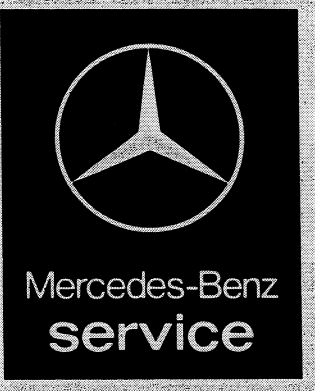
Service Manual

Clutches & Transmissions

4-Speed Manual / 4-Speed Automatic

Starting Model Year 1977



MERCEDES-BENZ OF NORTH AMERICA, INC.

Group Index

A/1 Instructions for Use of Service Manuals

Model Identification

In most sections of this manual, the individual models are identified by the chassis type instead of the model designation. The chassis type designations are the first six digits of the vehicle's serial number. A serial number tag is attached on all late model vehicles on the left windshield post, on older vehicles on the cross member above the radiator.

For example, sales designation model 280E is chassis type 123.033.

In some instances, only the first three digits (123) will be referred to. In this case, this section applies to all vehicles of this particular chassis type.

Location of Specific Repair Instructions

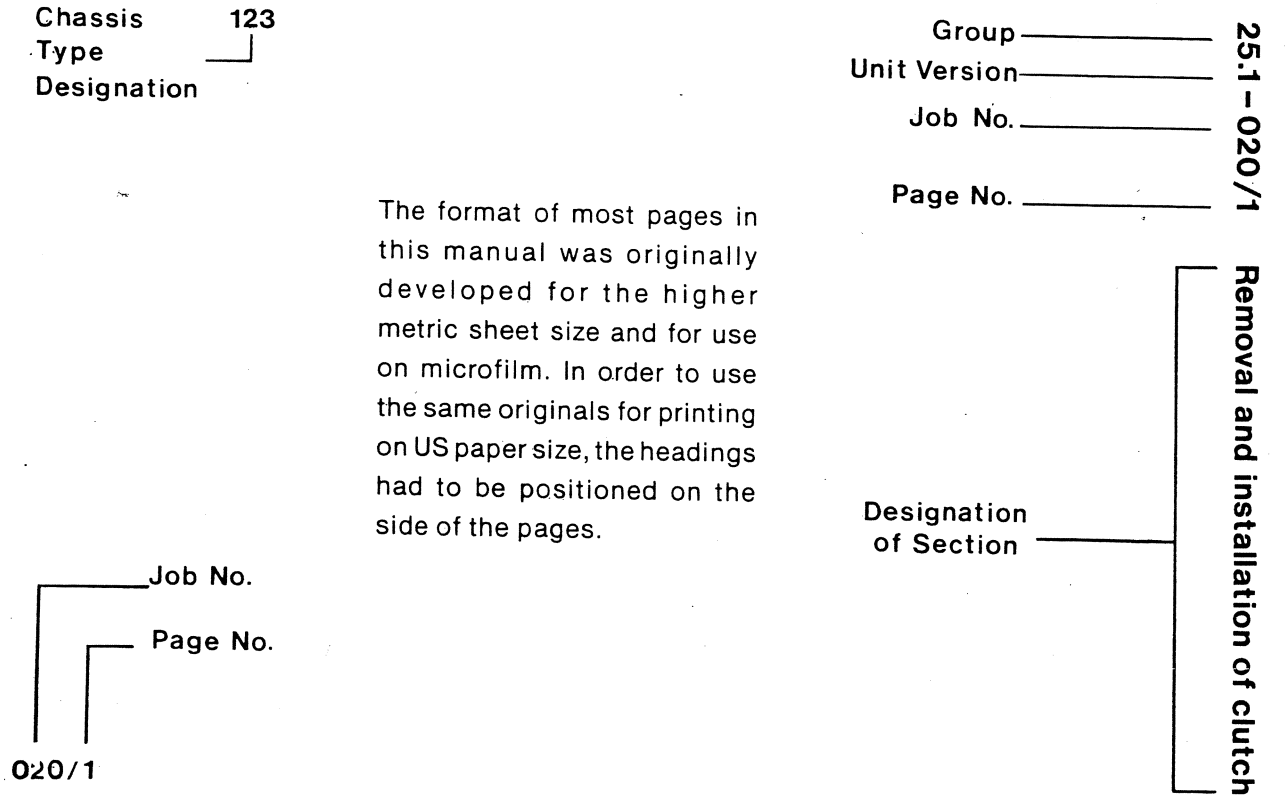
Locate main component group in Group Index. The group number is listed in the upper outside corner of each page within the group.

Check group contents (first page of each group), for the exact job description required. The Group Numbers, followed by Job Numbers and Page Numbers within each group, are shown in the upper outside margins of each page.

Unit Version *0* in the various Groups is *general* information applicable to the pertinent unit.

Unit Version with a *different numeral* is *specific* information for the title vehicle.

Depending on the unit installed in the vehicle, the numeral for the unit version may vary in the different groups.



The format of most pages in this manual was originally developed for the higher metric sheet size and for use on microfilm. In order to use the same originals for printing on US paper size, the headings had to be positioned on the side of the pages.

Data, adjusting values, processing dimensions, tightening torques and tools are listed at the beginning of each Section.

All the dimensions are in millimeters (mm), provided no other unit of measure is used.

The indicated part numbers are serving exclusively for identification and better differentiation of individual versions. When ordering spare parts, the part numbers must be taken from the spare parts literature on principle.

This manual covers Clutches and Transmissions installed in vehicles marketed in the U.S.A. starting model year 1977 as listed below.

Sales Designation	Chassis Type	Engine Type	Manual Transmission	Automatic Transmission
240D	123.123	616.912	716.005 (G 76/18C)	722.117 (W 4 B 025)
300D	123.130	617.912	—	722.118 (W 4 B 025)
300CD	123.150	617.912	—	722.118 (W 4 B 025)
300TD	123.190	617.912	—	722.118 (W 4 B 025)
230	123.023	115.954	—	722.119 (W 4 B 025)
280E	123.033	110.984	—	722.112 (W 4 B 025)
280CE	123.053	110.984	—	722.112 (W 4 B 025)
280SE	116.024	110.985	—	722.112 (W 4 B 025)

Note: Some Test and Adjustment Values for the U.S.A. models are different than those for the standard production versions. Make sure to use the correct values as specified for (USA) models.

For the identification of the transmission type on non-USA vehicles, refer to the Installation Survey page 26.1-005/1 and 005/2 for manual transmissions and page 27.0-001/1 for automatic transmissions.

25.1/1 Clutch and Pedal Assembly

**Preceding pages have been omitted because text does not apply to Models covered in this manual.*

Tightening torque	Nm	(kpm)
Screws for pressure plate	25	(2.5)

Special tool

Centering mandrel	 11004-6380	116 589 11 15 00

Removal

1 Remove transmission (26–020).

2 Loosen fastening bolts of pressure plate one after the other by 1 to 1 1/2 turns each until pressure plate is completely relaxed.

Note: Immediate, complete loosening or tightening of the individual fastening screws may result in damage to cup spring and may cause thrust ring to jump off.

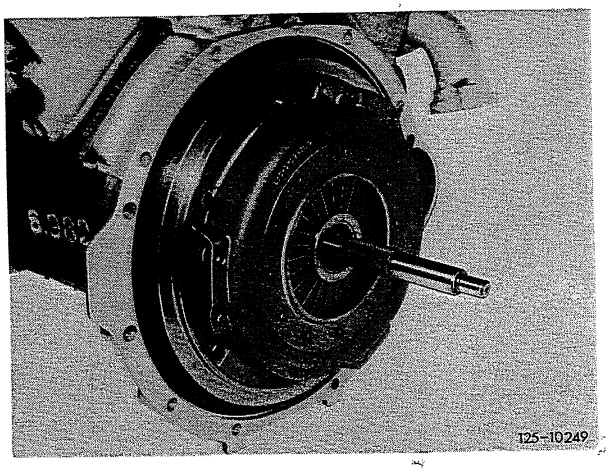
3 Unscrew fastening bolts completely and remove pressure plate with driven plate.

4 Check pressure plate for burnt cracks and score marks.

5 Check flywheel for burnt cracks and score marks and refinish, if required.

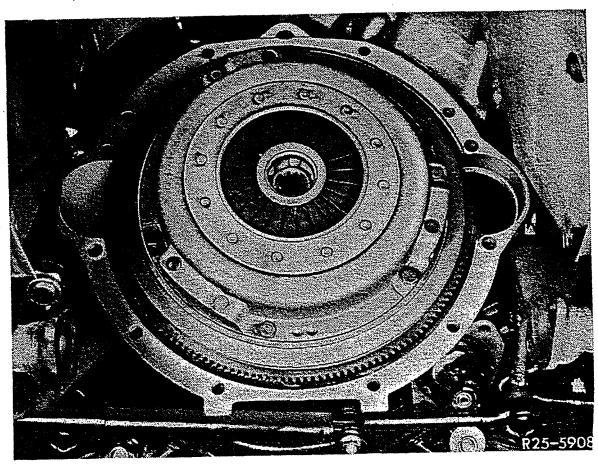
Attention!
Handle and store pressure plate carefully. Throwing or dropping of pressure plate may result in bending of spring bands between contact plate and cover plate, which in turn may result in considerable unbalance in installed condition coupled with grabbing or separation trouble.

Handle driven plate as carefully to avoid any bending (lateral runout) of lining.



Installation

6 Center driven plate with centering mandrel in relation to radial ball bearing in crankshaft.



7 Position pressure plate and tighten fastening screws one after the other by 1 to 1 1/2 turns each until pressure plate has been tightened well. Then remove centering mandrel.

Attention!
During assembly, make sure that the pressure plate is pulled into recess on flywheel uniformly and free of burr.

8 Install transmission.

Function test

9 Check clutch for unobstructed operation by engaging reverse gear with the engine running.

Note that a perfectly operating driven plate at idle speed and with transmission oil at operating temperature requires a little time after declutching up to stop. Each early engagement of reverse gear will necessarily result in noisy shifting. No tooth noise will be heard on transmissions with synchronized reverse speed.

10 Check actuation for function and system for leaks.

Data

Model	Part no.	Lining thickness Clutch end	Lining thickness Flywheel end	Permissible total wear of linings	Permissible lateral runout of driven plate
Models with 4- and 5-cylinder engines					
115.010 115.015 115.017 115.110	002 250 73 03 004 250 01 03				
115.114	003 250 43 03 004 250 03 03				
115.115	002 250 73 03 004 250 01 03				
115.117	003 250 36 03 004 250 02 03	3,6—3,8		2	0,5
123.020 123.023 123.120 123.126	004 250 01 03 003 250 93 03				
123.123	004 250 02 03				
123.130	004 250 03 03				
Models with 6-cylinder engines					
107.022 107.042 114.01 114.02 116.020 116.024 116.025 123.026 123.03	003 250 35 03	3,9—4,1		2	0,5
Models with 8-cylinder engines					
107.023 107.024 116.028 116.029	002 250 83 03	4,3—4,5	3,3—3,5	2	0,5

Conventional tools

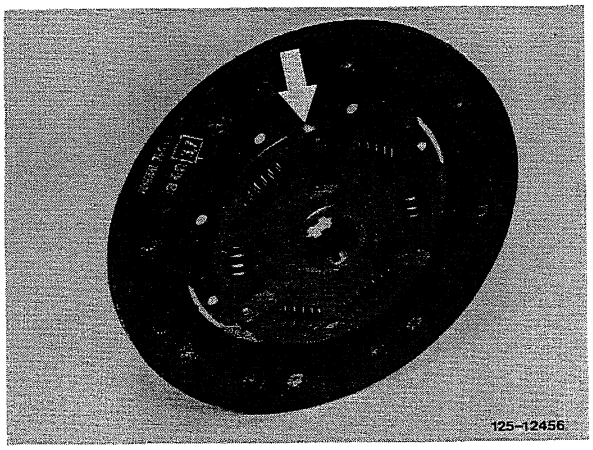
Dial gauge A 1 DIN 878	e.g. made by Mahr, D-7300 Esslingen, order no. 810
Measuring stand	e.g. made by Mahr, D-7300 Esslingen, order no.815 P

Checking

1 Check driven plate for oiling up, greasing up, mechanical damage, cracks in lining and for thickness of lining.

2 Check stop bolt and hub for wear (arrow).

3 Check driven plate for lateral runout, align with aligning fork, if required.



Special tool

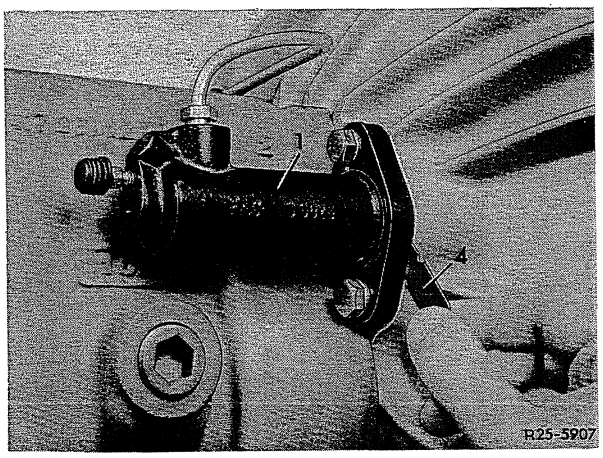
Check gauge	 11004-6371	115 589 07 23 00

Note

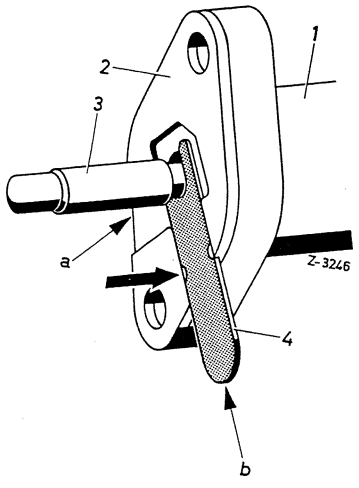
In installed condition, the wear of the driven plate lining can be inspected by means of check gauge on slave cylinder only. Due to the automatically adjusting free-of-play clutch actuation any wear of lining is not indicated at clutch pedal.

Checking

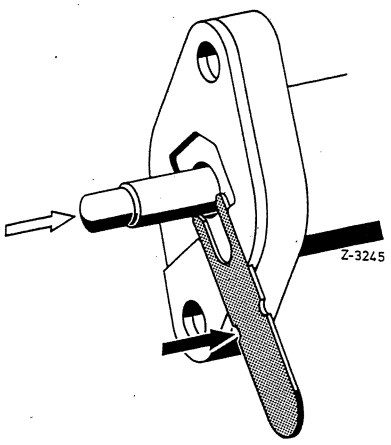
1 Slip check gauge (4) into groove of plastic shim.



2 When the notched marks in flange are disappearing, the driven plate is fully operable (arrow).



3 If the notched marks of the gauge slipped in up to stop remain visible, the wear limit of the driven plate has been attained (driven plate must be replaced).



Data

Model	Part no.	Contact pressure N	(kp)
Models with 4- and 5-cylinder engines			
115.010 115.015 115.017 115.110 115.114 115.115 115.117	001 250 43 04	4900–5600	(490–560)
123.020 123.023 123.120 123.126	001 250 43 04 003 250 02 04	4900–5600	(490–560)
123.123 123.130	001 250 43 04	4900–5600	(490–560)
Models with 6-cylinder engines			
107.022 107.042	001 250 42 04	6000–6600 (with yellow dot)	(600–660)
114.01 114.02	001 250 41 04	5400–6000 (with blue dot)	(540–600)
116.020 116.024 116.025 123.026 123.03	001 250 42 04	6000–6600 (with yellow dot)	(600–660)
Models with 8-cylinder engines			
107.023 107.024 116.028 116.029	002 250 22 04	7200–7900	(720–790)

Checking

1 Check pressure plate for burnt cracks and score marks.

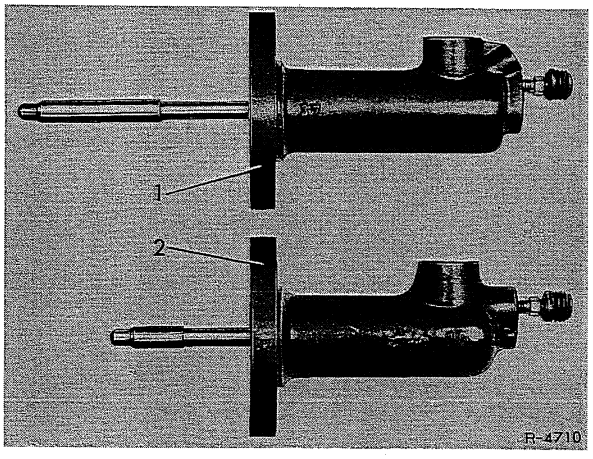
Attention!
Do not place pressure plate under screw press or the like. If thrust ring travels beyond max. 11 mm, the pressure plate will become unfit for use.

Data

Model	107.022, 107.042 114, 115 116.020, 116.024, 116.025 123	107.023, 107.043 116.028, 116.029
Dia.	23.81	22.2
Stroke	20	23

Note

The slave cylinder for vehicles with 8-cylinder engines differs externally as compared with the slave cylinder for vehicles with 4-, 5- and 6-cylinder engines by its longer thrust rod and a yellow ring on bleed screw.



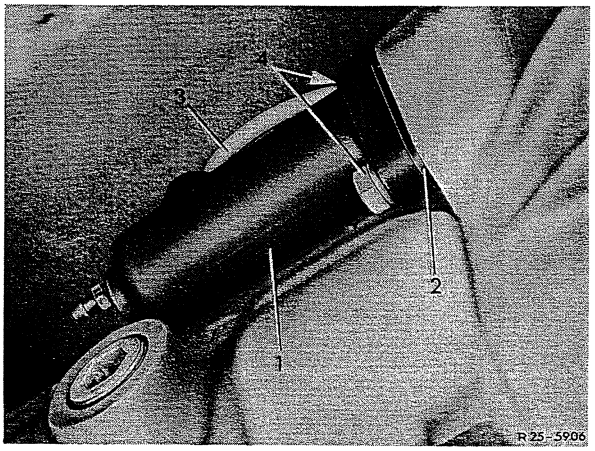
Removal

1 Unscrew pressure line (3) on slave cylinder.

2 Close pressure line with a rubber cap to prevent loss of brake fluid.

3 Unscrew fastening screws (4) of slave cylinder (5).

4 Remove slave cylinder with thrust rod from clutch housing, watching out for shim (2).



Installation

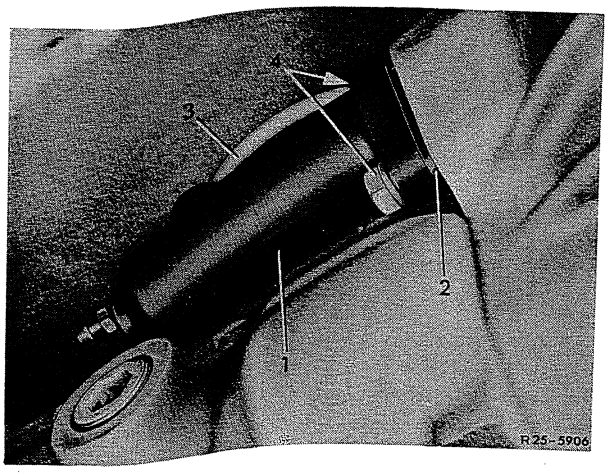
5 Position shim (2) with grooved end against clutch housing and hold.

6 Introduce slave cylinder with push rod into clutch housing in such a manner that the push rod comes to rest in spherical recess of throwout rocker. Watch out for correct seat of dust sleeve in slave cylinder.

7 Screw slave cylinder with fastening screws to clutch housing.

8 Connect pressure line (3) to slave cylinder.

9 Bleed clutch actuation (25—230).



NOTE: Pages 210/1 through 210/5 have been omitted because text does not apply to Models covered in this manual.

C. Model 123

Data

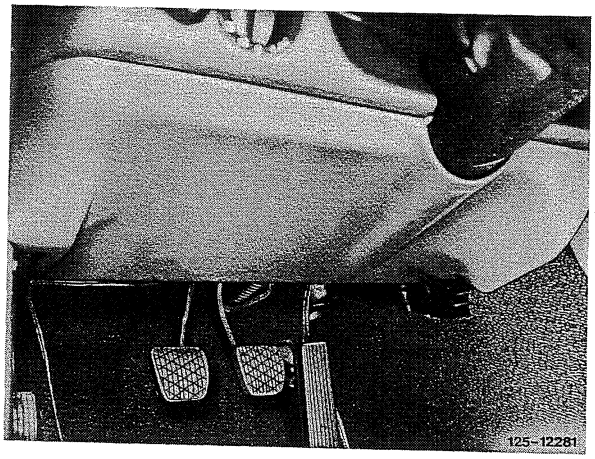
Model	123
Dia.	19.05
Stroke	34

Removal

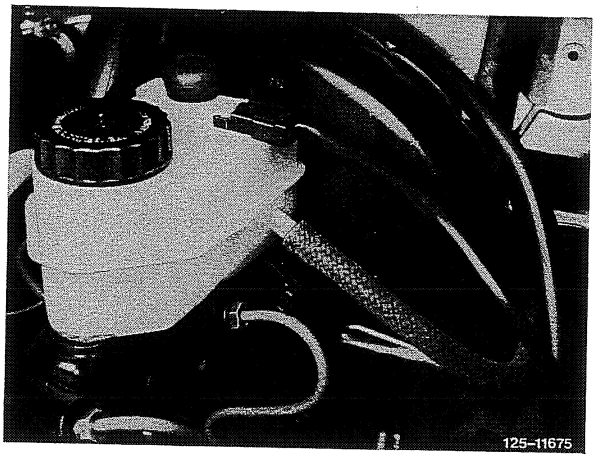
1 Remove floor mats and floor covering from cab leg room.

2 Remove cover under instrument panel.

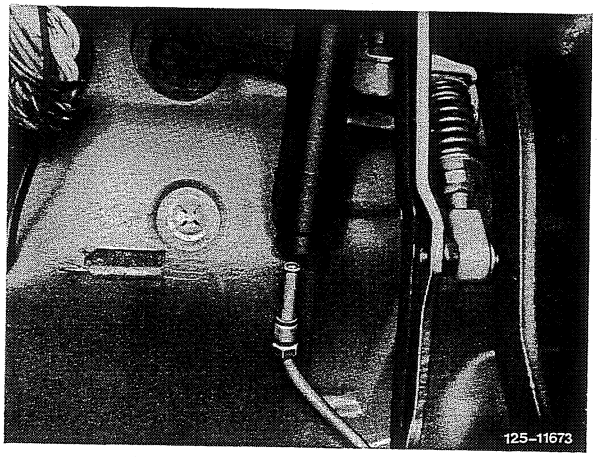
3 Draw brake fluid from **respective chamber** of supply tank down to under minimum mark.



4 Loosen connecting hose from combination brake and clutch expansion tank.

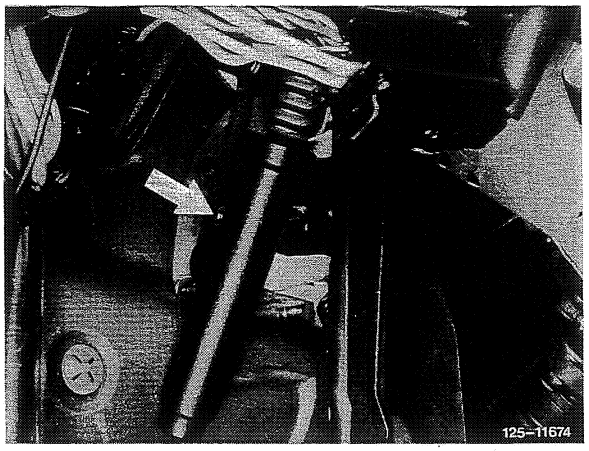


5 Unscrew pressure line on master cylinder.



6 Unscrew master cylinder from pedal assembly (arrow).

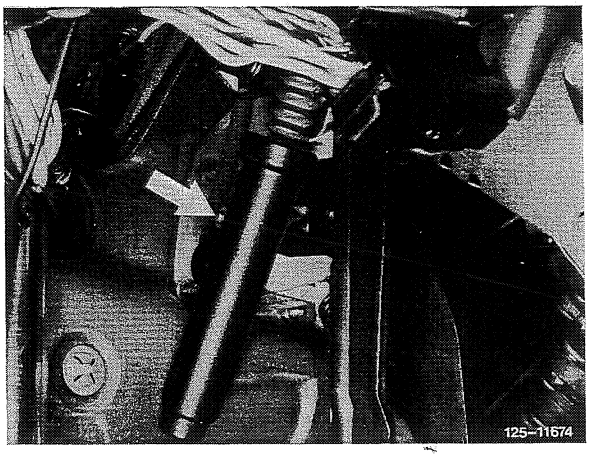
7 Remove master cylinder with connecting hose. Push rod remains on clutch pedal.



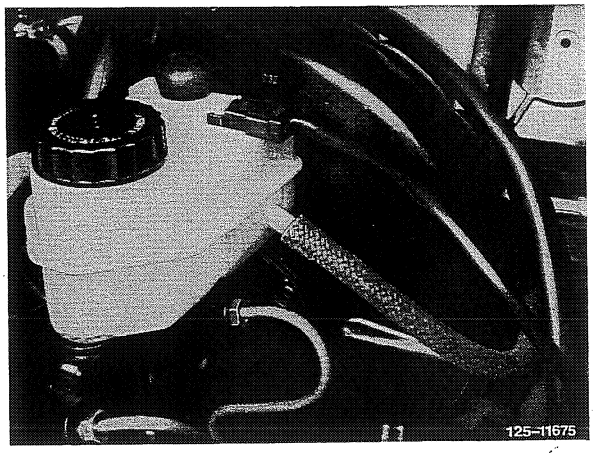
Installation

8 Slip master cylinder on push rod on clutch pedal.

9 Screw master cylinder to pedal assembly (arrow).



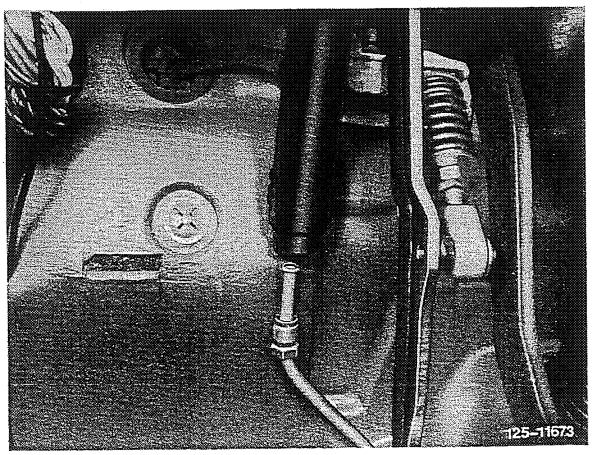
10 Slip connecting hose trhough rubber sleeve and plug to combination brake and clutch expansion tank.



11 Screw pressure line into master cylinder.

12 Check clearance between push rod and piston in master cylinder and adjust, if required (25–240).

13 Bleed clutch actuation (25–230), then check level of brake fluid in supply tank and correct, if required.



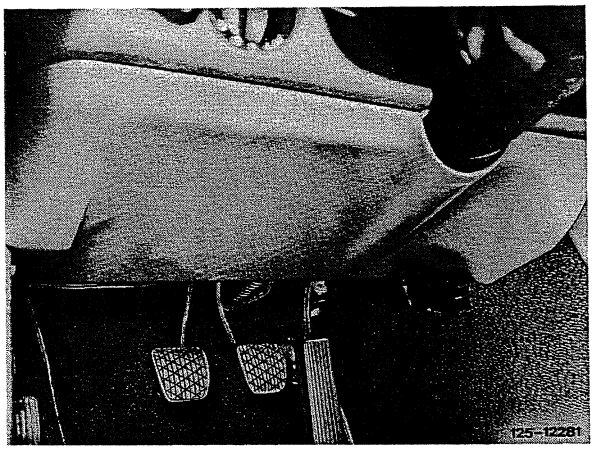
14 Check clutch for unobstructed operation with the engine running by engaging reverse speed.

15 Check actuation for function and system for leaks.

16 Check clutch pedal. Clutch pedal should rest against pedal stop, since otherwise separating troubles of clutch may occur.

17 Insert floor mats and floor cover in driver's leg room.

18 Mount cover under instrument panel.



Important note

Be careful when handling brake fluid!

a) Fill **brake fluid** only into containers where unintensional drinking of fluid is impossible. **(Fatal dose 100 cc.)**

b) Make sure that brake fluid is not coming into contact with paintwork of vehicle, since fluid contains particles which act as a solvent for the paint.

c) Brake fluid is highly hygroscopic, that is, it will absorb moist air, which in turn will reduce the boiling point. For this reason, brake fluid may be stored only in well-sealed storage containers.

A. Venting with a brake bleeding device

1 When using a brake bleeding device, proceed from the bottom up, that is, connect pressure line of bleeding unit to open venting screw of slave cylinder. The expanding tank should be almost empty, so that enough brake fluid can flow from the bottom up through the system and the remaining air can escape in upward direction.

2 Set bleeding unit to lowest possible pressure.

3 Watch expanding tank to prevent any overflowing of brake fluid.

4 When the brake fluid is at its max. level in expanding tank, connect pressure line to bleeding device and then close venting screw on slave cylinder and remove pressure hose from venting screw.

5 Check clutch for unobstructed operation with the engine running by engaging reverse speed.

6 Check actuation for function and system for leaks.

7 Replenish brake fluid in expanding tank up to max. level.

B. Venting with assistance of brake system

Venting of the clutch actuation with the assistance of a brake system is in principle the same as when using a brake bleeding device, but with the difference that no special aids are required.

1 Check brake fluid level in mutual expanding tank for brake system and clutch actuation and replenish to max. level, if required.

2 Place hose on bleeder screw of righthand front caliper and open bleeder screw.

3 Let a second person carefully actuate brake pedal until hose is filled with brake fluid and no more air bubbles are showing up. Any flowing out of brake fluid is prevented by keeping the hose closed.

4 Place free hose end on bleeder screw on slave cylinder and open bleeder screw.

5 Step down on brake pedal. Close bleeder screw of caliper, move brake pedal into release position. Open bleeder screw. Repeat until no more bubbles are showing up at expanding tank.

Note: It will be of advantage to replenish the fluid level in compensating tank in-between.

6 Close bleeder screws on brake caliper and slave cylinder and pull off hose.

7 Check clutch for unobstructed operation with the engine running by engaging reverse speed.

8 Check actuation for function and system for leaks.

9 Replenish brake fluid in expanding tank up to max. level.

Note

In the event of complaints about vehicles for delayed separation and poor dosage of clutch, adjustments should be made according to section B by means of brake bleeding device.

A. Adjusting without brake bleeding device

Data

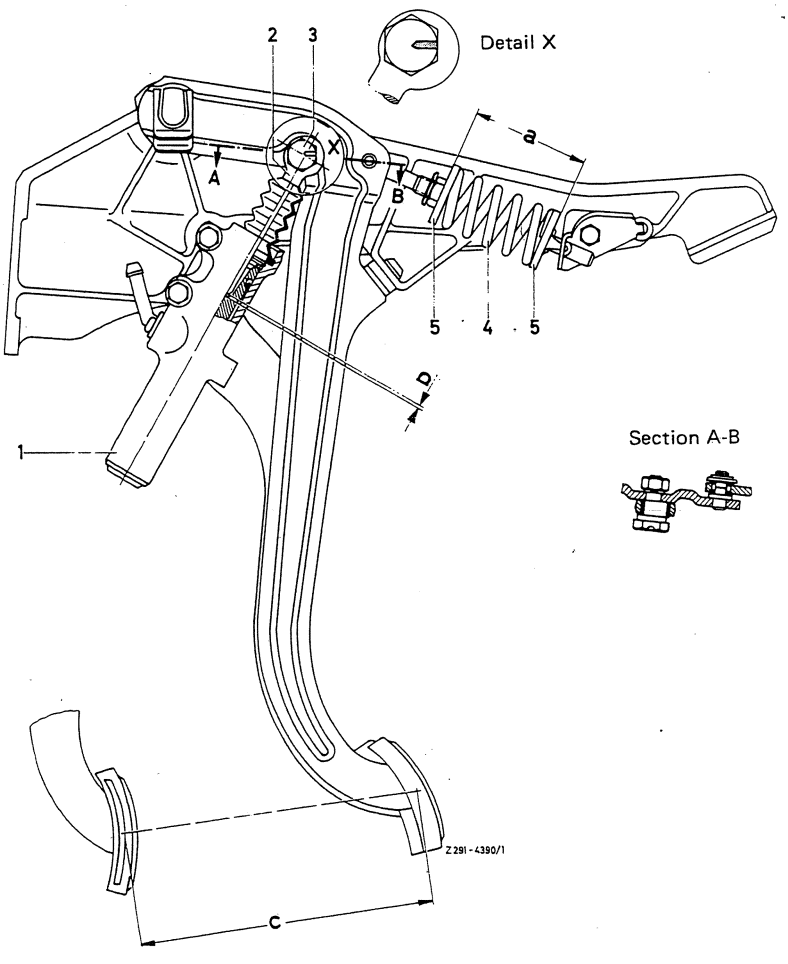
Clearance between push rod and piston in master cylinder	approx. 0.2

Adjustment

1 Loosen hex nut of adjusting screw (3).

2 Turn adjusting screw in such a manner that the push rod (2) will have to cover the idle path ,,b'' up to piston first when pedal is actuated.

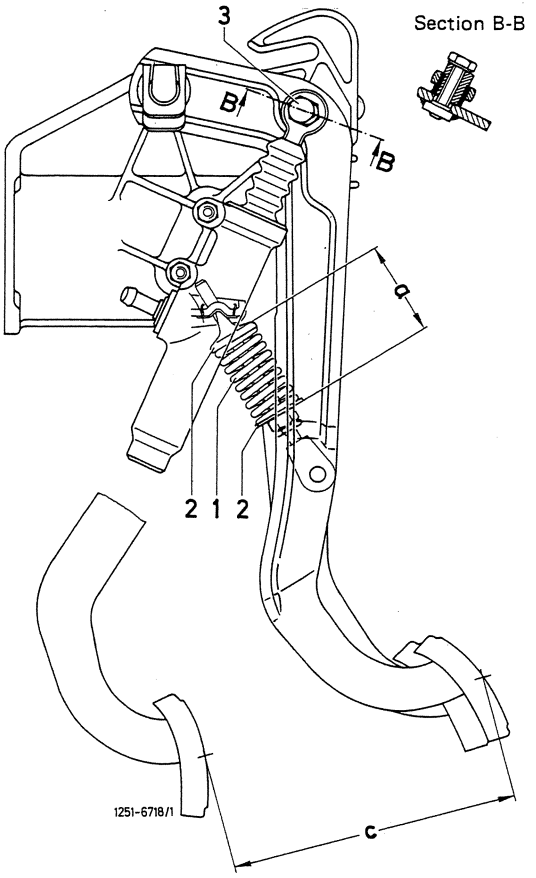
Note: When checking or adjusting clearance, make sure that the line marking on head of adjusting screw points toward the rear. There is no line marking on model 123.



Layout models 107–116

1 Master cylinder
2 Push rod
3 Adjusting screw
4 Dead center spring
5 Spring retainer

a Adjusting dimension of dead center spring
b Clearance between piston in master cylinder and push rod
c Pedal travel (lash)



Layout model 123

1 Dead center spring
2 Spring retainer
3 Adjusting screw

a Adjusting dimension of dead center spring
c Pedal travel (lash)

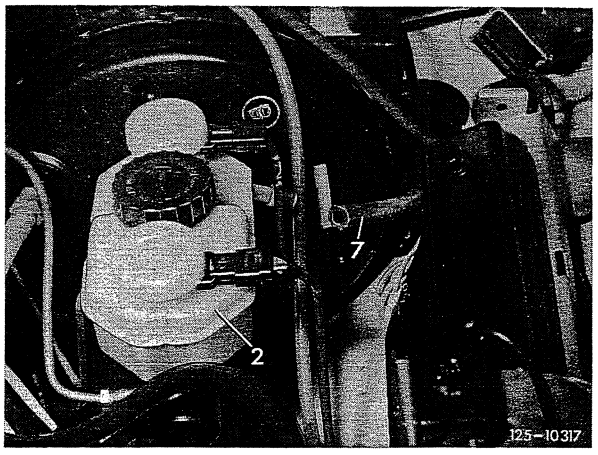
B. Adjustment with brake bleeding device

Adjustment

1 Draw brake fluid from respective chamber of expansion tank up to connection for clutch actuation.

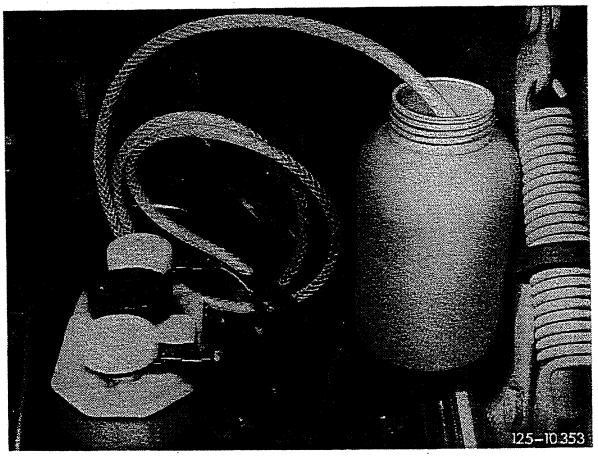
2 Pull connecting hose (7) to master cylinder from expansion tank (2).

3 Open venting screw on clutch sleeve cylinder and evacuate clutch system by stepping repeatedly on clutch pedal.



4 Insert plastic hose of approx. 1 m in length, 8 mm dia., into connecting hose (7) and immerse other end into a container filled with water.

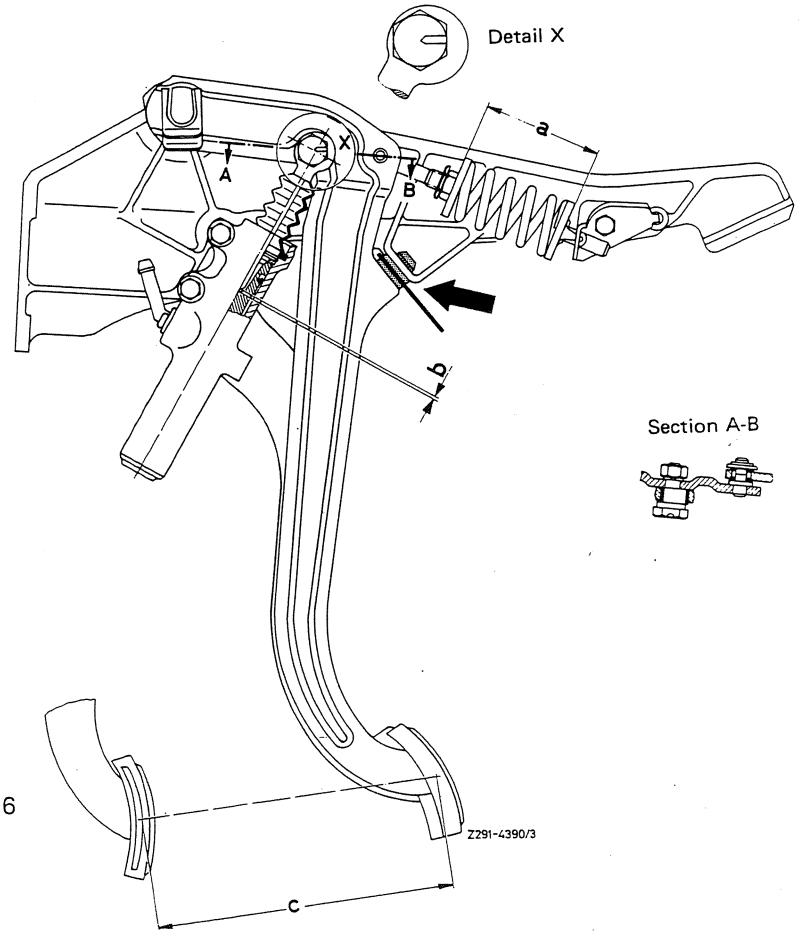
5 Remove cover under instrument panel left.



6 Clamp sheet metal approx. 1.5 mm thick between upper pedal stop and rubber buffer (arrow).

Illustration shows layout on models 107–116. Attach sheet metal on model 123 in a similar manner.

7 Fill brake bleeding device with air and set working pressure to 0.5 bar (atü) gauge pressure.



Layout models 107 – 116

8 Adjust brake bleeding device depending on make in such a manner that air is blown from clutch system and bubbles will rise in water tank.

Note: It will be of advantage to place water tank into lefthand leg room.

9 Turn adjusting screw on clutch pedal only until the airflow is interrupted and no more bubbles are rising in water tank. Then counterlock adjusting screw.

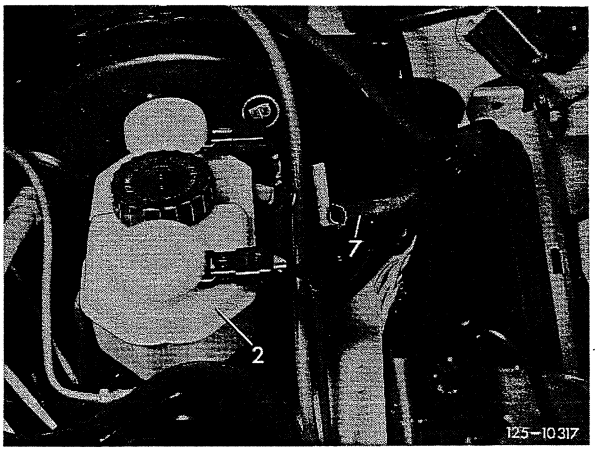
10 Remove sheet metal at upper pedal stop. Bubbles should rise again in water tank. Then set brake bleeding device to ,,0" .

11 Connect feed line (7) to expansion tank (2).

12 Vent clutch actuation (25–230).

13 Check clutch actuation for function with engine running.

14 Attach cover under instrument panel left.



Data

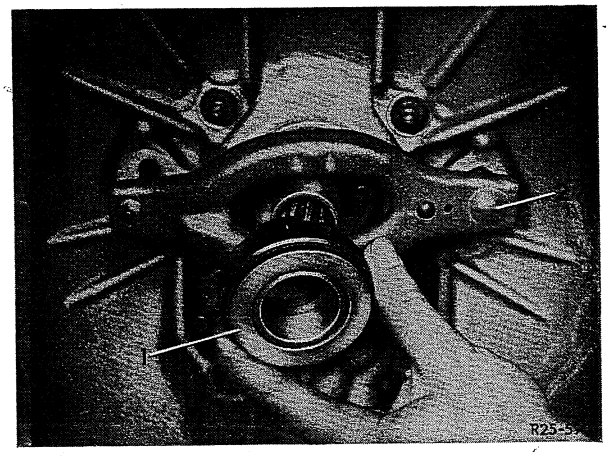
ID of throwout	34.05 / 34.11
OD of guide tube on front transmission housing cover	34.00 / 33.94
Clearance between throwout and guide tube on front transmission housing cover	0.05–0.17

Type of grease

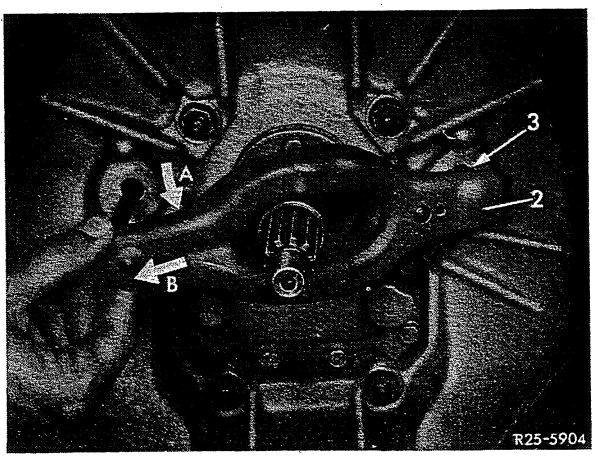
Longterm grease	refer to specifications for service products	page 266.2

Removal

1 Remove throwout (1) from bearing tube on front transmission cover.



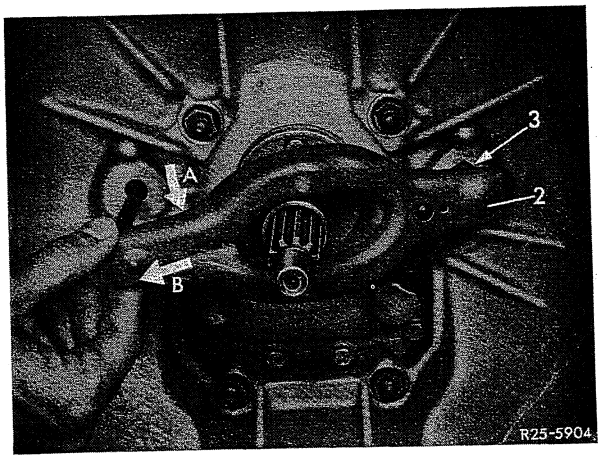
2 Move throwout rocker (2) in direction of arrow A and then pull in direction of arrow B from ball pin (3) on clutch housing and remove.



Installation

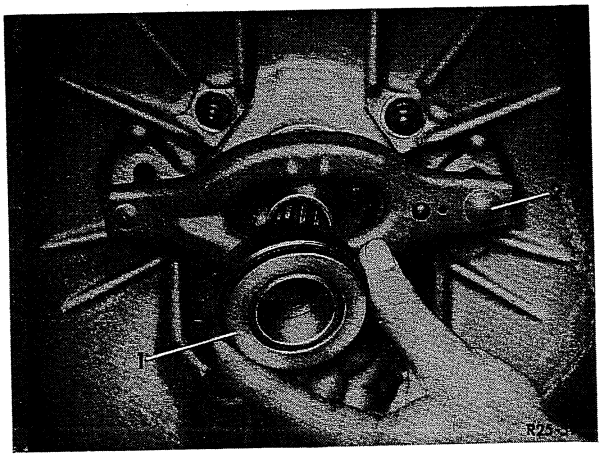
3 Carefully grease bearing tube on front transmission cover, ball pin (3) on clutch housing and all points on throwout rocker (2) which come into contact with throwout (1) with longterm grease.

4 Push throwout rocker (2) in reverse direction of arrow B onto ball pin (3) until spring clip of rocker engages on ball pin. Then move rocker in reverse direction of arrow A until push rod of slave cylinder comes to rest in spherical recess of throwout rocker.



5 Grease throwout inside and on both lateral machined surfaces on rear sleeve portion.

6 Slip throwout (1) on guide tube on front transmission cover and keep turning until throwout snaps with the lateral machined surfaces into rocker (2).



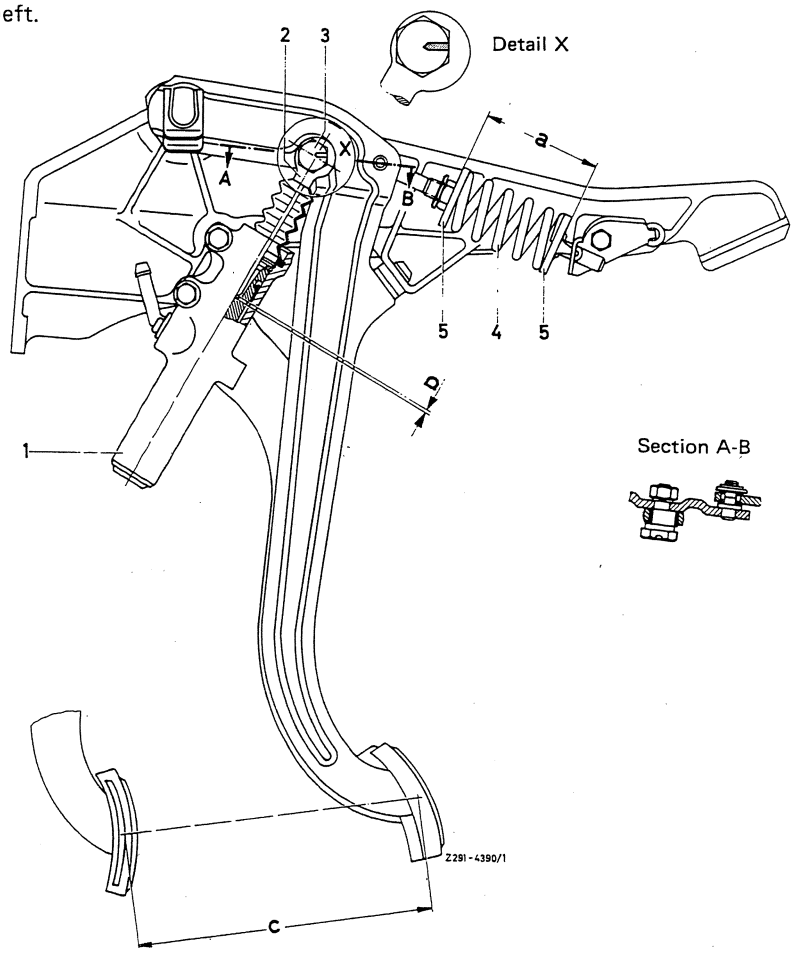
Data

Model			107	114 115	116	123.020 123.023 123.1	123.026 123.030 123.033
Adjusting dimension „a" of dead center spring measured across both spring retainers	with	metal retainer	66	45.5	66	–	–
		plastic retainer	68	47.5	68	52.5	47.5

1 Remove cover under instrument panel left.

2 Measure dimension „a" across both spring retainers.

3 Loosen counternut, preload dead center spring by turning adjusting nut until adjusting dimension is attained.



Layout models 107–116

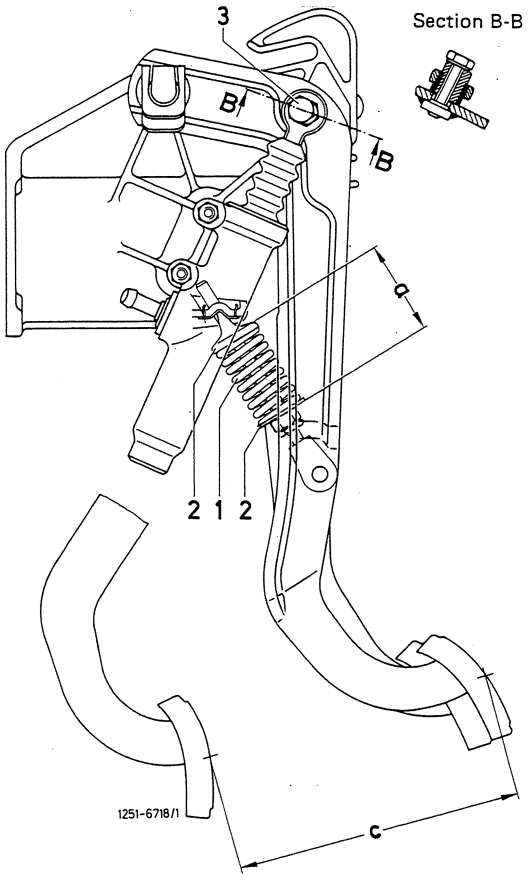
1 Master cylinder
2 Push rod
3 Adjusting screw
4 Dead center spring
5 Spring retainer

a Adjusting dimension of dead center spring
b Clearance between piston in master cylinder and push rod
c Pedal travel (lash)

Note: If the dead center spring is given an excessive preload below the specified adjusting dimension, the pedal will remain stuck when clutching or will return hesitantly only.

If the dimension is too high, there will be insufficient support. This will increase the pedal pressure.

4 Tighten counternut and attach cover under instrument panel.



Layout model 123

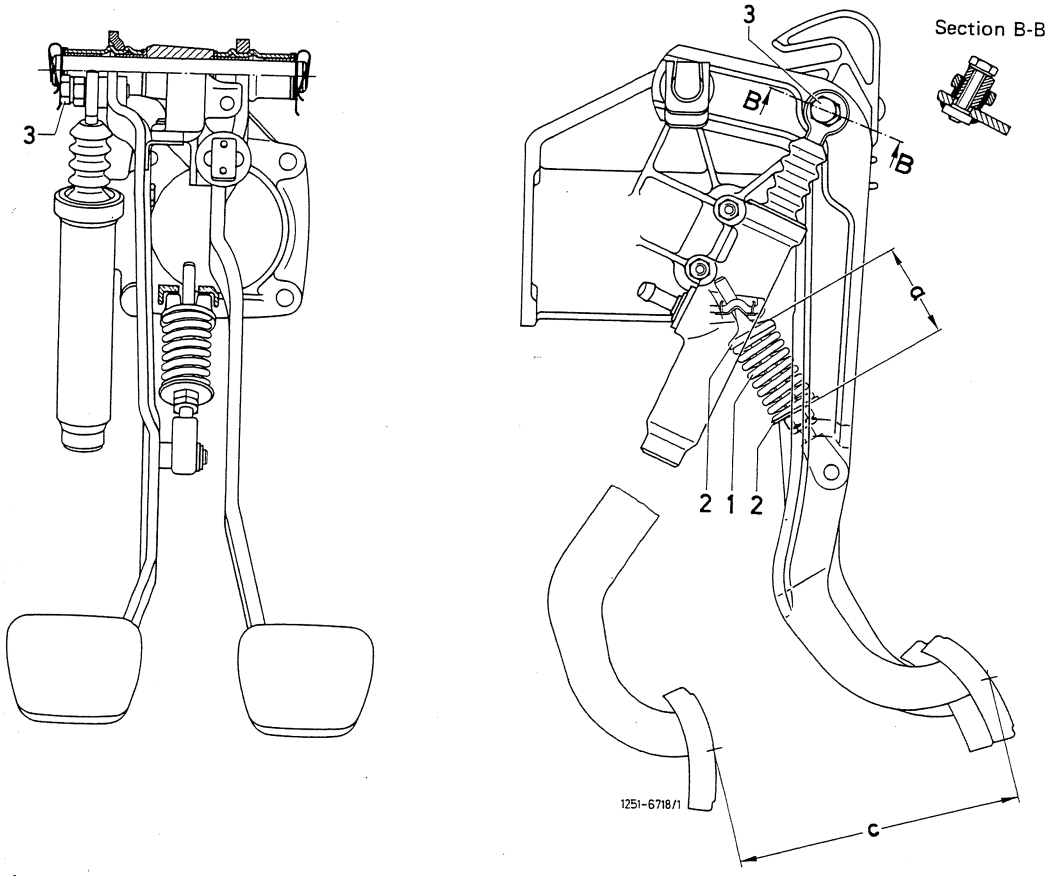
1 Dead center spring
2 Spring retainer
3 Adjusting screw

a Adjusting dimension of dead center spring
c Pedal travel (lash)

Adjusting dimensions

Model		123.020 123.023 123.1	123.026 123.030 123.033
Adjusting dimension „a" of dead center spring measured across both spring retainers		52.5	47.5
Lash „c"	Brake pedal	165	
	Clutch pedal	150[1])	

[1]) Up to rest against pedal stop.



1 Dead center spring
2 Spring retainer
3 Adjusting screw

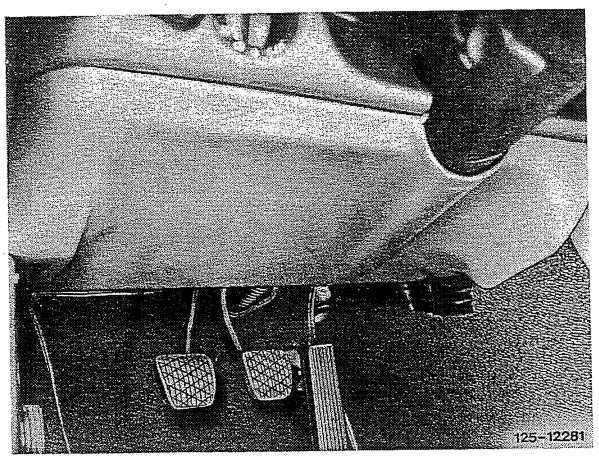
a Adjusting dimension of dead center spring
b Pedal travel

Removal

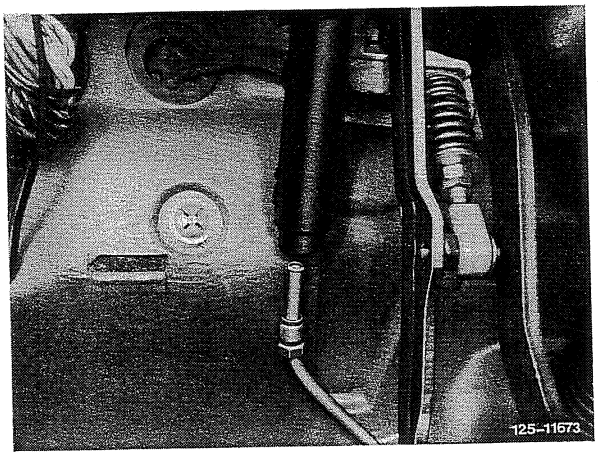
1 Remove cover under instrument panel at left.

2 Remove floor mat at left.

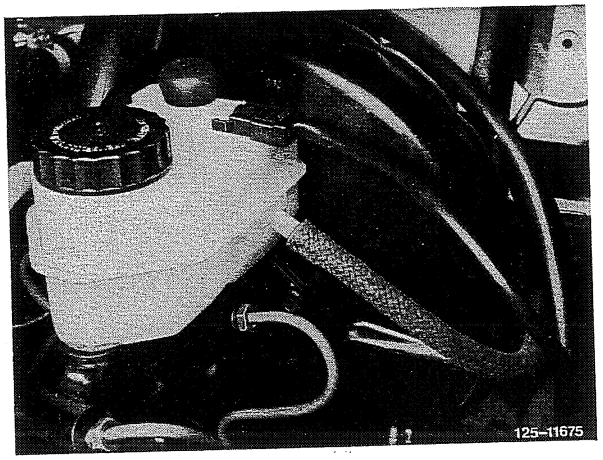
3 To prevent contamination inside vehicle, draw brake fluid from respective chamber of combination clutch and expansion tank.



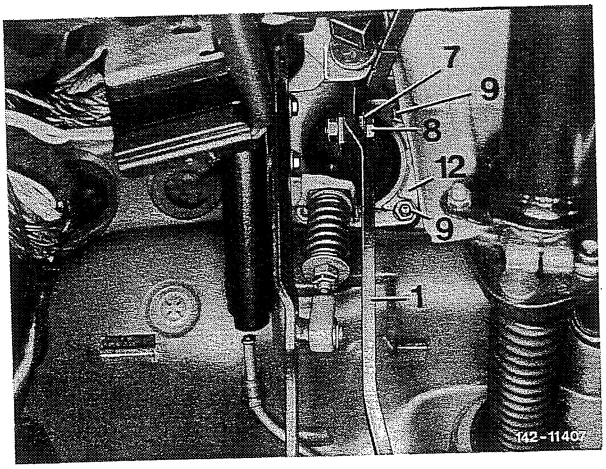
4 Unscrew pressure line on master cylinder.



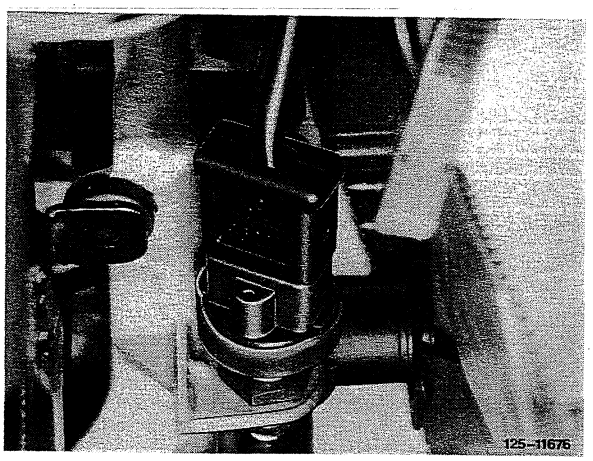
5 Pull off connecting hose on combination brake and clutch expansion tank.



6 Loosen hex screw (8) on brake pedal and remove with steel bushing.



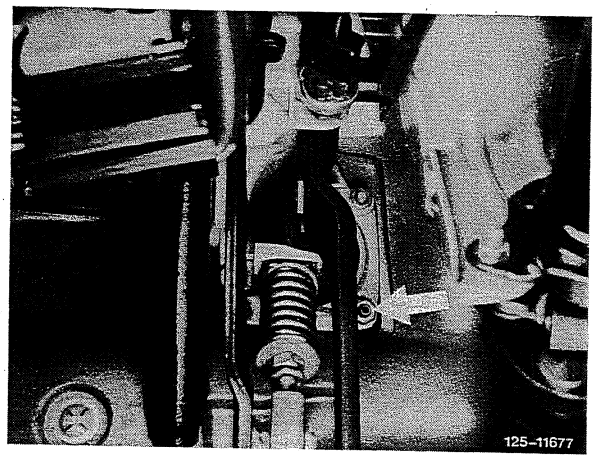
7 Pull cable plug from stop light switch.



8 Unscrew nuts for attaching pedal carrier to front wall (arrow).

9 Move pedal assembly toward the rear until the screw plate of the pedal carrier is released from stud of brake unit and holder on top of header tank.

10 Remove pedal assembly in downward direction while paying attention to connecting hose for master cylinder.

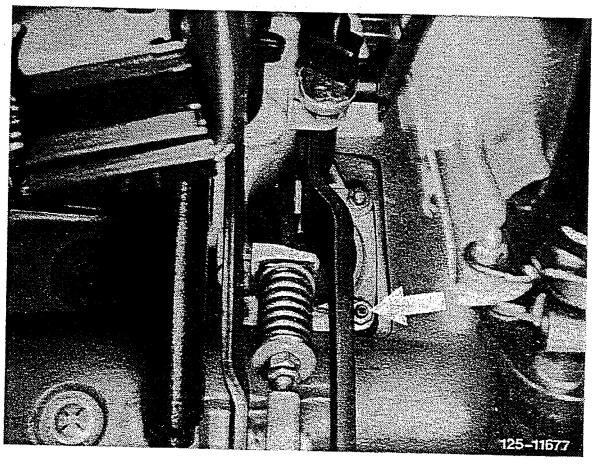


Installation

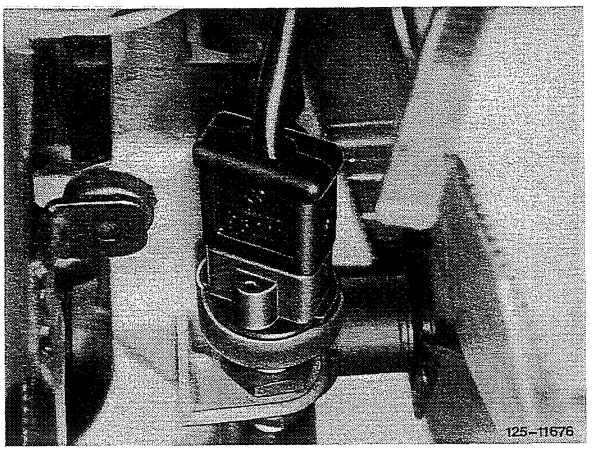
11 Return any fallen rubber mount into holder on header tank in such a manner that the two elevations of rubber mount enter into the recesses of the holder.

12 Slip pedal assembly from below simultaneously into holder on header tank and on studs of brake unit.

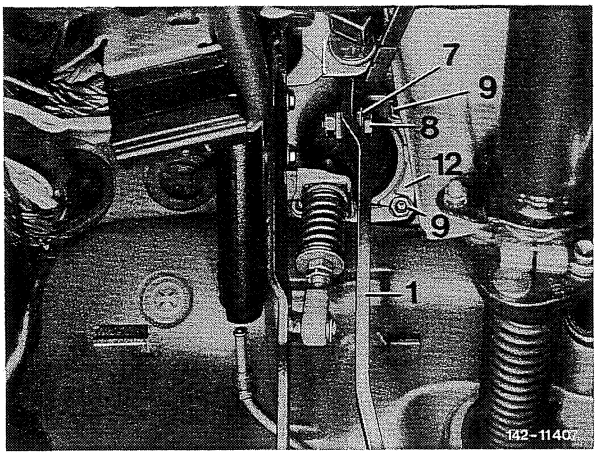
13 Tighten pedal assembly on front end (arrow).



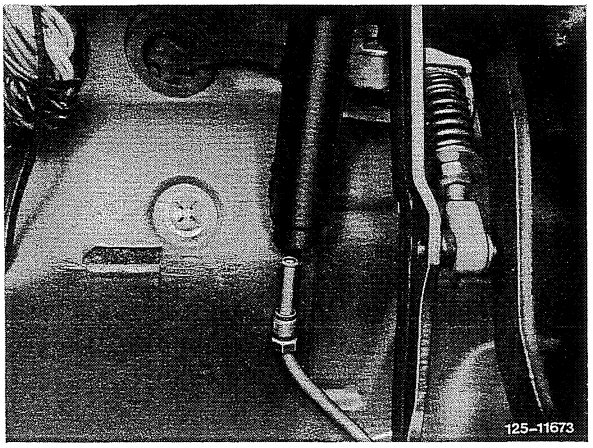
14 Plug on cable plug of brake light switch.



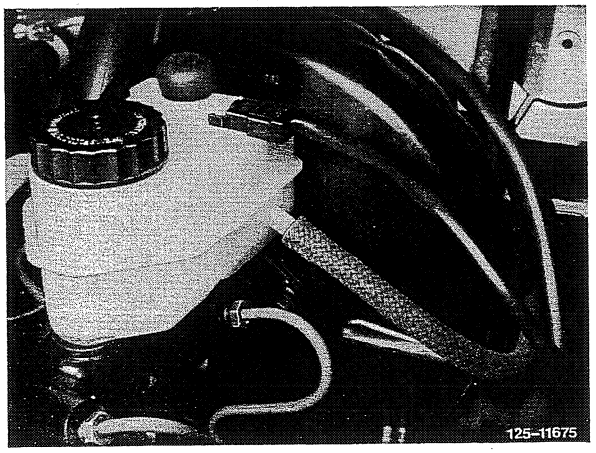
15 Screw push rod for brake unit to brake pedal. Insert steel bushing first.



16 Connect pressure line to master cylinder.



17 Slip connecting hose of master cylinder through rubber sleeve and plug to combination brake and clutch expansion tank.

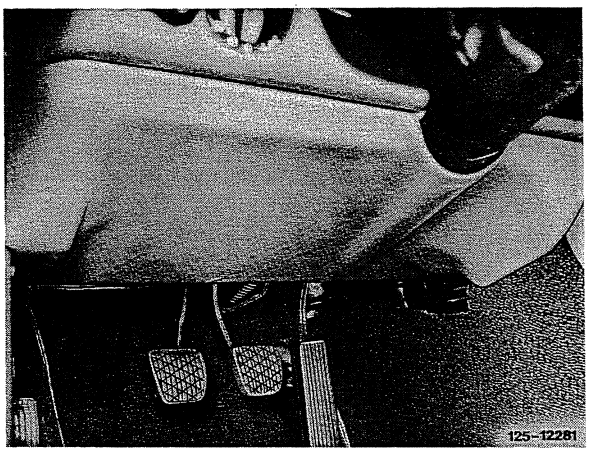


18 Bleed clutch actuation (25–230).

19 Check clutch actuation for function and leaks.

20 Insert floor mat into leg room.

21 Mount cover under instrument panel at left.



* *Please refer to text which applies to your Model.*

General information

Manual four-speed transmissions G 76/18, G 76/27, 716.0, as well as 716.1, are essentially the same. A few changes in these transmission types have been made since the start of the series in January 1968 in the course of general technological development. However, assembly procedure for all the named transmissions of series 716 remains almost unchanged.

Based on a thorough similarity of assembly procedures, the reconditioning sequence is predominantly shown with reference to transmission 716.0. Specific deviations between these transmissions are specially referred to in the respective sections.

Due to the in part differing dimensions and the varying surface finishes of the toothed flanks, the components of the individual transmission types **cannot** be exchanged in relation to each other.

Parts subject to wear should therefore be ordered in principle according to the pertinently valid spare parts literature. Essential modifications are always placed ahead of the respective job number.

Installation survey

Transmission	Transmission No.	Installed in vehicle model from . . . to	Remarks or changes
G 76/18	up to 669 557	114 115 from January 1968 to March 1972	
716.001	as from 000 001	107.022 107.042 116.020 116.024 116.025 114.060 114.062 114.072 114.073 up to August 1976	Reinforced 1st speed by wider helical gear of main and countershaft. 1st speed scraped, 2nd and 3rd speed as well as constant gear ground. Reversing gear of countershaft and rear transmission cover modified due to modified countershaft.
716.002	as from 669 558	114.010 114.011 114.015 114.021 114.022 114.023 115 (all) as from March 1972 115.017 115.117 up to October 1973	Reinforced 1st speed by wider helical gear of main and countershaft. 1st speed scraped, 2nd and 3rd speed, as well as constant gear, scraped and lapped. Reversing gear of countershaft and rear transmission cover modified due to modified countershaft.
716.003		115.017 115.117 as from October 1973 115.114	–

716.005		123.020 123.023 — 123.026 up to April 1977 123.1	
716.006		107.002 107.042 — 116.020 116.024 116.025 as from September 1976 123.026 as from May 1977 123.030 123.033 123.043 123.050 123.053 as from begin of series	
716.100	as from 006 294	107.023 107.043 108.057 108.058 109.056 111.026 116.028 116.020 as from April 1972	Modification of countershaft, of reversing gear of countershaft and of rear transmission cover. Reason: Matching to transmission 716.001.

Oil types/filling capacity

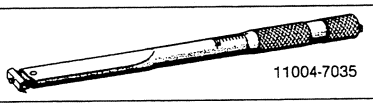
Automatic transmission fluid (ATF) Type A, Suffix A	refer to specification for service products page 236.1, 236.2	
Engine oil SAE 10W or 20W-20		
Filling capacities in liters	Model 114, 115, 107.022/042 116.020/024/025, 123	1.6
	Model 107.023/043 116.028/029	1.8

Lubricants

e. g. Longterm 2	refer to specification for service products page 266.2

Tightening torques	Nm	(kpm)
Clamping nut of universal shaft	30-40	(3-4)
Oil drain and filler plug	60	(6)
Hex bolts on universal shaft intermediate bearing	25	(2.5)

Special tools

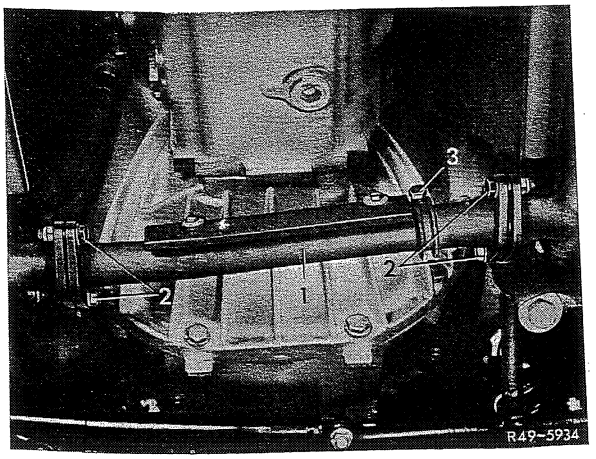
Torque wrench handle for open end wrench 20-100 Nm (2-10 kpm)	 11004-7035	001 589 35 21 00
Open end wrench insert 46 mm for torque wrench handle	 11004-7082	000 589 13 01 00

A. Models 107, 116.028/029

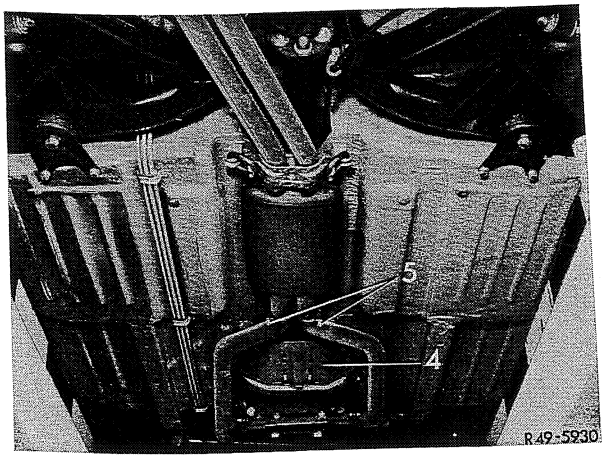
Removal

1 Disconnect grounding cable on battery.

2 Remove compensating connection (1) between the two exhaust pipes.

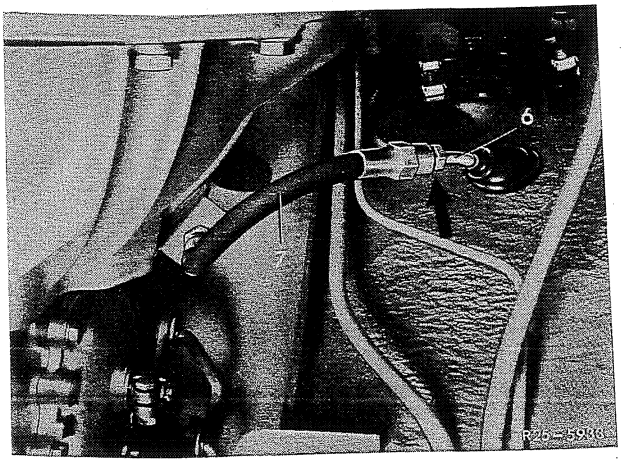


3 Remove exhaust as from plug connection.



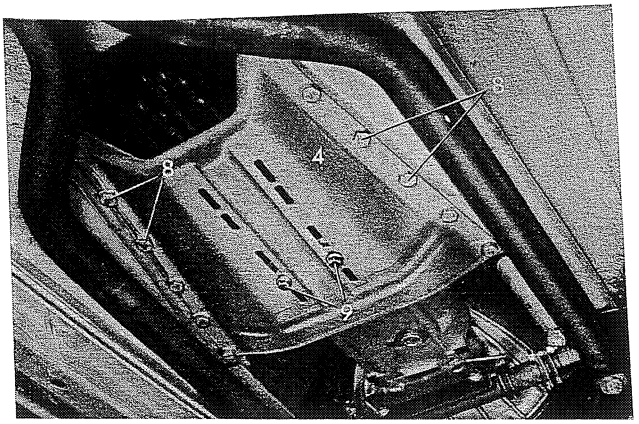
4 Separate pipe line (6) to slave cylinder at lefthand end on hose screw connection (arrow).

Note: Close lines with blind plugs or draw fluid from **rear** chamber of combination supply tank to prevent the brake fluid from running out.



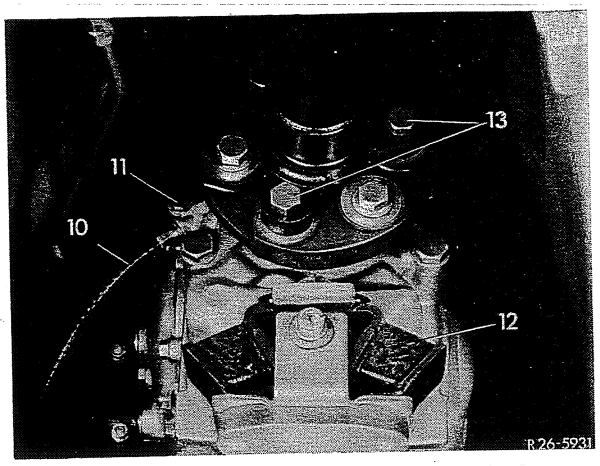
5 Unscrew both fastening bolts (9) for rear engine rubber mount.

6 Slightly raise transmission with vehicle jack or pit lift and unscrew tunnel closing plate.

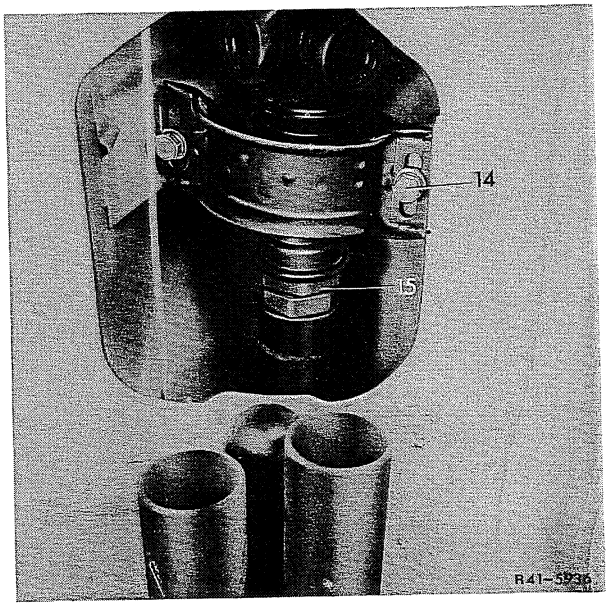


7 Loosen drive shaft (10) for tachometer on rear transmission cover and pull off.

8 Remove shift rods of gear shift from transmission shift levers upon removal of SL locks.

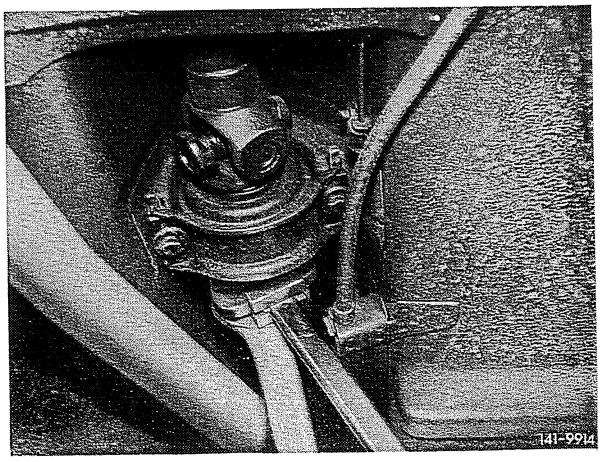


9 Loosen both fastening bolts (14) of universal shaft intermediate bearing, but do not screw out.



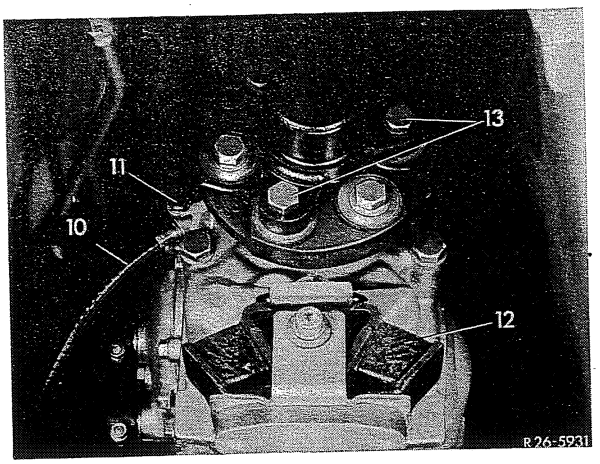
10 Loosen universal shaft clamping nut.

Note: To maintain balanced condition, mark companion plate in relation to universal shaft.

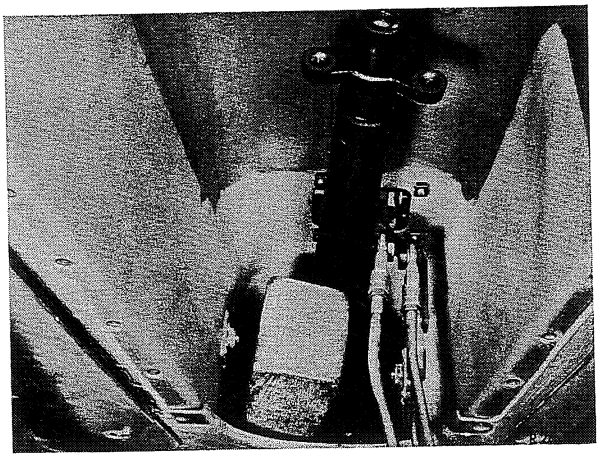


11 Unscrew universal shaft on transmission in such a manner that the universal plate remains on three-legged flange of transmission.

12 Slide universal shaft toward the rear as far as the center bearing and the clamping piece permit.



13 Place suitable piece of wood underneath universal shaft in front of tunnel, so that shaft is pushed completely up.

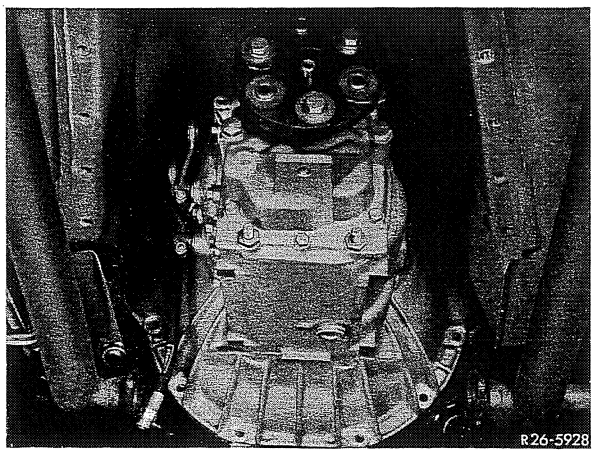


14 Unscrew bolts for attaching starter and push starter out of its holding bracket.

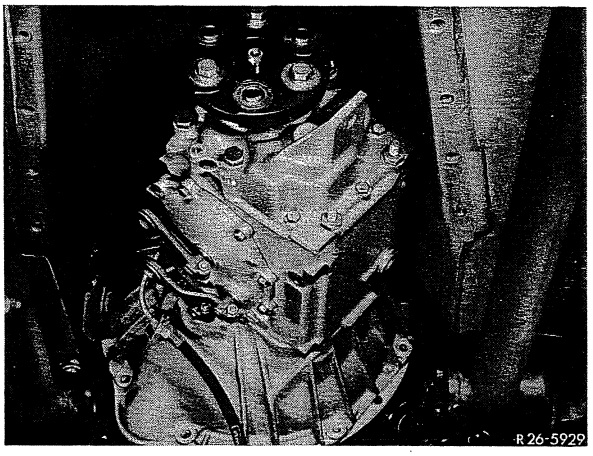
Note: No nut is provided for upper starter bolt, since the threads are inside the starter flange.

15 Unscrew all bolts for attaching transmission to intermediate flange and remove the upper two bolts last.

Note: As a result of the heavy ribbing of the clutch housing most of the fastening bolts can only be reached by means of a 17 mm or 19 mm insert and extension.



16 Prior to pulling out of fitted round center, **turn transmission for at least 45° to the left,** so that the starter domes on both sides of clutch housing cannot abut against front tunnel edge.



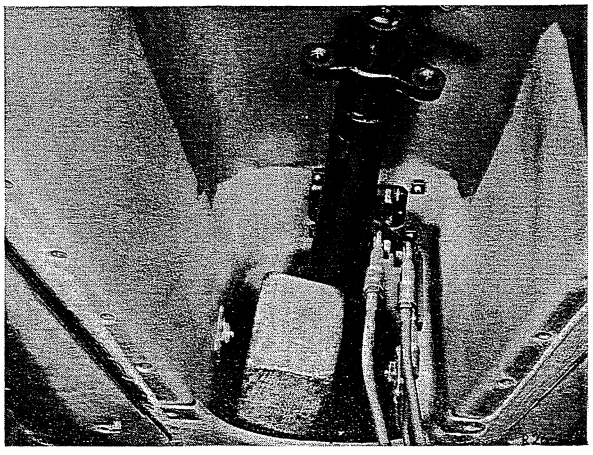
17 Pull inclined transmission horizontally out of round center and clutch and then remove in downward direction.

Attention!
Tilt transmission to the rear only when the drive shaft is safely pulled out of driven plate hub. If this instruction is not observed, damage to driven plate may result.

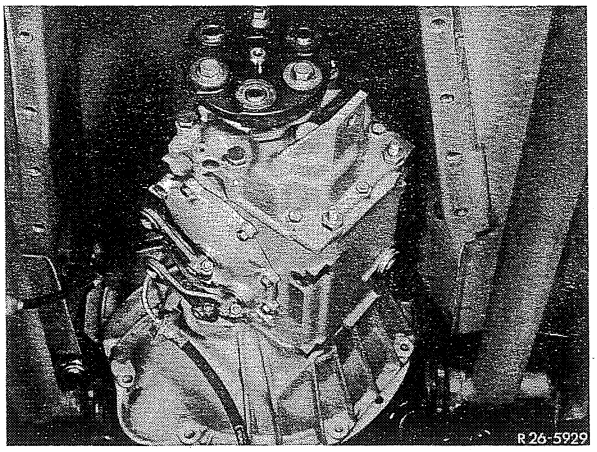
Installation

18 Grease centering pin and splining on transmission drive shaft **lightly** with approved grease types.

19 Push universal shaft at front completely up against tunnel and hold in this position by means of a suitable piece of supporting wood.

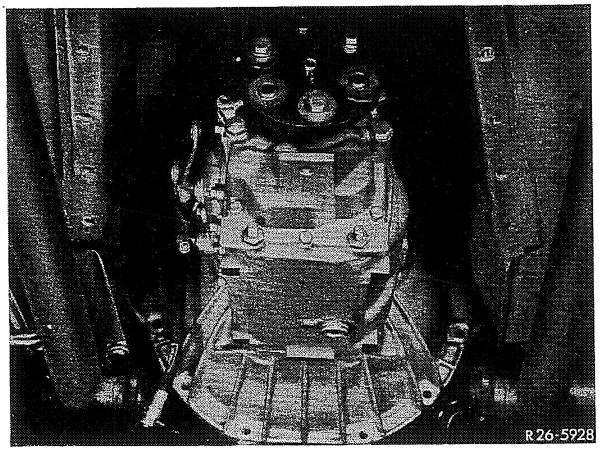


20 Engage one gear step and then introduce transmission at a longitudinal tilt of at least 45° toward the left into tunnel. Then introduce **horizontally** into clutch and fit round center while rotating transmission main shaft in both directions until the splinings of the input shaft and the driven plate are in alignment.



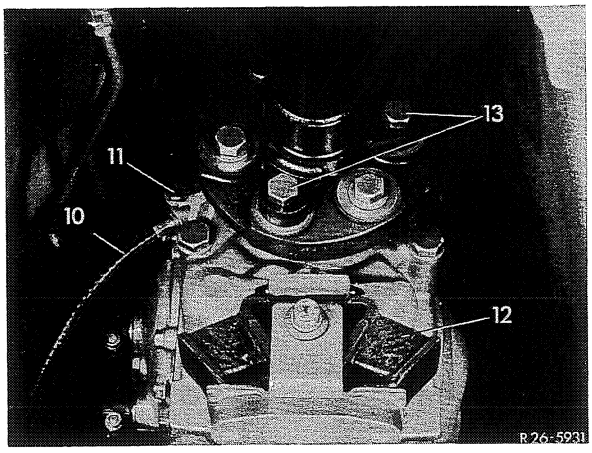
21 Turn transmission to its normal position and screw to intermediate flange by means of pertinent fastening bolts, starting from the top. Watch out for grounding cable at left.

22 Insert starter into holder on intermediate flange and tighten by means of the two fastening bolts.



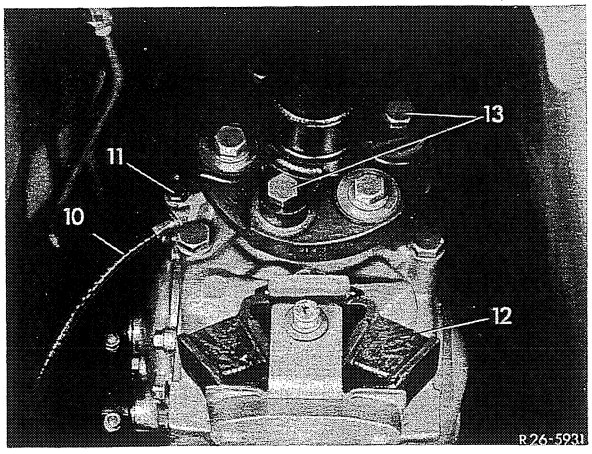
23 Remove wooden supports under universal shaft and screw shaft to transmission while paying attention to the respective marks, so that the balance condition between universal shaft and transmission remains intact. To do so, lift engine and transmission by means of a vehicle jack or pit lift as required.

24 If previously removed, check rear engine mount (12) and screw to transmission.



25 Attach transmission shift rods and secure with SL locks.

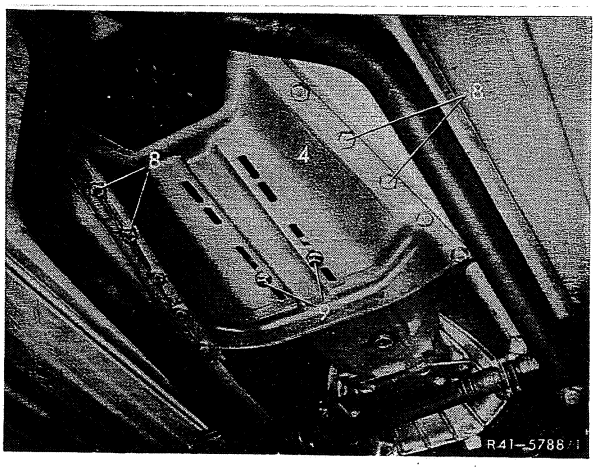
26 Attach drive shaft (10) for tachometer to rear transmission housing cover and tighten clamping bolt (11).



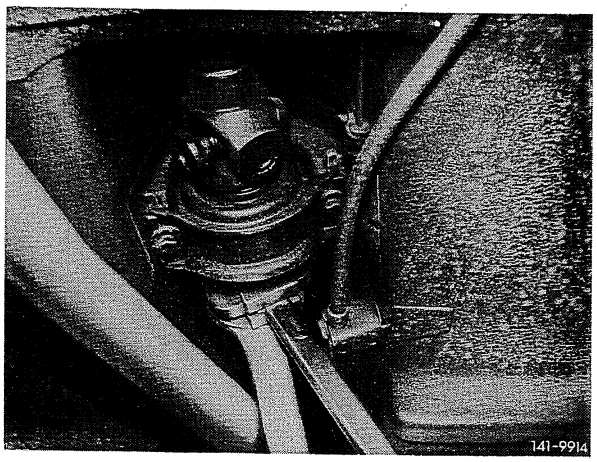
27 Mount tunnel closing plate (4). Tighten the twelve fastening bolts (8) uniformly.

28 Insert both fastening bolts (9) for rear engine mount on tunnel closing plate and tighten.

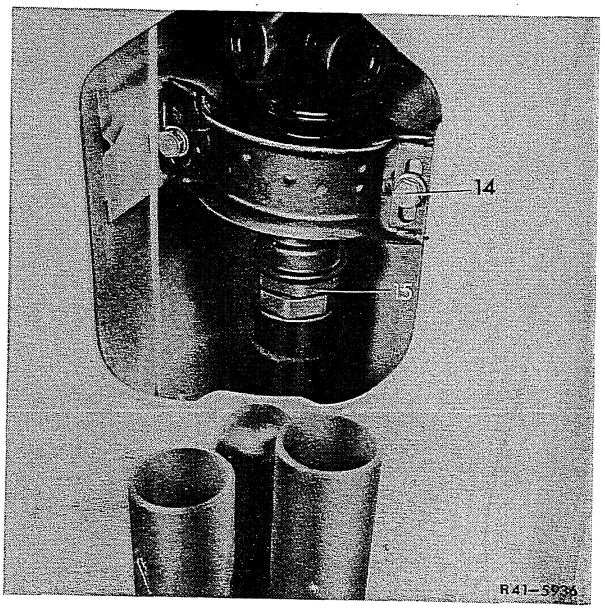
29 Position fastening bolts for universal shaft intermediate bearing, but do not yet tighten.



30 Move vehicle several times back and forth and then tighten universal shaft clamping nut to a tightening torque of 30—40 Nm (3—4 kpm).

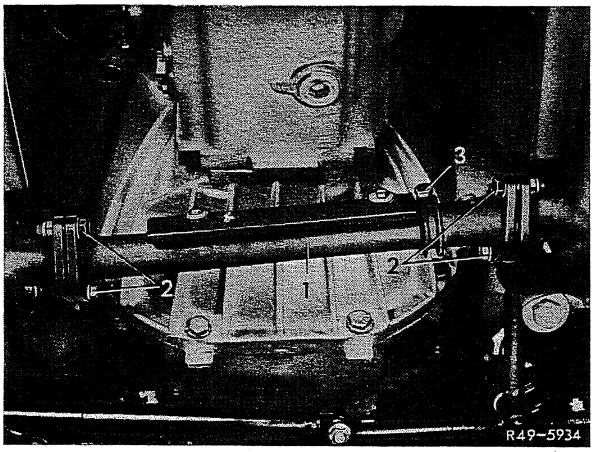


31 Tighten fastening bolts of universal shaft intermediate bearing.

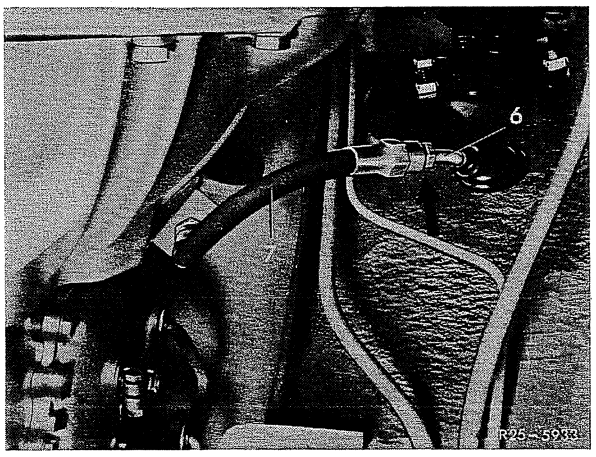


32 Mount exhaust system.

33 Install compensating connection (1) between the two exhaust pipes at front. Tighten flange bolts (2) uniformly, since otherwise leaks might occur.



34 Screw pipe line (6) of hydraulic clutch actuation with clutch hose (7) to hose screw connection (arrow).



35 Vent hydraulic clutch actuation from bottom in upward direction and correct fluid level in combined expansion tank for brake and clutch system (25–230).

36 Connect grounding cable to battery.

37 Check transmission and clutch for perfect function.

Note

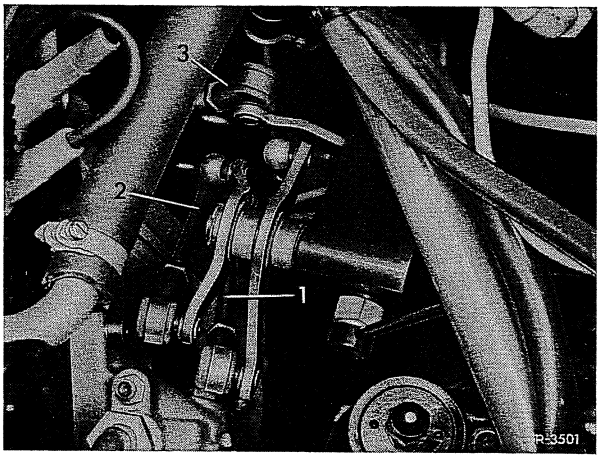
The following description covers removal and installation of transmission for models 114 and 115.

For models 116.020/024/025 assembly is essentially the same, so that these instructions can be applied.

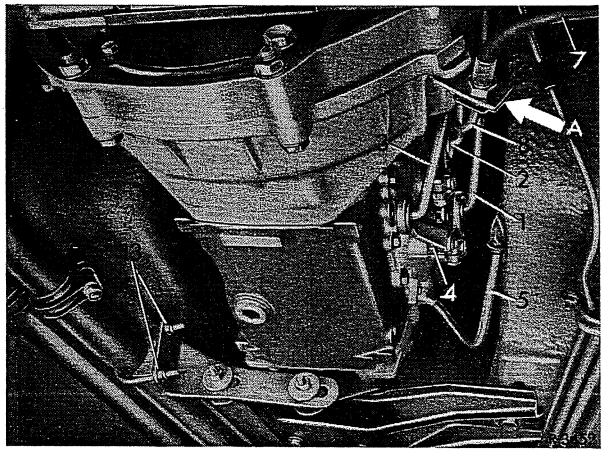
Removal

1 Disconnect grounding cable on battery.

2 Disconnect shift rods: On steering column shift, disconnect shift rods (1 and 2) on shift bracket, and shift rod (3) on reversing shift lever of transmission shift cover.



Shift lever on shift bracket of steering column shift



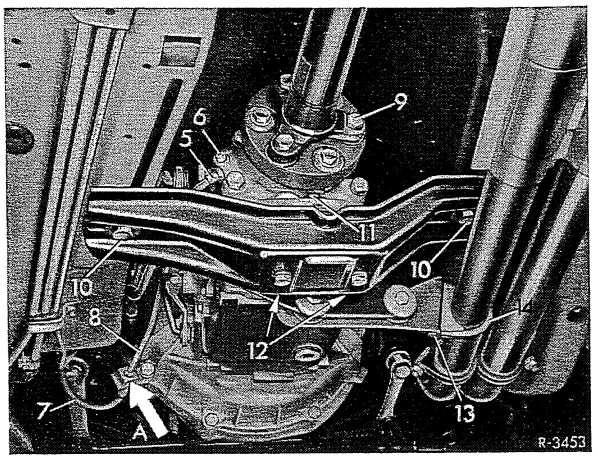
Shift lever on transmission shift cover of steering column shift

On floor shift, disconnect shift rods of shift levers on transmission shift cover.

3 Loosen drive shaft (5) for tachometer on rear transmission cover and pull off.

4 Separate pipe line (8) to slave cylinder on hose screw connection "A" (arrow).

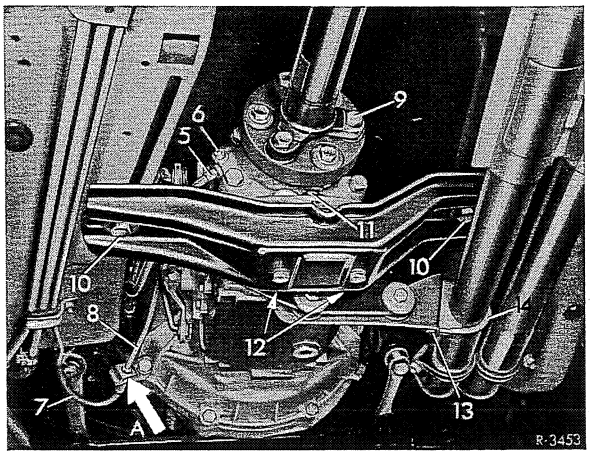
Note: Close lines with blind plugs or draw fluid from respective chamber of combination supply tank to prevent the brake fluid from running out.



5 Support transmission with a pit lift or vehicle jack.

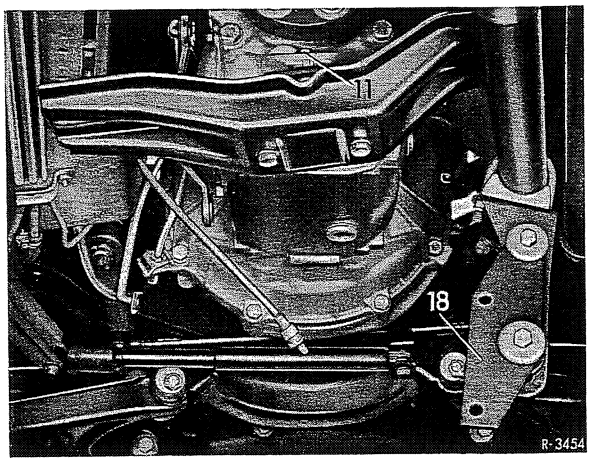
6 Unscrew bolts (10) for engine mount on frame floor.

7 Unscrew nuts (12) for exhaust support (18).

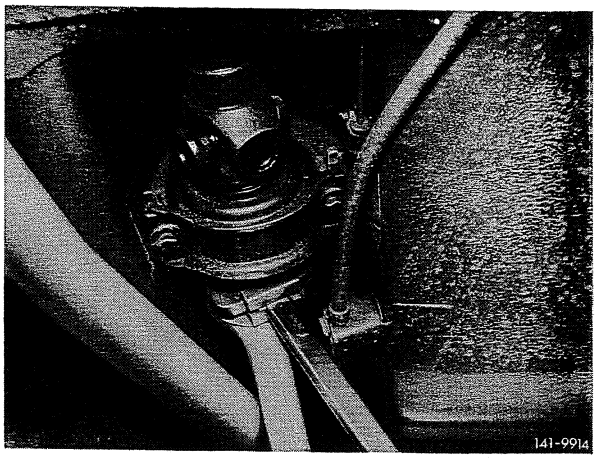


8 Loosen nuts (13) for clamp (14) and turn exhaust support in downward direction.

9 Unscrew nut (11) for rear engine mount and remove cross member together with engine mount.

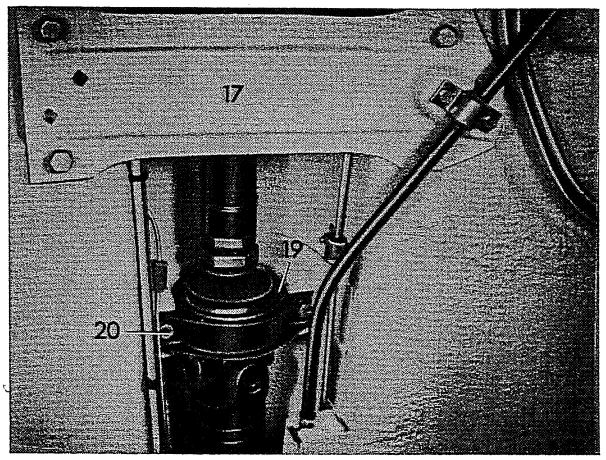


10 Loosen clamping nut of universal shaft.



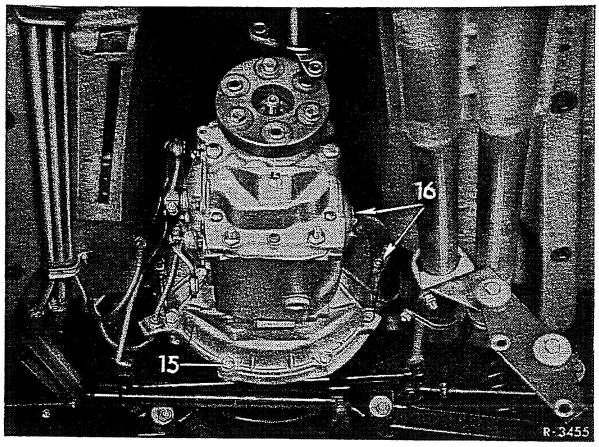
11 Loosen bolts (20) of universal shaft intermediate bearing, but do not unscrew.

12 Mark companion plate in relation to universal shaft to maintain balanced condition.

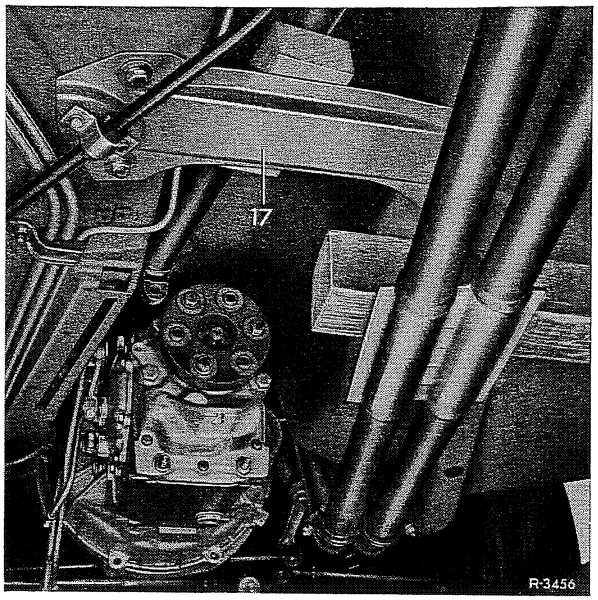


13 Unscrew universal shaft on transmission in such a manner that the companion disk remains on three-legged flange of transmission.

14 Slide universal shaft toward the rear as far as the intermediate bearing and the clamping piece permit.

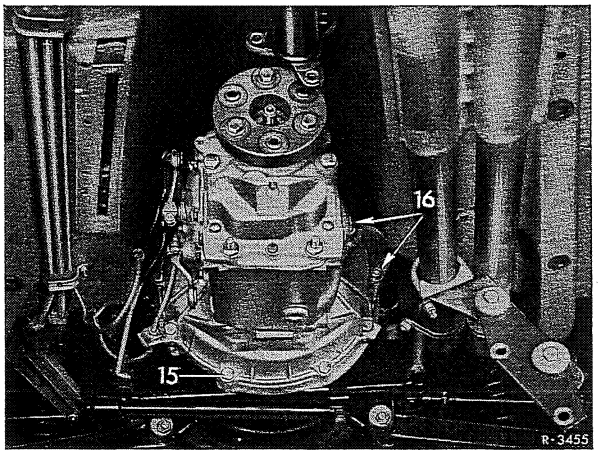


15 Push universal shaft upwards and place suitable piece of wood underneath at bridge (17).



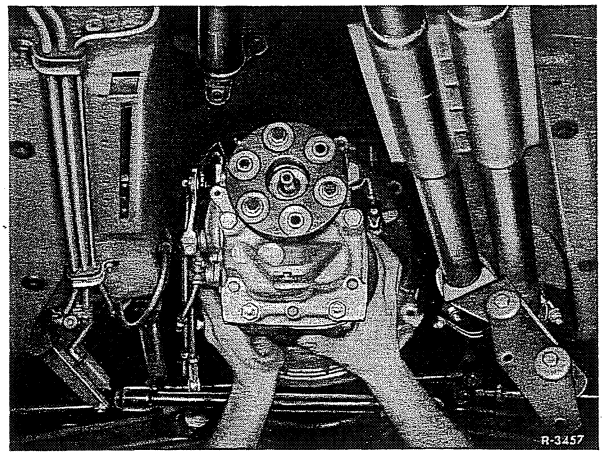
16 Unscrew bolts (16) for attaching starter and push starter out of its holder.

17 Unscrew all bolts for attaching transmission to intermediate flange while removing the two upper bolts last.



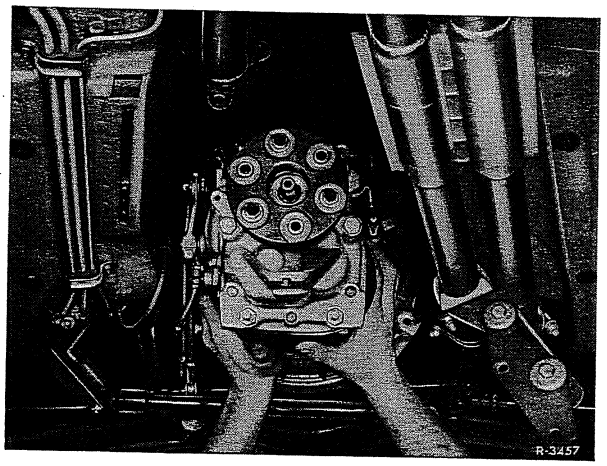
18 Pull transmission horizontally toward the rear out of round fitted center and clutch and then remove in downward direction.

Attention!
Tilt transmission to the rear only when the drive shaft is safely pulled out of driven plate. If this instruction is not observed, damage to driven plate may result.



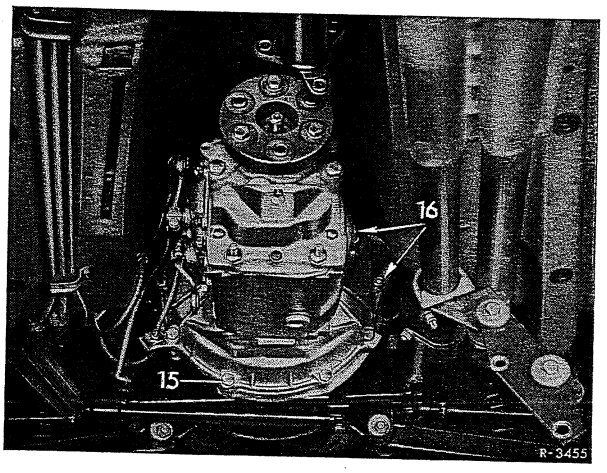
19 **Slightly** grease centering pin and splining on transmission input shaft with approved grease types.

20 Engage one gear step, then insert transmission horizontally into clutch while turning transmission main shaft back and forth until the splinings of input shaft and driven plate match.



21 Tighten transmission with fastening bolts starting from the top. Make sure that the grounding cable is not squeezed in.

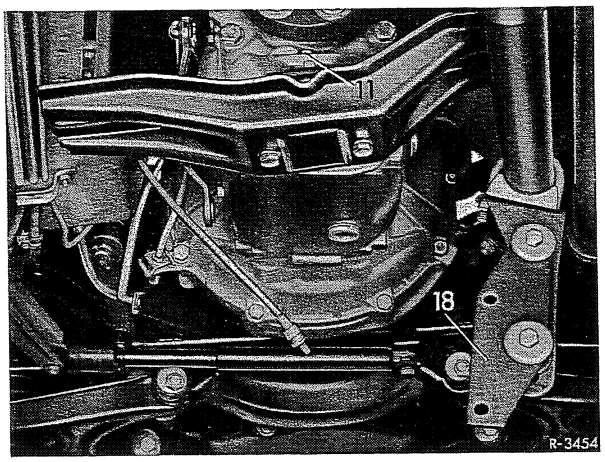
22 Insert starter into fit and tighten with bolts. Also screw grounding cable to the bottom bolt.



Attention!
Tighten starter without heli-coil insert bolts only to 60 Nm (6 kpm).

23 Pull universal shaft in slide piece apart to permit flanging to transmission. Pay attention to marks.

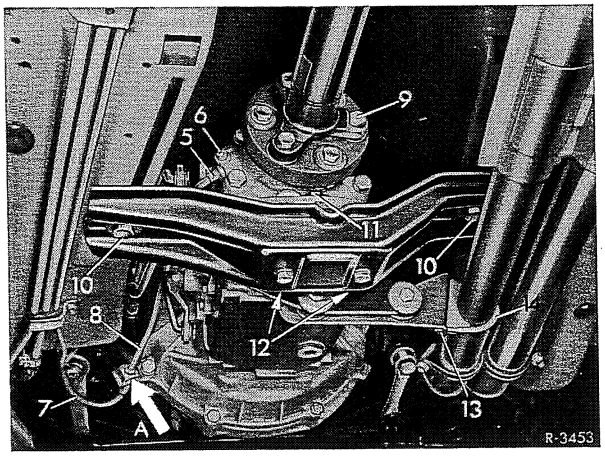
24 Screw cross member and rear engine mount to transmission by means of nut (11).



25 Connect input shaft (5) for tachometer to rear transmission cover and tighten with bolt (6).

26 Connect pipe line (8) toward slave cylinder to hose screw connection "A" (arrow).

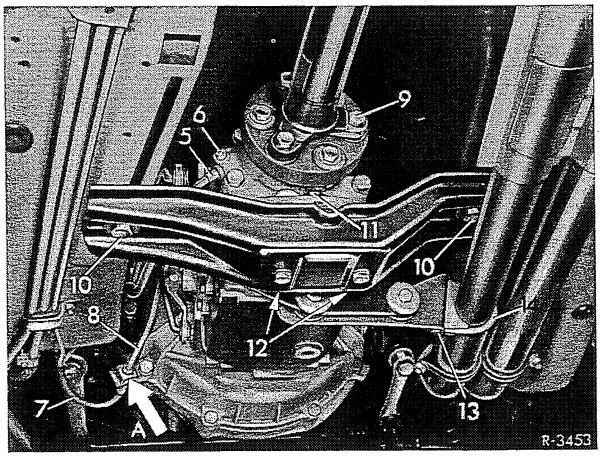
27 Turn exhaust support (18) upwards, plug bolts to rear transmission cover and tighten with nuts (12).



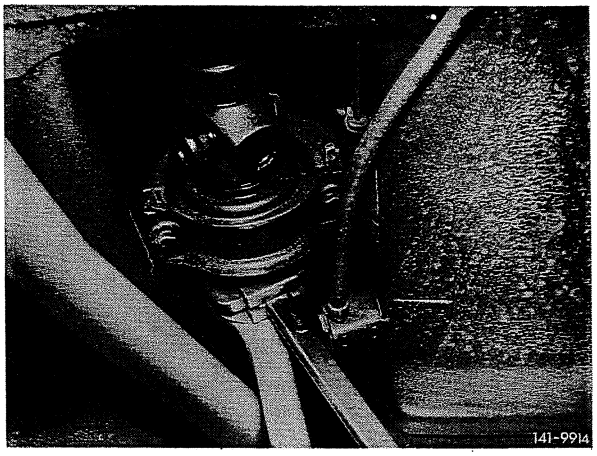
28 Lower pit lift or vehicle jack on transmission and on rear axle.

29 Tighten nuts (13) for clamp (14) of exhaust support (18).

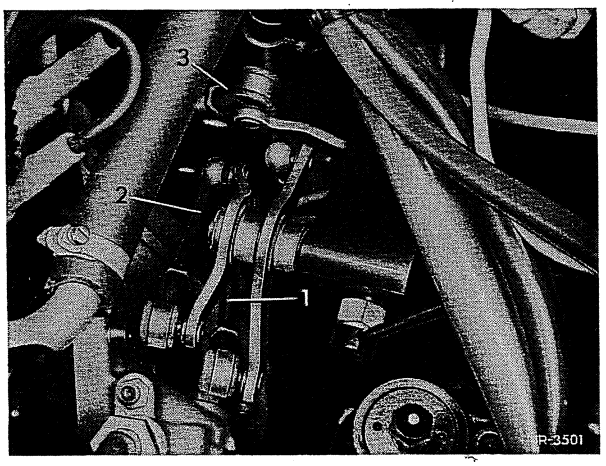
30 Move vehicle several times back and forth on its wheels and then tighten universal shaft intermediate bearing free of tension.



31 Tighten universal shaft clamping nut to a tightening torque of 30–40 Nm (3–4 kpm).



32 Attach shift rods: For steering column shift, attach shift rods (1 and 2) on bearing body and shift rod (3) in reverse speed shift lever (4) to transmission shift cover. For floor shift, attach shift rods on shift levers to transmission shift cover and secure with SL locks.



33 Bleed hydraulic clutch actuation (25–230).

34 Check oil level in transmission and correct, if required.

35 Connect grounding cable to battery.

36 Check transmission and clutch for perfect function.

C. Model 123

Note

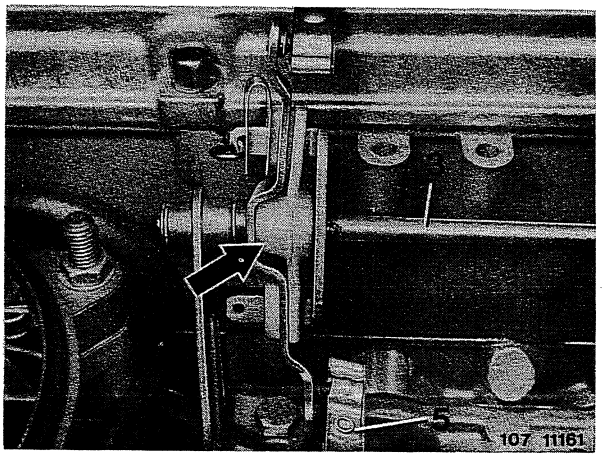
The following description covers removal and installation of transmission for model 123.026. For models 123.020/023/030/033/043/050/053 and 123.1 assembly is essentially the same, so that these instructions can be applied. Note special deviations.

Removal

1 Disconnect grounding cable on battery.

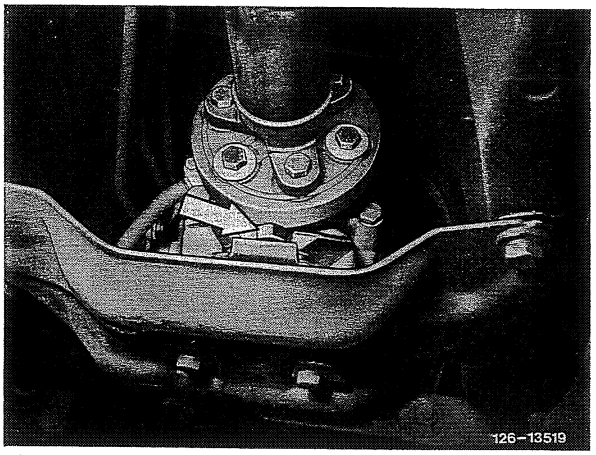
2 Completely remove exhaust system (models 123.030/033/050 and 053 only).

3 On models 123.030/033/050 and 053 additionally disconnect regulating shaft (3).

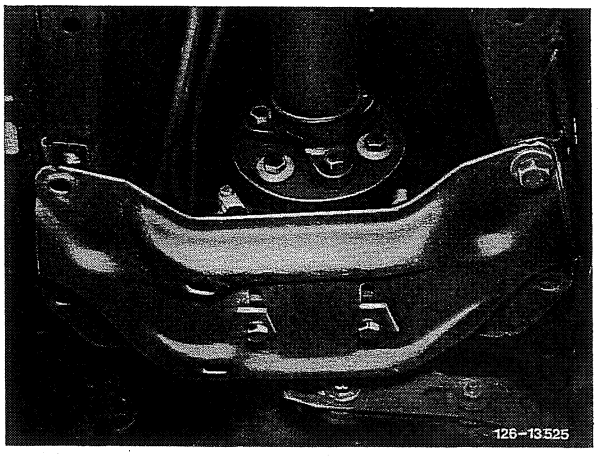


4 Support transmission with a pit lift or vehicle jack.

5 Unscrew engine mount on rear transmission cover.

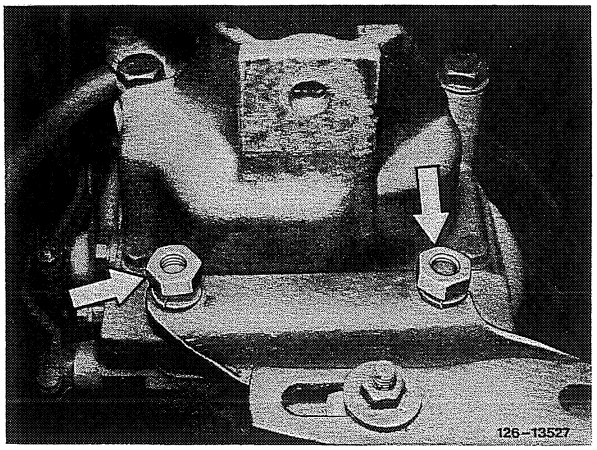


6 Unscrew engine mount on frame floor.



7 Unscrew nuts for exhaust support.

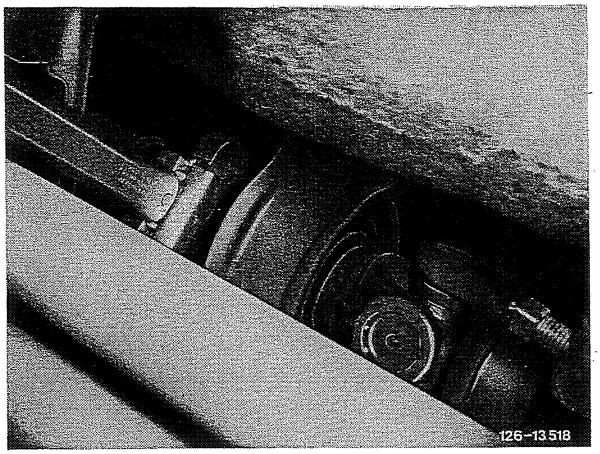
8 Unscrew nuts from clamp and remove exhaust support.



9 On models 123.030/033/050/053, additionally unscrew shield under universal shaft intermediate bearing.

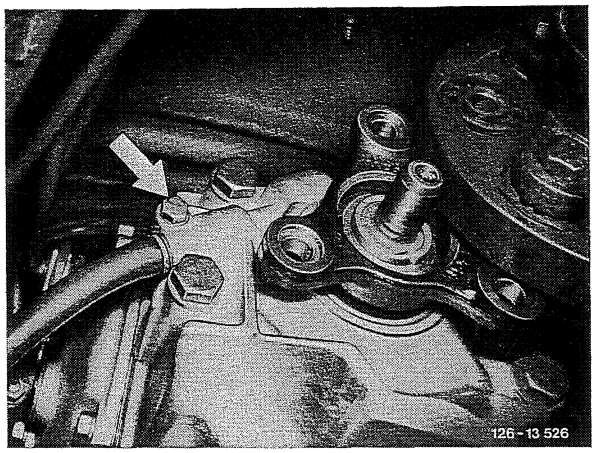
10 Loosen clamping nut of universal shaft.

11 Loosen screws for universal shaft intermediate bearing, but do not yet screw out.

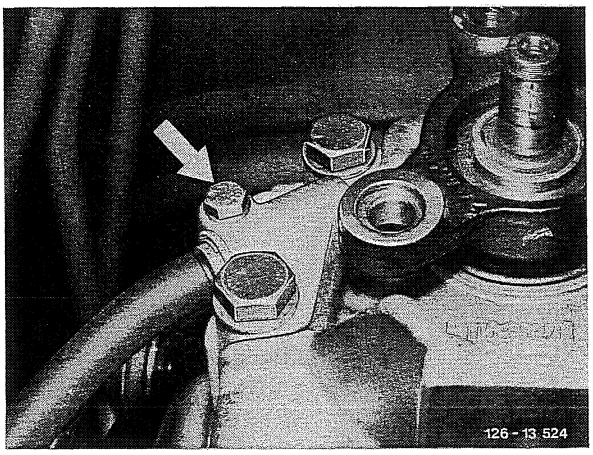


12 Unscrew universal shaft on transmission in such a manner that the companion plate remains on universal shaft.

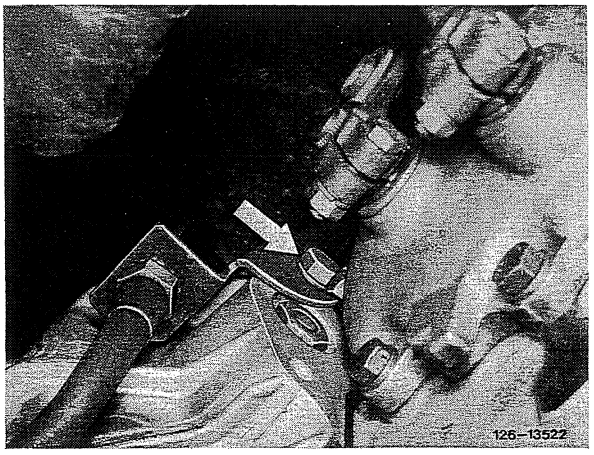
13 Push universal shaft toward the rear to the extent permitted by intermediate bearing and clamping piece.



14 Loosen drive shaft for tachometer on rear transmission cover and screw off.



15 Unscrew holder for line on clutch housing.



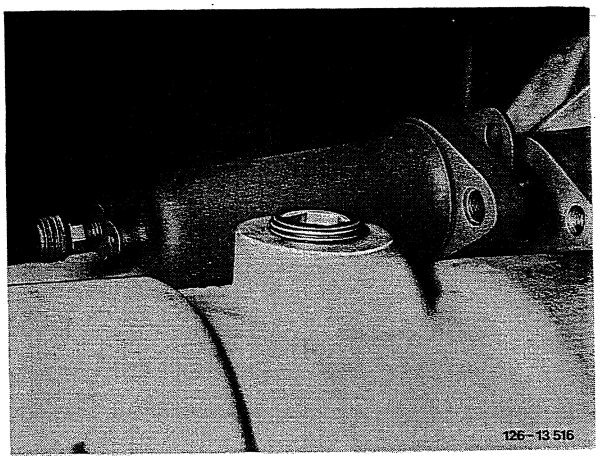
16 Unscrew slave cylinder and pull with line toward the rear until the push rod is released from clutch housing.

17 Remove shift rods after pushing SL locks from transmission shift levers.

18 Unscrew bolts holding starter and push starter out of its holder.

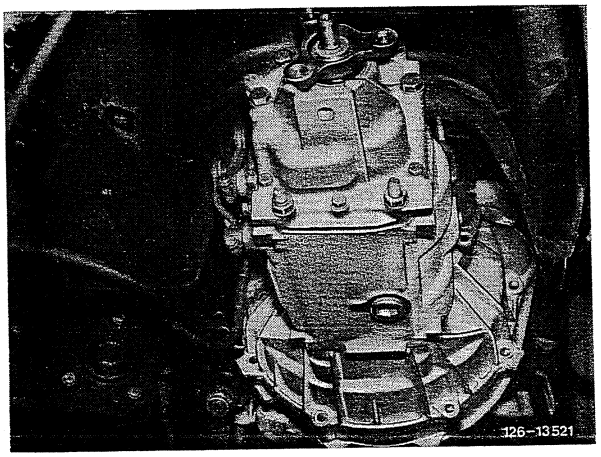
Note: No nut is provided for upper starter bolt. Here, the threads are in starter flange.

19 Unscrew all bolts for attaching transmission to intermediate flange, removing the two upper bolts last.



20 Pull transmission horizontally out of round fitted center and clutch toward the rear and then remove in downward direction.

Attention!
Tilt transmission to the rear only when the drive shaft is safely pulled out of driven plate. If this instruction is not observed, damage to driven plate may result.

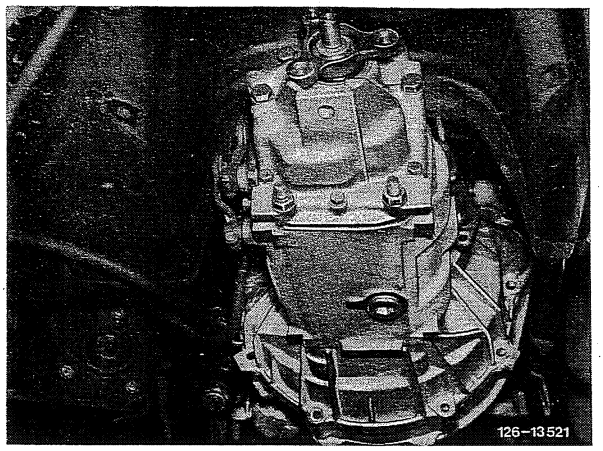


Installation

21 Grease centering pin and splining on transmission drive shaft lightly with approved grease types.

Attention!
Before horizontal installation of transmission, place slave cylinder with line above transmission.

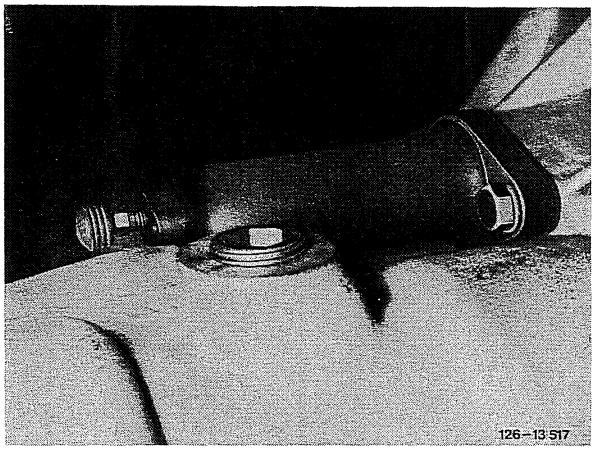
22 Engage one gear step and then introduce transmission horizontally while rotating transmission main shaft in both directions until the splinings of the input shaft and the driven plate are in alignment.



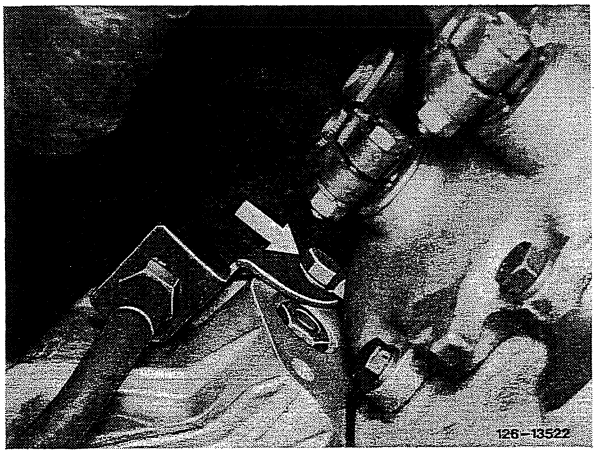
23 Screw transmission to intermediate flange while making sure that the holder for the tachometer drive shaft and the grounding cable is also screwed on.

24 Insert starter into holder of intermediate flange and tighten by means of the two bolts.

25 Introduce slave cylinder with push rod into clutch housing and tighten. Make sure of correct seat of plastic shim.

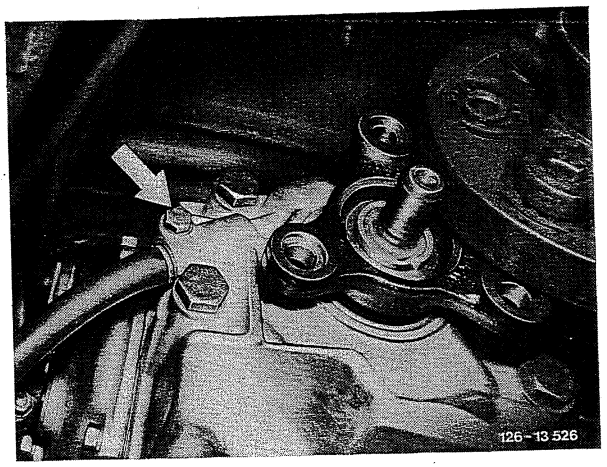


26 Screw holder for line to clutch housing.

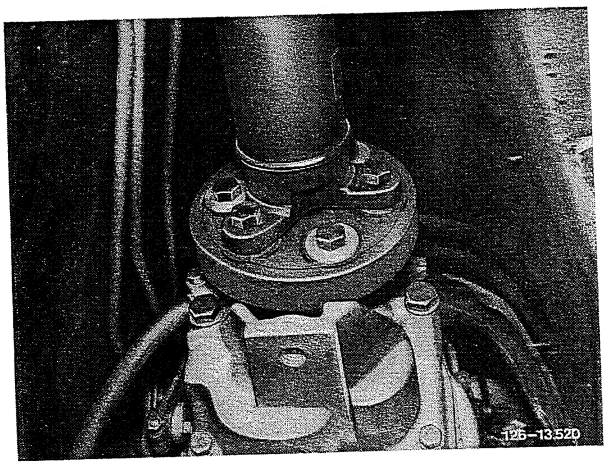


27 Attach transmission shift rods and secure with SL locks.

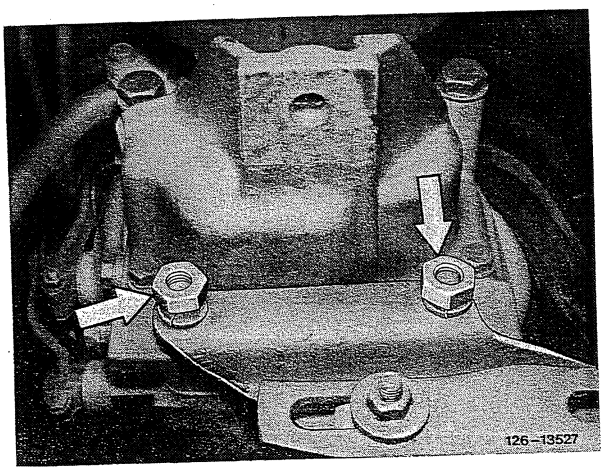
28 Connect drive shaft for tachometer to rear transmission cover.



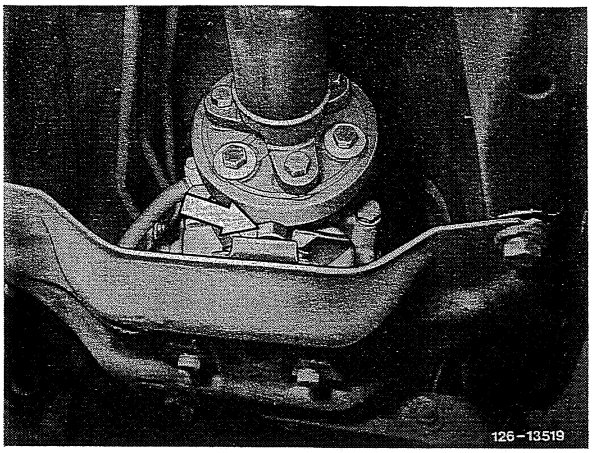
29 Pull universal shaft in slide piece apart as far as possible and flange to transmission. For this purpose, raise engine and transmission with a pit lift or vehicle jack.



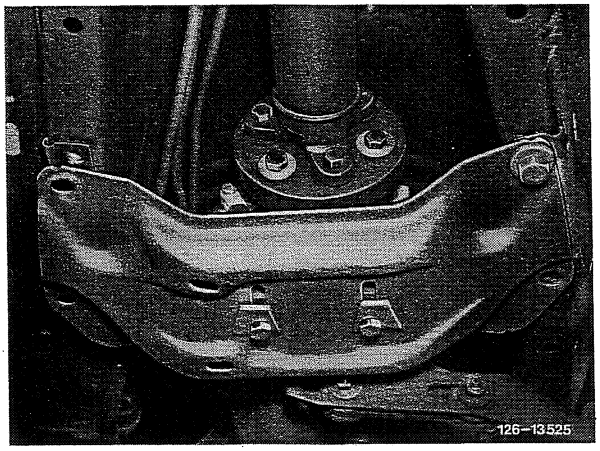
30 Screw exhaust holder to rear transmission cover.



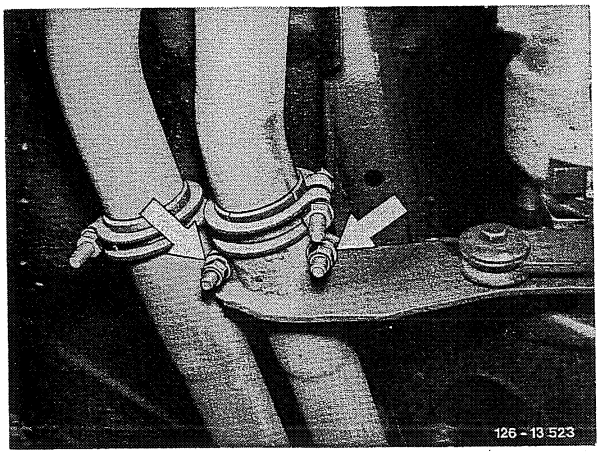
31 Screw rear engine mount with engine carrier to transmission.



32 Screw engine carrier to frame floor.

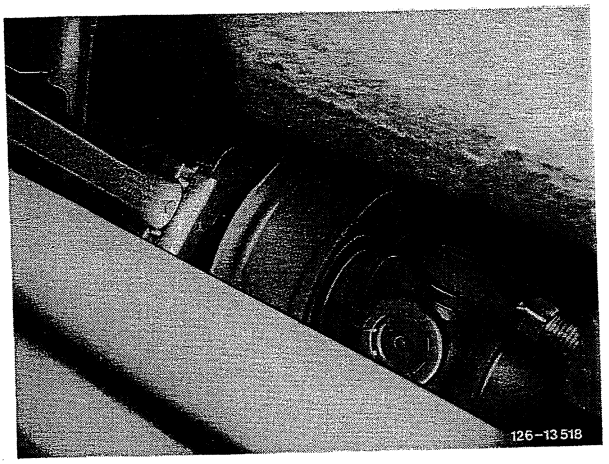


33 Tighten nuts for clamp of exhaust support.



34 Move vehicle several times back and forth on its wheels and then tighten universal shaft intermediate bearing free of tension.

35 Tighten universal shaft clamping nut to a tightening torque of 30—40 Nm (3—4 kpm).

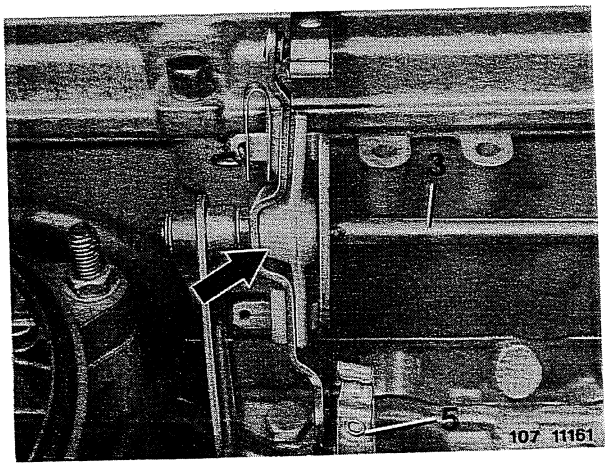


36 Check adjustment of gear shift.

37 On models 123.030/033/050/053 additionally mount shield to universal shaft intermediate bearing.

38 Install complete exhaust system (models 123.030/033/050/053 only).

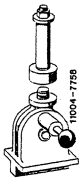
39 On models 123.030/033/050/053 attach regulating shaft (3).



40 Connect grounding cable to battery.

41 Check transmission and clutch for perfect function.

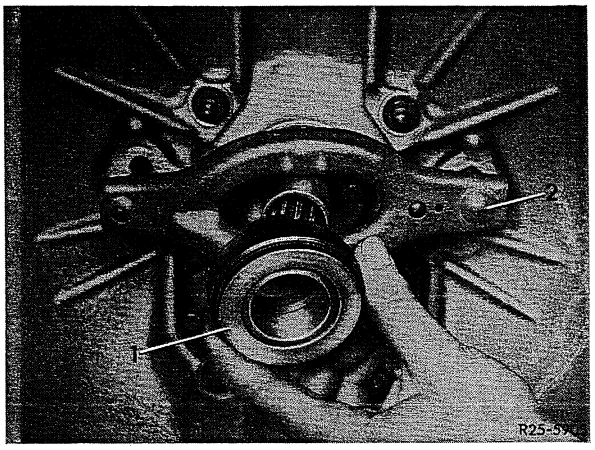
Special tool

Clamping device		111 589 08 31 00

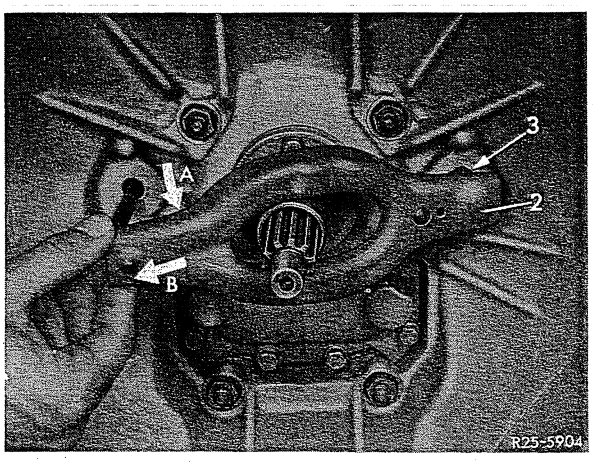
Note

For replacements, the transmissions are supplied without clutch housing.

1 Remove clutch throwout (1) on front transmission cover.

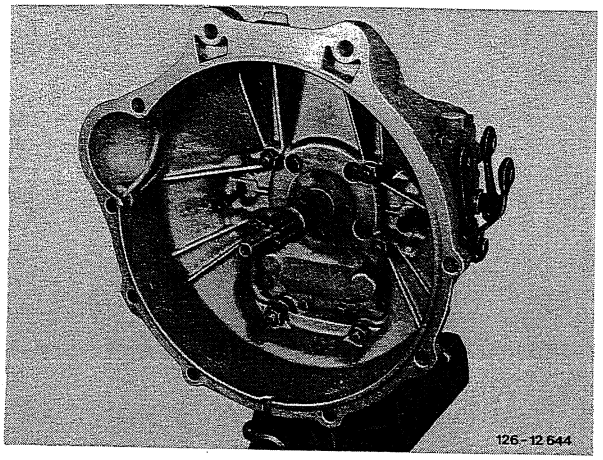


2 Move throwout rocker (2) in direction of arrow A and then pull from ball pin (3) on clutch housing in direction B and remove.

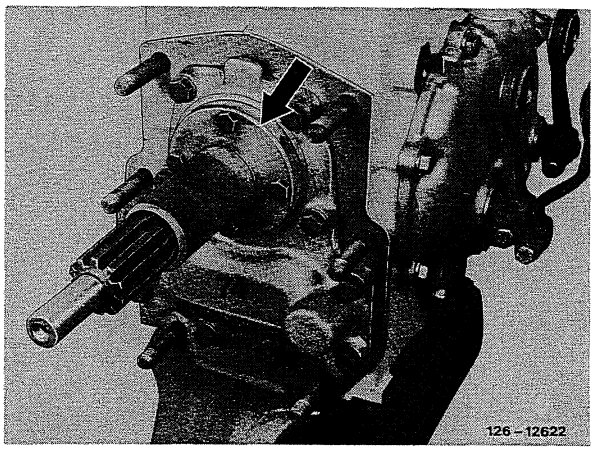


Screwing-off

3 Uniformly loosen tightening nuts for clutch housing and remove together with shaft washers.



4 Knock clutch housing from fitted flange (arrow) on front transmission housing cover with light hammer blows and remove from studs.

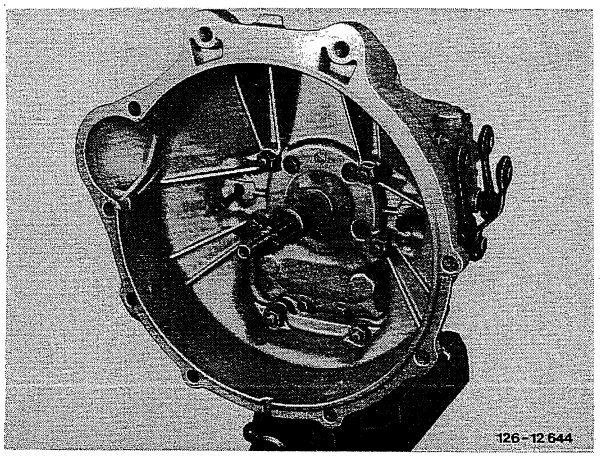


Screwing-on

5 Slip clutch housing on studs of transmission housing and force onto fitted flange on front transmission housing cover by means of light hammer blows until seated against parting surface on transmission housing.

6 Position fastening nuts with shaft washers and tighten uniformly.

7 Attach clutch throwout rocker and clutch throwout.

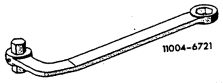
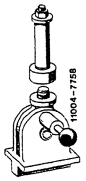


Oil grades/filling capacities

Automatic transmission fluid type A, Suffix A	refer to specifications for service products page 236.1, 236.2	
Filling capacities	G 76/18 716.0	1.6
	716.1	1.8

Tightening torque	Nm	(kpm)
Fastening bolts for shift cover	15	(1.5)

Special tools

Allen-box wrench combination 14 x 17 mm for oil drain plug		000 589 24 07 00
Clamping device		111 589 08 31 00

Revisions

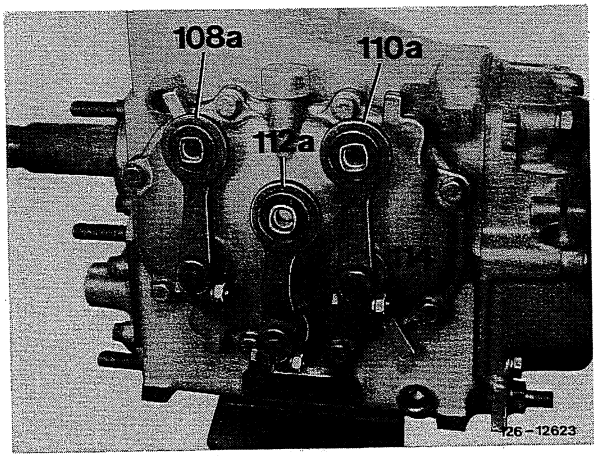
Designation	Transmission	as from transmission no.
Increase of breather neck on transmission shift cover by means of a spacer sleeve	G 76/18	124 950
Increase of breather neck on transmission shift cover in casting. No spacing sleeve (on G 76/18)	G 76/18	315 700
	716.100	as from start of series
Sealing of needle sleeve for gear-shifting shaft bearing 1st and 2nd speed changed from lip sealing ring to O-ring	716.001	006 336
	716.002	771 951
	716.003	as from start of series
	716.100	008 471

Transmission breather replaced by end cap, breather neck on transmission shift cover reinforced	716.001	048 101
	716.002	093 500 (as from 18.12.1974)
	716.003	083 420
	716.100	013 684
Gear-shifting shaft bearing for 3rd and 4th speed changed from sintered bushing to needle bushing, shift detent now without groove	716.001	062 678
	716.002	225 200
	716.003	147 722
	716.100	015 780

Removal

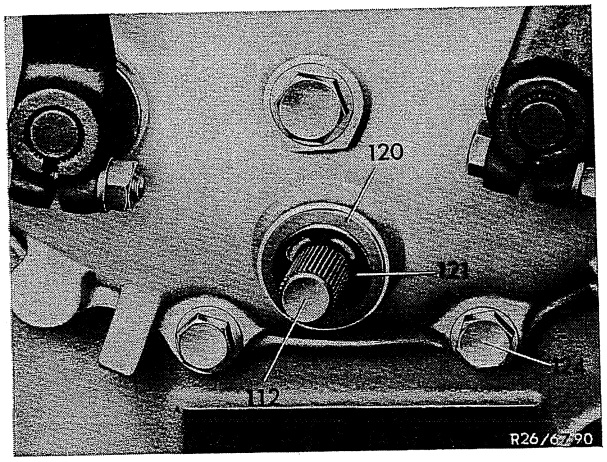
1 Drain transmission fluid.

2 Remove shift lever (112a) for reverse speed after loosening clamping bolt.

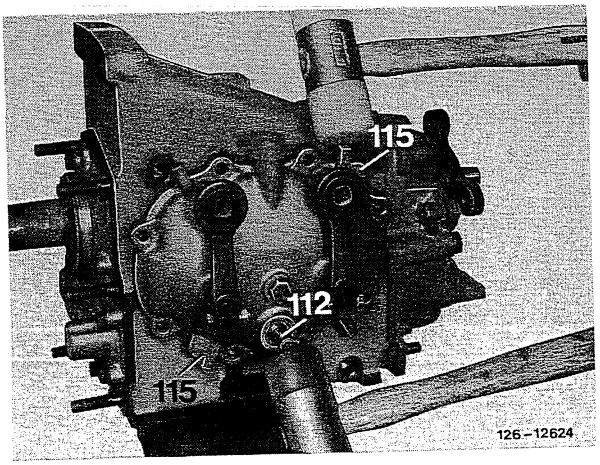


3 Force lock washer (121) from gear shifting shaft (112) for reverse speed and remove washer (120).

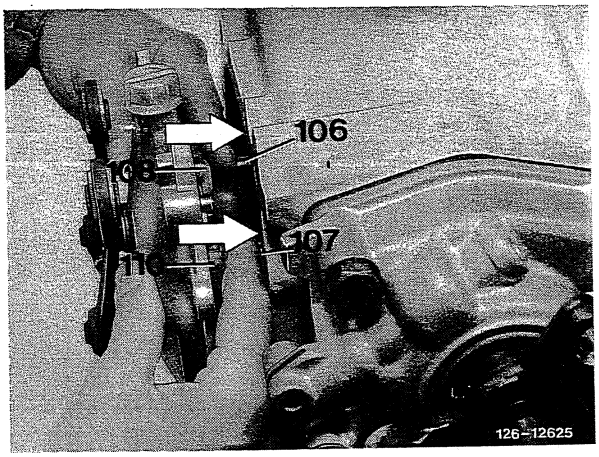
4 Unscrew fastening bolt (124) for shift cover (114).



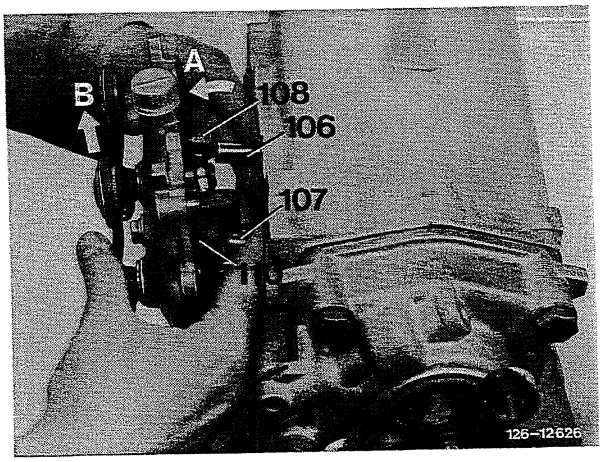
5 Carefully knock shift cover from fitted pins (115) while simultaneously moving gear shifting shaft (112) for reverse speed by means of a second hammer inwards until the distance between the gear shifting cover and the parting surface of the transmission housing is so large that the flat hand can be inserted in between.



6 Remove shift forks (106 and 107) in direction of arrow out of shift rockers (108 and 110).



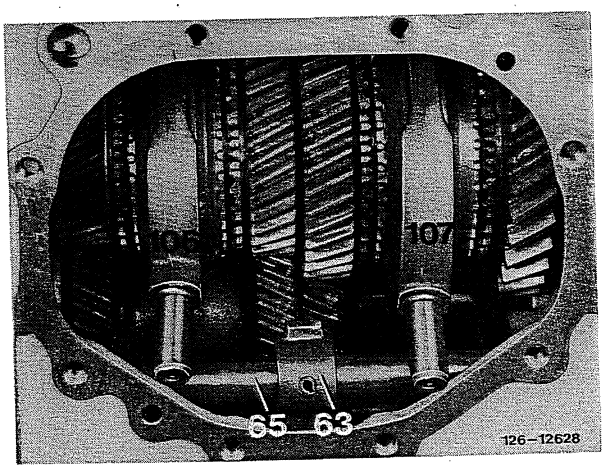
7 Tilt shift cover first in direction of arrow A, then move in direction of arrow B and remove.



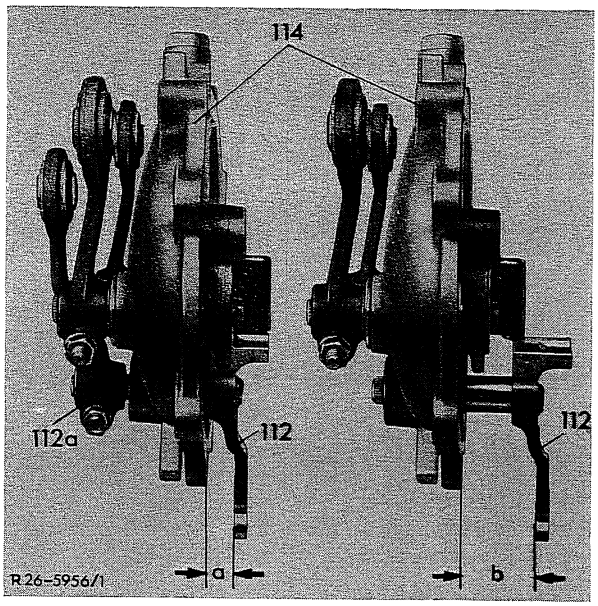
Installation

8 Glue new paper seal with grease on carefully cleaned parting surface on transmission housing.

9 Place shifter (63) for reverse speed shift rod (65) accurately in center position.

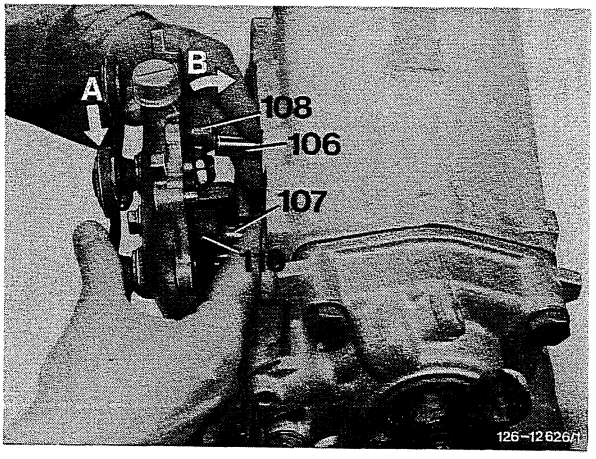


10 Prior to positioning shift cover between shift finger (112) and inside of shift cover, adjust to a distance of approx. 25 mm.

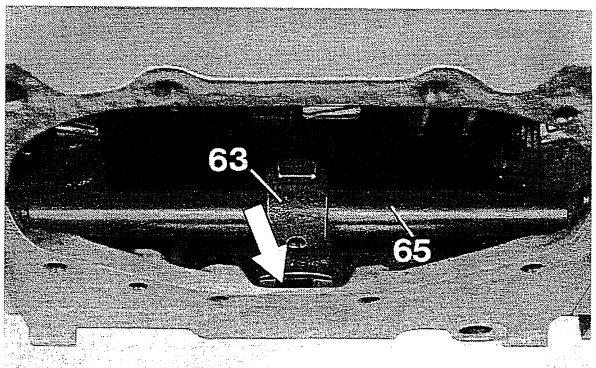


a 10 mm
Distance between parting surface and shift finger with cover ready for operation
b approx. 25 mm
assembly-oriented distance between shift lever and cover
112 Shift finger with shaft for reverse speed
112a Shift lever for reverse speed
114 Shift cover

11 Move shift cover in direction of arrow A in such a manner that the shift finger (112) for reverse speed enters the groove on shifter (63) (arrow). Then move shift cover in direction of arrow B while simultaneously introducing shift forks (106 and 107) into shift rockers (108 and 110).



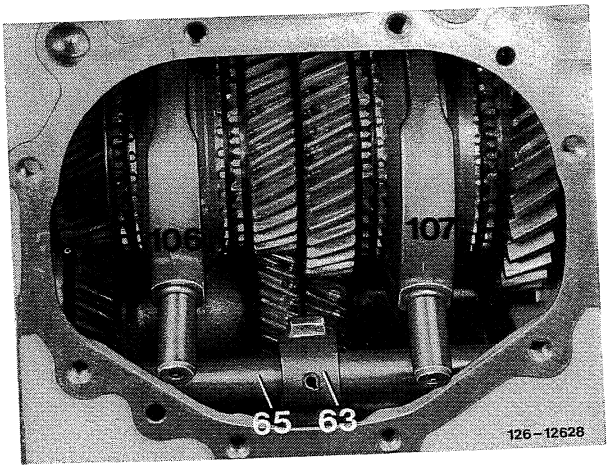
12 Move shift cover against parting surface of transmission housing with light hammer blows, making sure that the shift cover is correctly guided on the two fitted pins. The gear shifting shaft for reverse speed should come out of cover by the same distance the shift cover is moved against the parting surface of the transmission housing.

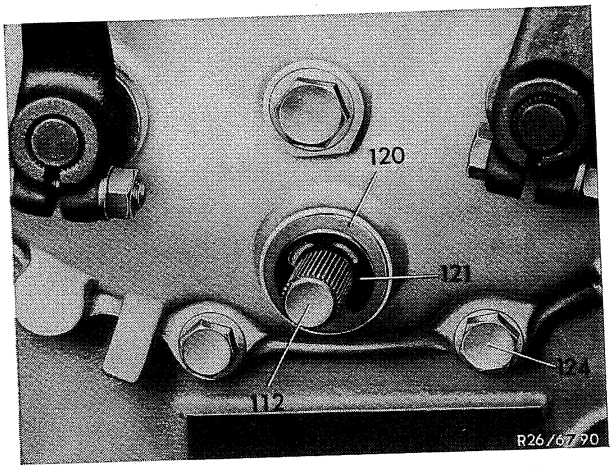


13 Screw down shift cover by means of fastening screws (124) uniformly and crosswise.

Note: To avoid leaks, make bolts and threads in transmission housing free of grease and provide with a non-hardening sealing compound.

14 Mount washer (120) and insert lock washer (121) into ring groove on gear shifting shaft for reverse speed.

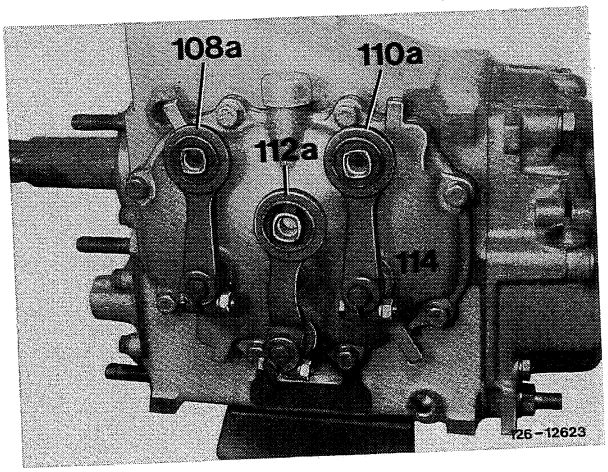




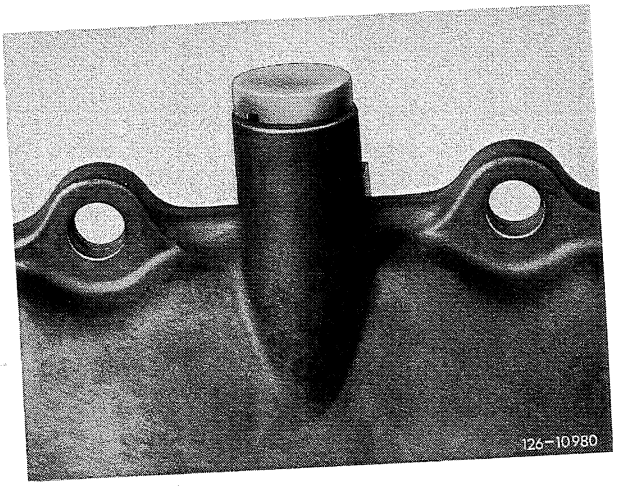
15 Slide shift lever (112a) for reverse speed with reference to adjusting dimension on splining of gear shifting shaft and tighten clamping screw.

16 Check shift cover for function by shifting through all the gears.

17 Fill up with ATF up to overflow at filler hole.

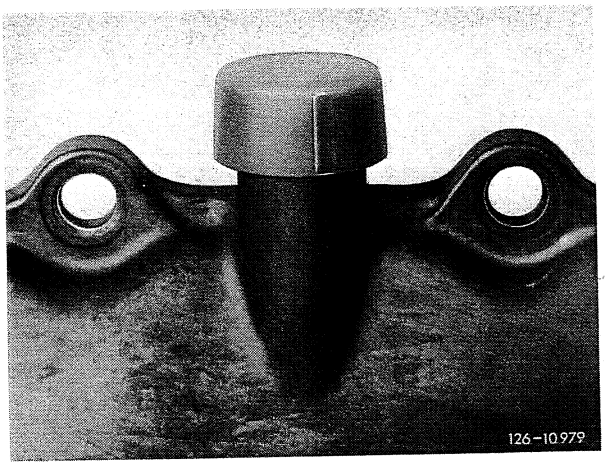


Note: In the event of repairs with regard to transmission 716.003, install end cap and transmission cover with reinforced breather neck.



Transmission breather 1st version

Transmission breather 2nd version



Tightening torque	Nm	(kpm)
Fastening bolt for locking cage in shift cover	25	(2.5)

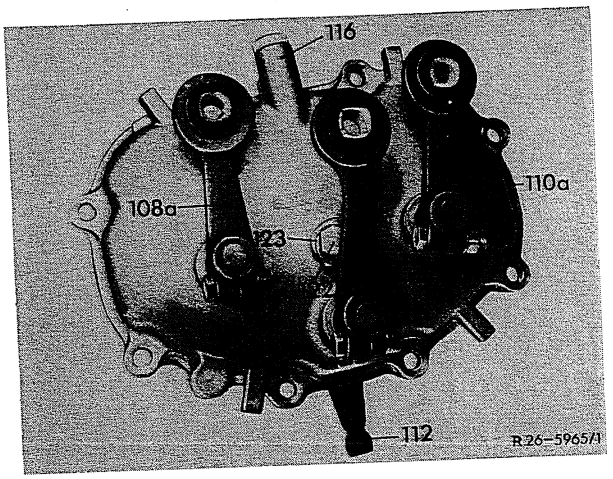
Note

Dimensions of shift covers differ in relation to differences in size between transmission type 716.0 and 716.1.

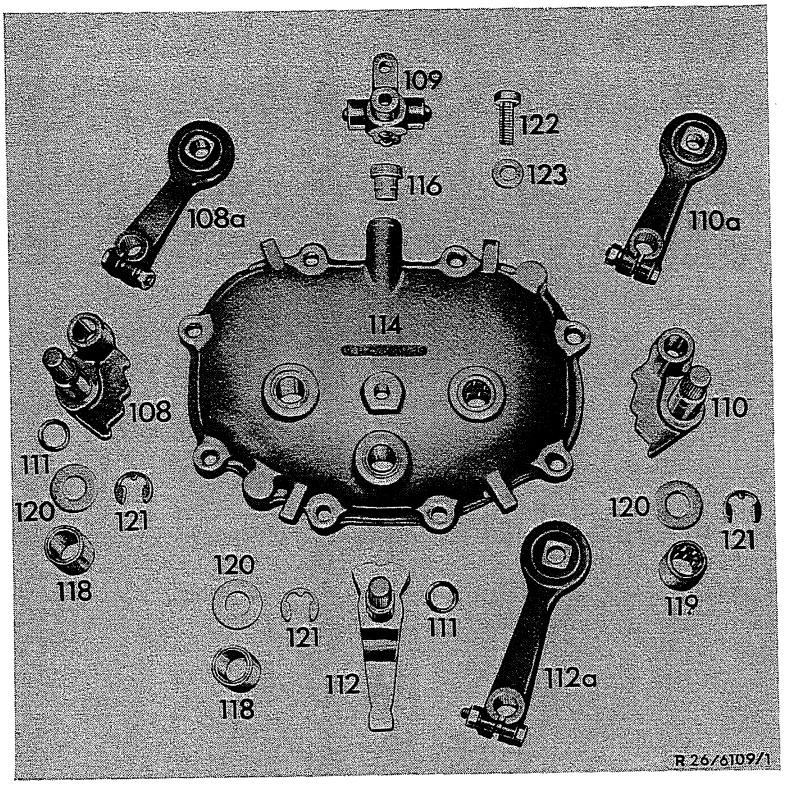
Disassembly

1 Loosen clamping bolts and pull off shift levers.

Note: Shift lever (112a) has already been removed when removing shift cover from transmission.



2 Force lock washers (121) from gear shifting shafts and remove together with washers (120).

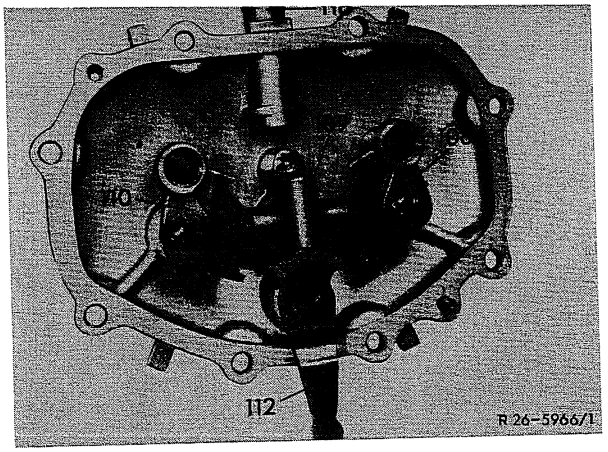


108 Shift rocker for 3rd and 4th speed
108a Shift lever for 3rd and 4th speed
109 Locking cage
110 Shift rocker for 1st and 2nd speed
110a Shift lever for 1st and 2nd speed
111 O-ring
112 Shift finger for reverse speed
112a Shift lever for reverse speed
114 Transmission shift cover
116 Breather
118 Bushing (bearing gear shifting shaft 3rd and 4th speed or reverse speed)
119 Needle bearing (bearing gear shifting lever 1st and 2nd speed)
120 Washer
121 Lock washer
122 Hex. bolt
123 Sheet metal lock or spring washer

3 Pull shift rockers (108 and 110) and shift fingers (112) from inside of shift cover.

4 After unbending lock washer (123), unscrew fastening bolt (122) for locking cage (109) and carefully force locking cage from locating pin in cover and remove.

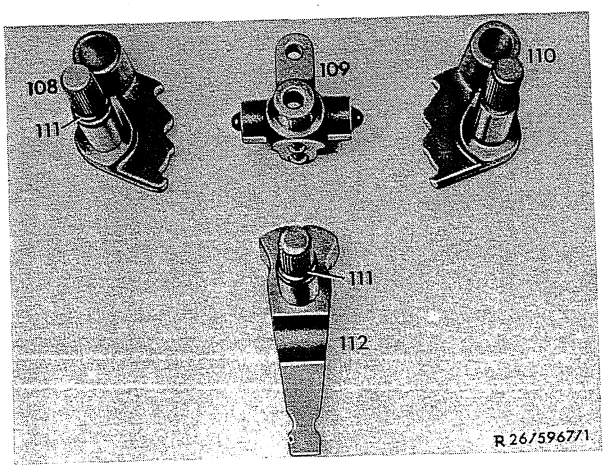
Note: Instead of lock washer, a spring washer may already be installed or may be installed now.



Sealing jobs

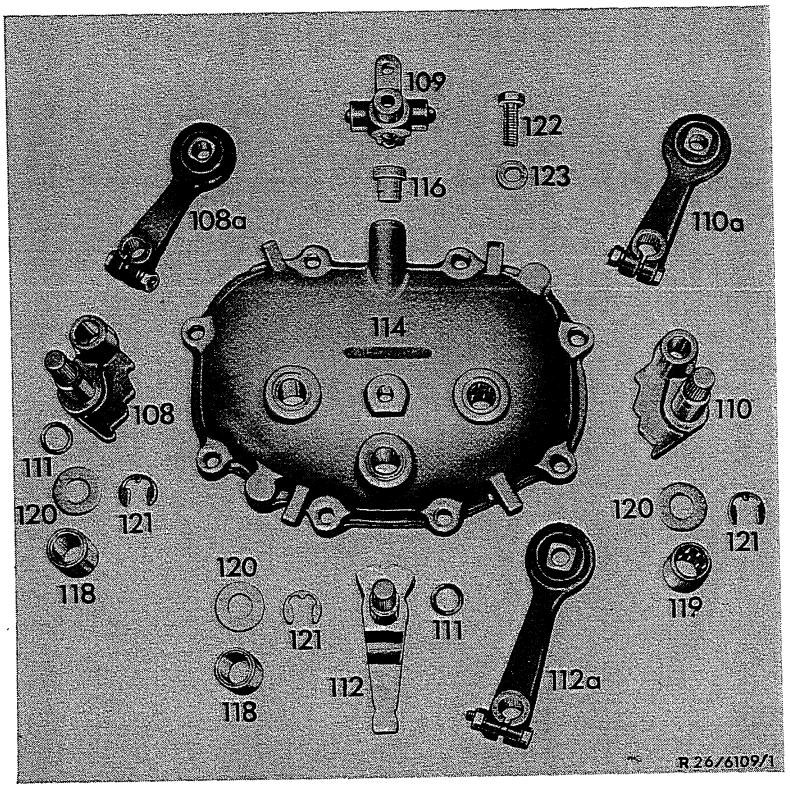
In the event of leaks on shaft of shift rocker for 3rd and 4th speed (108), renew O-ring (111) or self-locking needle bearing (119).

In the event of leaks on shift finger for reverse speed (112), renew O-ring (111).



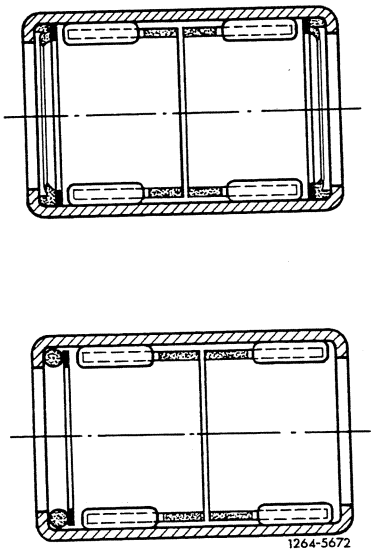
5 In the event of oil losses on shaft of shift rocker for 1st and 2nd speed (110), renew self-sealing needle bearing (119).

Note: When renewing bushing or needle bearing, check bores in shift cover for score marks and renew shift cover, if required.



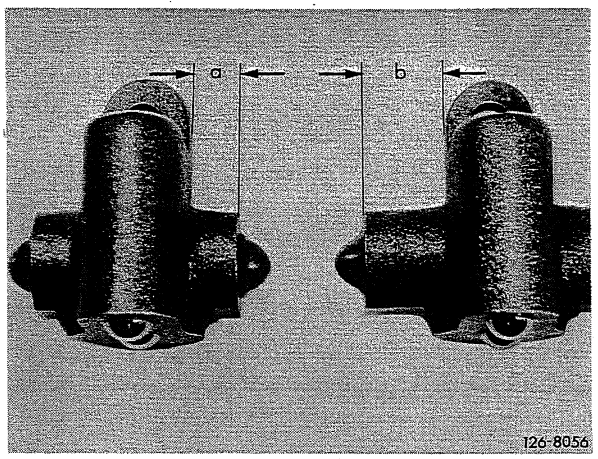
Starting October 1972, the self-locking needle bearing is replaced by a needle bearing with O-ring.

For sealing jobs, simply renew O-ring.



Upper view: self-sealing needle bearing
Lower view: needle bearing with O-ring

Note: As a result of the different dimensions of the shift covers, the locking cages differ with regard to their lateral projection. When renewing locking cage, make sure that the correct locking cage is mounted in each shift cover. Changing the locking cage (109) does not require disassembly of shift cover.



Lefthand view for transmission G 76/18 or 716.0
Righthand view for transmission G 76/27 or 716.1
Difference: Distance "a" approx. 7 mm, "b" approx. 13 mm

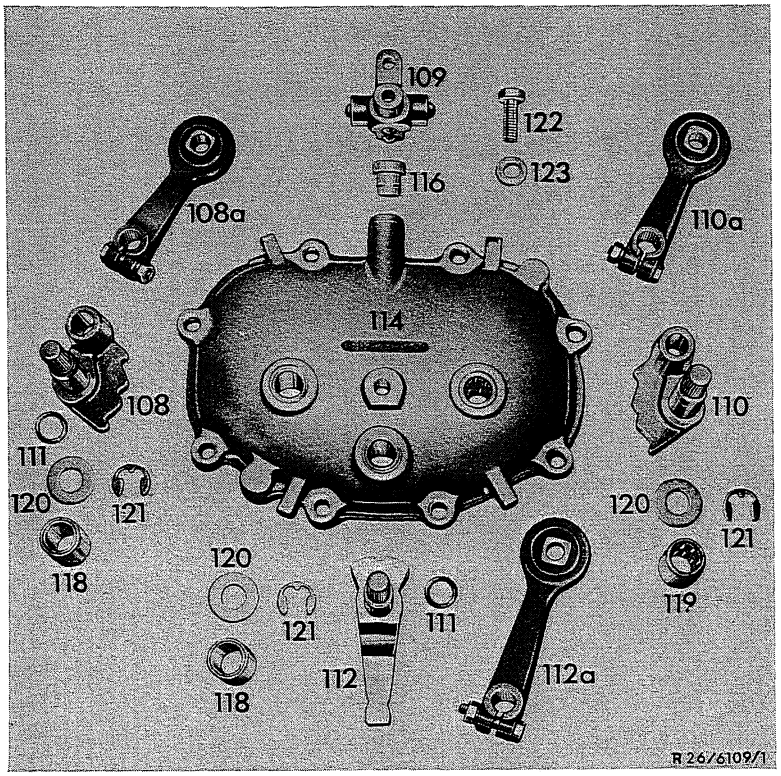
Assembly

6 Push locking cage (109) with fitted pin into bore of cover and push with fitted bore against locating pin. Then tighten with fastening screw (122) and secure with lock washer (123) or use spring washer.

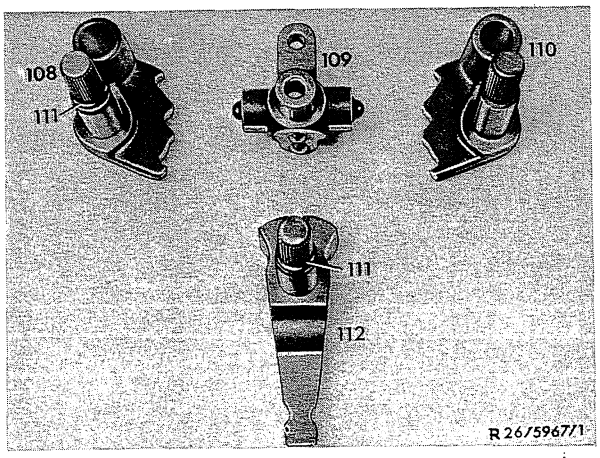
7 Grease shafts of shift rockers (108 and 110) and of shift finger (112) for reverse speed lightly with antifriction bearing grease and insert in shift cover. Make particularly sure that the O-rings (111) are not damaged.

8 Place washers (120) on shafts of shift rockers (108 and 110) on front end of cover and secure by sliding lock washers (121) on gear shifting shafts.

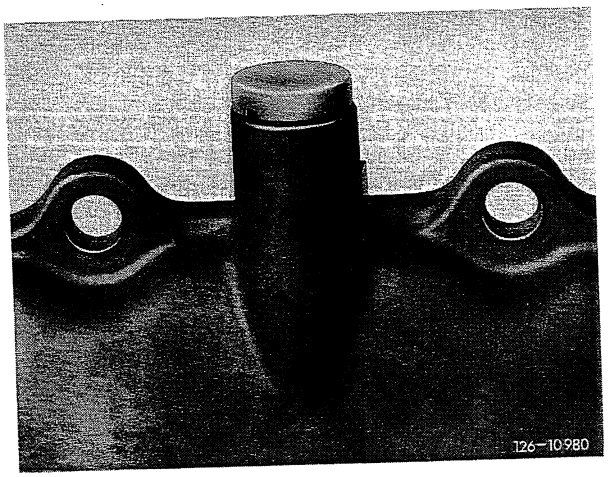
9 Secure shift finger (112) for reverse speed only after moving cover to transmission using washer (120) and shaft lock (121).



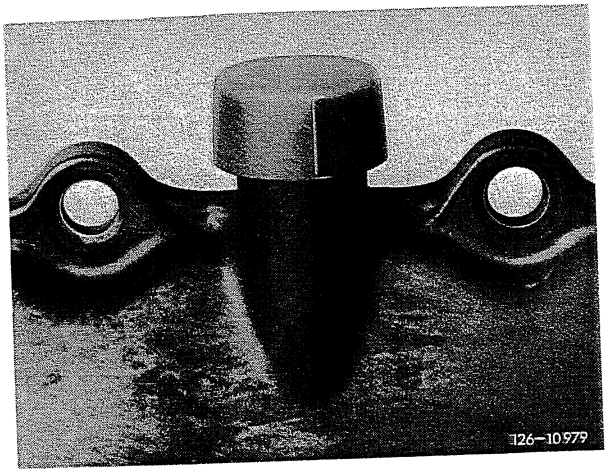
10 Attaching and clamping of shift levers (108a, 110a and 112a) on gear shifting shaft is done best after screwing cover to transmission (26–610 or 26–710).



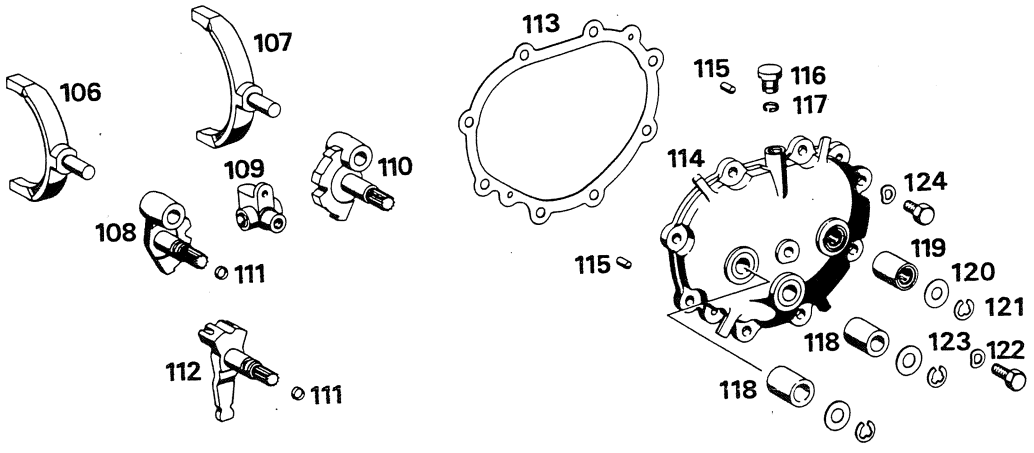
Note: In the event of repairs with regard to transmission 716.003, install end cap and transmission cover using reinforced breather neck.



Transmission breather 1st version



Transmission breather 2nd version



Transmission shift cover

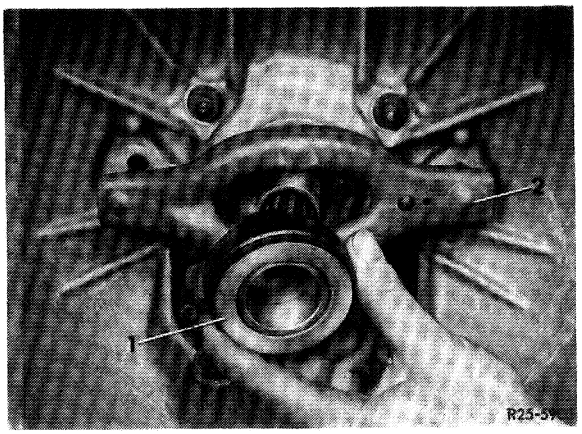
106 Shift fork 3rd and 4th speed
107 Shift fork 1st and 2nd speed
108 Shift rocker for 3rd and 4th speed
109 Locking cage
110 Shift rocker for 1st and 2nd speed
111 O-ring
112 Shift finger for reverse speed
113 Gasket
114 Transmission shift cover
115 Cyl. pin
116 Breather
117 Circlip
118 Bushing (bearing of gear shifting shaft for 3rd/4th or reverse speed)
119 Needle bearing (bearing of gear shifting shaft 1st/2nd speed)
120 Washer
121 Lock washer
122 Hex. bolt
123 Locking plate or spring washer
124 Hex. bolt

Tightening torque	Nm	(kpm)
Bolts for fastening front transmission cover	15	(1.5)

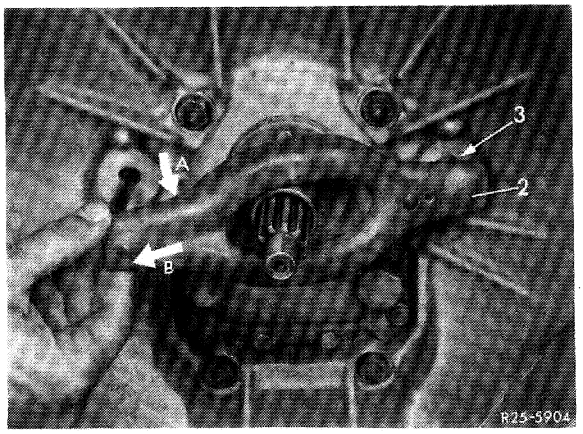
Special tool

Clamping device		111 589 08 31 00

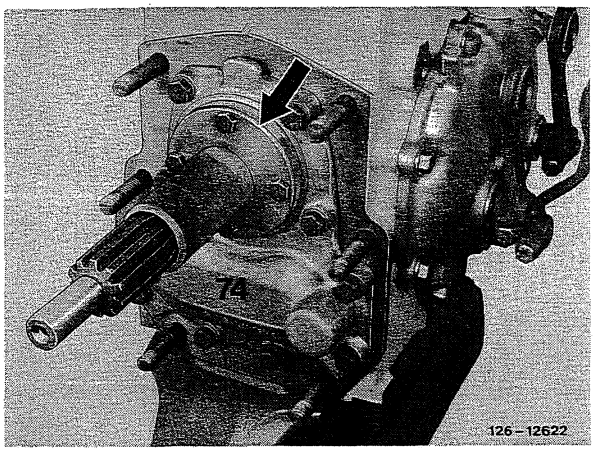
1 Remove throwout (1) from bearing tube on front of transmission cover.



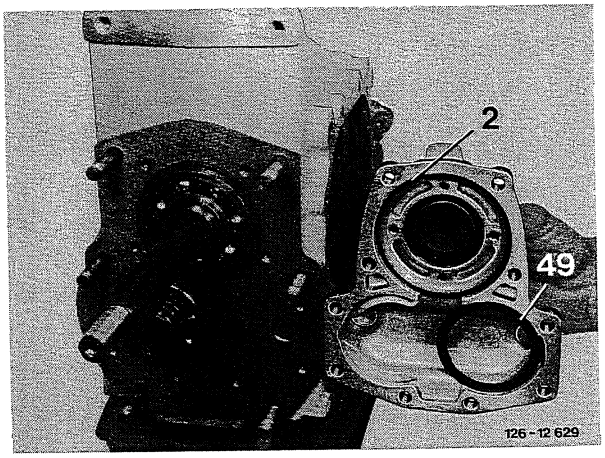
2 Move throwout rocker (2) in direction of arrow A and then pull in direction of arrow B from ball pin (3) on clutch housing and remove.

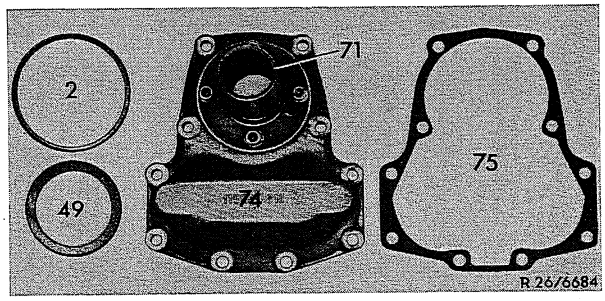


3 Unscrew fastening bolts for front transmission cover.



4 Carefully pull off front transmission cover over input shaft. Pay attention to compensating washer (2) for input shaft and compensating washer (49) for countershaft.





2 Compensating washer for input shaft
49 Compensating washer for countershaft
71 Bearing tube
74 Front transmission cover
75 Gasket

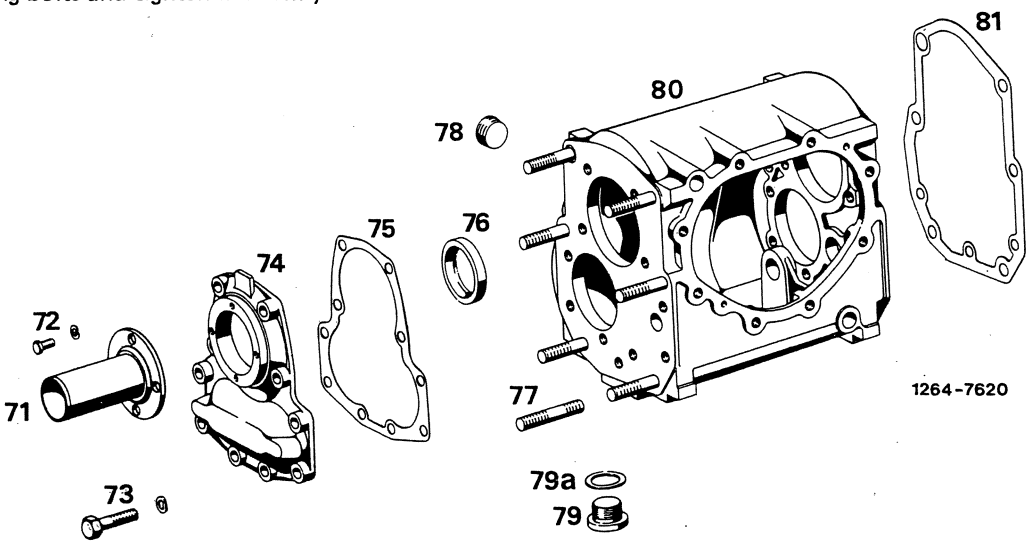
5 Insert or place compensating washers (2 and 49) and gasket (75) into cover and glue down with grease to facilitate assembly.

6 Grease sealing ring on sealing lip and contact surface on input shaft.

7 Make bolts and threads in transmission housing free of grease and provide with a non-hardening sealing compound.

8 Carefully slip transmission cover (74) on input shaft and move against parting surface of transmission housing.

9 Screw in fastening bolts and tighten uniformly and crosswise.



Front transmission cover

71 Bearing tube for transmission housing cover front
72 Hex. bolt
73 Hex. bolt
74 Transmission housing cover front
75 Gasket
76 Radial sealing ring

Transmission housing

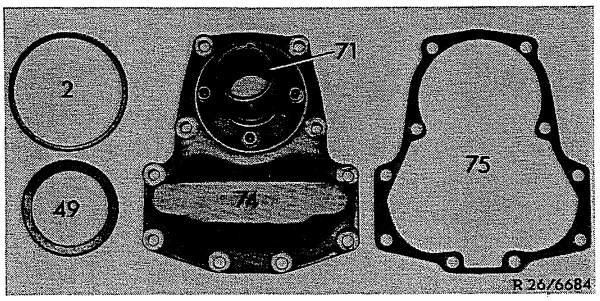
77 Stud
78 Closing plug for oil filler hole
79 Closing plug with collar for draining oil
79a Sealing ring
80 Transmission housing
81 Gasket

Scope

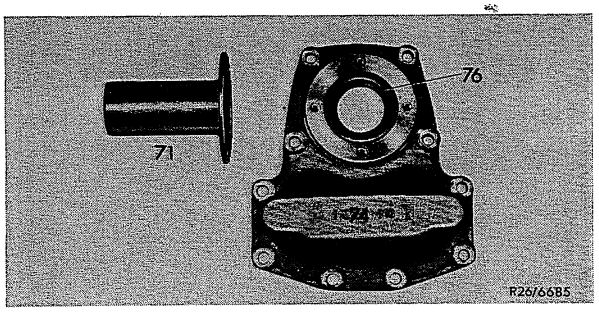
1 Unscrew clutch housing (26–050).

2 Unscrew front transmission cover (26–210).

3 Unscrew fastening bolts for bearing tube (71) and remove bearing tube.



4 Force sealing ring (76) out of cover (74) by means of a suitable mandrel of approx. 45 mm dia.



71 Bearing tube
74 Front transmission cover
76 Sealing ring

5 Press new sealing ring (76) into cover flush with parting surface.

6 Lightly screw bearing tube (71) to cover by means of fastening bolts, but do not yet tighten. Provide fastening screws with a non-hardening sealing compound.

7 Mount front transmission cover (26–210).

8 Screw-on clutch housing (26–050).

9 Then tighten fastening bolts of bearing tube (71).

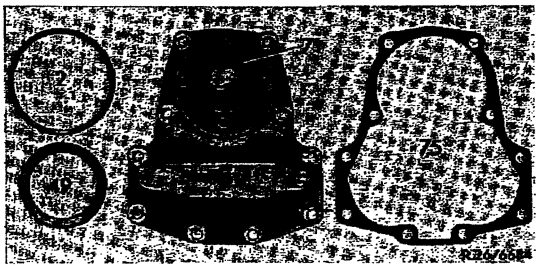
26–220 Screwing bearing tube of front transmission cover off and on, replacing radial sealing ring

Scope

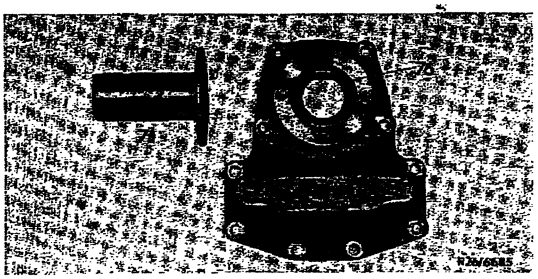
1 Unscrew clutch housing (26–050).

2 Unscrew front transmission cover (26–210).

3 Unscrew fastening bolts for bearing tube (71) and remove bearing tube.



4 Force sealing ring (76) out of cover (74) by means of a suitable mandrel of approx. 45 mm dia.



71 Bearing tube
74 Front transmission cover
76 Sealing ring

5 Press new sealing ring (76) into cover flush with parting surface.

6 Lightly screw bearing tube (71) to cover by means of fastening bolts, but do not yet tighten. Provide fastening screws with a non-hardening sealing compound.

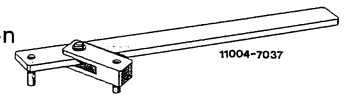
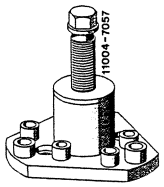
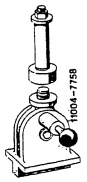
7 Mount front transmission cover (26–210).

8 Screw-on clutch housing (26–050).

9 Then tighten fastening bolts of bearing tube (71).

Tightening torques	Nm	(kpm)
Fastening bolts M 10	45	(4.5)
Fastening bolts M 7	15	(1.5)
Slot nut for three-arm flange	150	(15)

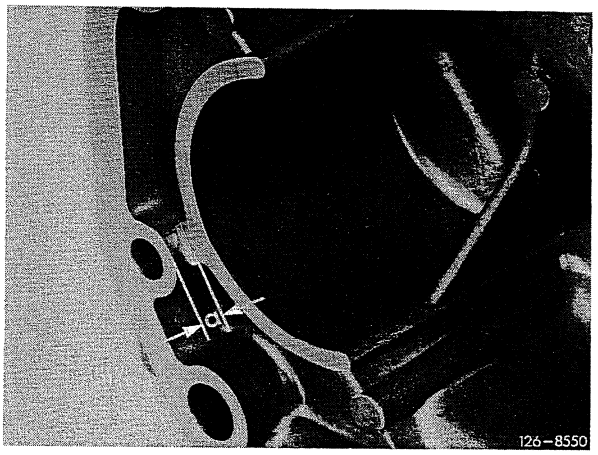
Special tools

Slot nut wrench insert 3/4" square for slot nut on transmission flange	 11004-7072	115 589 01 07 00
Allen wrench for applying counterhold to transmission flange when loosening and tightening slot nut	 11004-7037	116 589 10 07 00
Puller for three-arm flange	 11004-7057	116 589 19 33 00
Clamping device	 11004-7758	111 589 08 31 00

Revisions

Designation	Transmission	as from transmission no.
Change from slot nut with pinch collar to slot nut with polystop insert on three-arm flange	G 76/18	005 001
Change from slot nut with polystop insert to slot nut with pinch collar on three-arm flange	G 76/18	239 470
	716.1	–

To protect slot nut on three-arm flange, the round groove used up to now has been replaced by a triangular groove milled into main shaft	716.002	793 237
	716.001	009 922
	716.003	as from start of series
	716.1	010 233
With transmissions 716.001 and 002 installed in production vehicles, a modified rear transmission cover is employed. Stop collar for rear countershaft bearing is machined deeper by 1 mm. New and old cover cannot be interchanged.	G 76/18	–
	716.1	006 294



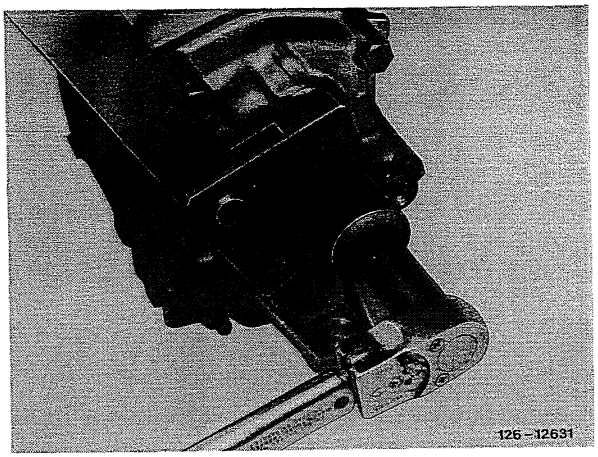
Dimension "a" on old cover 4 mm
on new cover 5 mm

Attention!
If the rear transmission cover of transmission types G 76/18, G 76/27 and 716.1 is renewed, a cover with the former machining depth of 4 mm must be again installed.

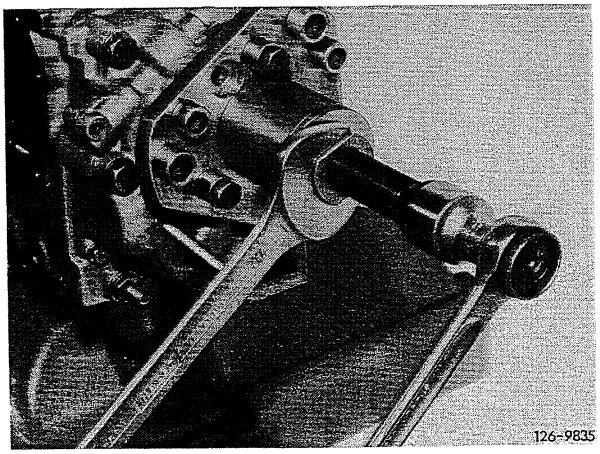
In exceptional cases, the 4-mm version can also be replaced by the modified transmission cover with its stop point for the rear countershaft bearing machined to a depth of 5 mm. However, this requires placing a steel washer 1 mm thick between teeth of 1st speed of countershaft and rear bearing after pulling rear countershaft bearing. If this is not done, the countershaft will have too much end play and the gear wheels of 2nd gear main shaft and 3rd gear countershaft will touch each other. In addition, the new, shorter reversing gear must be mounted on countershaft, since otherwise no accurate locking of slot nut or hex. nut is possible.

Screwing-off

1 Unlock slot nut for attaching universal flange and loosen and unscrew with slot nut wrench insert while counterholding with allen wrench.

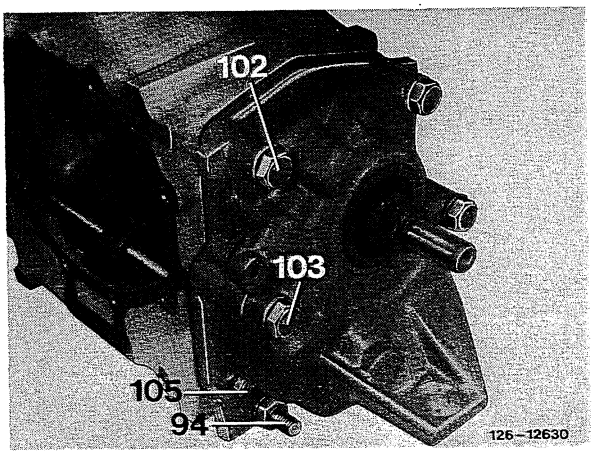


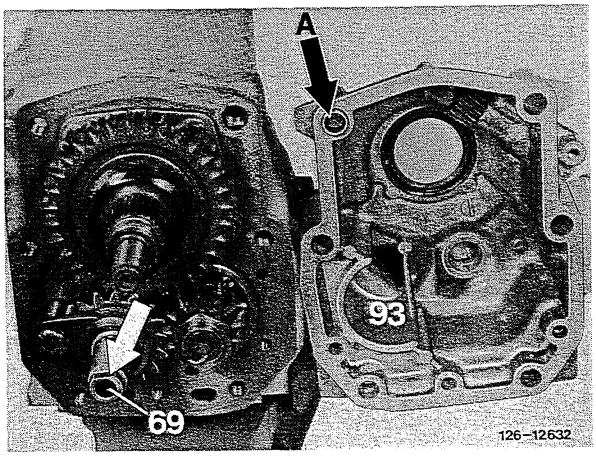
2 Remove universal flange with puller.



3 Unscrew fastening bolts (94, 102, 103 and 105) and remove rear transmission cover.

Note: No special preparations are required for gear assembly of transmission when removing rear cover.

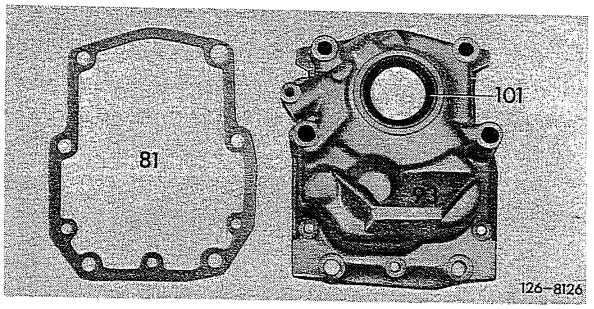




Replacing radial sealing ring

4 Force radial sealing ring (101) out of cover by means of a suitable mandrel of approx. 52 mm dia.

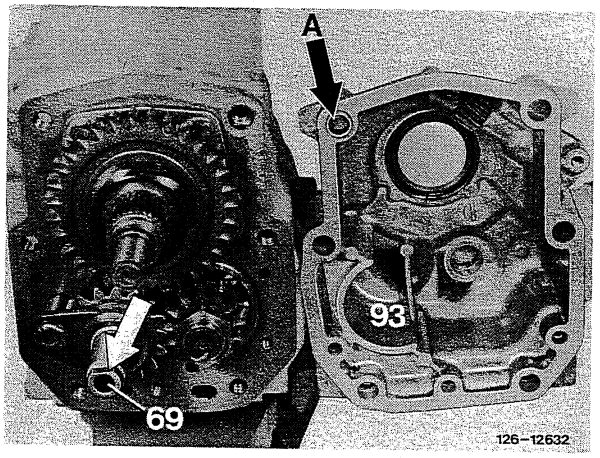
5 Press new radial sealing ring into cover flush with outer edge.



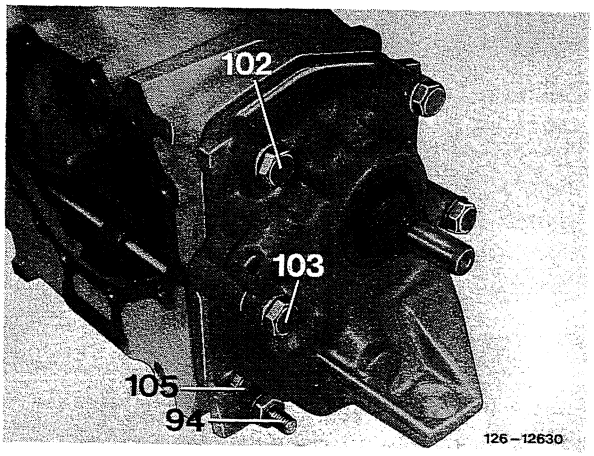
Screwing-on

6 Glue new gasket with grease on parting surface of cover to facilitate assembly.

7 Carefully slide cover over main shaft against parting surface of transmission housing, paying attention to the fitted sleeve (arrow A) and making particularly sure that the milled surface (arrow) of the reversing shaft (69) is on top and is correctly introduced into the locating bore in cover.



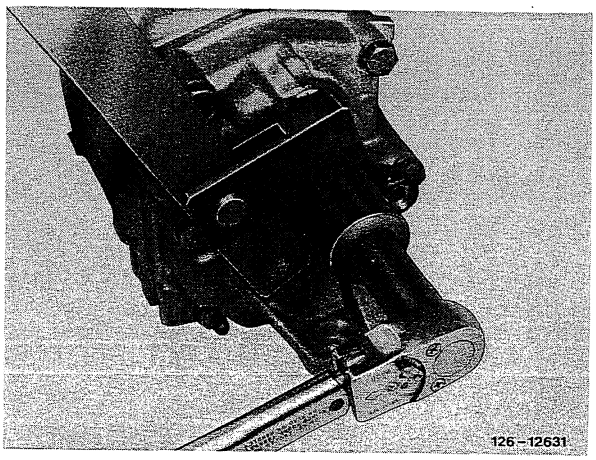
8 Screw down cover uniformly and crosswise by means of fastening bolts (94, 102, 103 and 105).



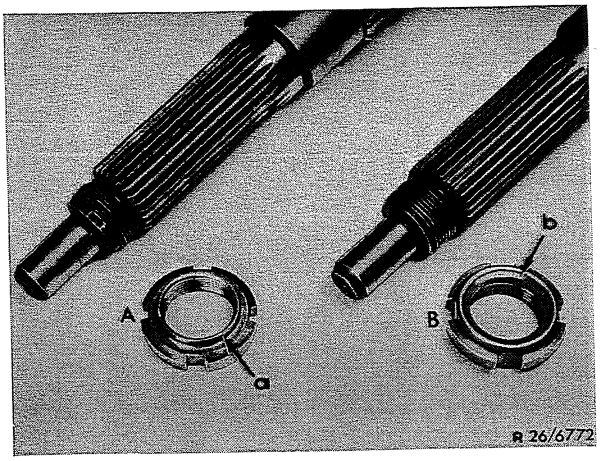
9 Grease three-arm flange on one surface of radial sealing ring.

10 Slide three-arm flange on main shaft and screw-on slot nut for attaching flange by hand.

11 Tighten slot nut with slot nut wrench insert while applying counterhold with allen wrench.

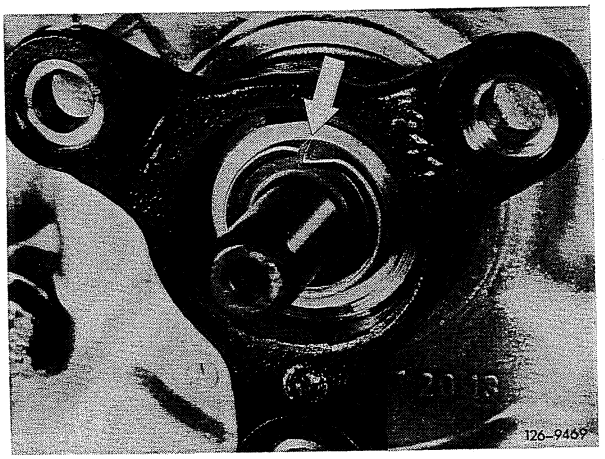


Note: For attaching three-arm flange slot nut with polystop insert or slot nut with pinch collar is used. When repairing transmission with polystop nut, use new polystop nut, since the main shaft has no slot for securing pinch nut.

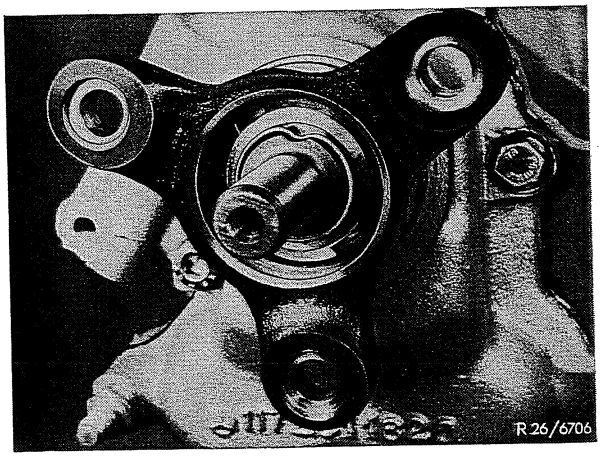


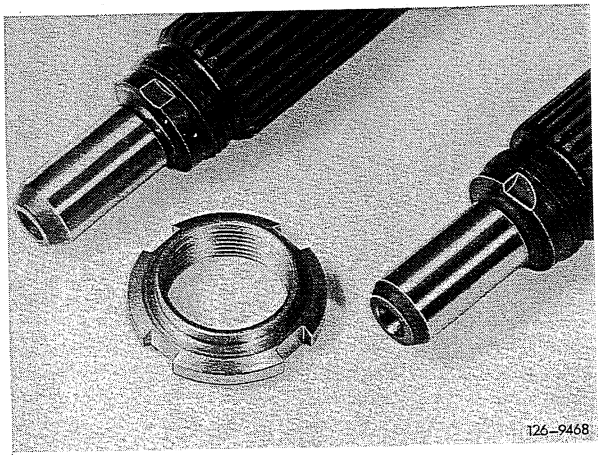
12 Secure slot nut.

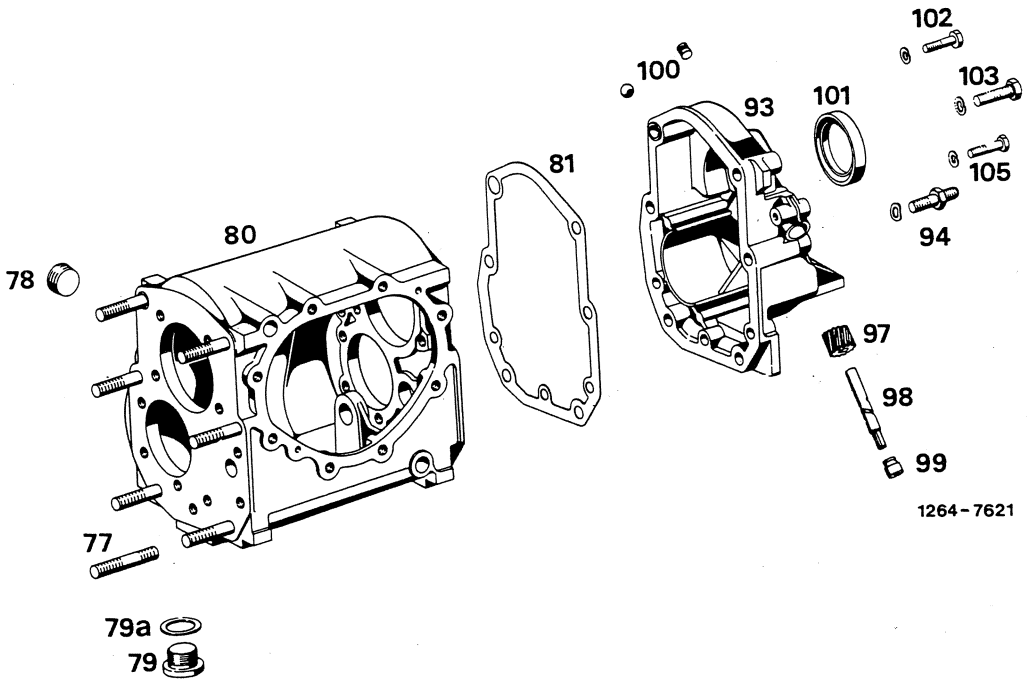
On main shafts with triangular groove, secure slot nut by means of a punch by cutting up pinch collar, and on main shafts with round groove by pressing down pinch collar.



Attention!
Renew tachometer drive, that is, helical gear on main shaft and pinion in rear transmission cover in pairs only.







Transmission housing

77 Stud
78 Closing plug for oil filler hole
79 Closing plug with collar for oil drain
79a Sealing ring
80 Transmission housing
81 Gasket

Rear transmission cover

93 Transmission housing cover rear
94 Collar bolt
97 Pinion for tachometer
98 Shaft drive for tachometer
99 Radial sealing ring
100 Plug or steel ball
101 Radial sealing ring for main shaft
102 Hex. bolt
103 Hex. bolt
105 Hex. bolt

Revisions

Designation	Transmission	as from transmission no.
Seal for tachometer drive on rear transmission cover has been changed from a plug to a ball	G 76/18	412 370
	716.100	001 001
Helical gear on main shaft changed from brass to plastics. Pinion changed from steel to sintered metal	716.001	0056 570
	716.002	171 580 (starting July 15, 1975)
	716.003	119 795
	716.100	015 290

Removal

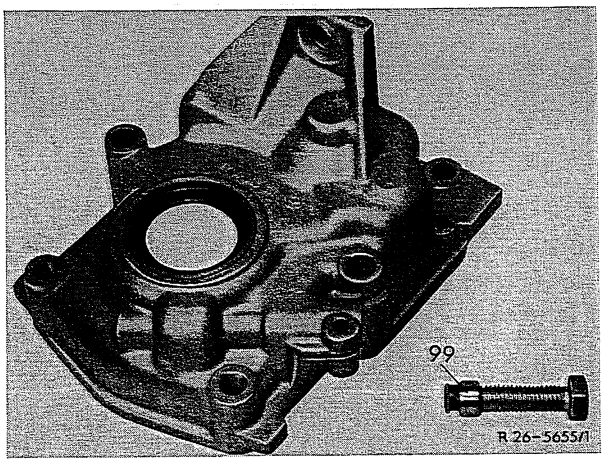
1 Unscrew rear transmission cover (26–310).

2 Press-out tachometer drive in direction toward ball with the aid of suitable supports and a mandrel, using a manually operated press.

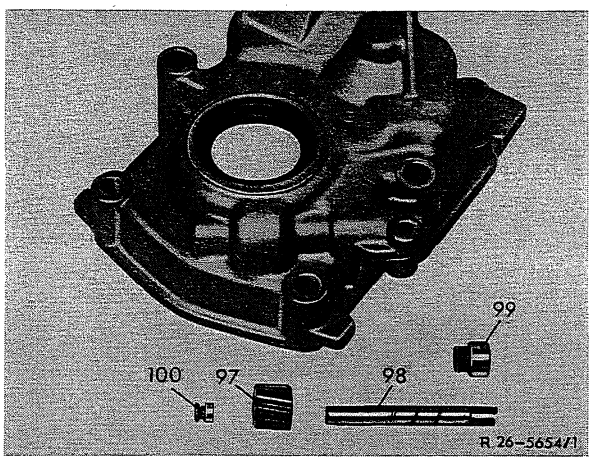
Note: On transmissions with plug, remove plug prior to pressing out tachometer drive by means of screwdriver or pliers.

3 Pull radial sealing ring (99) out of tachometer drive.

Note: To facilitate removal, screw a hex. bolt M 12 into sealing ring and clamp into vise. Apply light blows with a plastic hammer against cover while pulling out radial sealing ring.



4 Check individual parts in tachometer drive for wear and damage.



97 Drive pinion
98 Shaft – drive for tachometer
99 Radial sealing ring
100 Plug or ball

Installation

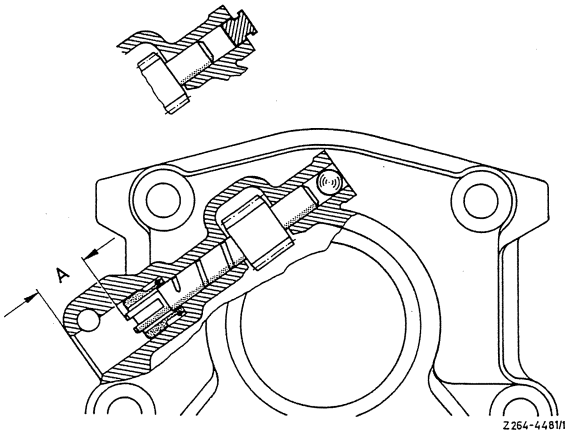
5 Place radial sealing ring (99) flush on side of drive shaft (98) on which the groove for connecting the flexible tachometer shaft is milled in.

6 Insert drive pinion (97) into rear transmission cover.

Attention!
Renew tachometer drive, that is, helical gear on main shaft and pinion in rear transmission cover, in pairs only.

7 Press drive shaft (98) with radial sealing ring (99) on a hand press until a distance A of 19 mm between cover and upper edge of input shaft is established.

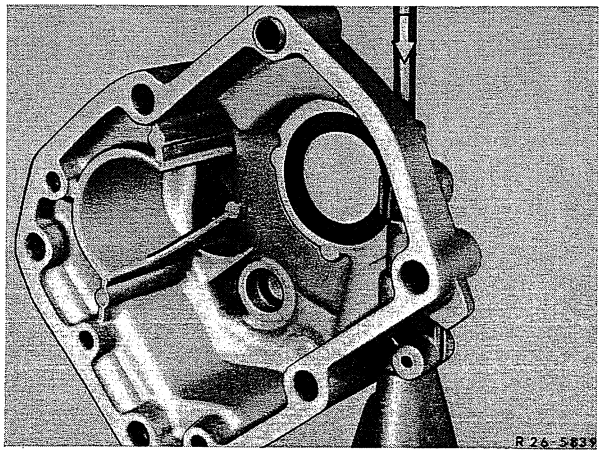
8 Press-in sealing ball until it is flush with upper edge of transmission cover.



A = 19 mm

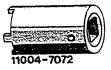
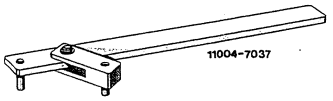
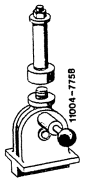
9 On transmissions with plug, coat plug with sealing compound and knock in by lightly tapping with a plastic hammer.

10 Screw-on rear transmission cover (26–310).



Tightening torques	Nm	(kpm)
Fastening bolts M 10 for rear transmission cover	45	(4.5)
Fastening bolts M 7 for rear transmission cover	15	(1.5)
Slot nut with polystop insert or with pinch collar for three-arm flange	150	(15)
Slot nut or hex. nut with pinch collar on countershaft rear	150	(15)

Special tools

Slot nut wrench insert 3/4" square for slot nut on transmission flange	 11004-7072	115 589 01 07 00
Allen wrench for counterholding on transmission flange when loosening and tightening slot nut	 11004-7037	116 589 10 07 00
Clamping device	 11004-7758	111 589 08 31 00

Revisions

Designation	Transmission	as from transmission no.
Change of complete reversing gear assembly from taper to round point Reason: to improve shifting of reverse gear	G 76/18	064 856
Change from slot nut to hex. nut on countershaft rear	G 76/18	554 275
	716.100	003 737
Change of reversing gear on countershaft Reason: to match transmission G 76/18 B	716.100	006 294
With synchronizing unit Reason: to improve shifting of reverse gear	716.100	014 398
	716.001	057 804

A. Without synchronizing unit

Note

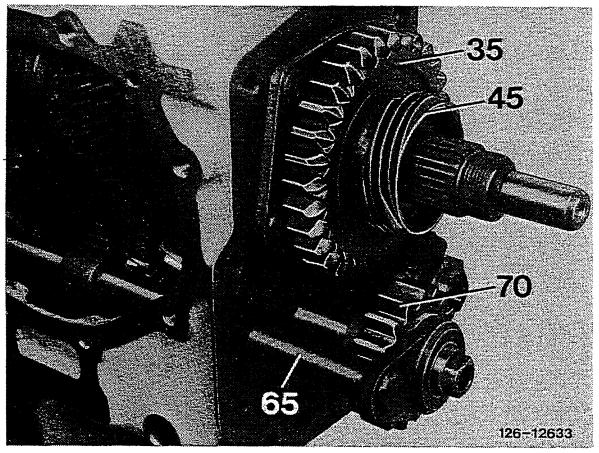
If the assembly jobs are exclusively restricted to reversing gears, no removal of transmission is required.

Removal

1 Unscrew rear transmission cover (26–310).

2 Remove helical gear (45) for tachometer drive.

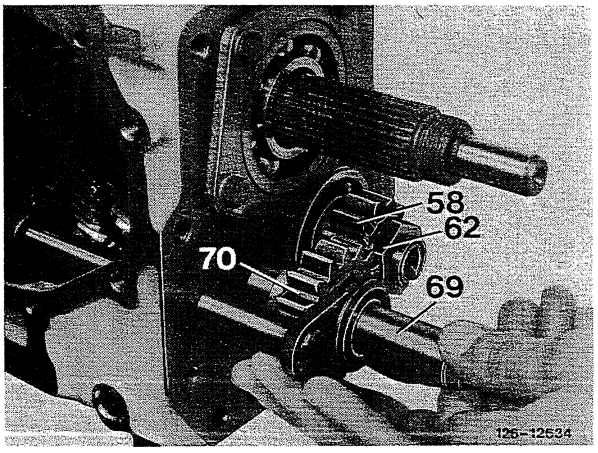
3 Pull reversing gear (35) from main shaft.



4 Pull reversing shaft (69) for reversing slide gear (70) from transmission housing, while holding slide gear in position.

5 Unlock nut (62) on rear countershaft and screw off. While placing three-arm flange provisionally on main shaft and counterholding with allen wrench while loosening nut.

6 Force reversing gear – countershaft (58) from countershaft by means of a screwdriver.

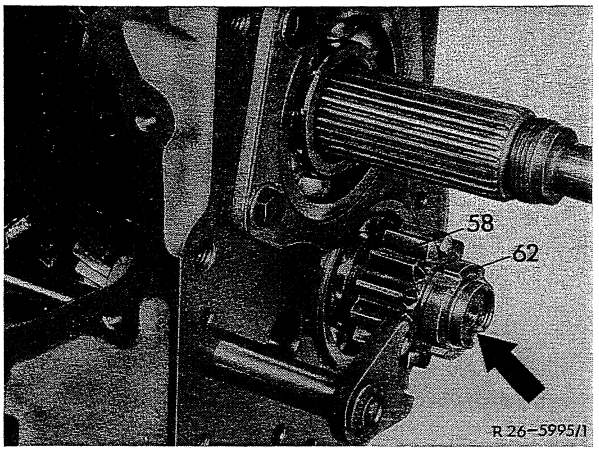


Installation

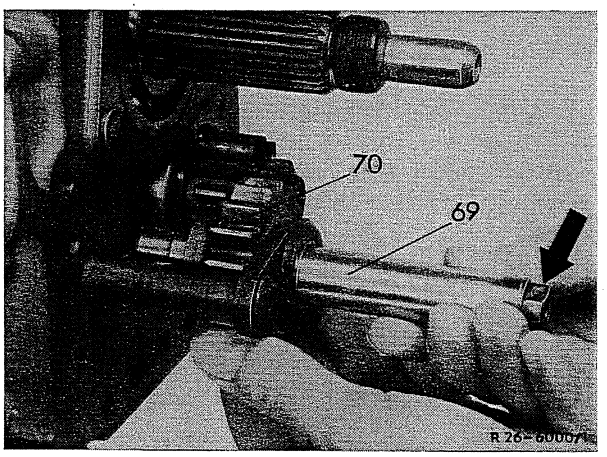
7 Slide reversing gear – countershaft (58) on countershaft and attach with nut (62).

Note: Slot nut (62) on countershaft can be replaced by a hex. nut with pinch collar. This hex. nut is now standard.

8 Carefully secure nut (62) by peening pinch collar into groove provided in countershaft (arrow).

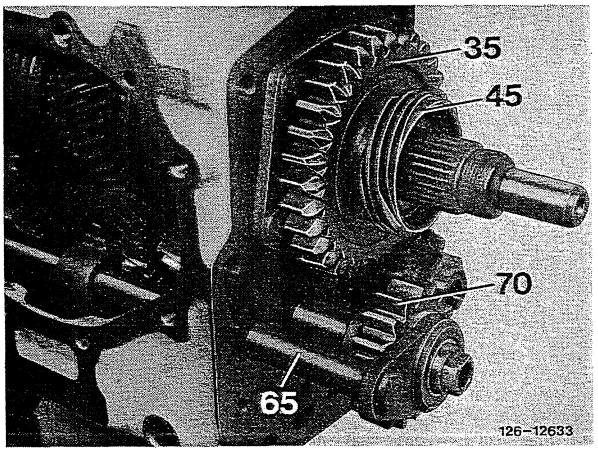


9 Insert reversing speed slide gear (70) with its ring groove to shifting claw (dog) of reversing speed gear shifting shaft and slip reversing shaft (69) for reversing speed slide gear through the latter into transmission housing. **Make sure that the milled surface on shaft journal is on top (arrow).**



10 Slide-on reversing speed gear – main shaft (35), as well as helical gear (45) for tachometer drive. Recess of helical gear (45) should face toward the rear.

Note: Mount reversing gear – main shaft (35) in such a manner that the points of the tooth flanks are facing toward the rear.



11 Screw-on rear transmission cover (26–310).

B. With synchronizing unit

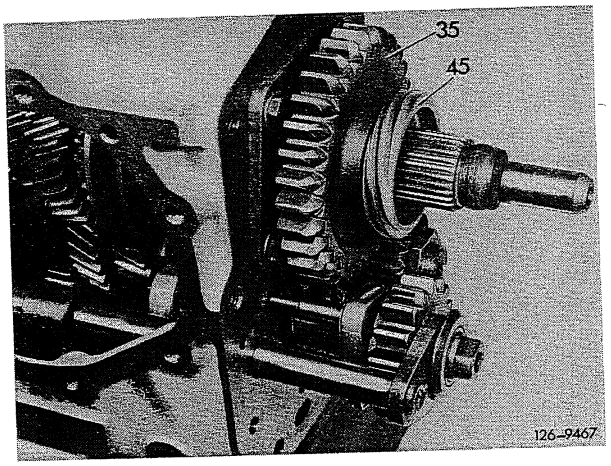
Removal

1 Remove transmission shift cover and take out shift forks (26—110).

2 Unscrew rear transmission cover (26—310).

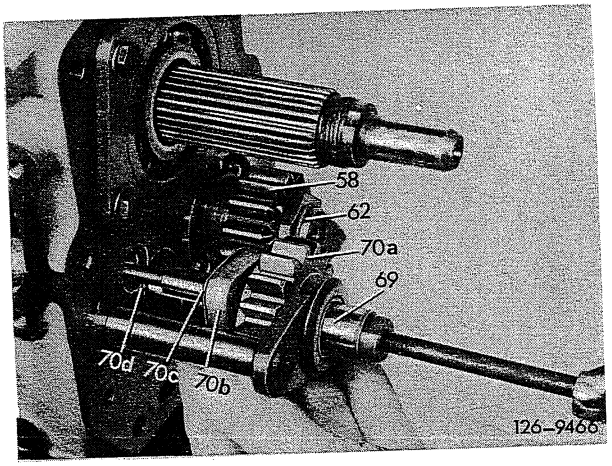
3 Remove helical gear (45) for tachometer drive.

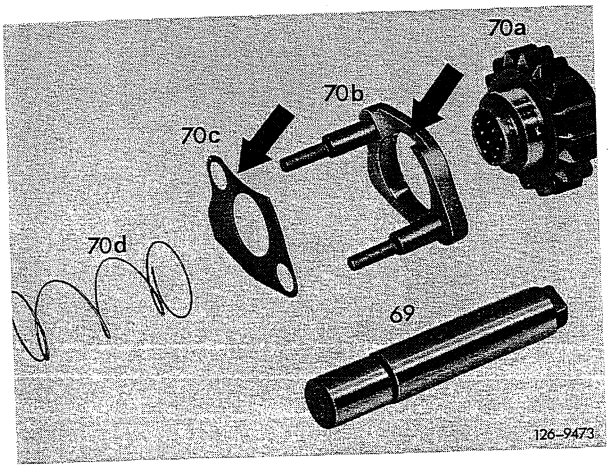
4 Pull reversing gear (35) from main shaft.



5 Pull reversing shaft (69) for reversing speed slide gear (70a) out of transmission housing, while holding reversing speed slide gear, synchronizing ring (70b) with locking bolt, retaining plate (70c) and compression spring (70d) in place.

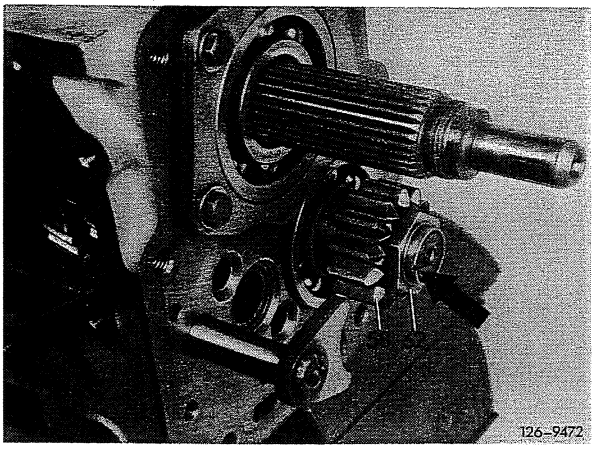
6 Remove reversing speed slide gear with synchronizing members.





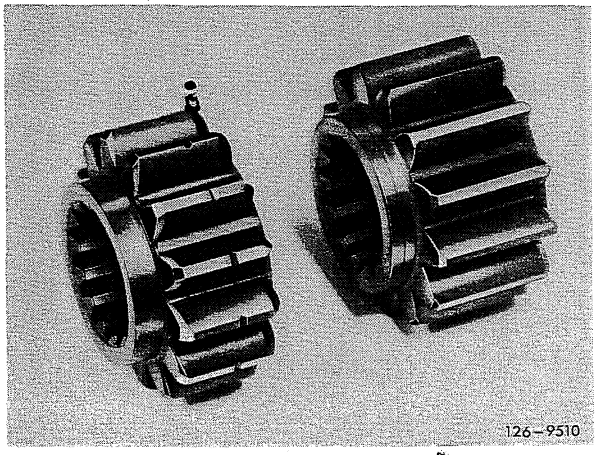
7 Unlock slot nut (62) on countershaft rear and screw off, while placing three-arm flange provisionally on main shaft and counterholding nut with allen wrench.

8 Force reversing gear – countershaft (58) from countershaft by means of a screwdriver.



Installation

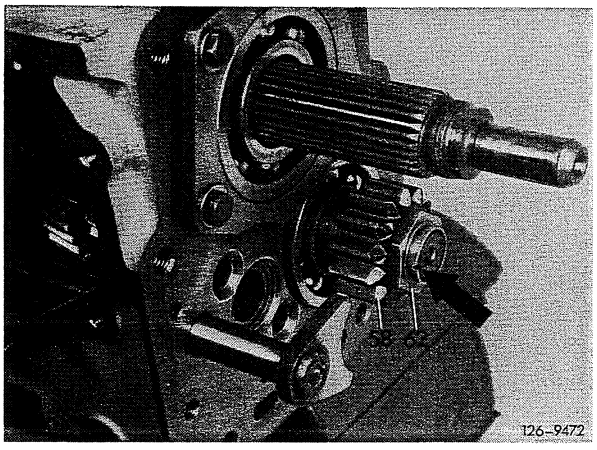
Note: When renewing reversing gear – countershaft (58), pay attention to gear width.



Lefthand view:
Reversing gear – countershaft without synchronizing unit
Righthand view:
Reversing gear – countershaft with synchronizing unit

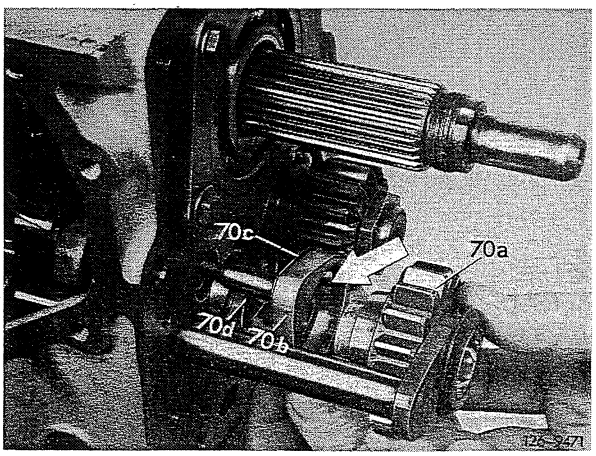
9 Slide reversing gear (58) on countershaft and attach with nut (62).

10 Carefully secure nut (62) by peening pinch collar into groove provided in countershaft (arrow).

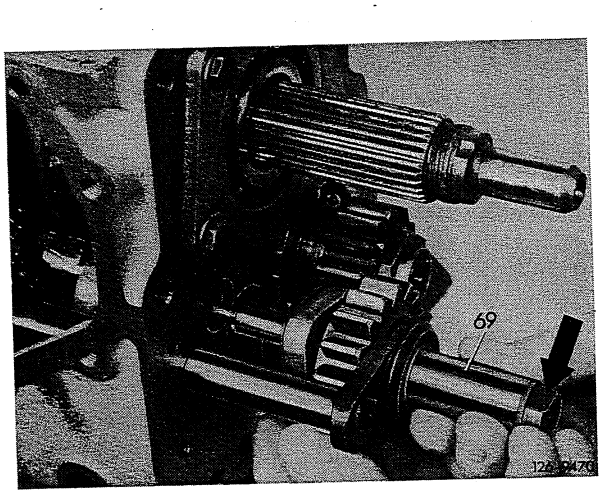


11 Insert reversing speed slide gear (70a) to shifting claw (dog) of reversing speed gear shifting shaft and mount together with synchronizing ring (70b), retaining plate (70c) and compression spring (70d) in such a manner, that the recesses of synchronizing ring (70b) and retaining plate (70c) are facing the countershaft bearing (arrow).

Note: Mount reversing speed slide gear (70a) in such a manner that points of gear flanks are facing to transmission housing.

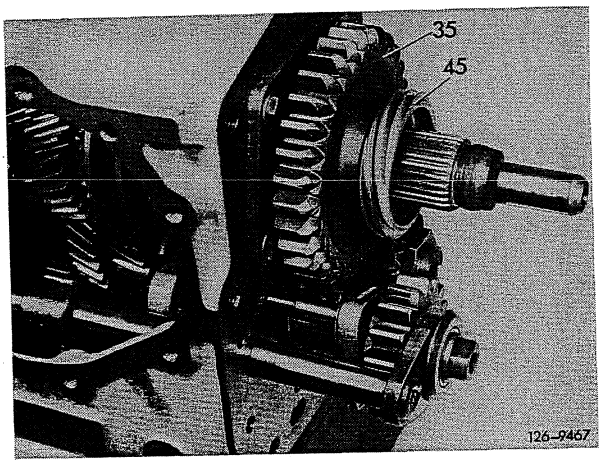


12 Slip reversing shaft (69) into reversing speed slide gear.
Make sure that milled flat on shaft journal is facing upward (arrow).



13 Mount reversing gear – main shaft (35) as well as helical gear (45) for tachometer drive. Recess of helical gear (45) should face toward the rear.

Note: Mount reversing gear – main shaft (35) in such a manner that points of tooth flanks are facing toward the rear.



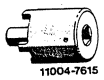
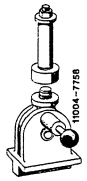
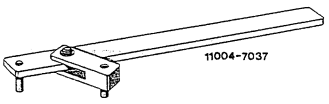
14 Screw-on rear transmission cover (26–310).

15 Insert shift forks into shift sleeves of synchronizing bodies and install transmission shift cover (26–110).

Adjusting dimension or end play	
Input shaft	0–0.05
Main shaft	0–0.05
Countershaft	0.07–0.15

Tightening torques	Nm	(kpm)
Slot nut or hex nut with pinch collar on countershaft front	150	(15)
Slot nut on input shaft 716.100	150	(15)

Special tools

Allen-box wrench 14 x 17 mm for oil plug	 11004-6721	000 589 24 07 00
8-arm puller for ball bearing on main shaft	 11004-6934	001 589 02 33 00
7-arm puller for ball bearing on main shaft		123 589 02 33 00
Puller for ball bearing on countershaft	 11004-6936	000 589 94 33 00
Slot nut wrench insert 1/2" square for slot nut on countershaft front	 11004-7615	115 589 03 07 00
Slot nut wrench insert 1/2" square for slot nut on countershaft rear	 11004-7614	115 589 04 07 00
Clamping device for transmission housing	 11004-7758	111 589 08 31 00
Slot nut wrench 1/2" square for slot nut on input shaft 716.100	 11004-7613	116 589 09 07 00
Slot nut wrench insert 3/4" square for slot nut on transmission flange	 11004-7072	115 589 01 07 00
Allen-wrench, adjustable, for counterhold on transmission flange when loosening and tightening slot nut	 11004-7037	116 589 10 07 00

Revisions

Designation	Transmission	as from transmission no.
Change from slot nut to hex nut with pinch collar at countershaft front	G 76/18	547 750
	716.100	003 262
Web in transmission housing for mounting reversing shaft has been removed. Result: shorter reversing shaft	G 76/18	496 842
	716.100	001 648
Gear wheels changed from long teeth to super long teeth. Exchange gear wheels only in pairs	716.006	022 957

Removal

1 Unscrew clutch housing (26–050).

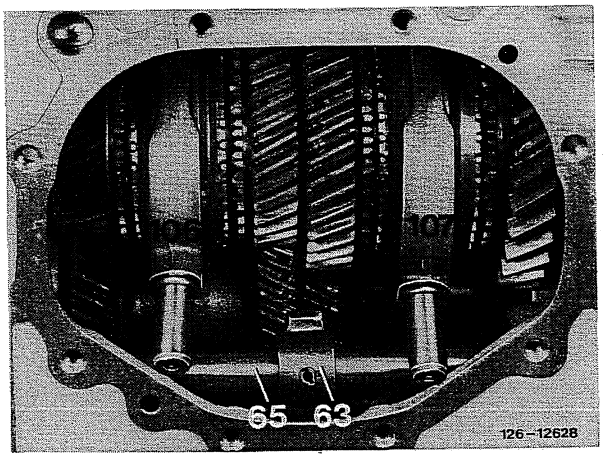
2 Remove transmission shift cover (26–110).

3 Unscrew transmission cover front (26–210).

4 Unscrew transmission cover rear (26–310).

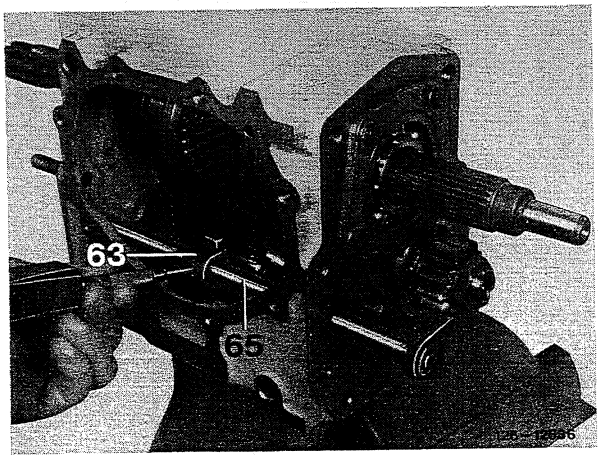
5 Remove reversing gear (26–410).

6 Upon installation of shift cover, remove shift forks (106 and 107).



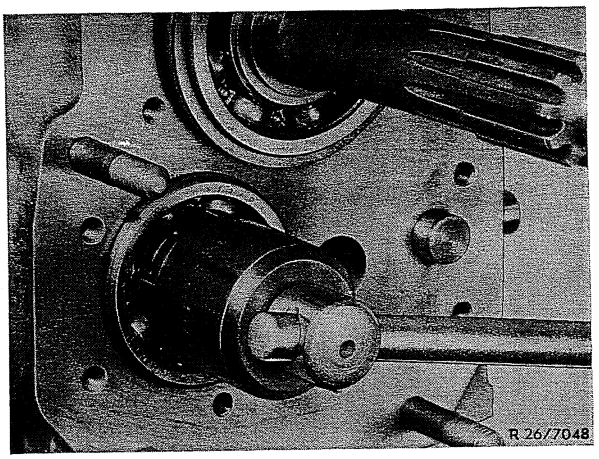
7 Knock-out hollow set pin of shifter (63) of gear shifting shaft (65) for reverse speed and move shifter as far as possible in forward direction.

8 Pull gear shifting shaft (65) out of housing while simultaneously removing shifter (63) in forward direction.

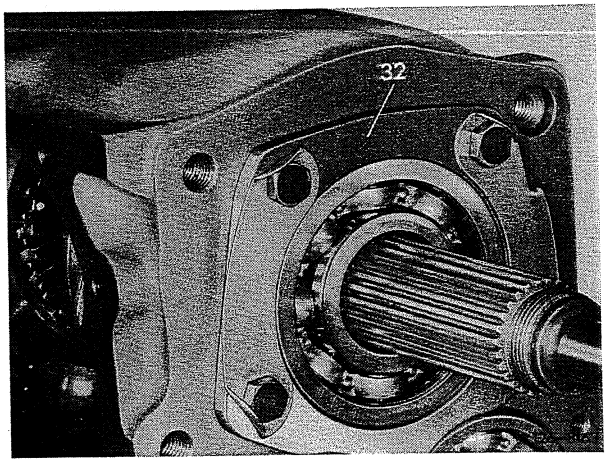


9 Unlock slot nut or hex nut with pinch collar, loosen with slot nut wrench and unscrew.

Note: To facilitate loosening of slot nut or hex nut, two speeds may be simultaneously engaged to lock gear assembly.

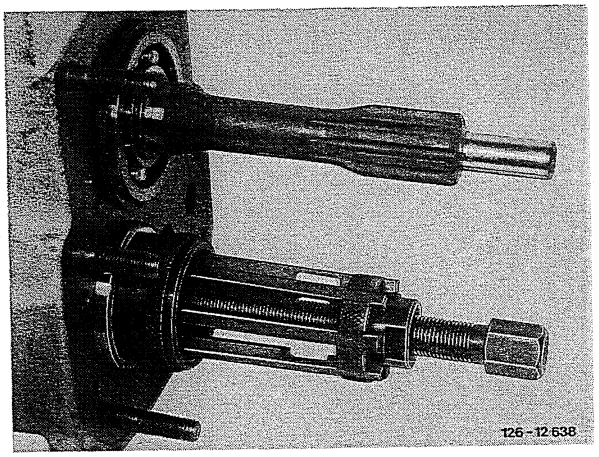


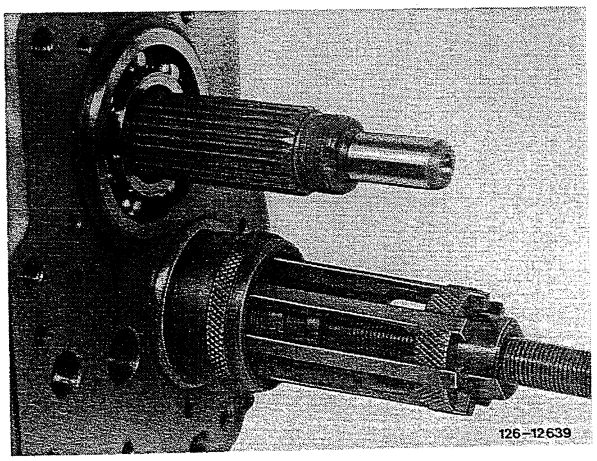
10 Unscrew fastening bolts of holding ring (32) and remove from main shaft bearing.



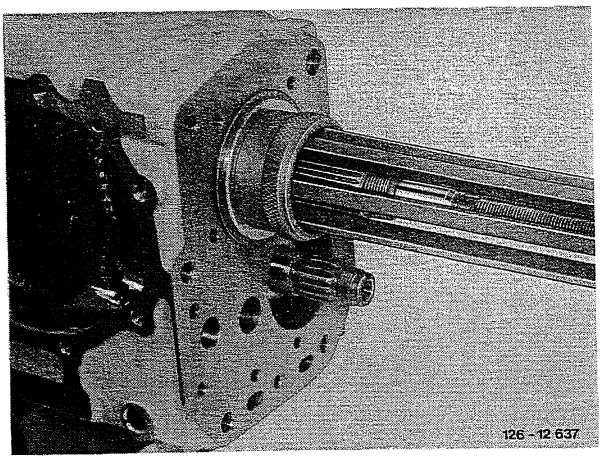
11 Pull-off radial ball bearing of countershaft front and rear.

Note: Items 11a to 18a of scope apply to transmission 716.100.



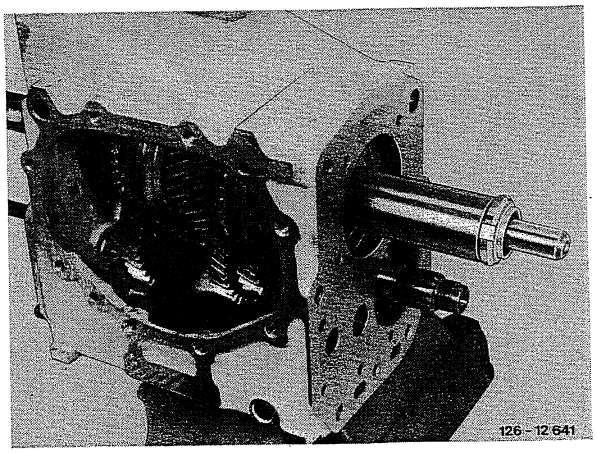


12 Pull-off radial ball bearing of main shaft rear.

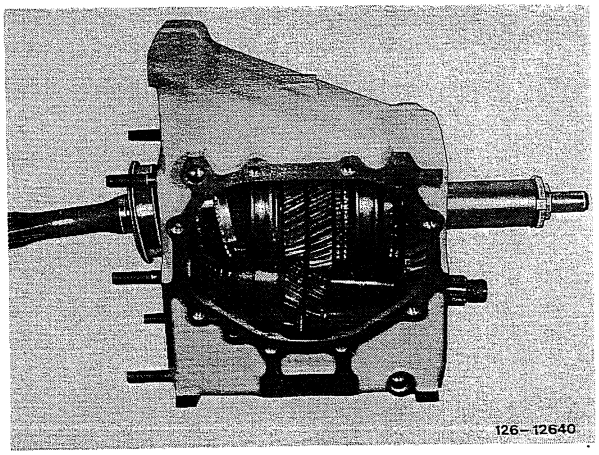


13 Slide one assembly sleeve over free, rear shaft end and tighten with slot nut of universal flange.

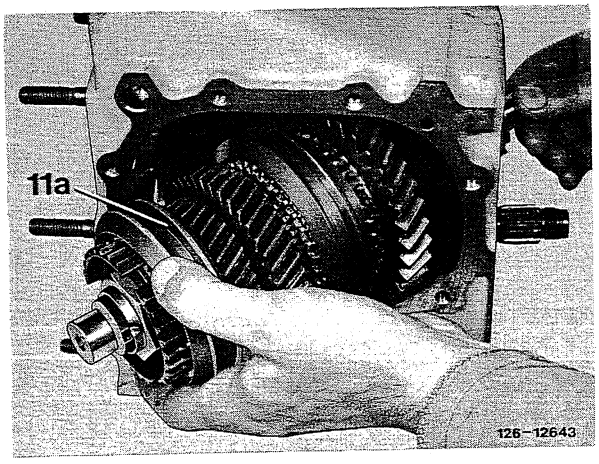
Assembly sleeve prevents any slipping of 1st gear wheel from its needle bearing, which would aggravate removal and installation.



14 Lift main shaft at the rear and pull input shaft completely out of housing in forward direction. Watch out for released synchronizing ring of 4th speed and for needle bearing between input shaft and main shaft.

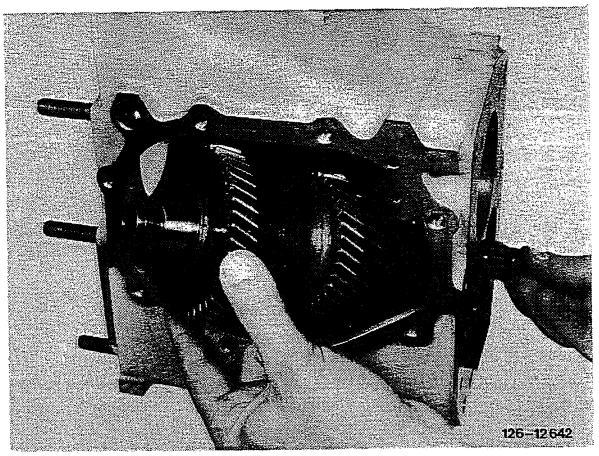


15 Move sliding sleeve (11a) of 3rd and 4th speed into 3rd speed position, push main shaft completely toward the rear and then remove at an angle in forward direction out of housing.



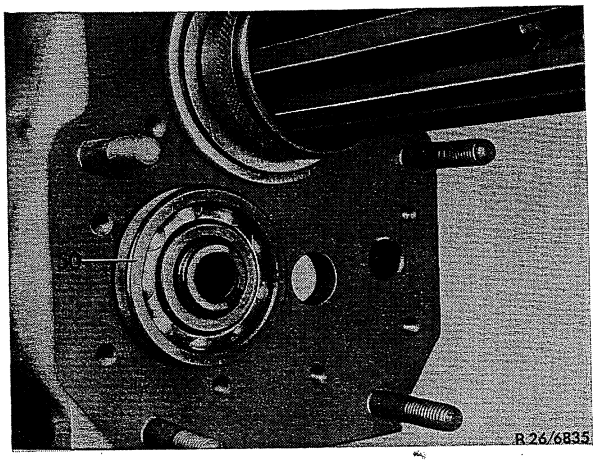
16 Remove countershaft from transmission housing similar to removing main shaft.

17 Check gear assembly components for re-use. Place all synchronizing rings on respective helical gear taper and measure distance between short teeth of synchronizing ring and short teeth of helical gear by means of slip gauge.
The wear limit of the synchronizing ring is attained at a distance of 0.5 mm.

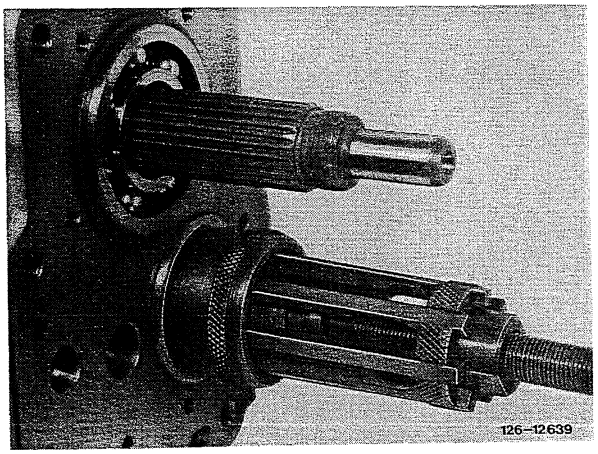


Assembly deviations on transmission type 716.100

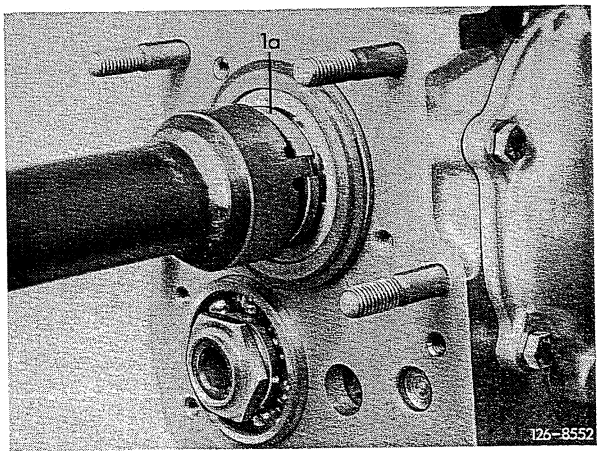
On transmission 716.100 up to unit No. 544 the countershaft has been provided with a bevelled shoulder bearing at the front. This bearing cannot be pulled off and procedure for removal of gear assembly as from item 11 should be as follows:



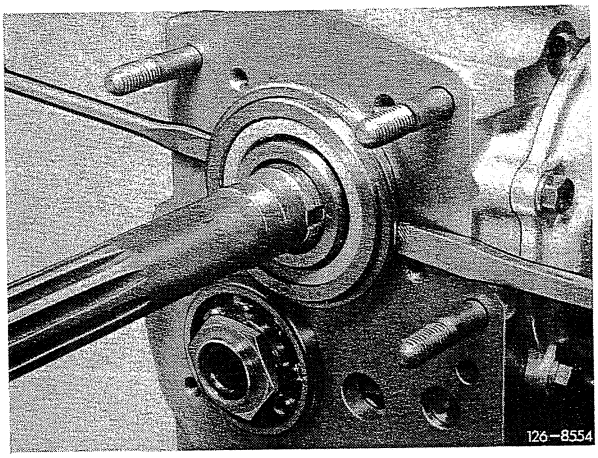
11a Pull-off radial ball bearing of countershaft rear.



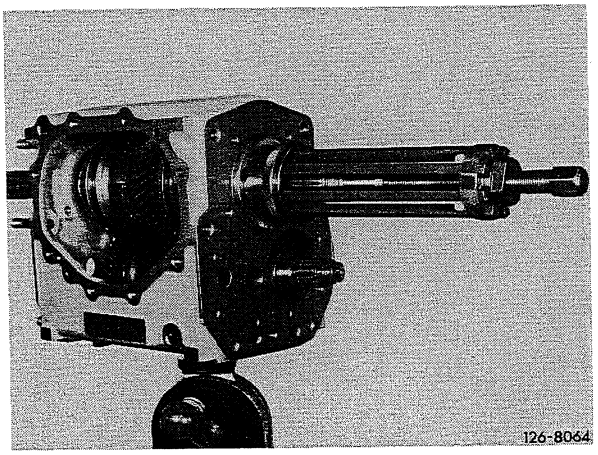
12a Unscrew slot nut (1a) on input shaft.



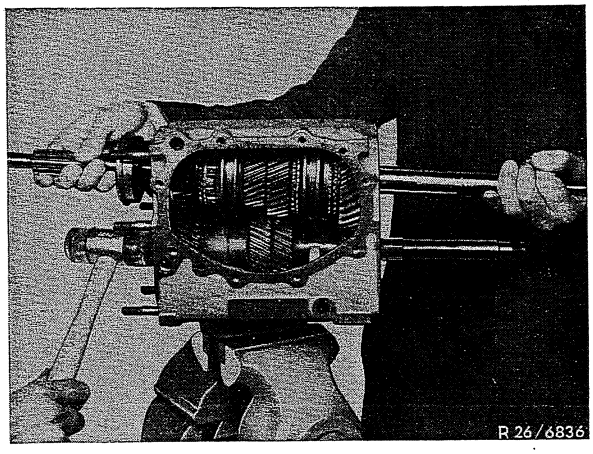
13a Pull-off radial ball bearing of input shaft.



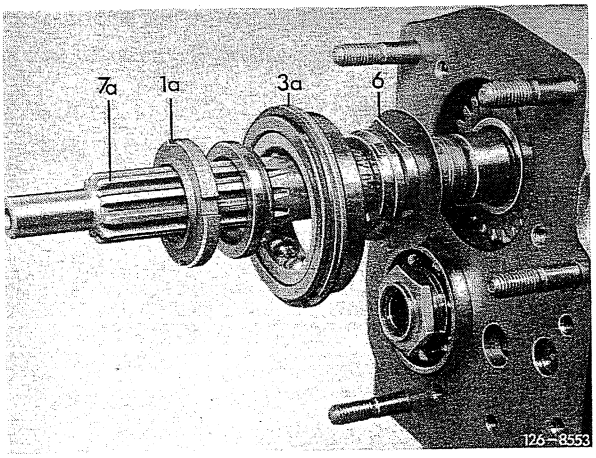
13b Pull-off radial ball bearing of main shaft rear.



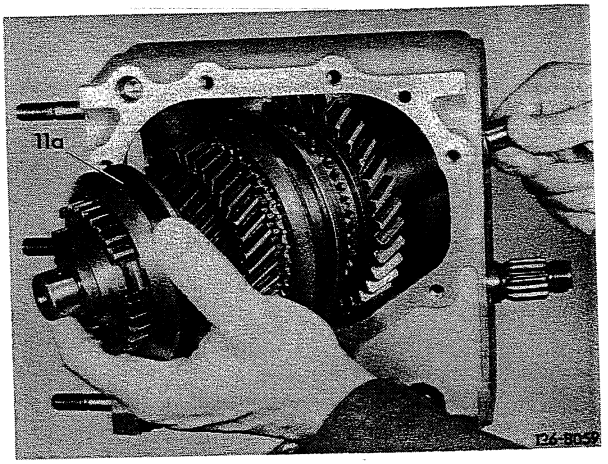
14a Lift input and main shaft together as high as possible (using helper) and push or knock bevelled shoulder bearing toward the rear until bearing comes completely out of housing bore (shown on transmission 717.0).



15a Pull input shaft with radial ball bearing pulled off in forward direction out of transmission housing, while watching out for freed synchronizing ring of 4th speed and needle bearing between input and main shaft.

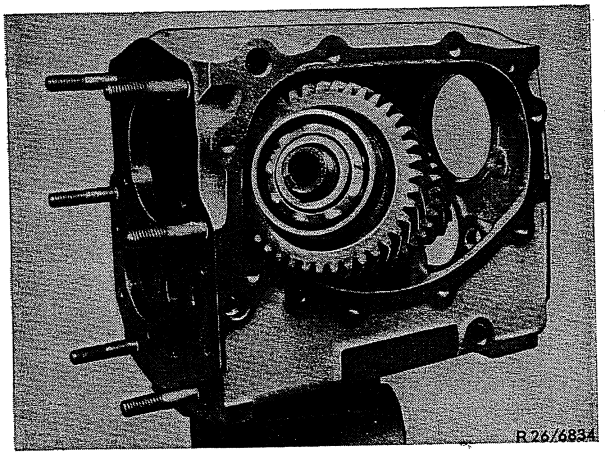


16a Move sliding sleeve (11a) of 3rd and 4th speed into 3rd speed position. Push main shaft completely toward the right and then take out of housing at an angle in forward direction.



17a Remove countershaft with bevel shoulder bearing in the same manner as main shaft out of transmission housing and force-off bevel shoulder bearing.

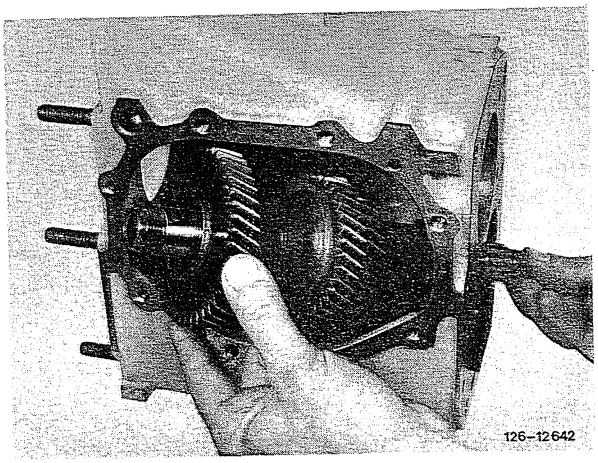
18a Check gear assembly components for re-use. Place all synchronizing rings on respective helical gear taper and measure distance between short teeth of synchronizing ring and short teeth of helical gear with a slip gauge. The wear limit of the synchronizing ring is attained at a distance of 0.5 mm.



Installation

19 Introduce countershaft into housing.

20 Slide assembly sleeve over free, rear end of main shaft and tighten with slot nut of three-arm flange.



21 Move sliding sleeve (11a) of 3rd and 4th speed into 3rd speed position and introduce main shaft at an angle toward the rear into housing.

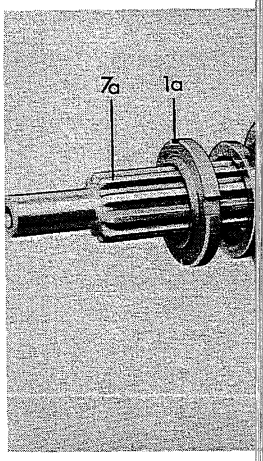
22 Insert needle bearing into input shaft and slide synchronizing ring for 4th speed onto cone on input shaft gear.

23 Introduce input shaft completely into transmission housing from the front, while lifting main shaft until bearing journal at its front end can be introduced into needle bearing of input shaft without tension.

Assembly deviations of transmission 716.100

23a Since in the event of repairs the countershaft is provided at the front with a bevelled shoulder bearing instead of a radial ball bearing, the drive shaft can be installed complete with bearing as described in item 23 (also refer to note following item 25).

23b Tighten slot nut (1a) on input shaft to specified torque and secure.



24 Remove assembly sleeve from rear main shaft end and mount radial ball bearing. When knocking-in bearing, apply counterhold to input shaft to prevent shaft from slipping out.

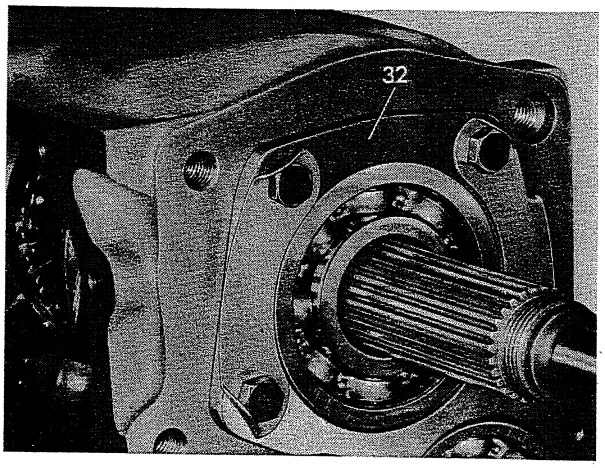
25 Knock-in radial ball bearing of countershaft front and rear with the aid of a steel mandrel or steel hammer, applying light blows. Raise countershaft for this purpose, so that bearings can be easily mounted.

Note: Transmission 716.100 has been provided for some time with a bevel shoulder bearing on countershaft front. In the event of repairs, only a radial ball bearing may be installed. As a result, the assembly procedure is the same as for other transmission types.

28 Insert determined compensating washers into spacing ring and glue down with grease to facilitate assembly.

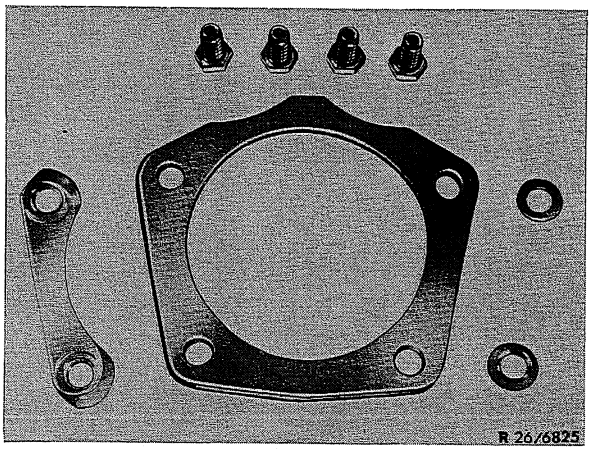
29 Carefully slide holding ring (32) over bearing of main shaft and screw down.

Note: Instead of sheet metal locks, spring washers may also be used.



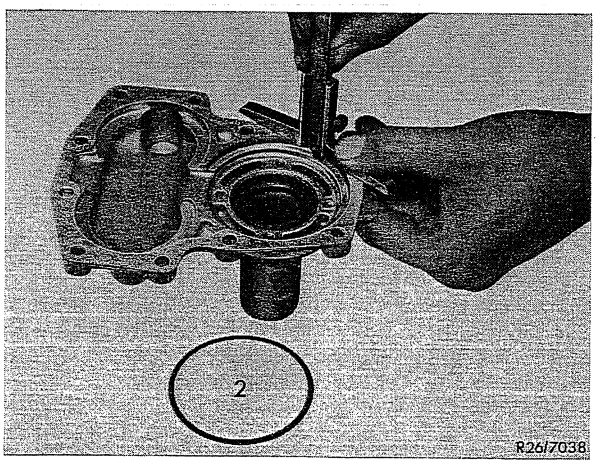
30 Mount reversing gears (26–410).

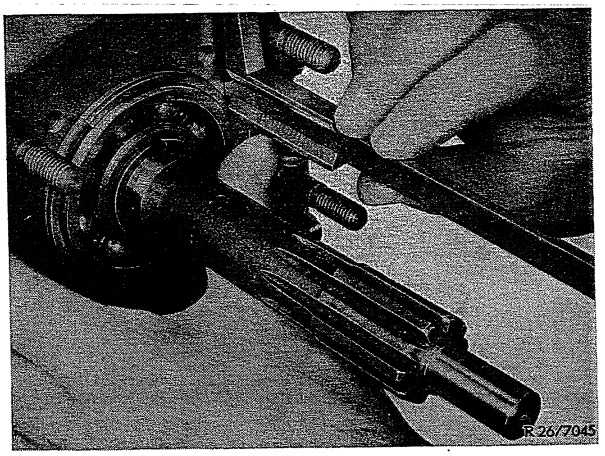
31 Screw-on transmission cover rear (26–310).



32 Set **end play** of input shaft to 0–0.05 mm, trying for 0.

For this purpose, measure depth of recess in front transmission cover **with gasket mounted,** as well as distance between face of circlip on input shaft bearing and parting surface of transmission housing.





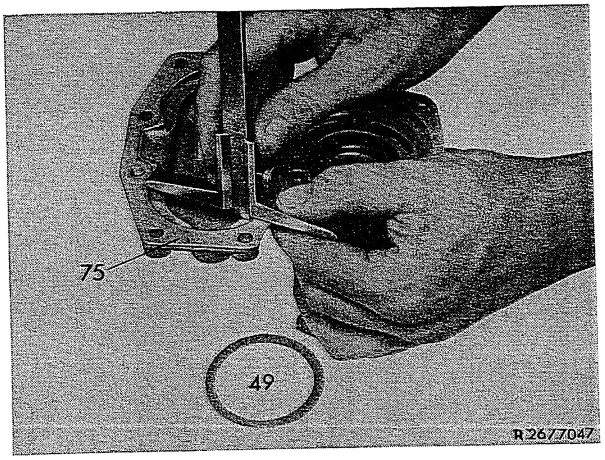
Determine thickness of spacing washers required for adjustments according to the following example:

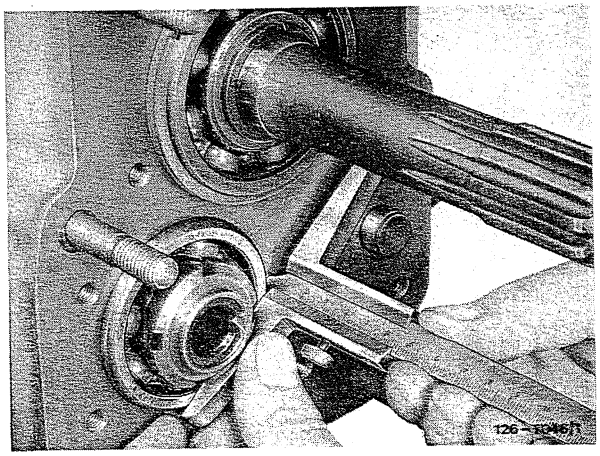
Depth (with gasket)	4.90 mm
Distance	– 4.50 mm
Difference	0.40 mm
Spacing washers 2 x 0.20 mm	– 0.40 mm
End play	0.00 mm

Spacing washers are available 0.1, 0.2 and 0.3 mm thick (refer to spare parts data).

33 Adjust **end play** of countershaft to 0.07 to 0.15 mm.

For this purpose, measure depth of recess in front transmission cover with **gasket mounted** (75), as well as distance between face of bearing outer race and parting surface of transmission housing, for this purpose countershaft should rest well against rear transmission cover.





Determine thickness of spacing washers required for adjustment according to the following example:

Depth (with gasket)	5.10 mm
Distance	– 4.65 mm
Difference	0.45 mm
Spacing washers 1 x 0.10 and 1 x 0.25	– 0.35 mm
End play	0.10 mm

Spacing washers are available 0.1, 0.25 and 0.5 mm thick (refer to spare parts data).

34 Insert spacing washers into front transmission cover and glue down with grease.

35 Screw-on transmission cover front (26–210).

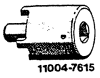
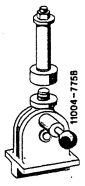
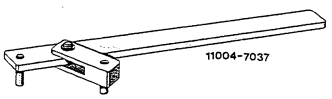
36 Install transmission shift cover (26–110).

37 Screw-on clutch housing (26–050).

Test dimension		
Wear limit of synchronizing rings (distance between synchronizing ring and short teeth on gear wheel)		min. 0.5 mm

Tightening torque	Nm	(kpm)
Slot nut or hex nut 41 mm for main shaft front	80	(8)

Special tools

Slot nut wrench insert 1/2" square for slot nut on transmission main shaft	 11004-7616	115 589 05 07 00
Insert 41 mm for hex nut on transmission main shaft	 11004-7617	116 589 02 09 00
Allen-box wrench for hex socket oil drain plug 14 mm	 11004-6721	000 589 24 07 00
8-arm puller for ball bearing on main shaft	 11004-6934	001 589 02 33 00
7-arm puller for ball bearing on main shaft		123 589 02 33 00
Puller for ball bearing on countershaft	 11004-6935	000 589 94 33 00
Slot nut wrench insert 1/2" square for slot nut on countershaft front	 11004-7615	115 589 03 07 00
Slot nut wrench insert 1/2" square for slot nut on countershaft rear	 11004-7614	115 589 04 07 00
Clamping device for transmission housing	 11004-7758	111 589 08 31 00
Slot nut wrench for slot nut on input shaft 716.1	 11004-7613	115 589 09 07 00
Slot nut wrench insert 3/4" square for slot nut on transmission flange	 11004-7072	115 589 01 07 00
Allen-wrench for counterhold on transmission flange when loosening and tightening slot nut	 11004-7037	116 589 10 07 00

Revisions

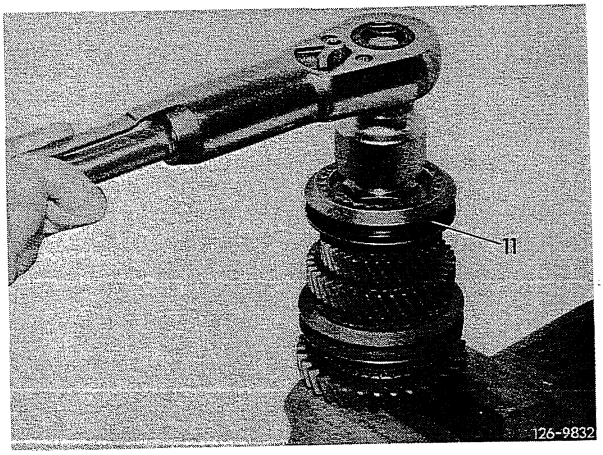
Designation	Transmission	as from transmission no.
Change from slot nut to hex nut on main shaft front	G 76/18	556 950
	716.100	003 737
Change from coil spring synchronization to annular spring synchronization	716.001	005 991
	716.002	766 041
	716.003	as from start of series
	716.100	008 151
Gear wheels changed from long teeth to super long teeth. Exchange gear wheels only in pairs	716.006	022 957

Disassembly

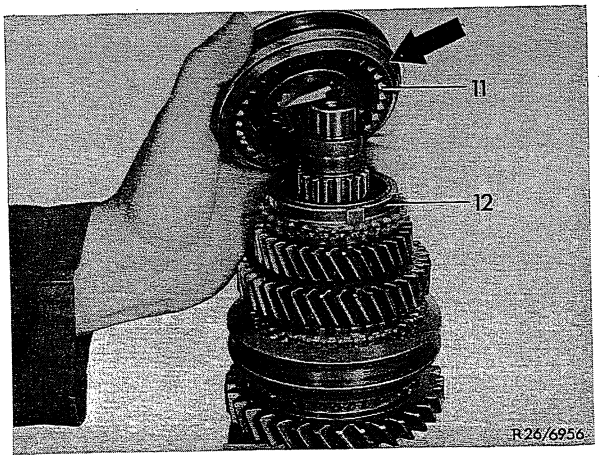
1 Remove gear assembly (26–420).

2 Clamp main shaft into vise by means of 3-arm flange.

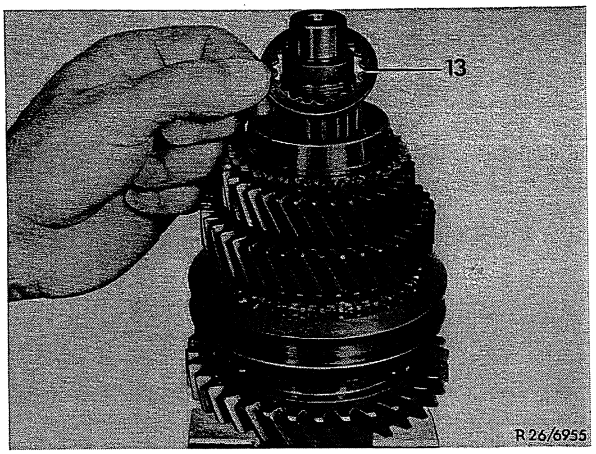
3 Loosen slot nut or hex nut on main shaft front on synchronizing body for 3rd and 4th speed with slot nut wrench.



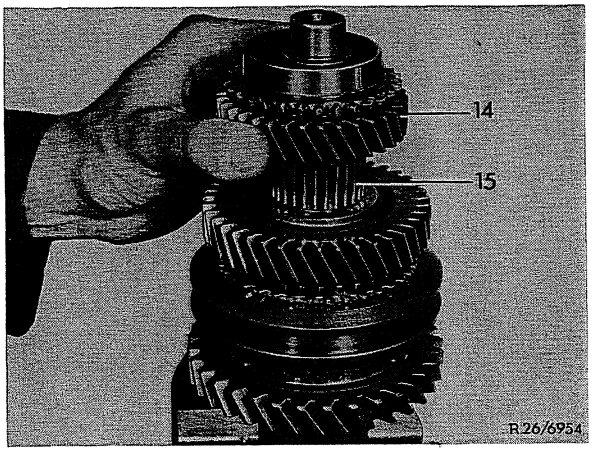
4 Remove synchronizing body (11) for 3rd and 4th speed from main shaft.



5 Remove thrust washer (13) with internal teeth from shaft.



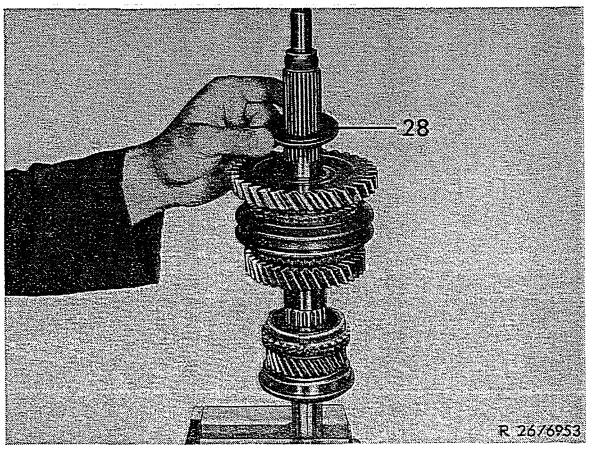
6 Remove helical gear (14) for 3rd speed and needle cage (15).

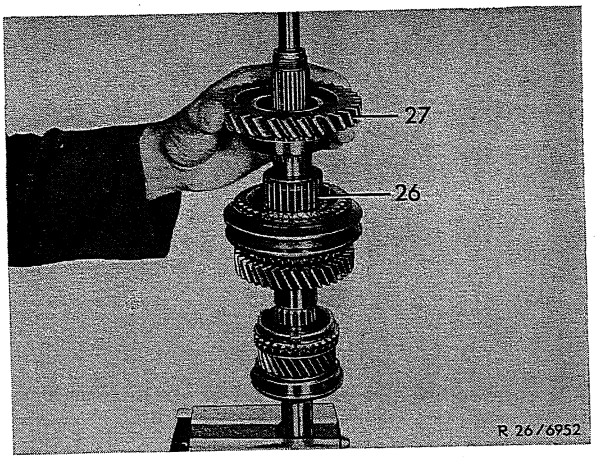


7 Turn main shaft around and clamp into vise by means of input shaft and inserted needle cage.

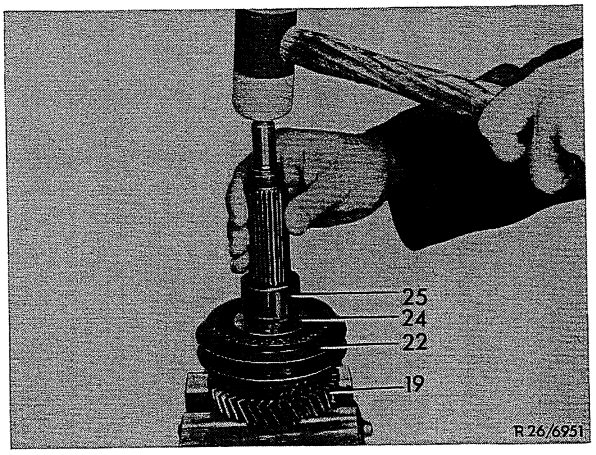
Note: Use aluminum jaws to protect input shaft against damage.

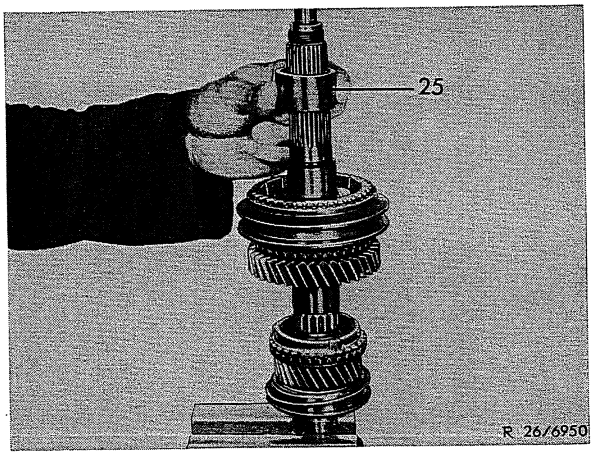
8 Remove thrust washer (28) and helical gear (27) for 1st speed, as well as needle cage (26) from main shaft.



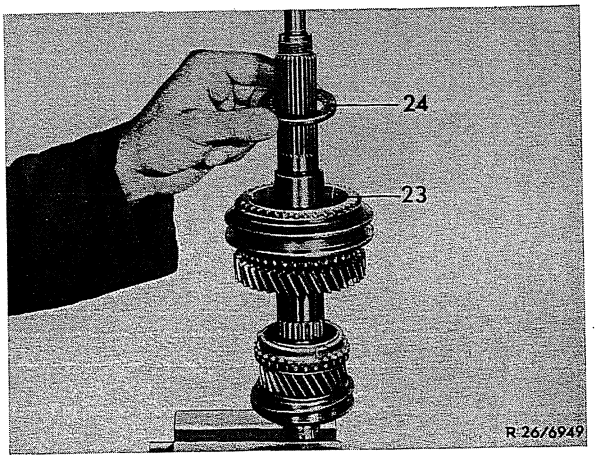


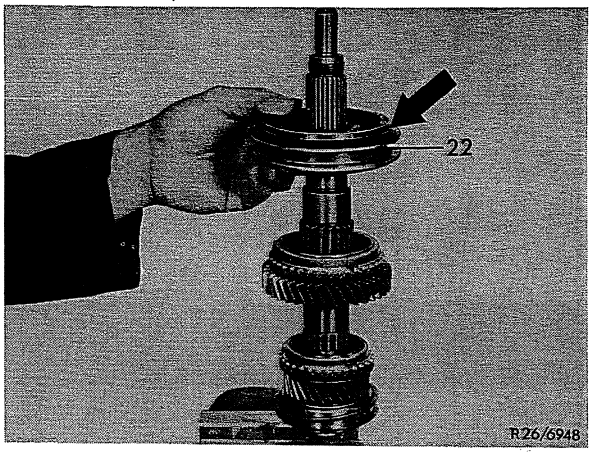
9 Knock race (25) of 1st gear wheel bearing from shaft by placing main shaft with helical gear (19) of 2nd speed on pertinently opened vise and knock-in in downward direction.

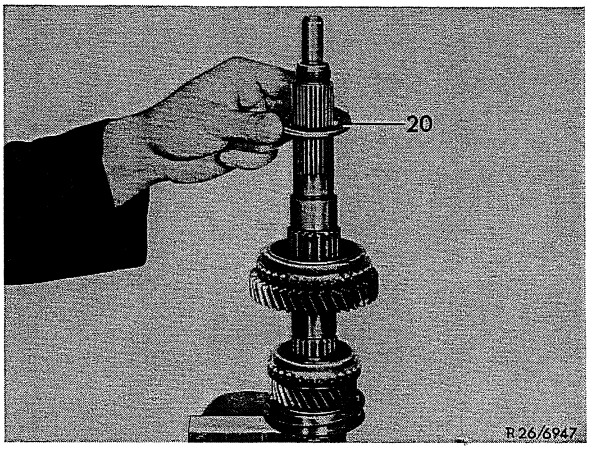




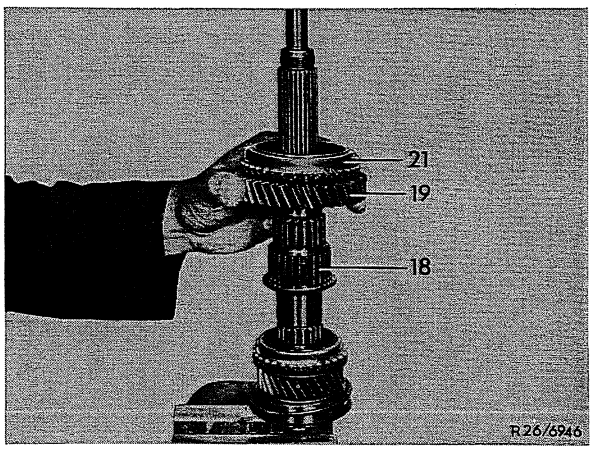
10 Remove thrust washer (24), synchronizing ring (23), synchronizing body (22) and thrust washer (20).







11 Remove helical gear (19) with synchronizing ring (21) for 2nd speed and needle cage (18) from main shaft.

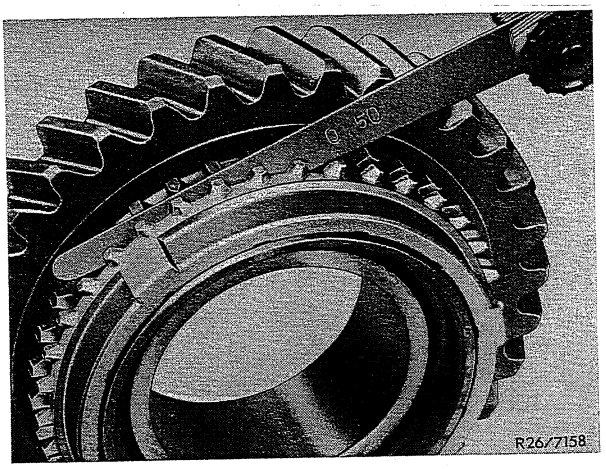


Checkup

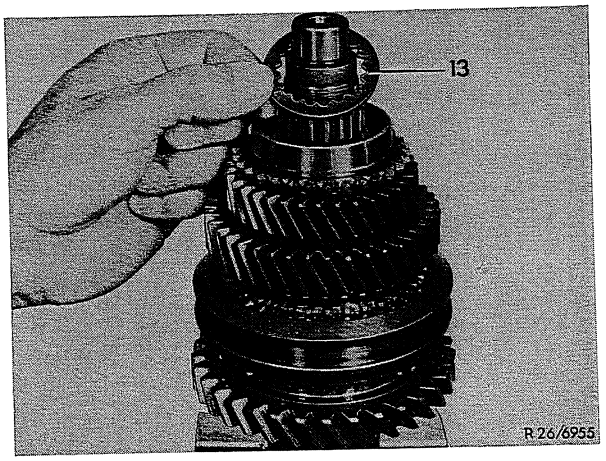
12 Check all parts for wear and condition of wear.

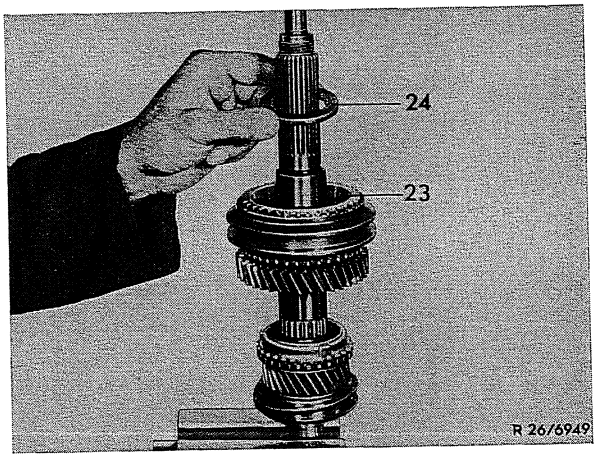
13 Place all synchronizing rings on pertinent helical gear cone and use slip gauge to measure distance between short teeth of synchronizing ring and short teeth of helical gear.

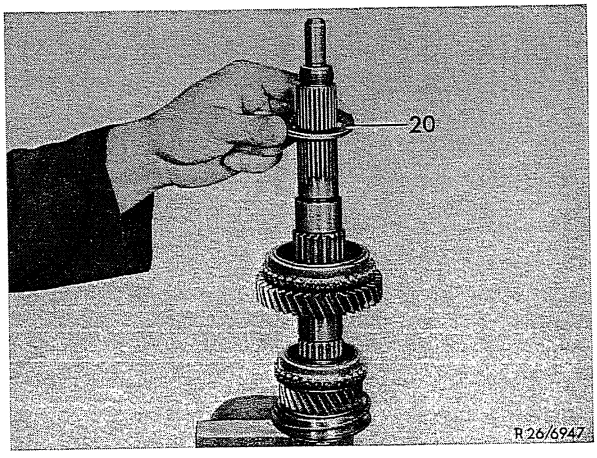
Note: The wear limit of the synchronizing ring is attained at a distance of 0.5 mm. In such a case, the synchronizing ring must be replaced.



Attention!
If in the event of repairs a transmission is changed from coil spring synchronization to annular spring synchronization, the renewal of the synchronizing body for 3rd/4th speed will eliminate thrust washer (13), and the renewal of the synchronizing body for 1st/2nd speed will eliminate thrust washers (2) and (24) as a result of pertinent widening of the hub.



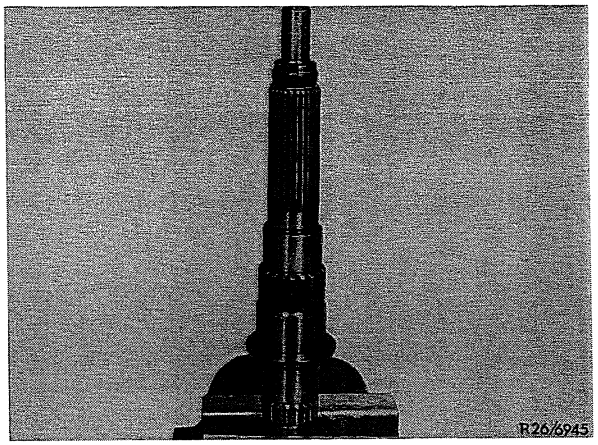




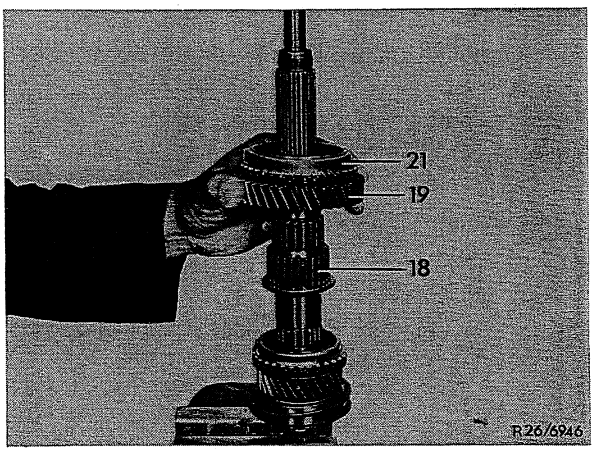
Assembly

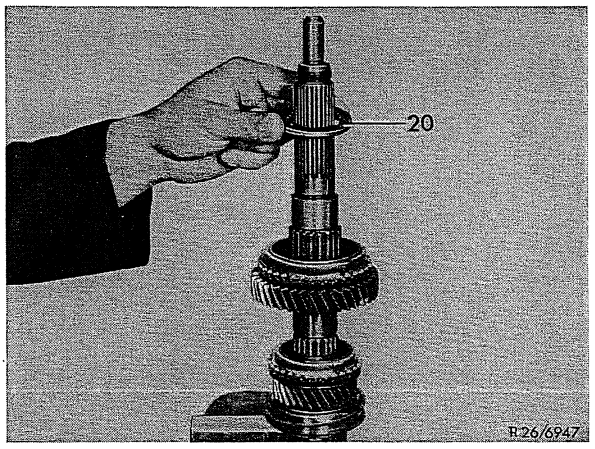
14 Clamp main shaft into vise.

Note: To prevent damage to main shaft when clamping into vise, use aluminum jaws. In addition, the main shaft can also be clamped by means of input shaft.

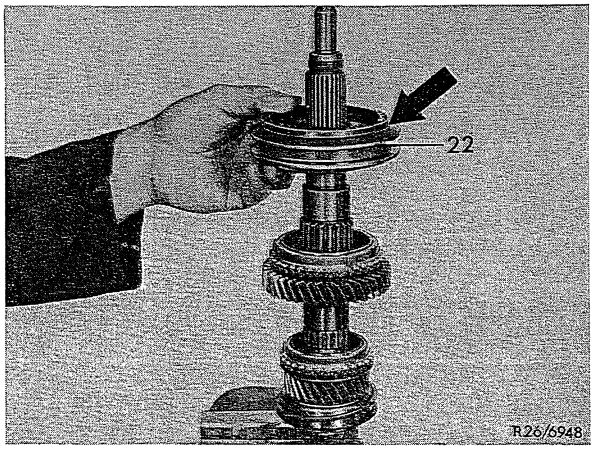


15 Place lubricated needle cage (18), helical gear (19) with synchronizing ring (21) for 2nd speed and steel thrust washer (20) on main shaft.

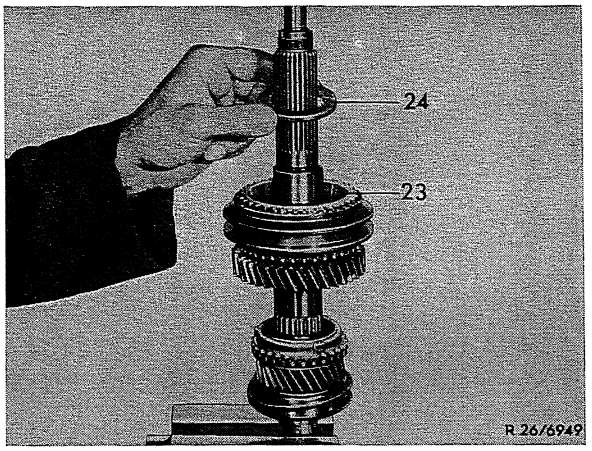




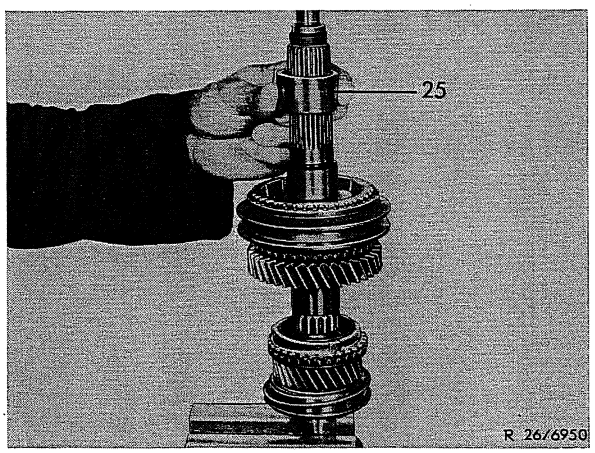
16 Place synchronizing body (22) of 1st and 2nd speed on main shaft in such a manner that flange (arrow) is facing 1st gear wheel.

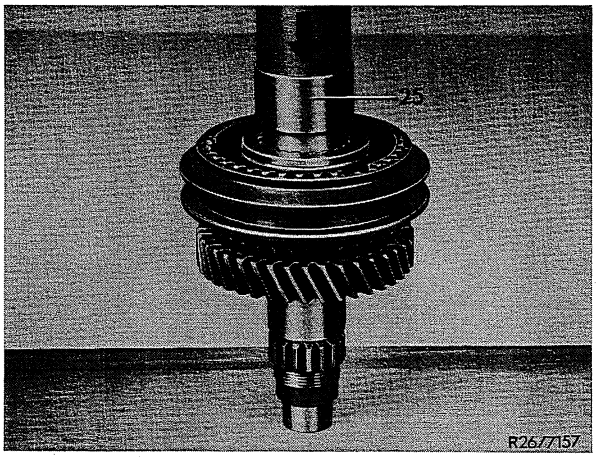


17 Mount synchronizing ring (23) and thrust washer (24).



18 Place main shaft on a sturdy support and knock-on heated race (25) of 1st gear wheel bearing with a piece of tubing of approx. 42 x 3 x 260 mm.

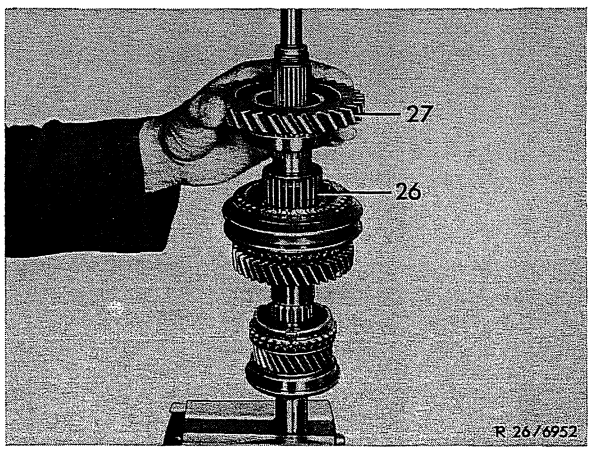




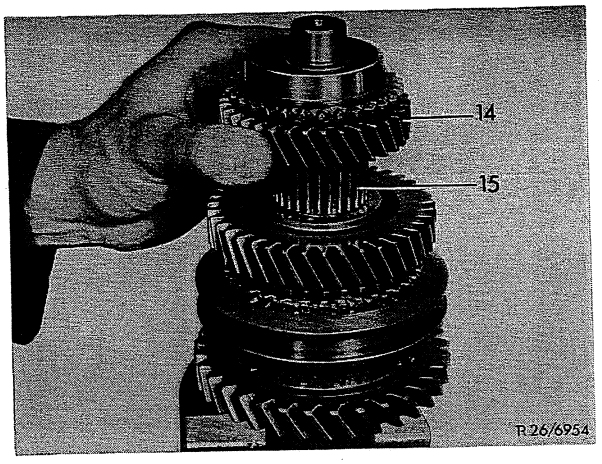
19 Mount needle cage (26) and helical gear (27) for 1st speed.

20 Place steel thrust washer on 1st gear wheel, slip assembly sleeve on main shaft and tighten manually with slot nut or hex nut.

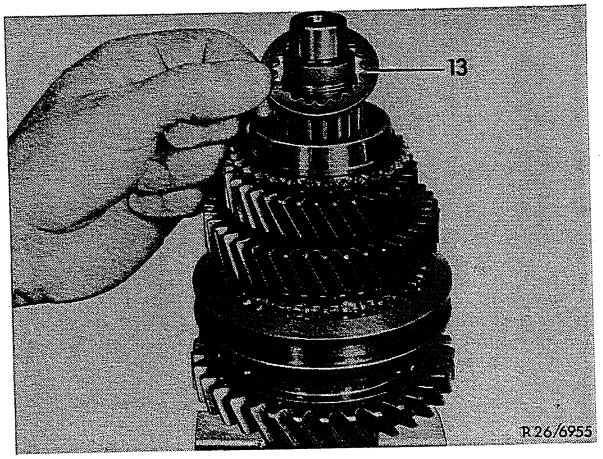
21 Turn main shaft around and carefully clamp into vise at assembly sleeve.



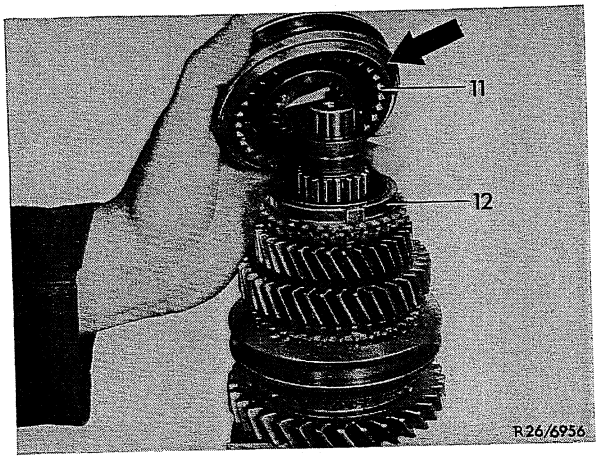
22 Lubricate needle cage (15) and place on shaft together with helical gear (14).



23 Insert or mount brass thrust washer (13) with internal teeth and synchronizing ring (12).



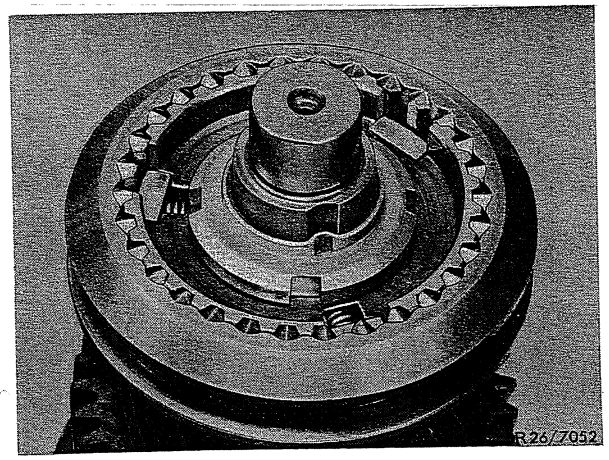
24 Place synchronizing body (11) for 3rd and 4th speed on shaft in such a manner that the end with the machined groove (arrow) faces 3rd speed.

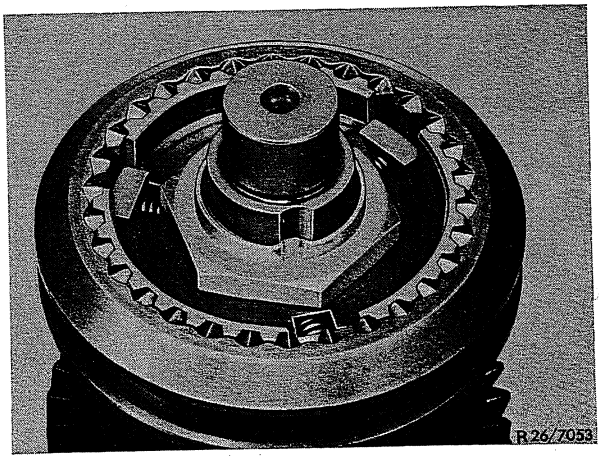


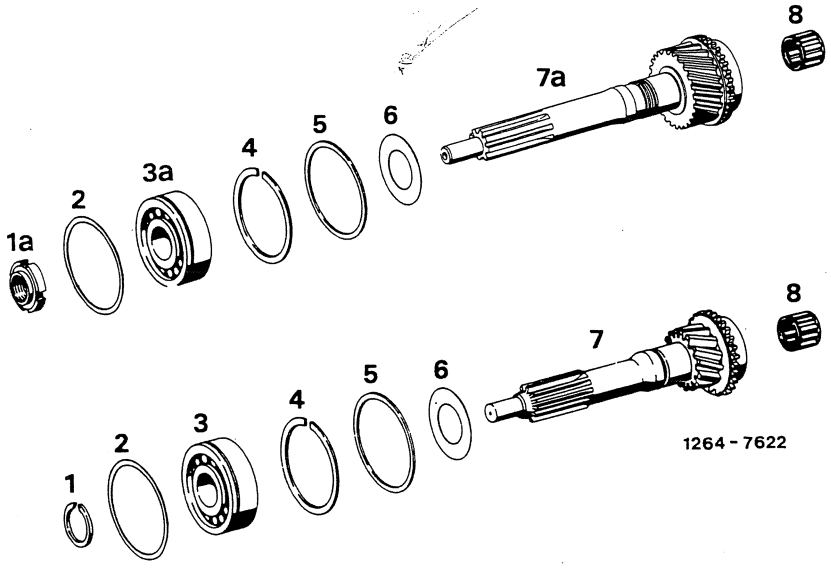
25 Tighten slot nut or hex nut with pinch collar on main shaft front with slot nut wrench to specified torque, clamping main shaft into vise by means of three-arm flange.

Note: As from transmission No. 6350 the main shaft is provided at the front with a hex nut SW 41 with pinch collar instead of the slot nut. In the event of repairs, the slot nut can be replaced by a hex nut.

26 Install gear assembly (26.1—420).

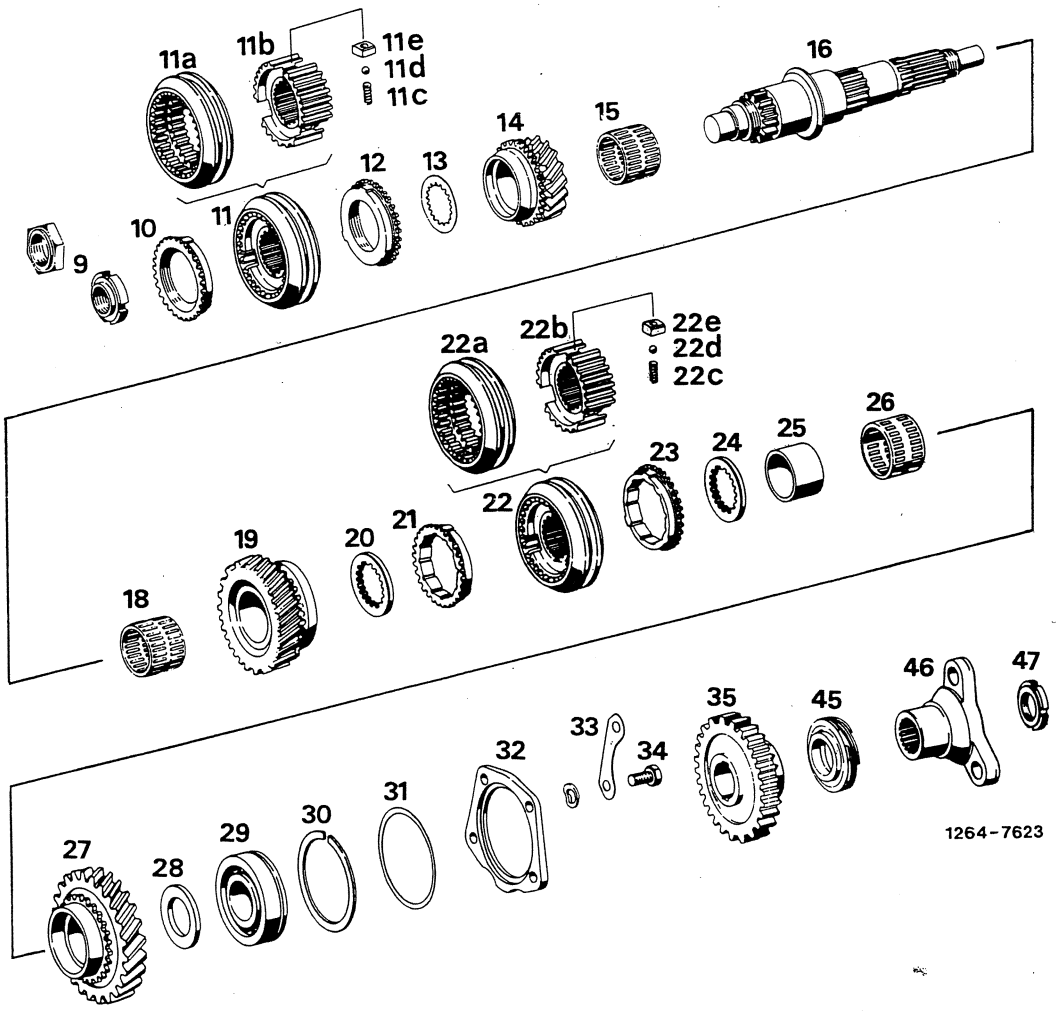






Input shaft

1 Circlip
1a Slot nut for input shaft 716.100
2 Compensating washer
3 Radial ball bearing with split inner race 716.100
4 Circlip
5 Spacing ring
6 Oil throwing washer
7 Input shaft with synchronizing cone
7a Input shaft with synchronizing cone for transmission 716.100
8 Needle cage



Main shaft

9 Slot nut or hex nut main shaft front
10 Synchronizing ring for 4th speed
11 Synchronizing body with sliding sleeve for 3rd and 4th speed
11a Sliding sleeve
11b Synchronizing body
11c Compression springs synchronizing body
11d Steel ball
11e Driver
12 Synchronizing ring for 3rd speed
13 Thrust washer for 3rd speed
14 Helical gear 3rd speed
15 Needle cage for 3rd gear wheel
16 Main shaft
18 Needle cage for 2nd gear wheel
19 Helical gear 2nd speed with synchronizing cone
20 Thrust washer
21 Synchronizing ring for 2nd speed
22 Synchronizing body with sliding sleeve 1st and 2nd speed
22a Sliding sleeve
22b Synchronizing body
22c Compression spring synchronizing body
22d Steel ball
22e Driver
23 Synchronizing ring for 1st speed
24 Thrust washer
25 Race 1st gear wheel
26 Needle cage for 1st gear wheel
27 Helical gear for 1st speed
28 Thrust washer
29 Radial ball bearing (for 716.100 simular to 3a)
30 Circlip
31 Compensating washer
32 Holding ring rear bearing main shaft
33 Locking plate or spring washer
34 Hex bolt
35 Reversing gear main shaft
45 Helical gear tachometer drive
46 Universal flange
47 Locking nut universal flange on main shaft

A. Coil spring synchronization

Disassembly

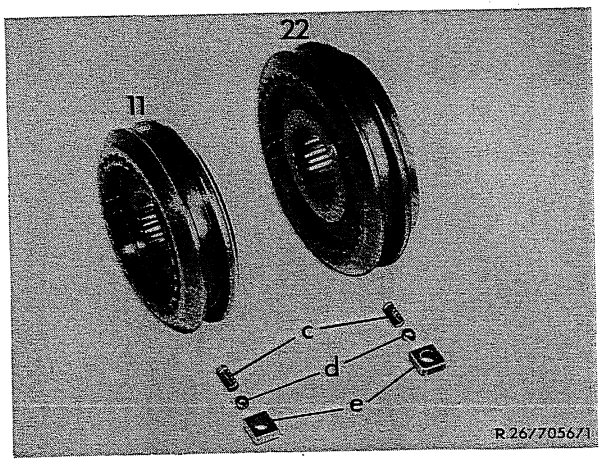
1 Wrap synchronizing body in a cloth so that steel balls and springs will not be lost when forced apart.

2 Force synchronizing body including drive member from sliding sleeve.

3 Check individual parts for wear and condition of wear.

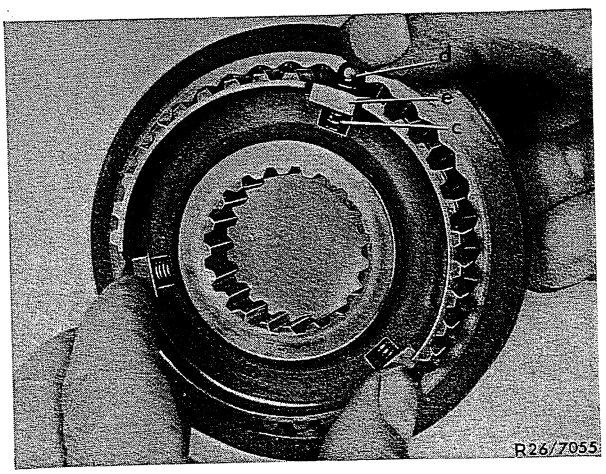
Assembly

4 Insert springs (c) and drive members (e) into synchronizing body and introduce synchronizing body into sliding sleeve.



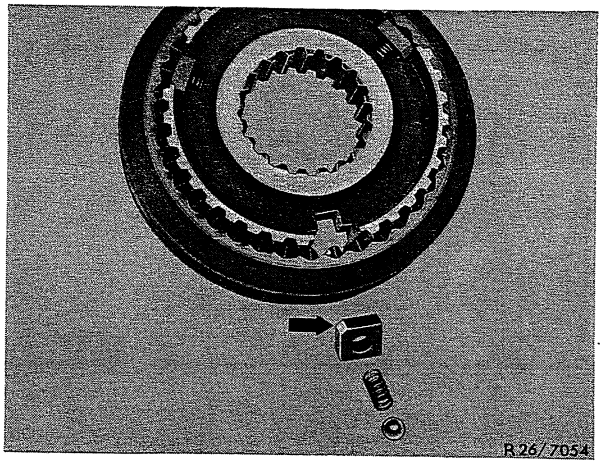
c Spring
d Steel ball
e Drive member
11 Synchronizing body 3rd and 4th speed
22 Synchronizing body 1st and 2nd speed

5 Push one drive member forward at a time, insert one ball and push drive member back.

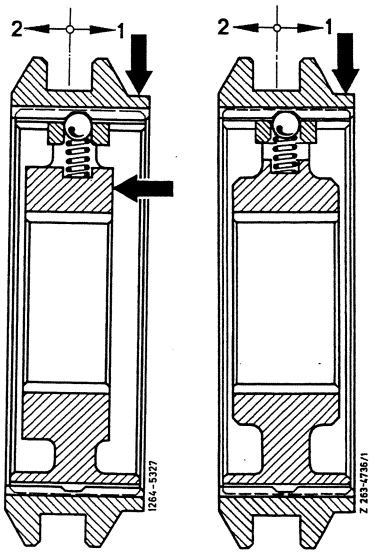


c Spring
d Steel ball
e Drive member

6 For better differentiation the drive members of the synchronizing body for 1st and 2nd speed are characterized by a chamfer (arrow). Drivers should be mounted in such a manner that the chamfer faces the side of the 2nd gear wheel.



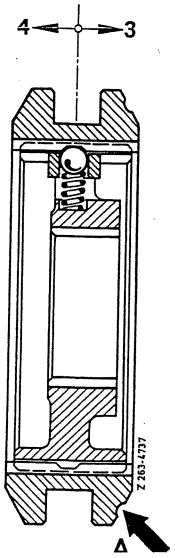
7 Mount synchronizing body for 1st and 2nd speed of transmissions G 76/18, 716.001 and 716.002 in such a manner, that the shorter hub end and the flange on sliding sleeve (arrows) are facing 1st speed.



Synchronizing body 1st and 2nd speed

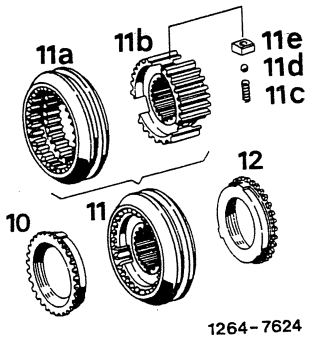
G 76/18	G 76/27
716.001	716.100
716.002	

8 Mount synchronizing body for 3rd and 4th speed in such a manner that the wide hub end and the machined groove of sliding sleeve (arrow) are on the same side.



Synchronizing body 3rd and 4th speed

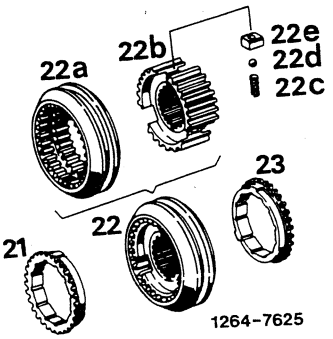
10 Synchronizing ring for 4th speed
11 Synchronizing body with sliding sleeve for 3rd and 4th speed
11a Sliding sleeve
11b Synchronizing body
11c Compression spring – synchronizing body
11d Steel ball
11e Drive member
12 Synchronizing ring for 3rd speed



1264-7624

Synchronizing body 1st and 2nd speed

21 Synchronizing ring for 2nd speed
22 Synchronizing body with sliding sleeve 1st and 2nd speed
22a Sliding sleeve
22b Synchronizing body
22c Compression spring – synchronizing body
22d Steel ball
22e Drive member
23 Synchronizing ring for 1st speed

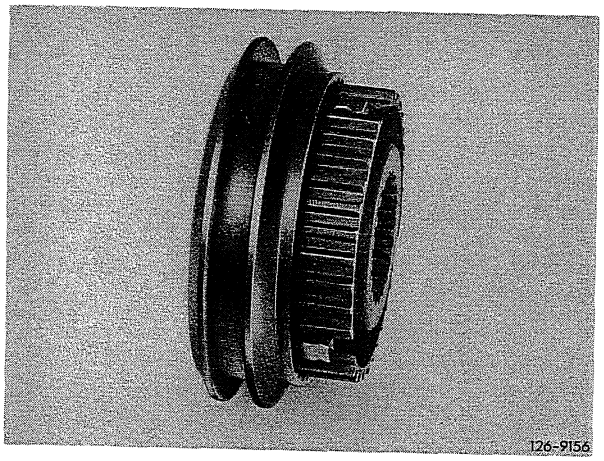


1264-7625

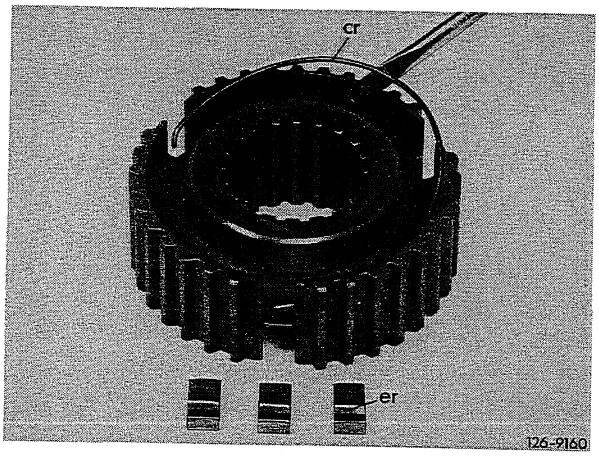
B. Annular spring-synchronization

Disassembly

1 Push synchronizing body out of sliding sleeve.

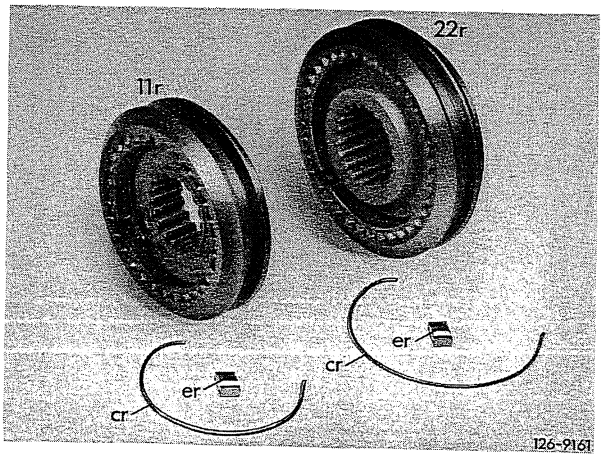


2 Remove drive member (er) and annular spring (cr) out of synchronizing body.



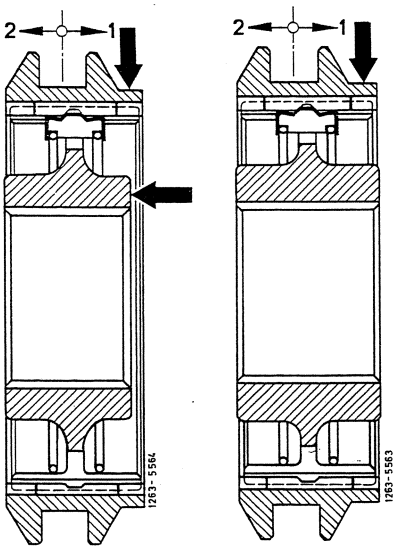
3 Check parts for wear and condition of wear.

Note: Annular springs differ in accordance with different diameters of synchronizing bodies.



11r	Synchronizing body 3rd and 4th speed
cr	Annular spring
er	Drive member
22r	Synchronizing body 1st and 2nd speed
cr	Annular spring
er	Drive member

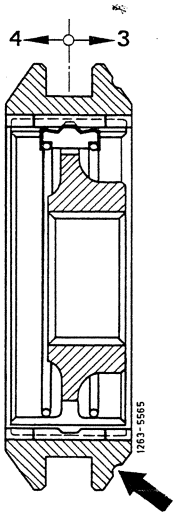
4 Mount synchronizing bodies for 1st and 2nd speed of transmissions 716.0 in such a manner that the shorter hub end and the flange on sliding sleeve (arrows) are facing 1st speed.



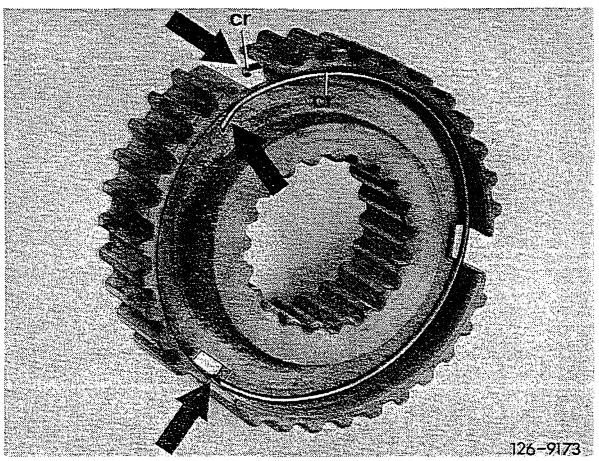
Synchronizing body 1st and 2nd speed

716.0 716.1

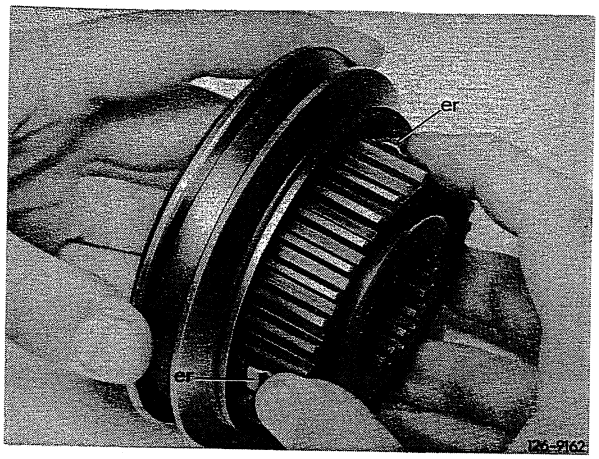
5 Mount synchronizing bodies for 3rd and 4th speed in such a manner that the wide hub end and the machined groove of sliding sleeve (arrow) are on the same side.



6 Angular end of the one spring and the free end of the other spring should rest against same drive member (arrows).

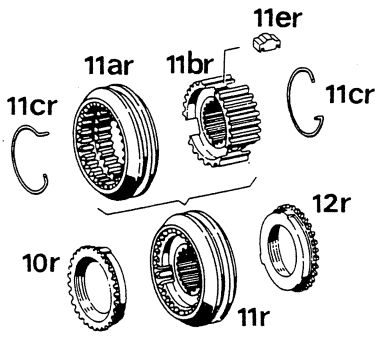


7 Place drive members (er) one after the other on annular springs and slip sliding sleeve over synchronizing body and drive members.



Synchronizing body 3rd and 4th speed

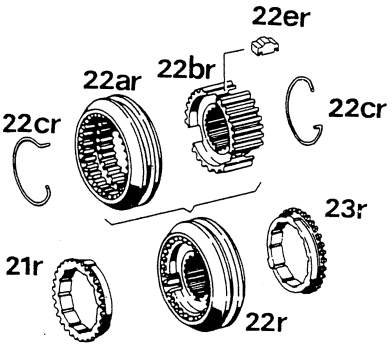
10r Synchronizing ring for 4th speed
11r Synchronizing body with sliding sleeve for 3rd and 4th speed
11ar Sliding sleeve
11br Synchronizing body
11cr Annular spring
11er Drive member
12r Synchronizing ring for 3rd speed



1264-7626

Synchronizing body 1st and 2nd speed

21r Synchronizing ring for 2nd speed
22r Synchronizing body with sliding sleeve for 1st and 2nd speed
22ar Sliding sleeve
22br Synchronizing body
22cr Annular spring
22er Drive member
23r Synchronizing ring for 1st speed



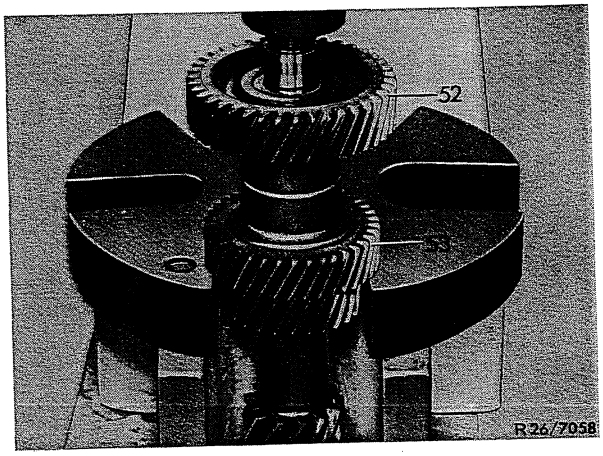
1264-7627

Revisions

Designation	Transmission	as from transmission no.
Change of countershaft Reason: to match transmission 716.001	716.100	006 294
Gear wheels changed from long teeth to super long teeth. Exchange gear wheels in pairs only	716.006	022 957

Disassembly

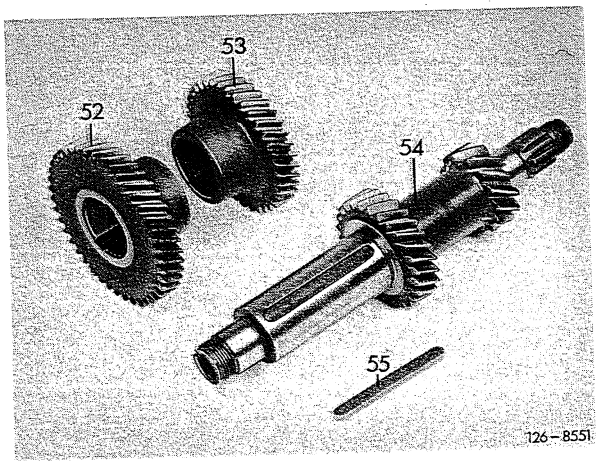
1 Position countershaft with the aid of suitable supports on 3rd gear wheel (53) as required and press-out shaft by means of press.



52 Countershaft helical gear – constant gear
53 Countershaft helical gear 3rd speed

2 Remove woodruff key (55) from shaft by means of a screw driver.

3 Check all parts for wear and condition of wear.



52 Countershaft helical gear – constant gear
53 Countershaft helical gear 3rd speed
54 Countershaft with helical gear wheel for 2nd and 1st speed
55 Woodruff key

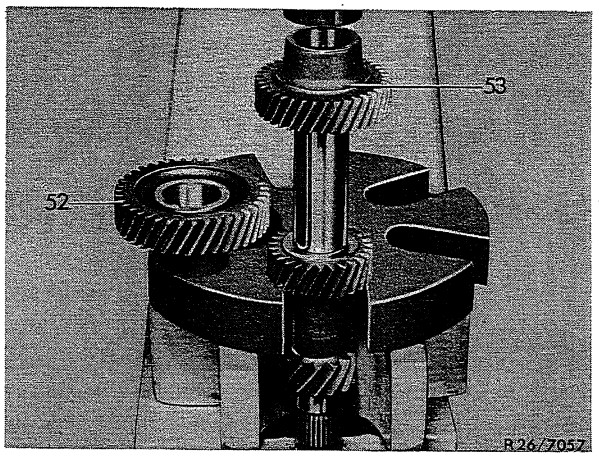
Assembly

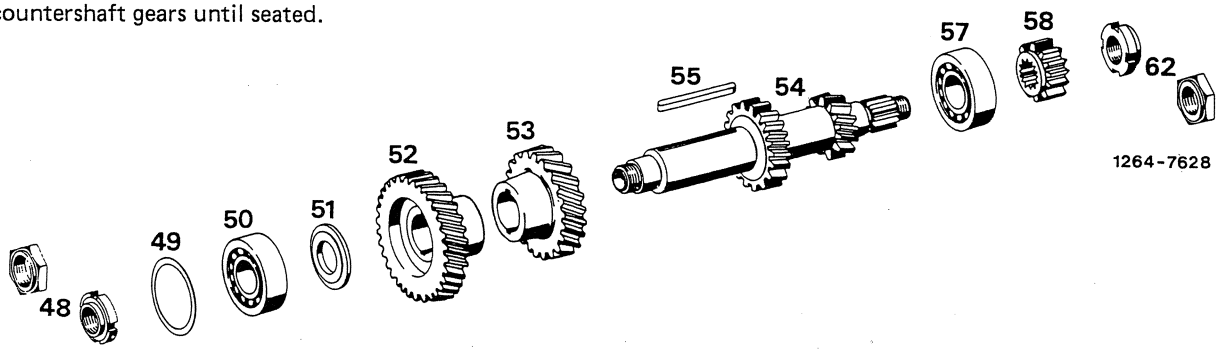
4 Knock woodruff key into countershaft.

5 Position countershaft at helical gears for 2nd speed and press-on 3rd gear wheel (53) with high flange in upward direction.

6 Press-on countershaft helical gear – constant gear (52) with high flange in downward direction.

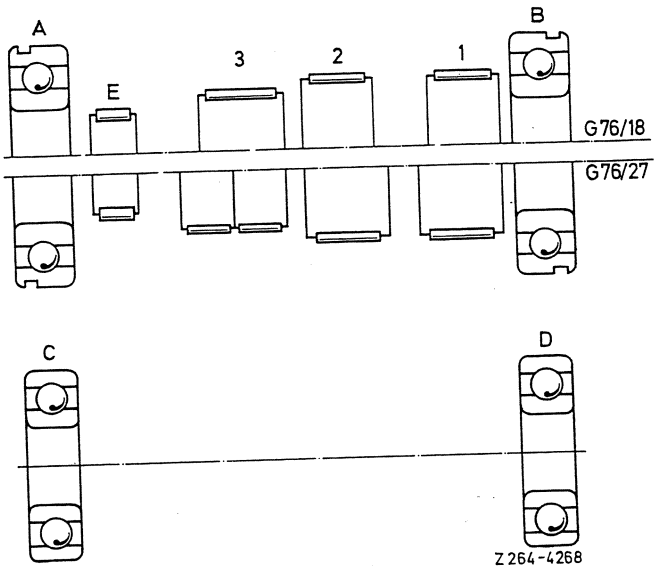
When pressing-on, make sure that no material is scraped from woodruff key. Before countershaft gear for 3rd speed comes to rest against helical gears for 2nd speed, check whether material has been scraped off. If required, remove such material, since the faces of the flanges must be clean. Then press-on countershaft gears until seated.





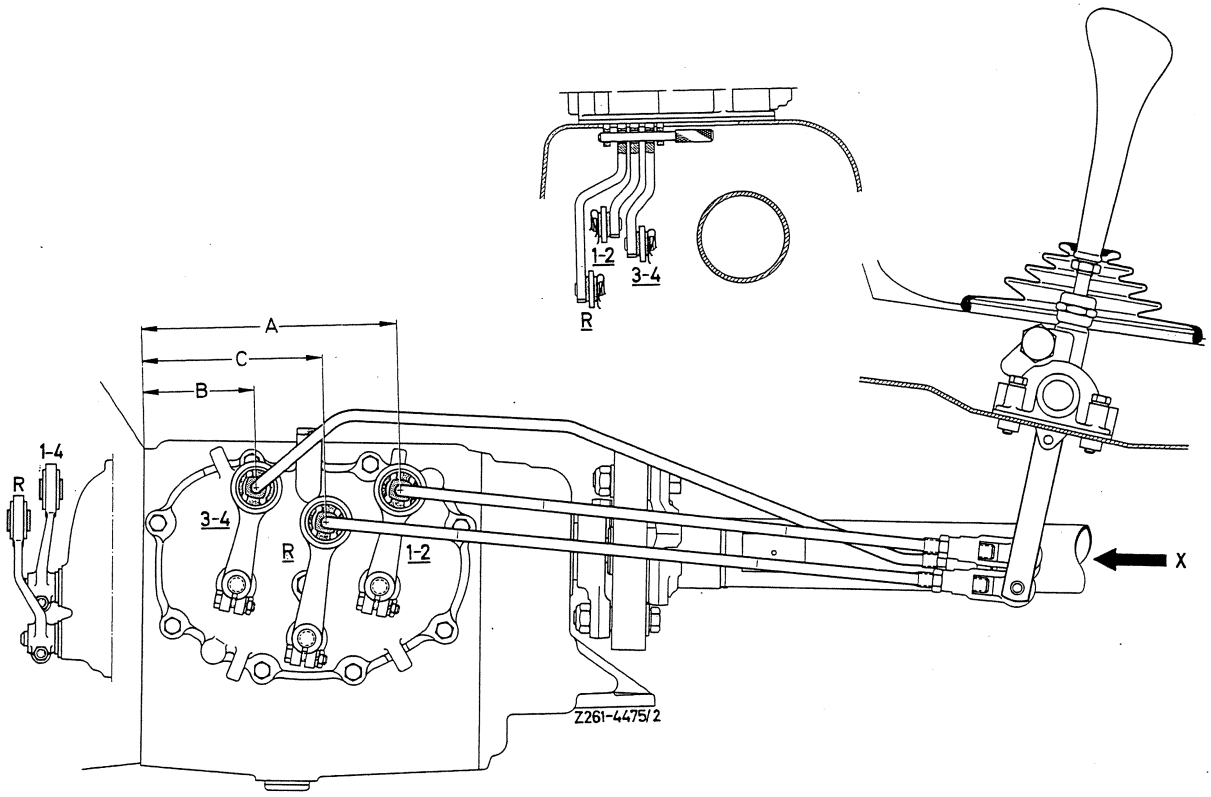
Countershaft

48 Slot nut or hex nut
49 Compensating shaft
50 Radial ball bearing
51 Spacing washer (for countershaft gear – constant gear)
52 Countershaft helical gear – constant gear
53 Countershaft helical gear 3rd speed
54 Countershaft helical gears for 2nd and 1st speed
55 Woodruff key
57 Radial ball bearing
58 Reversing gear – countershaft
62 Slot nut or hex nut



Item	Designation	Dimensions OD	ID	Width
Bearing of input shaft in transmission housing G 76/18, 716.0				
A	Radial ball bearing 002 981 06 25 Radial ball bearing 002 981 07 25	72	30	19
Bearing of input shaft in transmission housing 716.1				
A	Radial ball bearing 000 981 68 25 with split inner race	72	30	19
Bearing of main shaft G 76/18, 716.0, 716.1				
B	Radial ball bearing 002 981 06 25 Radial ball bearing 002 981 07 25 Radial ball bearing 000 981 68 25 (716.1)	72	30	19
E	Needle cage 005 981 54 10 Needle cage 002 981 81 10	30	22	15
Bearing of countershaft G 76/18, 716.0, 716.1				
C D	Radial ball bearing 001 981 23 25 Radial ball bearing 002 981 00 25 Radial ball bearing 001 981 71 25	62	25	17

Item	Designation	Dimensions OD	ID	Width
Bearing of 1st and 2nd gear wheel G 76/18, 716.0				
1 2	Needle cage 005 981 56 10 Needle cage 006 981 53 10	42	35	24.5
Bearing of 1st and 2nd gear wheel 716.1				
1 2	Needle cage 004 981 08 10	47	42	28.2
Bearing of 3rd gear wheel G 76/18, 716.0				
3	Needle cage 005 981 55 10 Needle cage 006 981 52 10	40	35	28.5
Bearing of 3rd gear wheel 716.1				
3	Needle cage 004 981 07 10 Needle cage 002 981 00 10 Needle cage 003 981 04 10 Needle cage 003 981 12 10	40	35	34.7

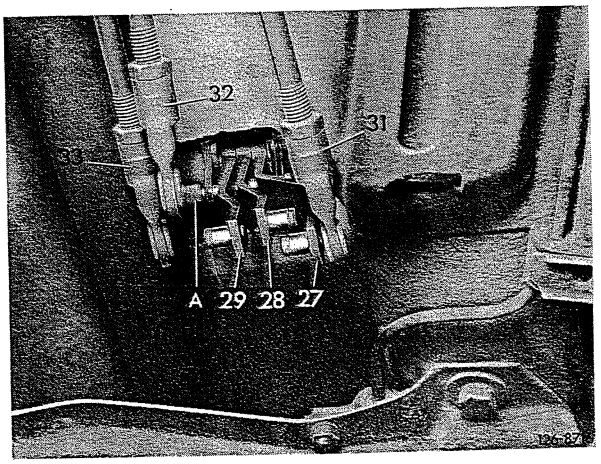


Dimensions for adjustment of shift levers of floor shift

Adjusting dimension	107.022/042 114.115 116.020/024/025	123	107.023/043 116.028/029
A = 1st and 2nd speed	152	142	168
B = 3rd and 4th speed	58		62
C = Reversing speed	111		120

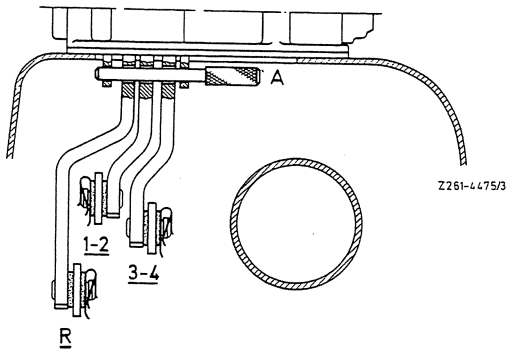
Adjustment

1 Disconnect shift rods on levers of bearing bracket of floor shift after removing SL-locks.



27 Intermediate lever for reverse speed
28 Intermediate lever for 1st and 2nd speed
29 Intermediate lever for 3rd and 4th speed
31 Shift rod for reverse speed
32 Shift rod for 1st and 2nd speed
33 Shift rod for 3rd and 4th speed
A Locating pin

2 Locate the three intermediate shift levers at bottom of shift bracket by inserting locating pin into holes provided.



3 Move transmission into idle position, then check position of shift levers on transmission shift cover for specified dimensions and correct, if required (Fig. and table).

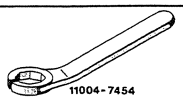
4 Adjust shift rods to length and push rod heads free of tension on bolts of intermediate shift levers and secure with SL locks. Shift levers on transmission shift cover should not move out of their center position.

5 Remove locating pin out of intermediate shift levers.

6 Check gearshift for function with engine running.

Tightening torque	Nm	(kpm)
Closing cap for shift lever	7	(0.7)

Special tool

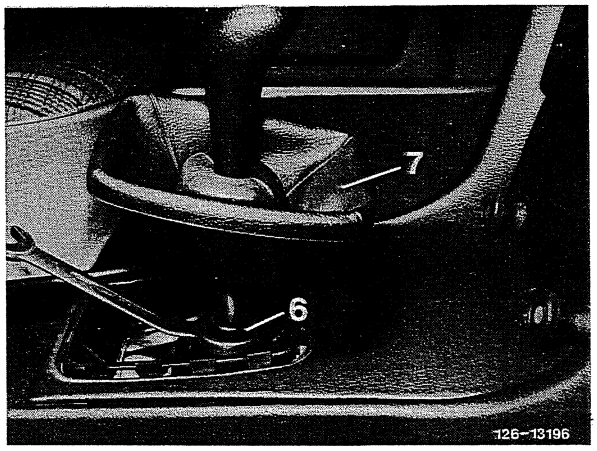
Box wrench 27 mm for closing cap (octagon) on shift lever	 11004-7454	115 589 00 03 00

Self-made tool

Holding device for shift lever

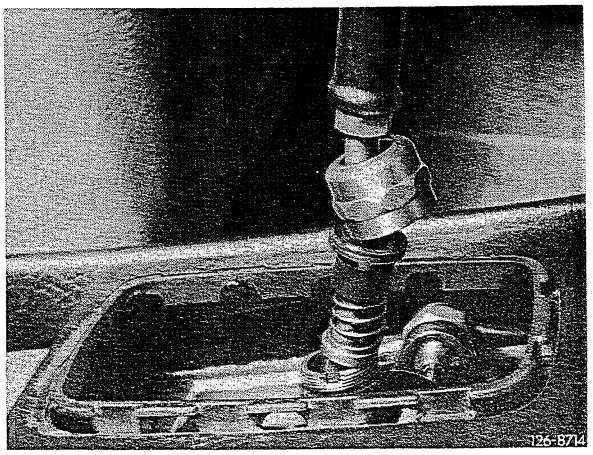
Removal

1 Pull shift lever cuff (7) from bead of recess on cover and push out in upward direction.



2 Loosen closing cap (6) with box wrench and screw-off.

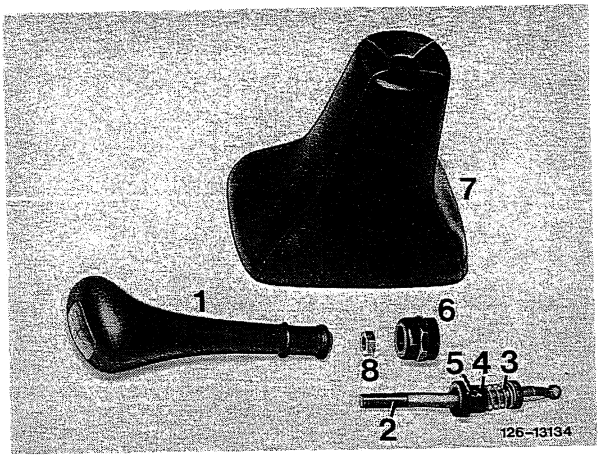
3 Pull shift lever out of shift tube in upward direction.



Disassembly

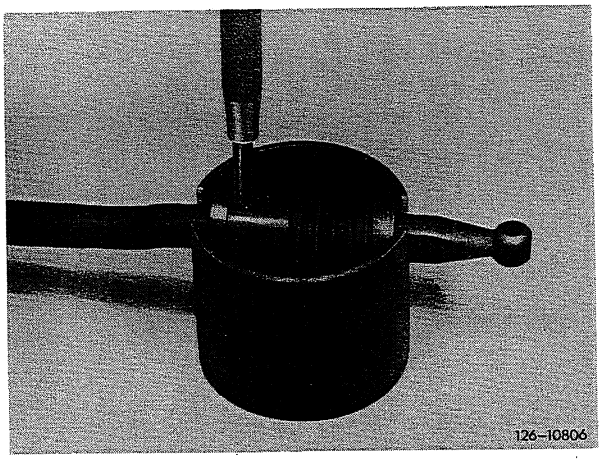
4 Unscrew shift lever handle with shift lever cuff and hex nut from shift lever.

5 Remove closing cap from shift lever.

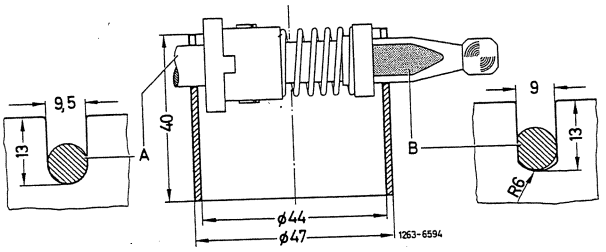


1 Shift lever handle
2 Shift lever
3 Compression spring
4 Bushing
5 Hollow set pin
6 Closing cap
7 Shift lever cuff
8 Nut

6 Insert shift lever into holding device and knock out hollow set pin by means of a punch.

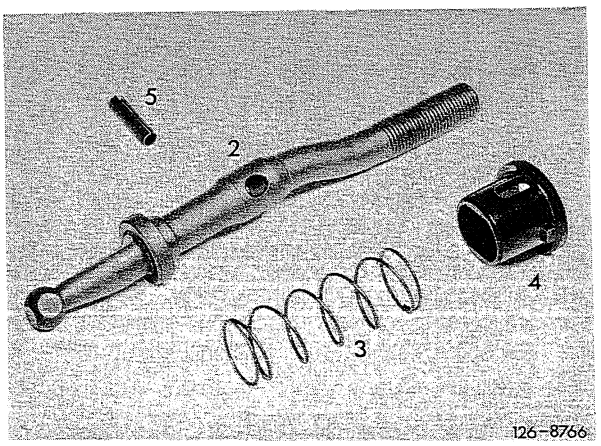


7 Make holding device according to dimensions shown in drawing.



8 Remove bushing (4) and compression spring (3) from shift lever (2).

9 Check individual parts for wear and condition of wear.



2 Shift lever
3 Compression spring
4 Bushing

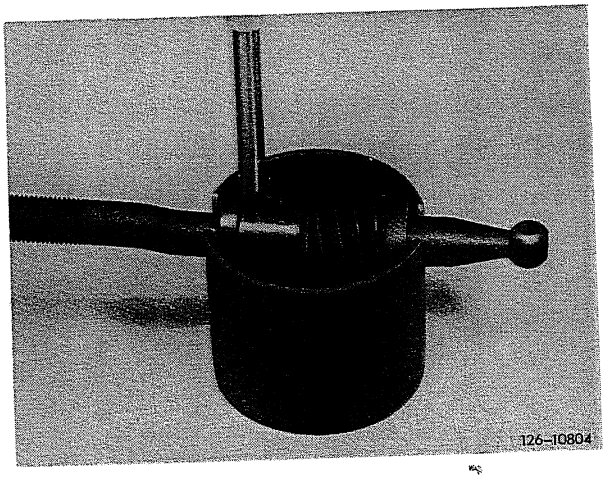
Assembly

Attention!
Bore in shift lever has been increased from 4 mm dia. to 5 mm dia. Accordingly, the dia. of the hollow set pin (5) as well that of the oblong hole in bushing (4) has been increased. During assembly, make sure that only parts with similar dimensions are mounted. Also note that in the 4-speed gearshift only the black plastic bushing (4) is installed. If the white plastic bushing (5-speed) is installed, reverse speed cannot be shifted.

10 Slip compression spring (3) and bushing (4) on shift lever (2).

11 Place shift lever into holding device and knock hollow set pin with punch into shift lever until both ends of hollow set pin are flush with bushing.

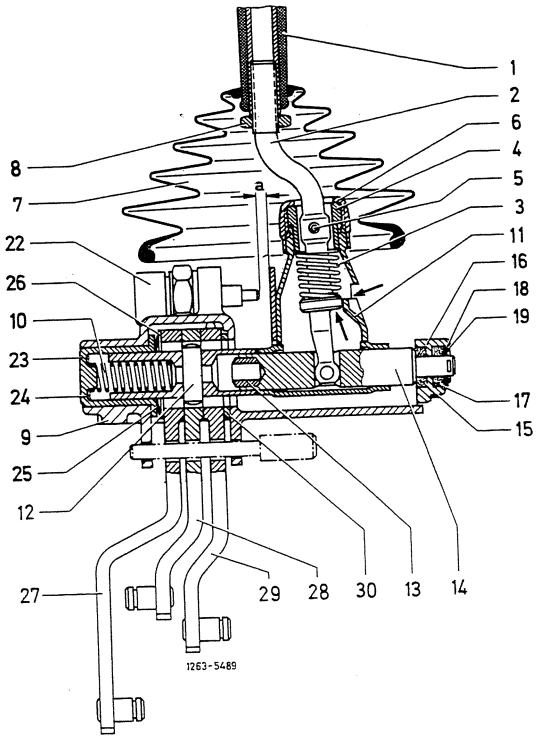
Slot of hollow set pin should face spring.



12 Slip closing cap (6) on shift lever.

13 Screw hex nut and shift lever handle with shift lever cuff as far as possible on shift lever.

14 Insert shift lever from above into shift tube, making sure that both locating pins at collar of bushing (4) are well-seated in machined recesses on shift tube provided and that the machined end at bottom of shift lever is at the right (arrows).



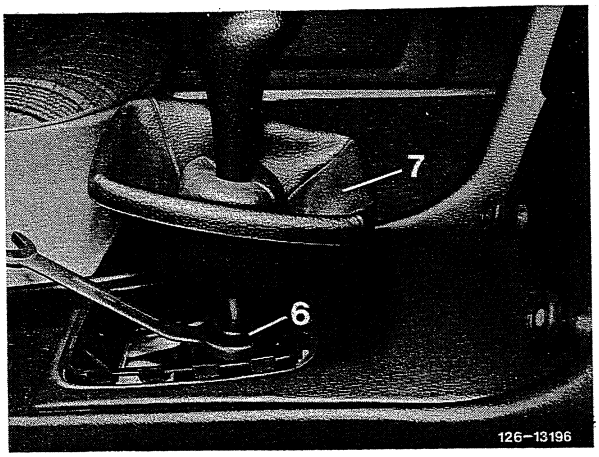
1 Shift lever handle
2 Shift lever
3 Compression spring
4 Bushing
5 Hollow set pin
6 Closing cap
7 Cuff for shift lever
8 Nut
9 Bearing bracket
10 Compression spring
11 Shift tube
12 Bolt in shift tube
13 Damping bushing
14 Guide pin
15 Guide ring
16 Bearing cap
17 Guide ring
18 Washer
19 Lock
22 Backup light switch
23 Bushing
24 Washer
25 Spring plate
26 Washer
27 Intermediate lever for reverse speed
28 Intermediate lever for 1st and 2nd speed
29 Intermediate lever for 3rd and 4th speed
30 Washer

15 Tighten closing cap (6) with box wrench.

16 Turn shift lever into correct position and tighten hexagon counter nut.

17 Push shift lever cuff into bead of recess on cover.

18 Check gearshift for function with engine running.



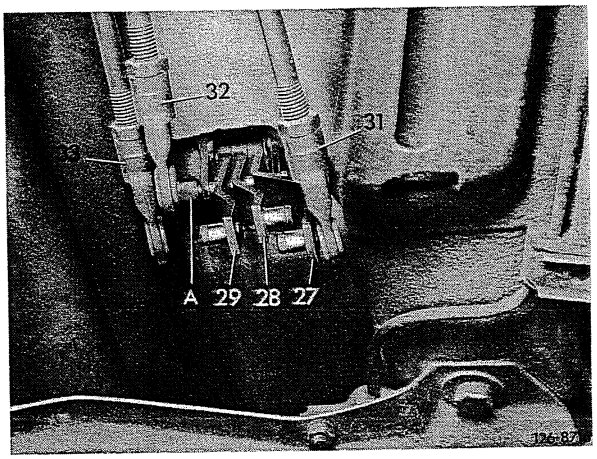
Tightening torque	Nm	(kpm)
Shift bracket on tunnel	6	(0.6)

Note

Removal and installation of floor shift for model 115 is described below. For models 107, 114, 116, 123 assembly is essentially the same, so that the following instructions can be used.

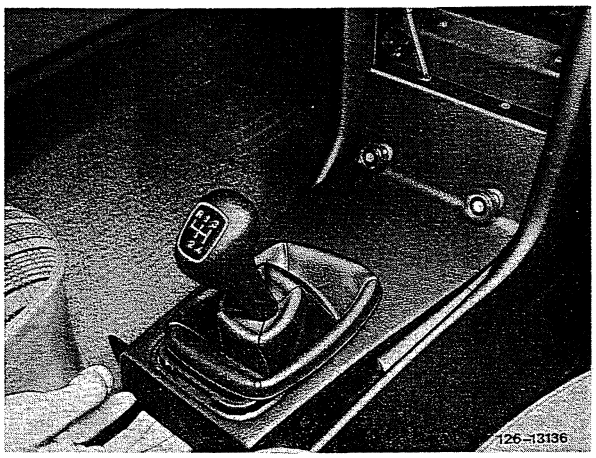
Removal

1 Disconnect shift rods on levers of bearing bracket of floor shift after removing SL-locks.



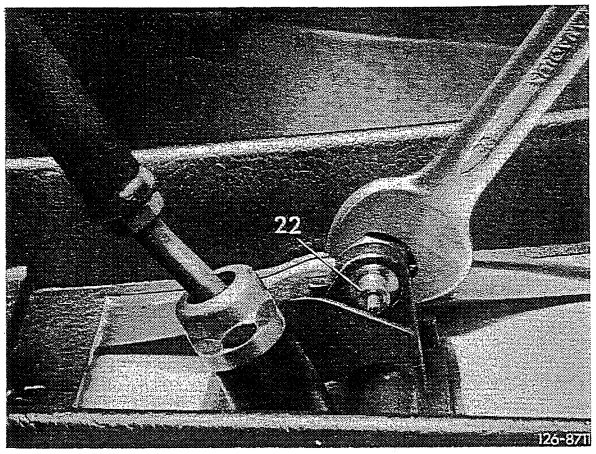
27 Intermediate shift lever reverse speed
28 Intermediate shift lever 1st and 2nd speed
29 Intermediate shift lever 3rd and 4th speed
31 Shift rod reverse speed
32 Shift rod 1st and 2nd speed
33 Shift rod 3rd and 4th speed
A Locating pin

2 Remove ash-tray and cover.



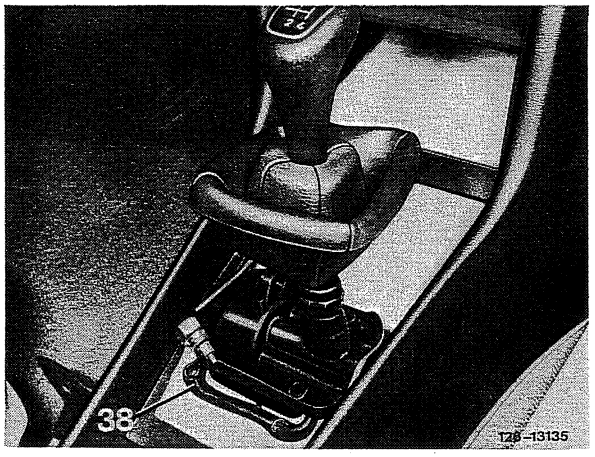
3 Loosen backup light switch (22) on shift bracket and screw out.

4 Unscrew fastening bolts from shift bracket.



5 Remove shift bracket with gasket (38).

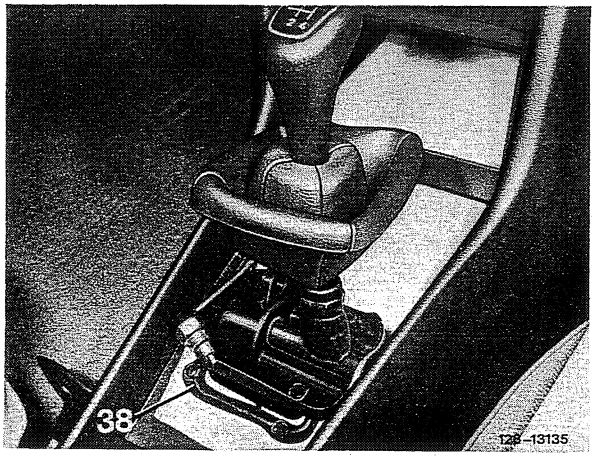
Attention!
When removing shift bracket, make particularly sure that tunnel cover is not damaged.



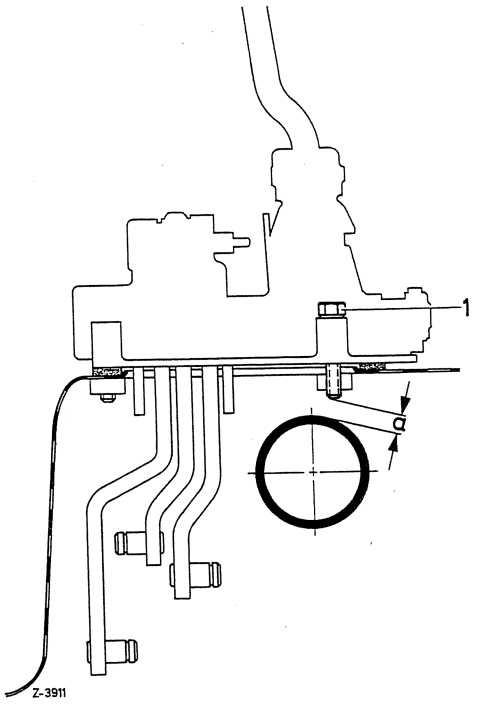
Installation

6 Place gasket on shift bracket and insert fastening bolts.

7 Carefully introduce shift bracket with fastening bolts through tunnel cover and tighten.

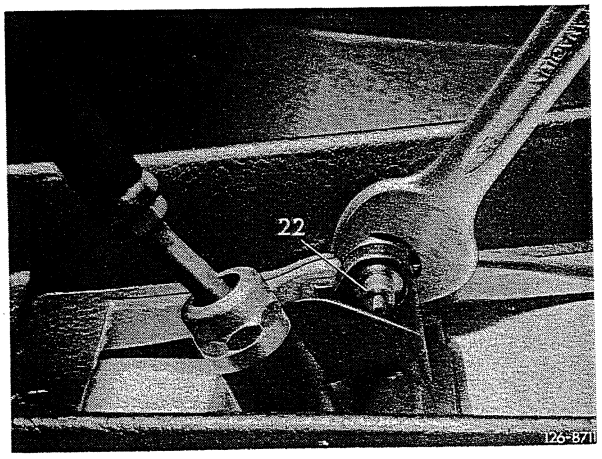


Attention!
When tightening screws of shift bracket, make absolutely sure that rear righthand fastening bolt extends into tunnel only to the extent that a minimum distance of "a" = 8 mm is available between bolt and universal shaft.

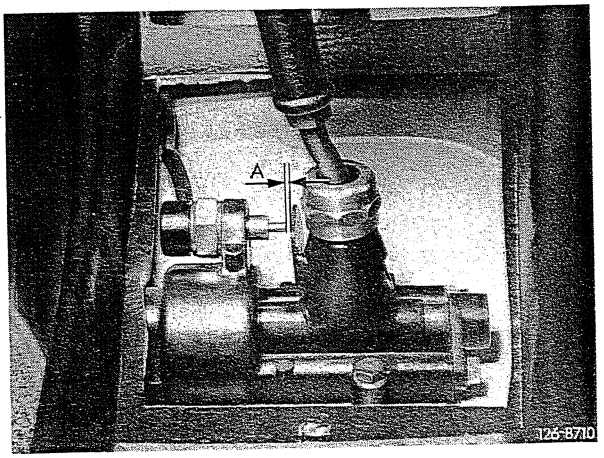


a distance from universal shaft min. 8 mm

8 Screw backup light switch (22) into bearing cap of shift bracket.



9 Push shift lever into 1st gear level and check distance between contact pin of backup light switch and contact plate. Distance should be 4 mm.



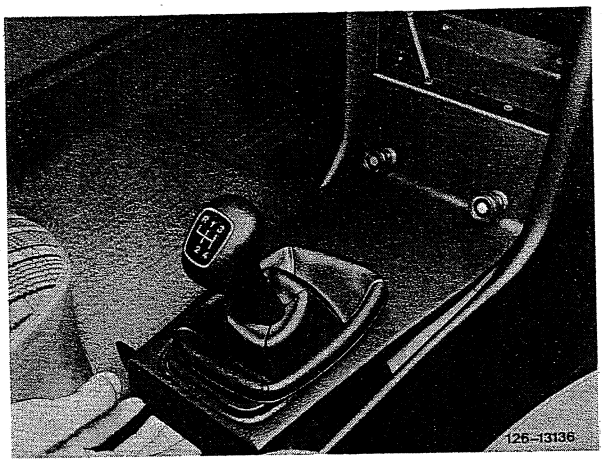
A = 4 mm adjusting dimension for contact pin of backup light switch

10 Install cover and insert ashtray.

11 Check adjustment of gearshift (26—610).

12 Push shift rods on bolts of intermediate shift lever and secure with SL-locks.

13 Check gearshift for function with engine running.



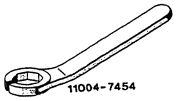
A. Models 107, 114, 115, 116

Lubricant

e.g. Longterm 2	refer to specifications for service products page 266.2

Tightening torques	Nm	(kpm)
Closing cap for shift lever	7	(0.7)
Bearing cap on shift bracket	10	(1)
Shift bracket on tunnel	6	(0.6)

Special tool

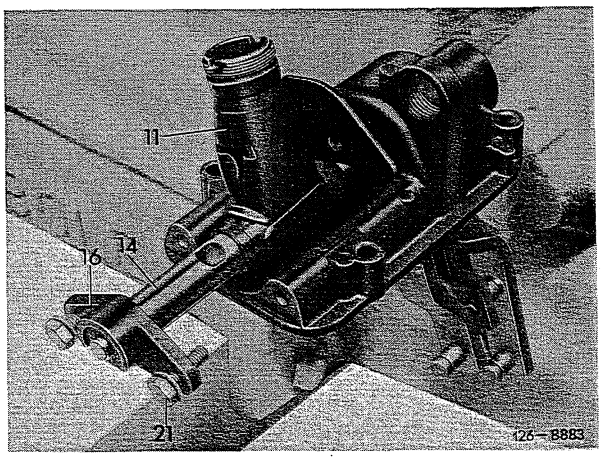
Box wrench 27 mm for octagon nut on shift lever	 11004-7454	115 589 00 03 00

Disassembly

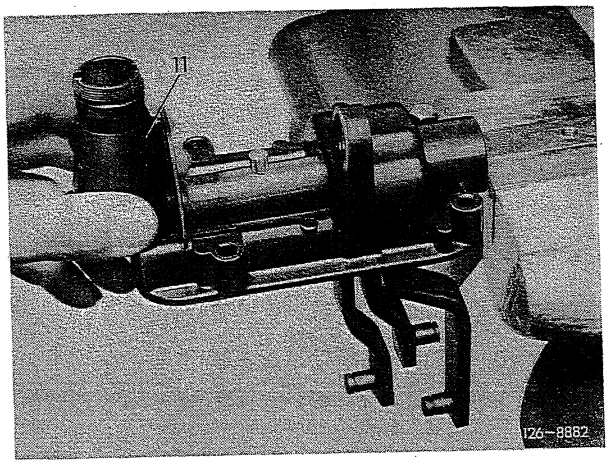
1 Remove floor shift (26–630).

2 Remove shift lever (26–620).

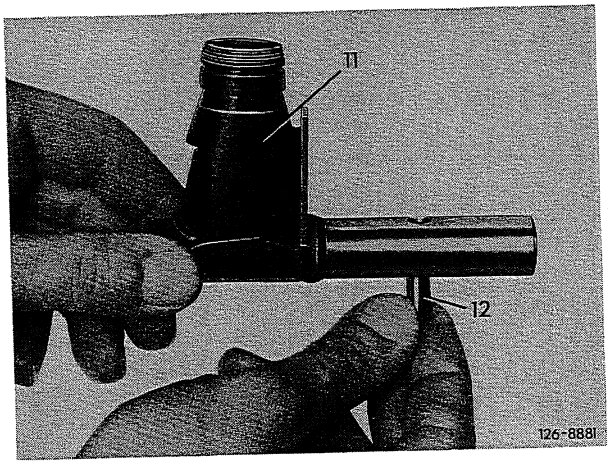
3 Unscrew fastening bolts (21) of bearing cap (16). Pull bearing cap with guide bolt (14) out of shift tube (11).



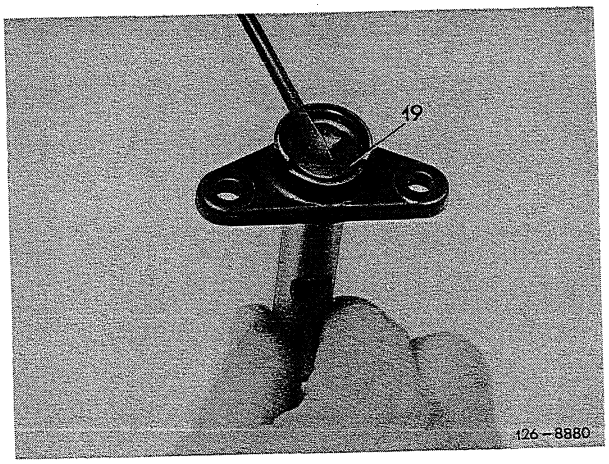
4 Pull shift tube (11) out of shift bracket (9) or intermediate shift levers (27, 28 and 29).



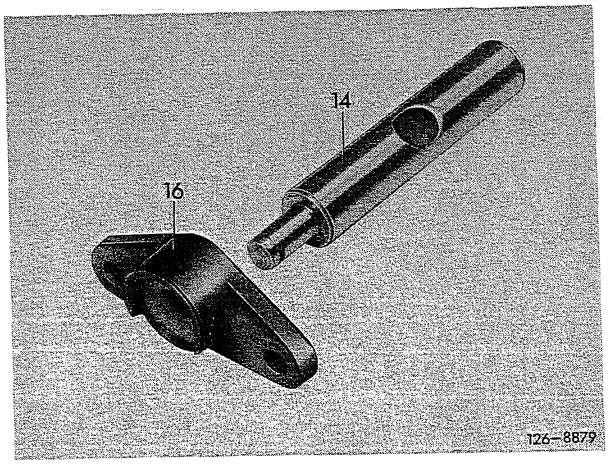
5 Pull pin (12) out of shift tube.



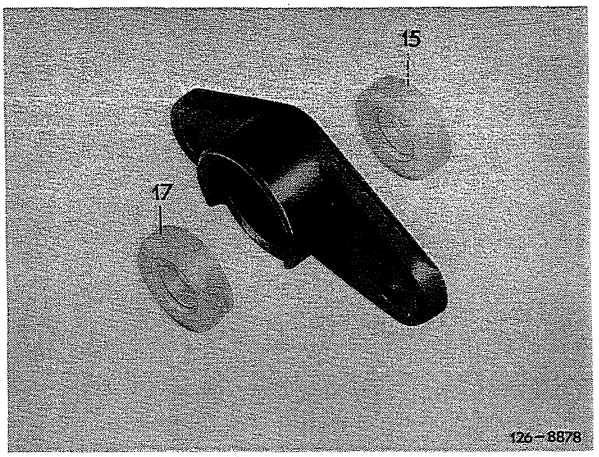
6 Push out lock (19) on bearing cap by means of screw driver and remove together with compensating washers. This requires turning guide bolt first by 180°.



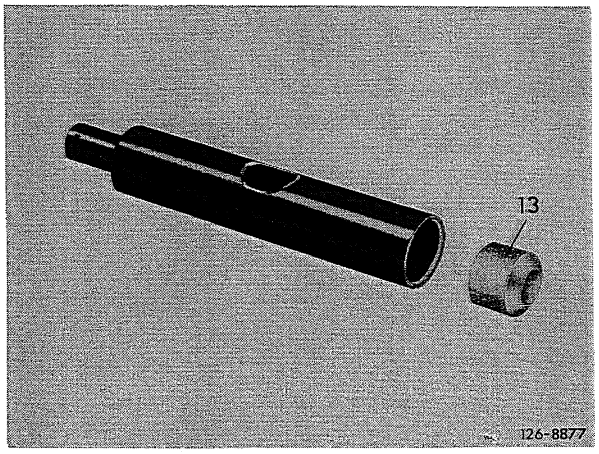
7 Pull bearing cap (16) from guide bolt (14).



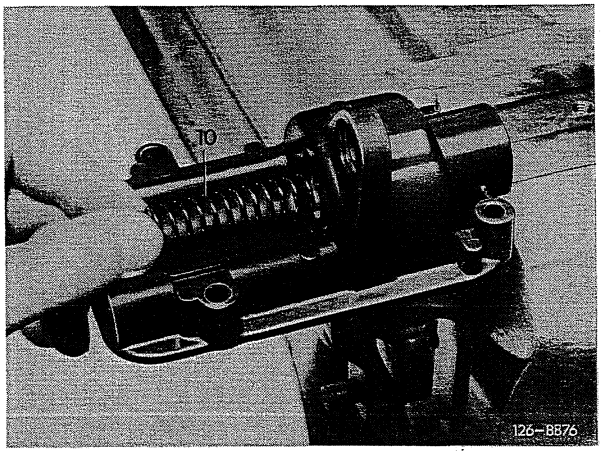
8 Carefully push guide rings (15 and 17) out of bearing cap by means of a screw driver.



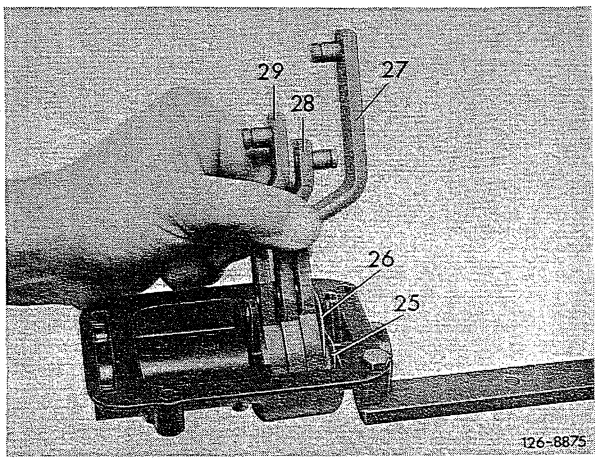
9 Pull damping bushing (13) out of guide bolt.



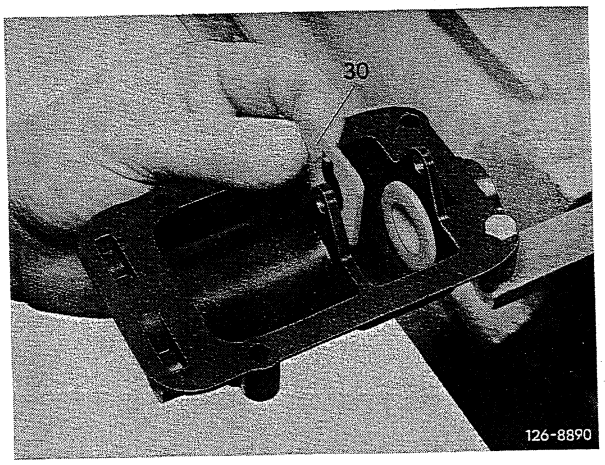
10 Remove compression spring (10) from shift bracket.



11 Remove released intermediate levers (27, 28 and 29), as well as washer (26) and spring washer (25) out of bearing bracket.

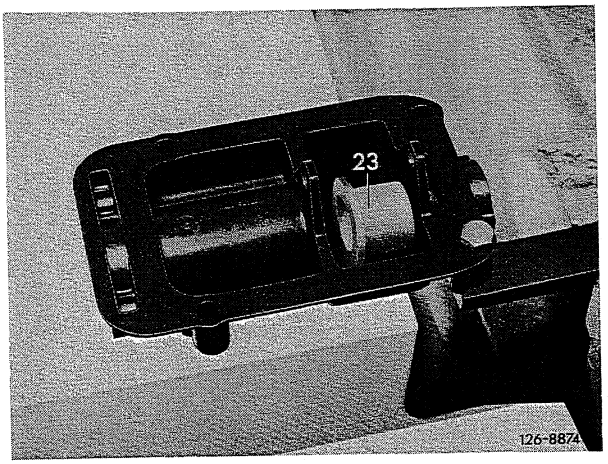


12 Remove plastic washer (30) for shift tube out of bearing bracket.



13 Push plastic bushing (23) out of bearing bracket.

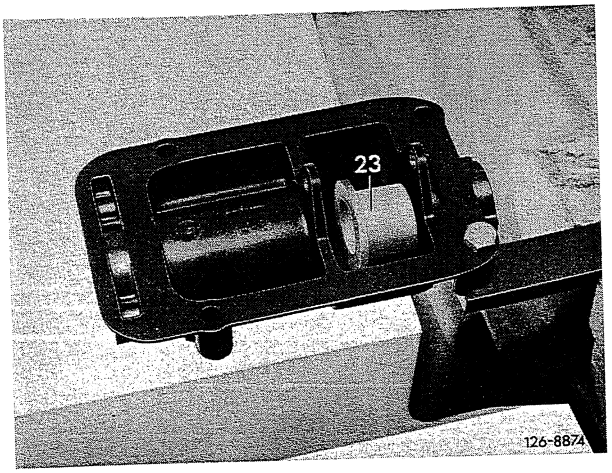
14 Check all parts for wear or condition of wear and renew, if required.



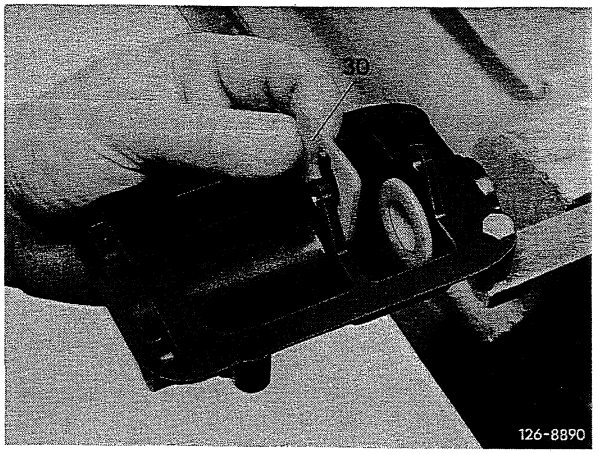
Assembly

Attention!
Prior to inserting plastic bushing, check whether washer (24) is inserted (illustrated table). Use grease to insert washer into bushing, if required.

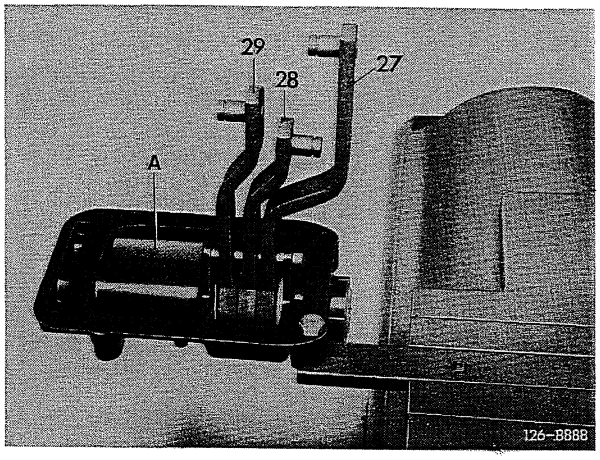
15 Insert plastic bushing (23) into bearing bracket.



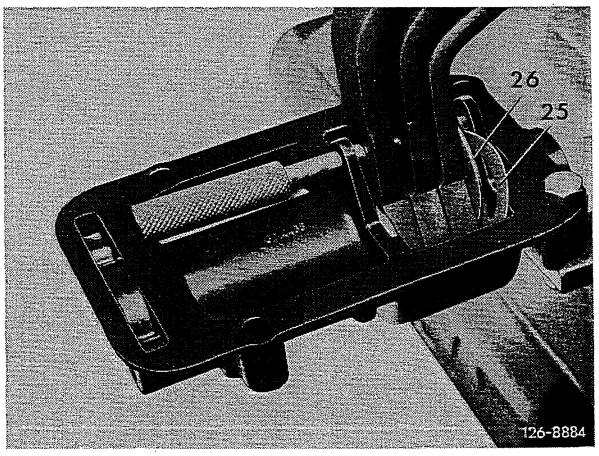
16 Insert plastic washer (30) into bearing bracket.



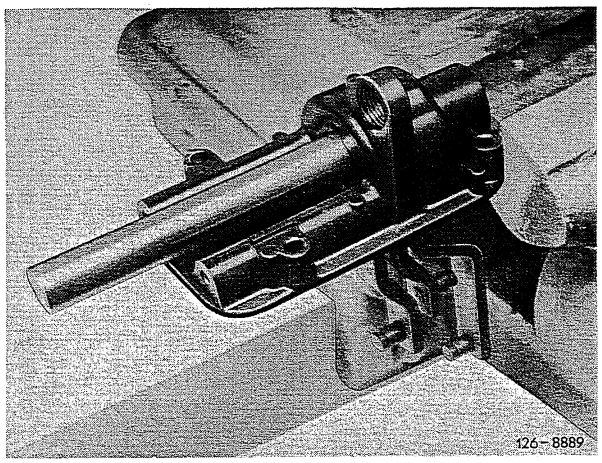
17 Insert intermediate levers (27, 28 and 29) together into bearing bracket and hold by inserting locating pin.



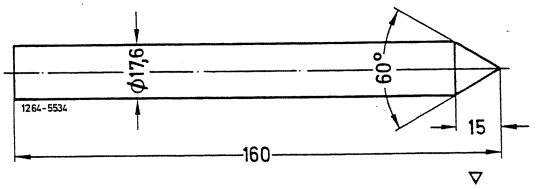
18 Push spring plate (25) and washer (26) into bearing bracket so that spring washer (25) faces collar of bushing (23).



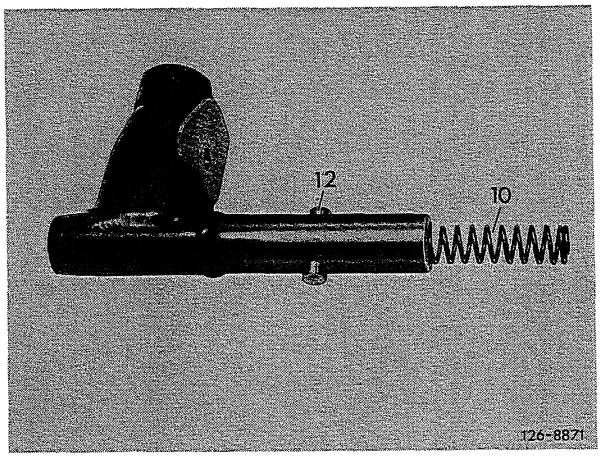
19 Insert centering mandrel into bearing bracket so that intermediate levers (27, 28 and 29) as well as spring washer (25) and washer (26) are all in alignment. Then pull out centering mandrel.



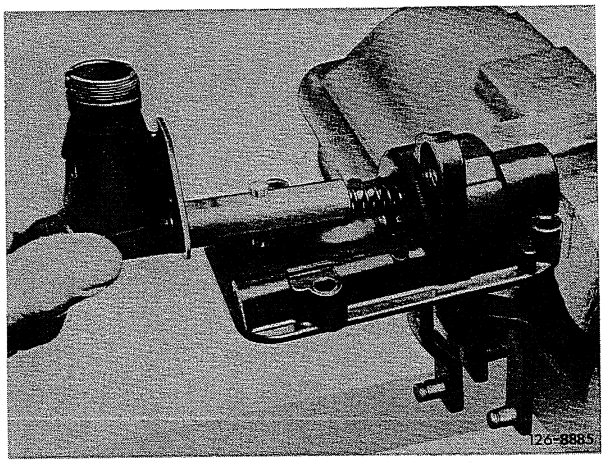
Note: Make centering mandrel according to specified dimensions.



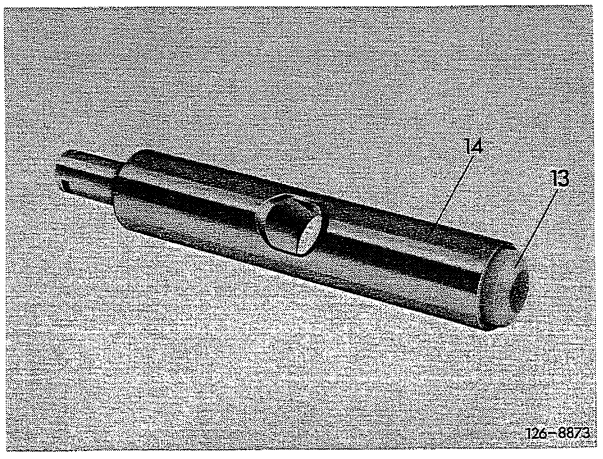
20 Insert pin (12) and compression spring (10) into shift tube.



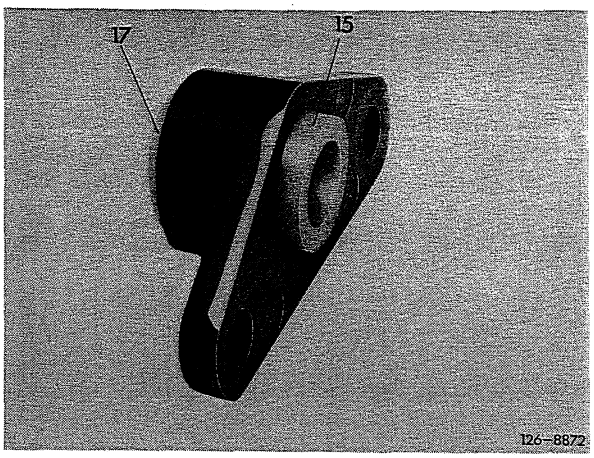
21 Introduce shift tube (11) into bearing bracket.



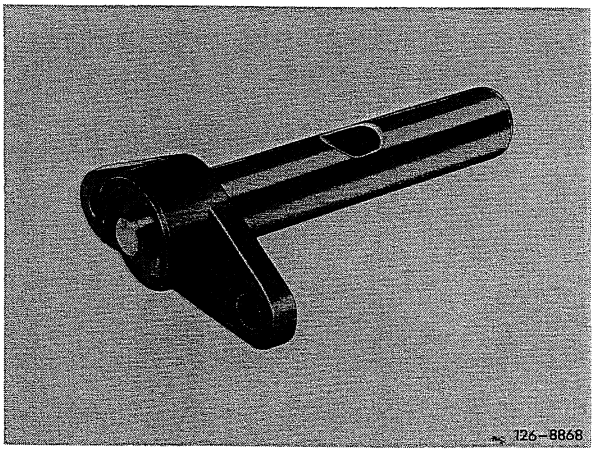
22 Force damping bushing (13) into guide bolt (14).



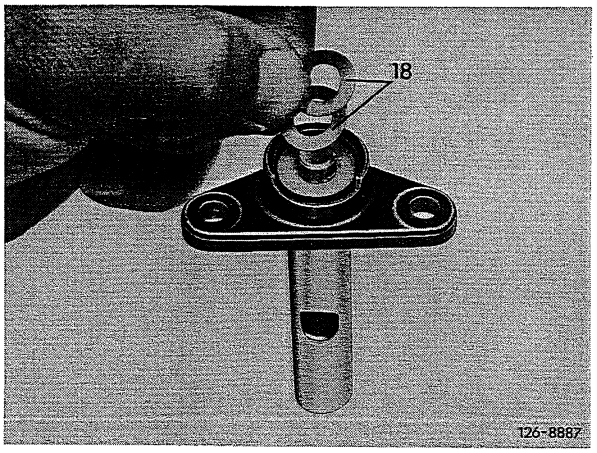
23 Push guide ring (15 and 17) into bearing cap.

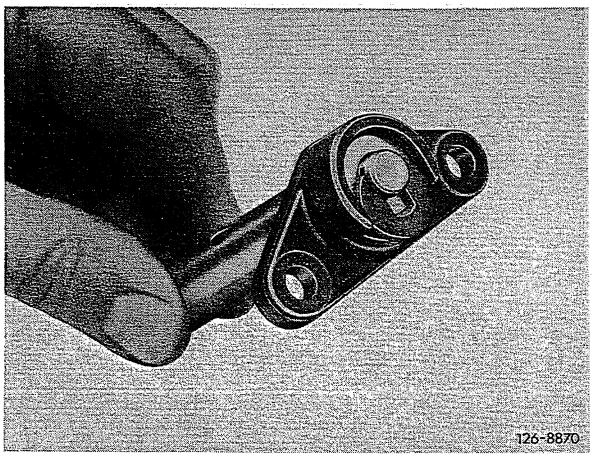


24 Place bearing cap with guide ring on guide bolt.

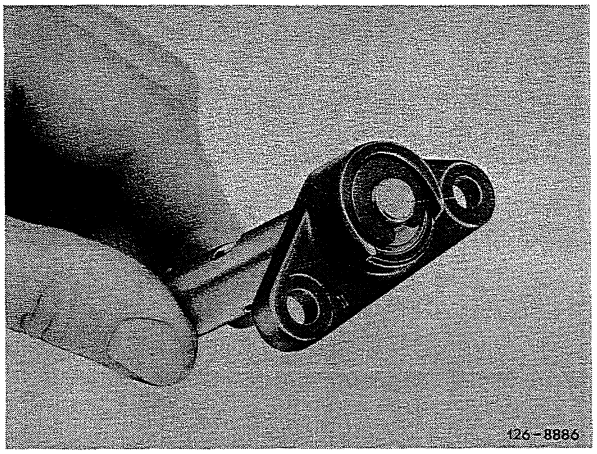


25 Turn guide bolt until lock can be pushed into grooves from below. First add enough compensating washers (18), so that lock slips on tightly.



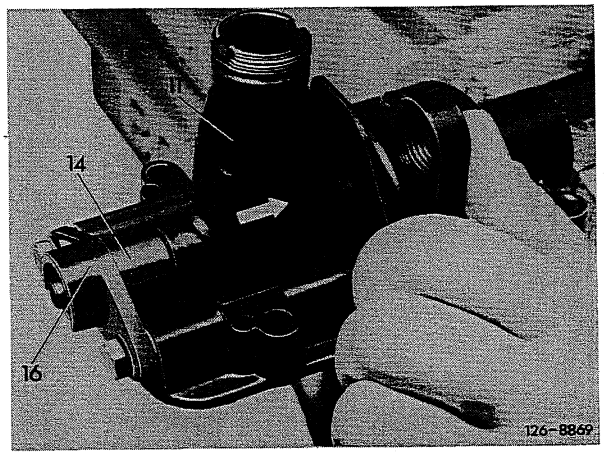


26 Secure lock against slipping out by turning guide bolt by 180°.



27 Push shift tube (11) against compression spring (10), insert guide bolt with bearing cap into shift tube and screw to shift bracket.

28 Pull locating pin out of intermediate shift lever.



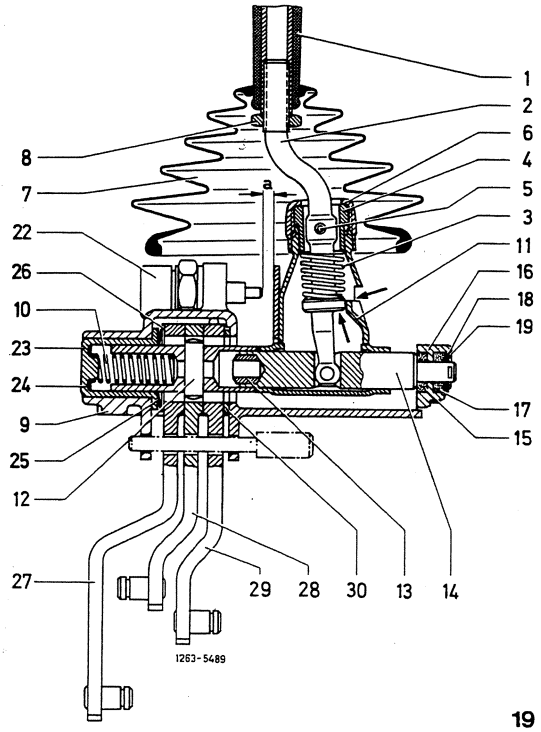
29 Install shift lever (26–620).

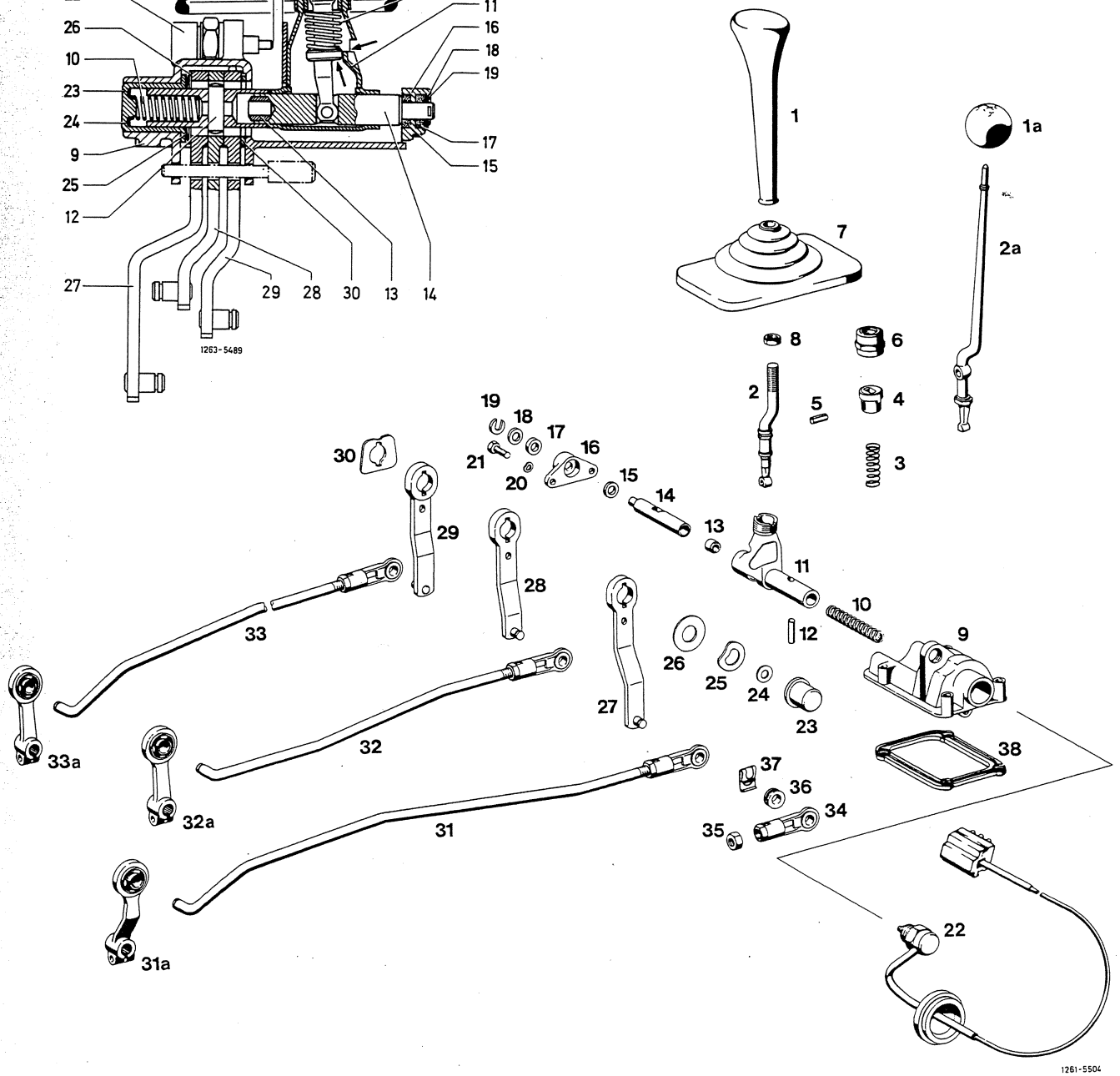
30 Install floor shift (26–630).

31 Adjust floor shift (26–610).

32 Check floor shift for function with engine running.

1 Shift lever handle
1a Shift lever knob
2 Shift lever
2a Shift lever
3 Compression spring
4 Bushing
5 Hollow set pin
6 Closing cap
7 Cuff for shift lever
8 Nut
9 Bearing bracket
10 Compression spring
11 Shift tube
12 Pin in shift tube
13 Damping bushing
14 Guide bolt
15 Guide ring
16 Bearing cap
17 Guide ring
18 Washer
19 Lock
20 Spring washer
21 Hex bolt
22 Backup light switch
23 Bushing
24 Washer
25 Spring washer
26 Washer
27 Intermediate lever for reverse speed
28 Intermediate lever for 1st and 2nd speed
29 Intermediate lever for 3rd and 4th speed
30 Washer
31 Shift rod for reverse speed
31a Shift lever for reverse speed
32 Shift rod for 1st and 2nd speed
32a Shift lever for 1st and 2nd speed
33 Shift rod for 3rd and 4th speed
33a Shift lever for 3rd and 4th speed
34 Rod head
35 Hex nut
36 Bushing
37 SL lock
38 Gasket





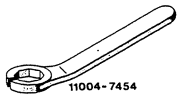
B. Model 123

Lubricant

e.g. Longterm 2	refer to specifications for service products page 266.2

Tightening torques	Nm	(kpm)
Closing cap for shift lever	7	(0.7)
Bearing cap on shift bracket	10	(1)
Shift bracket on tunnel	6	(0.6)

Special tool

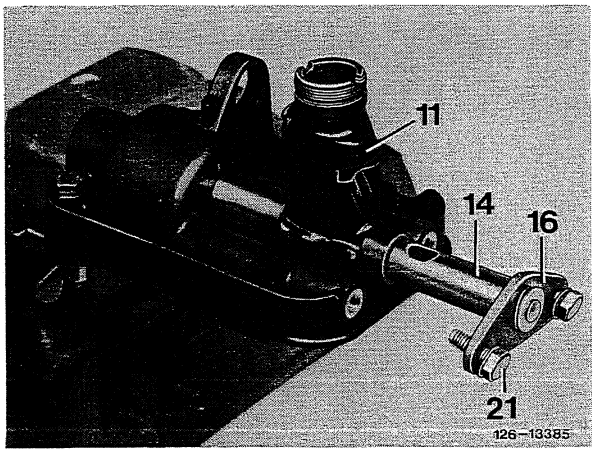
Box wrench 27 mm for octagon nut on shift lever	 11004-7454	115 589 00 03 00

Disassembly

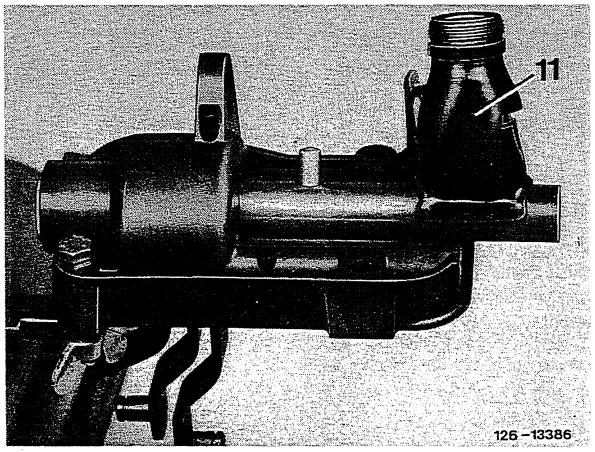
1 Remove floor shift (26–630).

2 Remove shift lever (26–620).

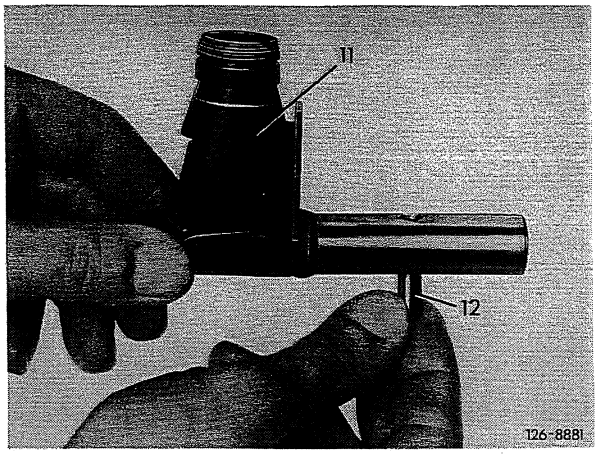
3 Unscrew fastening screws (21) of bearing cap (16). Pull bearing cap with guide bolt (14) out of shift tube (11).



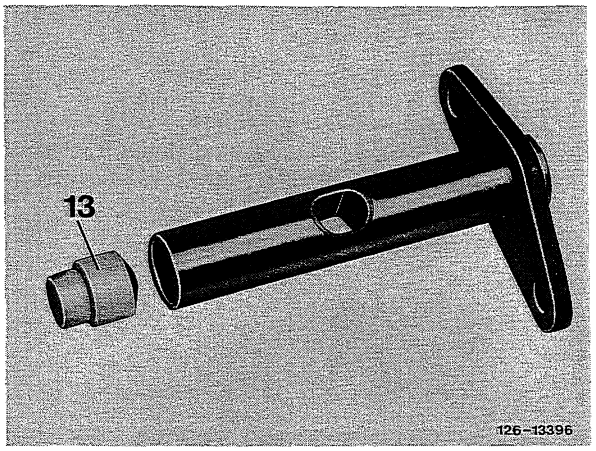
4 Pull shift tube (11) out of shift bracket or intermediate shift levers.



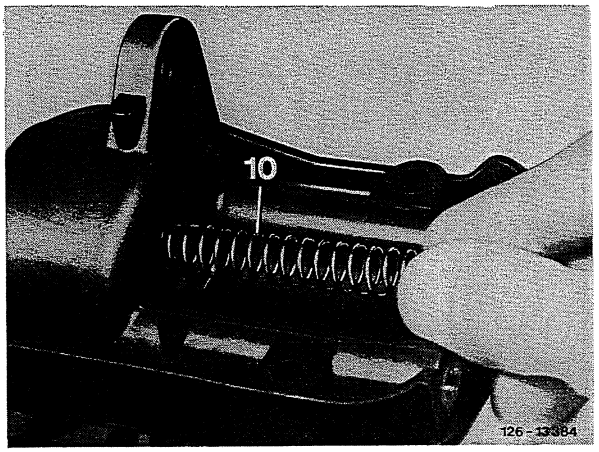
5 Pull pin (12) out of shift tube.



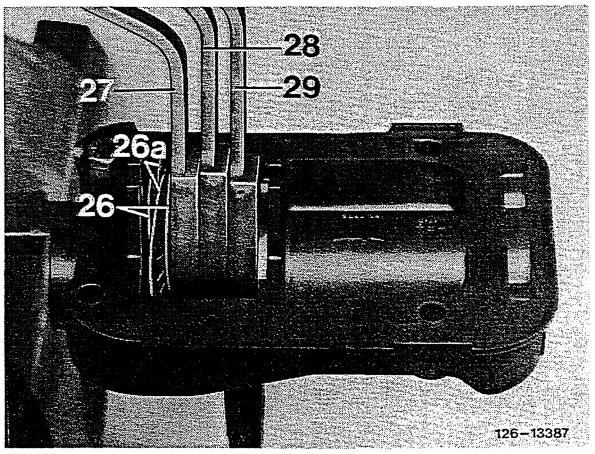
6 Pull damping bushing (13) out of guide pin.



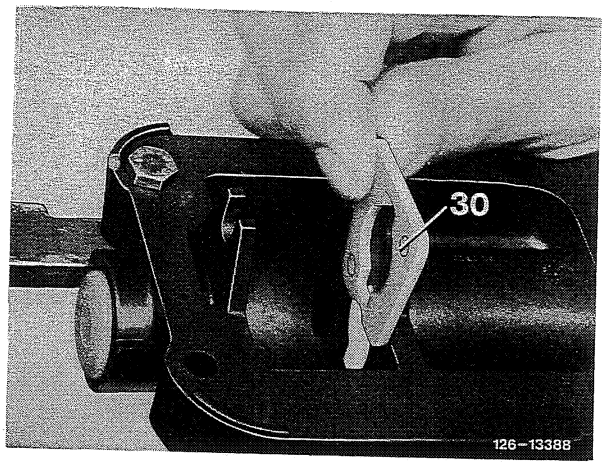
7 Remove compression spring (10) from shift bracket.



8 Remove released intermediate levers (27, 28 and 29), as well as washers (26) and cup springs (26a) out of bearing bracket.

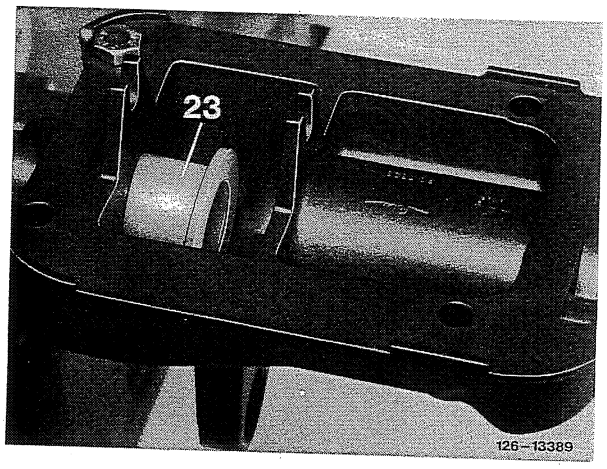


9 Remove plastic washer (30) for shift tube out of bearing bracket.



10 Push plastic bushing (23) out of bearing bracket.

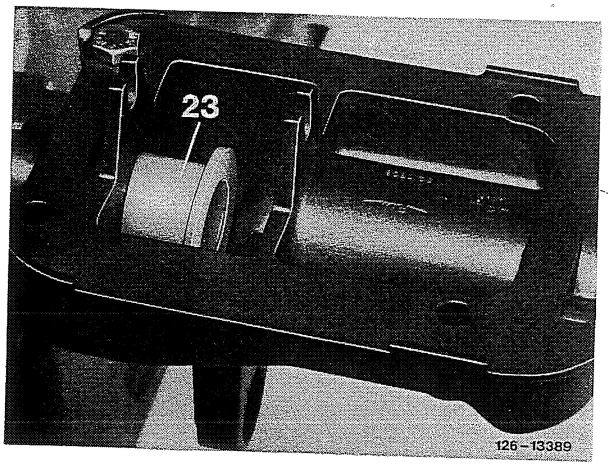
11 Check all parts for wear or condition of wear and renew if required.



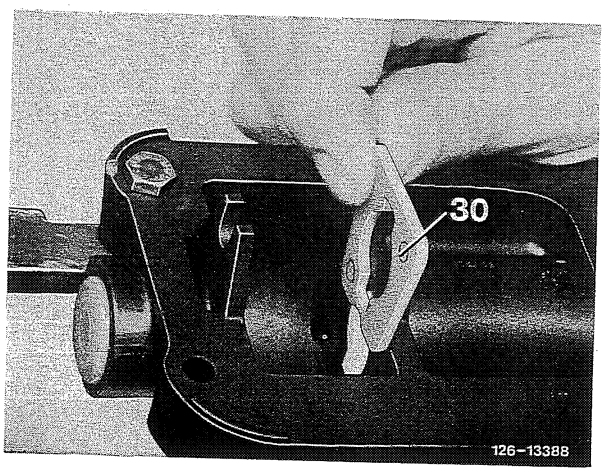
Assembly

Attention!
Prior to inserting plastic bushing, check whether washer (24) is inserted (illustrated table). If required, insert washer into bushing with grease.

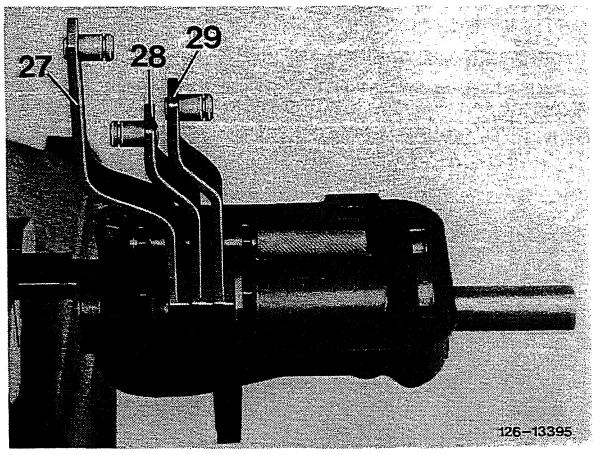
12 Force plastic bushing (23) manually into bearing bracket.



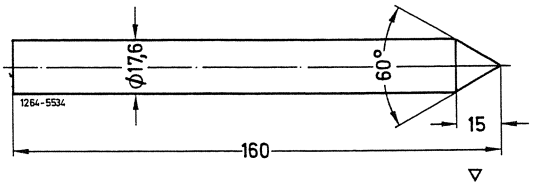
13 Insert plastic washer (30) into bearing bracket.



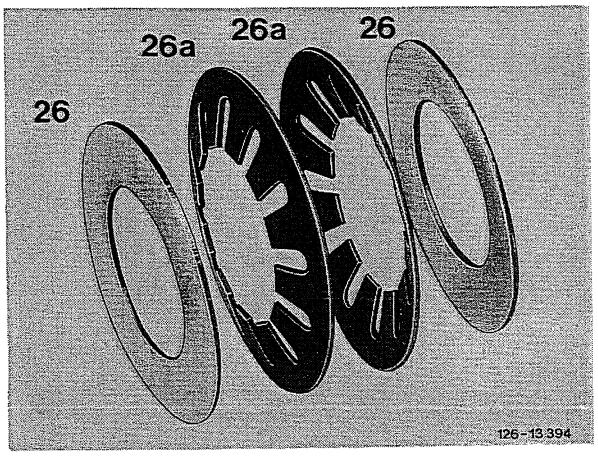
14 Introduce intermediate levers (27, 28 and 29) together into bearing bracket and hold in place by inserting centering pin.

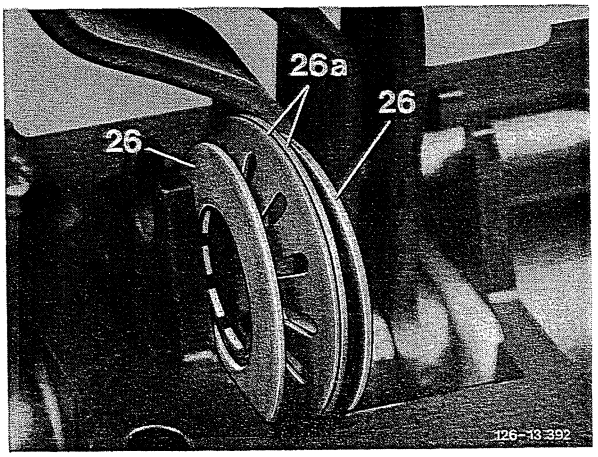


Note: Make centering mandrel according to specified dimensions.

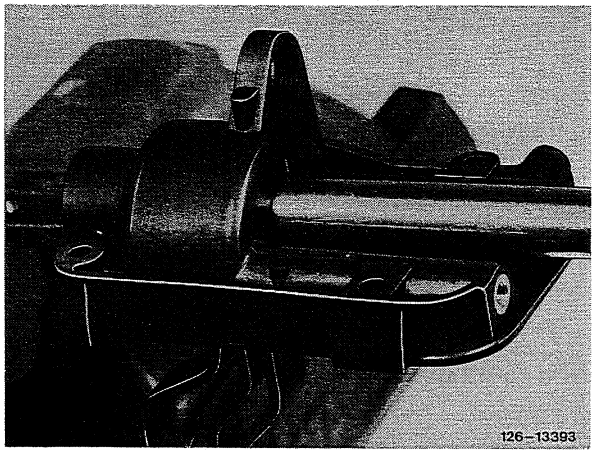


15 Push cup springs (26a) with their concave sides facing each other and with washers (26) into bearing bracket.

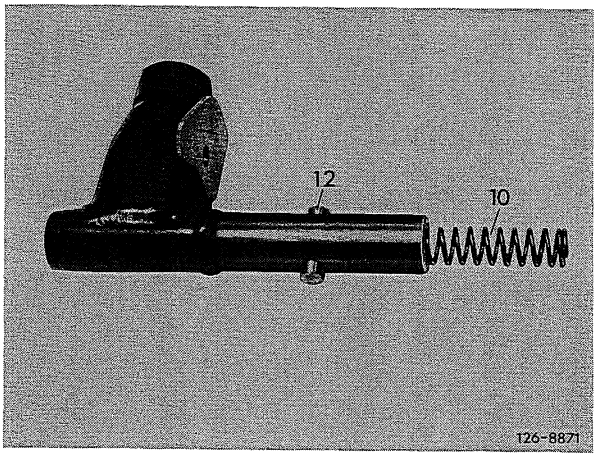




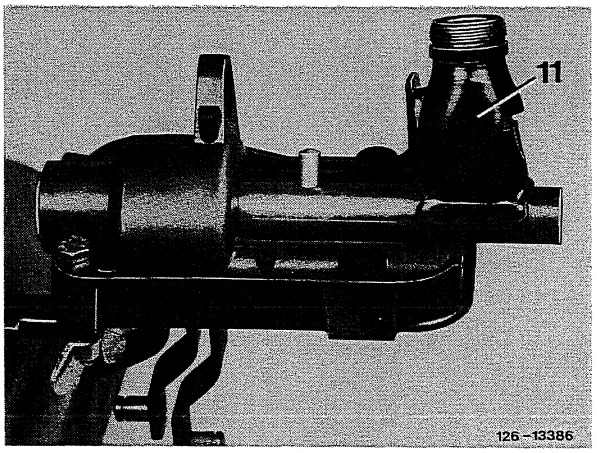
16 Push centering mandrel into bearing bracket so that intermediate levers (27, 28 and 29) as well as washers (26) and cup springs (26a) are in alignment. Then pull centering mandrel out again.



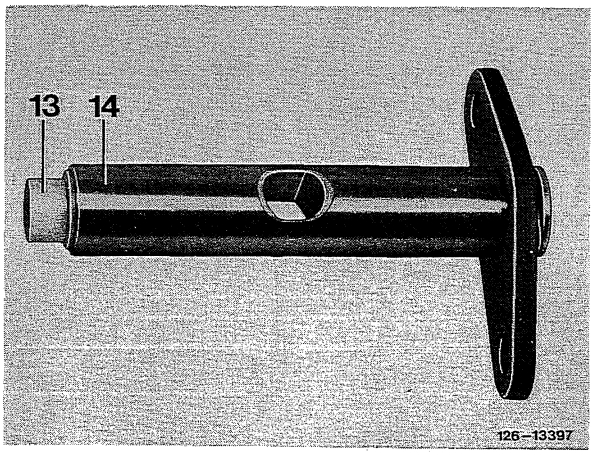
17 Insert pin (12) and compression spring (10) into shift tube.



18 Introduce shift tube (11) into bearing bracket.



19 Push damping bushing (13) into guide bolt (14).



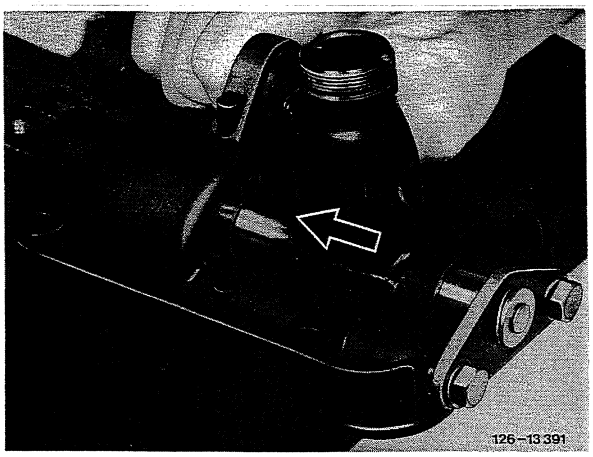
20 Push shift tube (11) against compression spring (10), insert guide bolt (14) with bearing cap (16) into shift tube and screw to shift bracket.

21 Install shift lever (26–620).

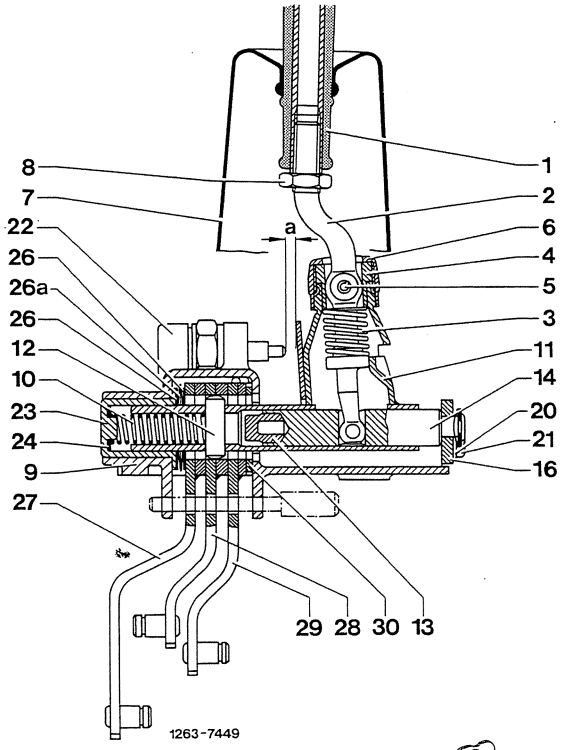
22 Install floor shift (26–630).

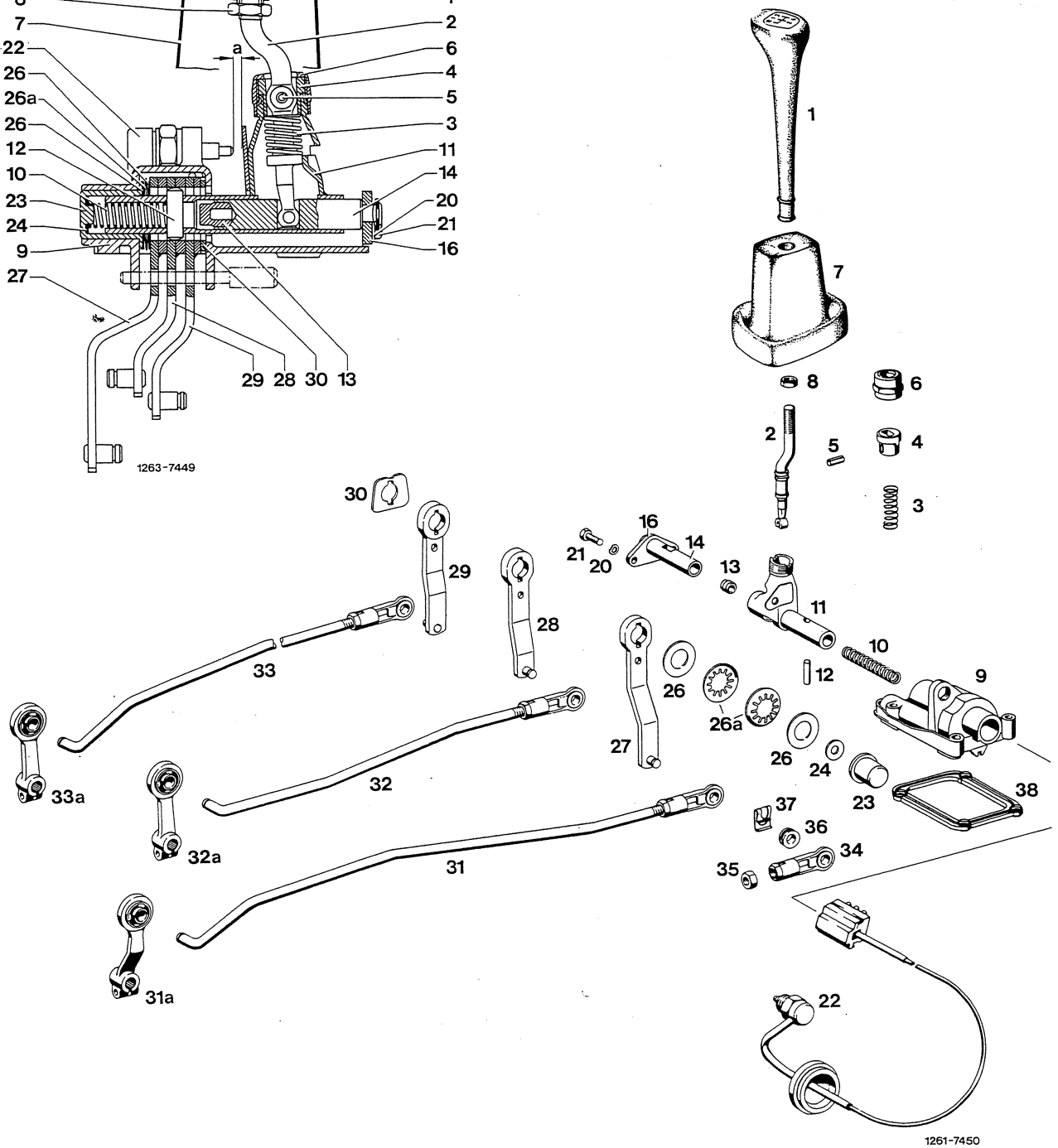
23 Adjust floor shift (26–610).

24 Check floor shift for function with engine running.

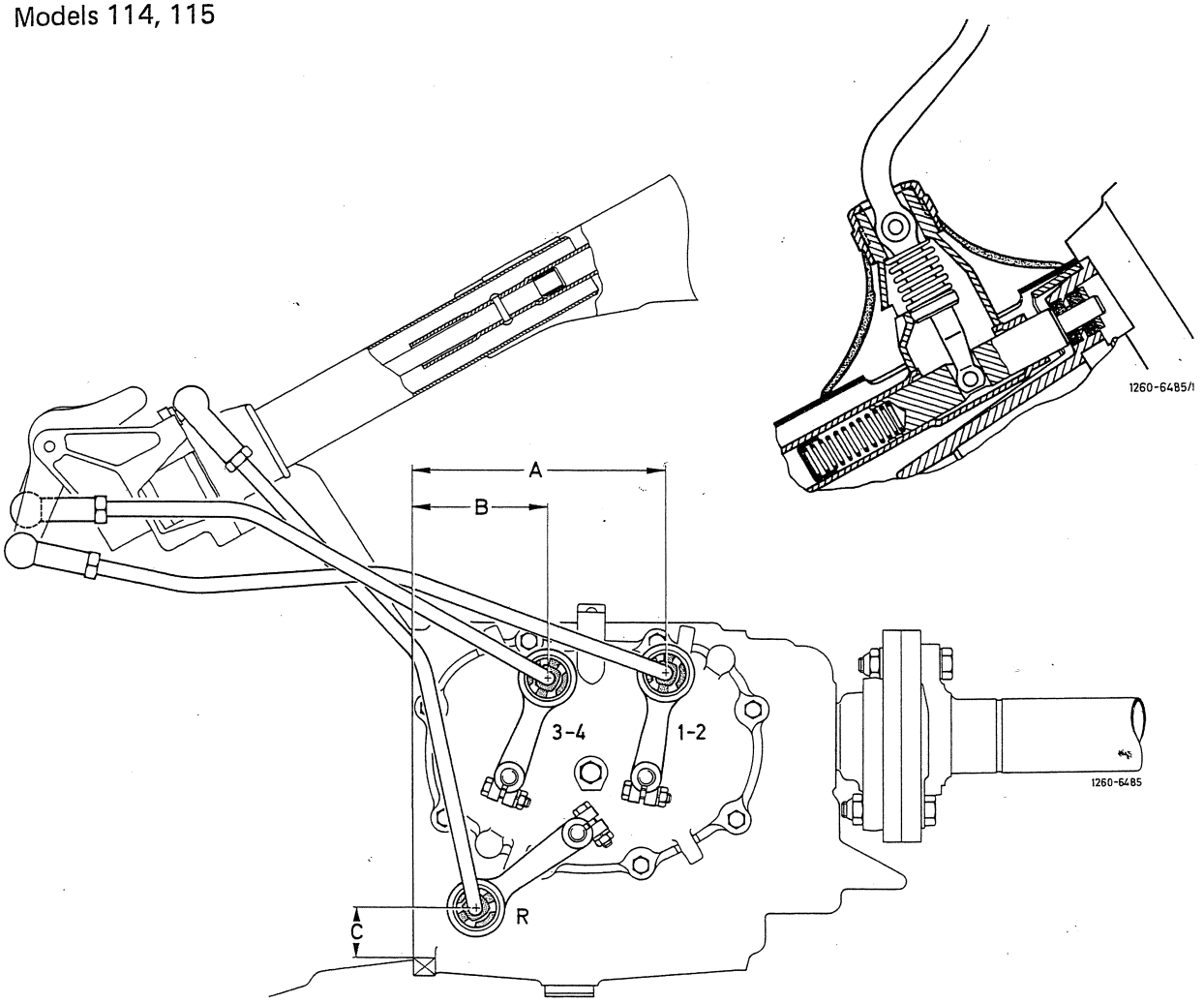


1 Shift lever handle
2 Shift lever
3 Compression spring
4 Bushing
5 Hollow set pin
6 Closing cap
7 Cuff for shift lever
8 Nut
9 Bearing bracket
10 Compression spring
11 Shift tube
12 Pin in shift tube
13 Damping bushing
14 Guide bolt
16 Bearing cap
20 Spring washer
21 Hex bolt
22 Backup light switch
23 Bushing
24 Washer
26 Washer
26a Cup spring
27 Intermediate lever for reverse speed
28 Intermediate lever for 1st and 2nd speed
29 Intermediate lever for 3rd and 4th speed
30 Washer
31 Shift rod for reverse speed
31a Shift lever for reverse speed
32 Shift rod for 1st and 2nd speed
32a Shift lever for 1st and 2nd speed
33 Shift rod for 3rd and 4th speed
33a Shift lever for 3rd and 4th speed
34 Rod head
35 Hex nut
36 Bushing
37 SL lock
39 Gasket





Models 114, 115



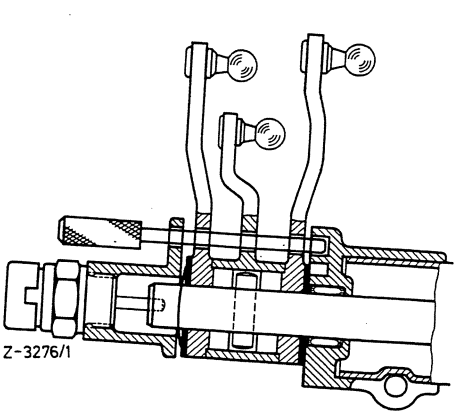
Dimensions for adjustment of shift lever for steering column shift

Adjusting dimension	Models 114, 115	
	Lefthand steering	Righthand steering
A = 1st and 2nd speed	152	166
B = 3rd and 4th speed	81	90
C = Reverse speed	26	30

Adjustment

1 Disconnect shift rods on levers of shift bracket of steering column shift.

2 Locate the three intermediate shift levers on shift bracket by slipping locating pin into the holes provided for this purpose.


Z-3276/1

3 Move transmission into idling position, then check position of shift levers on transmission shift cover for specified dimensions and correct, if required (table).

4 Adjust shift rods to length by turning ball sockets and push sockets without pressure on ball heads of intermediate shift levers. The shift levers with insulating bushings on transmission shift cover should not move out of their center position.

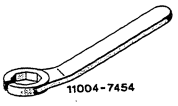
5 Remove locating pins from intermediate shift levers.

Attention!
If the backup lights in shift level 1st and 2nd speed lights up, unscrew backup light switch and remove sealing ring.

6 Check gearshift for function with engine running.

Tightening torques	Nm	(kpm)
Closing cap for shift lever	7	(0.7)

Special tool

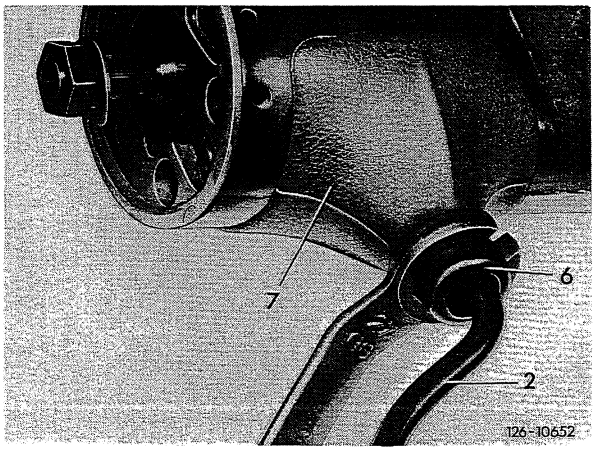
Box wrench 27 mm for closing cap (octagon) on shift lever	 11004-7454	115 589 00 03 00

Self-made tool

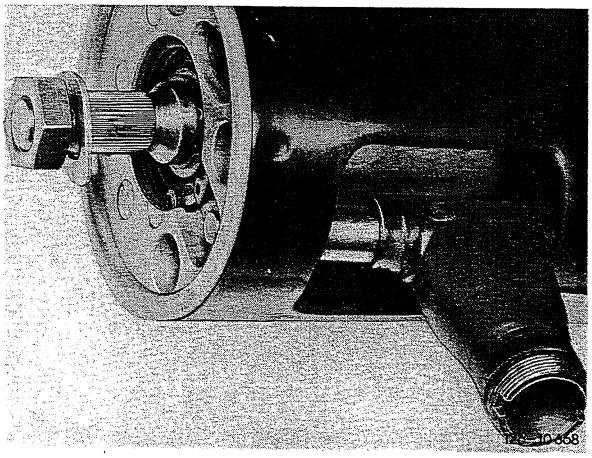
Holding device for shift lever	refer to fig. item 6

Removal and disassembly

1 Loosen closing cap (6) with box wrench and screw-off.

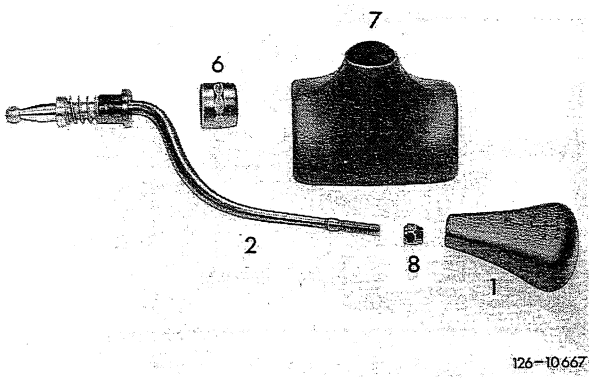


2 Pull shift lever (2) out of shift tube.

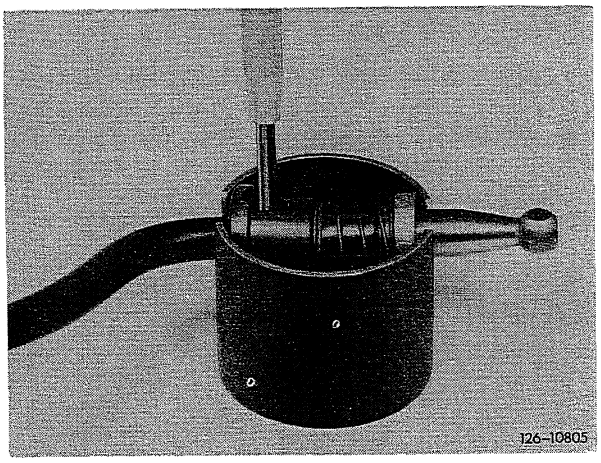


3 Unscrew shift lever knob and hex nut from shift lever and remove shift lever cuff.

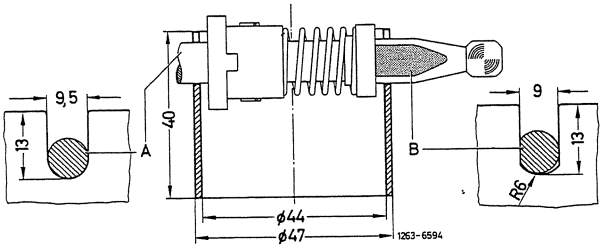
4 Remove closing cap from shift lever.



5 Insert shift lever into holding device and knock out hollow set pin by means of a punch.

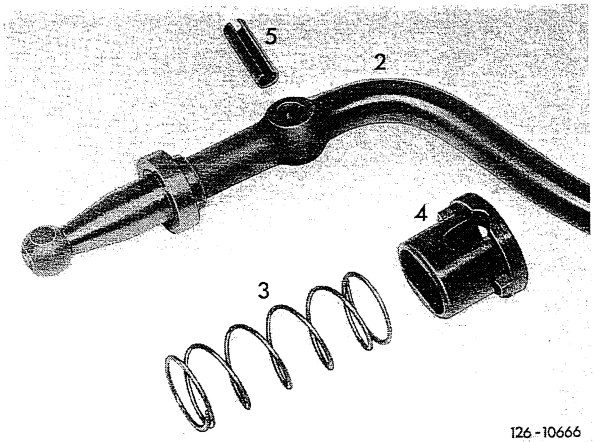


6 Make holding device according to specified dimensions.



7 Remove bushing (4) and compression spring (3) from shift lever (2).

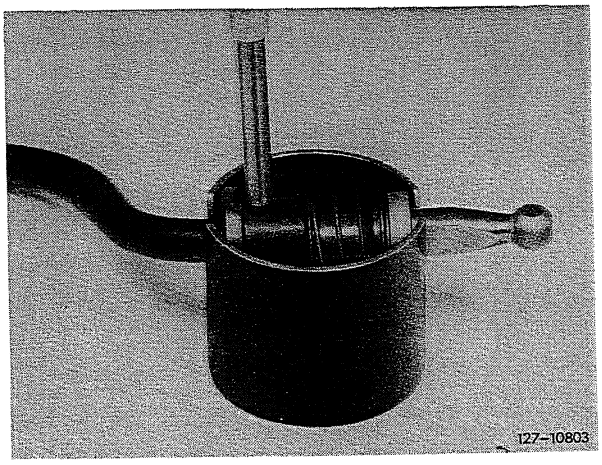
8 Check individual components for wear and condition of wear.



9 Slip compression spring (3) and bushing (4) on shift lever (2).

10 Place shift lever into holding device and knock hollow set pin into shift lever by means of a punch until the two ends of the hollow set pin are flush with bushing.

Slot of hollow set pin should face spring.



11 Slip closing cap (6) and shift lever cuff (7) on shift lever.

12 Screw hex nut and shift lever knob as far as possible on shift lever.

13 Insert shift lever into shift tube, making sure that the two locating pins on collar of bushing (4) are correctly seated in recesses on shift tube provided for this purpose.

14 Tighten closing cap (6) with box wrench.

15 Mount shift lever cuff in such a manner that the two stiffening ribs are facing downwards.

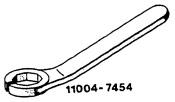
16 Turn shift lever knob into correct position and counterlock with hex nut.

17 Check gearshift for function with engine running.

Grease type	
Longterm grease	refer to specifications for service products page 266.2

Tightening torque	Nm	(kpm)
Closing cap for shift lever	7	(0.7)

Special tool

Box wrench 27 mm for closing cap (octagon) on shift lever	 11004-7454	115 589 00 03 00

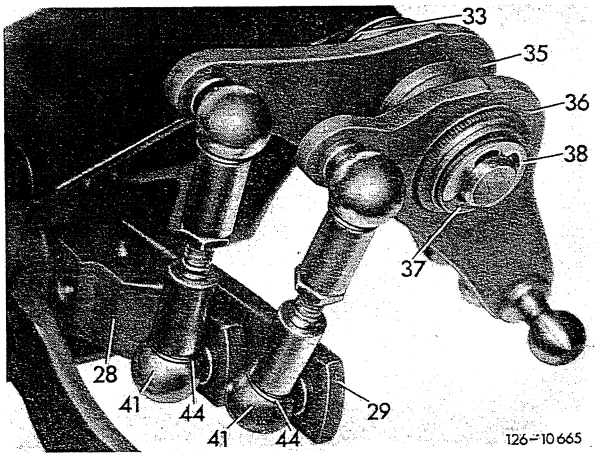
Note

The jobs described below can also be completed with jacket tube installed.

Disassembly

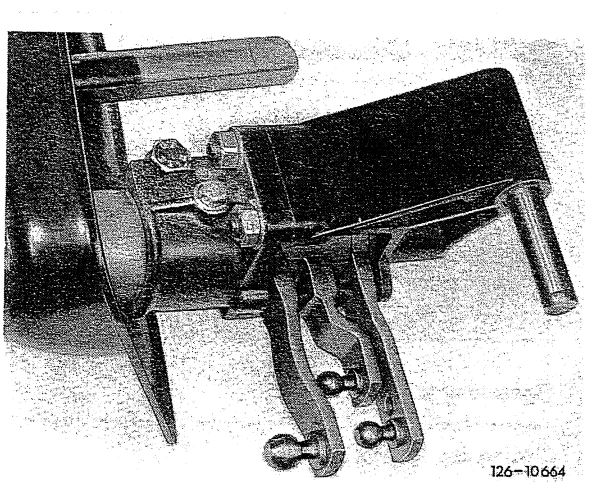
1 Remove shift lever (26–720).

2 Remove the two locking clips (44) and force ball sockets (41) from intermediate levers (28 and 29).

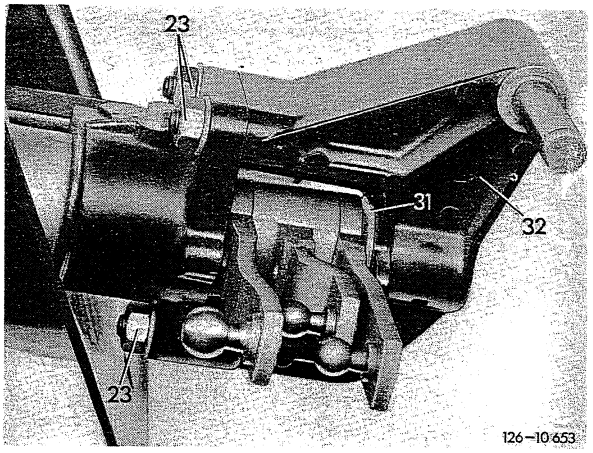


26 Intermediate lever for 1st and 2nd speed
29 Intermediate lever for 3rd and 4th speed
33 Spring washer
35 Guide lever for 1st and 2nd speed
36 Guide lever for 3rd and 4th speed
37 Compensating washer
38 Lock
41 Ball socket
44 Safety clip

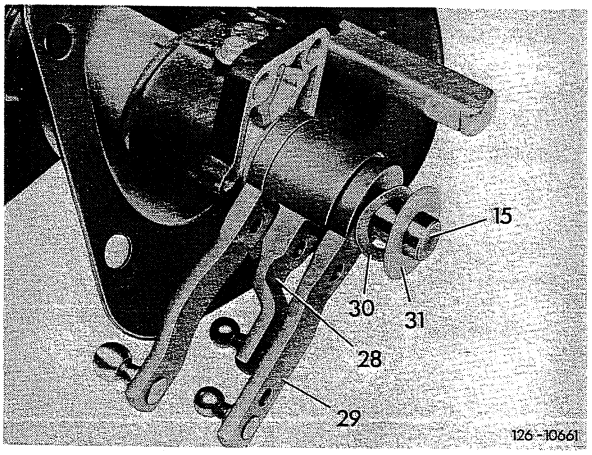
3 Upon removal of lock (38) and compensating washer (37), remove guide levers (36 and 35) with spring washer (33).



4 Unscrew the three nuts (23) and remove bearing bracket lower half (32), while paying attention to plastic washer (31).

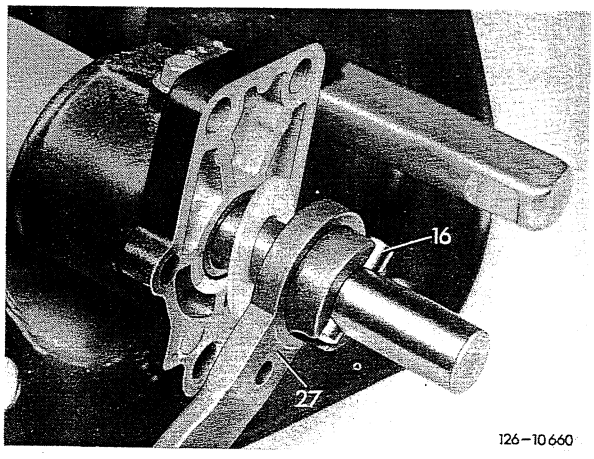


5 Pull plastic washer (31), spring washer (30), intermediate levers (29 and 28) from shift tube (15).

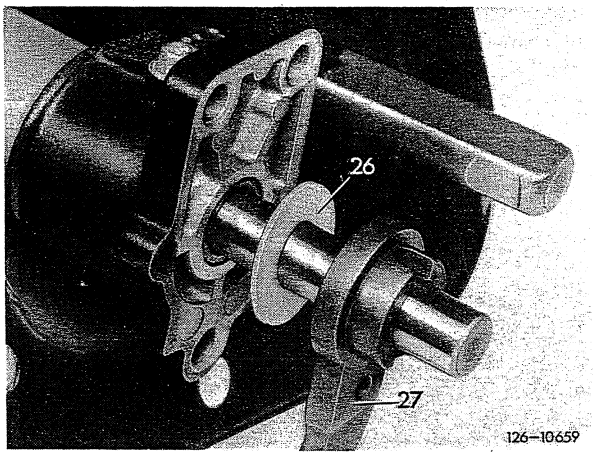


15 Shift tube
28 Intermediate lever for 1st and 2nd speed
29 Intermediate lever for 3rd and 4th speed
30 Spring washer
31 Plastic washer

6 Remove bolt (16) in shift tube.

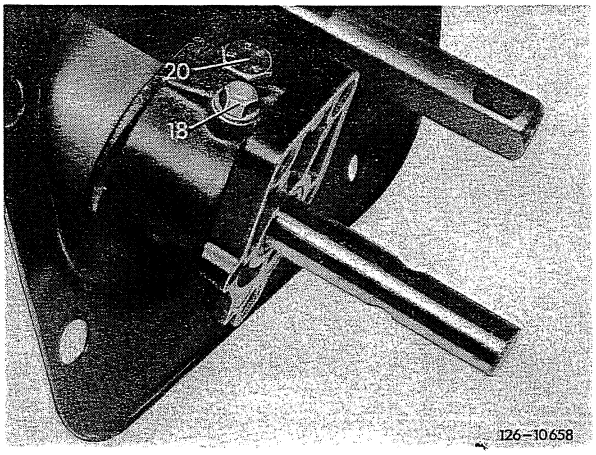


7 Pull intermediate lever (27) and plastic washer (26) from shift tube.



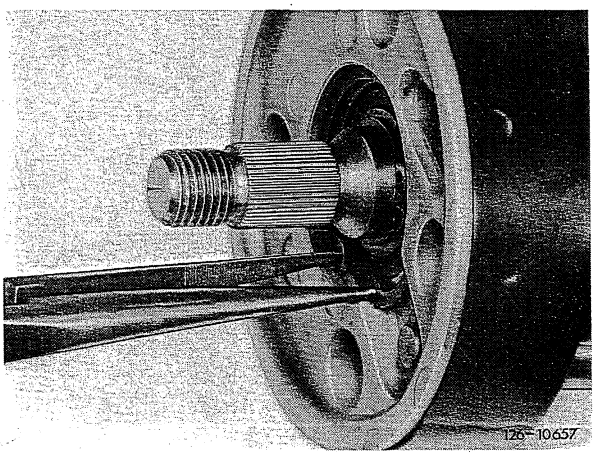
8 Unscrew locating screw (18) and clamping screw (20), then remove shift bracket top.

9 Remove steering wheel (46–610).

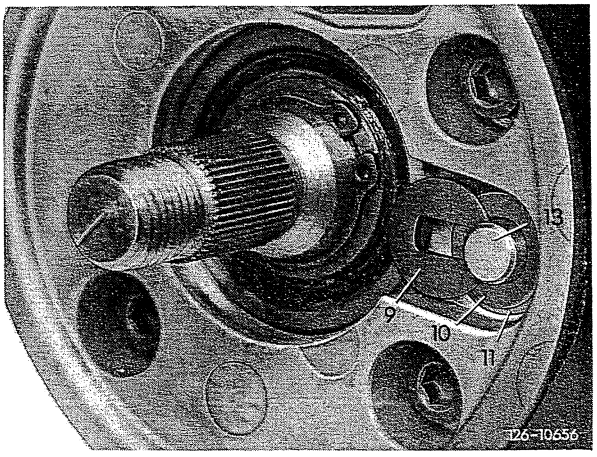


10 Take locking ring out of bearing body.

12 Remove steering shaft (46–630).



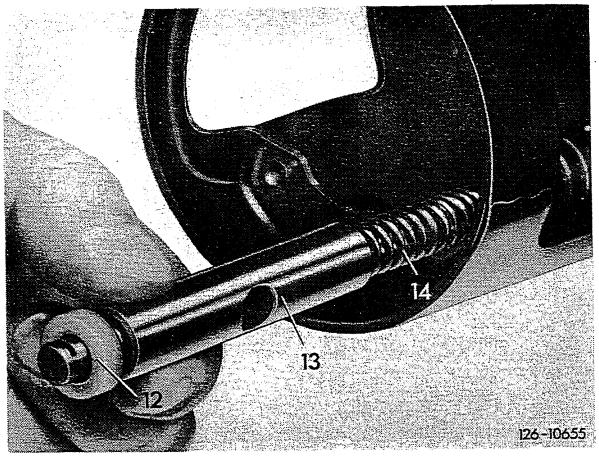
11 Turn guide pin (13) by 180°, remove lock (9) with washer (10) and guide ring (11).



13 Remove guide ring (12), guide shaft (13) and compression spring (14) out of shift tube.

14 Turn shift tube by 180° and remove from jacket tube.

15 Check all parts as well as needle bearing (25) in shift bracket top for wear or condition of wear and renew, if required.



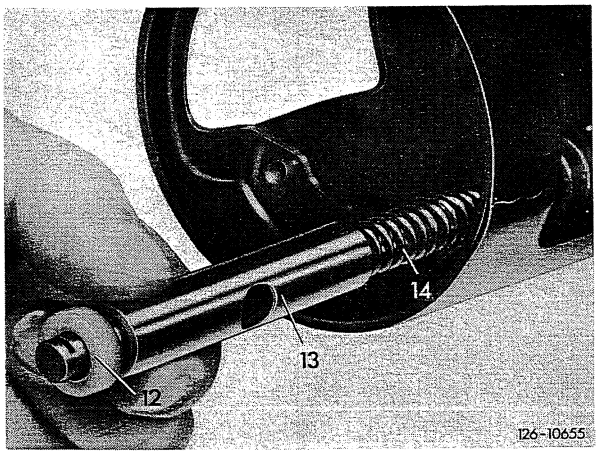
Assembly

Attention!
During assembly, grease all bearing points with longterm grease.

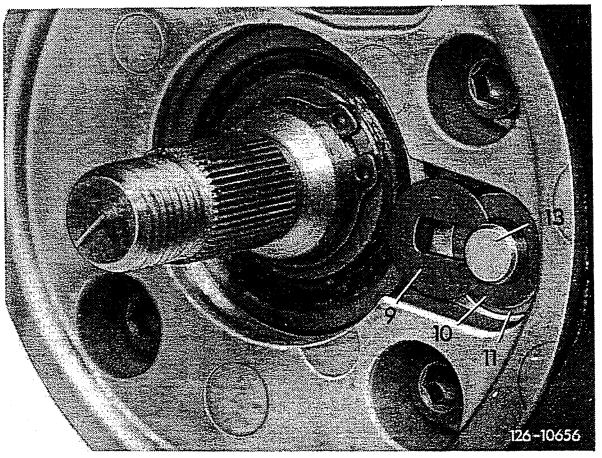
16 Introduce shift tube into jacket tube and turn by 180°.

17 Insert compression spring (14), guide shaft (13) with guide ring (12) into shift tube in such a manner that bore in guide shaft faces shift lever.

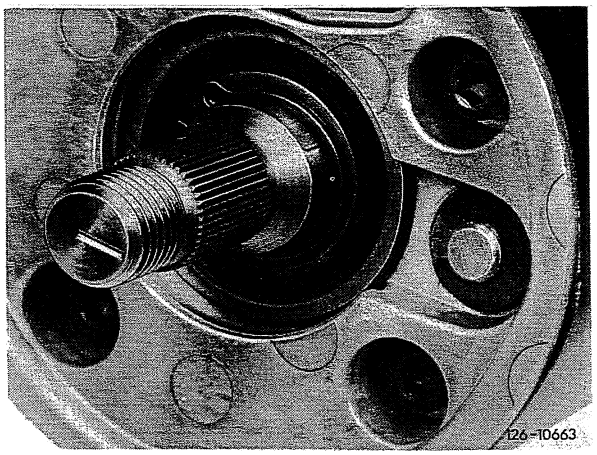
18 Install steering shaft (46–630).



19 Insert guide ring (11) with washer (10) and lock (9) into guide shaft (13).

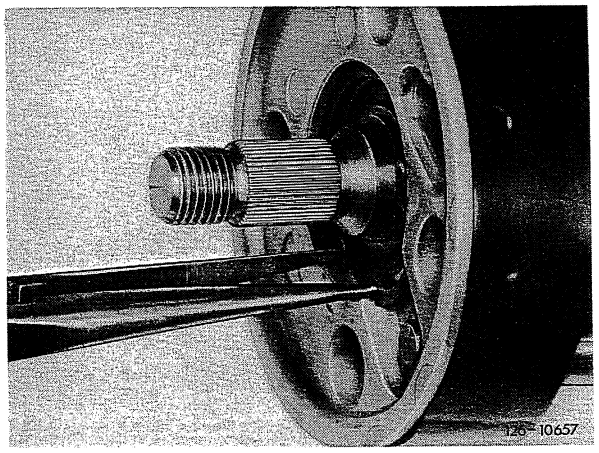


20 Secure lock against slipping-out by turning guide shaft by 180°.

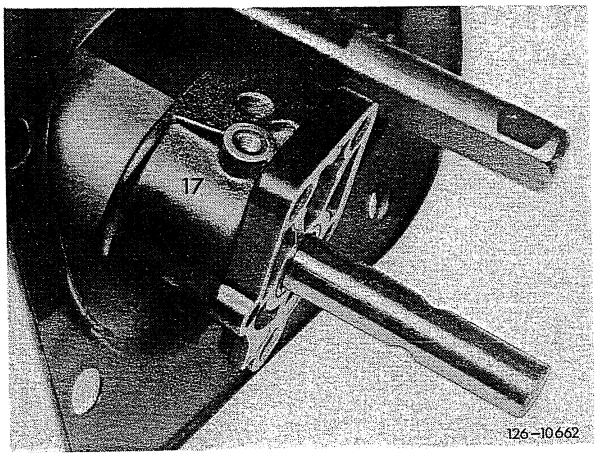


21 Insert locking ring into bearing body.

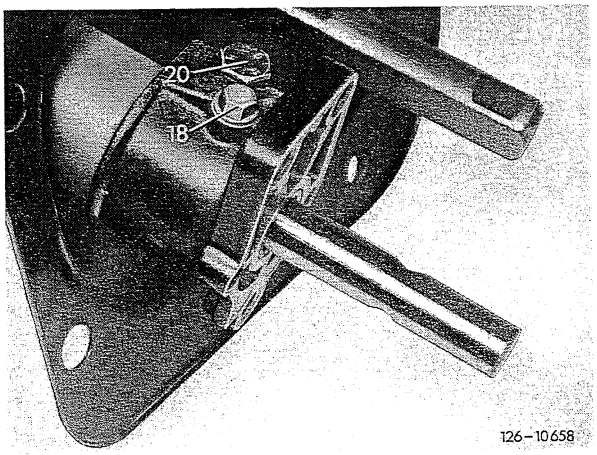
22 Install steering wheel (46–610).



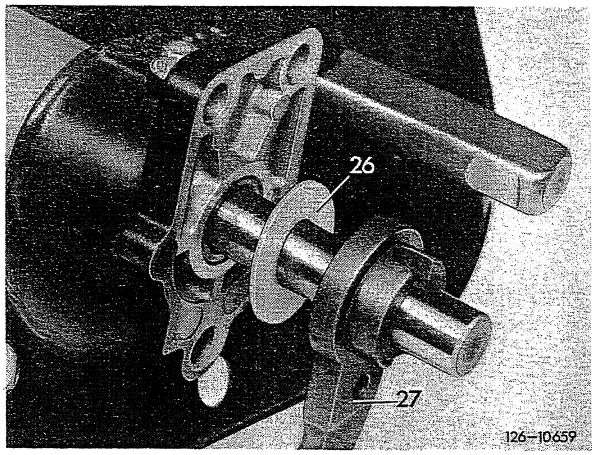
23 Slip shift bracket top (17) on jacket tube in such a manner that the threaded bore is in alignment with locating bore in jacket tube.



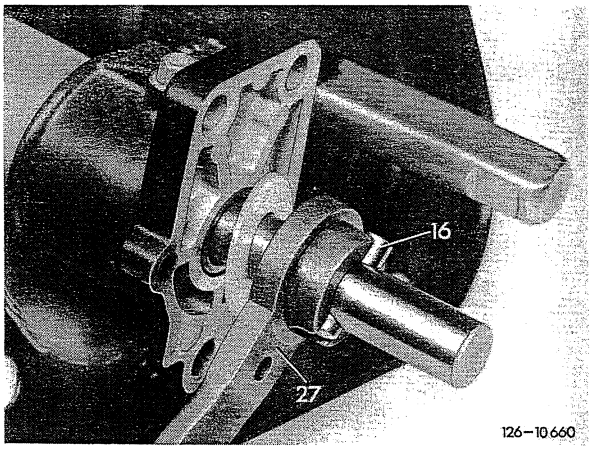
24 Insert locating bolt (18) and clamping screw (20) and tighten.



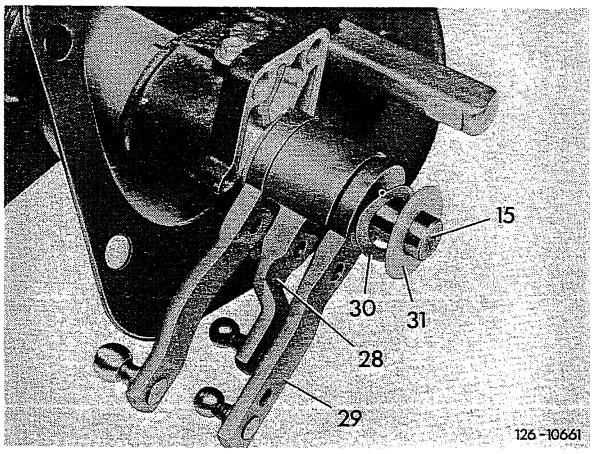
25 Slip plastic washer (26) and intermediate lever (27) on shift tube.



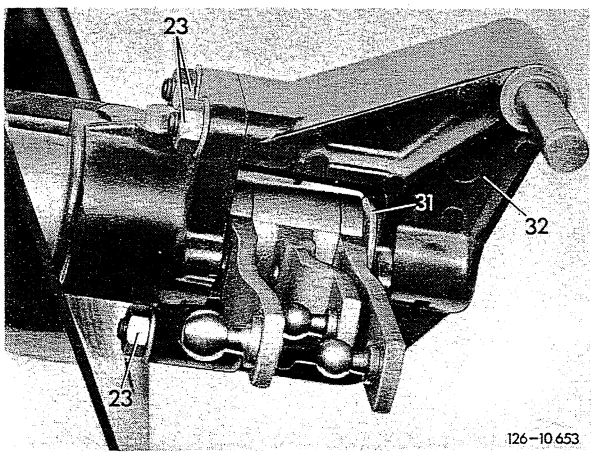
26 Insert bolt (16) into shift tube.



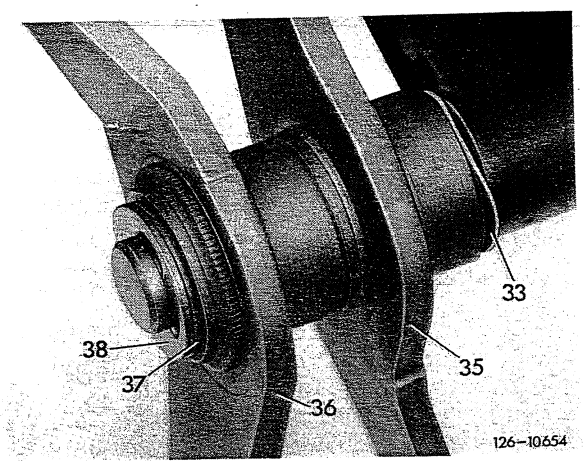
27 Slip intermediate lever (26 and 29), spring washer (30) and plastic washer (31) on shift tube.



28 Mount shift bracket lower half (32) and tighten with the three nuts (23).

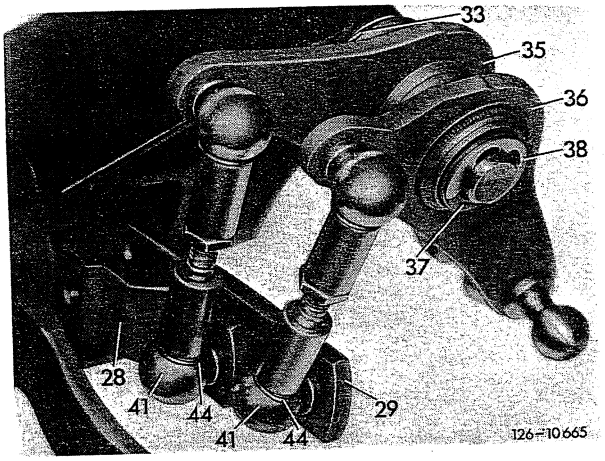


29 Slip spring washer (33), guide lever (35 and 36) on bearing bolt and insert compensating washer (37) together witl lock (38).



33 Spring washer
35 Guide lever for 1st and 2nd speed
36 Guide lever for 3rd and 4th speed
37 Compensating washer
38 Lock

30 Push ball sockets (41) on intermediate levers (28 and 29) and secure with locking clip (44).



31 Install shift lever (26–720).

32 Adjust steering column shift (26–710).

33 Check steering column shift for function with engine running.

Illustrated table steering column shift

1 Shift lever knob
2 Shift lever
3 Compression spring
4 Bushing
5 Hollow set pin
6 Closing cap
7 Cuff for shift lever
8 Nut
9 Lock
10 Washer
11 Guide ring
12 Guide ring
13 Guide shaft
14 Compression spring
15 Shift tube
16 Bolt in shift tube
17 Bearing bracket top
18 Locating screw
19 Washer
20 Hex bolt
21 Washer
22 Nut
23 Nut
24 Spring washer
25 Needle bearing
26 Plastic washer
27 Intermediate lever for reverse speed
28 Intermediate lever for 1st and 2nd speed
29 Intermediate lever for 3rd and 4th speed
30 Spring washer
31 Plastic washer
32 Bearing bracket bottom
33 Spring washer
34 Needle bearing
35 Guide lever for 1st and 2nd speed
36 Guide lever for 3rd and 4th speed
37 Compensating washer
38 Lock
39 Backup light switch
40 Pull rod
41 Ball socket
42 Threaded bolt
43 Nut
44 Locking clip
45 Shift rod for reverse speed
45a Shift lever for reverse speed
46 Shift rod for1st and 2nd speed
46a Shift lever for 1st and 2nd speed
47 Insulating bushing
48 Shift rod for 3rd and 4th speed
48a Shift lever for 3rd and 4th speed
49 Ball socket
50 Nut