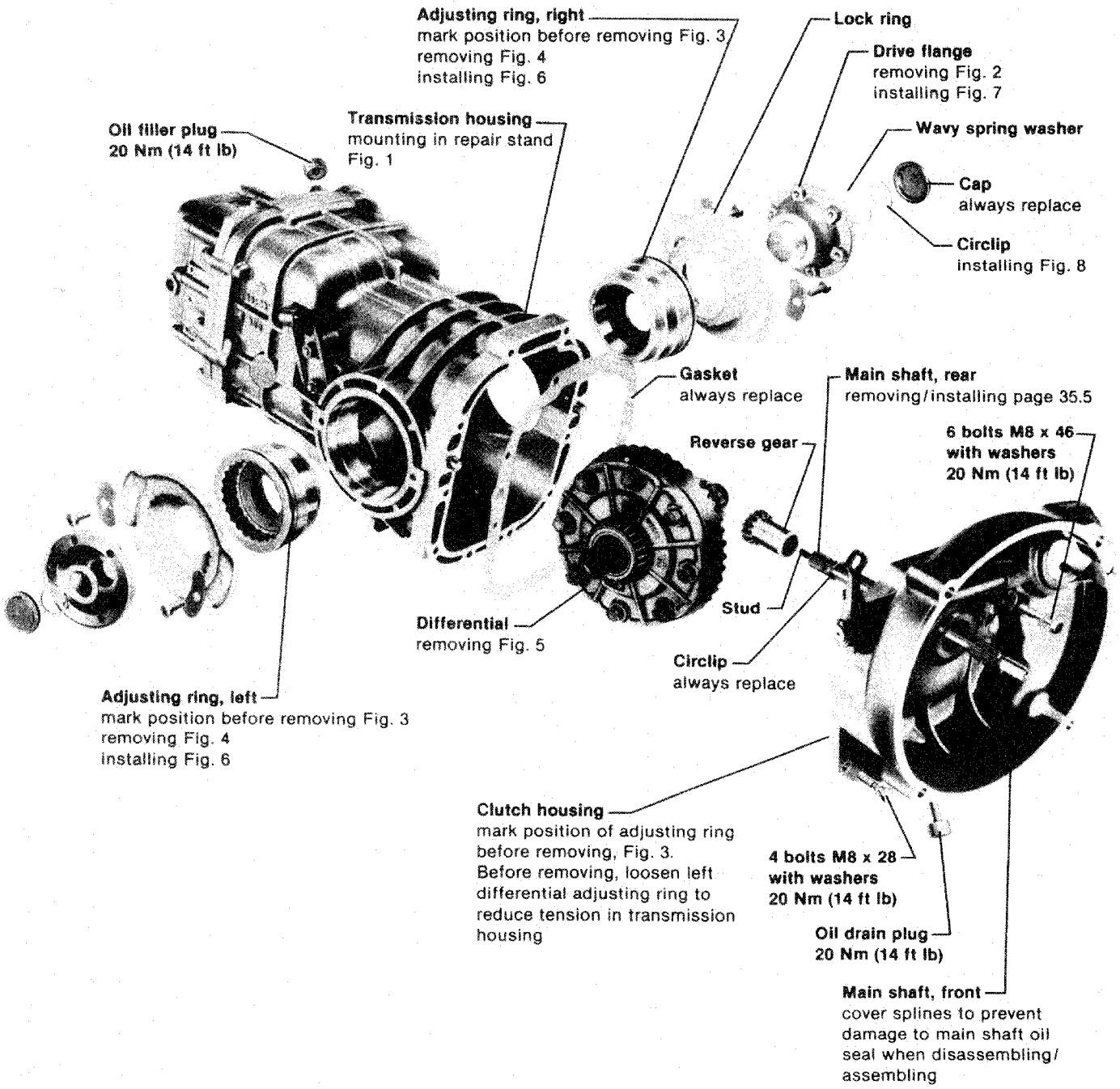
4-Speed 091 Manual Transmission Case, Gears, Shafts

Quick Data

Index

Transmission/Final drive lubricant:
Hypoid oil API/GL-4; MIL-L2105
SAE 80W, SAE 80W/90
Capacity: 3.5 ltr (3.7 US qt)



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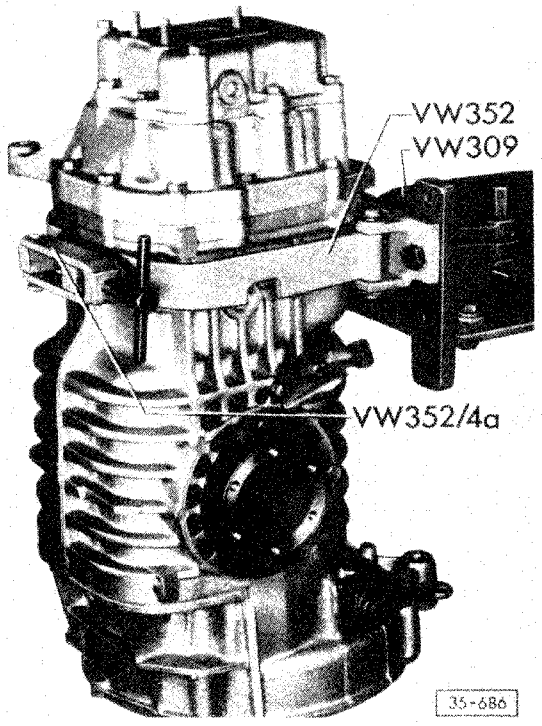


Fig. 1 **Transmission housing, mounting in repair stand**

— mount transmission in repair stand
— drain transmission oil

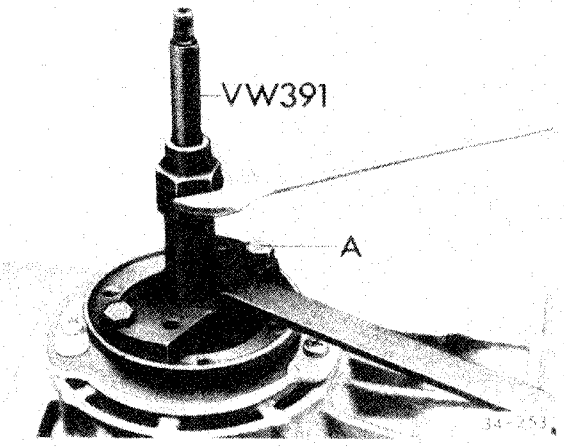


Fig. 2 **Drive flange, removing**

— remove circlip and wave washer
— attach VW391 to flange with 2 bolts
• A = M8 x 30 bolts
— pull drive flange out

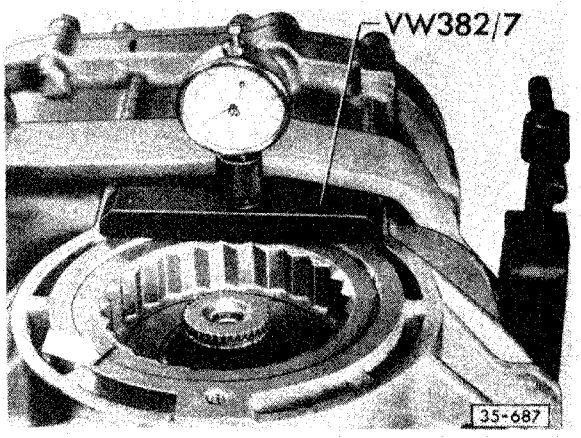


Fig. 3 **Adjusting ring, marking position**

Note

Before starting repair work (which does not require final drive to be adjusted) mark position of adjusting rings on transmission housing. Measure depth to which they are installed with VW 382/7 and write down readings

— scribe left side (ring gear side) with one mark (arrow)
— scribe right side with two marks

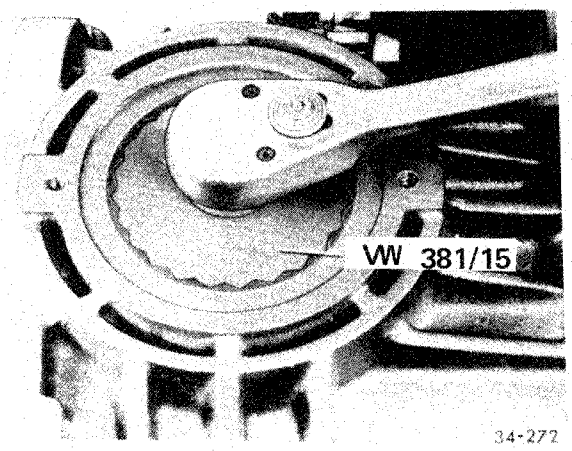


Fig. 4 **Adjusting rings, removing**

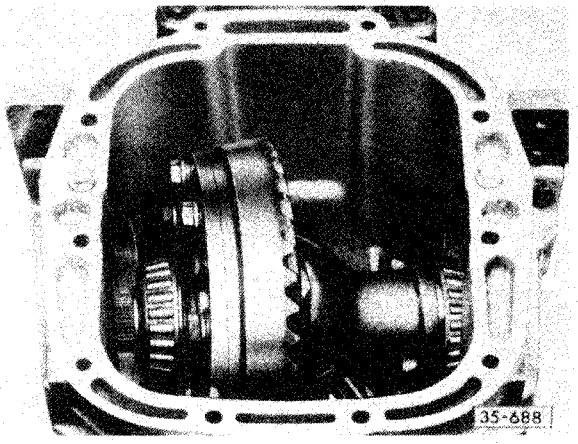


Fig. 5 **Differential, removing**

— remove adjusting rings and rear main shaft
— lift out differential

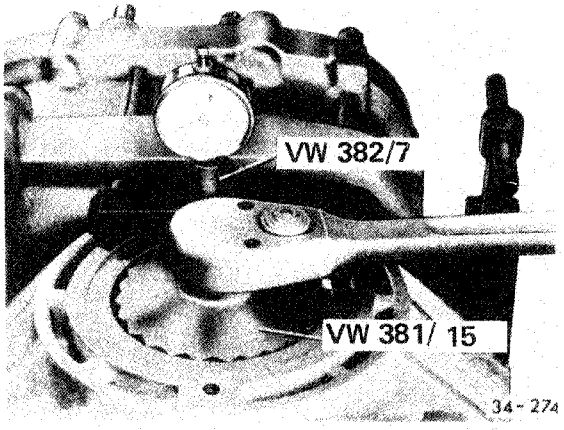


Fig. 6 **Adjusting rings, installing**

— install left and right adjusting rings and align marks at depth previously measured
— lubricate threads with MoS_2 grease

CAUTION

Do not tighten left side adjusting ring until clutch housing has been installed and bolts torqued

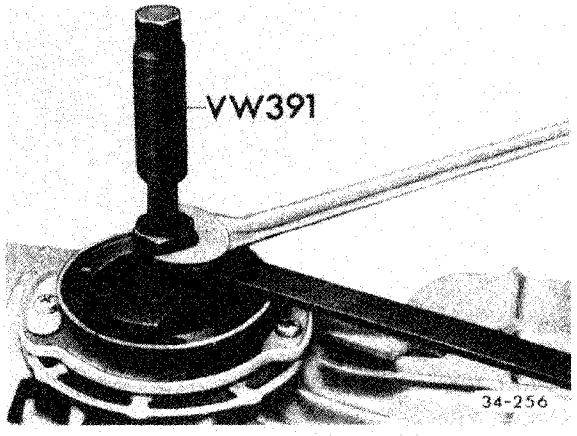


Fig. 7 **Drive flange, installing**

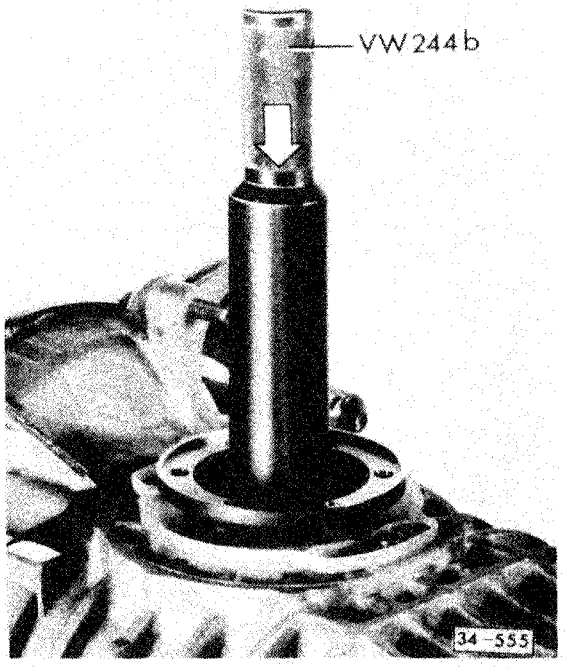
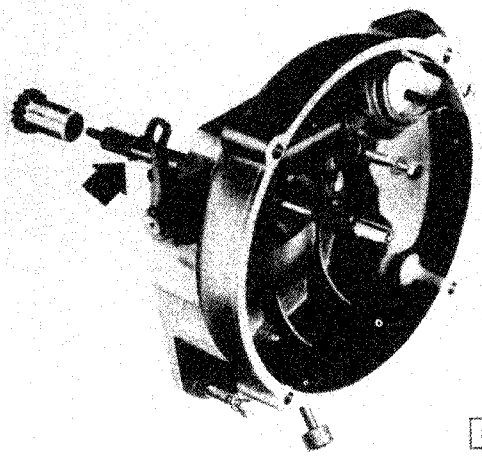


Fig. 8 **Circlip for drive flange, installing**

— insert wave washer
— press circlip into groove with VW 244b and at same time check that washer is centered

Rear main shaft, removing/installing

Work sequence



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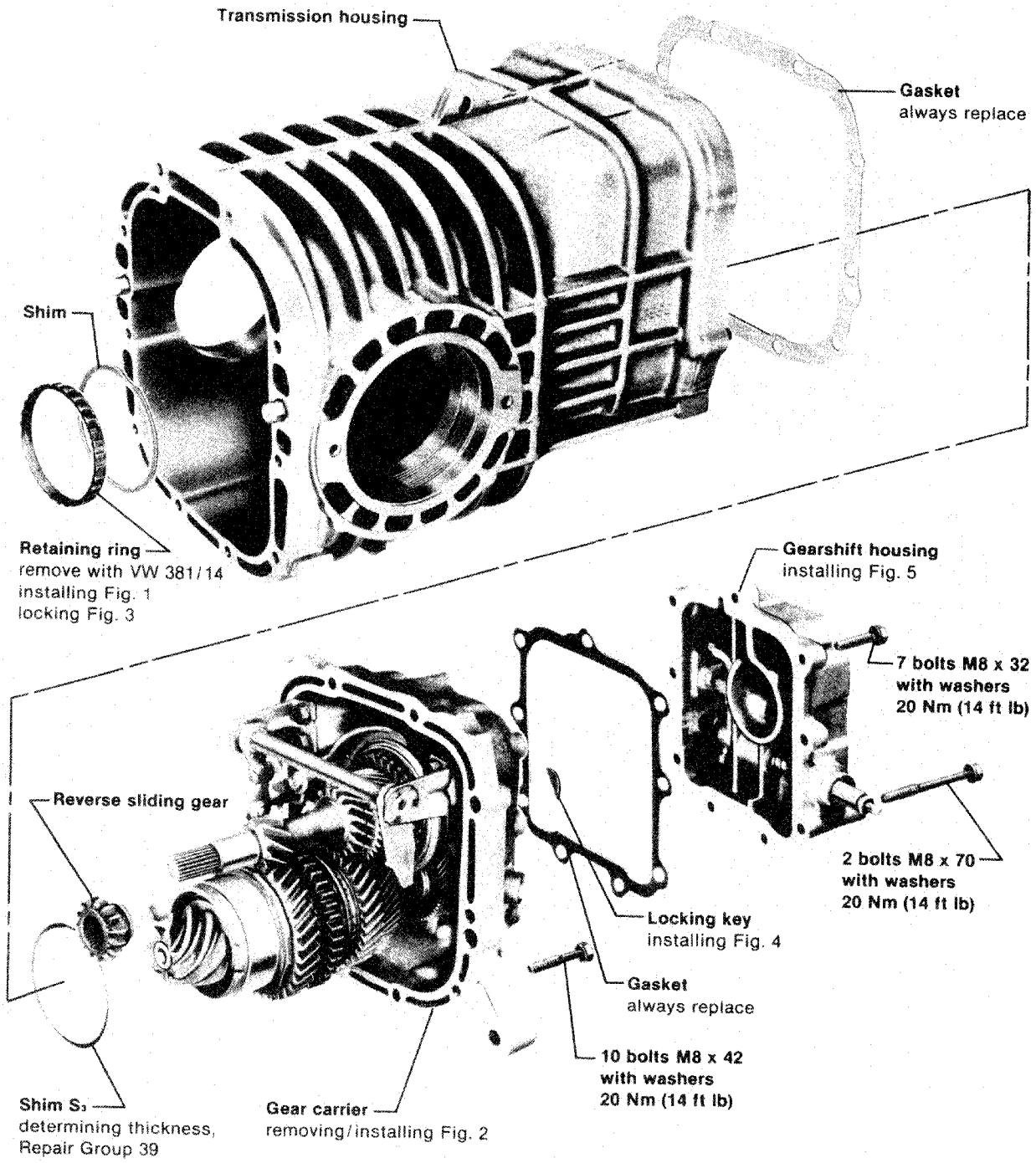
Removing

— remove circlip (arrow)
— push reverse gear backward and screw out main shaft

Installing

— screw front and rear main shafts together, then back off one spline
— push reverse gear on and install new circlip



Note

Differential must be removed before gear carrier can be removed, see page 35.4

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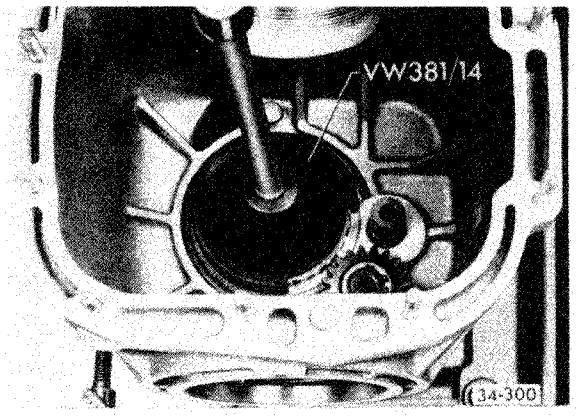


Fig. 1 **Retaining ring, installing**

— tighten to 225 Nm (162 ft lb), then back off and retighten to 225 Nm (162 ft lb)

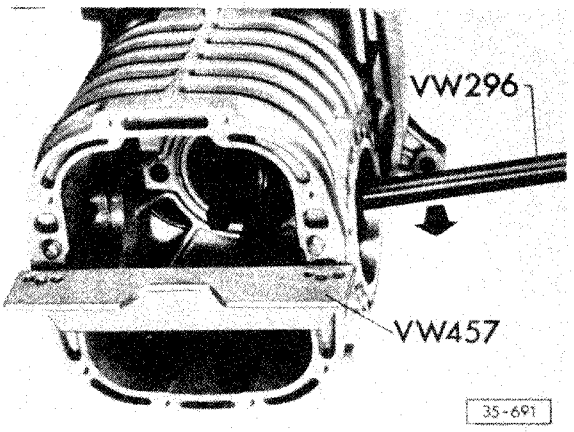


Fig. 2 **Gear carrier, removing/installing**

Note

If bearing and/or transmission housing are replaced, and dimension r is not marked on ring gear, pinion depth must be measured and noted **before** gear carrier is removed. This is dimension **r**. See Repair Group 39. When assembling, parts must be installed in same position. See Ring gear/pinion, adjusting, Repair Group 39

Work sequence

Removing

• use two M8 x 20 bolts to attach VW 457
— press gear carrier out with VW 296

Installing

— tap on pinion with plastic hammer to install
— turn reverse shaft so that reverse sliding gear slips onto splines properly
— align flat on bearing with recess in housing

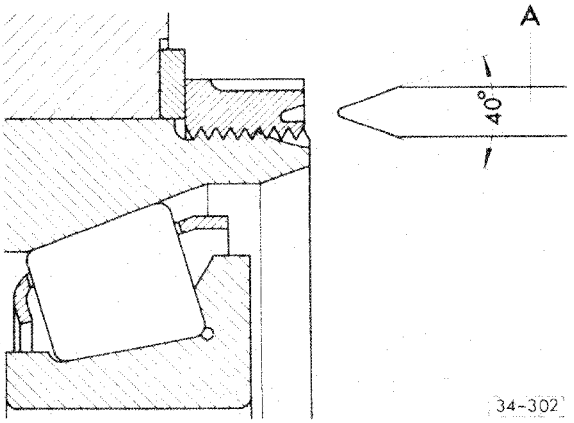


Fig. 3 **Retaining ring, locking**

— lock ring by peening twice with tool **A**

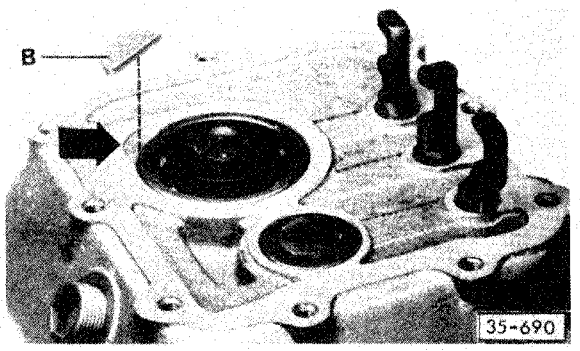


Fig. 4 **Main shaft bearing locking key B, installing**

— press locking key **B** into recess (arrow)

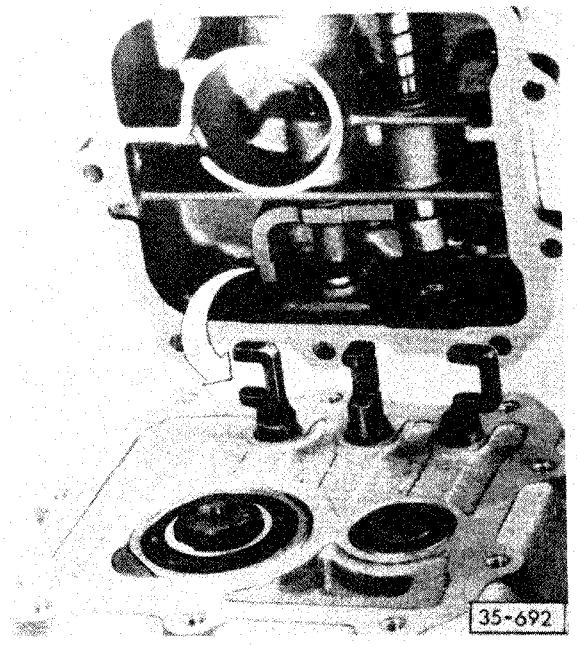
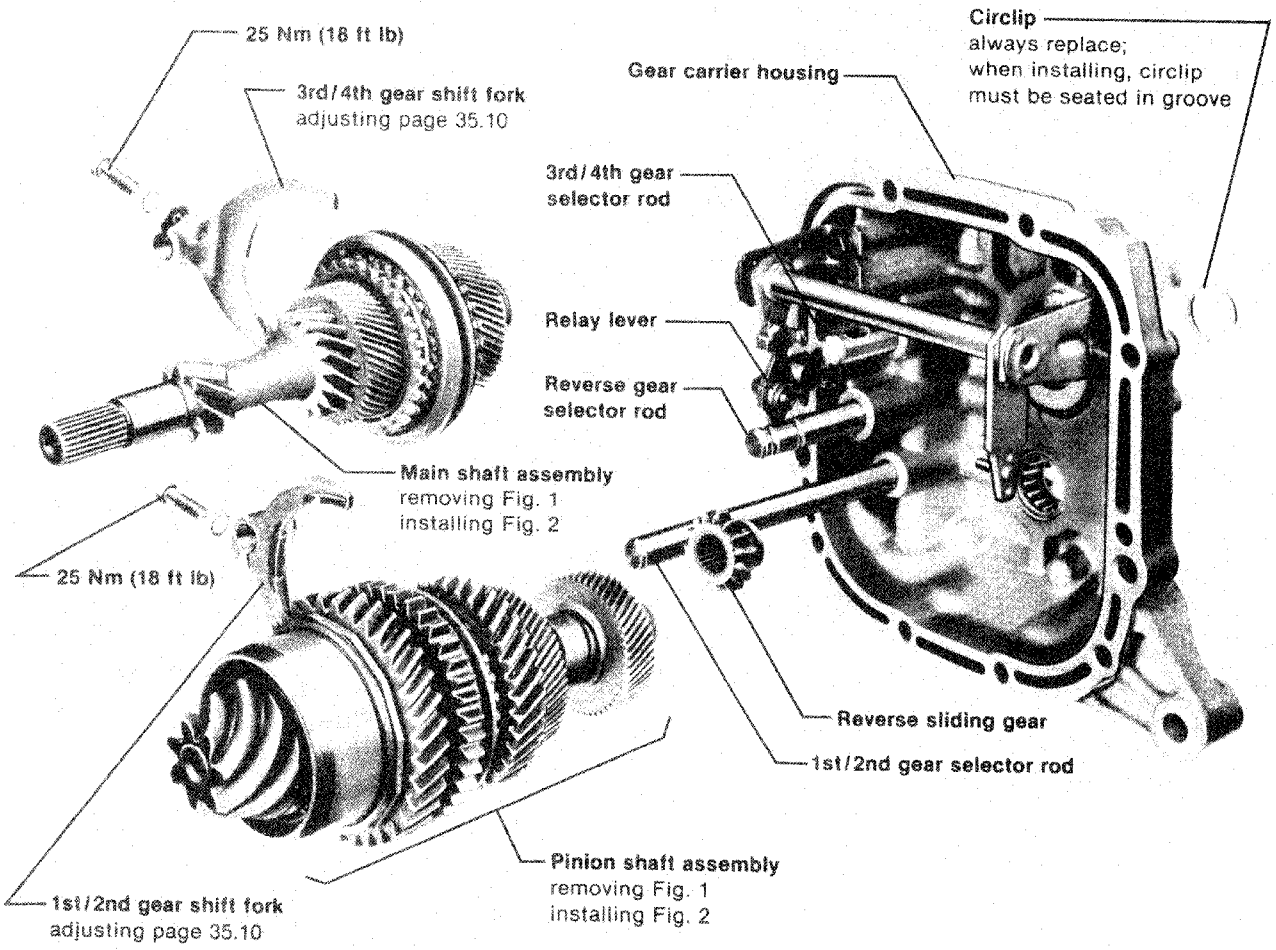


Fig. 5 **Gear shift housing, installing**

— guide inner shift lever into 3rd/4th gear selector shaft (arrow) when installing



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Gear Ratios

1st gear	3.78(9:34)
2nd gear	2.06(17:35)
3rd gear	1.26(50:63)
4th gear	0.852(61:52)
Reverse	3.28(13:16 x 15:40)
Final drive	4.57(7:32)

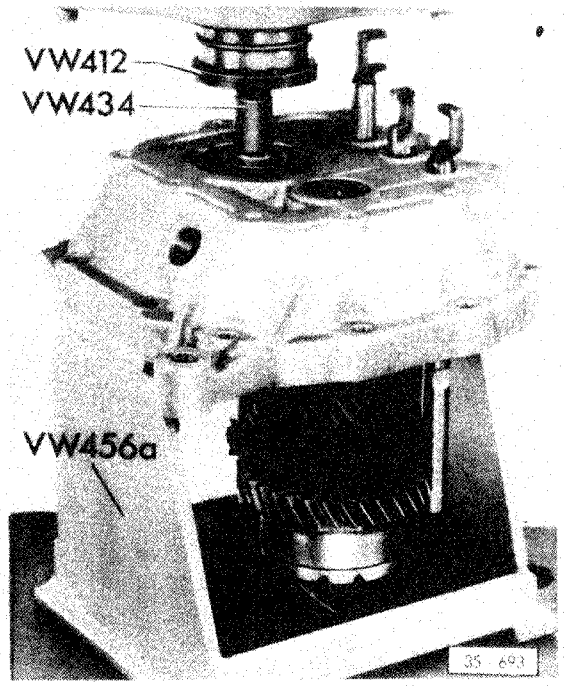


Fig. 1 **Main shaft/pinion shaft assemblies, removing**

— remove circlip
— remove shift fork for 1st/2nd gear
— move selector shaft back to neutral

— remove clamp bolt for 3rd/4th gear shift fork
— engage 3rd gear, pull selector shaft back until shift fork is free
— engage 4th gear

— loosen union nut on relay lever support
— lift pinion shaft when pressing out and guide it carefully so that gears and needle bearings do not jam and get damaged
— check 3rd/4th gear for free movement

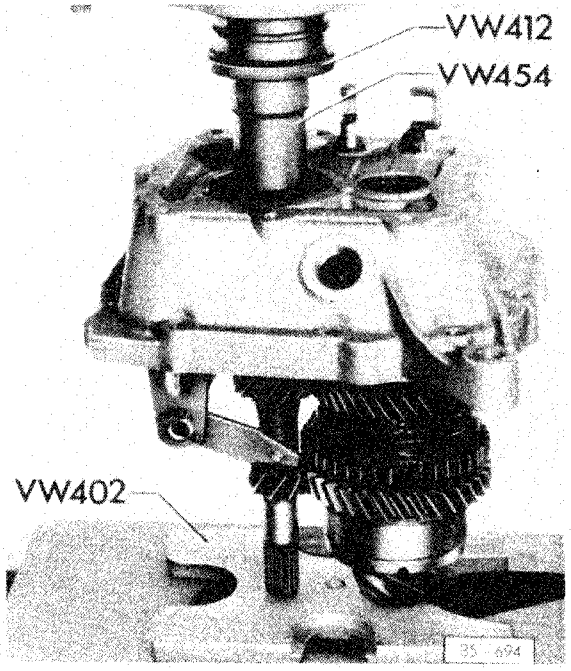
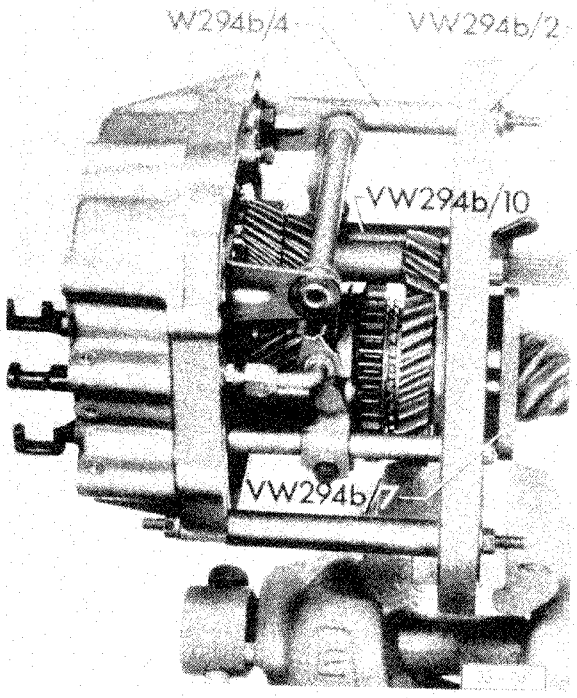


Fig. 2 **Main shaft/pinion shaft assemblies, installing**

— insert 3rd/4th gear shift fork and check for free movement when pressing in shafts
— lift pinion shaft and guide carefully when pressing in
— after installing shafts, adjust shift forks, see page 35.10

Shift forks, adjusting

Work sequence

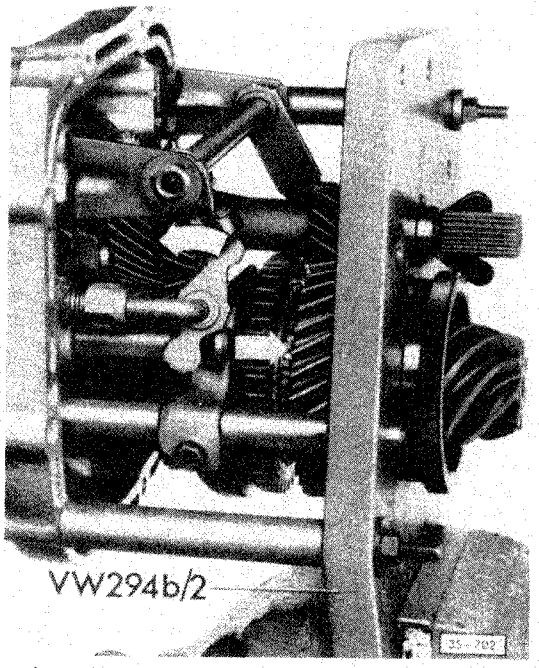


— position gear carrier, with shim S_3 (see Repair Group 39), in tool VW 294b **without** gasket for gear carrier
• length of bolts VW 294b = 106 mm (4-3/16 in.)
— tighten retaining ring VW 294b/7 by hand
— install shift forks for 1st/2nd and 3rd/4th gears

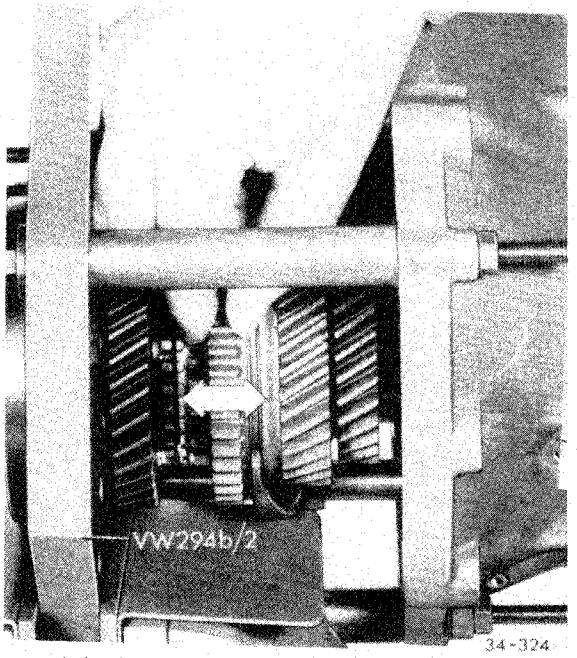
CAUTION

Shift fork for 1st/2nd gear (wider fork, marking: No. 551 A) is installed with flat side **away** from gear carrier.

Shift fork for 3rd/4th gear (thinner fork, marking: No. 561 A) is installed with flat side **toward** gear carrier.



— install relay lever support together with relay lever



— put 1st/2nd gear selector shaft in 2nd gear position
— slide operating sleeve with fork over synchronizing teeth until it is against 2nd gear
— center shift fork in groove of operating sleeve and tighten clamp screw

CAUTION

Shift fork must not rub or exert pressure on sides of groove in operating sleeve when in neutral position or when gear is engaged. **There must always be clearance**

— select 1st and 2nd gears several times while turning main shaft and check clearance of shift fork in operating sleeve in each position
  • if necessary, alter shift fork position until there is same amount of clearance on selector shaft in both end positions
— tighten clamp screw to 25 Nm (18 ft lb)
— put 3rd/4th gear selector shaft in 3rd gear position
— adjust 3rd/4th gear shift fork in same way as 1st/2nd gear shift fork

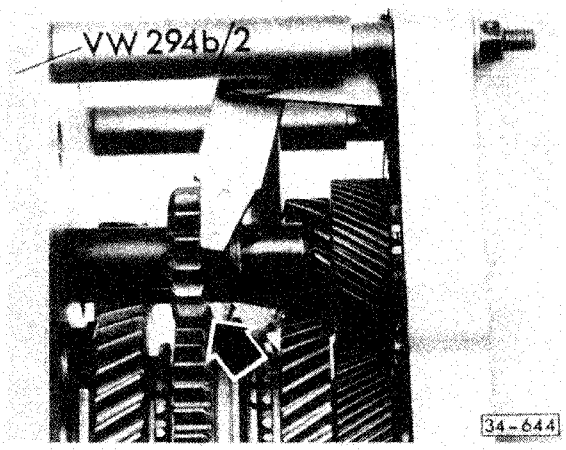
CAUTION

For correct adjustment of 3rd/4th gears, main shaft ball bearing must be pressed fully into gear carrier housing

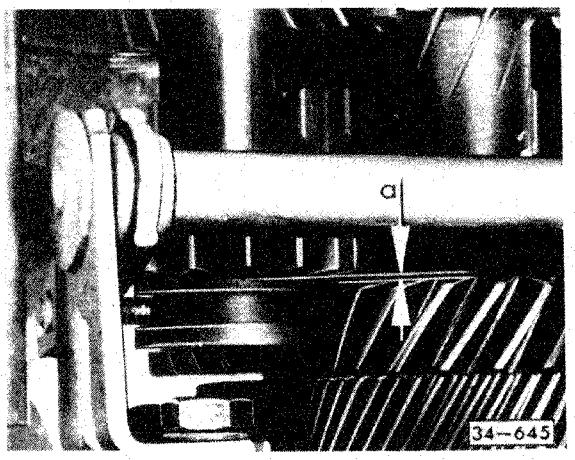
— press reverse gear selector shaft into reverse gear position

Note

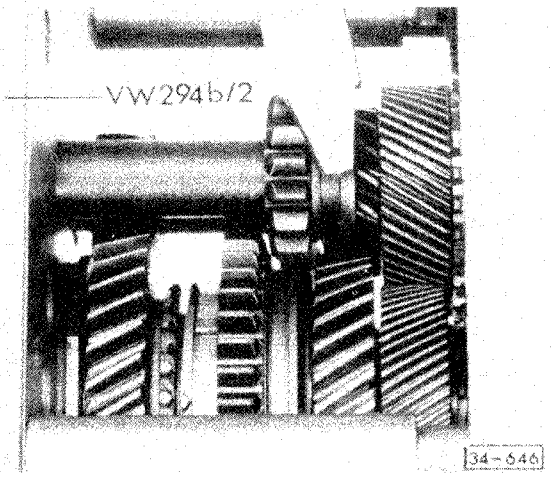
After repair work on gear carrier housing, adjust axial play in reverse sliding gear before adjusting reverse gear



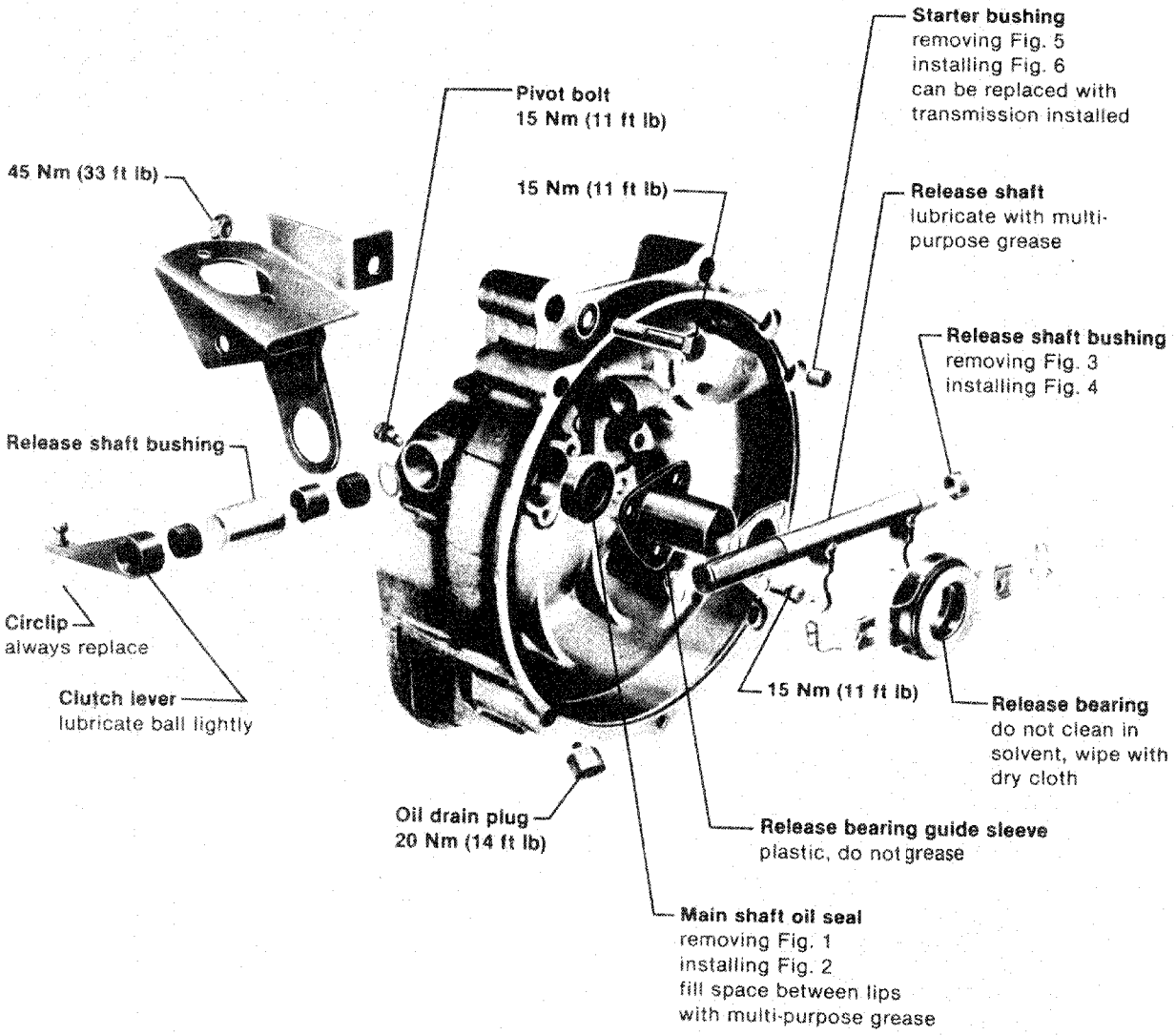
— adjust reverse gear so that sliding gear is fully in mesh with teeth on operating sleeve for 1st/2nd gear (arrow)
— tighten union nut on relay lever support



— shift out of reverse gear and press sliding gear lightly toward gear carrier housing. Clearance between reverse gear and 2nd gear on main shaft must be
  • **a** = min. 0.5 mm (0.020 in.)



— engage 2nd gear
— check clearance between operating sleeve and reverse sliding gear in this position and adjust if necessary
— check interlock mechanism
  • **when gear is engaged it must not be possible to engage any other gear**


Starter bushing
removing Fig. 5
installing Fig. 6
can be replaced with
transmission installed
Pivot bolt
15 Nm (11 ft lb)
45 Nm (33 ft lb)
15 Nm (11 ft lb)
Release shaft
lubricate with multi-
purpose grease
Release shaft bushing
removing Fig. 3
installing Fig. 4
Release shaft bushing
Circlip
always replace
Clutch lever
lubricate ball lightly
15 Nm (11 ft lb)
Release bearing
do not clean in
solvent, wipe with
dry cloth
Oil drain plug
20 Nm (14 ft lb)
Release bearing guide sleeve
plastic, do not grease
Main shaft oil seal
removing Fig. 1
installing Fig. 2
fill space between lips
with multi-purpose grease

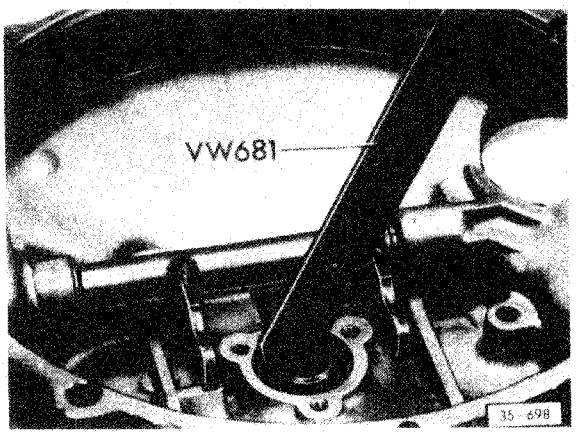


Fig. 1 Main shaft oil seal, removing

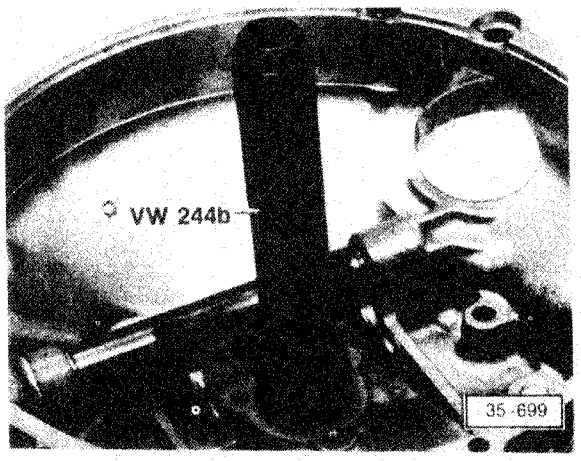


Fig. 2 Main shaft oil seal, installing

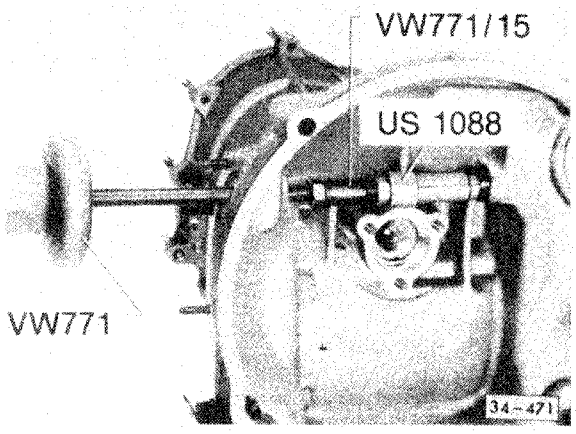


Fig. 3 Release shaft bushing, removing

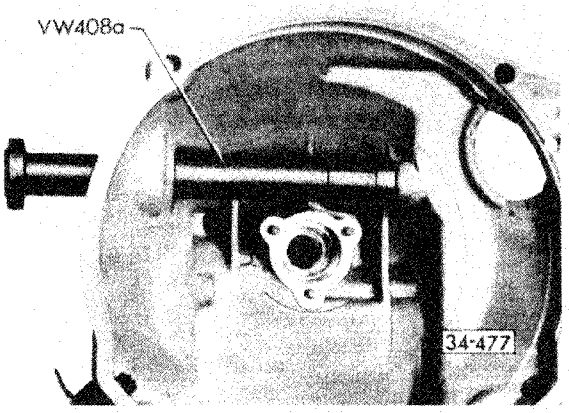


Fig. 4 Release shaft bushing, installing

— drive in flush

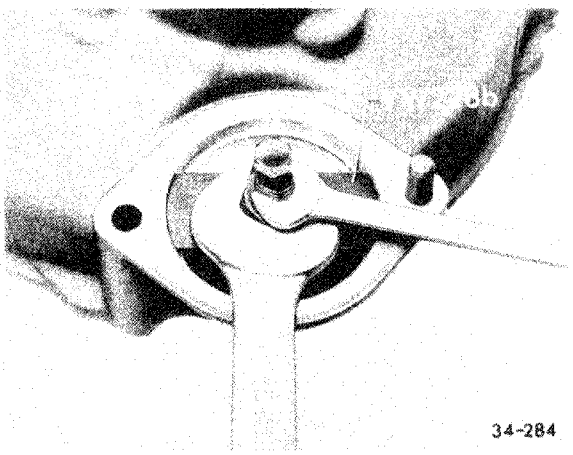


Fig. 5 Starter bushing, removing (transmission installed)

• when transmission is removed, use drift VW 222a

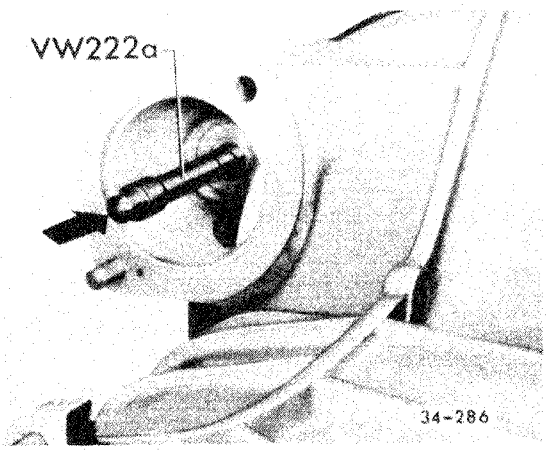
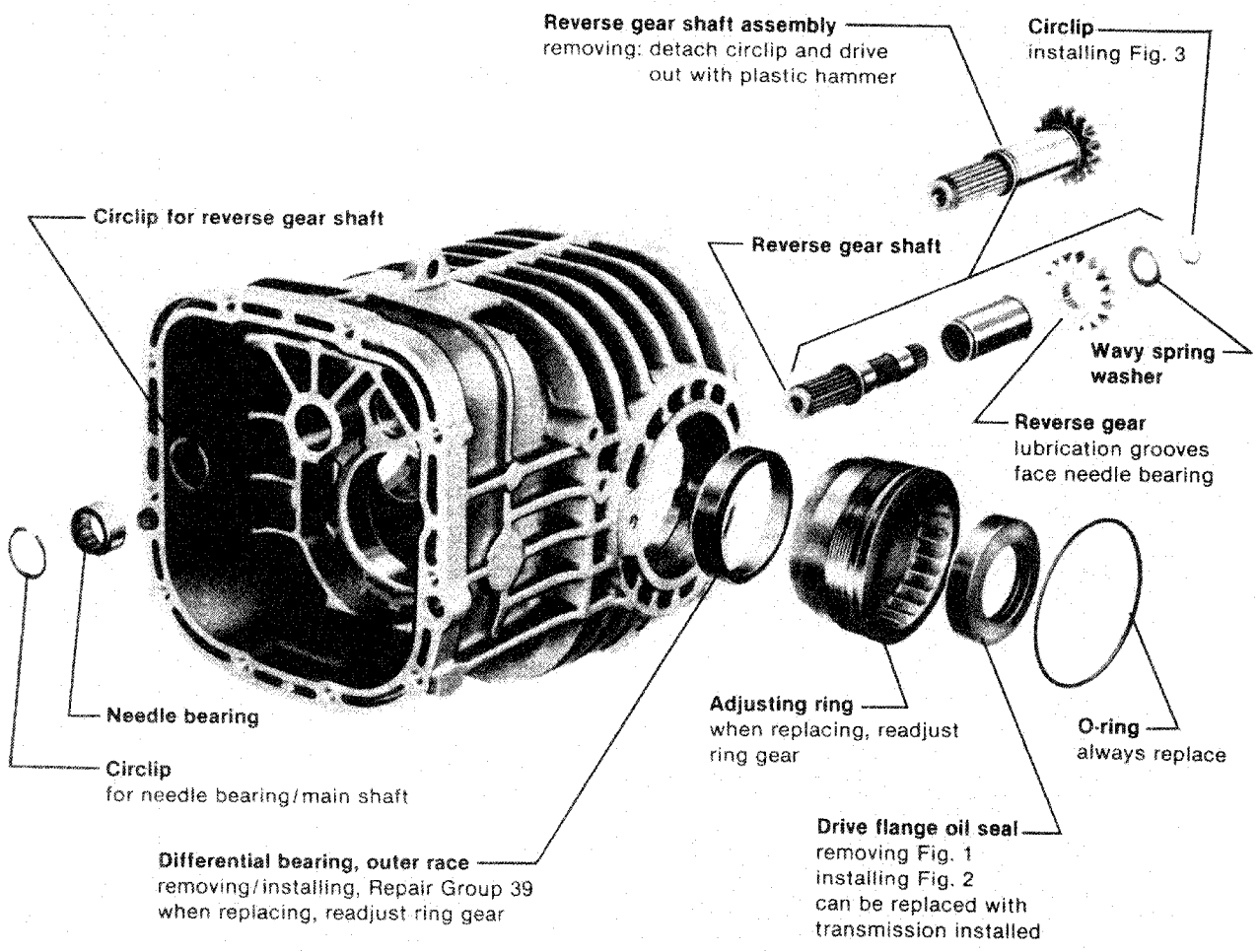


Fig. 6 Starter bushing, installing

— lubricate bushing and drive in flush


Reverse gear shaft assembly
removing: detach circlip and drive out with plastic hammer
Circlip
installing Fig. 3
Circlip for reverse gear shaft
Reverse gear shaft
Wavy spring washer
Reverse gear
lubrication grooves face needle bearing
Needle bearing
Circlip
for needle bearing/main shaft
Adjusting ring
when replacing, readjust ring gear
O-ring
always replace
Differential bearing, outer race
removing/installing, Repair Group 39
when replacing, readjust ring gear
Drive flange oil seal
removing Fig. 1
installing Fig. 2
can be replaced with transmission installed
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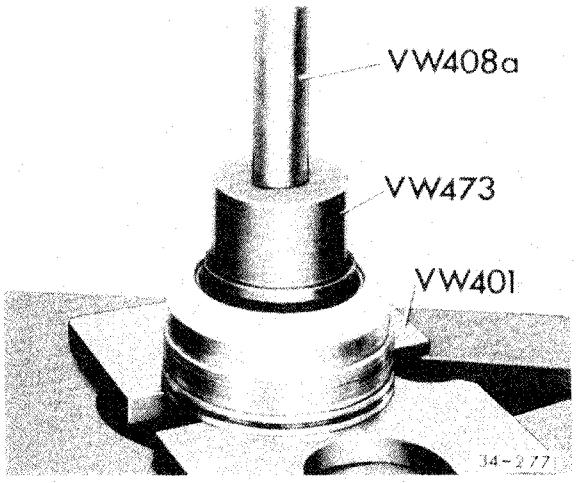


Fig. 1 Drive flange oil seal, removing

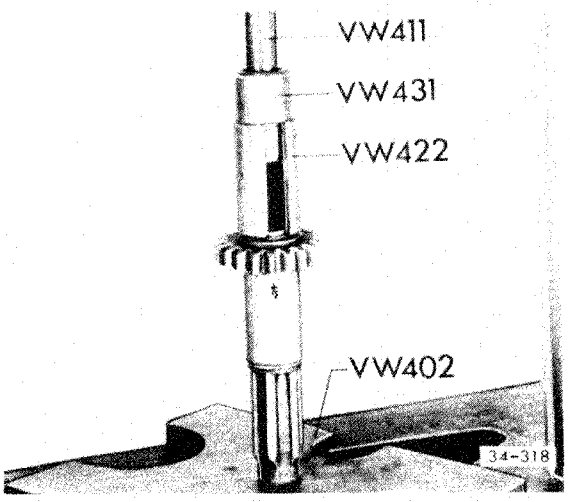


Fig. 3 Reverse gear shaft circlip, installing

— press circlip into groove
— squeeze into groove with waterpump pliers

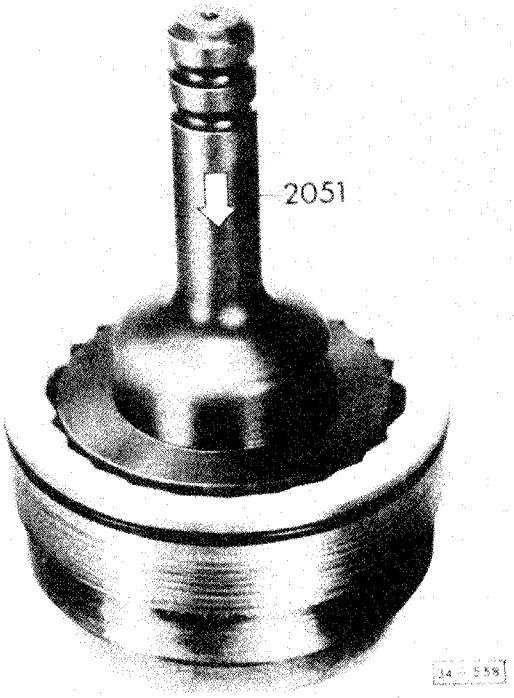
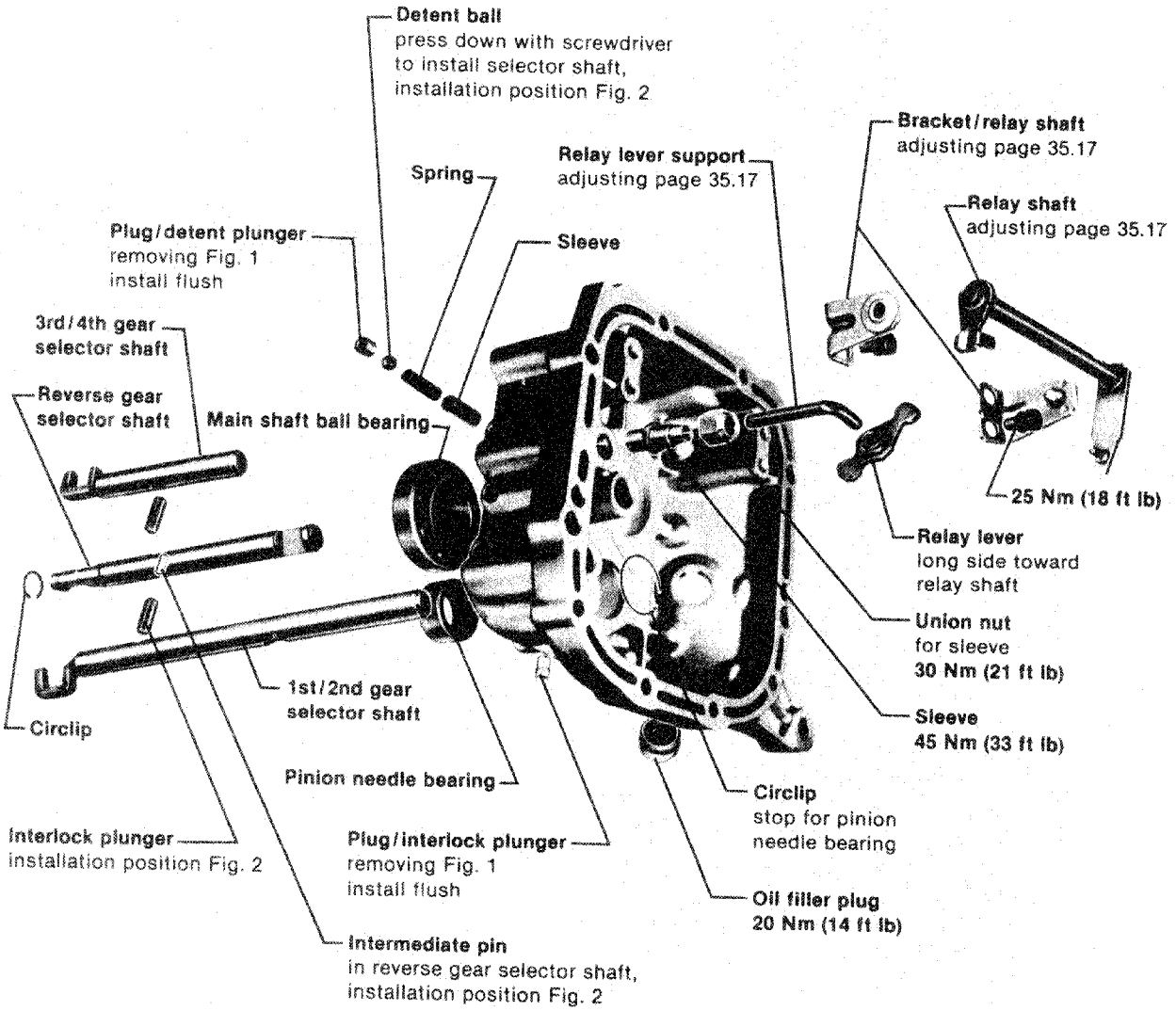


Fig. 2 Drive flange oil seal, installing

— press in flush


Detent ball
press down with screwdriver
to install selector shaft,
installation position Fig. 2
Spring
Relay lever support
adjusting page 35.17
Bracket/relay shaft
adjusting page 35.17
Relay shaft
adjusting page 35.17
Plug/detent plunger
removing Fig. 1
install flush
Sleeve
3rd/4th gear
selector shaft
Reverse gear
selector shaft
Main shaft ball bearing
25 Nm (18 ft lb)
Relay lever
long side toward
relay shaft
Union nut
for sleeve
30 Nm (21 ft lb)
Sleeve
45 Nm (33 ft lb)
1st/2nd gear
selector shaft
Circlip
Pinion needle bearing
Circlip
stop for pinion
needle bearing
Interlock plunger
installation position Fig. 2
Plug/interlock plunger
removing Fig. 1
install flush
Oil filler plug
20 Nm (14 ft lb)
Intermediate pin
in reverse gear selector shaft,
installation position Fig. 2

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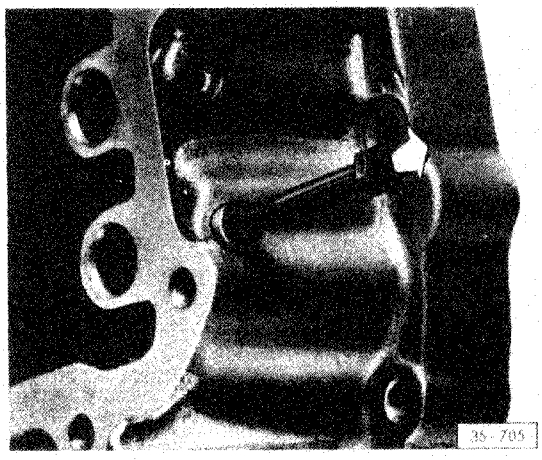


Fig. 1 Plug for interlock/detent plunger, removing

— tap 6 mm thread in plug and pull out with bolt (always use new plug)

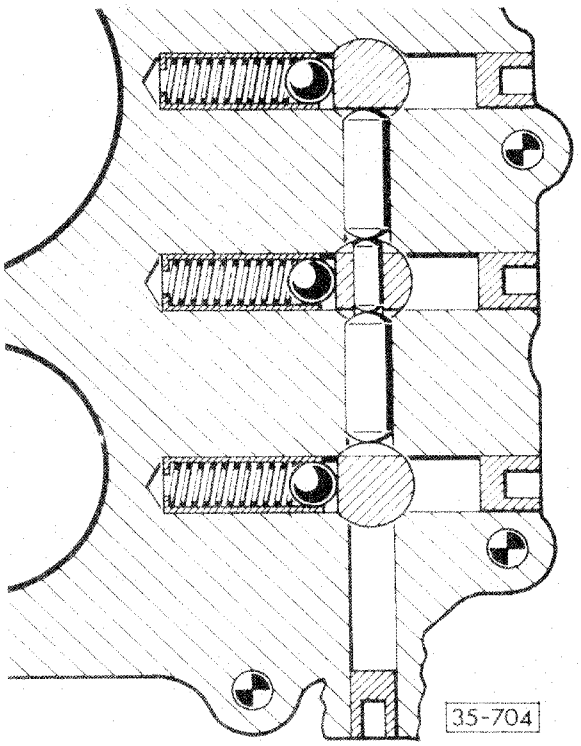


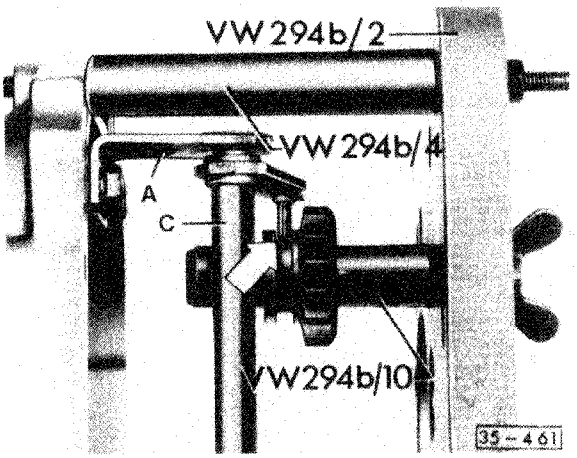
Fig. 2 Interlock plungers, positioning

— check that when gear is engaged it is not possible to engage any other gear

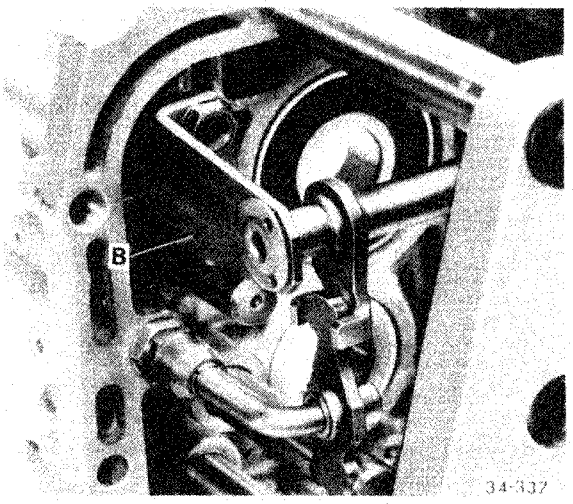
Reverse gear clearance, adjusting

Note

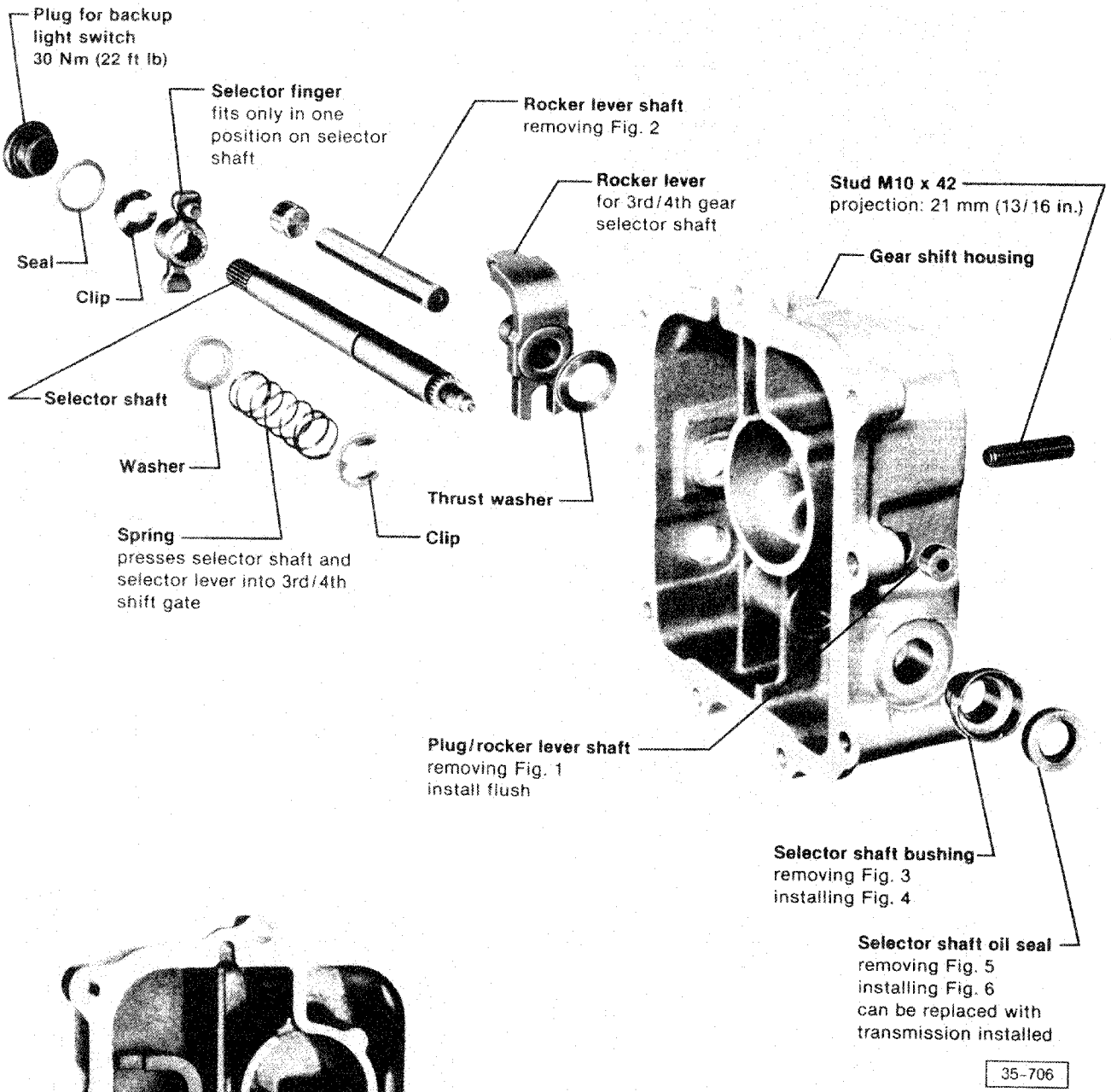
When reverse relay shaft and brackets have been removed, play between reverse gear and pin (arrow) on relay shaft must be adjusted by moving shaft and brackets vertically (as shown)

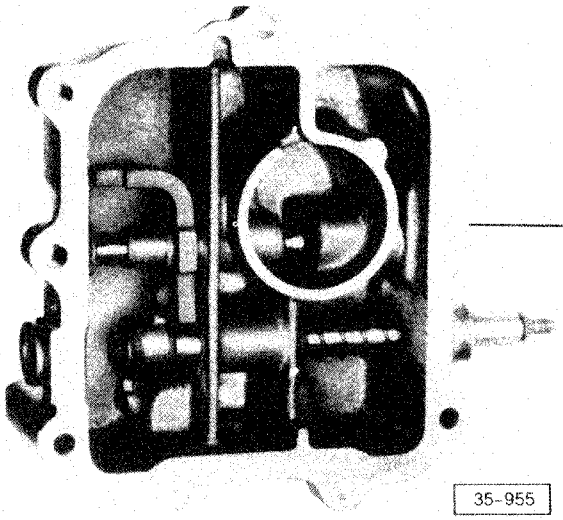


— install gear carrier with reverse gear in setting tool VW 294b
— loosen bolts on both brackets
— slide bracket **A** down against shaft **C** until pin (arrow) on relay shaft is firmly against reverse gear
— pull bracket back slightly until there is clearance between pin and reverse gear
— tighten bolts on bracket **A**



— press bracket **B** against relay shaft until relay shaft is installed firmly and without play
— tighten bolts on bracket **B**


Plug for backup light switch 30 Nm (22 ft lb)
Selector finger fits only in one position on selector shaft
Rocker lever shaft removing Fig. 2
Rocker lever for 3rd/4th gear selector shaft
Stud M10 x 42 projection: 21 mm (13/16 in.)
Gear shift housing
Seal
Clip
Selector shaft
Washer
Spring presses selector shaft and selector lever into 3rd/4th shift gate
Thrust washer
Clip
Plug/rocker lever shaft removing Fig. 1 install flush
Selector shaft bushing removing Fig. 3 installing Fig. 4
Selector shaft oil seal removing Fig. 5 installing Fig. 6 can be replaced with transmission installed
35-706


Gear shift housing assembly shows position of selector shaft and rocker shaft parts when installed
35-955

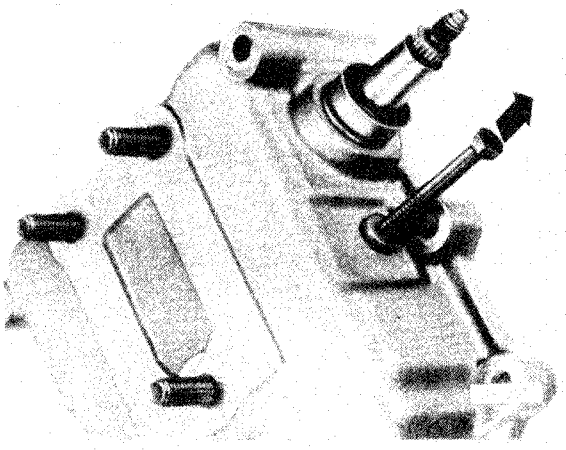


Fig. 1 Plug for rocker lever shaft, removing

— tap 6 mm thread in plug and pull out with bolt (always use new plug)

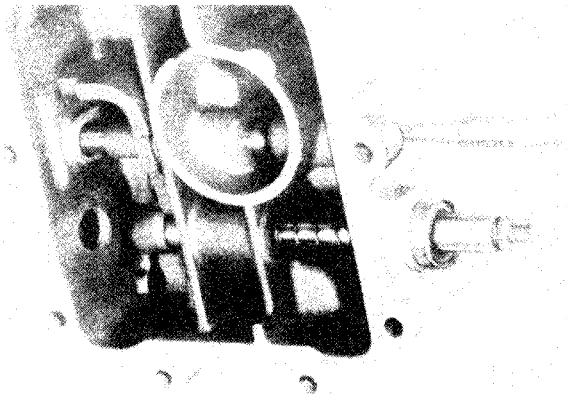


Fig. 2 Rocker lever shaft, removing

— first remove plug, see Fig. 1

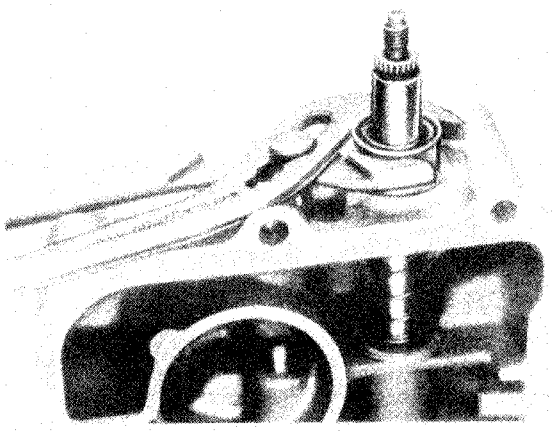


Fig. 3 Selector shaft bushing, removing

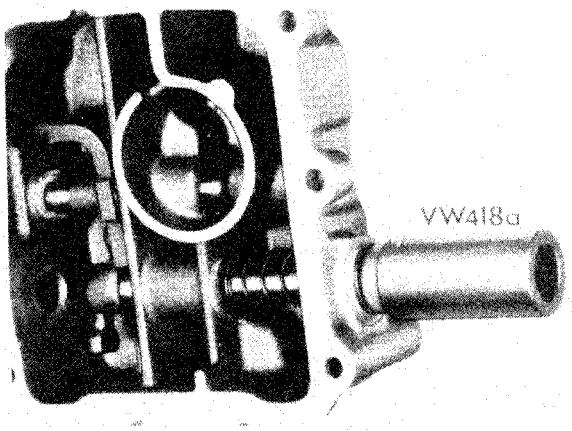


Fig. 4 Selector shaft bushing, installing

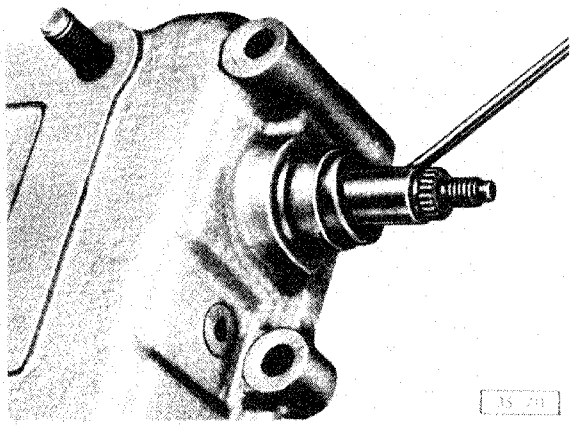


Fig. 5 Selector shaft oil seal, removing

— pull out with screwdriver

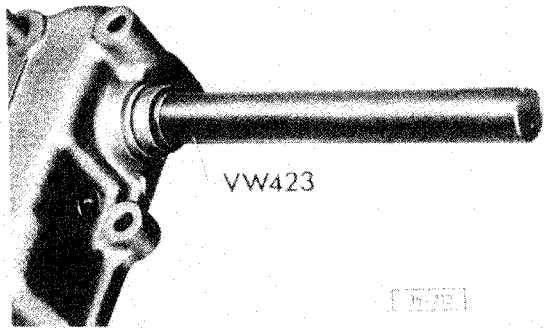
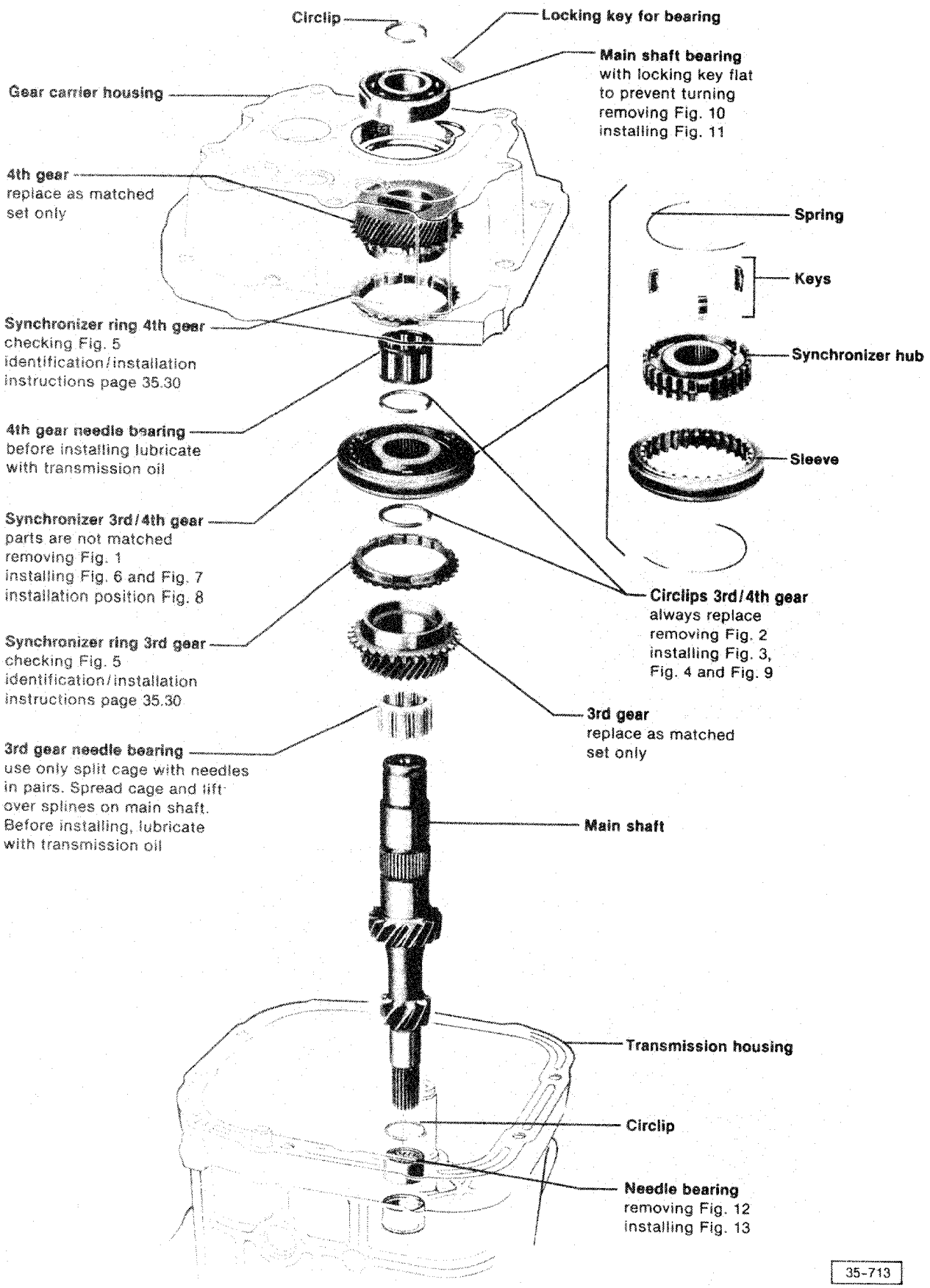


Fig. 6 Selector shaft oil seal, installing

— fill space between lips with multi-purpose grease


Circlip
Locking key for bearing
Main shaft bearing
with locking key flat
to prevent turning
removing Fig. 10
installing Fig. 11
Gear carrier housing
4th gear
replace as matched
set only
Spring
Keys
Synchronizer hub
Sleeve
Synchronizer ring 4th gear
checking Fig. 5
identification/installation
instructions page 35.30
4th gear needle bearing
before installing lubricate
with transmission oil
Synchronizer 3rd/4th gear
parts are not matched
removing Fig. 1
installing Fig. 6 and Fig. 7
installation position Fig. 8
Circlips 3rd/4th gear
always replace
removing Fig. 2
installing Fig. 3,
Fig. 4 and Fig. 9
Synchronizer ring 3rd gear
checking Fig. 5
identification/installation
instructions page 35.30
3rd gear
replace as matched
set only
3rd gear needle bearing
use only split cage with needles
in pairs. Spread cage and lift
over splines on main shaft.
Before installing, lubricate
with transmission oil
Main shaft
Transmission housing
Circlip
Needle bearing
removing Fig. 12
installing Fig. 13
35-713

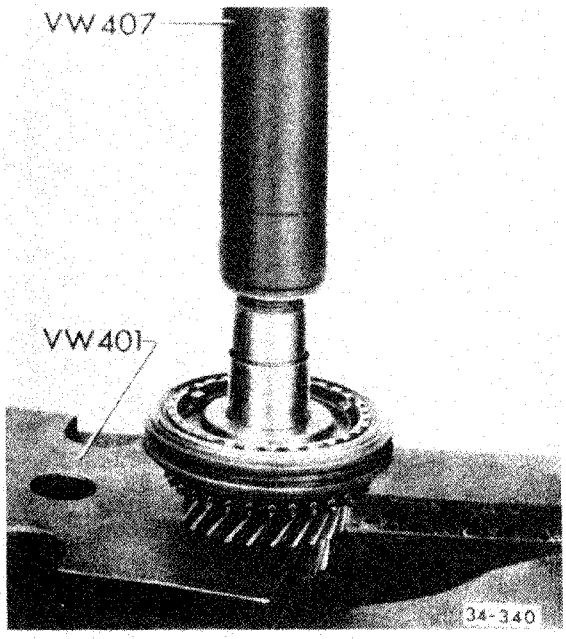


Fig. 1 Synchronizer 3rd/4th gear, removing

— press off together with 3rd gear

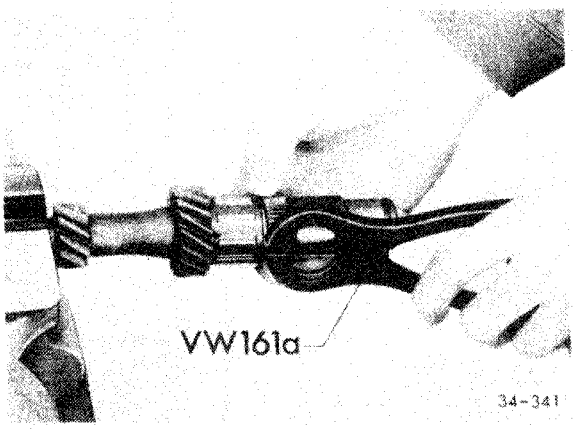


Fig. 2 Circlips 3rd/4th gear, removing

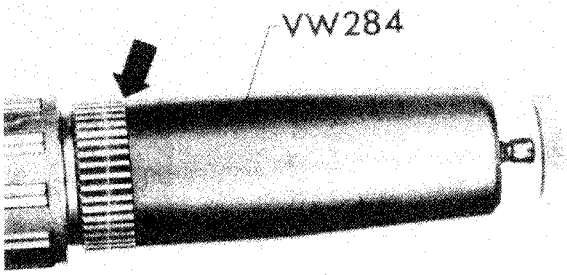


Fig. 3 Circlip 3rd/4th gear, installing

— slide sleeve over shaft until it contacts splines for hub (arrow). It may be necessary to back out knurled screw

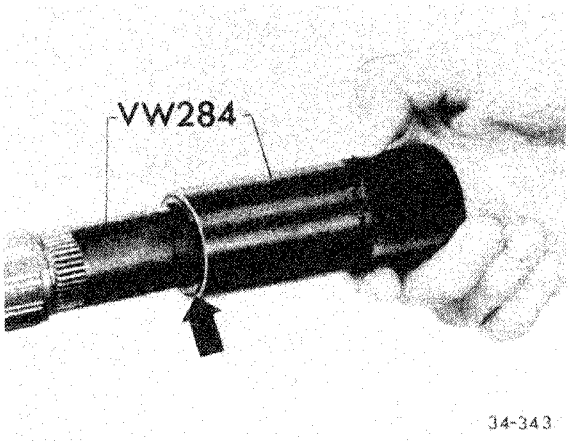


Fig. 4 Circlip 3rd/4th gear, installing

— place new circlip (arrow) on sleeve and push over splines with tube until circlip snaps into groove

CAUTION

Circlip must be located inside relieved part of installing tool while it is being pushed on so that it expands uniformly over complete circumference

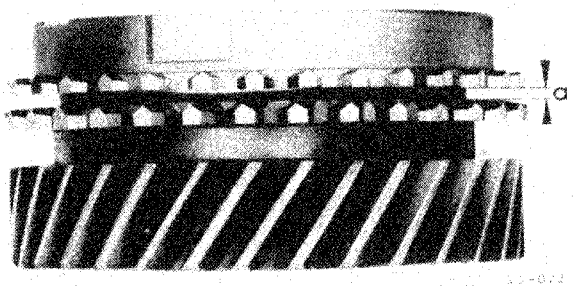


Fig. 5 Synchronizer rings 3rd/4th gear, checking

— press synchronizer rings onto gear by hand and measure gap a with feeler gauge

	New Part mm (in.)	Wear limit mm (in.)
Gap a	1.0–1.7 (0.039–0.067)	0.5 (0.020)

Note

Synchronizer ring identification marks and installation instructions, page 35.30

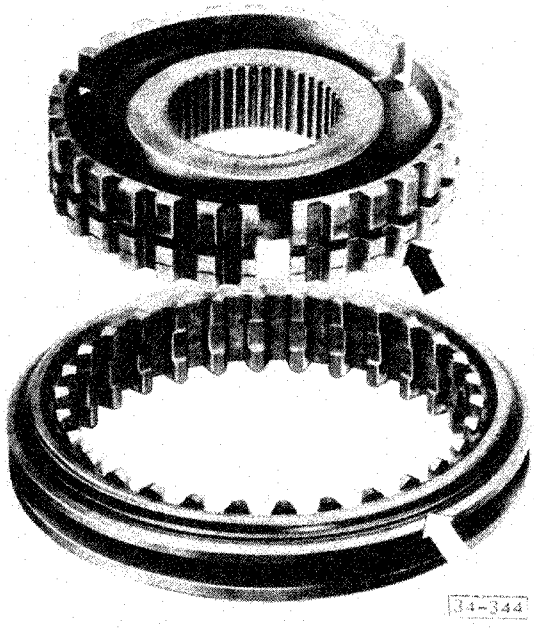


Fig. 6 **Synchronizer 3rd/4th gear, assembling**

- identification grooves (arrows) of sleeve and hub are on opposite sides. Groove on sleeve (white arrow) faces 4th gear
- sleeve and hub are not matched and can be replaced separately

— assemble parts at several positions before installing to determine position of smoothest operation with minimum backlash

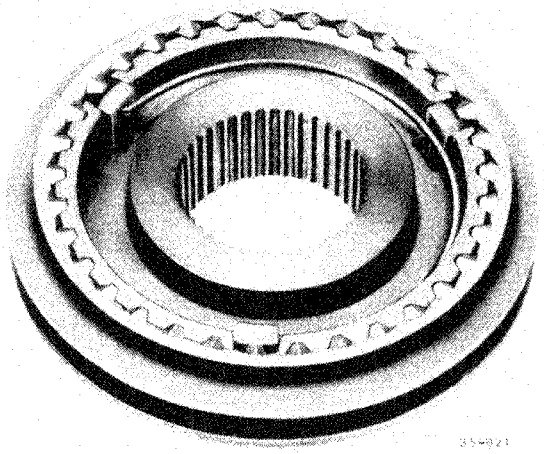


Fig. 7 **Synchronizer 3rd/4th gear, assembling**

— slide sleeve over synchronizer hub. Matched position is not necessary
— insert keys and install springs with ends offset 120°. Angled ends of springs must fit into keys

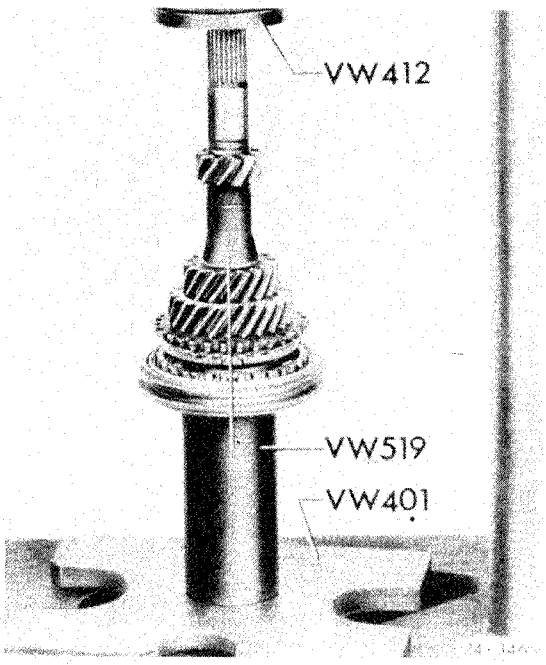


Fig. 8 **Synchronizer 3rd/4th gear, installing**

— turn synchronizer ring until grooves are in line with keys
- identification groove on sleeve (Fig. 6, white arrow) faces 4th gear

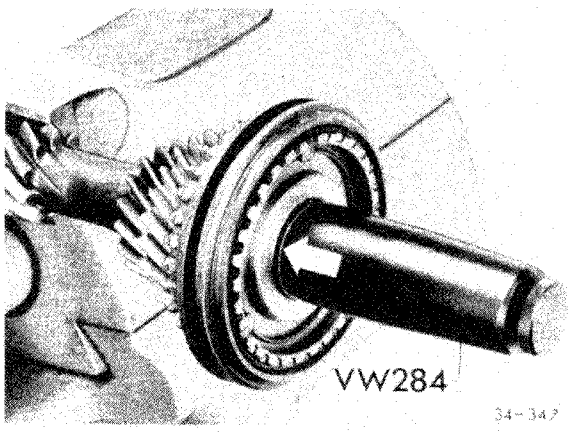


Fig. 9 **Circlip 3rd/4th gear, installing**

— slide sleeve over shaft and turn knurled screw in until groove (arrow) is exposed. If necessary, use M6 x 60 bolt instead of knurled screw
— push circlip on until it snaps into groove

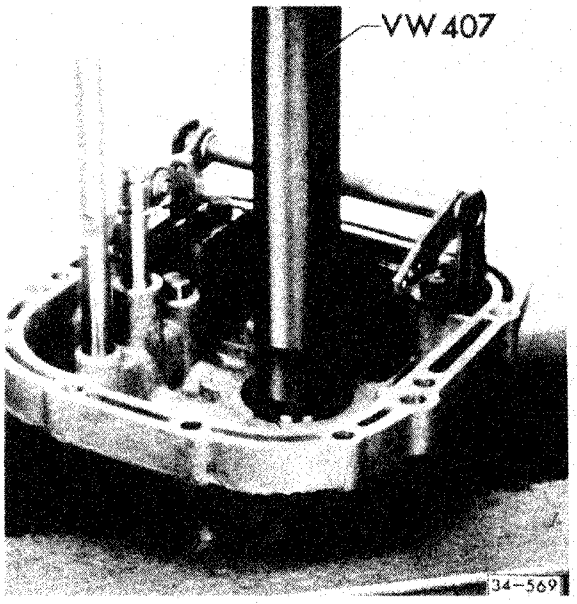


Fig. 10 Main shaft ball bearing, removing

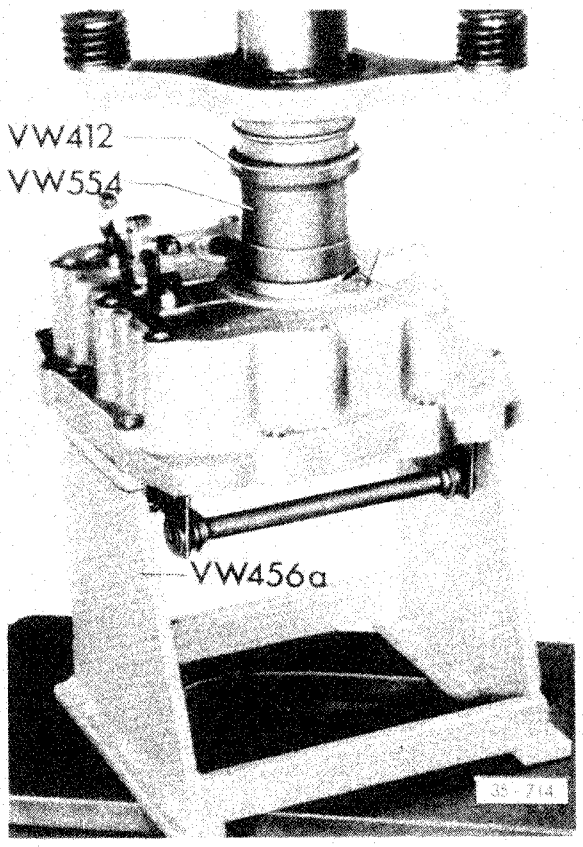


Fig. 11 Main shaft ball bearing, installing

— press in so that recess in bearing is aligned with recess (arrow) in housing
— install locking key to prevent bearing from turning

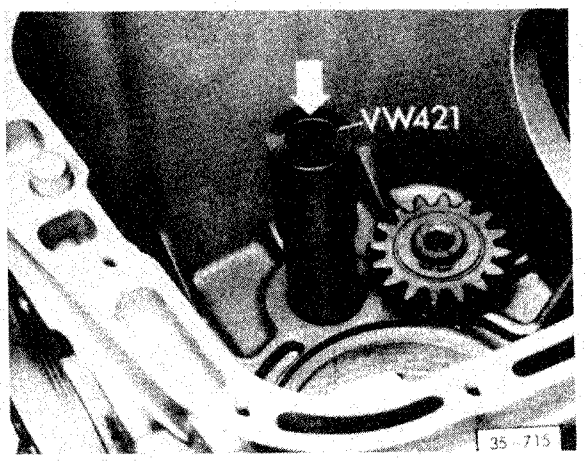


Fig. 12 Pinion needle bearing in housing, removing

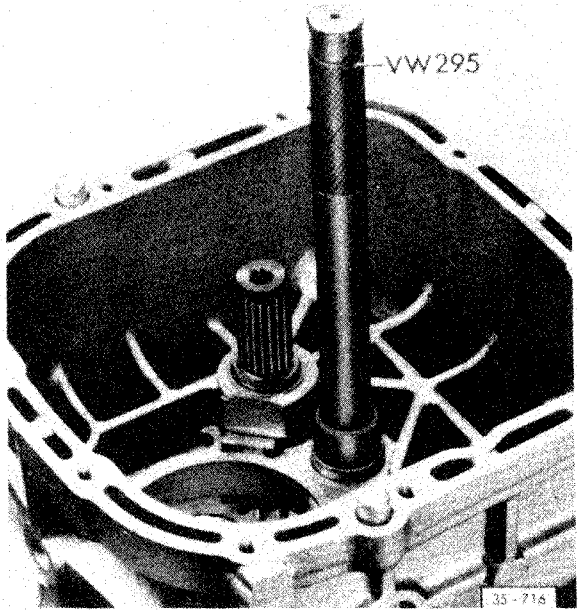
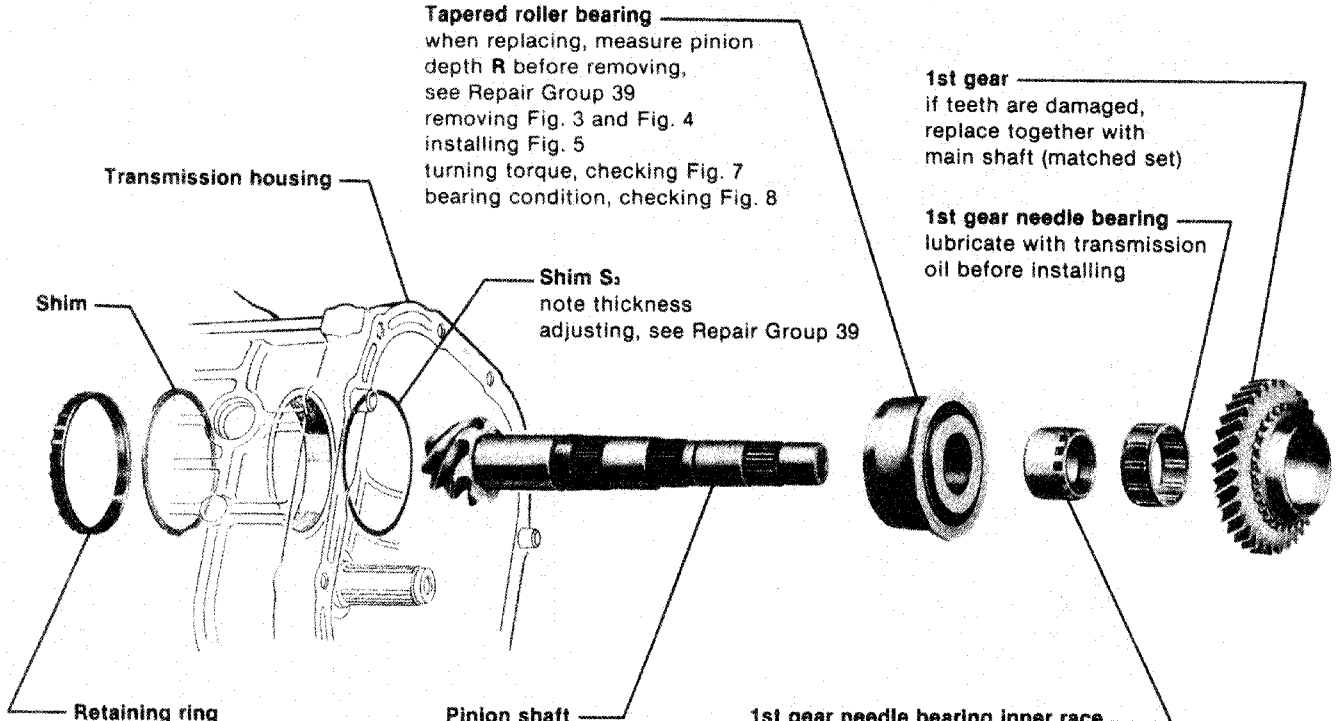


Fig. 13 Pinion needle bearing in housing, installing

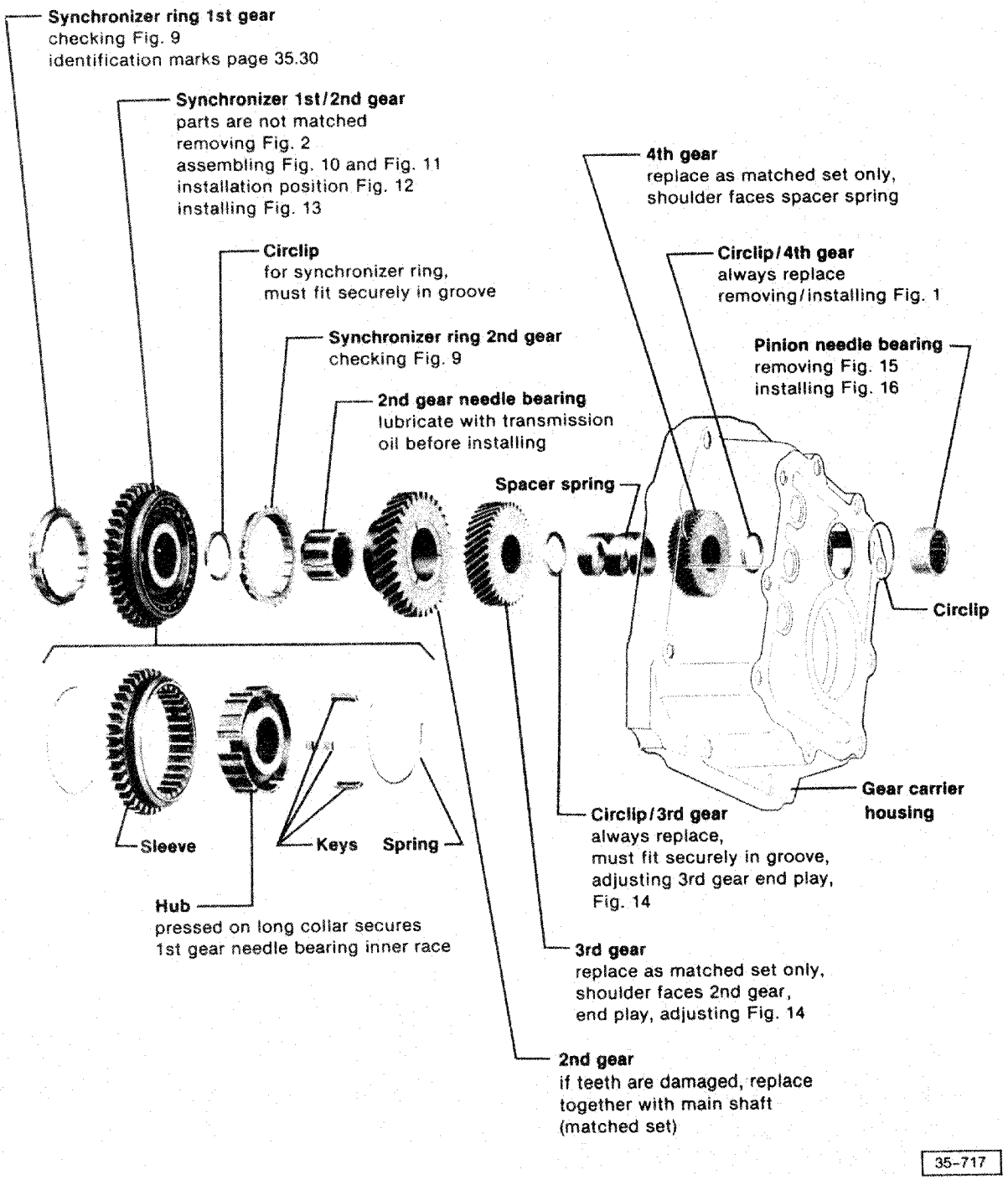
— press in flush

CAUTION

When installing, lettered side of bearing (thicker material) must face installing tool


Tapered roller bearing
when replacing, measure pinion depth R before removing, see Repair Group 39
removing Fig. 3 and Fig. 4
installing Fig. 5
turning torque, checking Fig. 7
bearing condition, checking Fig. 8
1st gear
if teeth are damaged, replace together with main shaft (matched set)
Transmission housing
1st gear needle bearing
lubricate with transmission oil before installing
Shim S3
note thickness adjusting, see Repair Group 39
Shim
Retaining ring
removing/installing page 35.7
Pinion shaft
matched with ring gear, when replacing adjust ring gear/pinion, see Repair Group 39
1st gear needle bearing inner race
secured by long collar pressed onto synchronizer hub
loosening/tightening Fig. 6
installation position Fig. 12

35-717


Synchronizer ring 1st gear
checking Fig. 9
identification marks page 35.30
Synchronizer 1st/2nd gear
parts are not matched
removing Fig. 2
assembling Fig. 10 and Fig. 11
installation position Fig. 12
installing Fig. 13
Circlip
for synchronizer ring,
must fit securely in groove
Synchronizer ring 2nd gear
checking Fig. 9
2nd gear needle bearing
lubricate with transmission
oil before installing
4th gear
replace as matched set only,
shoulder faces spacer spring
Circlip/4th gear
always replace
removing/installing Fig. 1
Pinion needle bearing
removing Fig. 15
installing Fig. 16
Spacer spring
Circlip
Gear carrier
housing
Sleeve
Keys
Spring
Hub
pressed on long collar secures
1st gear needle bearing inner race
Circlip/3rd gear
always replace,
must fit securely in groove,
adjusting 3rd gear end play,
Fig. 14
3rd gear
replace as matched set only,
shoulder faces 2nd gear,
end play, adjusting Fig. 14
2nd gear
if teeth are damaged, replace
together with main shaft
(matched set)
35-717

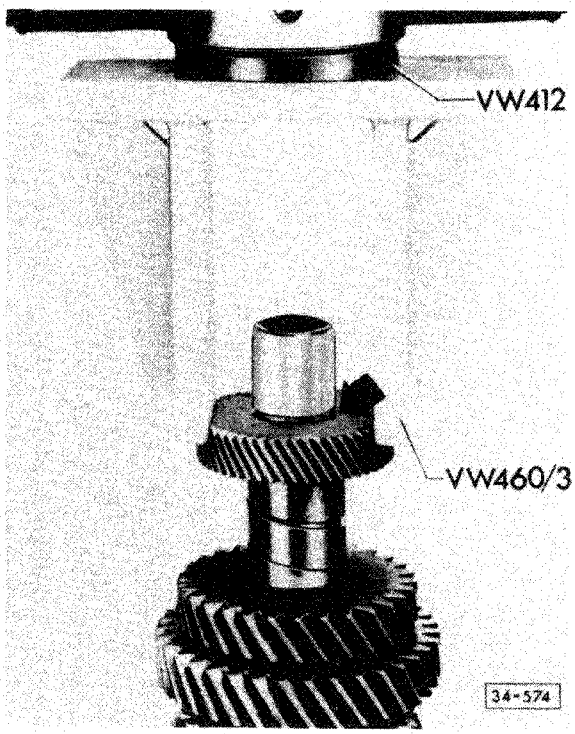


Fig. 1 Circlip/4th gear, removing/installing

- must fit securely in groove (arrow)

CAUTION

Hold 4th gear down (spring under tension)

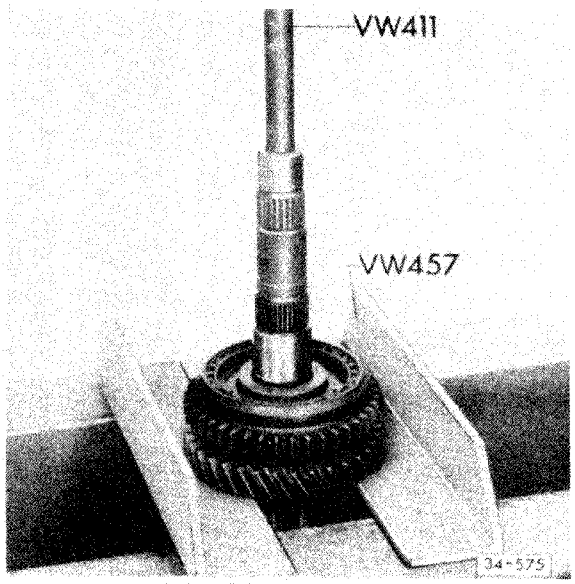


Fig. 2 Synchronizer sleeve/hub and 1st gear, removing

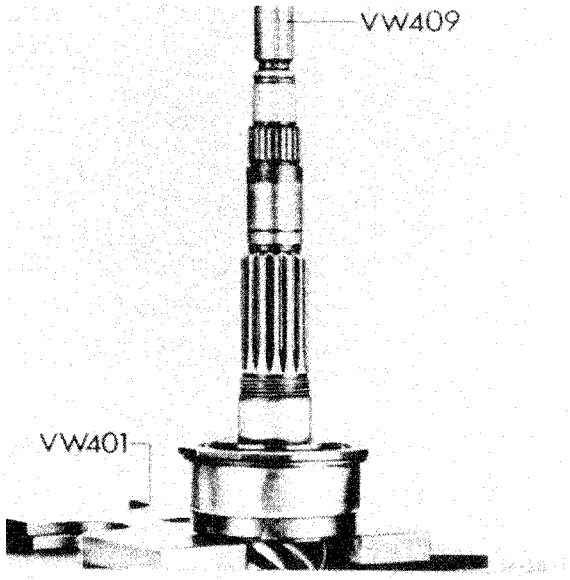


Fig. 3 Tapered roller bearing, removing

— press off by supporting outer race
— if necessary, press 2nd inner race off separately, see Fig. 4

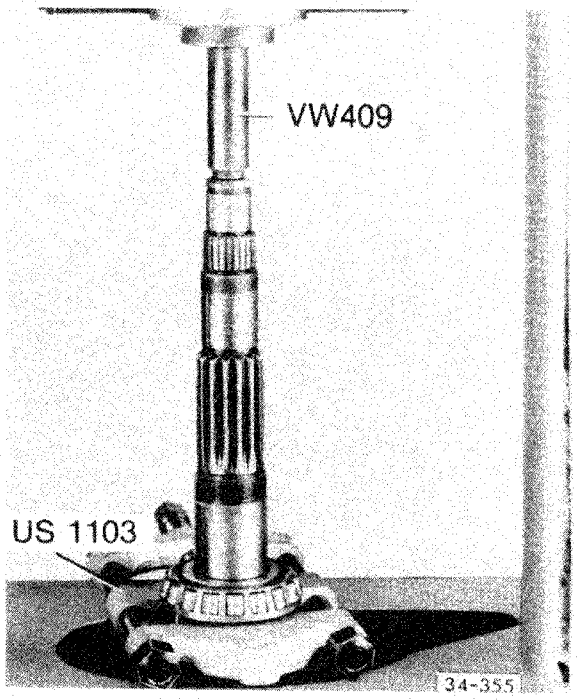


Fig. 4 Tapered roller bearing 2nd inner race, removing

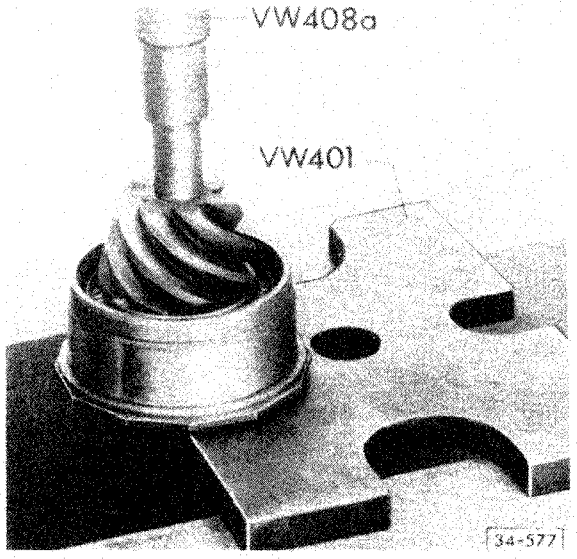


Fig. 5 Tapered roller bearing, installing

— heat inner races to about 100 °C (212 °F) and press on
— before tightening needle bearing inner race, let tapered roller bearing cool to room temperature

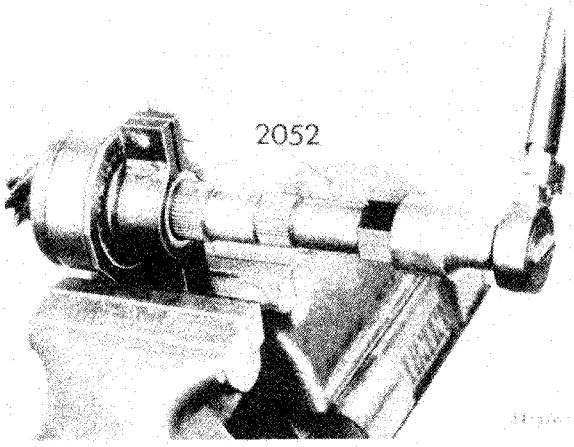


Fig. 6 1st gear needle bearing inner race, loosening/tightening

— heat inner race to about 60 °C (140 °F) and screw on as far as possible by hand

> **CAUTION**
> Inner race is **hot.** Do not touch with bare hand

— place pinion shaft in tool 2052 and tighten wing nut lightly
— tighten inner race to 210 Nm (152 ft lb)
— check turning torque of tapered roller bearing, see Fig. 7

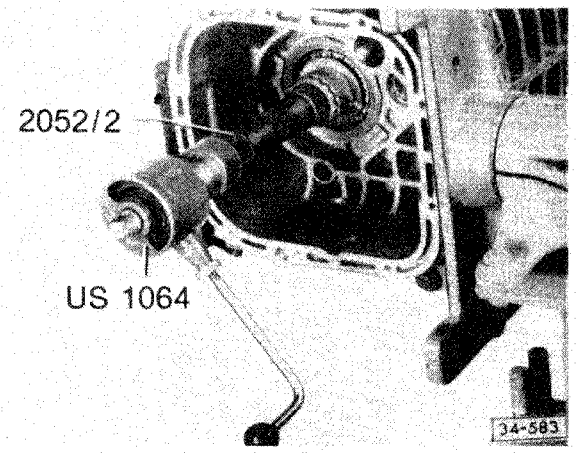


Fig. 7 Tapered roller bearing, checking turning torque

— lubricate bearings with transmission oil and tighten retaining ring, see page 35.7
— turn pinion shaft in both directions about 15-20 times
— turn further and read turning torque
  • new bearings:
  up to 210 Ncm (**180 in. lb**)
  • used bearings*:
  up to 70 Ncm (**61 in. lb**)
  (*after running at least 30 miles)
  • if no turning torque can be measured, see Fig. 8

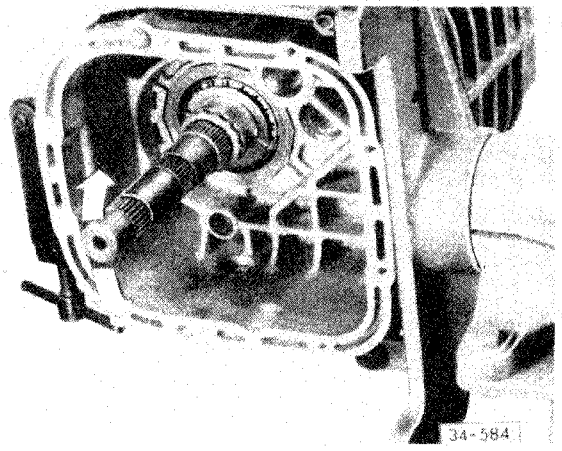


Fig. 8 Bearing condition, checking

— check for rock at end of pinion. There must not be any detectable movement
if **YES**, replace tapered roller bearing

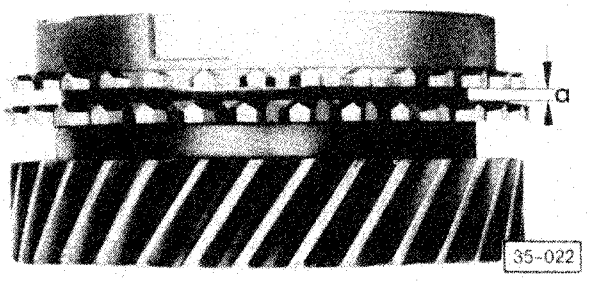


Fig. 9 Synchronizer ring 1st/2nd gear, checking

— press synchronizer rings onto gear by hand and measure gap a with feeler gauge

	New Part mm (in.)	Wear limit mm (in.)
Gap a	1.0–1.7 (0.039–0.067)	0.5 (0.020)

Note

Synchronizer ring identification marks and installation instructions, page 35.30

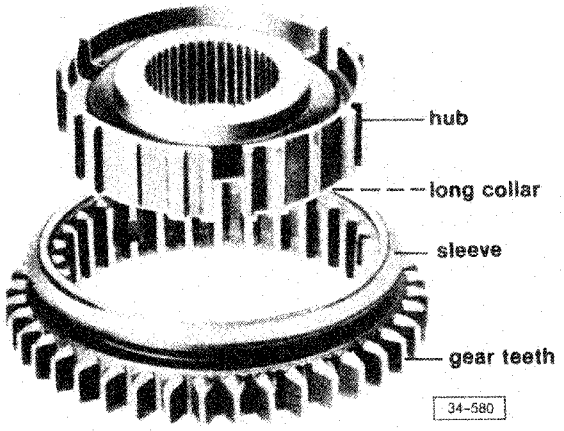


Fig. 10 Synchronizer 1st/2nd gear, assembling

- gear teeth on sleeve and long collar on hub must face 1st gear when installing
- sleeve and hub are not matched and can be replaced separately

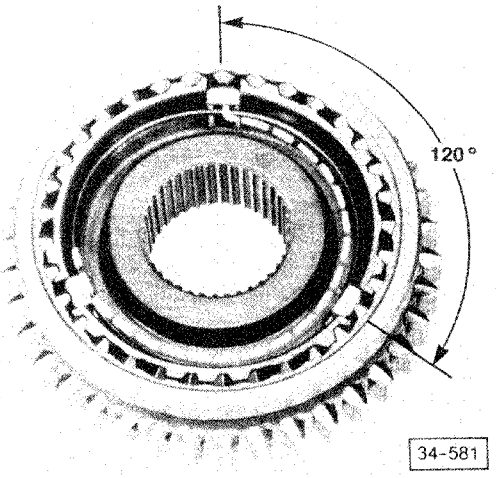


Fig. 11 Synchronizer 1st/2nd gear, assembling

— slide sleeve over sychronizer hub. Matched position is not necessary
— insert keys and install springs with ends offset 120°. Angled ends of springs must fit into keys

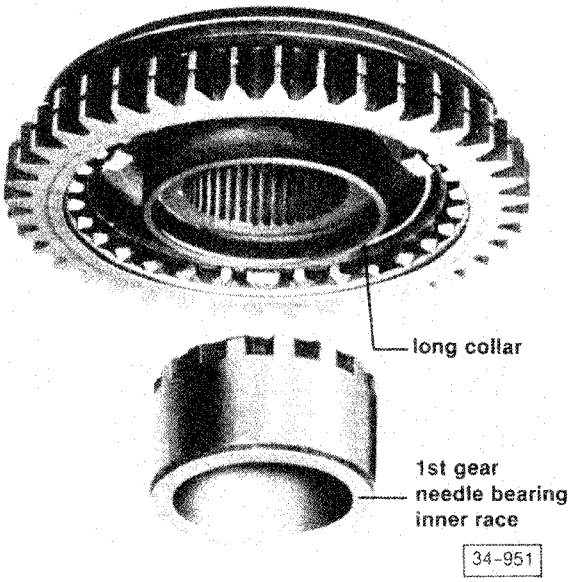


Fig. 12 Synchronizer assembly 1st/2nd gear and 1st gear needle bearing inner race, installation position

— position synchronizer assembly on needle bearing inner race so that old marks on long collar of synchronizer hub (from lugs on needle bearing inner race) are now opposite gaps on needle bearing inner race
- sleeve and hub are not matched and can be replaced separately

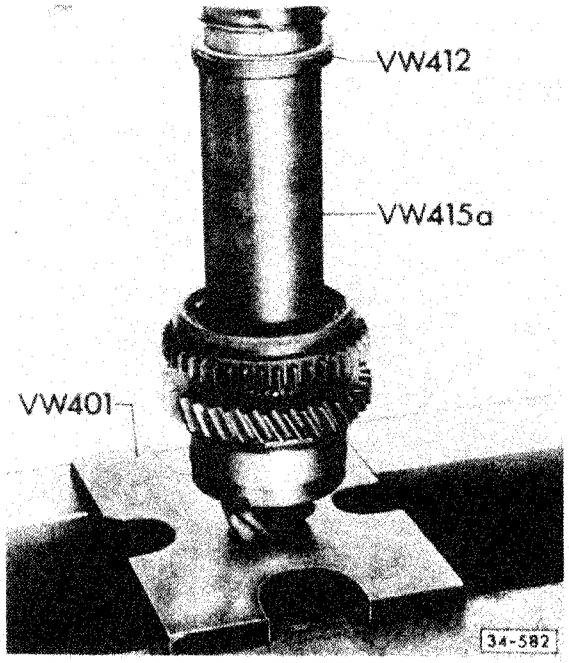


Fig. 13 Synchronizer 1st/2nd gear, installing

— turn synchronizer ring until grooves are in line with keys (installation position, see Fig. 10 and Fig. 11)

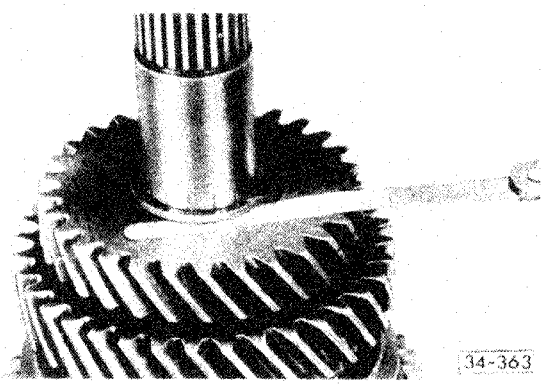


Fig. 14 3rd gear end play, adjusting

— measure end play with feeler gauge
— adjust by selecting suitable circlip
• play should be 0.05 mm–0.20 mm (try to keep lower limit)

Circlips available:

Thickness mm	Color	Part No.
1.60	black	113 311 382
1.75	blue	113 311 383
1.90	brown	113 311 384
2.05	gray	113 311 385
2.20	copper	113 311 386
2.30	brass	113 311 387
2.40	silver	113 311 388

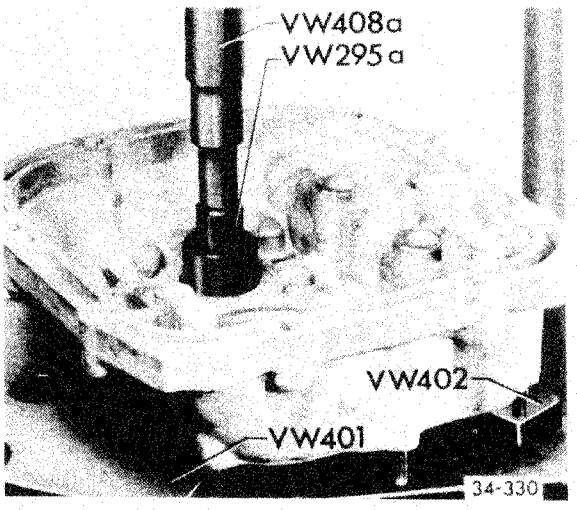


Fig. 15 Pinion needle bearing in gear carrier housing, removing

— press out without damaging circlip

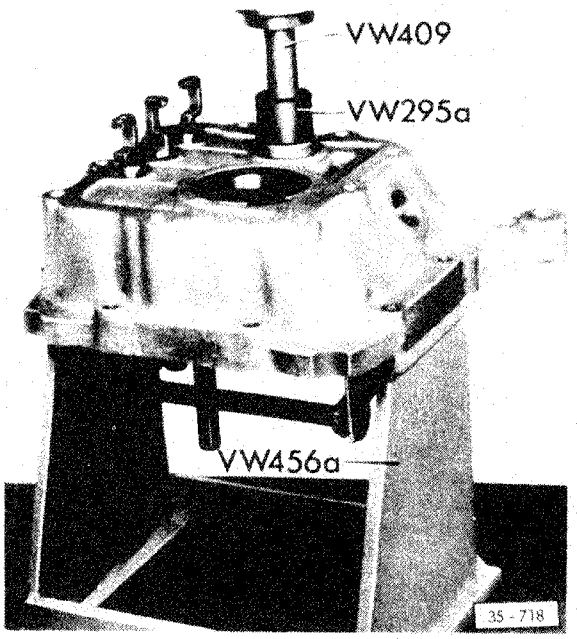


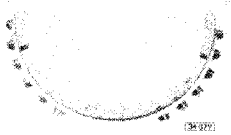
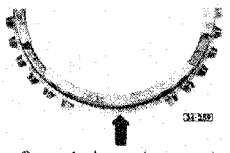
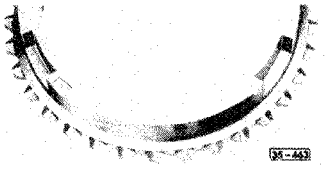
Fig. 16 Pinion needle bearing in gear carrier housing, installing

— press in until seated

Synchronizer rings, identification marks/installation instructions

Note

When assembling transmission, install synchronizer ring to same gear from which it was removed

Synchronizer ring	1st gear	2nd gear	3rd gear	4th gear
markings	 without notches		 3 notches (arrow)	
production	brass ring coated with molybdenum, Part No. 091 311 247 B	brass ring coated with molybdenum	special brass ring coated with molybdenum, Part No. 091 311 295 A, shown below	brass ring
spare part	brass ring coated with molybdenum, Part No. 091 311 247 B	special brass ring coated with molybdenum, Part No. 091 311 295 A, marked as shown on right	 teeth all around circumference	

4-Speed 091/1 Manual Transmission Case, Gears, Shafts

Quick Data

Transmission 091/1
(1985 MY Vanagons only)

Gear Ratios	Trans. DU
1st gear	34:9 = 3.78
2nd gear	33:16 = 2.06
3rd gear	63:50 = 1.26
4th gear	52:61 = 0.85
Reverse	33:9 = 3.67
Final drive	34:7 = 4.86

Gear Ratios	Trans. ABD
1st gear	34:9 = 3.78
2nd gear	33:16 = 2.06
3rd gear	49:40 = 1.225
4th gear	41:48 = 0.85
Reverse	33.9 = 3.67
Final drive	29:6 = 4.83

Lubricant Specifications
lubricant capacity (incl. differential)
091/1 ..... 3.0 L (3.2 US qt)
viscosity ..... SAE 80W, SAE 80W/90
type ..... hypoid, MIL-L-2105; API/GL-4

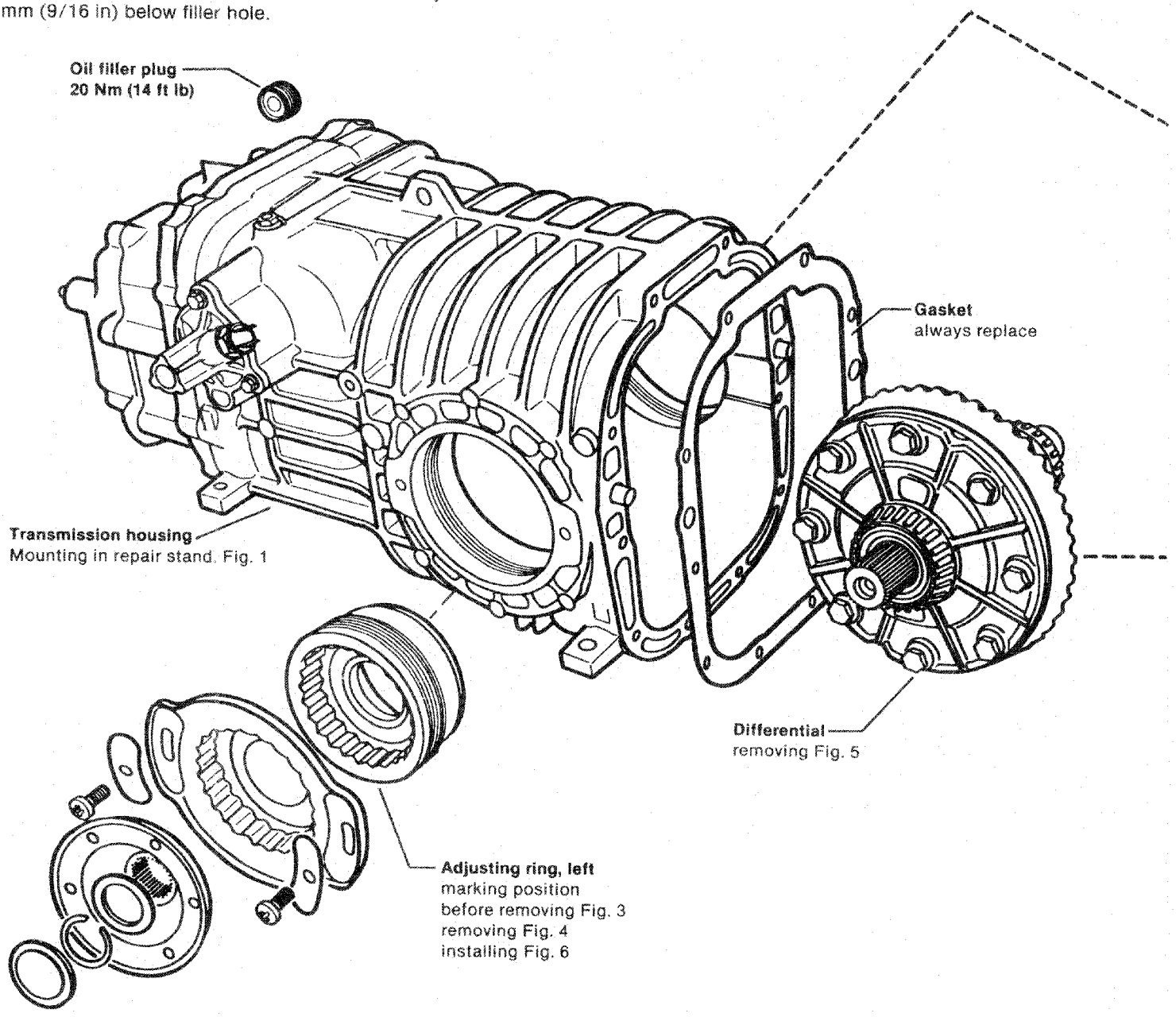
Lubricant Specifications
lubricant capacity (incl. differential)
Vehicles w/Diesel engines
4.0 L (4.2 US qt)
Vehicles w/gasoline engines
3.0 L (3.2 US qt)
viscosity ..... SAE 80W, SAE 80W/90
type ..... hypoid, MIL-L-2105; API/GL-4

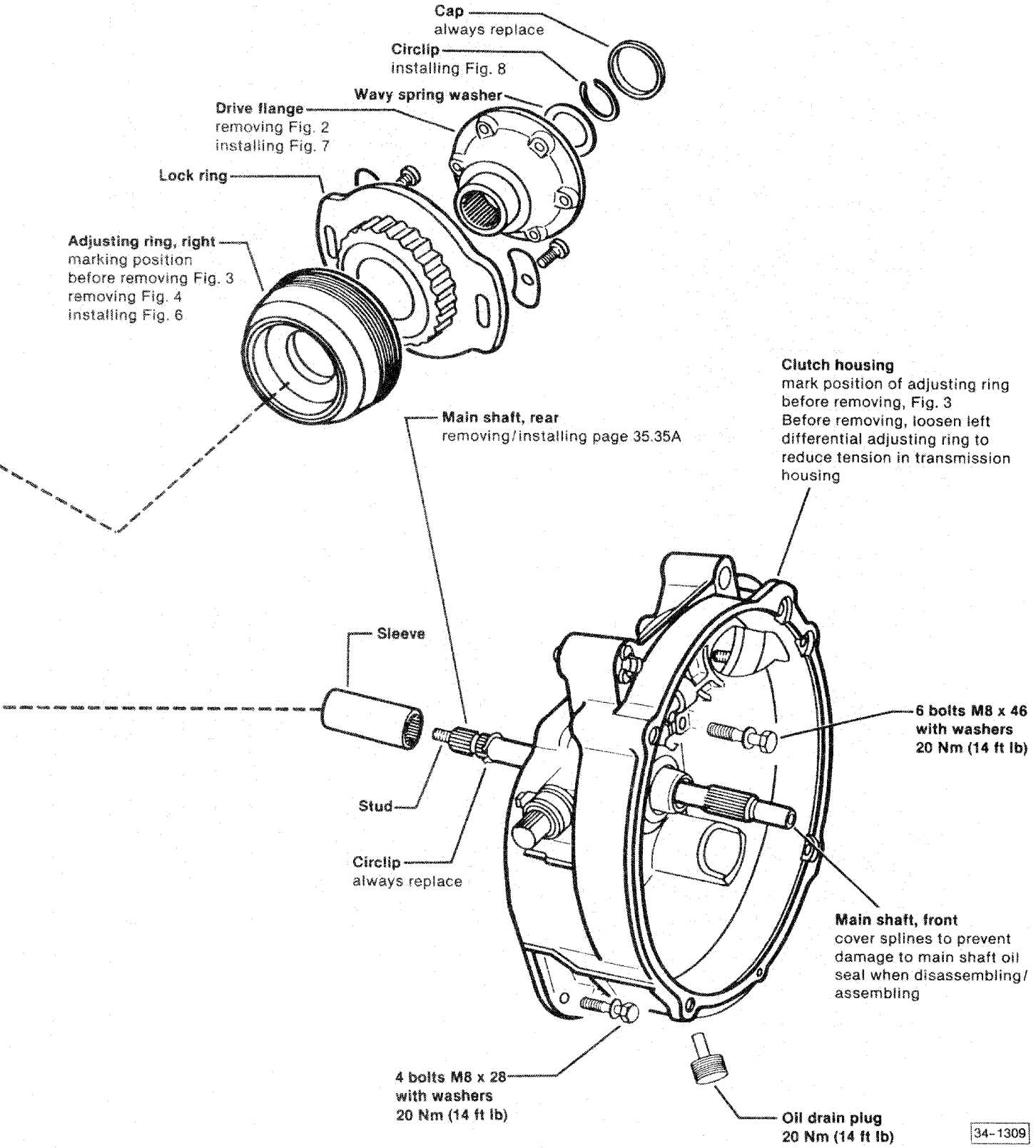
NOTE
- To reduce shifting effort, transmission oil capacity has been reduced.
- For production reasons, the oil filler hold remains at the same location.
- Oil should only be poured into a level approximately 15 mm (9/16 in.) below the filler hole.

Index

Transmission/Final drive lubricant:
Hypoid oil API/GL-4; MIL-L2105
SAE 80W, SAE 80W/90
Capacities:
Vehicles with gasoline engines 3.0 L (3.2 US qt)
Vehicles with Diesel engines 4.0 L (4.2 US qt)

Note
To reduce shifting effort, transmission oil capacity has been reduced. For production reasons, the oil filler hole remains at the same location
Oil should only be poured into a level approximately 15 mm (9/16 in) below filler hole.




Cap
always replace
Circlip
installing Fig. 8
Wavy spring washer
Drive flange
removing Fig. 2
installing Fig. 7
Lock ring
Adjusting ring, right
marking position
before removing Fig. 3
removing Fig. 4
installing Fig. 6
Main shaft, rear
removing/installing page 35.35A
Clutch housing
mark position of adjusting ring
before removing, Fig. 3
Before removing, loosen left
differential adjusting ring to
reduce tension in transmission
housing
Sleeve
6 bolts M8 x 46
with washers
20 Nm (14 ft lb)
Stud
Circlip
always replace
Main shaft, front
cover splines to prevent
damage to main shaft oil
seal when disassembling/
assembling
4 bolts M8 x 28
with washers
20 Nm (14 ft lb)
Oil drain plug
20 Nm (14 ft lb)
34-1309

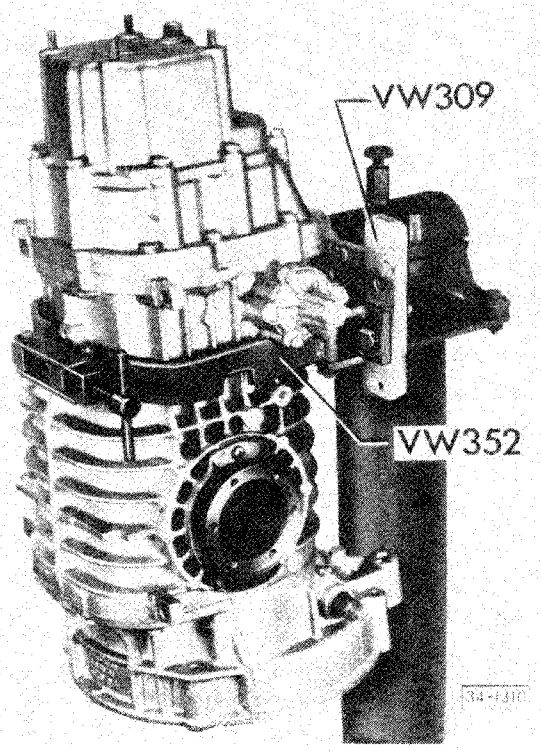


Fig. 1 Transmission assembly, mounting in repair stand

—drain transmission oil
—mount transmission in repair stand

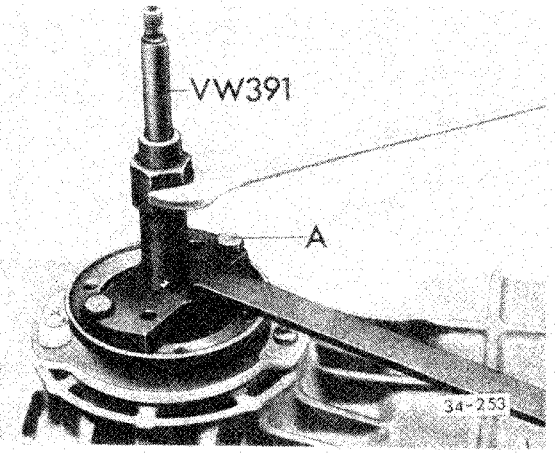


Fig. 2 Drive flange, removing

—remove circlip and wavy spring washer
—attach VW391 to flange with 2 bolts
• A = M8 x 30 bolts
—pull drive flange out

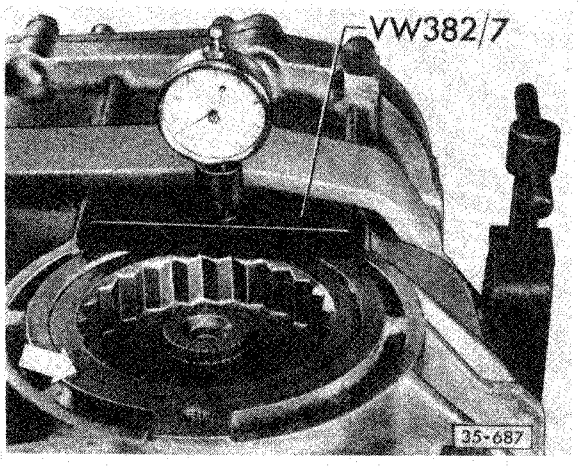


Fig. 3 Adjusting ring, marking position

Note

Before starting repair work (which does not require final drive to be adjusted) mark position of adjusting rings on transmission housing. Measure depth to which they are installed with VW 382/7 and write down readings

—scribe left side (ring gear side) with one mark (arrow)
—scribe right side with two marks

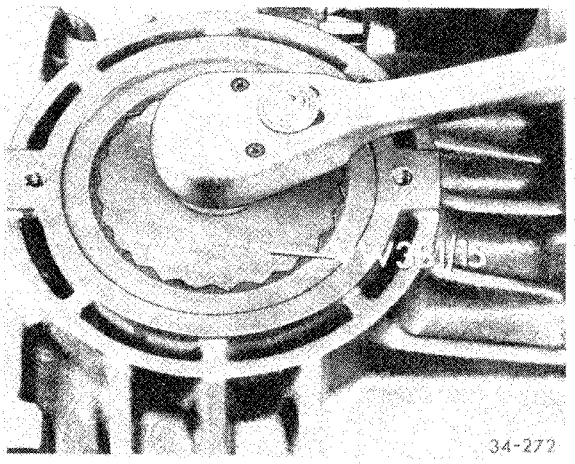


Fig. 4 Adjusting rings, removing

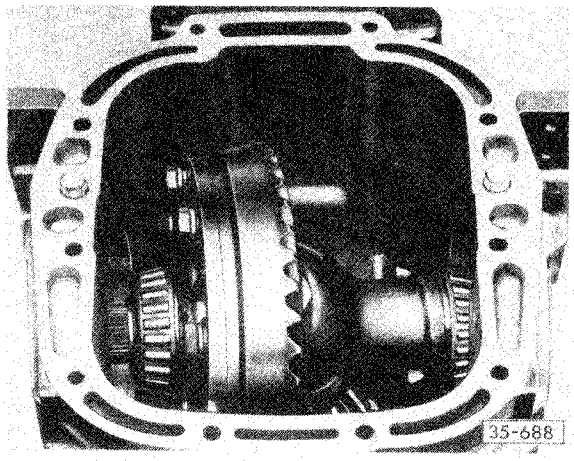


Fig. 5 Differential, removing

—remove adjusting rings and rear main shaft
—lift out differential

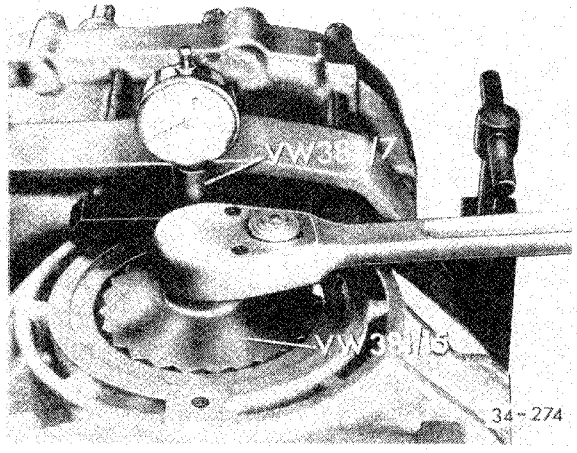


Fig. 6 Adjusting rings, installing

—install left and right adjusting rings and align marks at depth previously measured
—lubricate threads with MoS_2 grease

CAUTION

Do not tighten left side adjusting ring until clutch housing has been installed and bolts torqued

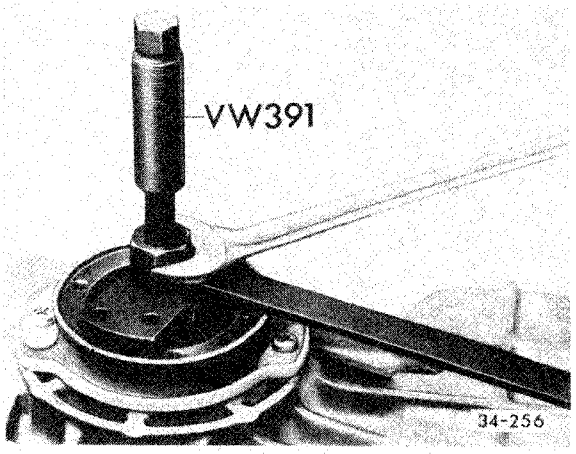


Fig. 7 Drive flange, installing

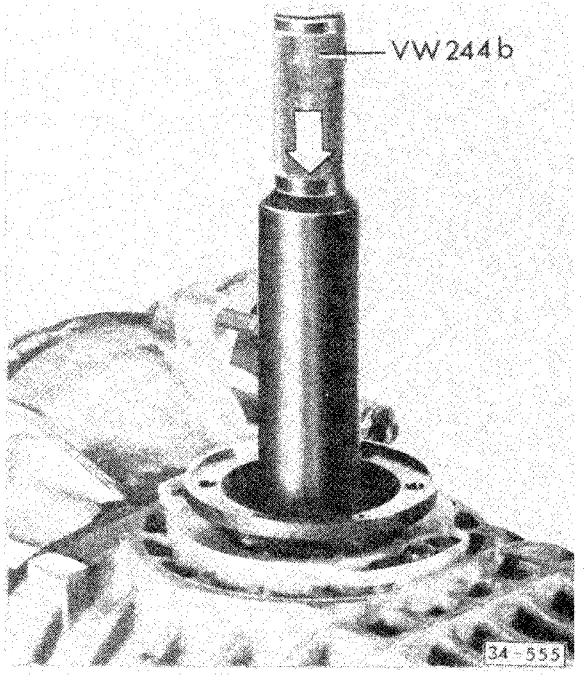
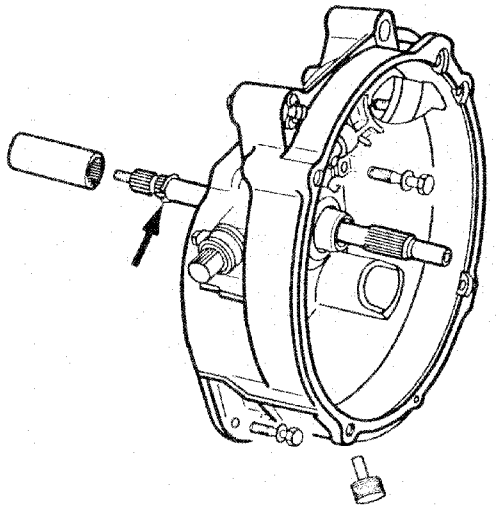


Fig. 8 Circlip for drive flange, installing

—insert wavy spring washer and circlip
—press circlip into groove with VW 244b and at same time check that washer is centered

Rear main shaft, removing/installing

Work sequence



34-1309 A

Removing

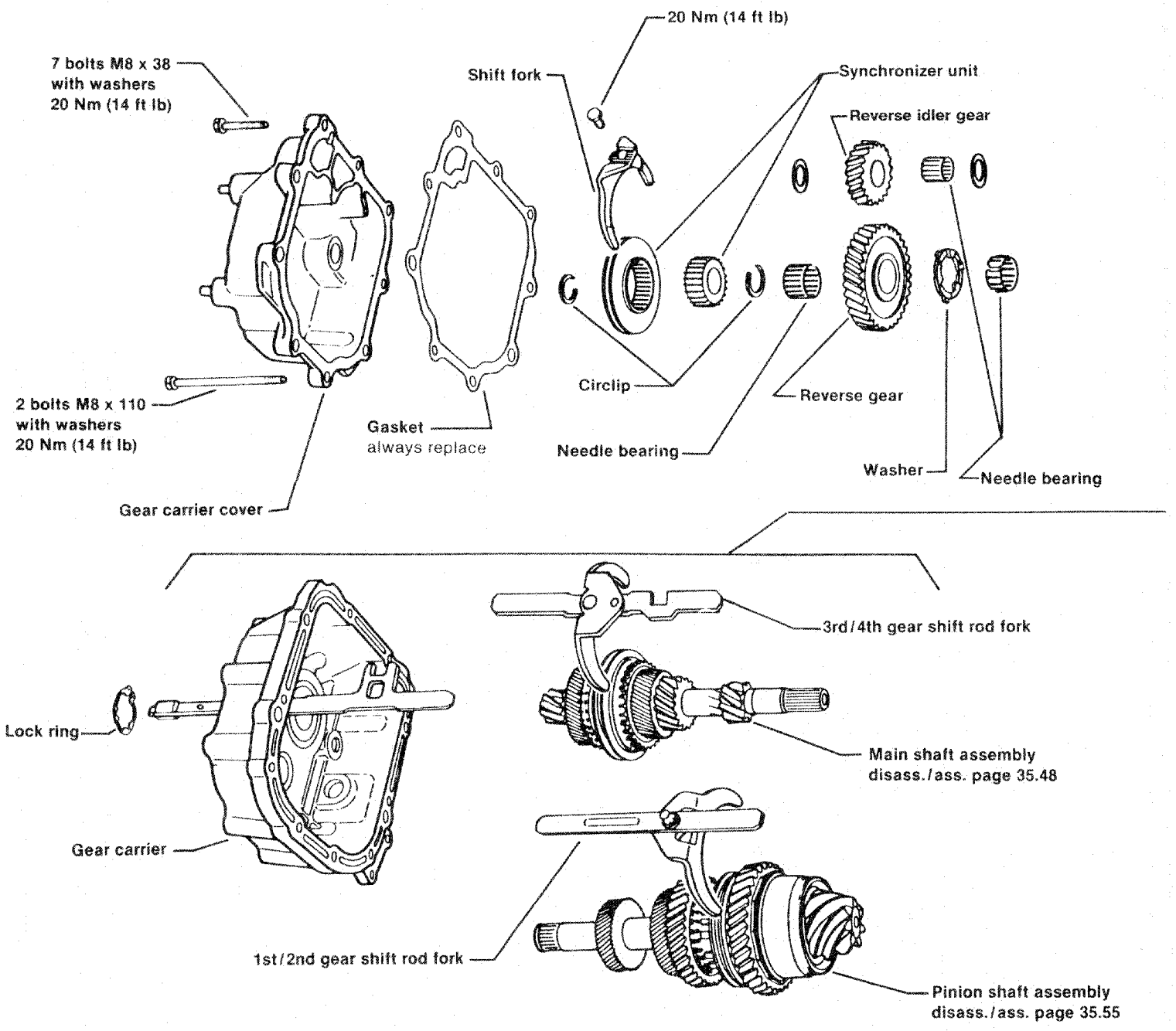
- remove circlip (arrow)
- push sleeve backward and screw out main shaft

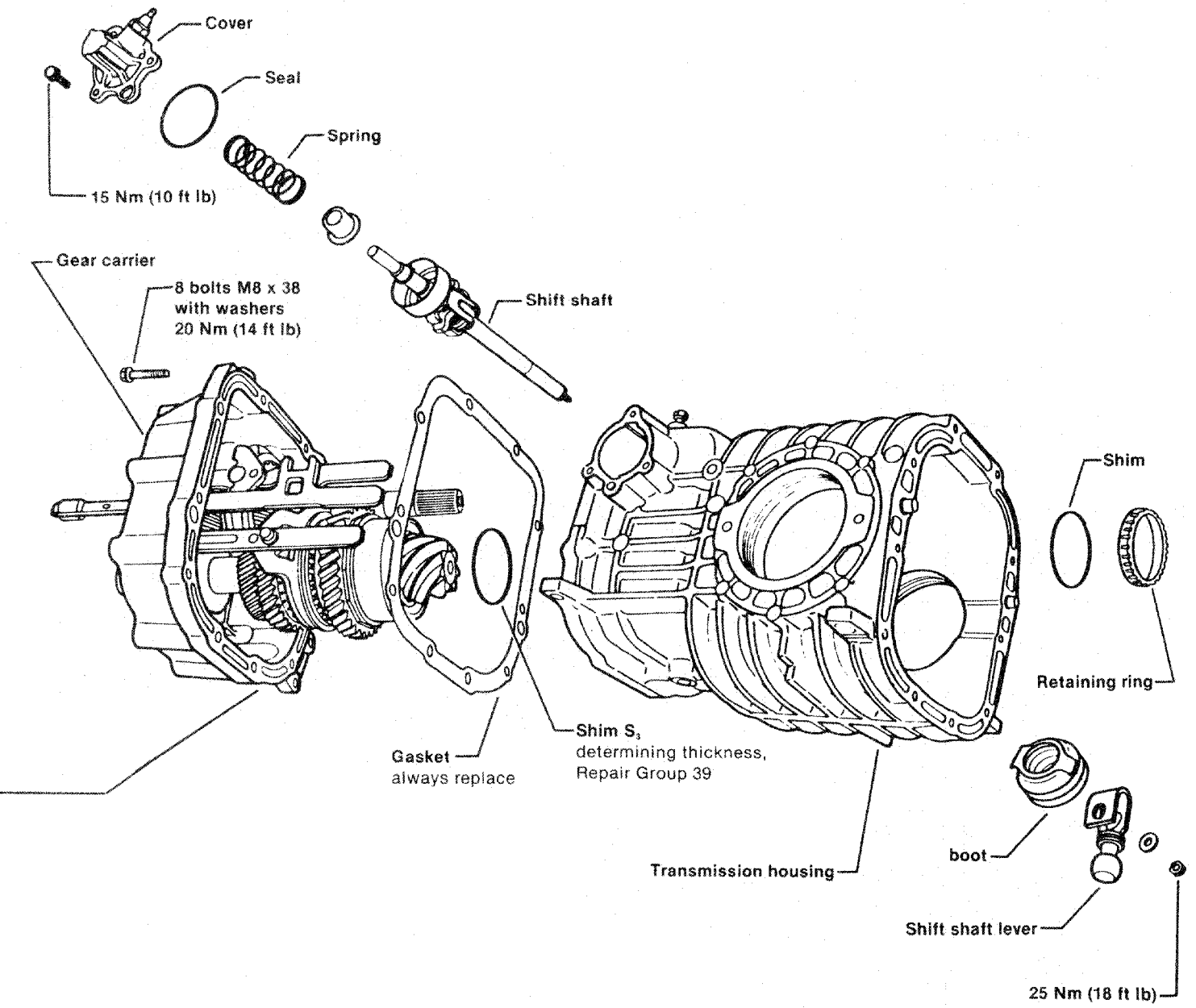
Installing

- screw front and rear main shafts together, then back off one spline
- push sleeve on and install new circlip

Note

Differential must be removed
before gear carrier can be removed,
see page 35.35

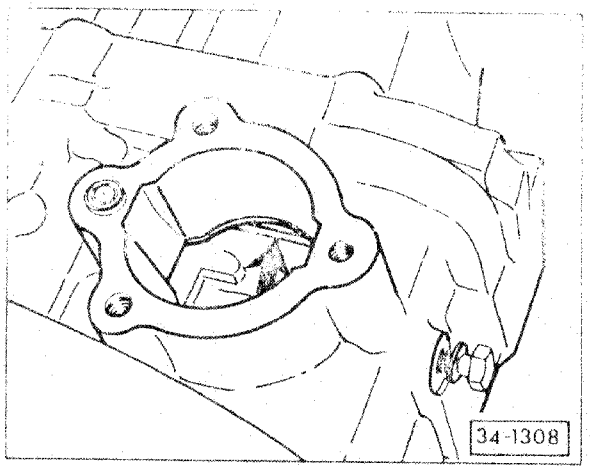



Cover
Seal
Spring
15 Nm (10 ft lb)
Gear carrier
8 bolts M8 x 38
with washers
20 Nm (14 ft lb)
Shift shaft
Shim
Retaining ring
Gasket
always replace
Shim S3
determining thickness,
Repair Group 39
Transmission housing
boot
Shift shaft lever
25 Nm (18 ft lb)
34-1312

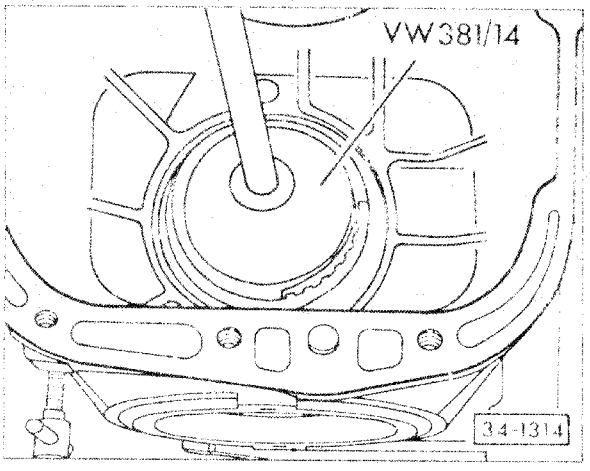
Transmission
Disassembling

Work sequence

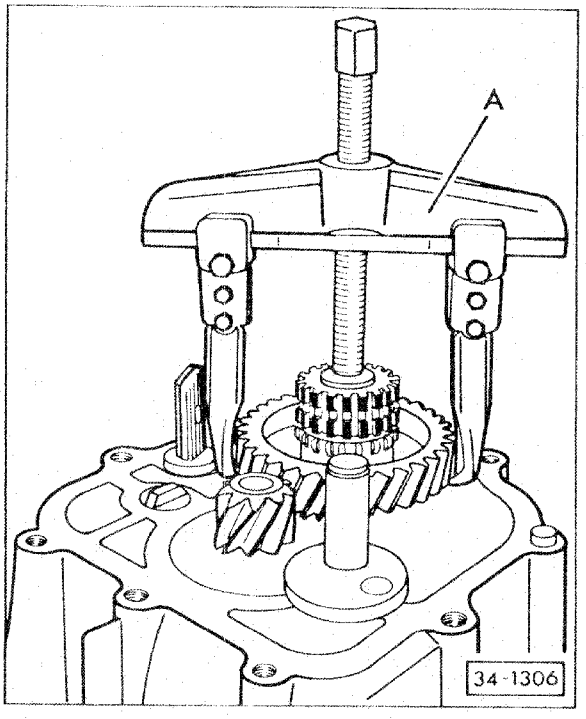
—remove coverplate
—remove shift shaft



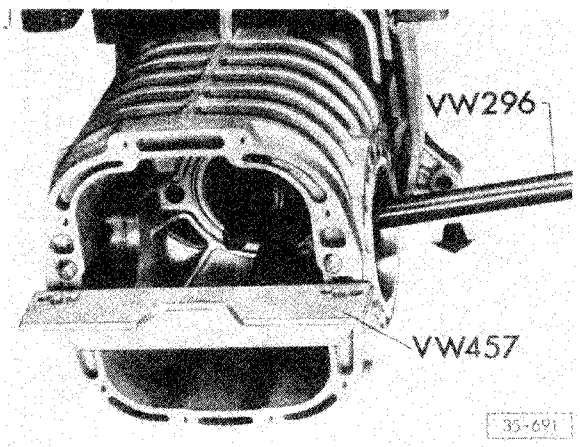
—loosen bolt until relay lever (arrow) can be pulled against housing
—tighten bolt to lock lever in that position



— remove retaining ring
— remove gear shift housing
— remove reverse gear shift fork and hub
— remove outer circlip



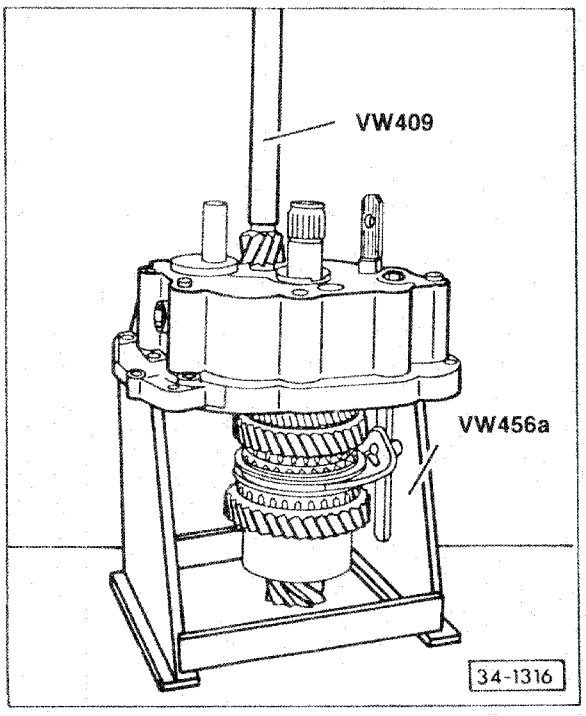
—pull off synchronizer hub and reverse gear
A—Puller US 1078
—remove inner circlip, washer and needle bearing
—remove reverse gear together with needle bearing and washer
—remove gear carrier housing bolts



—to remove gear carrier attach VW 457 with two M8 x 20 bolts
—press gear carrier out with VW 296
—remove shim S_3 and note thickness

Note

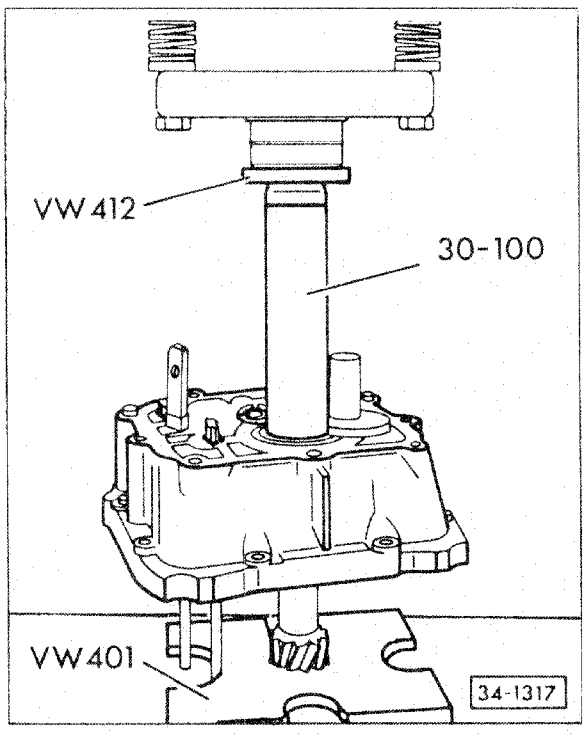
If bearing and/or transmission housing are replaced, and dimension r is not marked on ring gear, pinion depth must be measured and noted **before** gear carrier is removed. This is dimension **r**. See Repair Group 39. When assembling, parts must be installed in same position. See Ring gear/pinion, adjusting, Repair Group 39



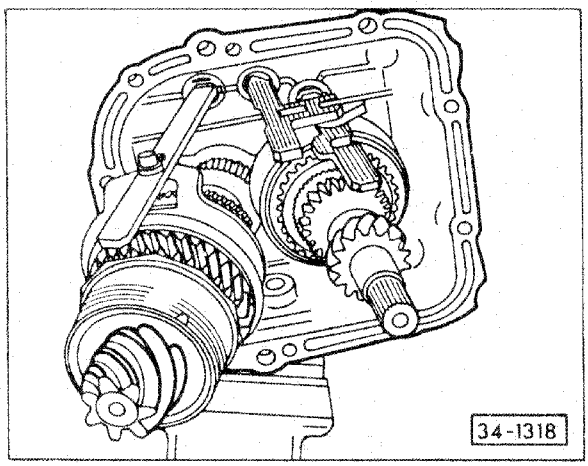
—press pinion shaft with main shaft and shift rod out of gear carrier

Assembling

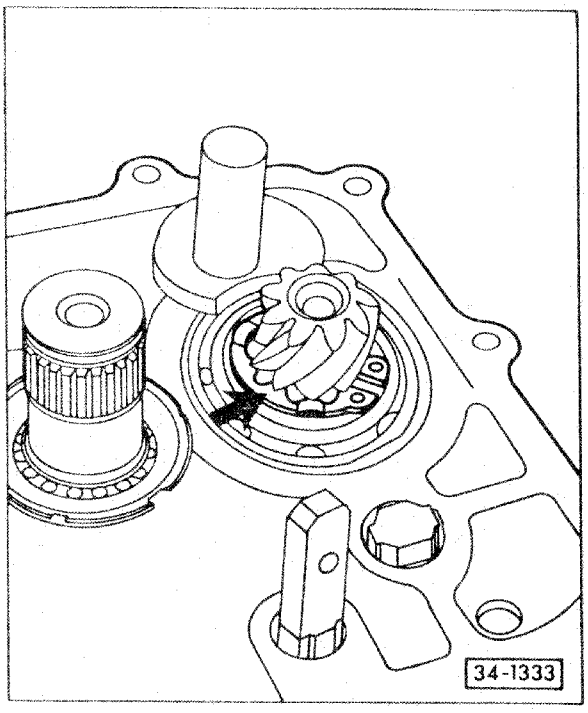
Work sequence



—press main shaft with shift rod into gear carrier



—install pinion shaft with shift rod
• shift into 3rd gear
—shift into neutral
—install pinion shaft needle bearing

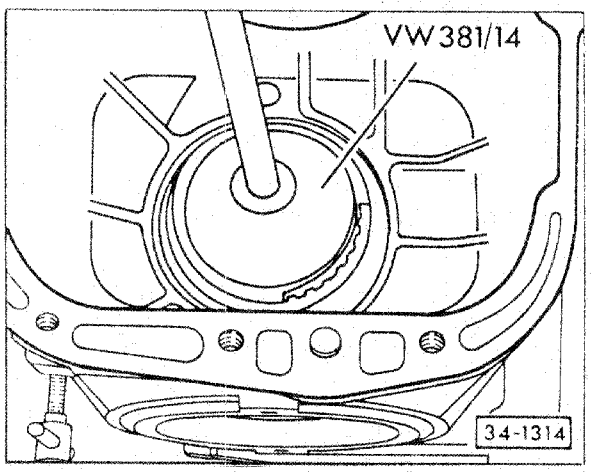


—install circlip
• make sure lugs of circlip are below teeth of pinion head (arrow)

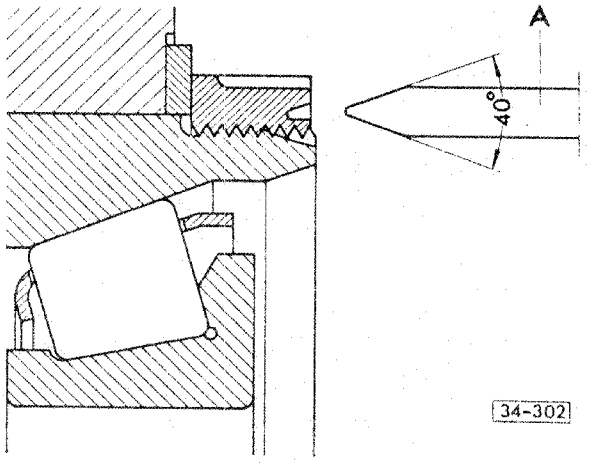
Gear carrier
Assembling

Work sequence

—install shim S_3
—install new gasket
—align shift rod
—align flat on piston with recess in housing
—tap on pinion with plastic hammer to install
• make sure teeth of gears match properly

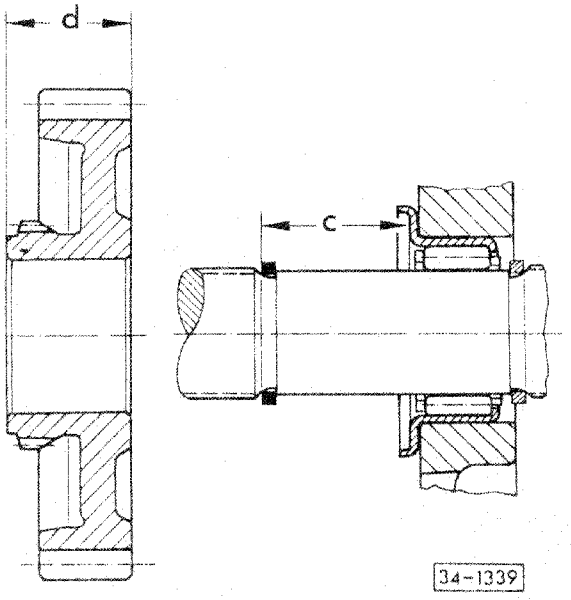


—install retaining ring and tighten to 225 Nm (162 ft lb), then loosen and retighten to 225 Nm (162 ft lb)



—peen retaining ring twice with suitable tool **A** (local manufacture)
—attach gear carrier to transmission housing and tighten bolts to 20 Nm (14 ft lb)

determining thickness of spacer for reverse gear



—install circlip
—measure distance **C**

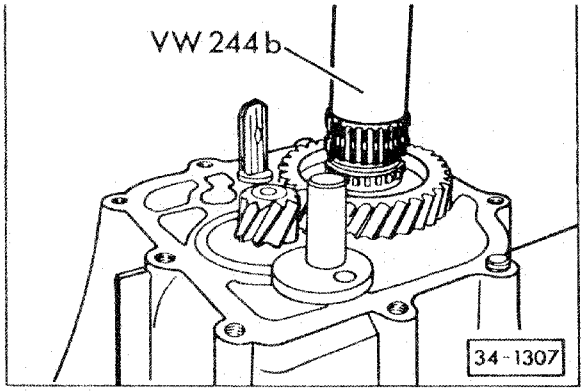
Example

measurement **c**	29.1 mm
measurement **d**	– 24.7 mm
thickness of spacer	4.4 mm

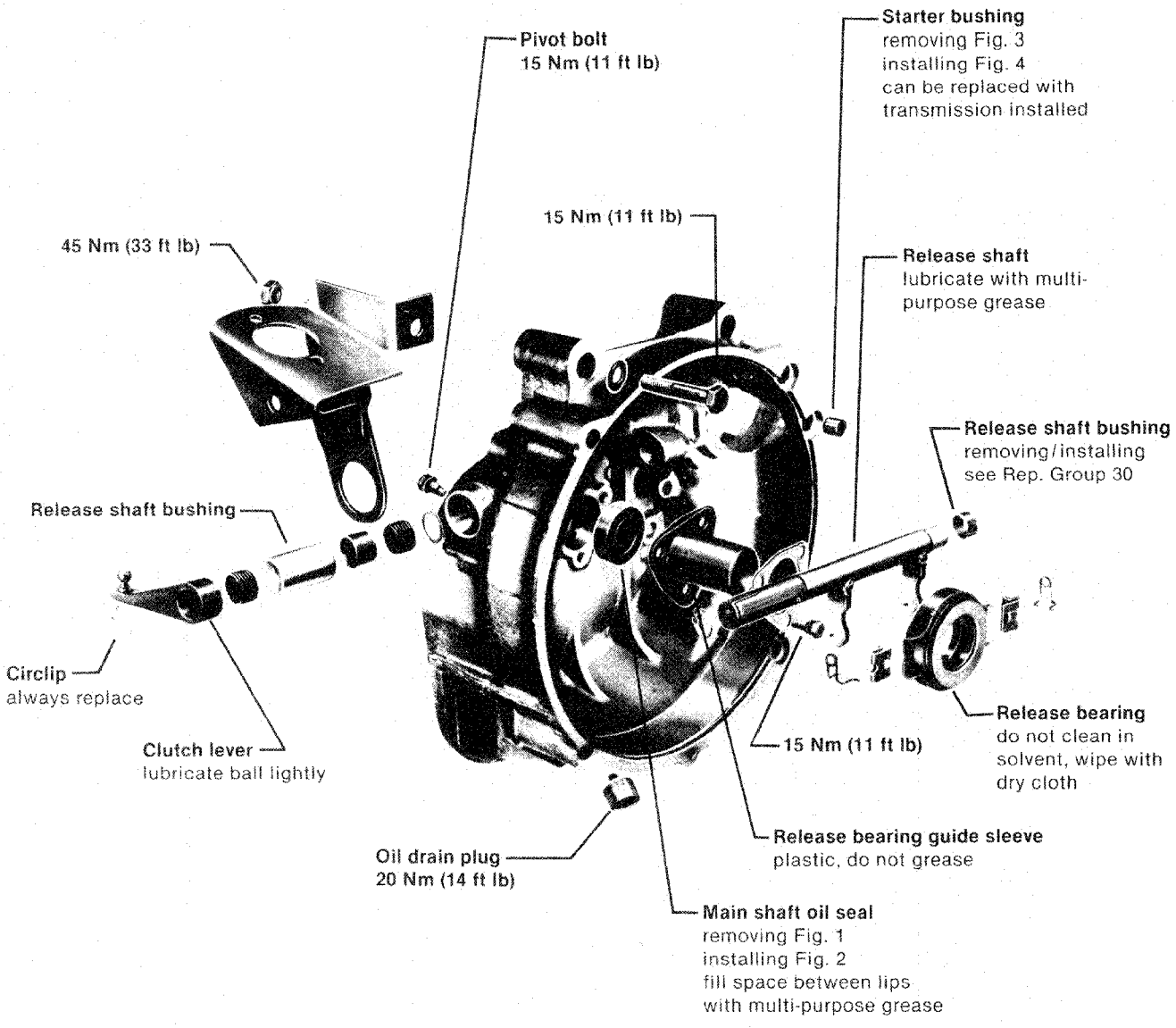
thickness of spacers available

gap to be adjusted (mm)	Spare part no.	color
3.97–4.19	091 311 379	white
4.20–4.39	091 311 379 A	black
4.40–4.59	091 311 379 B	green
4.60–4.90	091 311 379 C	red

—install selected spacer, reverse gear, needle bearing and circlip



—install synchronizer
—install circlip
—install reverse gear
• groove in gear must face cover
—install needle bearing and washers
—install shift rod/fork bolt and tighten to 20 Nm (14 ft lb)
• before installing coat thread of bolt with D6-locking compound
—install new gasket
—install cover
• align shaft and bore in cover
—tighten bolts to 20 Nm (14 ft lb)
—install shift shaft
• slotted side toward differential housing
—install new gasket
—install spring
—install cover and tighten bolts to 15 Nm (10 ft lb)
—install back-up light switch
—install shift shaft lever


Pivot bolt
15 Nm (11 ft lb)
Starter bushing
removing Fig. 3
installing Fig. 4
can be replaced with
transmission installed
15 Nm (11 ft lb)
45 Nm (33 ft lb)
Release shaft
lubricate with multi-
purpose grease
Release shaft bushing
removing/installing
see Rep. Group 30
Release shaft bushing
Circlip
always replace
Clutch lever
lubricate ball lightly
15 Nm (11 ft lb)
Release bearing
do not clean in
solvent, wipe with
dry cloth
Release bearing guide sleeve
plastic, do not grease
Oil drain plug
20 Nm (14 ft lb)
Main shaft oil seal
removing Fig. 1
installing Fig. 2
fill space between lips
with multi-purpose grease
35-697

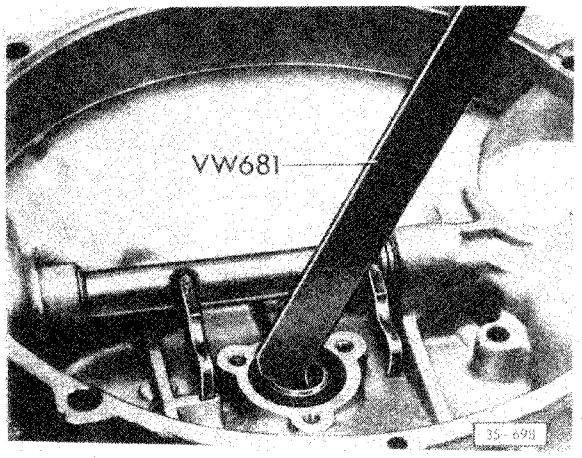


Fig. 1 Main shaft oil seal, removing

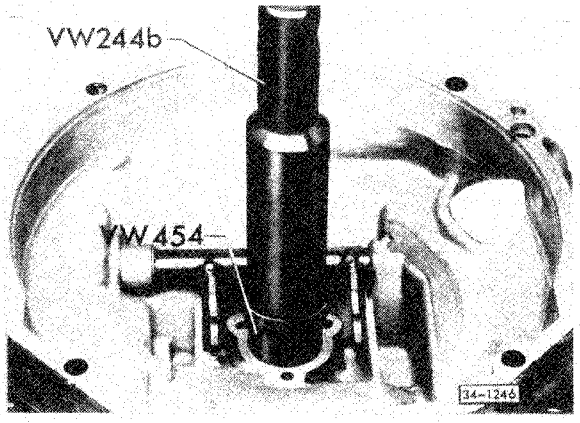


Fig. 2 Main shaft oil seal, installing

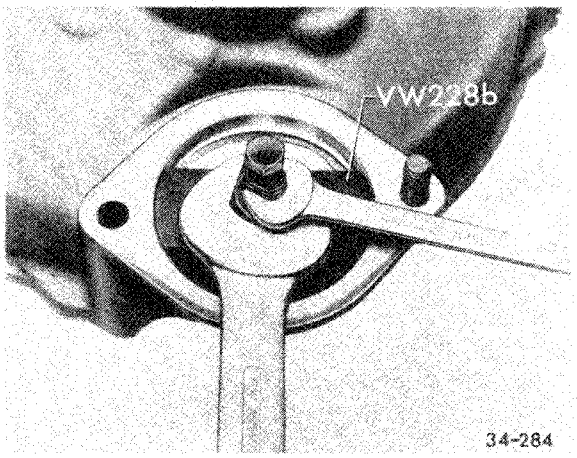


Fig. 3 Starter bushing, removing (transmission installed)

- when transmission is removed, use drift VW 222a

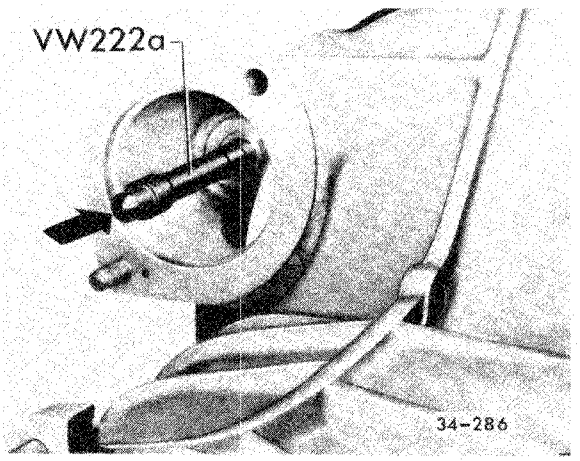
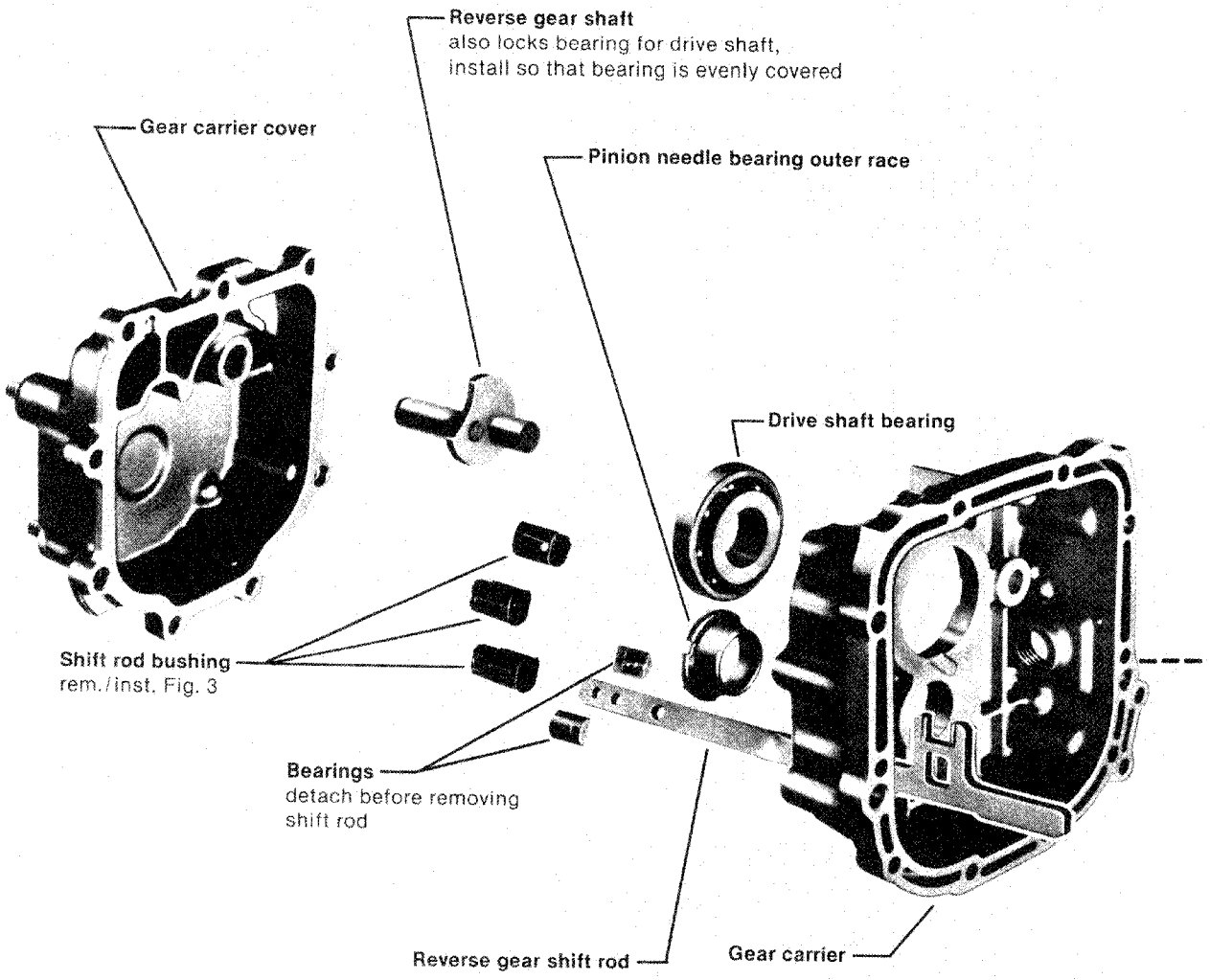
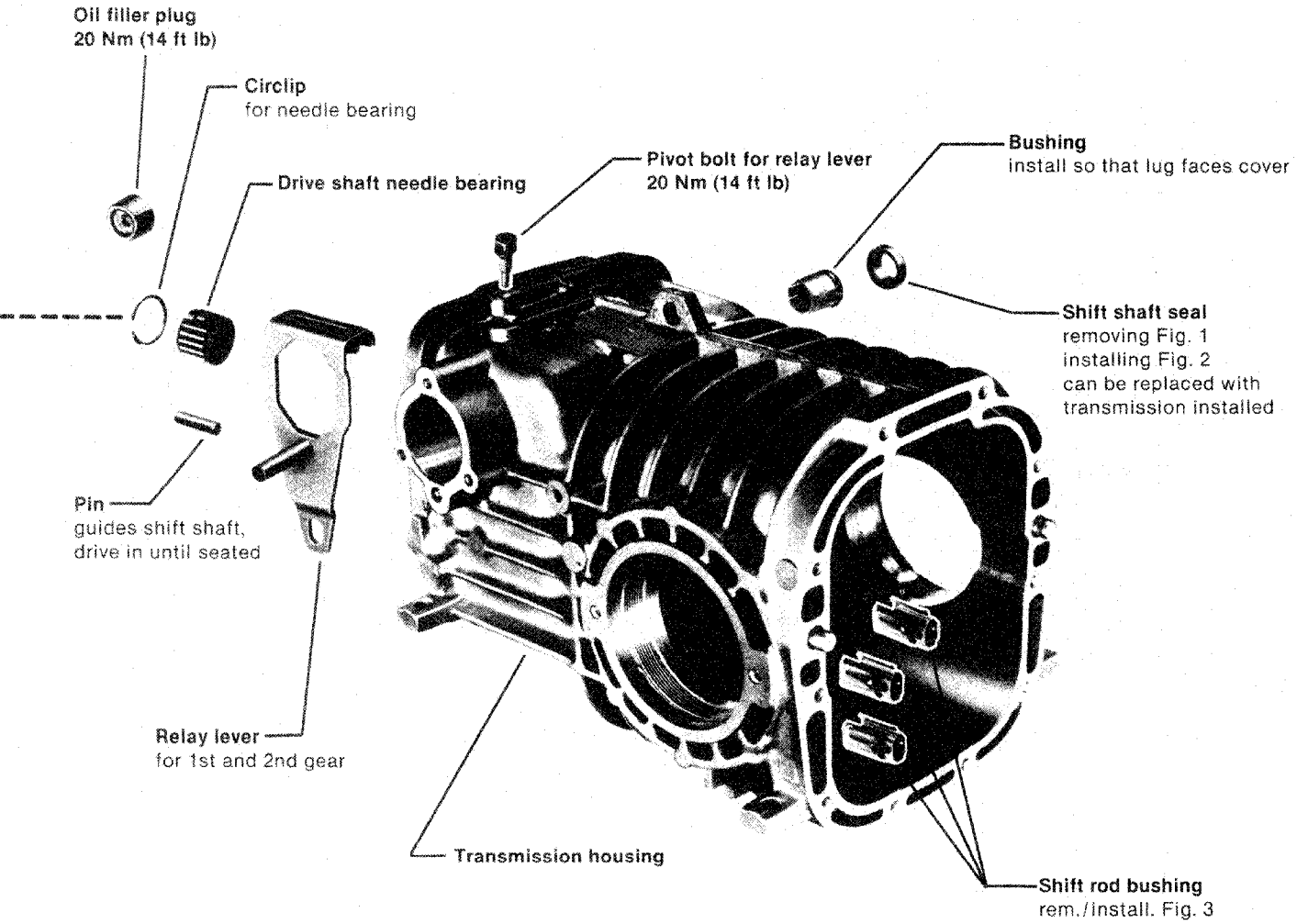


Fig. 4 Starter bushing, installing

—lubricate bushing and drive in flush


Reverse gear shaft
also locks bearing for drive shaft,
install so that bearing is evenly covered
Gear carrier cover
Pinion needle bearing outer race
Drive shaft bearing
Shift rod bushing
rem./inst. Fig. 3
Bearings
detach before removing
shift rod
Reverse gear shift rod
Gear carrier


Oil filler plug
20 Nm (14 ft lb)
Circlip
for needle bearing
Drive shaft needle bearing
Pivot bolt for relay lever
20 Nm (14 ft lb)
Bushing
install so that lug faces cover
Shift shaft seal
removing Fig. 1
installing Fig. 2
can be replaced with
transmission installed
Pin
guides shift shaft,
drive in until seated
Relay lever
for 1st and 2nd gear
Transmission housing
Shift rod bushing
rem./install. Fig. 3
34-1319

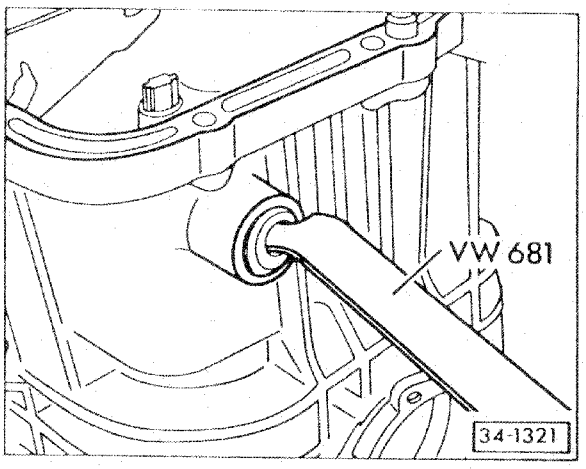


Fig. 1 Shift shaft oil seal, removing

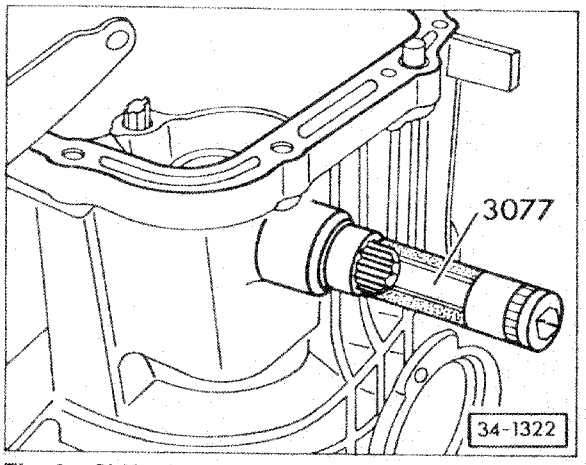


Fig. 2 Shift shaft oil seal, installing

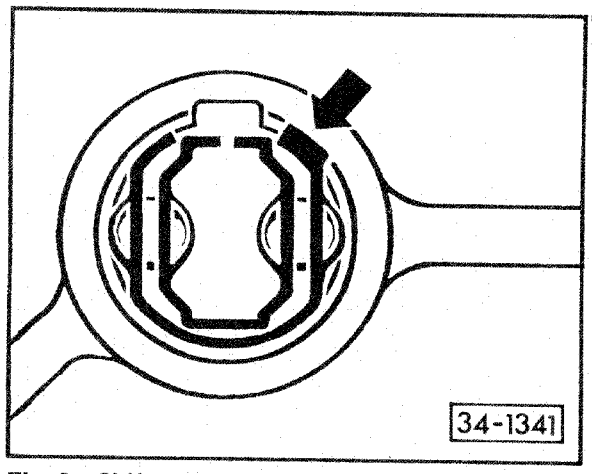
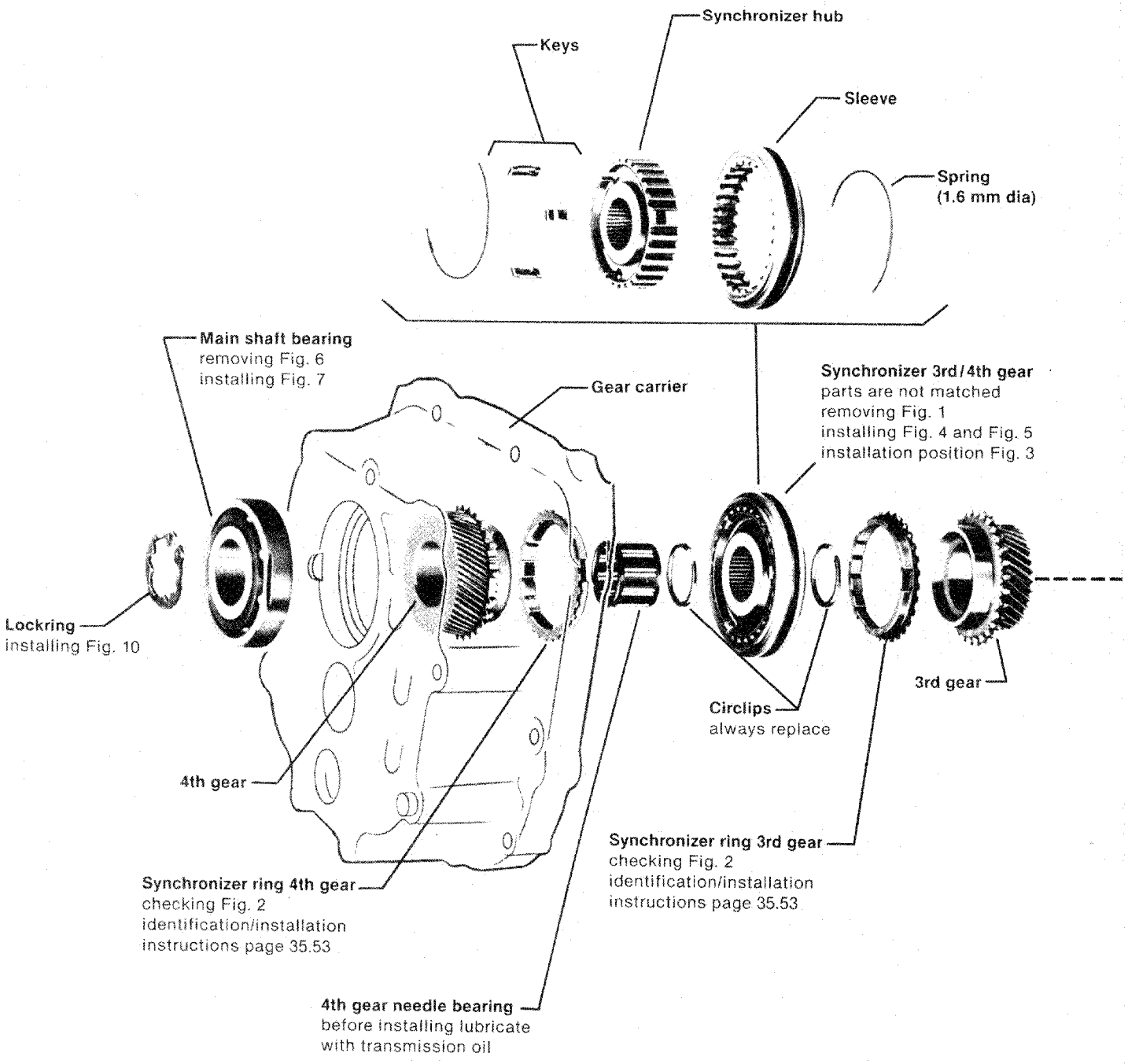
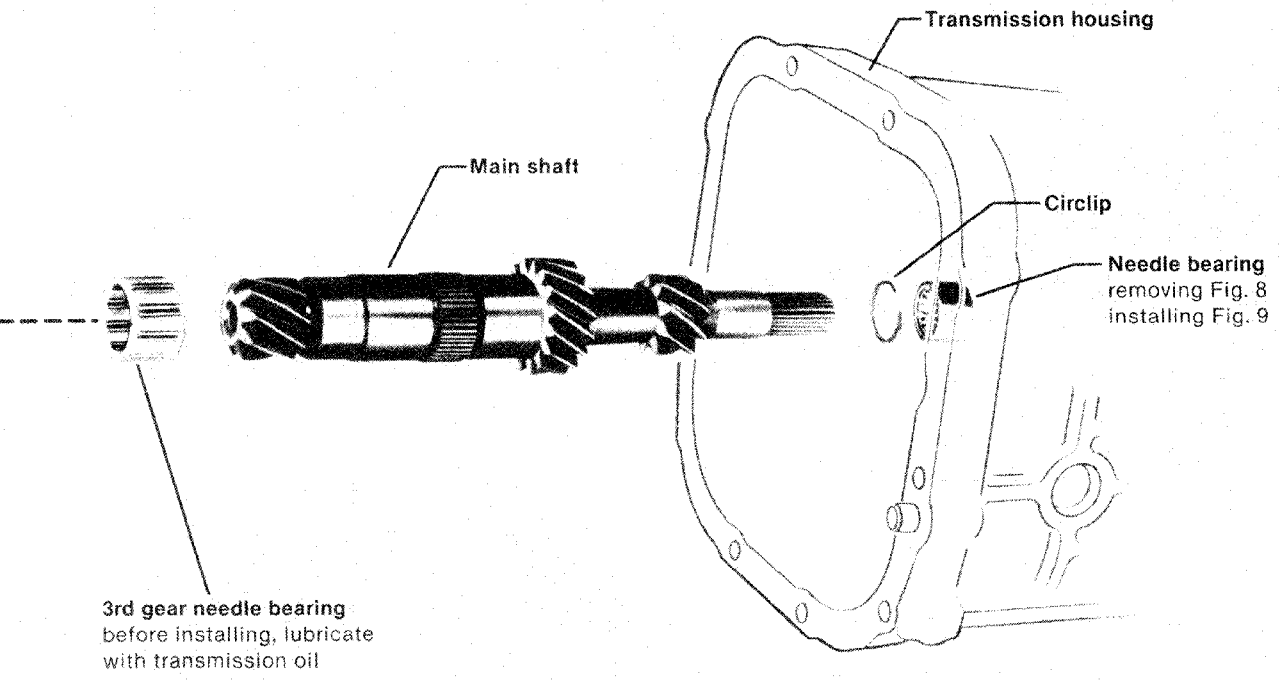


Fig. 3 Shift rod bushing

—removing
- turn bushing so that lug (arrow) is in recess of housing and press out

—installing
- align bushing and rod


Synchronizer hub
Keys
Sleeve
Spring
(1.6 mm dia)
Main shaft bearing
removing Fig. 6
installing Fig. 7
Gear carrier
Synchronizer 3rd/4th gear
parts are not matched
removing Fig. 1
installing Fig. 4 and Fig. 5
installation position Fig. 3
Lockring
installing Fig. 10
3rd gear
Circlips
always replace
4th gear
Synchronizer ring 3rd gear
checking Fig. 2
identification/installation
instructions page 35.53
Synchronizer ring 4th gear
checking Fig. 2
identification/installation
instructions page 35.53
4th gear needle bearing
before installing lubricate
with transmission oil


Transmission housing
Main shaft
Circlip
Needle bearing
removing Fig. 8
installing Fig. 9
3rd gear needle bearing
before installing, lubricate
with transmission oil
35-875

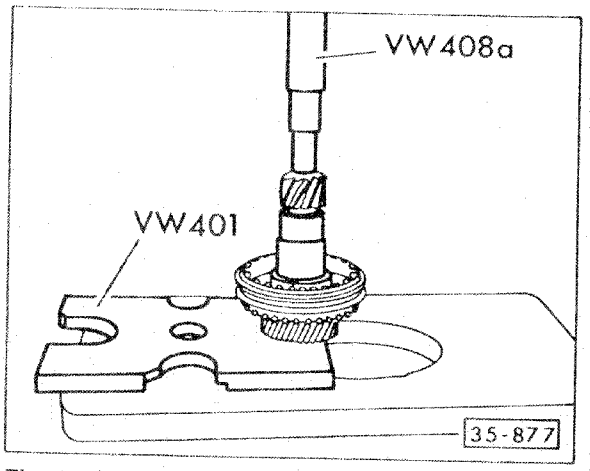


Fig. 1 **Synchronizer 3rd/4th gears, removing**

—press off together with 3rd gear

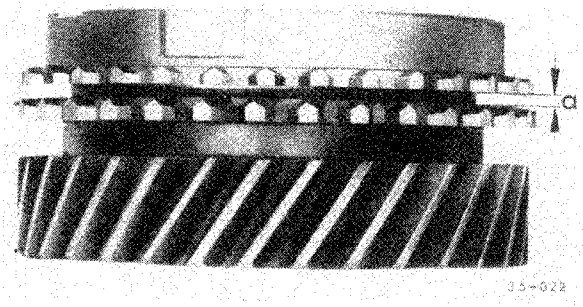


Fig. 2 **Synchronizer rings 3rd/4th gears, checking**

—press synchronizer rings onto gear by hand and measure gap **a** with feeler gauge

Gap a

Gear	New Part mm (in.)	Wear limit mm (in.)
3rd	1.25–1.95 (0.049–0.077)	0.5 (0.020)
4th	1.0–1.7 (0.039–0.067)	0.5 (0.020)

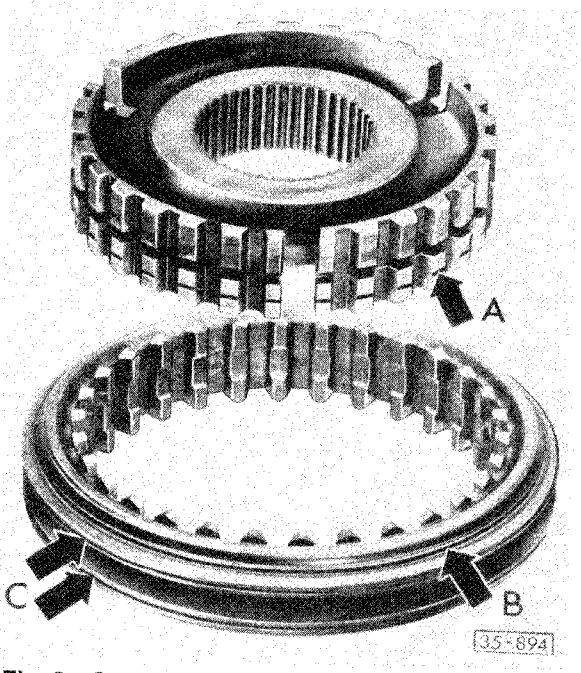


Fig. 3 **Synchronizer 3rd/4th gear, assembling**

- identification grooves (arrows A & B of sleeve and hub are on opposite sides. Groove on sleeve (arrow B) faces 4th gear
- grooves (arrow C) are for identification:
  1st & 2nd gear = 1 groove
  3rd & 4th gear = 2 grooves

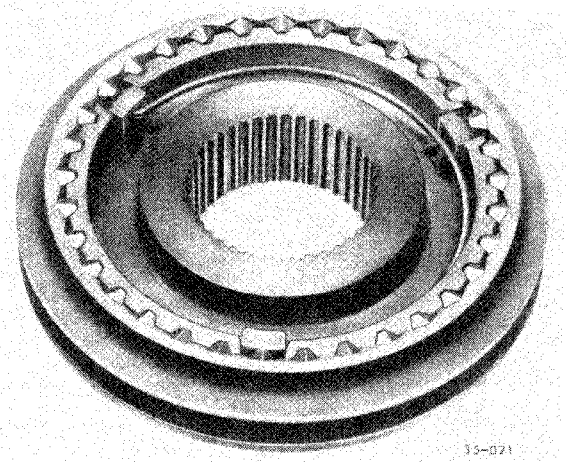


Fig. 4 **Synchronizer 3rd/4th gear, assembling**

—slide sleeve over synchronizer hub. Matched position is not necessary

—insert keys and install springs with ends offset 120°. Angled ends of springs must fit into keys

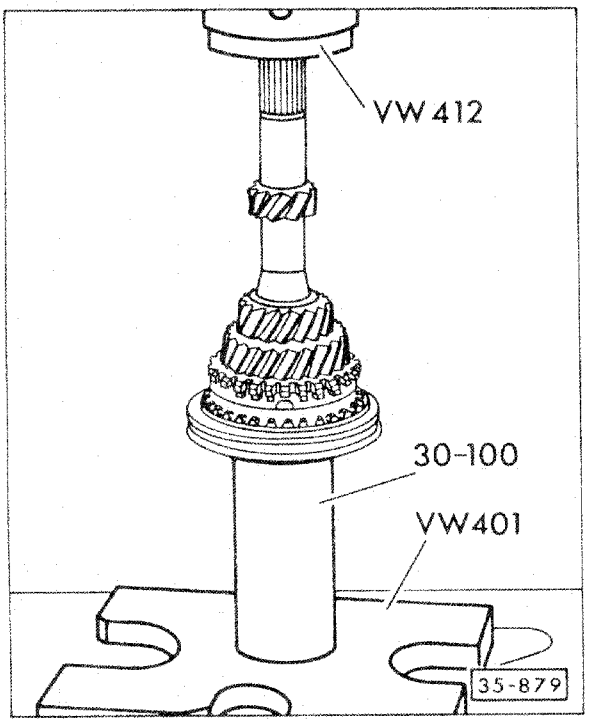


Fig. 5 Synchronizer 3rd/4th gear, installing

—turn synchronizer ring until grooves are in line with keys
• identification groove on sleeve (Fig. 3, arrow B) faces 4th gear

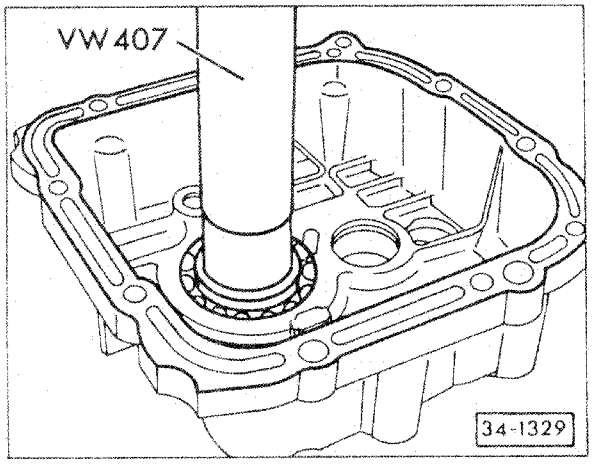


Fig. 6 Main shaft ball bearing, removing

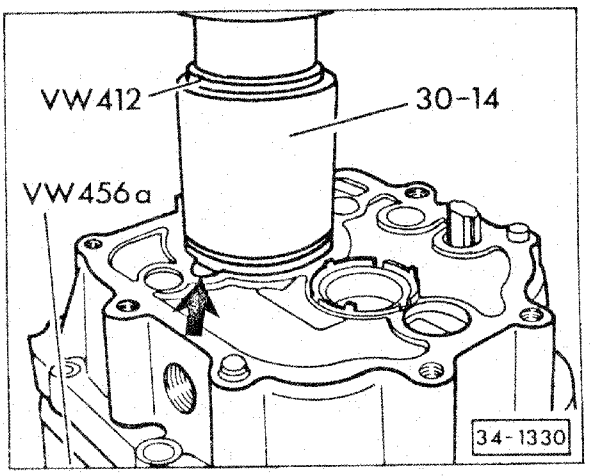


Fig. 7 Main shaft ball bearing, installing

—press in so that recess in bearing is aligned with recess (arrow) in housing

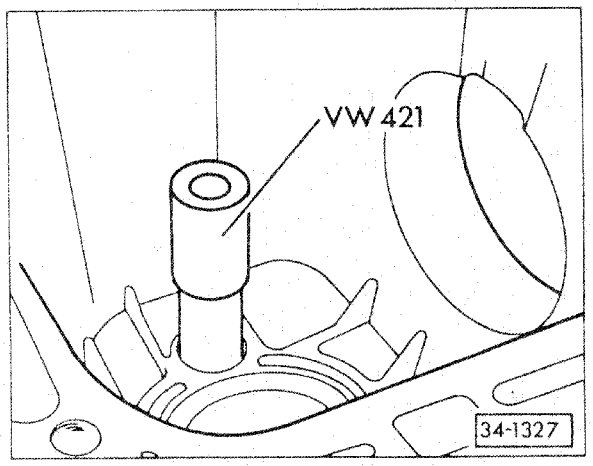


Fig. 8 Needle bearing in housing, removing

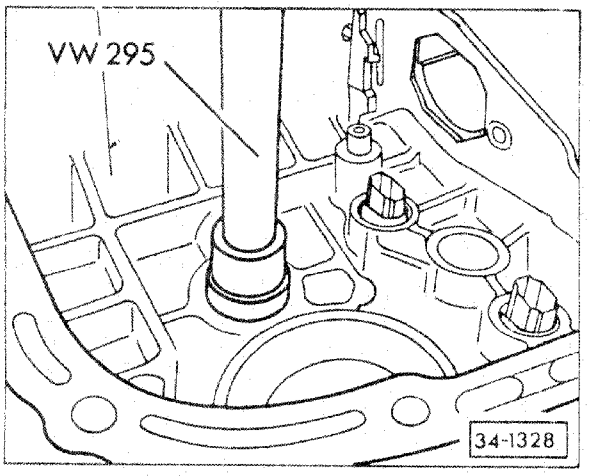


Fig. 9 Needle bearing in housing, installing

- lettered side of bearing (thicker material) must face installing tool

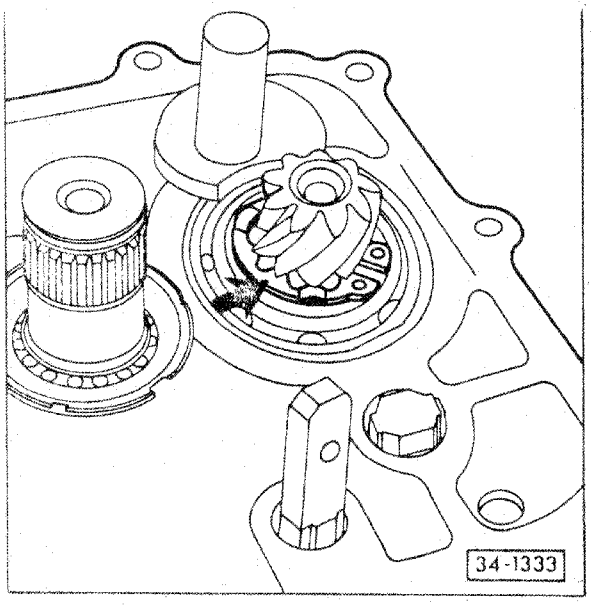


Fig. 10 Lockring, installing

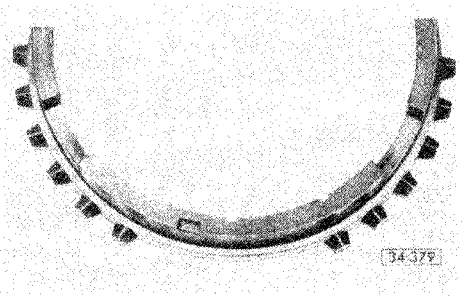
- make sure ring is seated correctly (arrow)

Synchronizer rings, identification

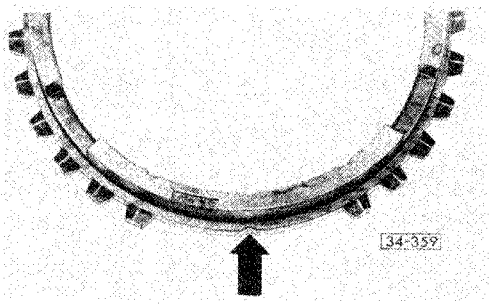
Note

When assembling transmission, install synchronizer ring to same gear from which it was removed

production

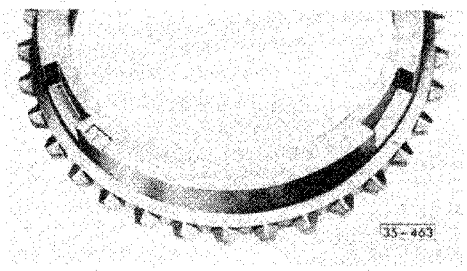


1st gear: brass ring,
molybdenum coated,
3 x 6 teeth,
without notches



2nd gear: brass ring,
molybdenum coated,
3 x 8 teeth,
with 3 notches (arrow)

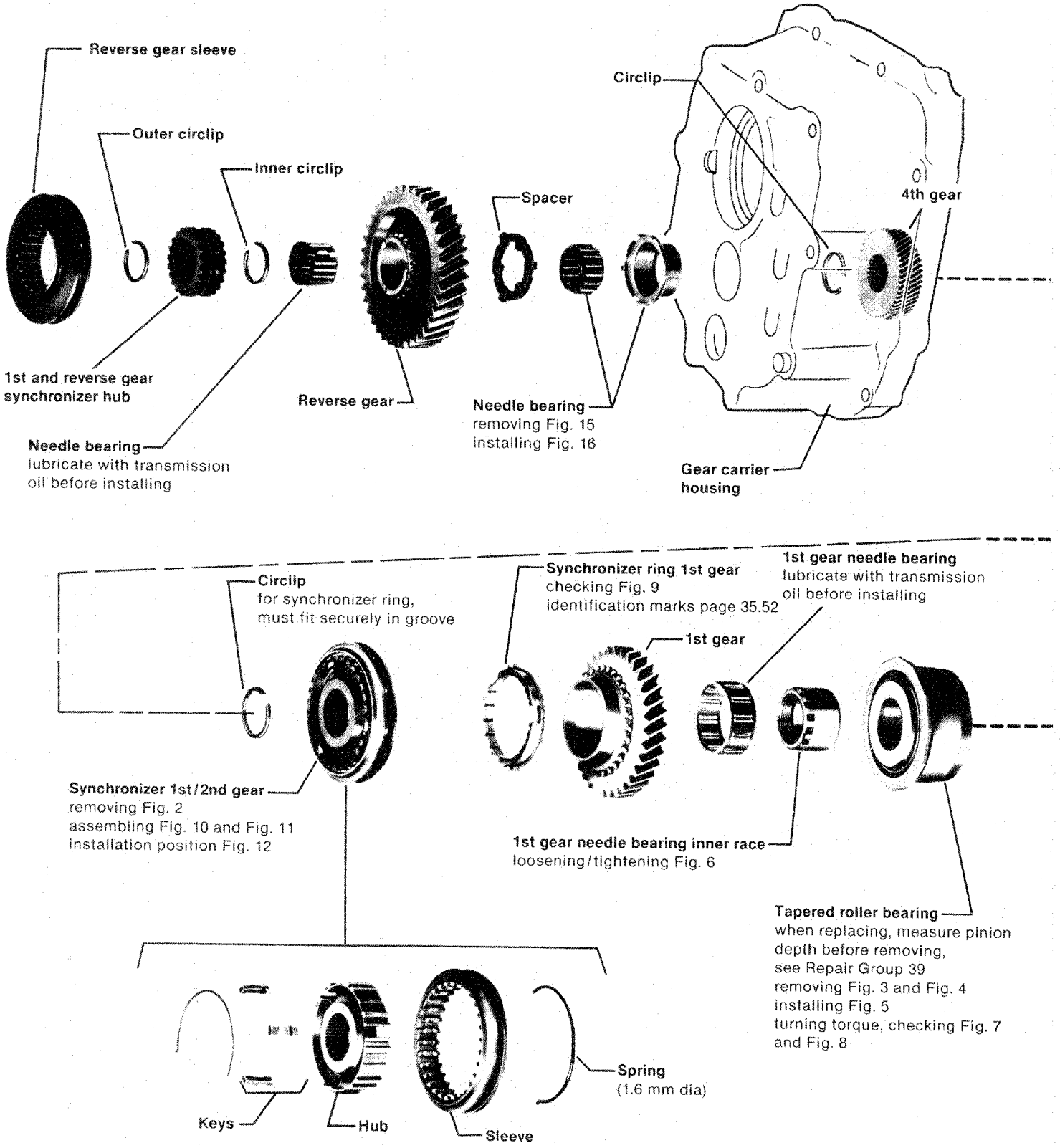
4th gear: brass ring,
3 x 8 teeth,
with 3 notches (arrow)

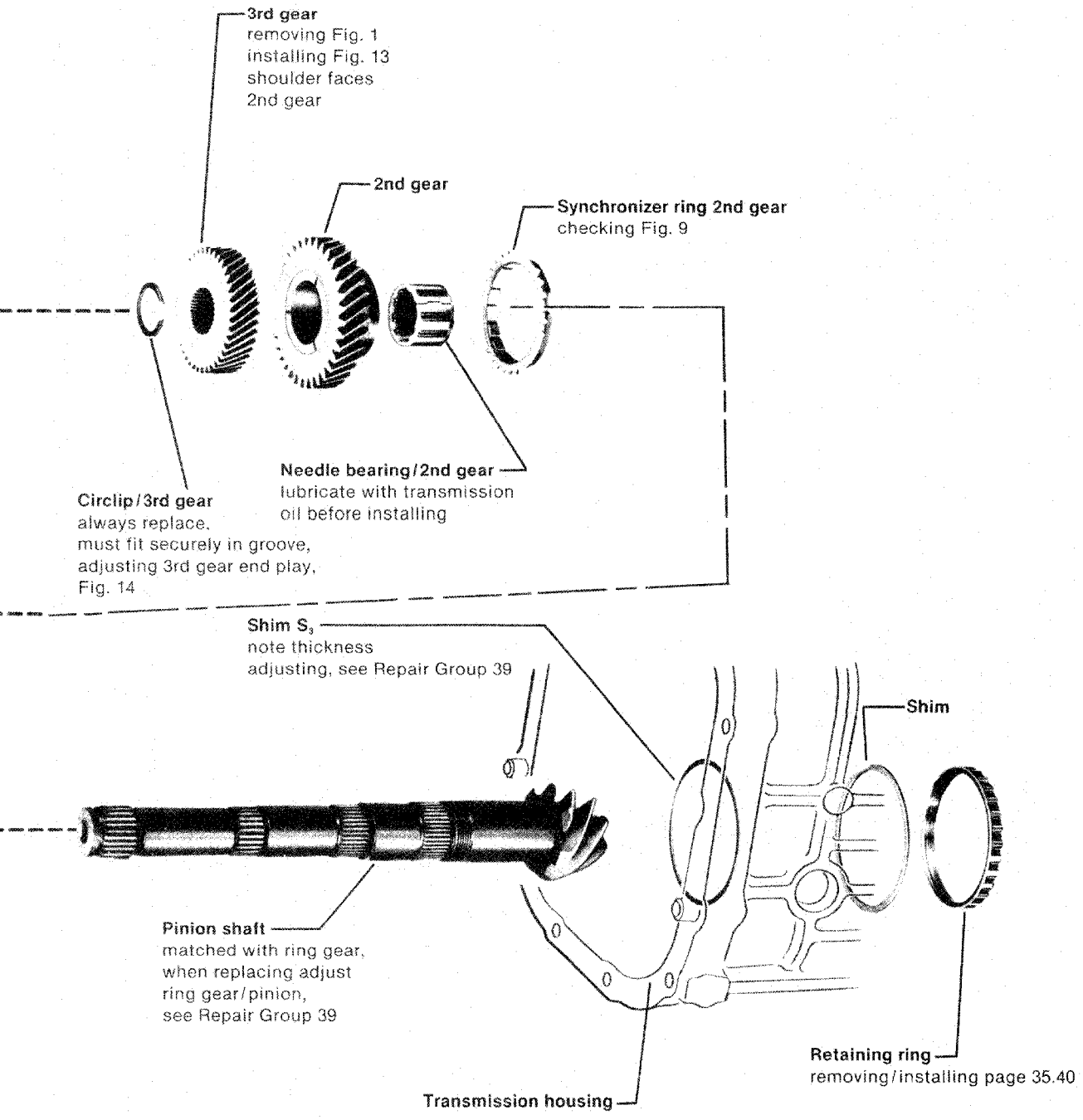


3rd gear: special brass ring,
molybdenum coated,
teeth all around circumference

spare part

For all gears install ring off 3rd gear which is supplied under Spare Part No.: 091 311 295 **A**


Reverse gear sleeve
Outer circlip
Inner circlip
1st and reverse gear synchronizer hub
Needle bearing
lubricate with transmission oil before installing
Reverse gear
Spacer
Needle bearing
removing Fig. 15
installing Fig. 16
Circlip
4th gear
Gear carrier housing
Circlip
for synchronizer ring, must fit securely in groove
Synchronizer 1st/2nd gear
removing Fig. 2
assembling Fig. 10 and Fig. 11
installation position Fig. 12
Synchronizer ring 1st gear
checking Fig. 9
identification marks page 35.52
1st gear
1st gear needle bearing
lubricate with transmission oil before installing
1st gear needle bearing inner race
loosening/tightening Fig. 6
Tapered roller bearing
when replacing, measure pinion depth before removing, see Repair Group 39
removing Fig. 3 and Fig. 4
installing Fig. 5
turning torque, checking Fig. 7 and Fig. 8
Keys
Hub
Sleeve
Spring
(1.6 mm dia)


3rd gear
removing Fig. 1
installing Fig. 13
shoulder faces
2nd gear
2nd gear
Synchronizer ring 2nd gear
checking Fig. 9
Needle bearing/2nd gear
lubricate with transmission
oil before installing
Circlip/3rd gear
always replace,
must fit securely in groove,
adjusting 3rd gear end play,
Fig. 14
Shim S_3
note thickness
adjusting, see Repair Group 39
Shim
Pinion shaft
matched with ring gear,
when replacing adjust
ring gear/pinion,
see Repair Group 39
Retaining ring
removing/installing page 35.40
Transmission housing
35-880

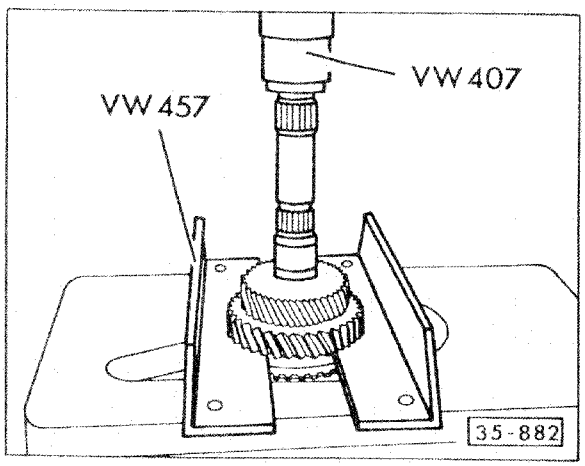


Fig. 1 3rd and 2nd gears, removing

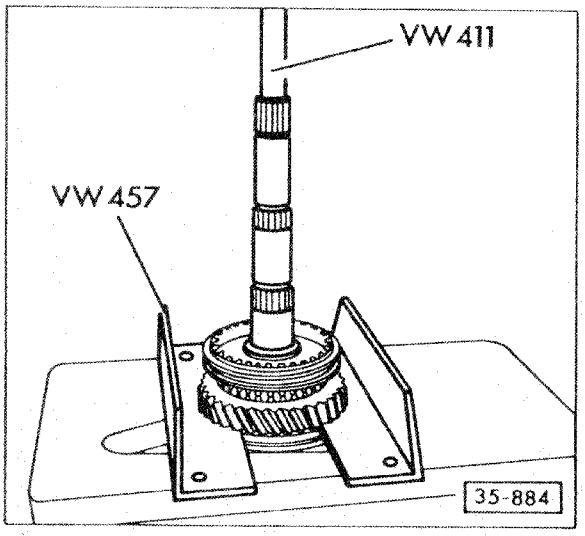


Fig. 2 Synchronizer sleeve/hub and 1st gear, removing

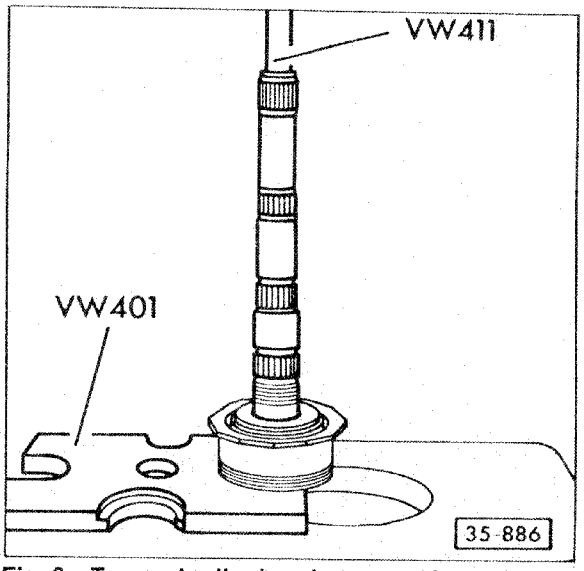


Fig. 3 Tapered roller bearing, removing

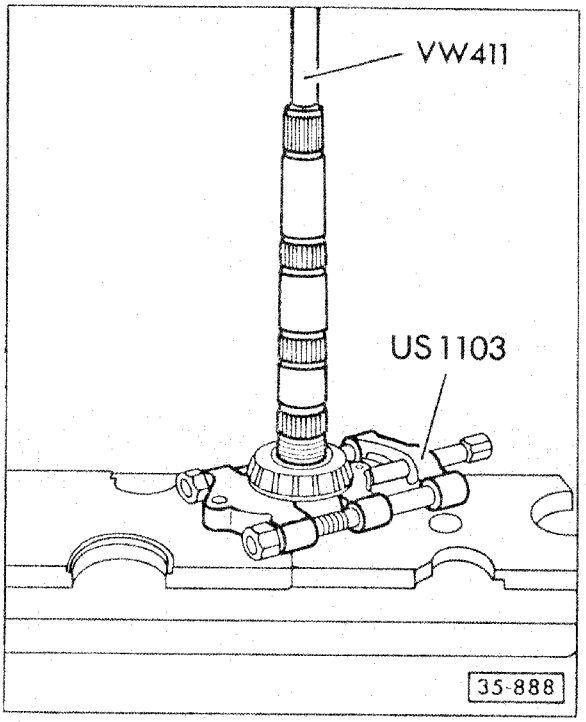


Fig. 4 Tapered roller bearing inner race, removing

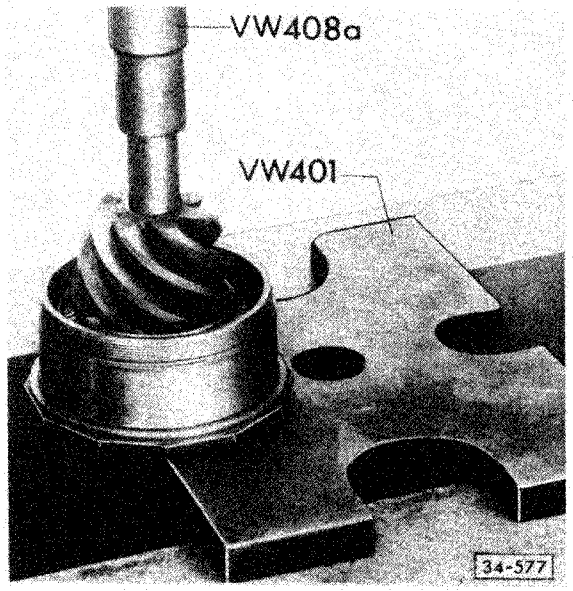


Fig. 5 **Tapered roller bearing, installing**

—heat inner race to about 100°C (212°F) and press on
—before tightening needle bearing inner race, let tapered roller bearing cool to room temperature

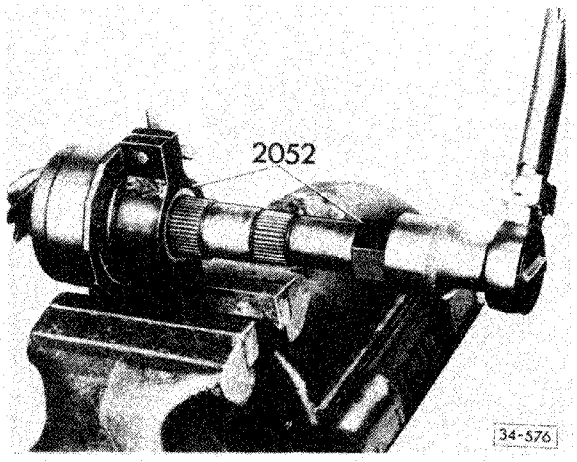


Fig. 6 **Needle bearing, loosening/tightening**

—heat inner race to about 60°C (140°F) and screw on as far as possible by hand
—place pinion shaft in tool 2052 and tighten wing nut lightly
—tighten inner race to 210 Nm (**152 ft lb**)
—check turning torque of tapered roller bearing, see Fig. 7

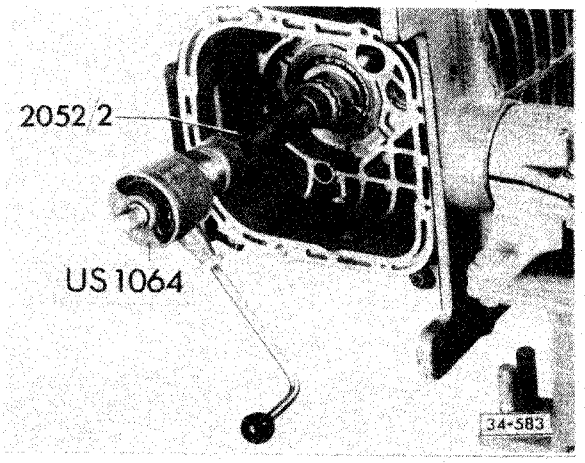


Fig. 7 **Tapered roller bearing, checking turning torque**

—lubricate bearings with transmission oil and tighten retaining ring
—turn pinion shaft in both directions about 15–20 times
—turn further and read turning torque
- new bearings: up to 210 Ncm (**180 in. lb**)
- used bearings*: up to 70 Ncm (**61 in. lb**) (*after running at least 30 miles)
- if no turning torque can be measured, see Fig. 8

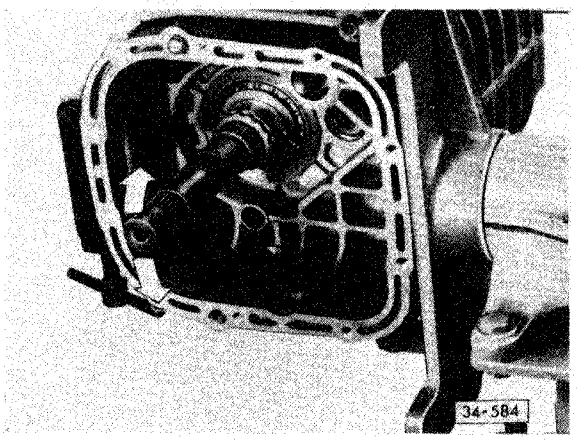


Fig. 8 **Bearing condition, checking**

—check for rock at end of pinion. There must not be any detectable movement
if **YES**, replace tapered roller bearing

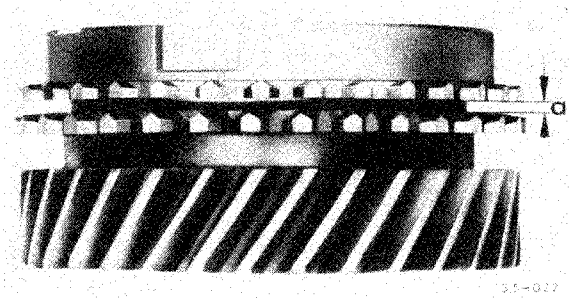


Fig. 9 Synchronizer ring 1st/2nd gear, checking

—press synchronizer rings onto gear by hand and measure gap **a** with feeler gauge

	New Part mm (in.)	Wear limit mm (in.)
Gap a	1.3–1.9 (0.051–0.075)	0.5 (0.020)

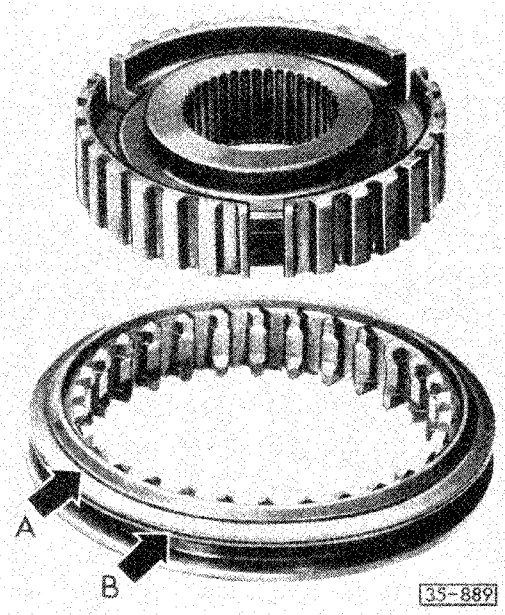


Fig. 10 Synchronizer 1st/2nd gear, assembling

—groove (arrow A) must face 2nd gear
—collar on hub must face 1st gear
—grooves (arrow B) are for identification:
- 1st gear & 2nd gear = 1 groove
- 3rd gear & 4th gear = 2 grooves

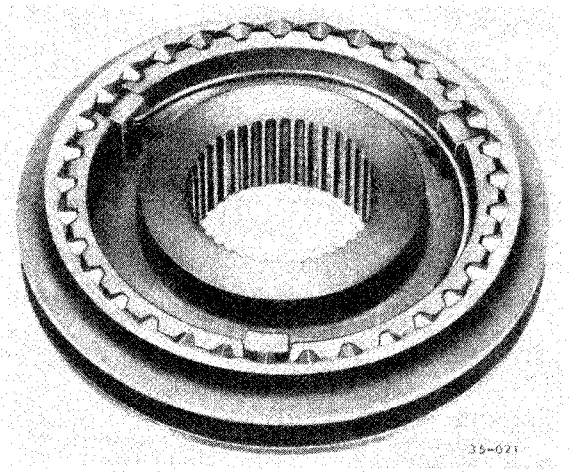


Fig. 11 Synchronizer 1st/2nd gear, assembling

—slide sleeve over sychronizer hub. Matched position is not necessary
—insert keys and install springs with ends offset 120°. Angled ends of springs must fit into keys

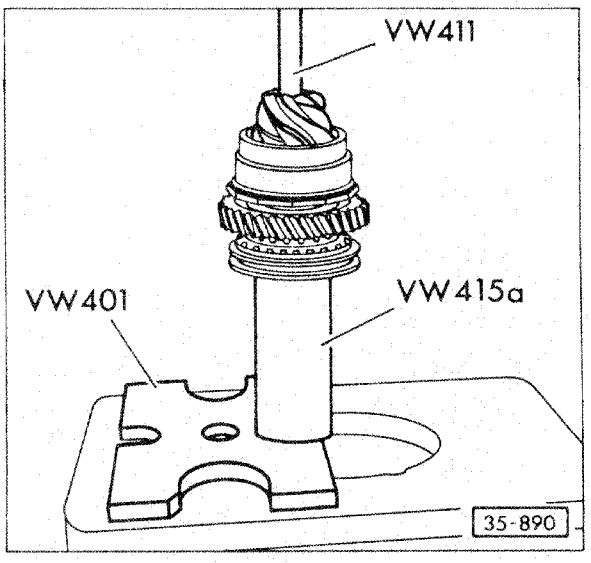


Fig. 12 Synchronizer 1st/2nd gear, installing

—turn synchronizer ring until grooves are in line with keys (installation position, see Fig. 10)

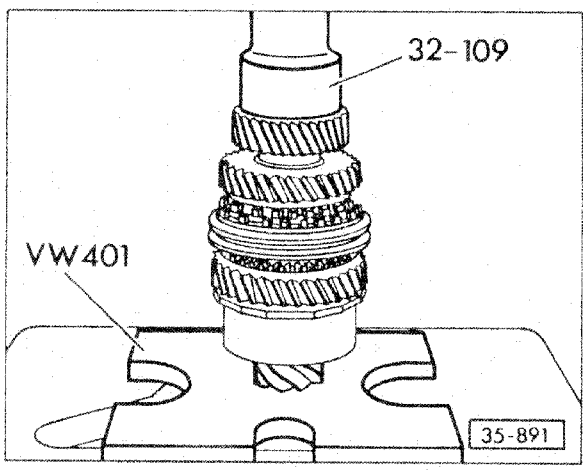


Fig. 13 3rd gear, installing

—collar must face 2nd gear

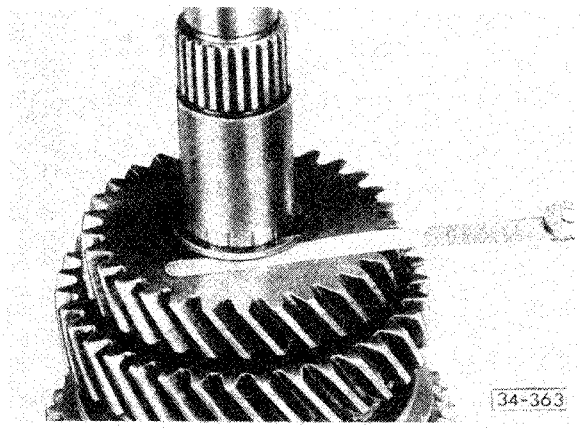


Fig. 14 3rd gear end play, adjusting

—measure end play with feeler gauge
—adjust by selecting suitable circlip
• play should be 0.05 mm-0.20 mm (try to keep lower limit)

Circlips available:

Thickness mm	Color	Part No.
1.60	black	113 311 382
1.75	blue	113 311 383
1.90	brown	113 311 384
2.05	gray	113 311 385
2.20	copper	113 311 386
2.30	brass	113 311 387
2.40	silver	113 311 388

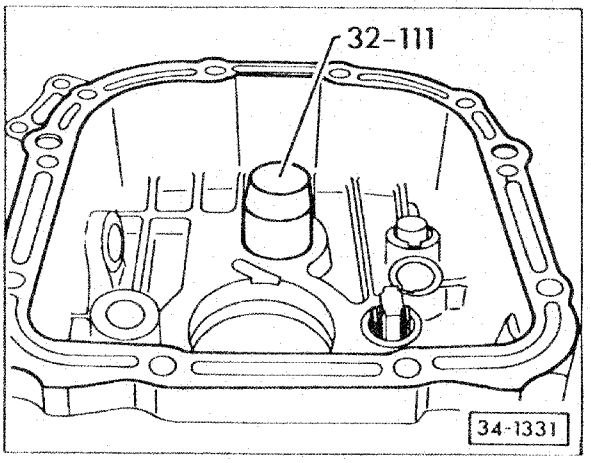


Fig. 15 Pinion needle bearing in gear carrier housing, removing

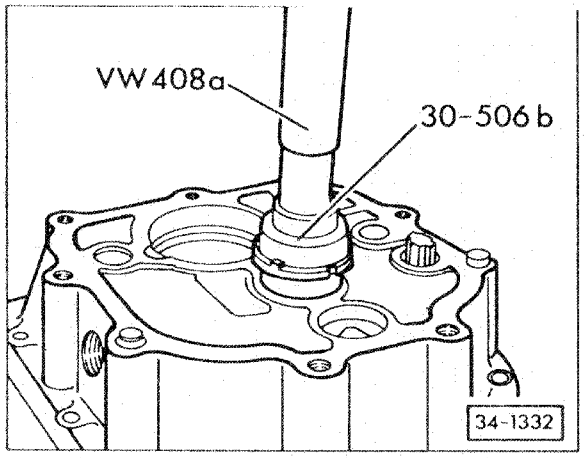


Fig. 16 Pinion needle bearing in gear carrier housing, installing

35 Manual Transmission–Case, Gears, Shafts

Listed below are gear ratios and lubricant specifications for 1985 MY Vanagons equipped with 4-speed manual transmission 091/l:

Gear Ratios	Trans. DU		
1st gear	34:9	=	3.78
2nd gear	33:16	=	2.06
3rd gear	63:50	=	1.26
4th gear	52:61	=	0.85
Reverse	33:9	=	3.67
Final drive	34:7	=	4.86

Gear Ratios	Trans. ABD		
1st gear	34:9	=	3.78
2nd gear	33:16	=	2.06
3rd gear	49:40	=	1.225
4th gear	41:48	=	0.85
Reverse	33:9	=	3.67
Final drive	29:6	=	4.83

lubricant capacity (incl. differential)
091/l . . . . . 3.0 l (3.2 US qt)
viscosity . . . . SAE 80W, SAE 80W/90
type . . hypoid, MIL-L-2105; API/GL-4

To reduce shifting effort, transmission oil capacity has been reduced.

For production reasons, the oil filler hole remains at the same location.

Oil should only be poured in to a level approximately 15 mm (9/16 in.) below the filler hole.

Transmission filling capacities:

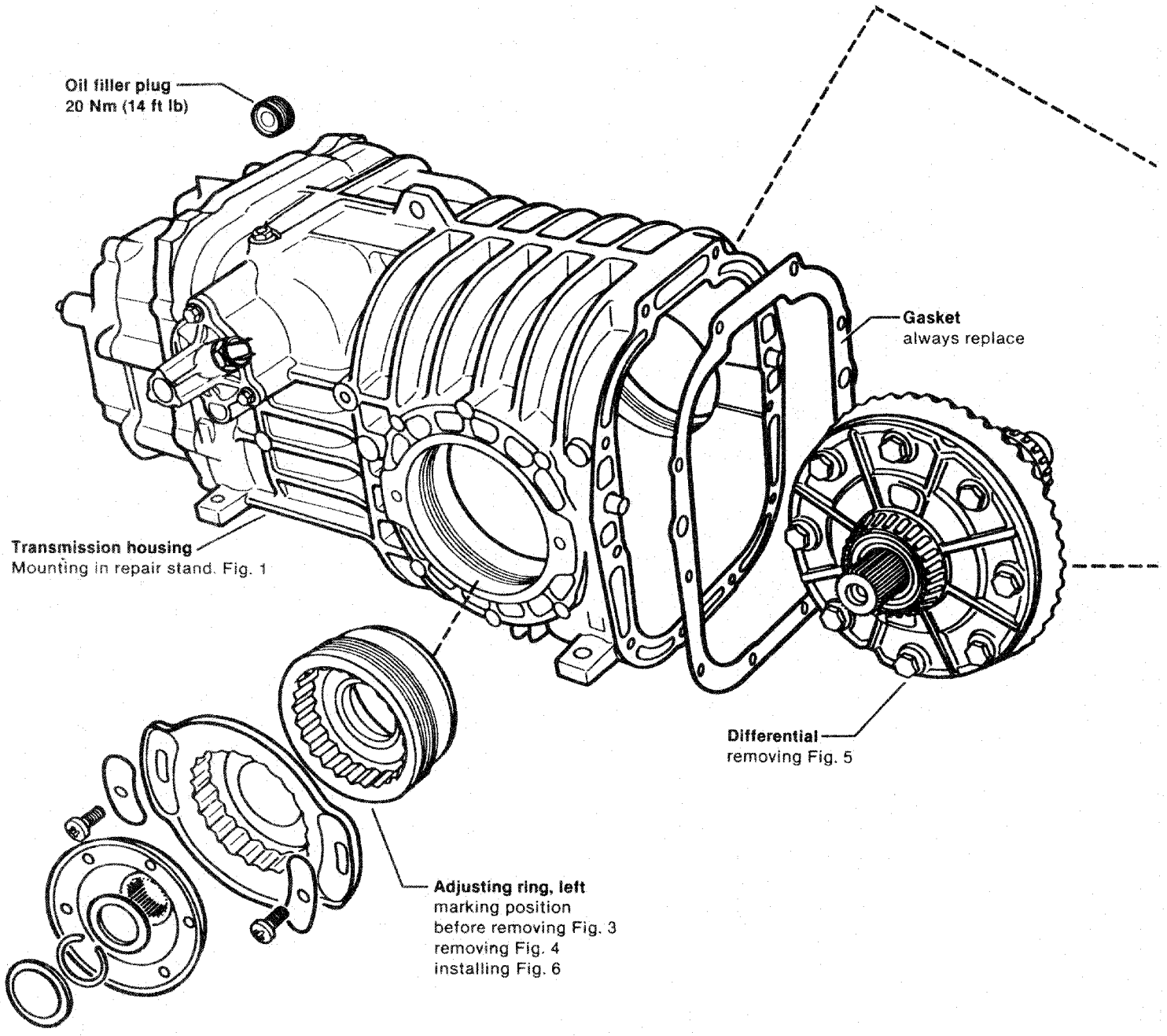
Vehicles with gasoline engines	3.0 liters (3.2 qt)
Vehicles with Diesel engines	4.0 liters (4.2 qt)

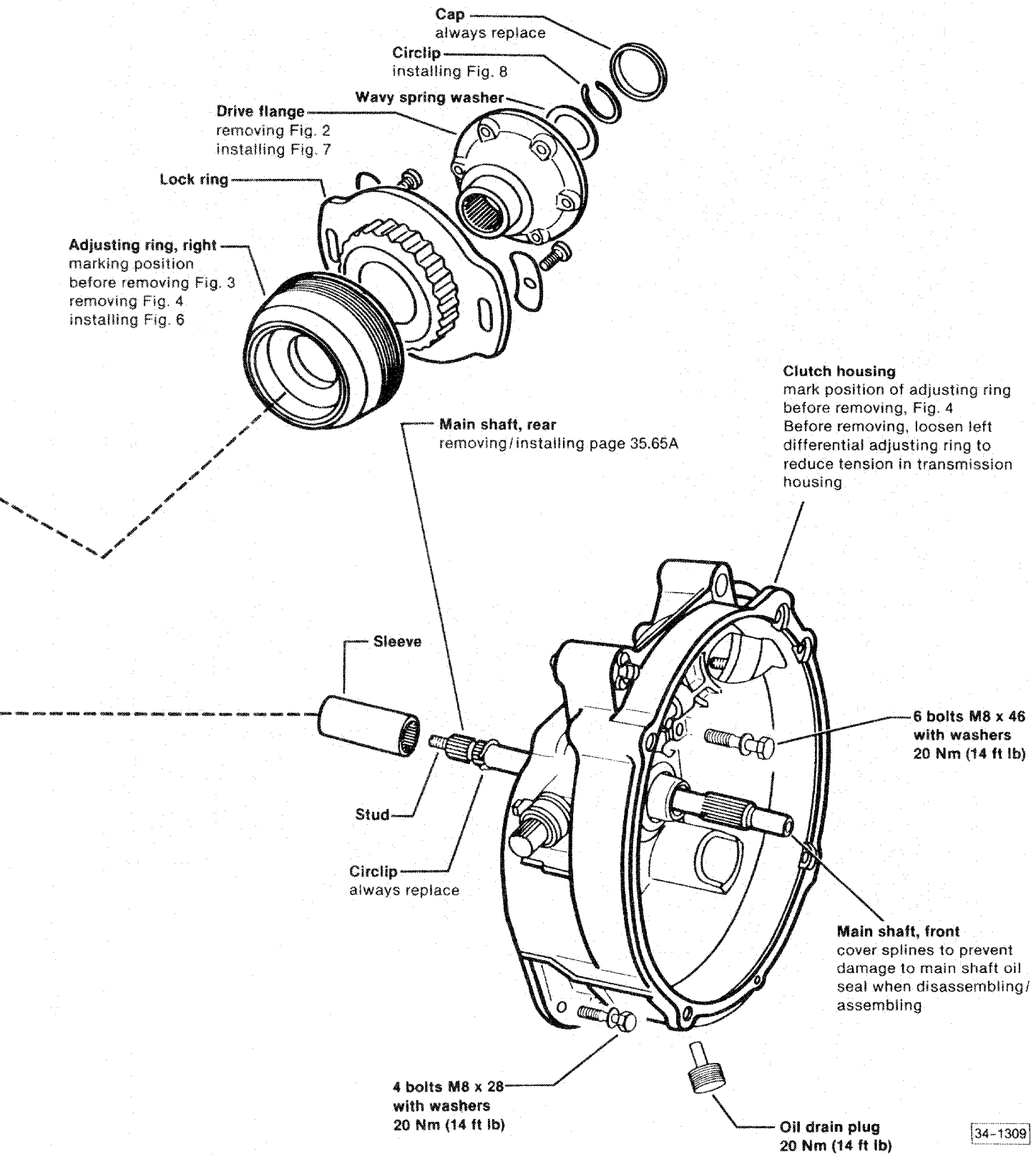
5-Speed 094 Manual Transmission Case, Gears, Shafts

Quick Data

Index

Transmission/Final drive lubricant:
Hypoid oil API/GL-4; MIL-L2105
SAE 80W, SAE 80W/90
Capacity: 4.0 ltr (4.2 US qt)




Cap
always replace
Circlip
installing Fig. 8
Wavy spring washer
Drive flange
removing Fig. 2
installing Fig. 7
Lock ring
Adjusting ring, right
marking position
before removing Fig. 3
removing Fig. 4
installing Fig. 6
Main shaft, rear
removing/installing page 35.65A
Clutch housing
mark position of adjusting ring
before removing, Fig. 4
Before removing, loosen left
differential adjusting ring to
reduce tension in transmission
housing
Sleeve
6 bolts M8 x 46
with washers
20 Nm (14 ft lb)
Stud
Circlip
always replace
Main shaft, front
cover splines to prevent
damage to main shaft oil
seal when disassembling/
assembling
4 bolts M8 x 28
with washers
20 Nm (14 ft lb)
Oil drain plug
20 Nm (14 ft lb)
34-1309

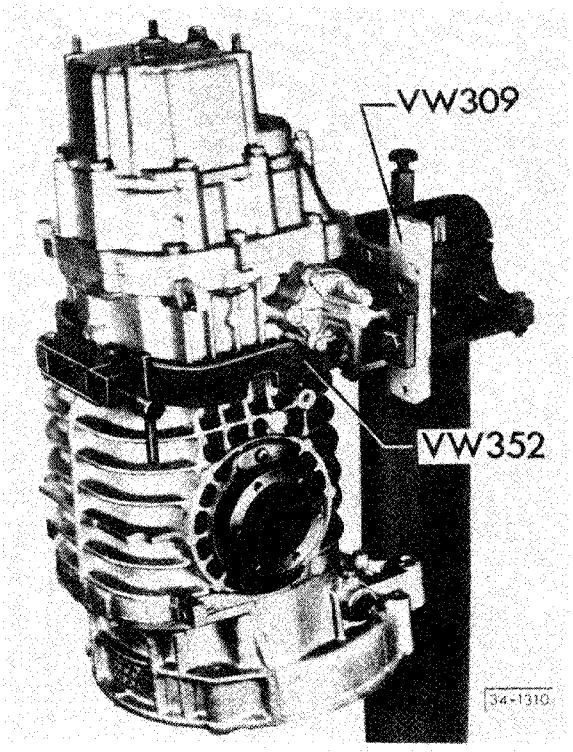


Fig. 1 Transmission assembly, mounting in repair stand

—drain transmission oil
—mount transmission in repair stand

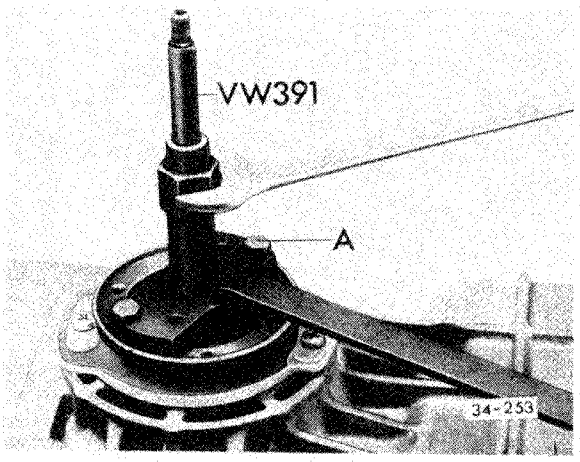


Fig. 2 Drive flange, removing

—remove circlip and wavy spring washer
—attach VW391 to flange with 2 bolts
• A = M8 x 30 bolts
—pull drive flange out

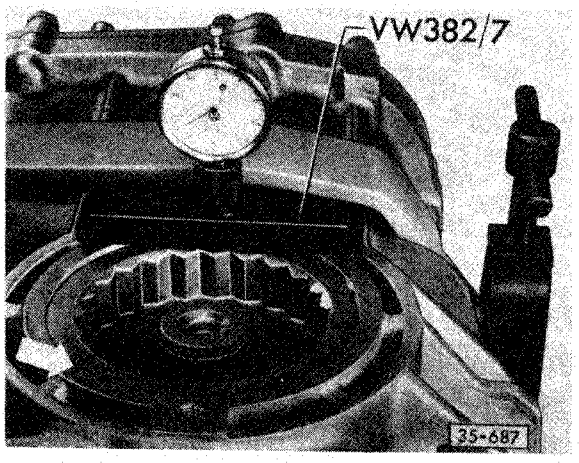


Fig. 3 Adjusting ring, marking position

Note

Before starting repair work (which does not require final drive to be adjusted) mark position of adjusting rings on transmission housing. Measure depth to which they are installed with VW 382/7 and write down readings

—scribe left side (ring gear side) with one mark (arrow)
—scribe right side with two marks

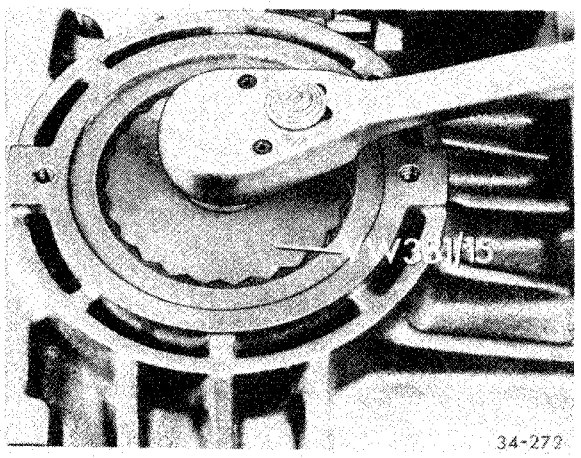


Fig. 4 Adjusting rings, removing

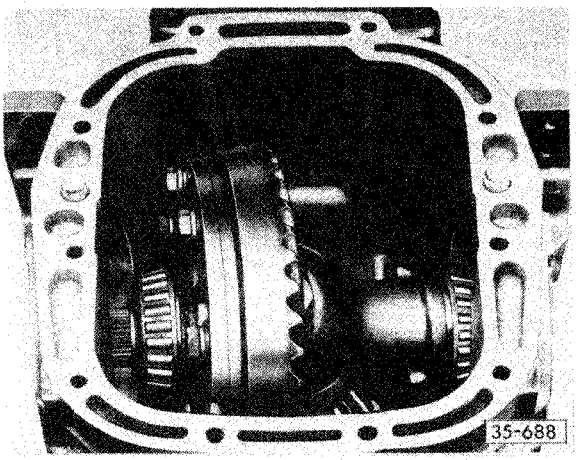


Fig. 5 Differential, removing

—remove adjusting rings and rear main shaft
—lift out differential

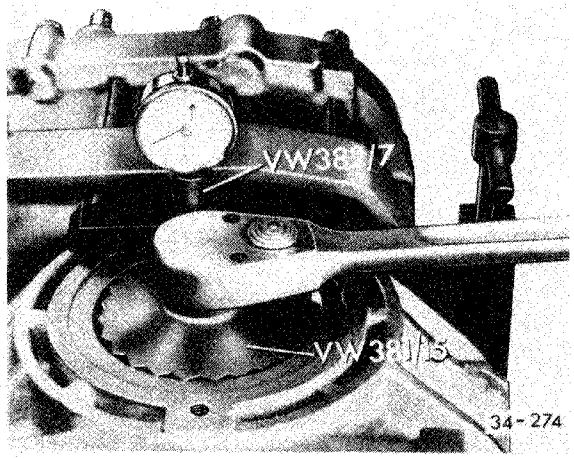


Fig. 6 Adjusting rings, installing

—install left and right adjusting rings and align marks at depth previously measured
—lubricate threads with MoS_2 grease

CAUTION

Do not tighten left side adjusting ring until clutch housing has been installed and bolts torqued

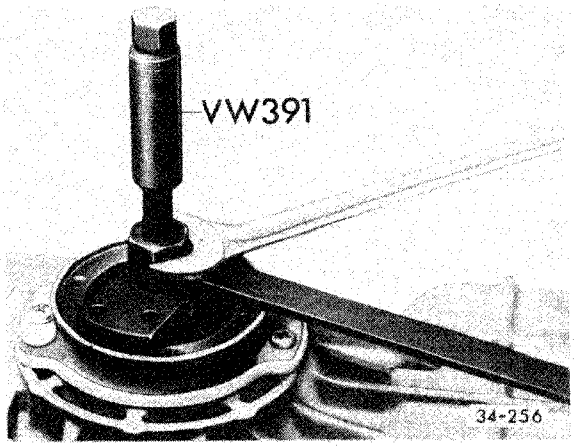


Fig. 7 Drive flange, installing

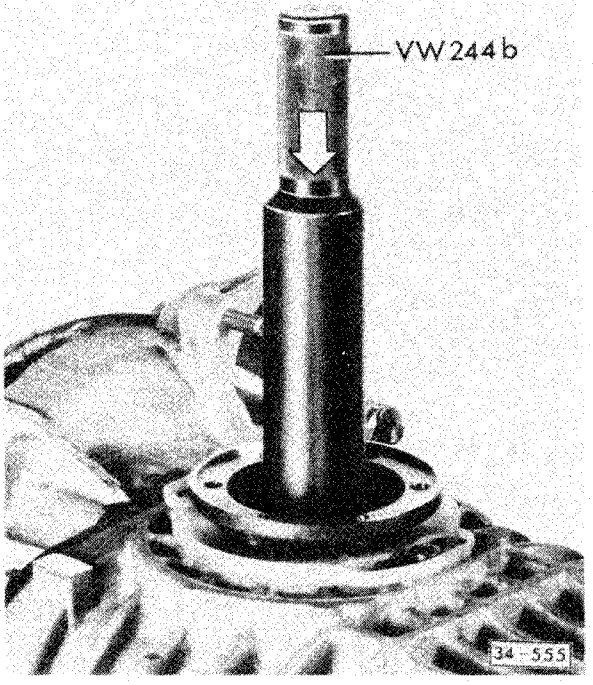
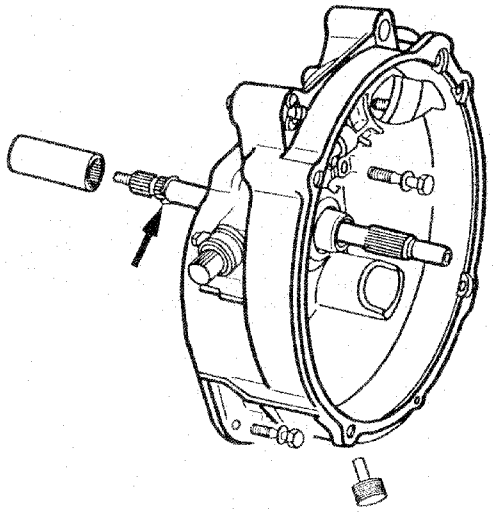


Fig. 8 Circlip for drive flange, installing

—insert wavy spring washer and circlip
—press circlip into groove with VW 244b and at same time check that washer is centered

Rear main shaft, removing/installing

Work sequence



34-1309 A

Removing

- remove circlip (arrow)
- push sleeve backward and screw out main shaft

Installing

- screw front and rear main shafts together, then back off one spline
- push sleeve on and install new circlip

Transmission modifications
(manufactured prior to Dec. 15, 1982)

Transmissions with date of manufacture (see transmission housing code) prior to 15 12 2 (December 15, 1982) are subject to refinements currently used in production. Transmissions needing repair should be inspected and repaired as necessary according to following two groups of procedures with required parts according to dates of manufacture.

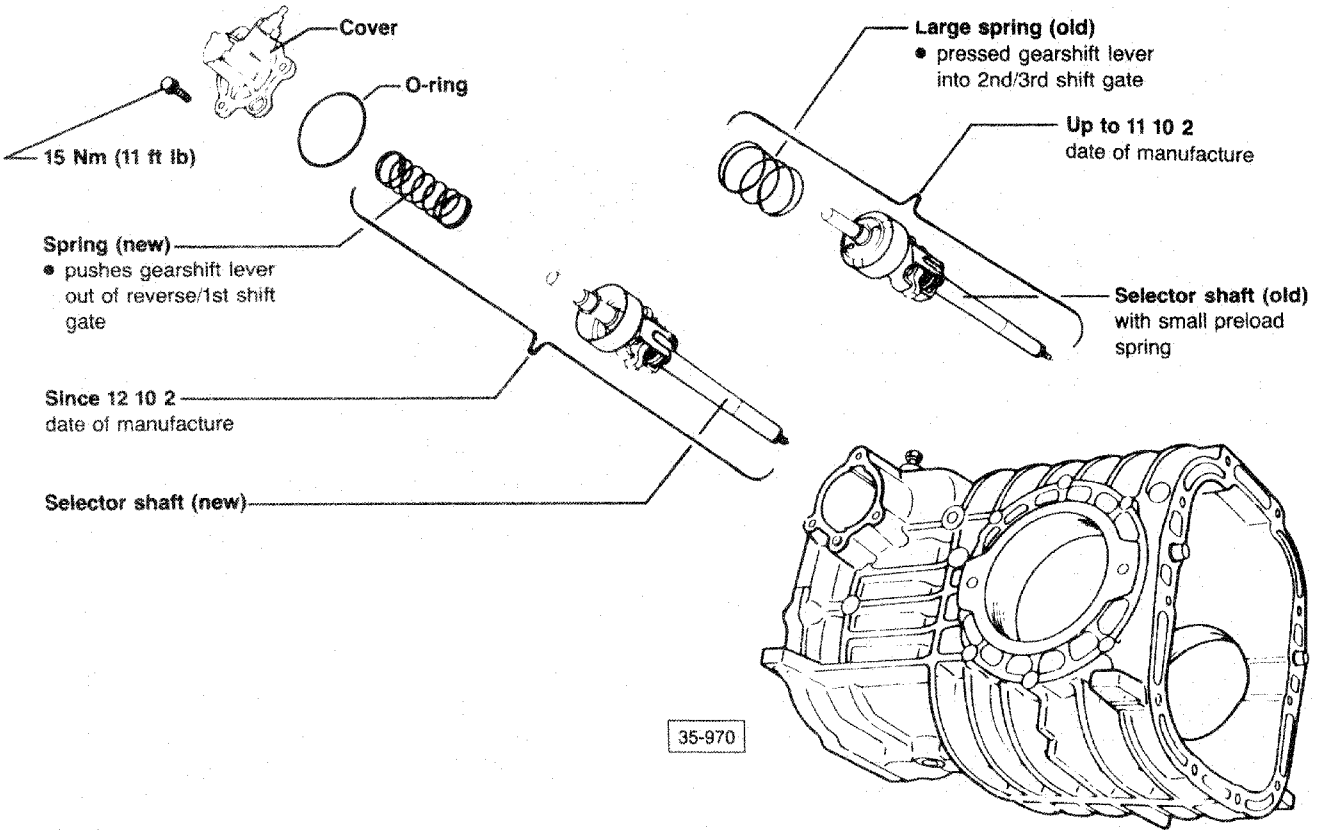
Note

Only latest version parts will be supplied as spare parts.

CAUTION

Part numbers are for reference only. Always check with your Parts Department for latest parts information.

Selector shaft, modifications
- external repairs performed without removing transmission



A — Selector shaft
— replace complete shaft with new version

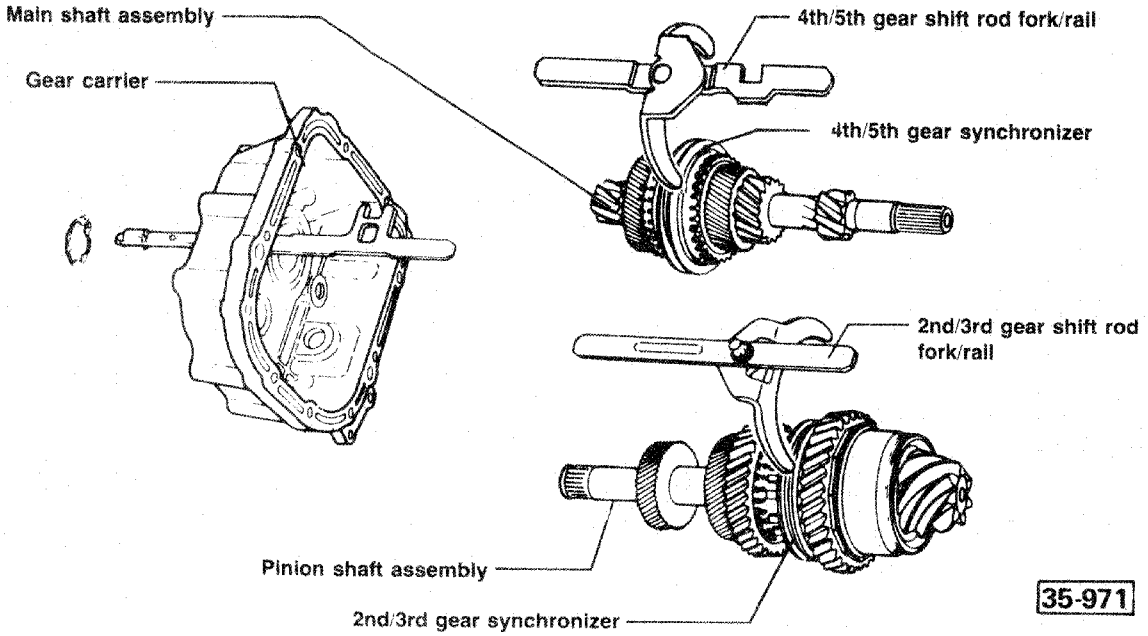
B — Selector shaft spring
Gearshift lever is now moved by spring pressure out of reverse/1st shift gate rather than into 2nd/3rd shift gate
— install new selector shaft spring

Note

Large spring may be left in transmissions in which originally installed to accommodate driver's current shifting habits.

C — Selector shaft cover
- provided with shoulder for spring to maintain proper position when assembling
— replace cover and o-ring

Shift forks/synchronizers, modifications
- internal repairs requiring disassembly of transmission



D — Shift forks/rails
- 2nd/3rd and 4th/5th gear shift forks/rails are riveted and welded to maintain proper alignment to each other
— replace with new shift forks/rails

E — Synchronizers
- 2nd/3rd and 4th/5th gear synchronizers have been changed to prevent jumping out of gear
- changes cannot be detected visually
— replace with new version synchronizers

Parts requirements (based on transmission date of manufacture)

Note

Previous version parts are not available and must be replaced by latest version listed below.

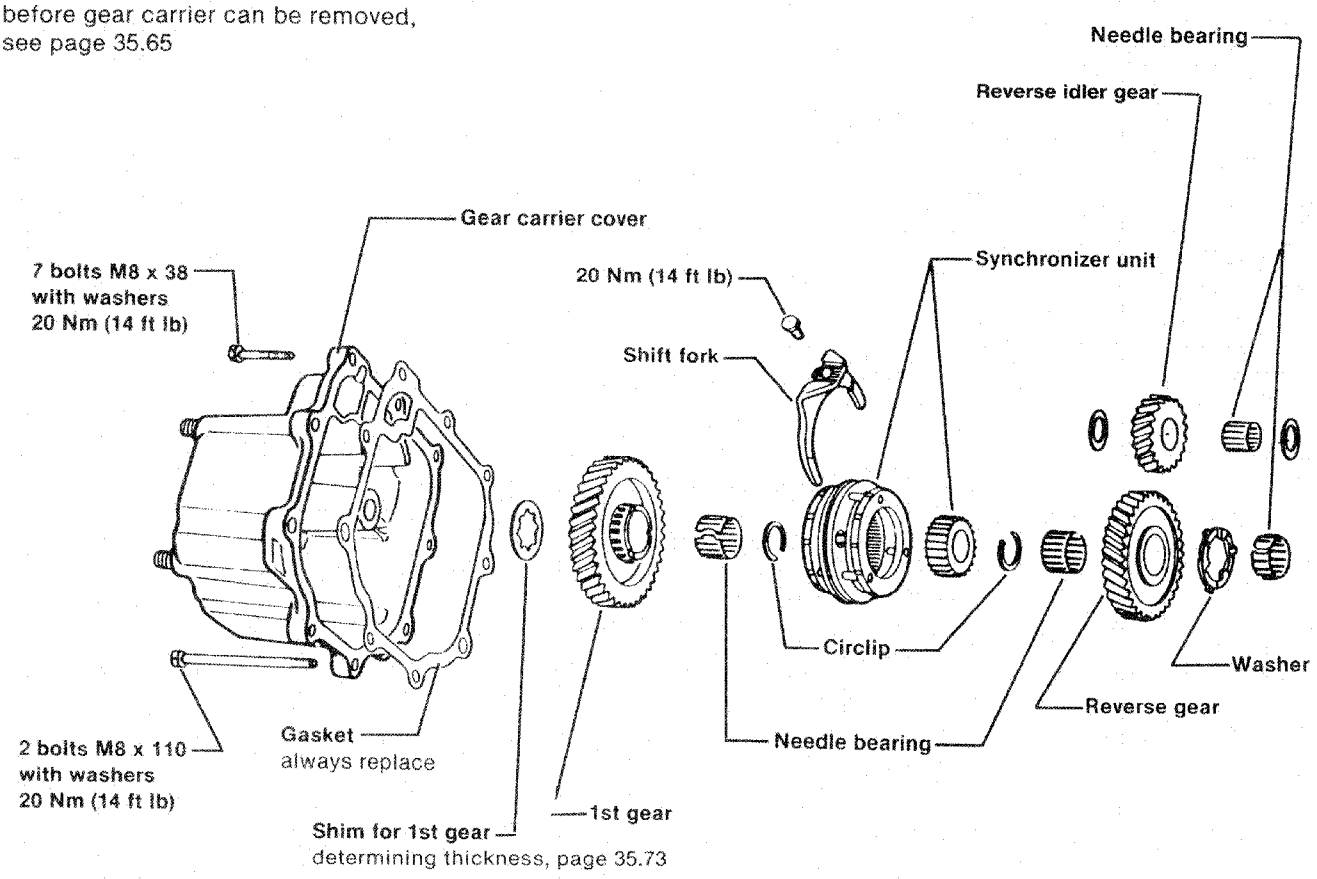
CAUTION

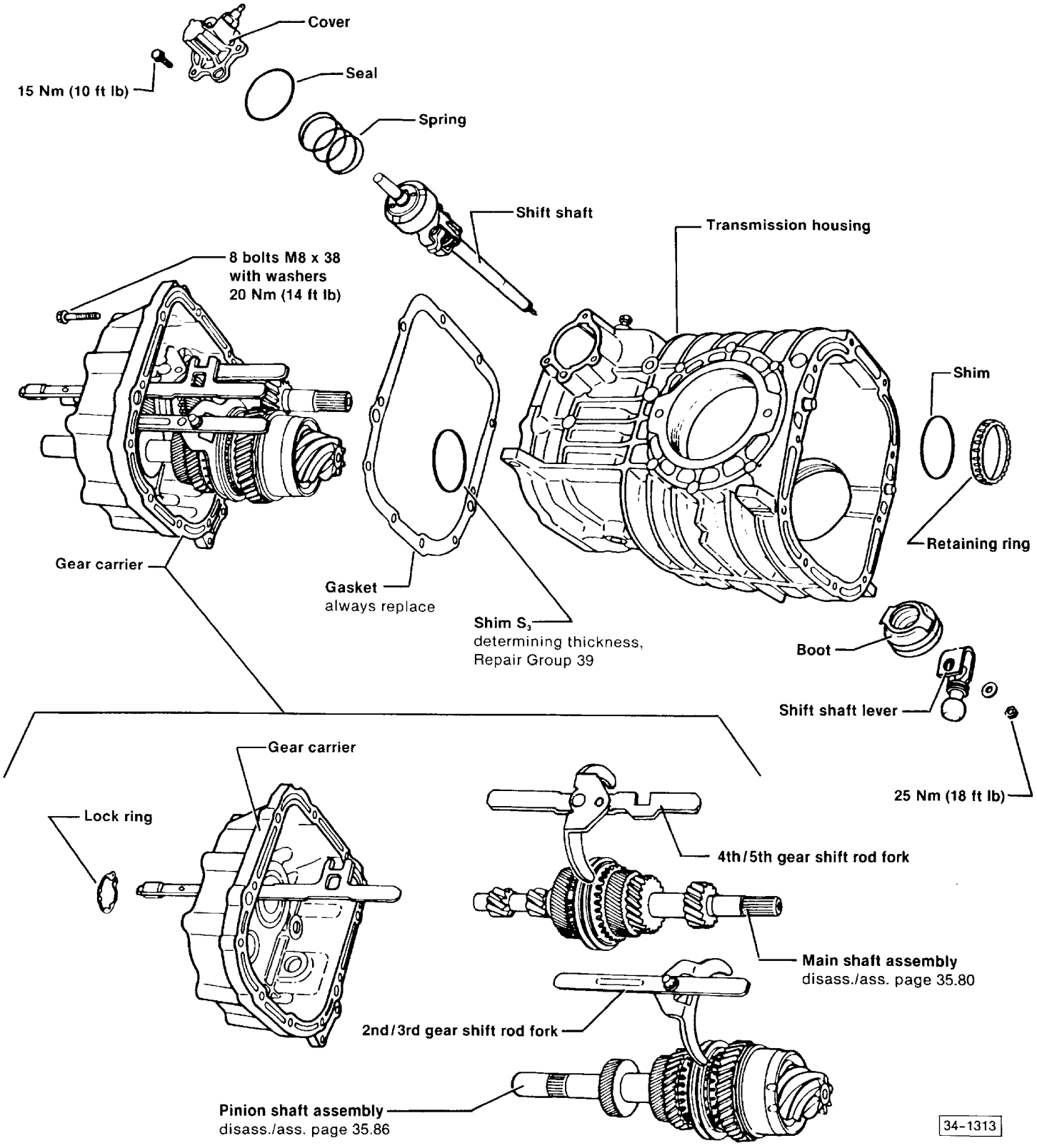
Part numbers are for reference only. Always check with your Parts Department for latest parts information.

Transmission date of manufacture	Parts required	
	Description	Part Number
Prior to 11 10 2	Selector shaft Selector shaft spring Selector shaft cover Selector shaft cover o-ring Synchronizer (2/3) Synchronizer (4/5) Shift fork (2/3) Shift fork (4/5)	091-311-534B 091-311-548B 091-301-232A 094-301-278A 091-311-241B 091-311-301B 091-311-549A 091-311-559A
From 12 10 2 to 18 11 2	Selector shaft Selector shaft cover Selector shaft cover o-ring Synchronizer (2/3) Synchronizer (4/5) Shift fork (2/3) Shift fork (4/5)	091-311-534B 091-301-232A 094-301-278A 091-311-241B 091-311-301B 091-311-549A 091-311-559A
From 19 11 2 to 24 11 2	Selector shaft Selector shaft cover Selector shaft cover o-ring Shift fork (2/3) Shift fork (4/5)	091-311-534B 091-301-232A 094-301-278A 091-311-549A 091-311-559A
From 25 11 2 to 02 12 2	Selector shaft Selector shaft cover Selector shaft cover o-ring	091-311-534B 091-301-232A 094-301-278A
From 03 12 2 to 14 12 2	Selector shaft	091-311-534B

Note

Differential must be removed
before gear carrier can be removed,
see page 35.65



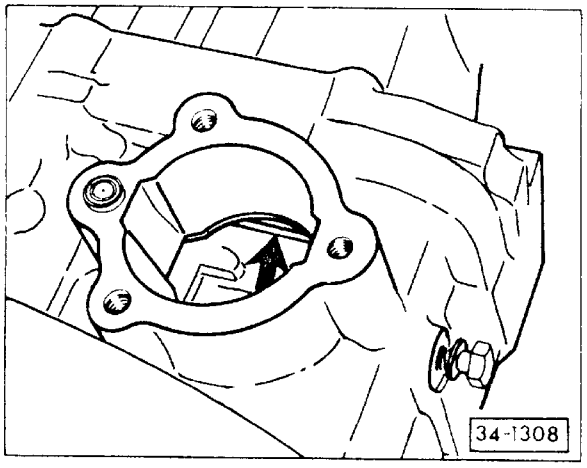

Cover
15 Nm (10 ft lb)
Seal
Spring
Shift shaft
Transmission housing
8 bolts M8 x 38
with washers
20 Nm (14 ft lb)
Shim
Retaining ring
Gear carrier
Gasket
always replace
Shim S_3
determining thickness,
Repair Group 39
Boot
Shift shaft lever
25 Nm (18 ft lb)
Gear carrier
Lock ring
4th/5th gear shift rod fork
Main shaft assembly
disass./ass. page 35.80
2nd/3rd gear shift rod fork
Pinion shaft assembly
disass./ass. page 35.86
34-1313

Transmission

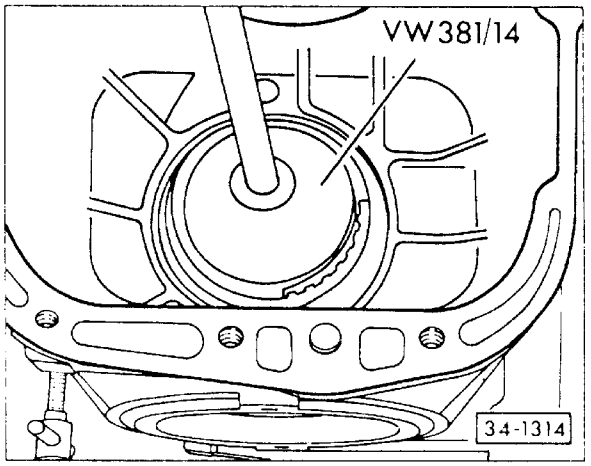
Disassembling

Work sequence

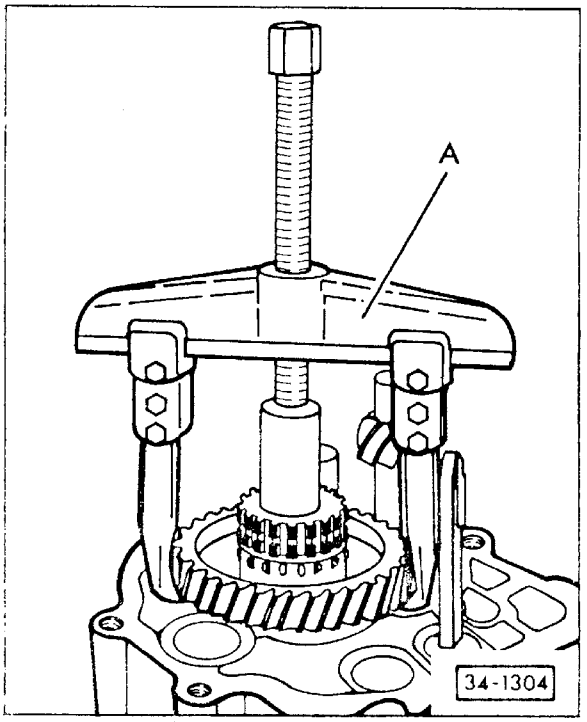
—remove coverplate
—remove shift shaft



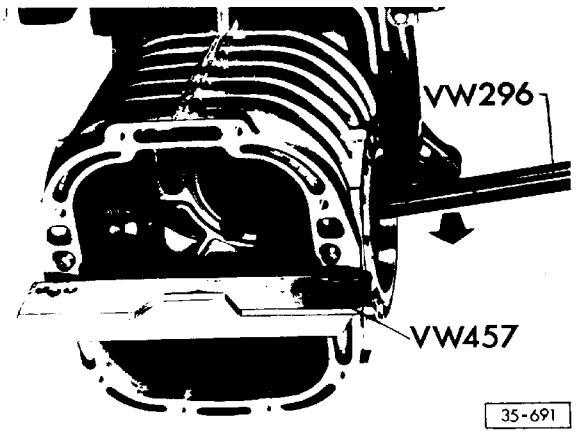
—loosen bolt until relay lever (arrow) can be pulled against housing
—tighten bolt to lock lever in that position



—remove retaining ring
—remove gear shift housing
—remove reverse gear shift rod and hub
—remove outer circlip



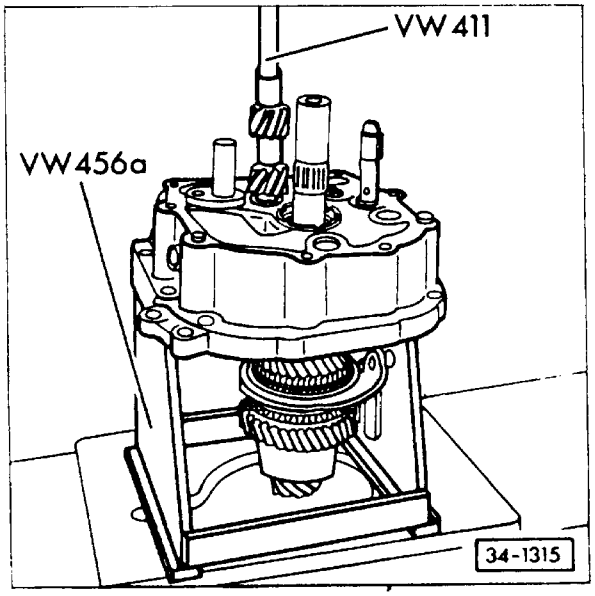
—pull off synchronizer hub and reverse gear
• **A**-puller US 1078
—remove inner circlip, washer and needle bearing
—remove reverse gear together with needle bearing and washer
—remove gear carrier housing bolts



—to remove gear carrier attach VW 457 with two M8 x 20 bolts
—press gear carrier out with VW 296
—remove shim S_3 and note thickness

Note

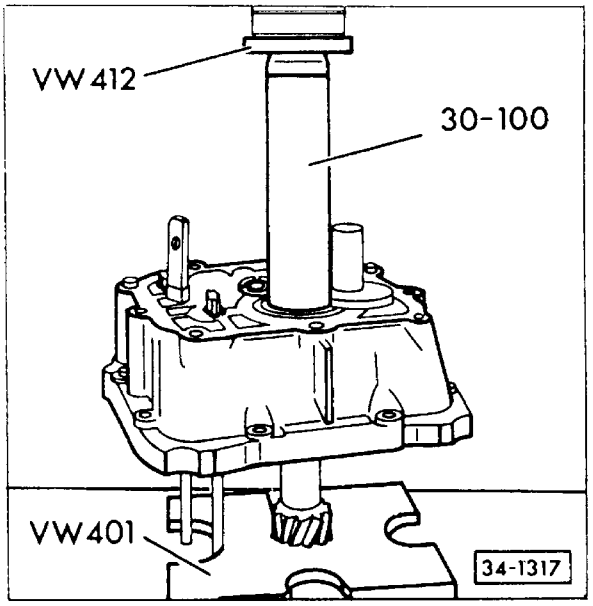
If bearing and/or transmission housing are replaced, and dimension **r** is not marked on ring gear, pinion depth must be measured and noted **before** gear carrier is removed. This is dimension **r**. See Repair Group 39. When assembling, parts must be installed in same position. See Ring gear/pinion, adjusting, Repair Group 39



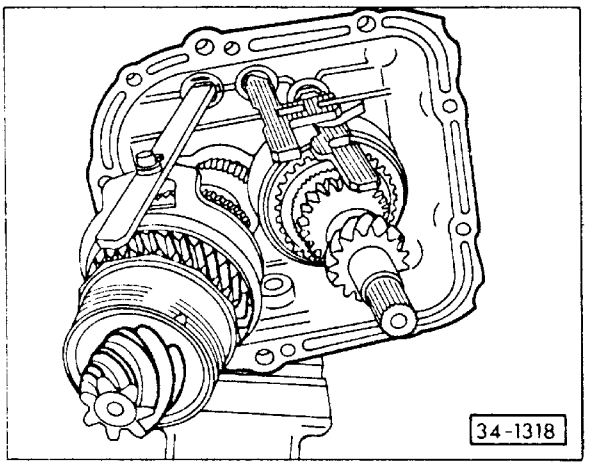
—press pinion shaft with main shaft and shift rod out of gear carrier

Assembling

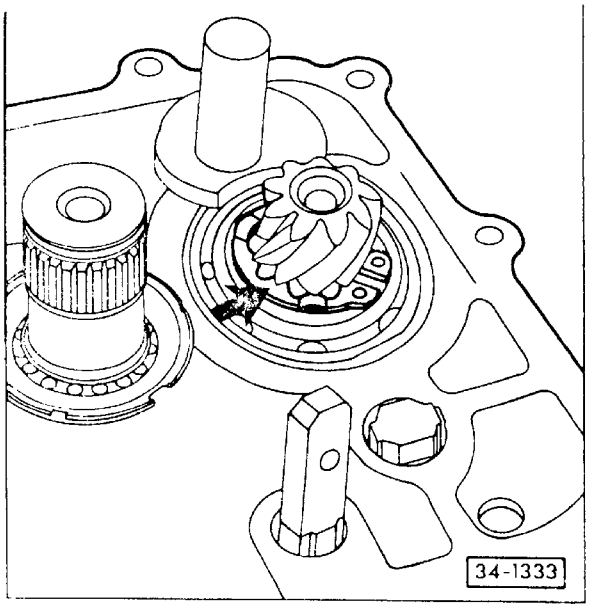
Work sequence



—press main shaft with shift rod into gear carrier



—install pinion shaft with shift rod
• shift into 4th gear
—shift into neutral
—install pinion shaft needle bearing



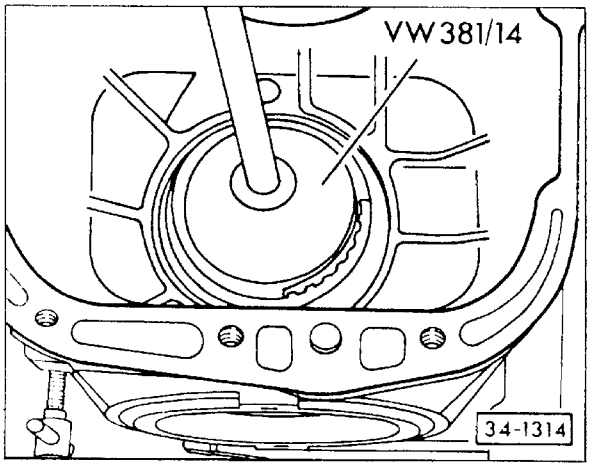
—install circlip
• make sure lugs of circlip are below teeth of pinion head (arrow)

Gear carrier

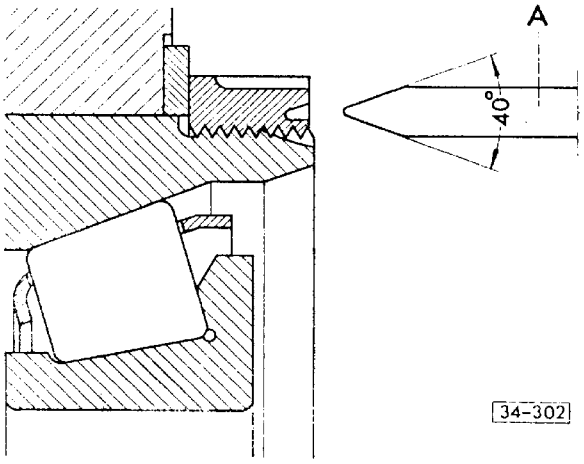
Assembling

Work sequence

—install shim S_3
—install new gasket
—align shift rod
—align flat on piston with recess in housing
—tap on pinion with plastic hammer to install
• make sure teeth of gears match properly

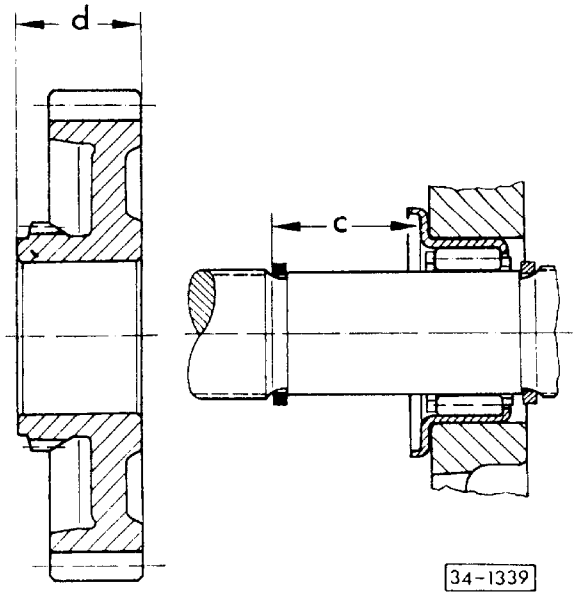


—install retaining ring and tighten to 225 Nm (162 ft lb), then loosen and retighten to 225 Nm (162 ft lb)



—peen retaining ring twice with suitable tool **A** (local manufacture)
—attach gear carrier to transmission housing and tighten bolts to 20 Nm (14 ft lb)

determining thickness of spacer for reverse gear



—install circlip
—measure distance **C**

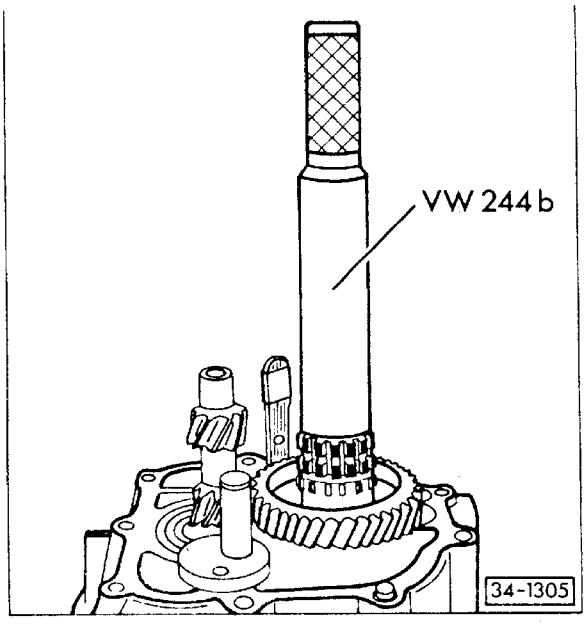
Example

measurement **c**	29.1 mm
measurement **d**	– 24.7 mm
thickness of spacer	4.4 mm

thickness of spacers available

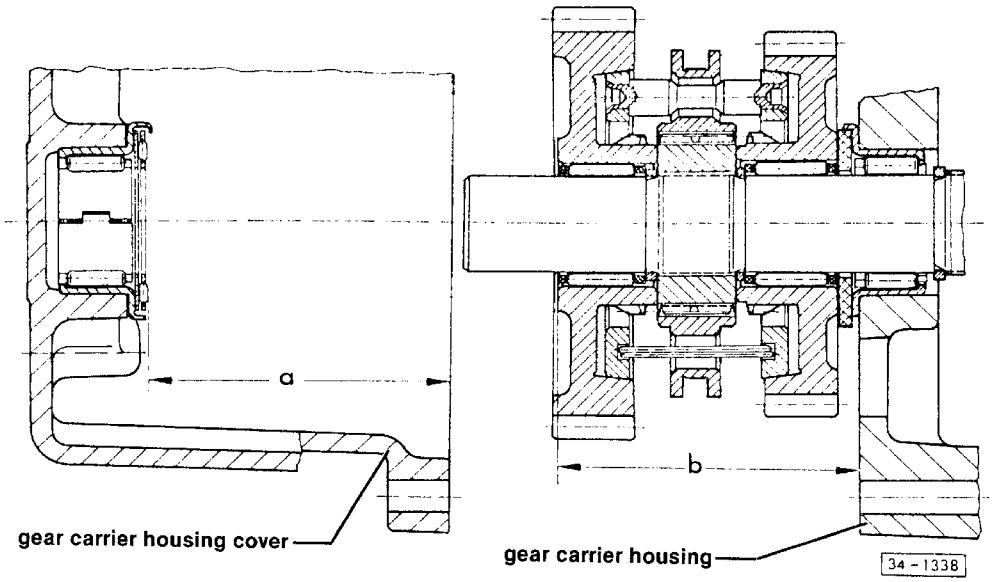
gap to be adjusted (mm)	Spare part no.	color
3.97–4.19	091 311 379	white
4.20–4.39	091 311 379 A	black
4.40–4.59	091 311 379 B	green
4.60–4.90	091 311 379 C	red

—install selected spacer, reverse gear, needle bearing and circlip



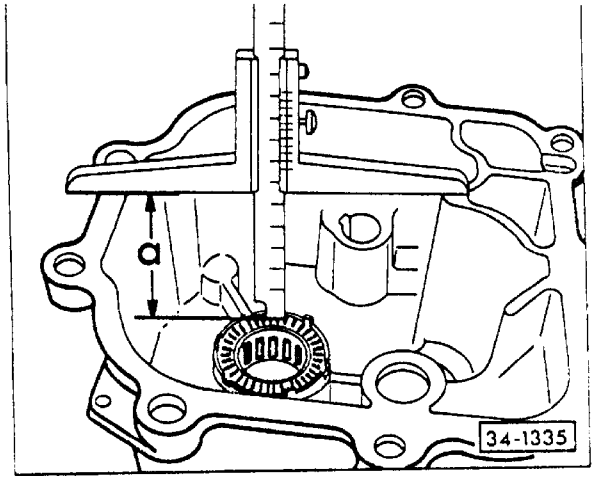
—install synchronizer
—install circlip
—install reverse gear
• groove in gear must face cover
—install needle bearing and washers
—install synchronizer for 1st/reverse gear and shift fork
• molybdenum coated side of synchronizer ring faces 1st gear
—install shift rod/fork bolt and tighten to 20 Nm (14 ft lb)
• before installing coat thread of bolt with D6-locking compound
—install 1st gear
—install needle bearing

Shim for 1st gear

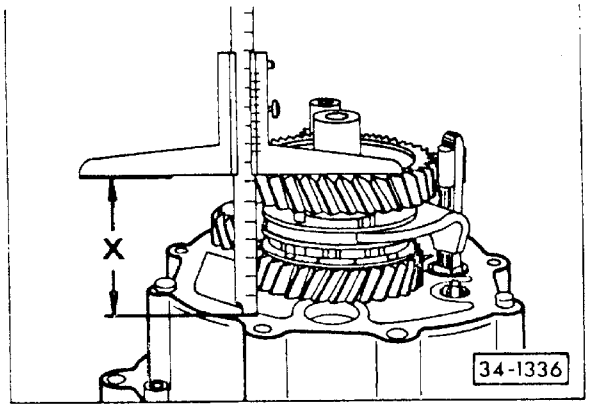


Determining thickness

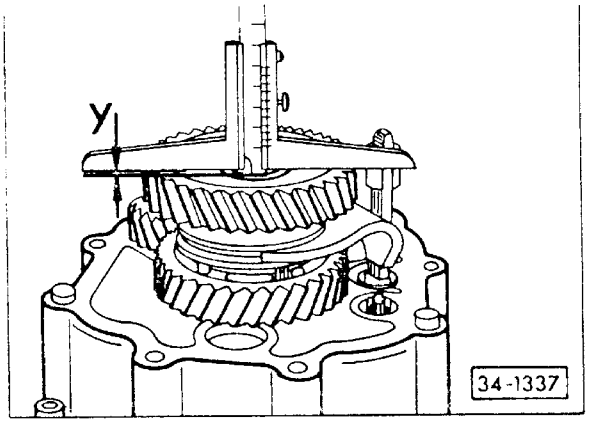
Work sequence



—measure depth **a**
Example: a = 77.8 mm



—measure distance **x**
Example: x = 77.6 mm



—measure distance **y**
Example y = 1.0 mm

b = x – y

Example:

b = 77.6 mm
– 1.0 mm
76.6 mm

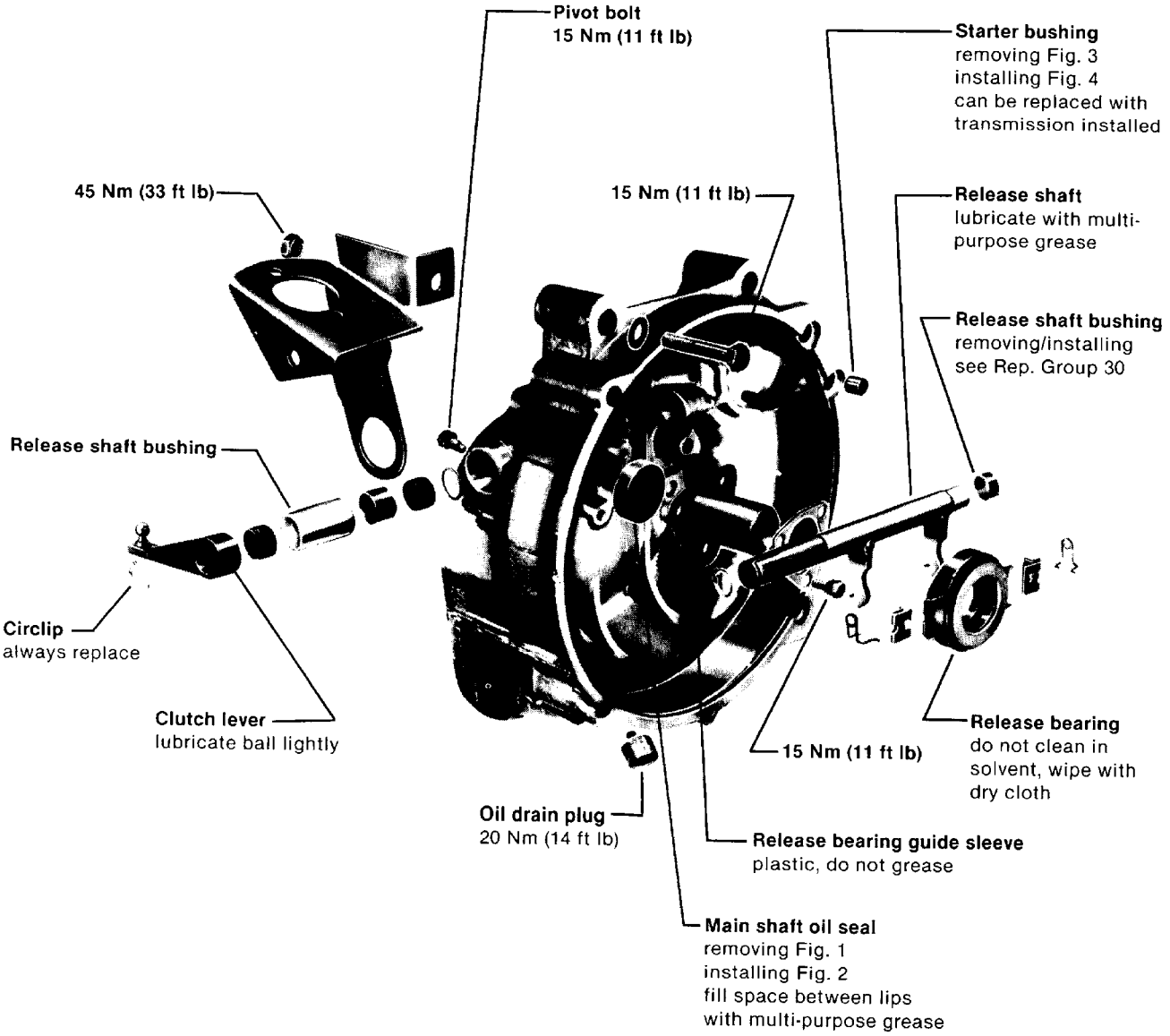
Measurement = a – b

= 77.8 mm
– 76.6 mm
1.2 mm

Following shims are available:

Measurement (mm)	Shim thickness (mm)	Spare Part No.
0.95...1.14	0.6	094 311 379
1.15...1.34	0.8	094 311 379 A
1.35...1.54	1.0	094 311 379 B
1.55...1.74	1.2	094 311 379 C
1.75...1.94	1.4	094 311 379 D
1.95...2.14	1.6	094 311 379 E
2.15...2.47	1.8	094 311 379 F

—select correct shim
—install new gasket
—install cover
• align shaft and bore in cover
—tighten bolts to 20 Nm (14 ft lb)
—loosen relay lever bolt
—push lever into position and tighten bolt to 15 Nm (14 ft lb)
—install shift shaft
• slotted side toward differential housing
—install new gasket
—install spring
—install cover and tighten bolts to 15 Nm (10 ft lb)
—install back-up light switch
—install shift shaft lever


Pivot bolt
15 Nm (11 ft lb)
Starter bushing
removing Fig. 3
installing Fig. 4
can be replaced with
transmission installed
45 Nm (33 ft lb)
15 Nm (11 ft lb)
Release shaft
lubricate with multi-
purpose grease
Release shaft bushing
removing/installing
see Rep. Group 30
Release shaft bushing
Circlip
always replace
Clutch lever
lubricate ball lightly
15 Nm (11 ft lb)
Release bearing
do not clean in
solvent, wipe with
dry cloth
Oil drain plug
20 Nm (14 ft lb)
Release bearing guide sleeve
plastic, do not grease
Main shaft oil seal
removing Fig. 1
installing Fig. 2
fill space between lips
with multi-purpose grease
35-697

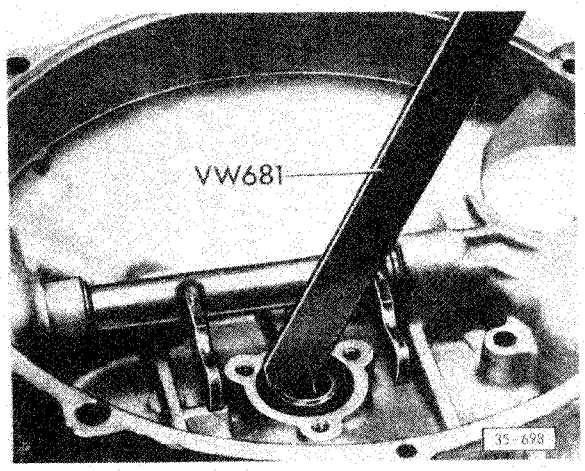


Fig. 1 Main shaft oil seal, removing

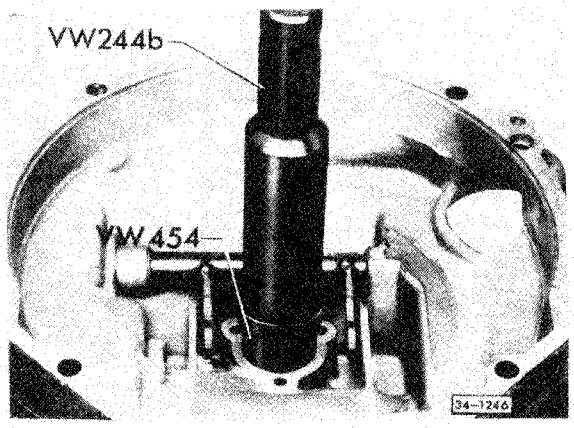


Fig. 2 Main shaft oil seal, installing

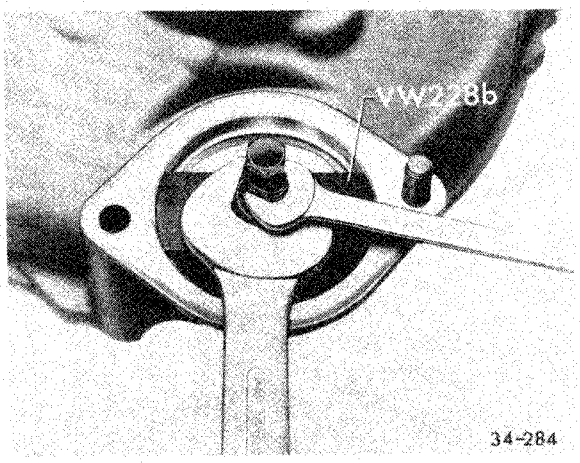


Fig. 3 Starter bushing, removing (transmission installed)

- when transmission is removed, use drift VW 222a

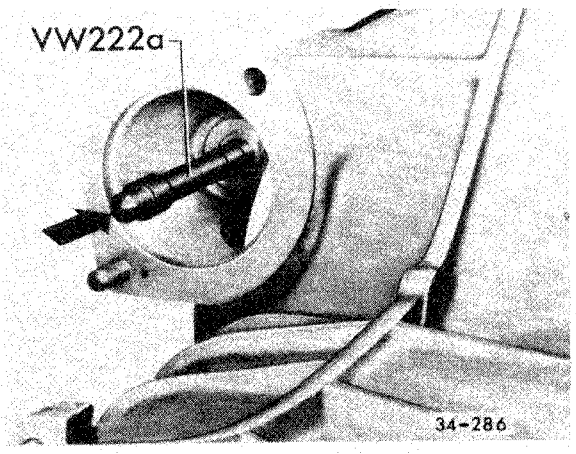
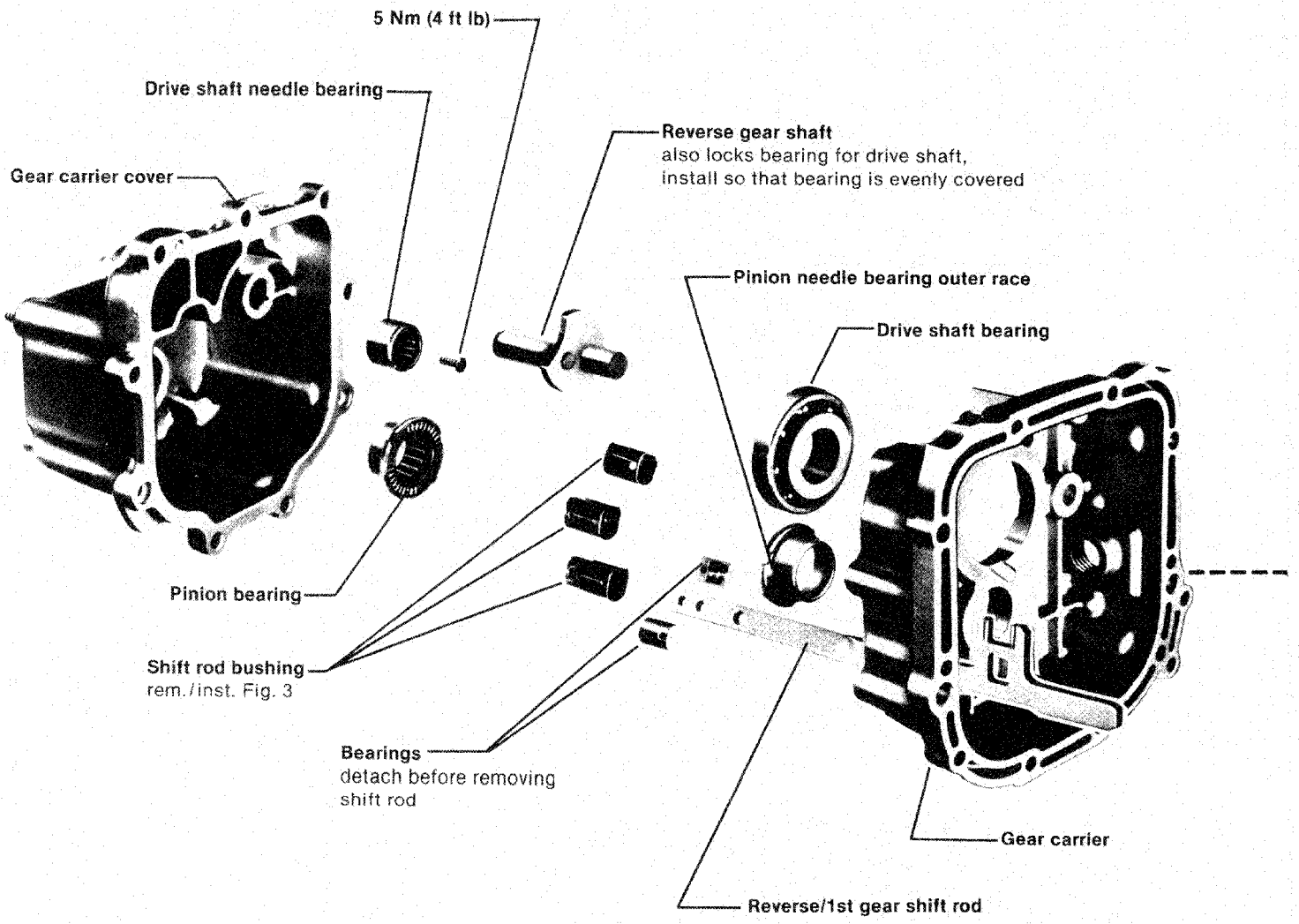
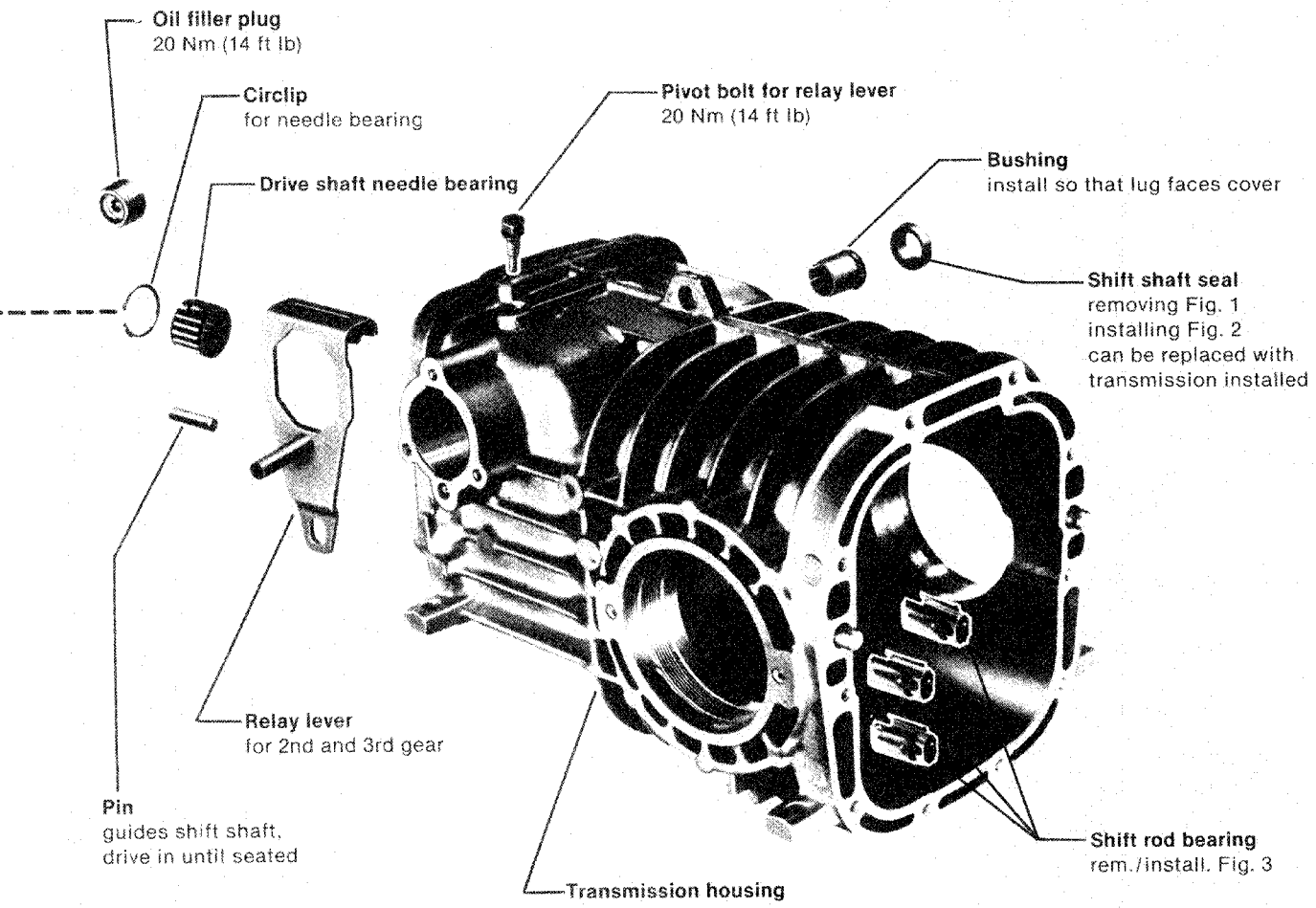


Fig. 4 Starter bushing, installing

—lubricate bushing and drive in flush


5 Nm (4 ft lb)
Drive shaft needle bearing
Reverse gear shaft
also locks bearing for drive shaft,
install so that bearing is evenly covered
Gear carrier cover
Pinion needle bearing outer race
Drive shaft bearing
Pinion bearing
Shift rod bushing
rem./inst. Fig. 3
Bearings
detach before removing
shift rod
Gear carrier
Reverse/1st gear shift rod


Oil filler plug
20 Nm (14 ft lb)
Circlip
for needle bearing
Drive shaft needle bearing
Pivot bolt for relay lever
20 Nm (14 ft lb)
Bushing
install so that lug faces cover
Shift shaft seal
removing Fig. 1
installing Fig. 2
can be replaced with
transmission installed
Relay lever
for 2nd and 3rd gear
Pin
guides shift shaft,
drive in until seated
Transmission housing
Shift rod bearing
rem./install. Fig. 3

34-1320

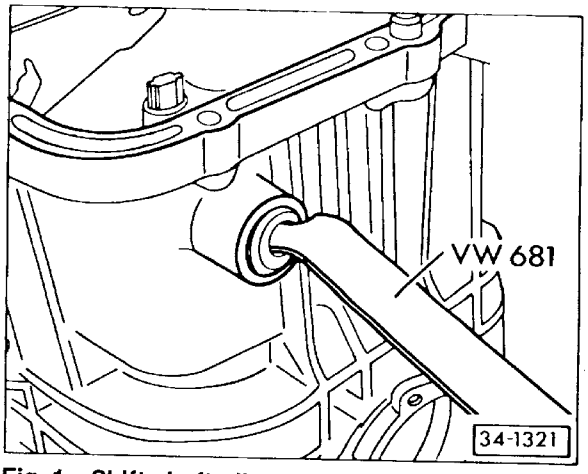


Fig. 1 Shift shaft oil seal, removing

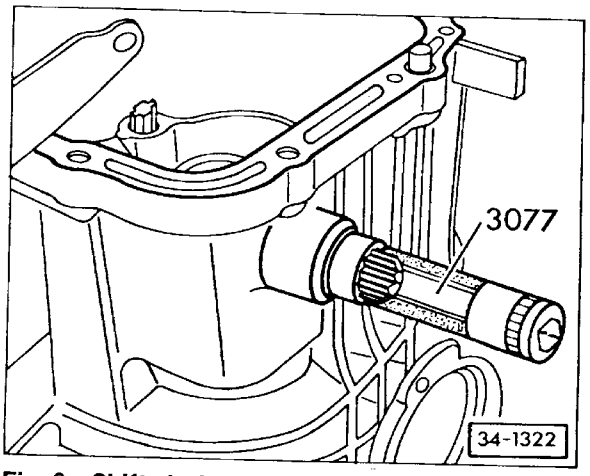


Fig. 2 Shift shaft oil seal, installing

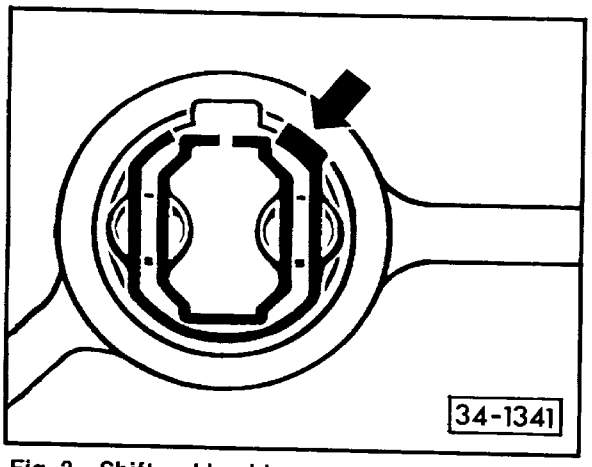
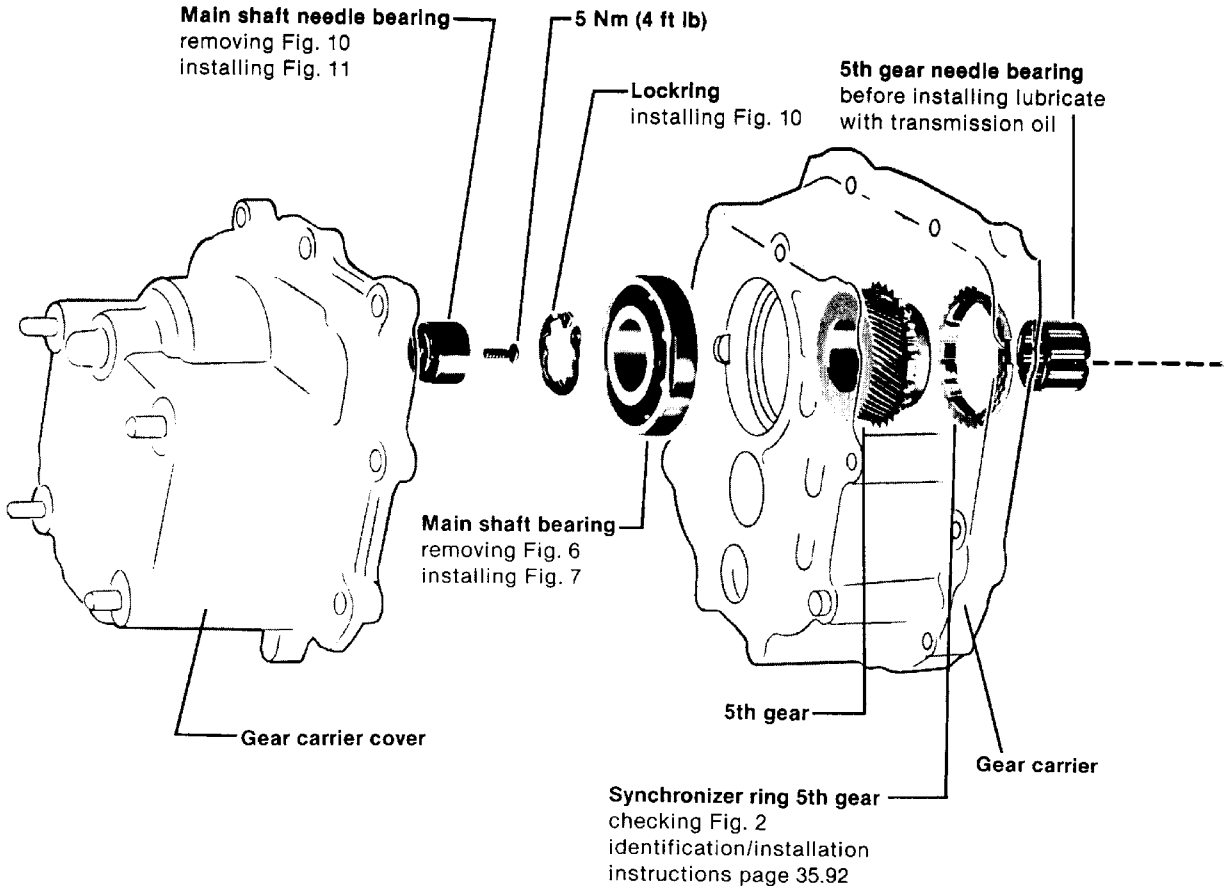
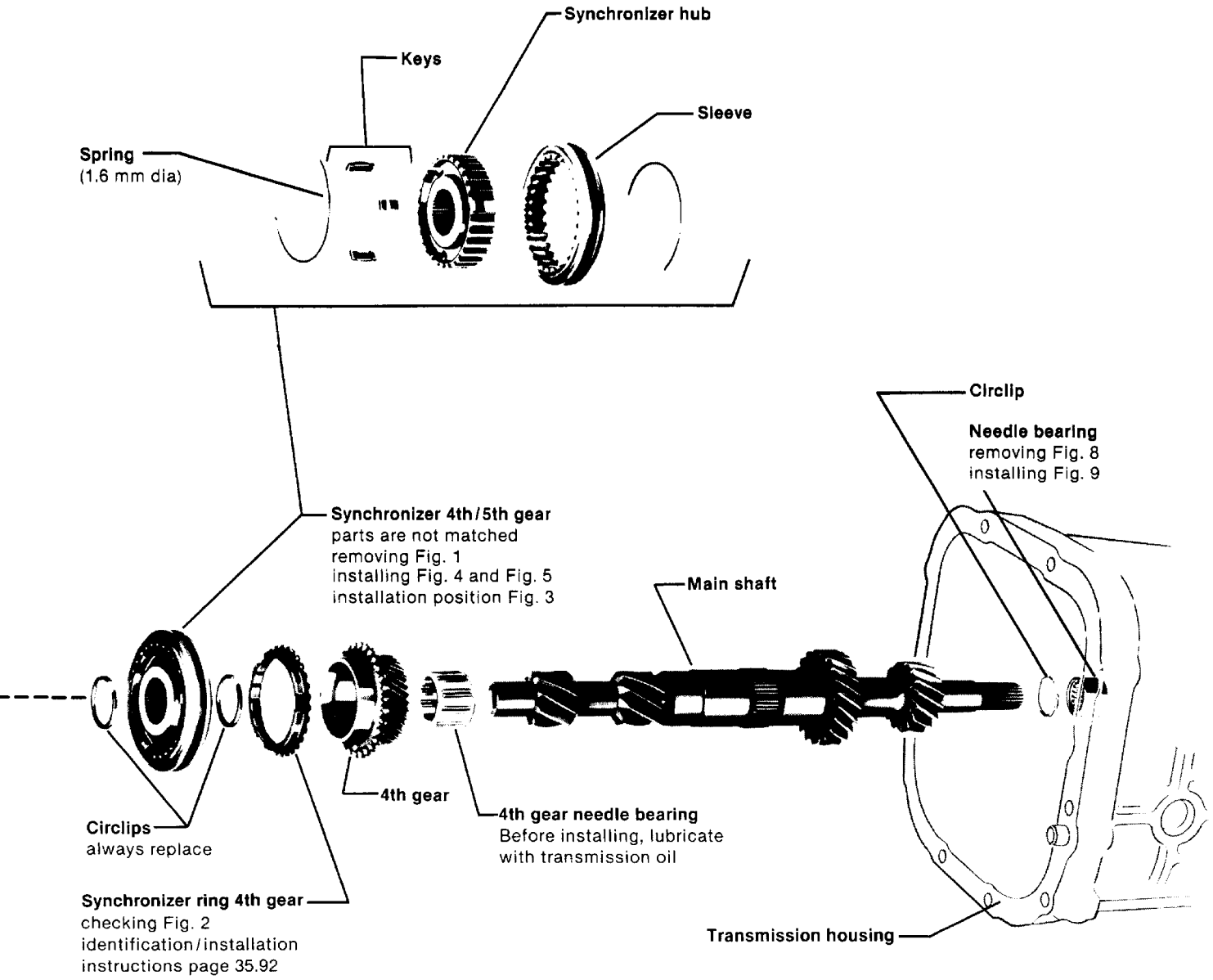


Fig. 3 Shift rod bushing

—removing
- turn bearing so that lug (arrow) is in recess of housing and press out

—installing
- align bearing and rod


Main shaft needle bearing
removing Fig. 10
installing Fig. 11
5 Nm (4 ft lb)
Lockring
installing Fig. 10
5th gear needle bearing
before installing lubricate
with transmission oil
Main shaft bearing
removing Fig. 6
installing Fig. 7
Gear carrier cover
5th gear
Gear carrier
Synchronizer ring 5th gear
checking Fig. 2
identification/installation
instructions page 35.92


Synchronizer hub
Keys
Sleeve
Spring
(1.6 mm dia)
Circlip
Needle bearing
removing Fig. 8
installing Fig. 9
Synchronizer 4th/5th gear
parts are not matched
removing Fig. 1
installing Fig. 4 and Fig. 5
installation position Fig. 3
Main shaft
4th gear
4th gear needle bearing
Before installing, lubricate
with transmission oil
Circlips
always replace
Synchronizer ring 4th gear
checking Fig. 2
identification/installation
instructions page 35.92
Transmission housing
35-876

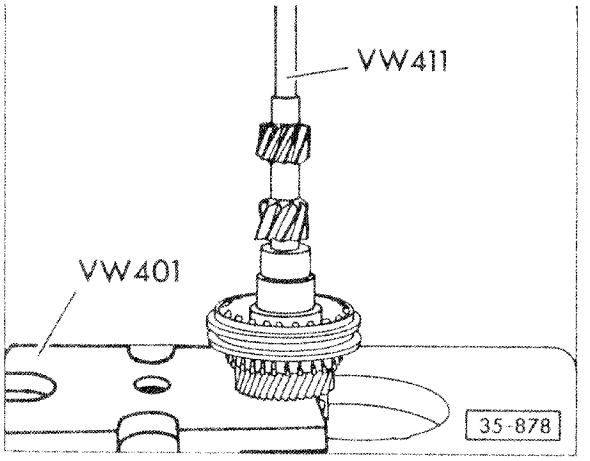


Fig. 1 Synchronizer, removing

—press off together with gear

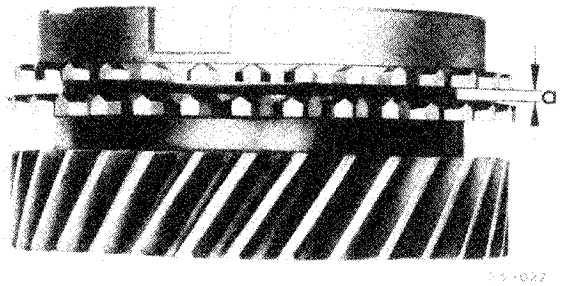


Fig. 2 Synchronizer rings, checking

—press synchronizer rings onto gear by hand and measure gap **a** with feeler gauge

Gap a

Gear	New Part mm (in.)	Wear limit mm (in.)
4th/5th	1.0–1.7 (0.039–0.067)	0.5 (0.020)

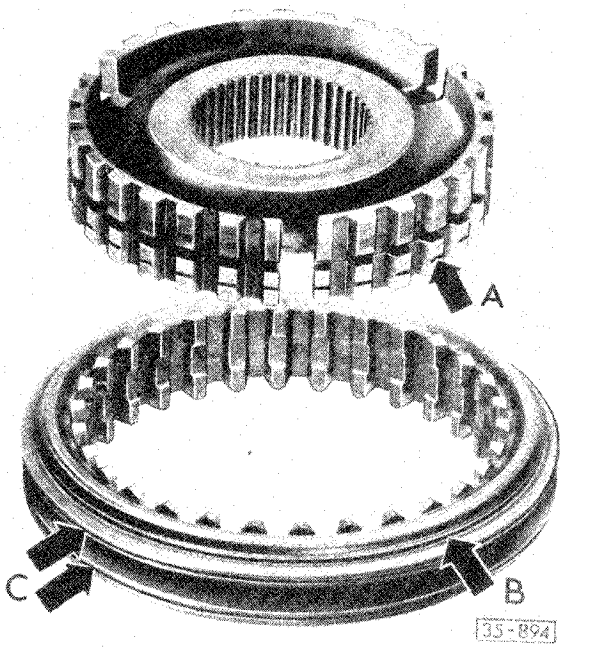


Fig. 3 Synchronizer 4th/5th gear, assembling

- identification grooves (arrows A & B) of sleeve and hub are on opposite sides. Groove on sleeve (arrow B) faces 4th gear
- grooves (arrow C) are for identification: 2nd & 3rd gear = 1 groove 4th & 5th gear = 2 grooves

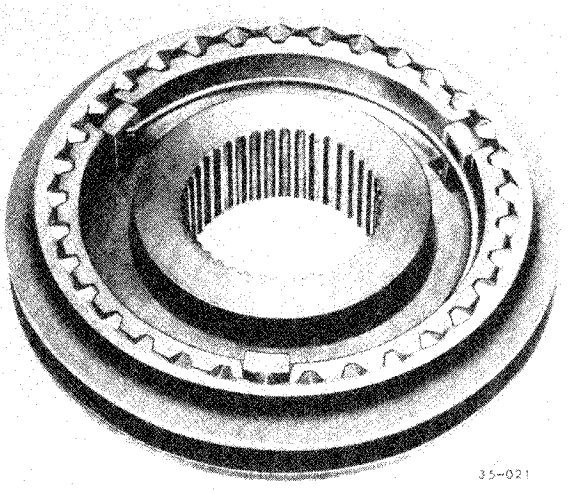


Fig. 4 Synchronizer 4th/5th gear, assembling

—slide sleeve over synchronizer hub. Matched position is not necessary

—insert keys and install springs with ends offset 120°. Angled ends of springs must fit into keys

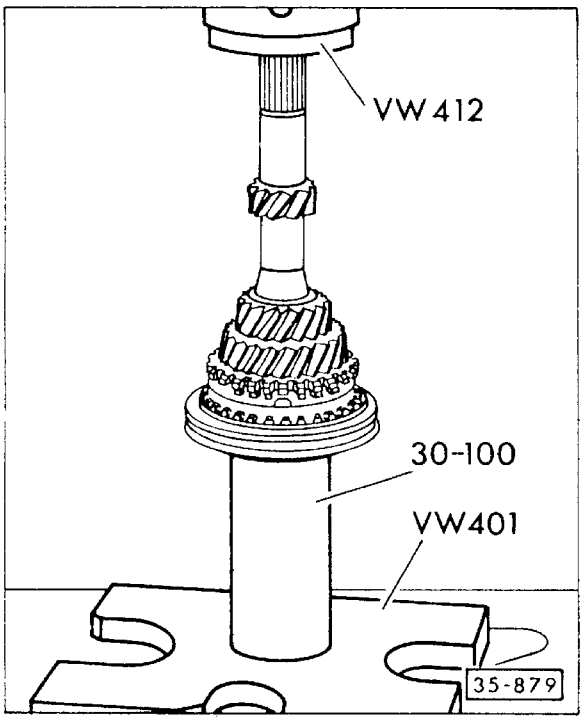


Fig. 5 Synchronizer 4th/5th gear, installing

—turn synchronizer ring until grooves are in line with keys
- identification groove on sleeve (Fig. 3, arrow B) faces 4th gear

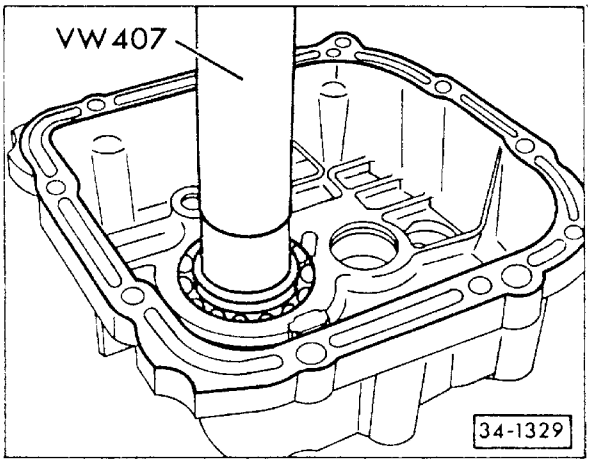


Fig. 6 Main shaft ball bearing, removing

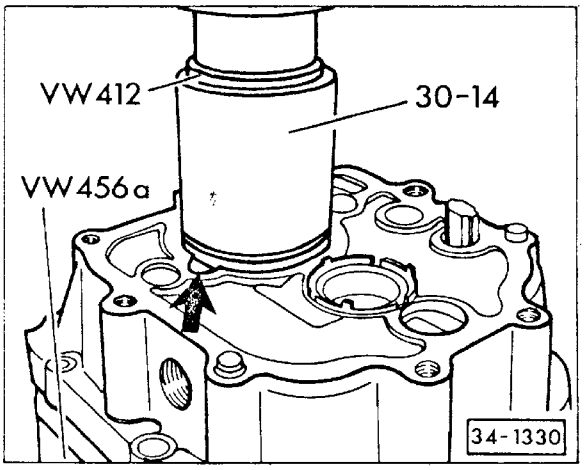


Fig. 7 Main shaft ball bearing, installing

—press in so that recess in bearing is aligned with recess (arrow) in housing

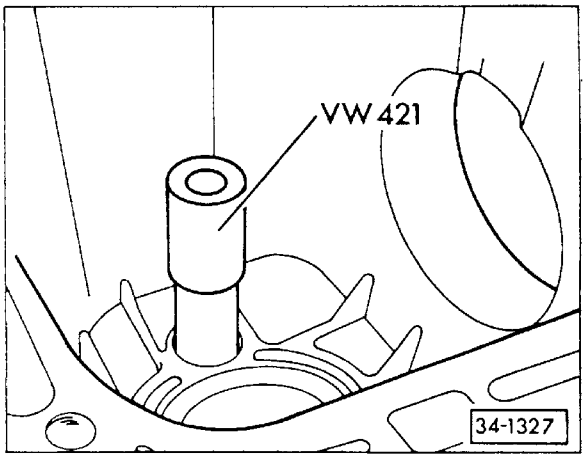


Fig. 8 Needle bearing in housing, removing

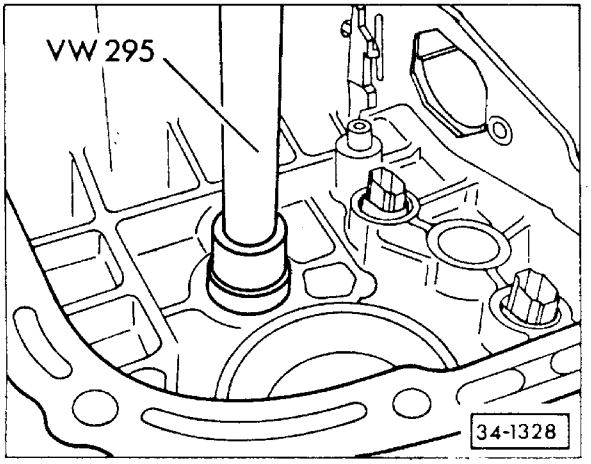


Fig. 9 Needle bearing in housing, installing

- lettered side of bearing (thicker material) must face installing tool

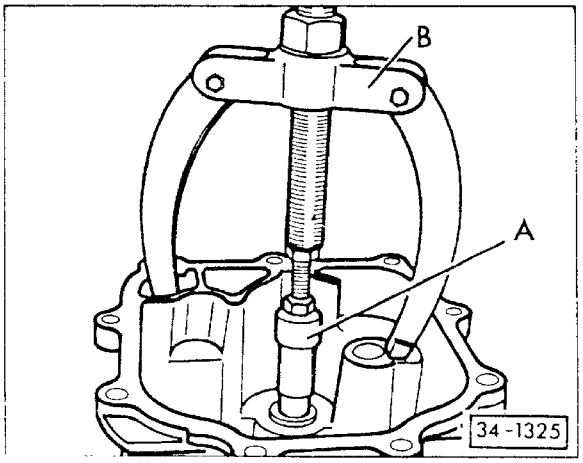


Fig. 10 Main shaft needle bearing in gear carrier housing cover, removing

—remove screw
—pull bearing out with
A—extractor US 1088
B—puller US 1039

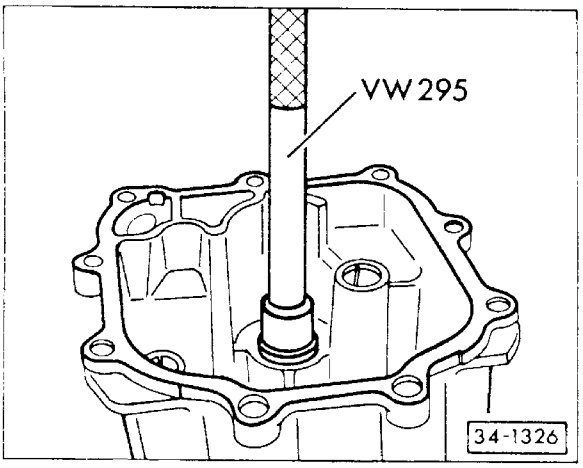


Fig. 11 Main shaft needle bearing in gear carrier housing cover, installing

—tighten screw to 5 Nm (4 ft lb)

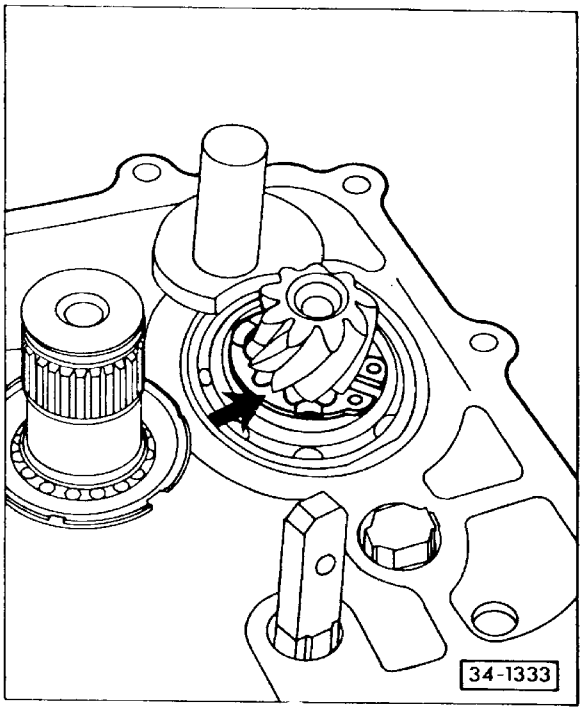
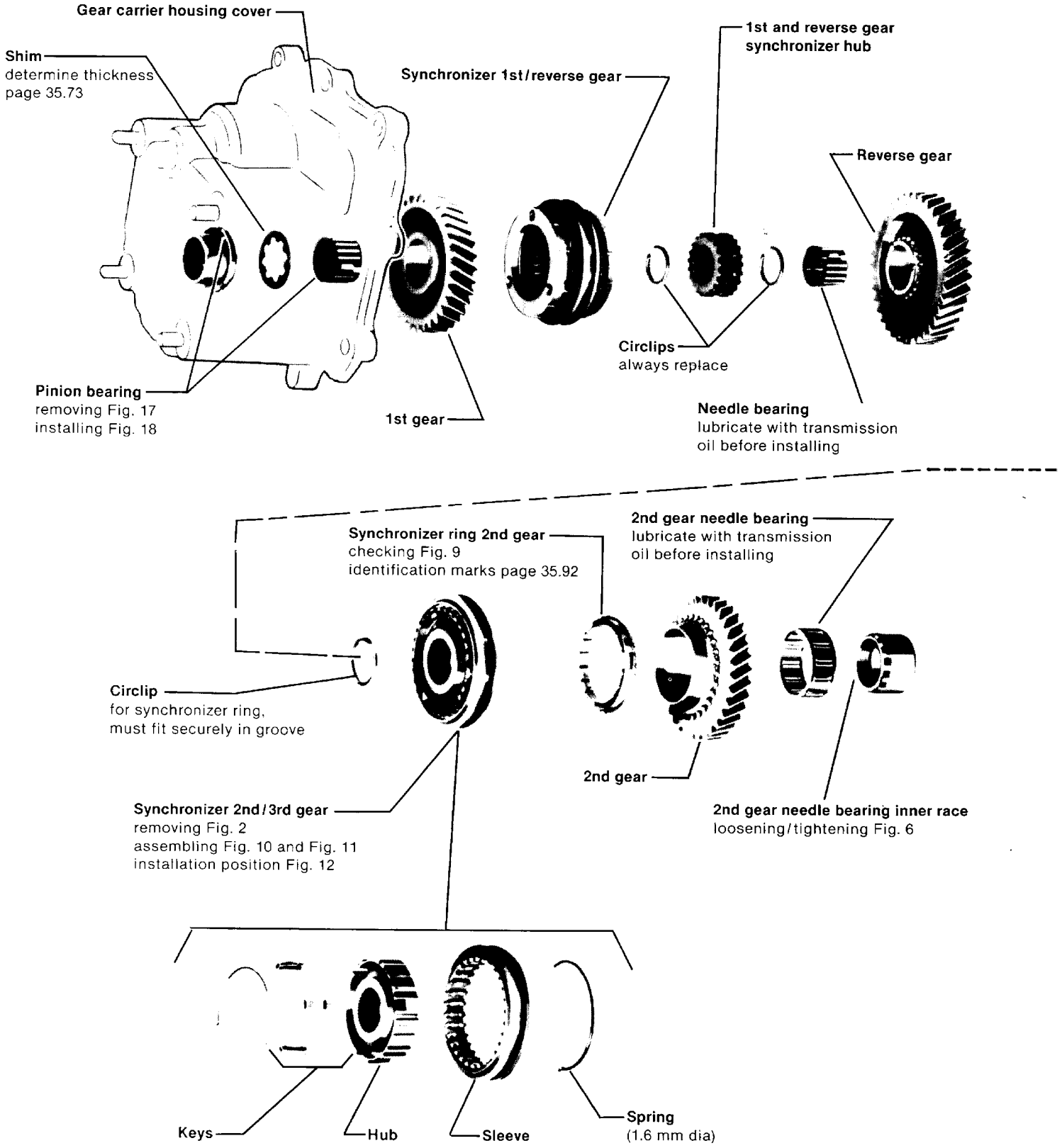
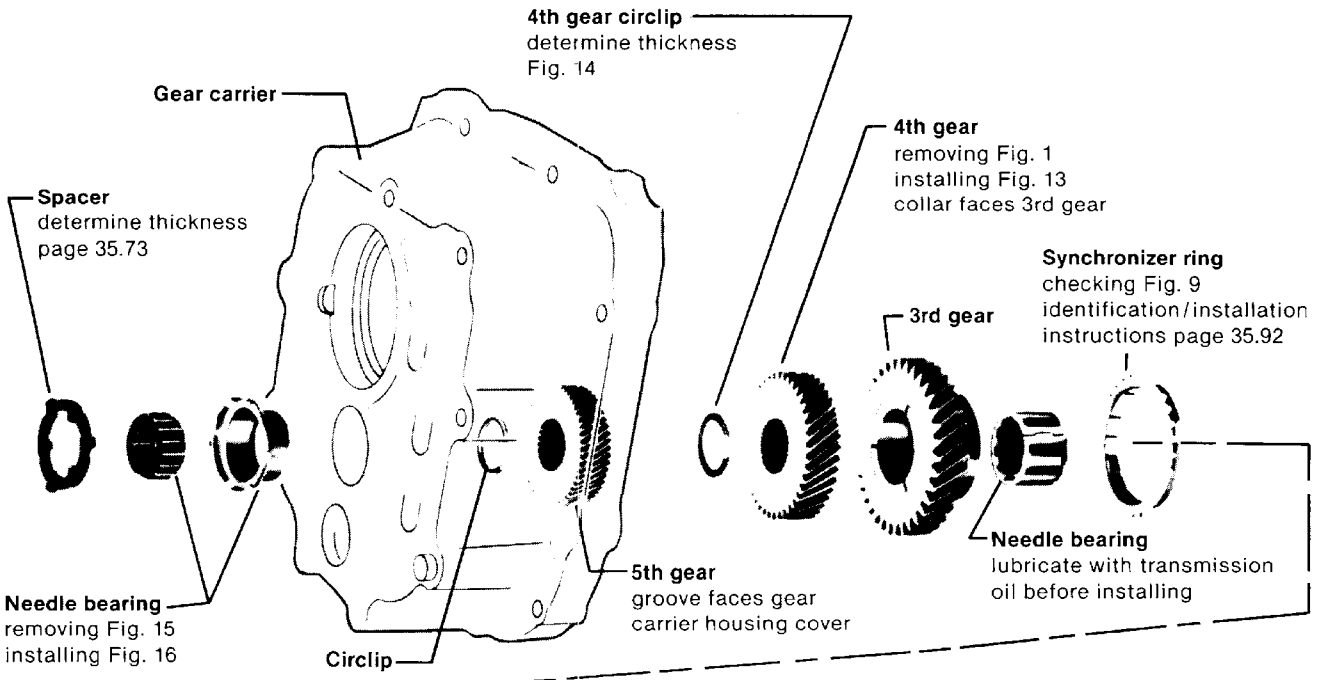
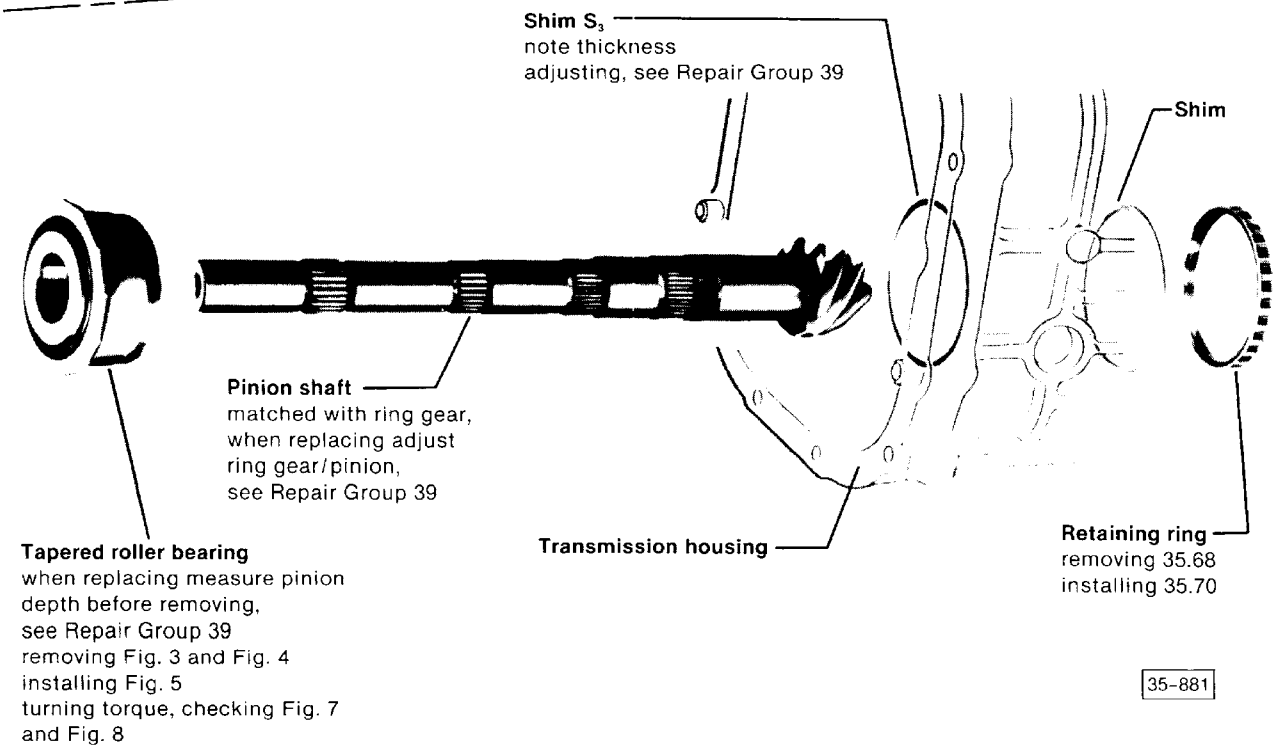


Fig. 10 Lockring, installing

- make sure ring is seated correctly (arrow)


Gear carrier housing cover
Shim
determine thickness
page 35.73
Synchronizer 1st/reverse gear
1st and reverse gear
synchronizer hub
Reverse gear
Pinion bearing
removing Fig. 17
installing Fig. 18
1st gear
Circlips
always replace
Needle bearing
lubricate with transmission
oil before installing
Synchronizer ring 2nd gear
checking Fig. 9
identification marks page 35.92
2nd gear needle bearing
lubricate with transmission
oil before installing
Circlip
for synchronizer ring,
must fit securely in groove
2nd gear
Synchronizer 2nd/3rd gear
removing Fig. 2
assembling Fig. 10 and Fig. 11
installation position Fig. 12
2nd gear needle bearing inner race
loosening/tightening Fig. 6
Keys
Hub
Sleeve
Spring
(1.6 mm dia)


4th gear circlip
determine thickness
Fig. 14
Gear carrier
4th gear
removing Fig. 1
installing Fig. 13
collar faces 3rd gear
Spacer
determine thickness
page 35.73
Synchronizer ring
checking Fig. 9
identification/installation
instructions page 35.92
3rd gear
Needle bearing
lubricate with transmission
oil before installing
5th gear
groove faces gear
carrier housing cover
Needle bearing
removing Fig. 15
installing Fig. 16
Circlip


Shim S_3
note thickness
adjusting, see Repair Group 39
Shim
Pinion shaft
matched with ring gear,
when replacing adjust
ring gear/pinion,
see Repair Group 39
Tapered roller bearing
when replacing measure pinion
depth before removing,
see Repair Group 39
removing Fig. 3 and Fig. 4
installing Fig. 5
turning torque, checking Fig. 7
and Fig. 8
Transmission housing
Retaining ring
removing 35.68
installing 35.70
35-881

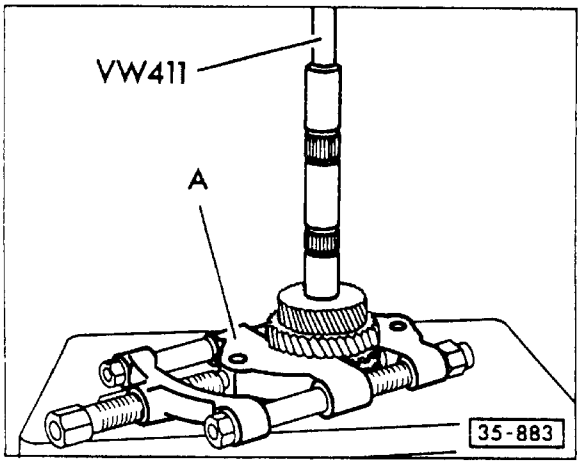


Fig. 1 3rd and 4th gear, removing

A—US 1103

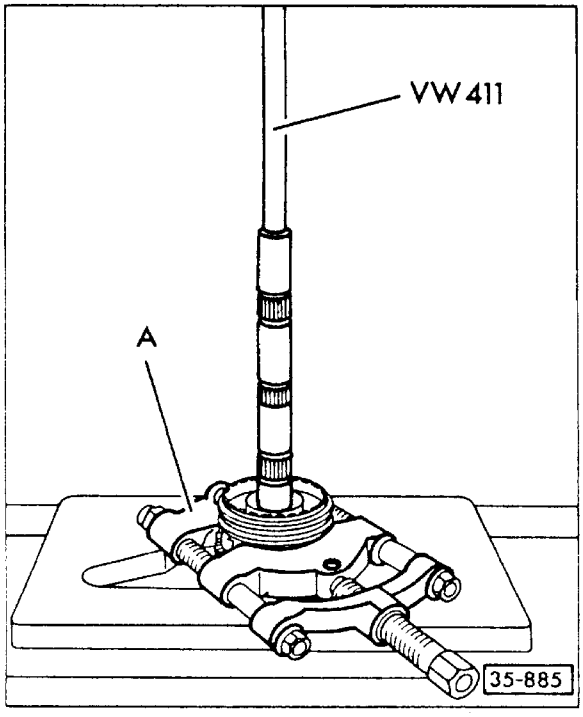


Fig. 2 Synchronizer and 2nd gear, removing

A—US 1103

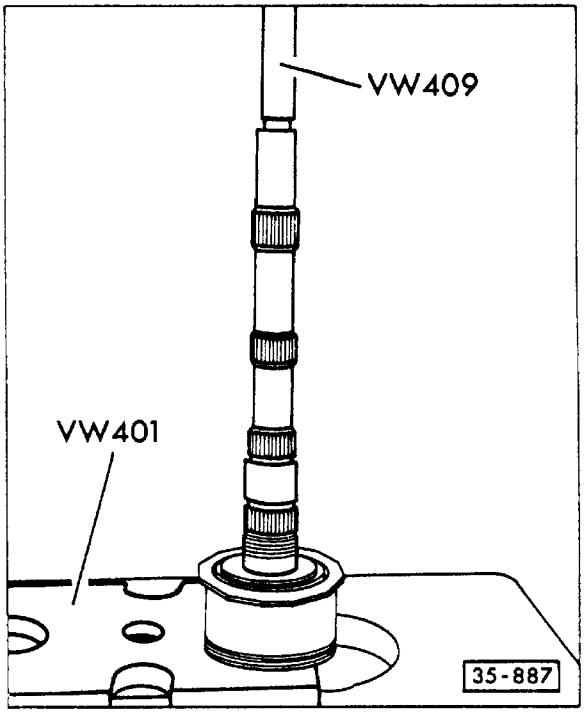


Fig. 3 Tapered roller bearing, removing

—remove retaining ring first

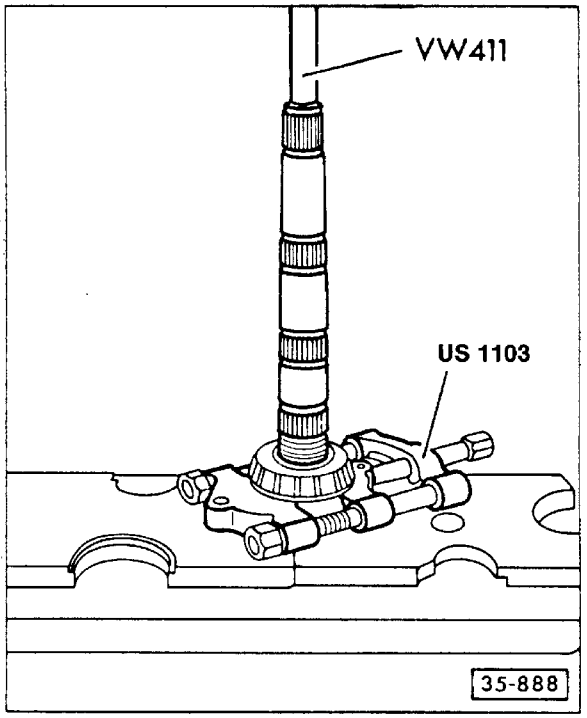


Fig. 4 Tapered roller bearing inner race, removing

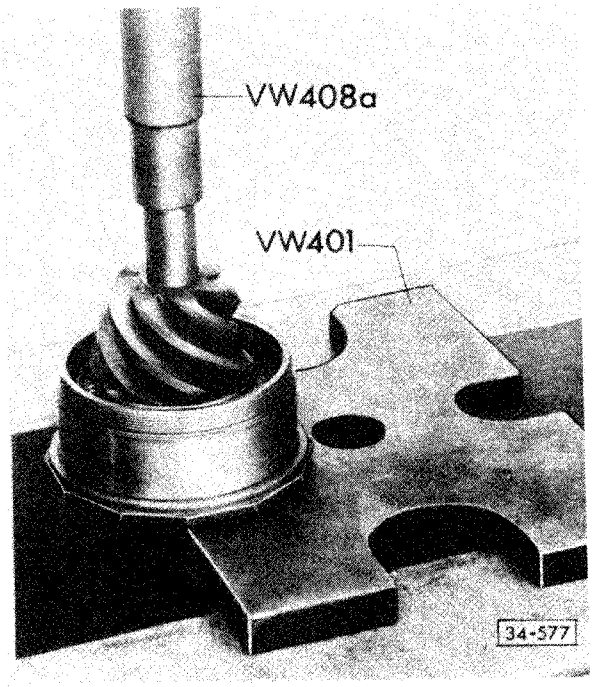


Fig. 5 **Tapered roller bearing, installing**

—heat inner race to about 100°C (212°F) and press on
—before tightening needle bearing inner race, let tapered roller bearing cool to room temperature

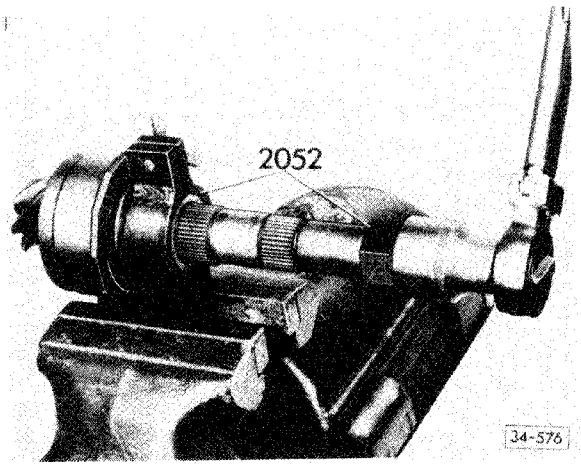


Fig. 6 **Needle bearing, loosening/tightening**

—heat inner race to about 60°C (140°F) and screw on as far as possible by hand
—place pinion shaft in tool 2052 and tighten wing nut lightly
—tighten inner race to 210 Nm (152 ft lb)

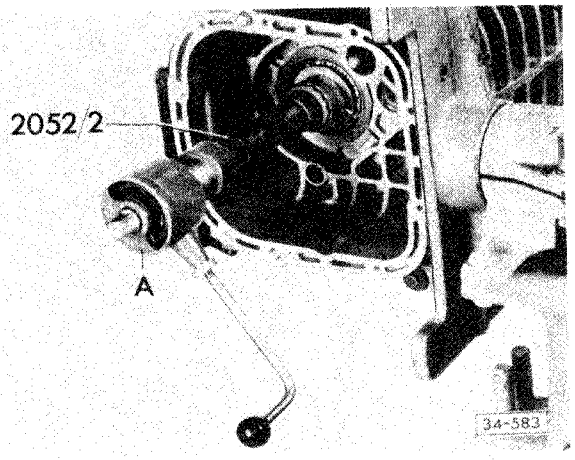


Fig. 7 **Tapered roller bearing, checking turning torque**

—lubricate bearings with transmission oil and tighten retaining ring,
—turn pinion shaft in both directions about 15–20 times
—turn further and read turning torque
- new bearings: up to 210 Ncm (**180 in. lb**)
- used bearings*: up to 70 Ncm (**61 in. lb**) (*after running at least 30 miles)
- if no turning torque can be measured, see Fig. 8

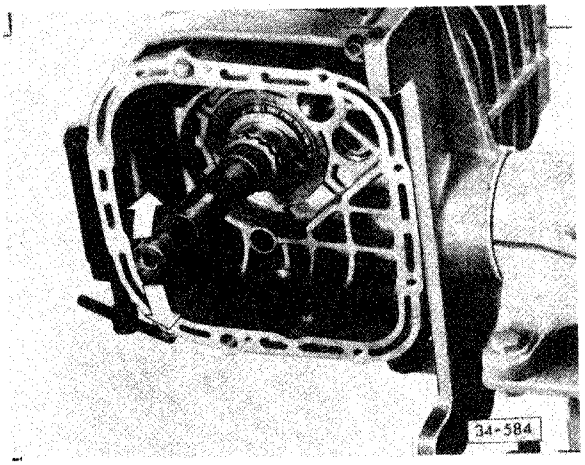


Fig. 8 **Bearing condition, checking**

—check for rock at end of pinion. There must not be any detectable movement
if **YES**, replace tapered roller bearing

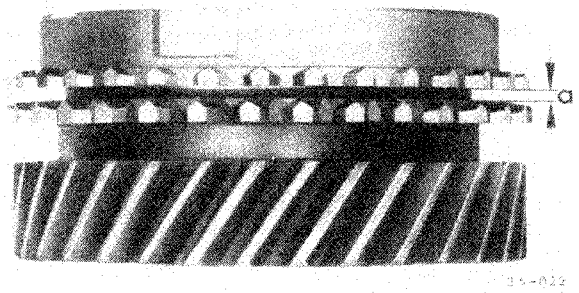


Fig. 9 Synchronizer ring, checking

—press synchronizer rings onto gear by hand and measure gap a with feeler gauge

	New Part mm (in.)	Wear limit mm (in.)
Gap a	1.3–1.9 (0.051–0.075)	0.5 (0.020)

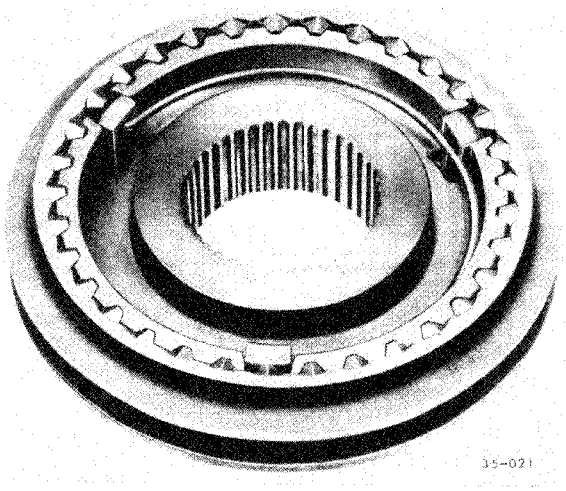


Fig. 11 Synchronizer, assembling

—slide sleeve over synchronizer hub. Matched position is not necessary
—insert keys and install springs with ends offset 120°. Angled ends of springs must fit into keys

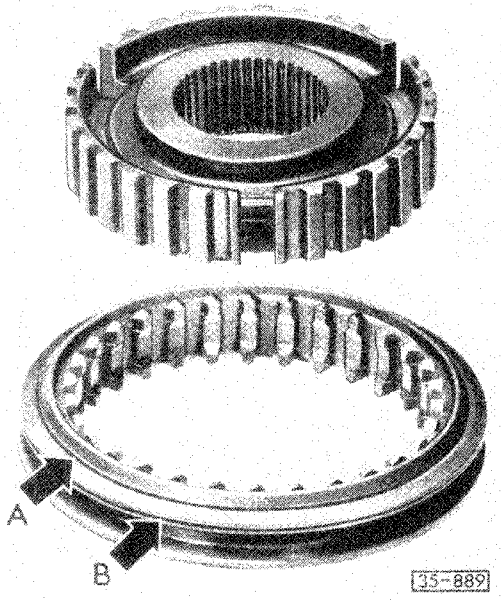


Fig. 10 Synchronizer 2nd/3rd gear, assembling

—groove (arrow A) must face 3rd gear
—collar on hub must face 2nd gear
—grooves (arrow B) are for identification:
• 2nd gear & 3rd gear = 1 groove
• 4th gear & 5th gear = 2 grooves

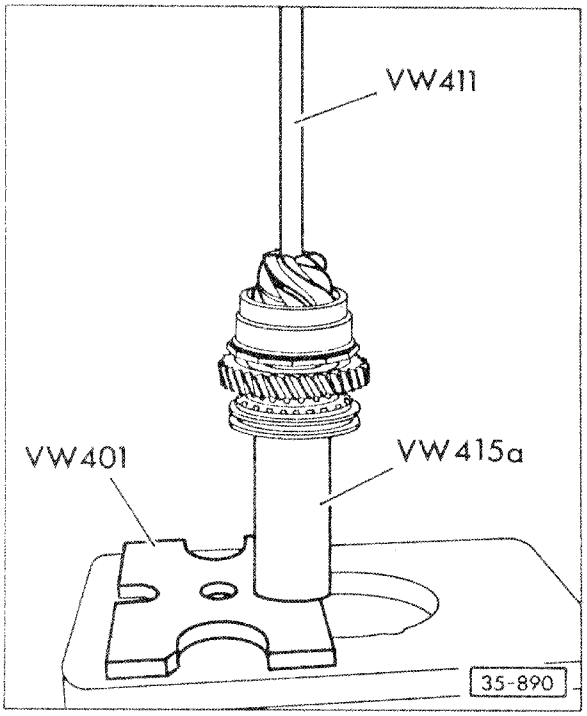


Fig. 12 Synchronizer, installing

—turn synchronizer ring until grooves are in line with keys (installation position, see Fig. 10)

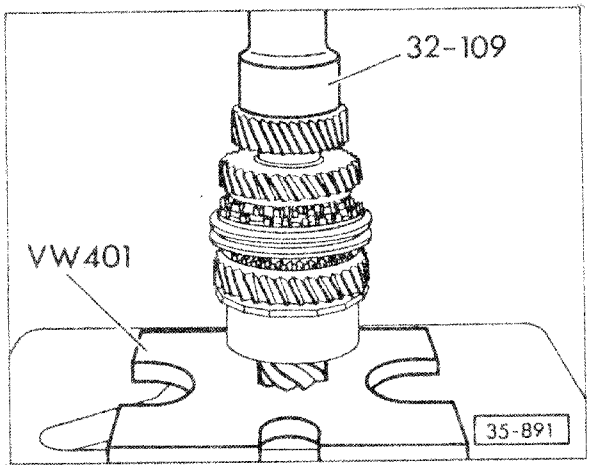


Fig. 13 4th gear, installing

—collar must face 3rd gear

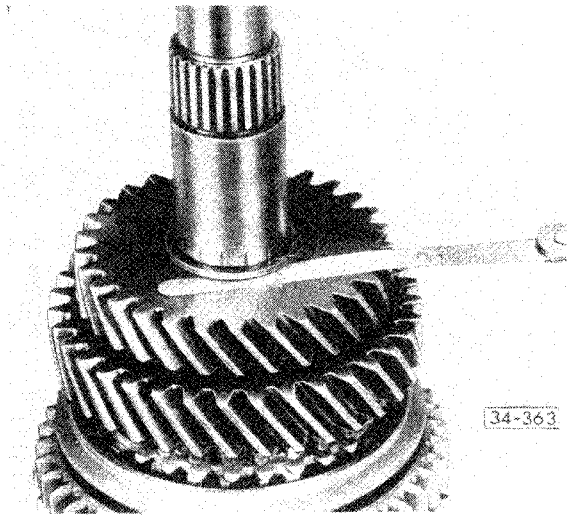


Fig. 14 4th gear end play, adjusting

—measure end play with feeler gauge
—adjust by selecting suitable circlip
• play should be 0.05 mm–0.20 mm (try to keep lower limit)

Circlips available:

Thickness mm	Color	Part No.
1.60	black	113 311 382
1.75	blue	113 311 383
1.90	brown	113 311 384
2.05	gray	113 311 385
2.20	copper	113 311 386
2.30	brass	113 311 387
2.40	silver	113 311 388

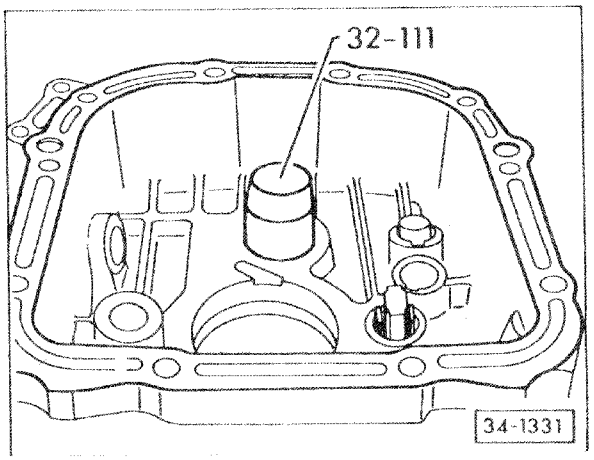


Fig. 15 Pinion needle bearing in gear carrier housing, removing

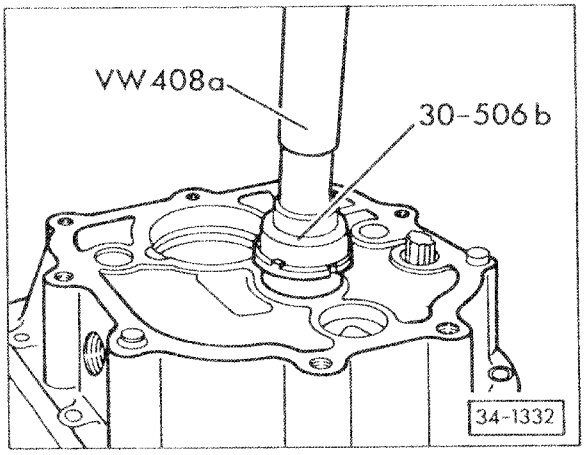


Fig. 16 Pinion needle bearing in gear carrier housing, installing

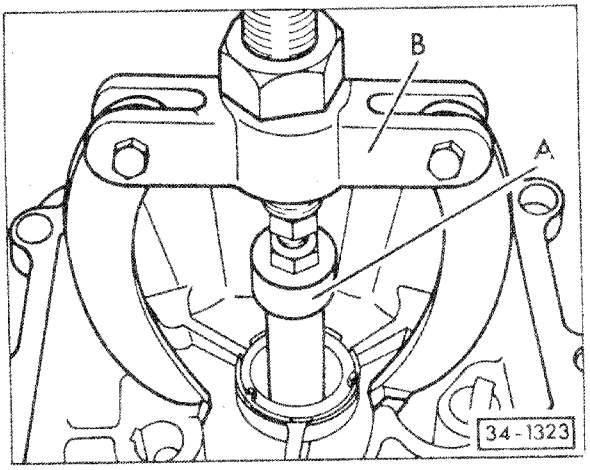


Fig. 17 Pinion bearing outer race in gear carrier housing cover, removing

A—extractor US 1088
B—puller US 1039

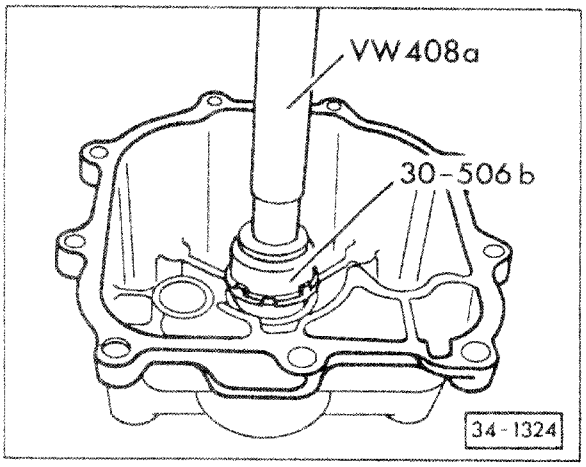


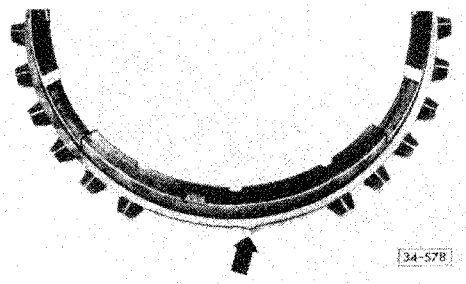
Fig. 18 Pinion bearing in gear carrier housing cover, installing

Synchronizer rings, identification

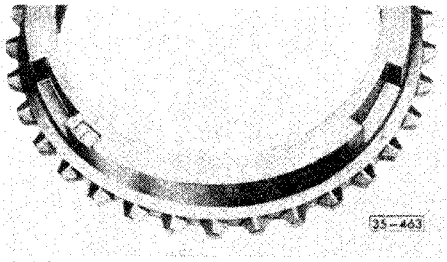
Note

When assembling transmission, install synchronizer ring to same gear from which it was removed

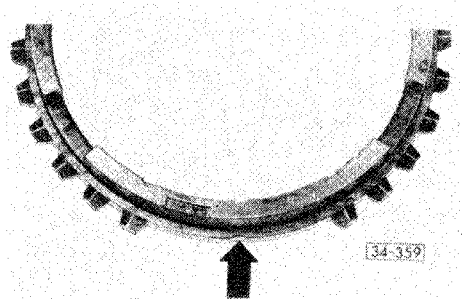
production



2nd gear:
special brass ring
molybdenum coated
3 x 6 teeth
with 3 lips (arrow)



3rd and 4th gear:
special brass ring
molybdenum coated
teeth all around circumference



5th gear:
brass ring
3 x 8 teeth
with 3 notches (arrow)

spare part

For all gears install ring (3rd and 4th gear) which is supplied under Spare Part No: 091 311 295 A