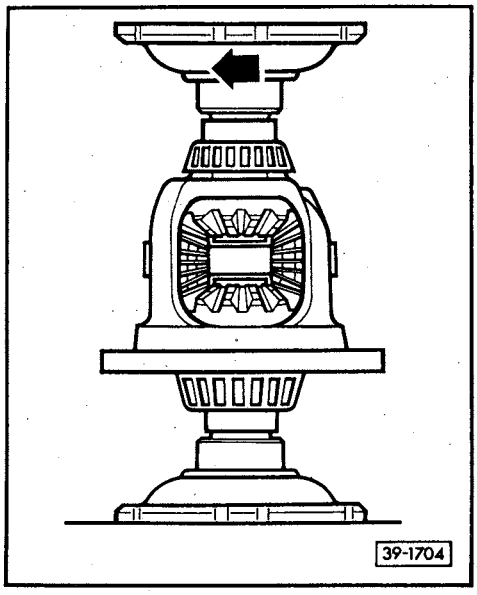
- Push small bevel gears to the outside and check the play of the large bevel gears by hand (arrows).
- Adjust play by inserting an appropriate shim so as to achieve a play of **max. 0.10 mm**.

Note:

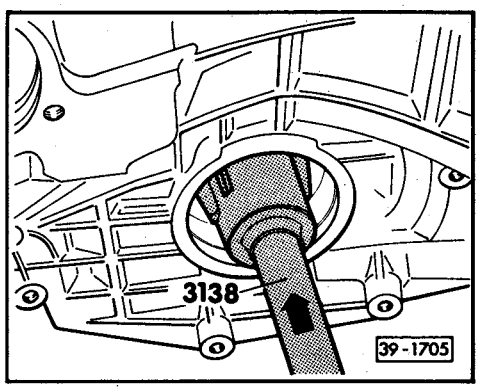
The adjustment is also correct if no further play can be felt although it is possible to rotate bevel gears easily and without the gears catching (Fig. 8).

The following shims are available:

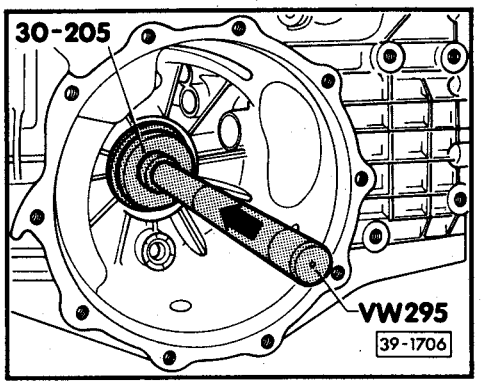
Part N°	Thickness (mm)
011 519 215	0.5
088 409 249	0.6
088 409 249 A	0.7
088 409 249 B	0.8
088 409 249 C	0.9
088 409 249 D	1.0



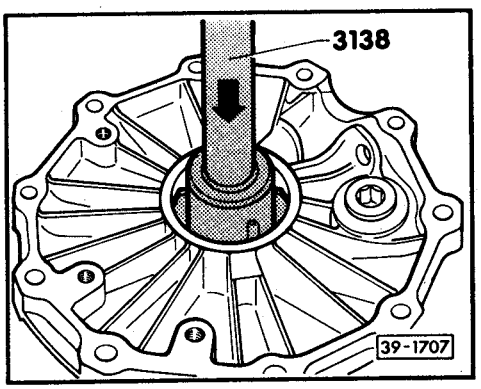
◄ **Fig. 8 Rotating bevel gears**



◄ **Fig. 9 Removing outer race for small taper roller bearing from gearbox housing**

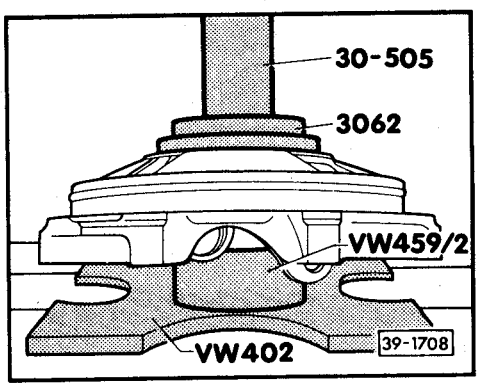


◄ **Fig. 10 Inserting outer race for small taper roller bearing in gearbox housing**



◄ **Fig. 11 Removing outer race for large taper roller bearing from cover**

– Use suitable base, e.g. VW 470 with recess facing cover.



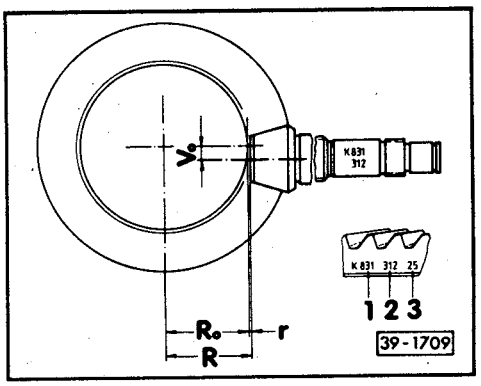
◄ **Fig. 12 Inserting outer race for large taper roller bearing in cover**

Adjusting drive pinion and crown wheel

General notes

Careful adjustment of drive pinion and crown wheel is decisive for the operating life and quiet running of the final drive. For this reason, drive pinions and crown wheels are already matched to each other during the production process and checked with special gauging machines to ensure good contact pattern and low noise level in both directions of rotation. The position of the quietest running is determined by moving the drive pinion in an axial direction, the crown wheel being constantly raised out of zero-play mesh far enough for the torsion backlash to move within the specified tolerance.
The deviation "r", related to the master gauge "Ro", is measured for the drive sets supplied as service parts and inscribed on the outer circumference of the crown wheel. Each drive set – drive pinion and crown wheel – must only be replaced together. The general repair instructions for taper roller bearings and shims ⇒ page 00–11 should be adhered to.
Taper roller bearings which have been in use for more than 50 000 km should be replaced.

Adjustment and inscription of drive sets



◄ **Service drive sets**

1 – Marking "K 831" means Klingelnberg drive set with ratio of 31:8.

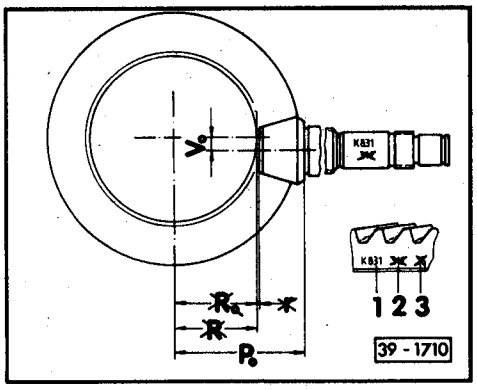
2 – Pairing number (312) of drive set.

3 – Deviation "r" related to master gauge of the special gauging machine used in production. The deviation "r" is always stated in 1/100 mm.
Example: "25" means
r = 0.25 mm

Ro – Length of master gauge used on special gauging machine
"Ro" = 59.65 mm

R – Actual dimension between crown wheel shaft and face end of drive pinion at the point of quietest running for this one drive set

Vo – Hypoid offset



◄ **Drive sets in series production**

X– These data are not required in series production.

"Po" – Adjustment size for series production.

Important!

In series production, the position of the drive pinion is determined by the size "Po" (centre of crown wheel to rear of drive pinion head). No inscription of the deviation "r" is indicated on the crown wheel and also no pairing number. As a result of the lack of the deviation "r", it is necessary, before removing the drive pinion, to perform an actual measurement if parts are replaced which directly affect the installation position of the drive pinion ⇒ page 39–24.

List of adjustments

- When performing removal and installation work on the gearbox, it is only necessary to re-adjust drive pinion, crown wheel or drive set if parts which **directly** affect the adjustment of the final drive are replaced. Pay attention to the table below to avoid unnecessary adjustment work.
- Position of shims "S" ⇒ page 39–26.

Part to be adjusted: / Part to be replaced:	Crown wheel ("S1" + "S2") ⇒ page 39–37	Drive pinion ("S3" + "S4") via deviation "r" ⇒ page 39–27	Drive pinion ("S3" + "S4") via "actual measurement" ⇒ page 39–24	Drive pinion only shim "S4" ⇒ page 34–72
Gearbox housing	X		X	
Bearing plate				X
Differential housing	X			
Taper roller bearings for drive pinion			X	
Taper roller bearings for differential	X			
Drive set	X	X		
Final drive cover	X			

Part to be adjusted: / Part to be replaced:	Crown wheel ("S1" + "S2") ⇒ page 39–37	Drive pinion ("S3" + "S4") via deviation "r" ⇒ page 39–27	Drive pinion ("S3" + "S4") via "actual measurement" ⇒ page 39–24	Drive pinion only shim "S4" ⇒ page 34–72
Needle bearing for 1st gear				X
Synchronizer body for 1st and 2nd gear				X
Needle bearing for 2nd gear				X
3rd speed gearwheel				X
Spacer sleeve				X
4th speed gearwheel				X

Determining installation position of drive pinion (actual measurement)

This operation should only be performed if the deviation "r" is not indicated on the crown wheel and parts which directly affect the position of the drive pinion are to be replaced.

These are:
Both taper roller bearings for drive pinion and gearbox housing.

Removing differential

Fit parts to universal gauging drift, as described on page 39–32, insert into gearbox housing and measure difference to "Ro" (max. deflection at reversal point, read off in red numerical range). The reading obtained corresponds to the deviation "r". Note reading.

After replacing the parts, the drive pinion should be adjusted as described from page 39–27 on. The deviation "r" measured should be inserted when determining the shim "S3".

Recommended sequence of operations for re-adjusting drive set

If drive pinion and crown wheel are to be adjusted, it is recommended to keep to the sequence stated below in the interest of rational working:

1 – Calculate total shim thickness "$S_{tot.}$" ("S1" + "S2") for the specified preload of the differential taper roller bearings.

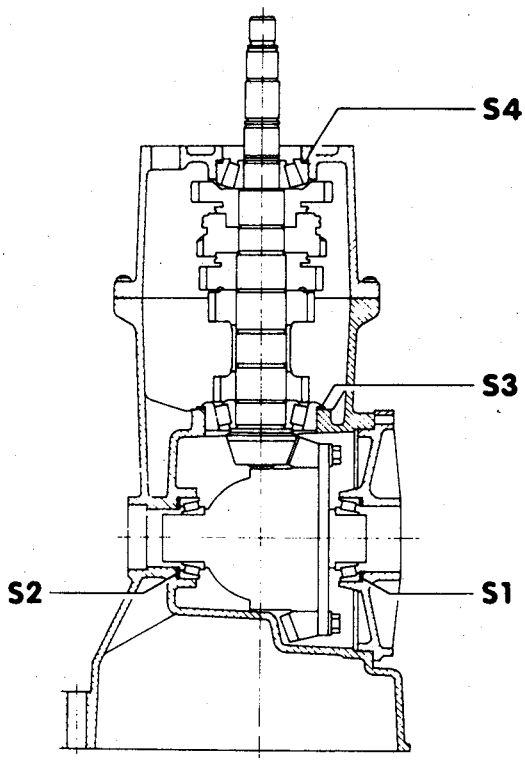
2 – Calculate total shim thickness "$S_{tot.}$" ("S3" + "S4") for the specified preload of the drive pinion taper roller bearings.

3 – Divide total shim thickness "$S_{tot.}$" (drive pinion) into "S3" + "S4" so that the size from the centre of the crown wheel to the face end of the drive pinion corresponds to the installation size "R" calculated during production.

4 – Divide total shim thickness "$S_{tot.}$" (crown wheel) into "S1" + "S2" so that the specified torsion backlash exists between crown wheel and drive pinion.

The aim of the adjustment is to re-create the position of quietest running which was calculated on the gauging machine in production.

The maximum care and cleanliness during all removal and installation work and measurement operations are essential to obtain a perfect result.



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◄ Position of shims

S1 – Shim for crown wheel in gearbox housing cover

S2 – Shim for crown wheel in gearbox housing

S3 – Shim for drive pinion in gearbox housing

S4 – Shim for drive pinion in bearing plate

Adjusting drive pinion

Re-adjustment of the drive pinion according to the instructions given below is only necessary if the **drive set** is replaced. If other parts which likewise affect the position of the drive pinion, are exchanged, the adjustment should be made via the installation position calculated previously (actual measurement), page 39–24 ⇒ also "List of adjustments", page 39–22.

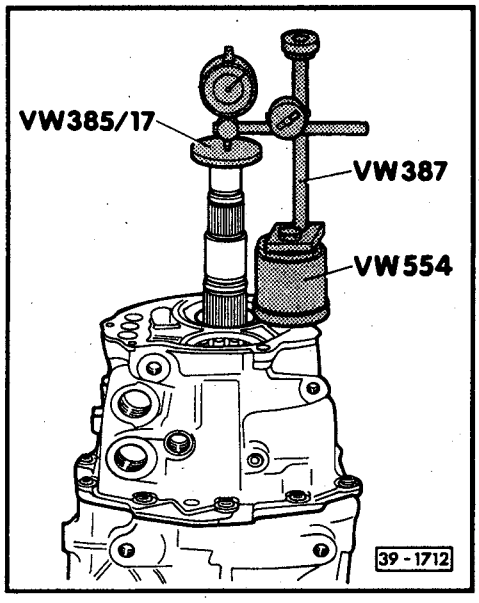
Calculating total shim thickness "$S_{tot.}$" ("S3" + "S4")

(Adjusting preload of drive pinion taper roller bearings)

Differential removed!

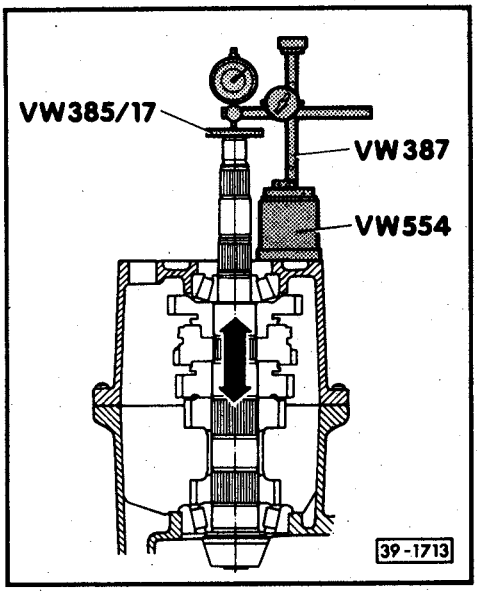
– Install outer races for taper roller bearings **without** shims in gearbox housing ⇒ page 35–11 and in bearing plate ⇒ page 34–63, respectively.

– Insert completely assembled drive pinion into gearbox housing, fit on bearing plate and tighten bolts to 25 Nm.



◄ – Fit on measuring tool and zero dial gauge (3 mm range) with a preload of 1 mm.

Dial gauge extension approx. 30 mm long.



Important!

Before the measurement, turn the drive pinion in both directions so that the taper roller bearings settle.

– Move drive pinion up and down several times without turning and read off play on dial gauge and note.

Example: 1.4 mm

Important!

If the drive pinion is turned, the result of the measurement will be incorrect.

Determining "$S_{tot.}$" ("S3" + "S4")

$S_{tot.}$ = Result of measurement + compression

Compression (design value) = 0.2 mm

Example:

Compression	0.2 mm
Result of measurement	+ 1.4 mm
"$S_{tot.}$"	= 1.6 mm

Determining size "e"

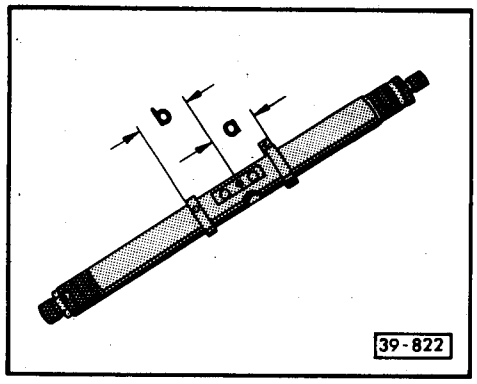
(⇒ Pages 39–32 and 39–33)

– Select shim of calculated total thickness "$S_{tot.}$" (in the example 1.6 mm) from the table, page 39–35 and install behind the taper roller bearing outer race in the bearing plate ("S4" side).

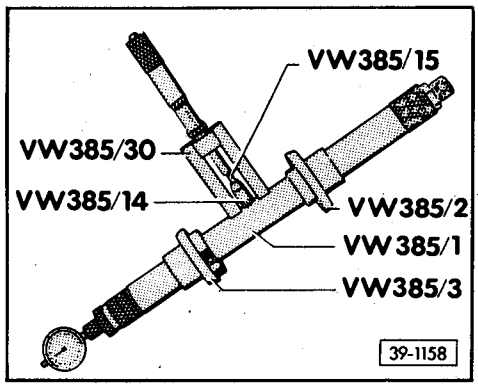
– Fit on bearing plate again.

Note:

Rotate drive pinions several times in both directions so that the taper roller bearings settle.



◄ – Set adjusting rings of universal gauging drift VW 385/1 to the sizes "a" = "b" = approx. 65 mm.

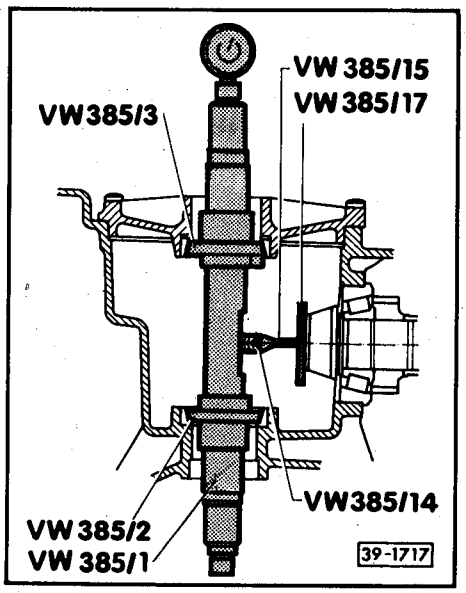


◄ – Fit parts to universal gauging drift as shown. Dial gauge extension VW 385/15 = 9.3 mm long.

– Set master gauge VW 385/30 to Ro = 59.65 mm, fit onto gauging drift and zero dial gauge (3 mm range) with a preload of 1 mm.

Note:

In place of the adjustable gauge VW 385/30, the gauge VW 385/27 (Ro = 59.65 mm) can also be used.



◄ Arrangement of measuring tools for determining size "e"

– Place end gauge plate VW 385/17 onto the drive pinion head.

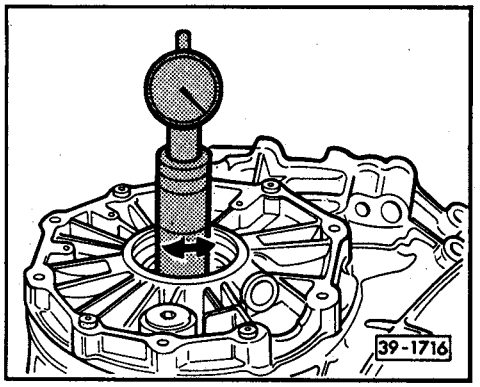
Note:

Ensure that the plate abuts properly and free of oil.

– Take master gauge off gauging drift ⇒ Fig. 39-1158 and insert gauging drift into gearbox housing. The centering disc VW 385/3 faces the final drive cover ⇒ page 39–33.

– Fit on final drive cover and tighten the 4 bolts.

– Move the 2nd centering disc VW 385/2 to the outside by turning the adjusting ring with the knurled screw to the point where the gauging drift can still just be turned by hand.



◄ – **Measuring size "e"**

– Turn gauging drift until the tip of the dial gauge touches the end gauging plate on the drive pinion head and indicates the maximum deflection (reversal point). The reading obtained is the size "e" (black numerical range).

Example: "e" = 0.46 mm

Determining thickness of shim "S3"

"S3" = "e" + "r"

"e" – Reading obtained (max. deflection)

"r" – Deviation (indicated on crown wheel in 1/100 mm or calculated during actual measurement ⇒ page 39–20)

Example

Reading "e" indicated on dial gauge	0.46 mm
Deviation "r" inscribed on crown wheel	+ 0.18 mm
Shim thickness "S3"	= 0.64 mm

Shims available as service parts **for "S3"**:

Thickness (mm)	Part n°
0.45	01 E 311 391
0.50	01 E 311 391 A
0.55	01 E 311 391 B
0.60	01 E 311 391 C
0.65	01 E 311 391 D
0.70	01 E 311 391 E
0.75	01 E 311 391 F
0.80	01 E 311 391 G
0.85	01 E 311 391 H

The tolerances of the shims enable any desired thickness to be gauged for "S3".

Determining thickness of shim "S4"

"S4" = "$S_{tot.}$" - "S3"

Example:

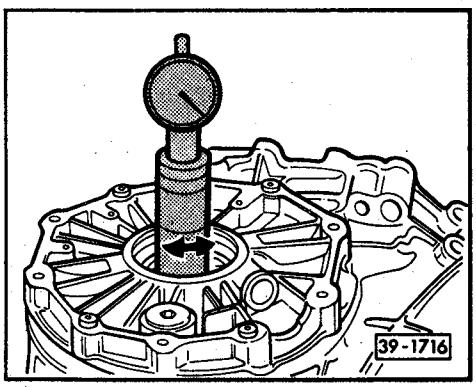
Total shim thickness	1.60 mm
Shim thickness "S3"	– 0.64 mm
Shim thickness "S4"	= 0.96 mm

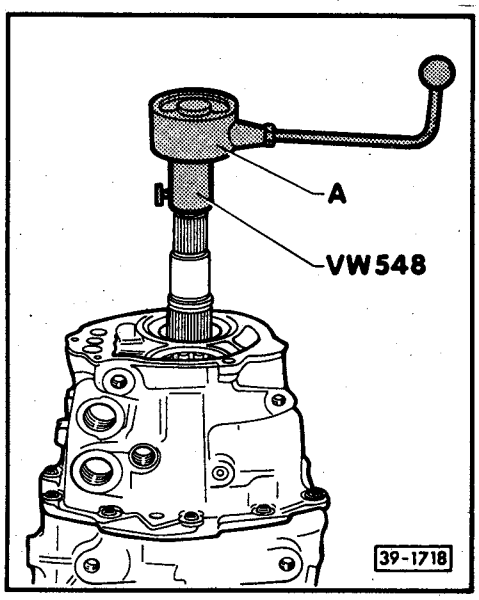
Shims available as service parts **for "S4"**:

Thickness (mm)	Part n°
0.45	01 E 311 393
0.50	01 E 311 393 A
0.55	01 E 311 393 B
0.60	01 E 311 393 C
0.65	01 E 311 393 D
0.70	01 E 311 393 E
0.75	01 E 311 393 F
0.80	01 E 311 393 G
0.85	01 E 311 393 H
1.25	01 E 311 393 J

Note:

If the measured shim thickness "S3" or "S4" is greater than that listed in the tables, 2 shims – corresponding to the reading obtained – can be installed.





Performing check measurement

◄ **Checking size "r"**

- Install drive pinion with gauged shims S3 and S4 and rotate several times in both directions.
- Insert universal gauging drift and perform check measurement.
- If the shims have been correctly selected, the dial gauge, when read counter-clockwise (red numerical range), must indicate the value of the inscribed deviation "r" with a tolerance of ± 0.04 mm.

◄ **Checking preload of taper roller bearings for drive pinion**

- Lubricate bearings with gear oil.
- Measure friction torque
  A – Torque gauge, commercially available, 0 – 600 Ncm
- The friction torque of new taper roller bearings must be 200 – 400 Ncm, for used taper roller bearings 50 – 60 Ncm.

Note:

When re-adjusting the drive set, the crown wheel adjustment with check measurement should now be performed (⇒ page 39–37).

Adjusting crown wheel

Re-adjustment of the crown wheel is necessary if

gearbox housing,
final drive cover,
taper roller bearings for differential,
differential housing or drive set
are replaced.

List of adjustments ⇒ page 39–22.

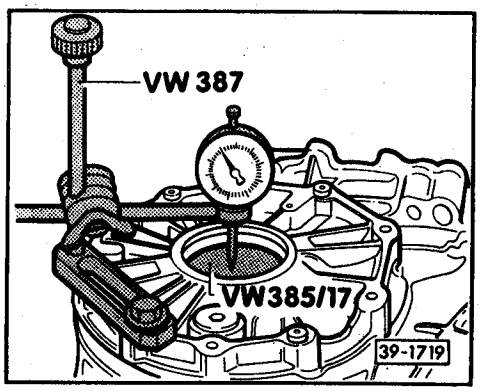
Calculating total shim thickness "$S_{tot.}$" ("S1" + "S2")

(Adjusting preload of differential taper roller bearings)

Drive pinion removed!

- Remove oil seal and taper roller bearing outer races for differential and take out shims (⇒ page 34–50 and page 39–6).
- Insert taper roller bearing outer races **without** shims as far as the stop (⇒ page 39–6 and page 39–8).

- Insert differential without speedometer gear into the housing. The crown wheel is on the left-hand side (in front of the final drive cover).
- Install cover and tighten bolts diagonally to 25 Nm. Cover faces up.

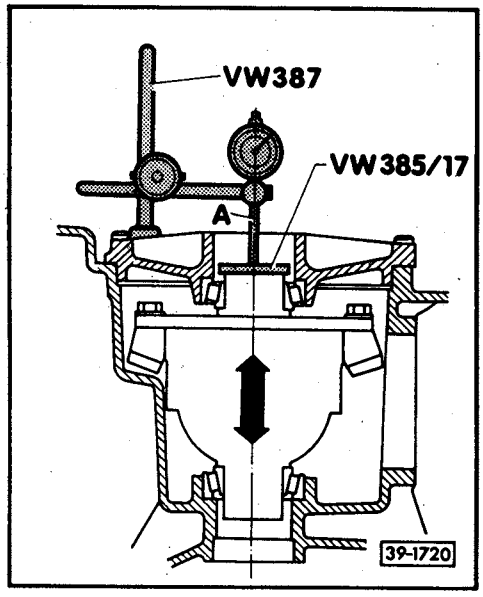


◄ – Fit on measuring tools.

- Zero dial gauge (3 mm range) with a preload of 1 mm. Dial gauge extension approx. 30 mm long.

Important!

Before the measurement, rotate the differential in both directions so that the taper roller bearings settle.



- Move differential up and down several times without rotating.
  Beforehand: Insert VW 521/4, combined with VW 521/8, into the right-hand side of the differential housing.

- Read off play on dial gauge and note.

  Example: 1.42 mm

Important!

Rotating the differential falsifies the result of the measurement.

Determining "$S_{tot.}$" ("S1" + "S2")

"$S_{tot.}$" = Result of measurement + compression

Compression (design value) = 0.35 mm

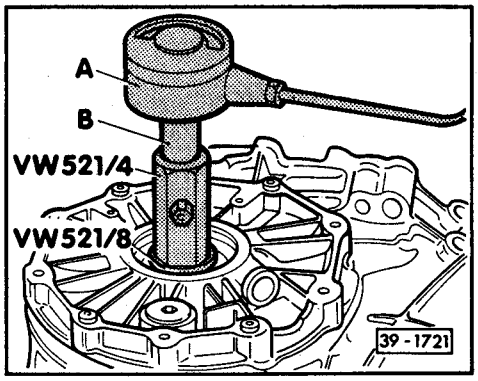
Example:

Compression	0.35 mm
Result of measurement	+ 1.42 mm
"$S_{tot.}$"	= 1.77 mm

- Select shims according to the table ⇒ page 39–44.

- Install shim of the calculated total thickness "$S_{tot.}$" (in the example 1.77 mm) behind the taper roller bearing outer race in the gearbox housing ("S2" side).

- Lubricate bearings with gear oil.



- Measure friction torque.
  A – Torque gauge, commercially available, 0 – 600 Ncm
  B – Wrench socket, width across flats 13

The friction torque of new taper roller bearings must be 250 – 350 Ncm, of used taper roller bearings 50 – 60 Ncm.

Note:

When re-adjusting the drive set, the drive pinion adjustment with check measurement should now be performed ⇒ page 39–27.

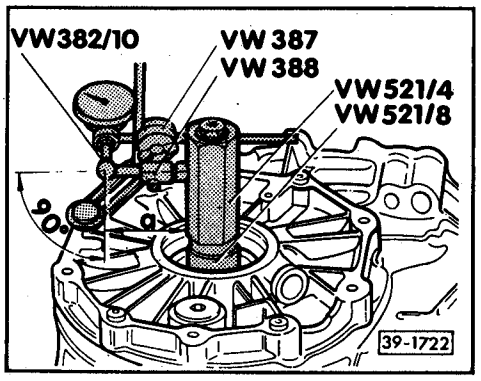
Adjusting torsion backlash

Drive pinion installed with "S3" and "S4".

Differential: "$S_{tot.}$" ("S1" + "S2") installed in gearbox housing (S2 side).

Note:

Rotate differential several times in both directions so that the taper roller bearings settle.



- Fit on measuring tools.
- Use dial gauge extension VW 382/10 (6 mm flat). Set measuring lever VW 388 to size "a" = 79 mm.
- Turn crown wheel as far as the stop. Zero dial gauge. Turn crown wheel back and read off **torsion backlash**. Note reading.

- Repeat measurement a further three times, each time turning on crown wheel 90°. Add together the results of the four measurements and calculate average torsion backlash.

Important!

If the individual readings obtained from this measurement differ by more than 0.06 mm from each other, the installation of the crown wheel or the drive set itself is not in order. Check installation work; replace drive set if necessary.

Determining average torsion backlash

Example

1st measurement	0.84 mm
2nd measurement	+ 0.85 mm
3rd measurement	+ 0.84 mm
4th measurement	+ 0.83 mm
Total	= 3.36 mm
Average torsion backlash: 3.36 mm:4	= 0.84 mm

Calculating shim thickness "S2"

(opposite crown wheel)

"S2" = "$S_{tot.}$"
– average torsion backlash
+ lift

Lift (design value) = 0.15 mm

Example:

"$S_{tot.}$"	1.77 mm
Average torsion backlash	– 0.84 mm
	= 0.93 mm
Lift	+ 0.15 mm
"S2"	= 1.08 mm

The following **shims for "S2" in the gearbox housing** are available:

Thickness (mm)	Part n°
0.45	012 409 385
0.50	012 409 385 A
0.55	012 409 385 B
0.60	012 409 385 C
0.65	012 409 385 D
0.70	012 409 385 E
0.75	012 409 385 F
0.80	012 409 385 G
0.85	012 409 385 H
1.25	012 409 385 R

Any desired thickness can be determined for "S2" as a result of the tolerances of the shims; insert 2 shims, if necessary.

Calculating shim thickness "S1" (crown wheel side)

"S1" = "$S_{tot.}$" - "S2"

Example:

"$S_{tot.}$"	1.77 mm
"S2"	- 1.08 mm
"S1"	= 0.69 mm

The following **shims for "S2" in the final drive cover** are available:

Thickness (mm)	Part n°
0.45	012 409 386
0.50	012 409 386 A
0.55	012 409 386 B
0.60	012 409 386 C
0.65	012 409 386 D
0.70	012 409 386 E
0.75	012 409 386 F
0.80	012 409 386 G
0.85	012 409 386 H
1.25	012 409 386 R

Any desired thickness for "S1" can be determined as a result of the tolerances of the shims; insert 2 shims, if necessary.

– Install calculated size of shims
  "S1" on crown wheel side
  "S2" opposite crown wheel.

Performing check measurement

– Measure torsion backlash four times around circumference ⇒ page 39–41; this must be **0.12 – 0.22 mm.**

Important!

The results of the individual measurements must not differ from each other by more than 0.06 mm.