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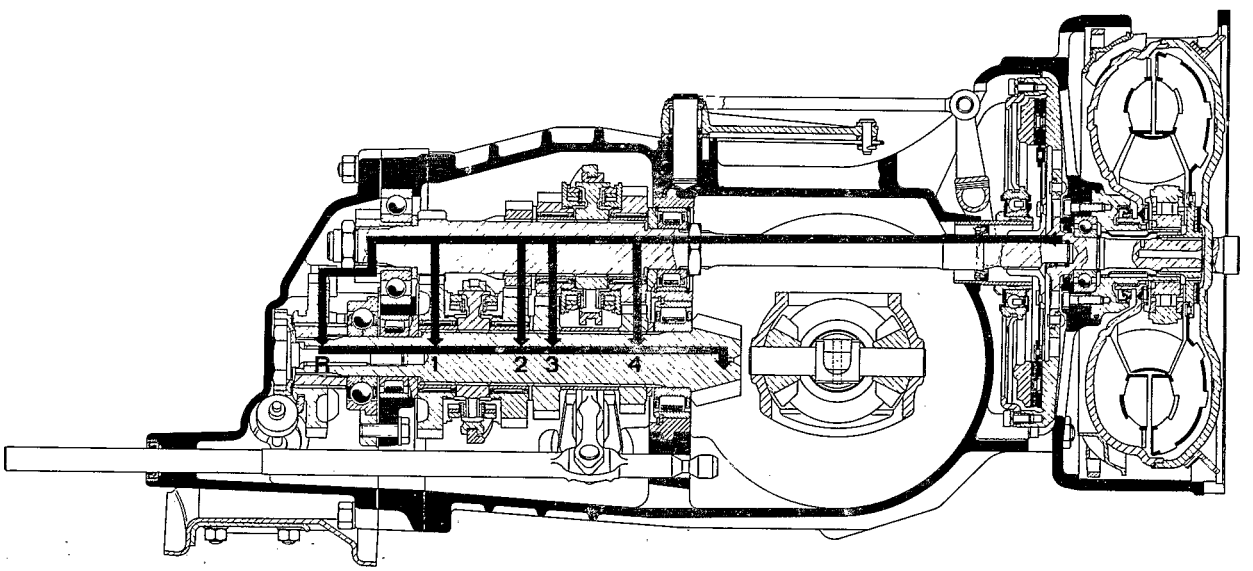
1 - Oil seal
2 - Expansion bolt
3 - Threaded stud
4 - Tapered roller bearing
5 - Axle flange
6 - Temperature sending unit
7 - Temperature switch
8 - Thrust washer
9 - Reverse idler gear
10 - Needle bearing cage
11 - Axial needle bearing cage
12 - 0-ring
13 - Ring gear
14 - Differential spider gear
15 - Differential side gear
16 - Roll pin
17 - Anchor piece
18 - Shaft

Power Transfer

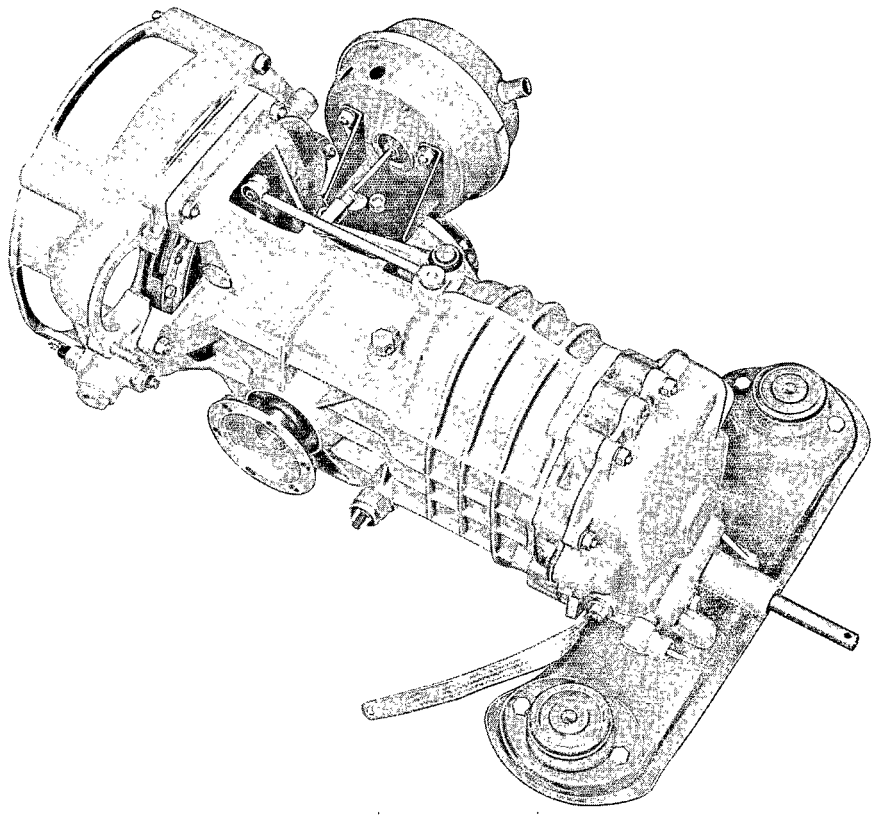
Power transfer from the engine through the torque converter and mechanical clutch is same in all driving ranges.

In ranges L and D, the power is transfered from the fixed gears on the input shaft, through the synchronization components and free-wheeling gears on the pinion shaft, to the pinion shaft. In ranges D3 and D4, the power transfers from the input shaft, through the synchronization components and free-wheeling gears, to the fixed gears on the pinion shaft. Reduction is accomplished by gears engaged in given driving range.

Reverse gear reduction is over two stages. The power flows from the input shaft, through the intermediate shaft, to the pinion.



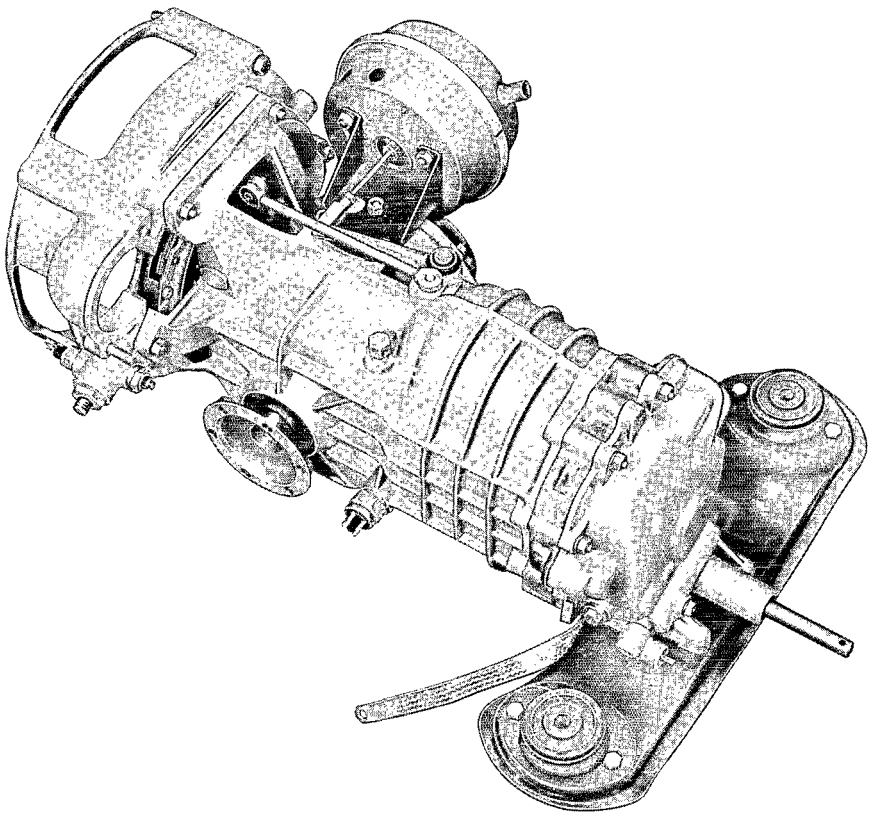
TYPE 925 SPORTOMATIC TRANSMISSION (1974 MODEL)



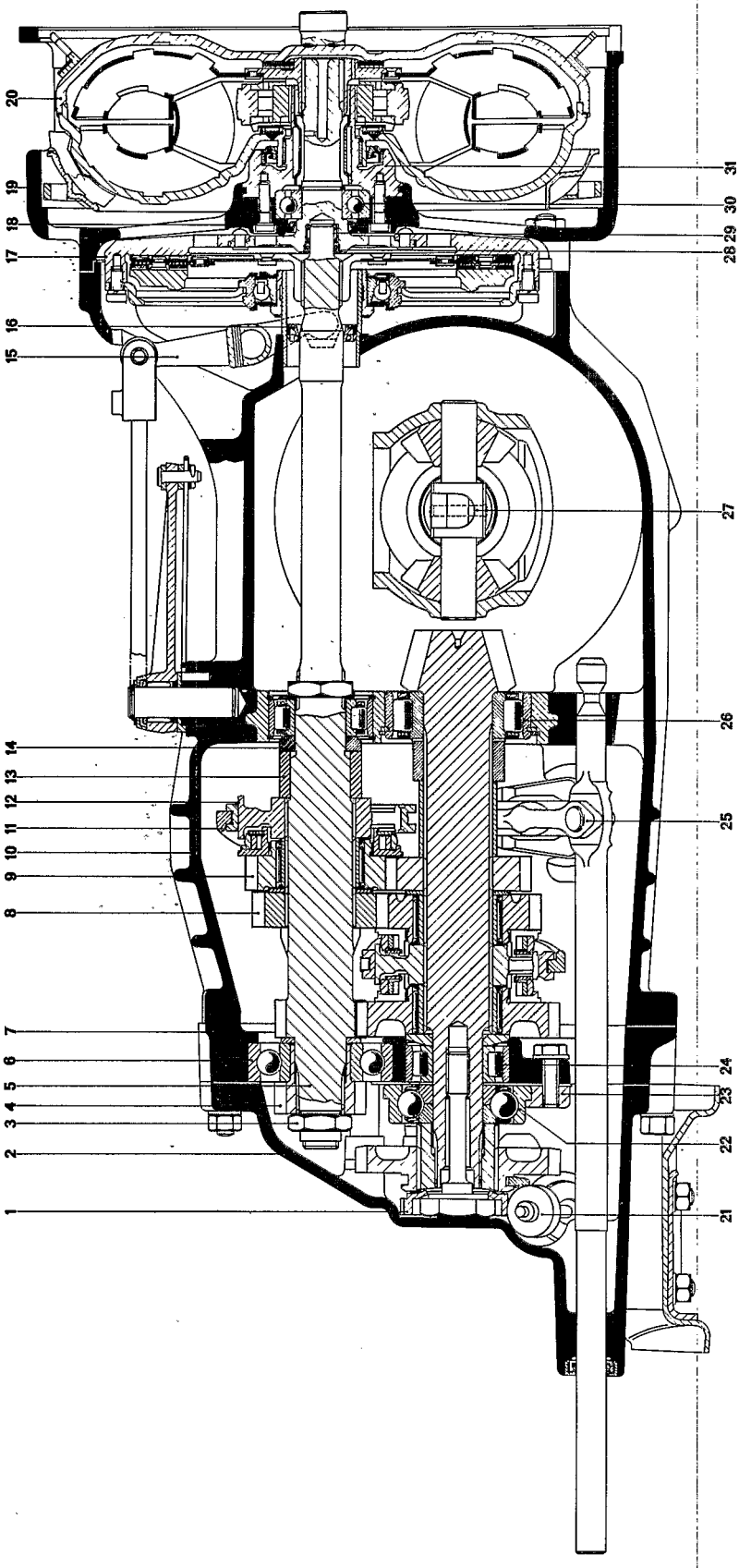
Beginning with 1974 models, Type 911 and 911 S vehicles can optionally be equipped with the Type 925/02 transmission.

This transmission version differs from that used in 1973 models only in the aspect of changed torque converter ratio (see Technical Data, page 0.2 - 2/6).

SPORTOMATIC 925 (1975 Models)



All 1975 models are available with a 3-speed sportomatic transmission (type 925/10) as optional extra equipment.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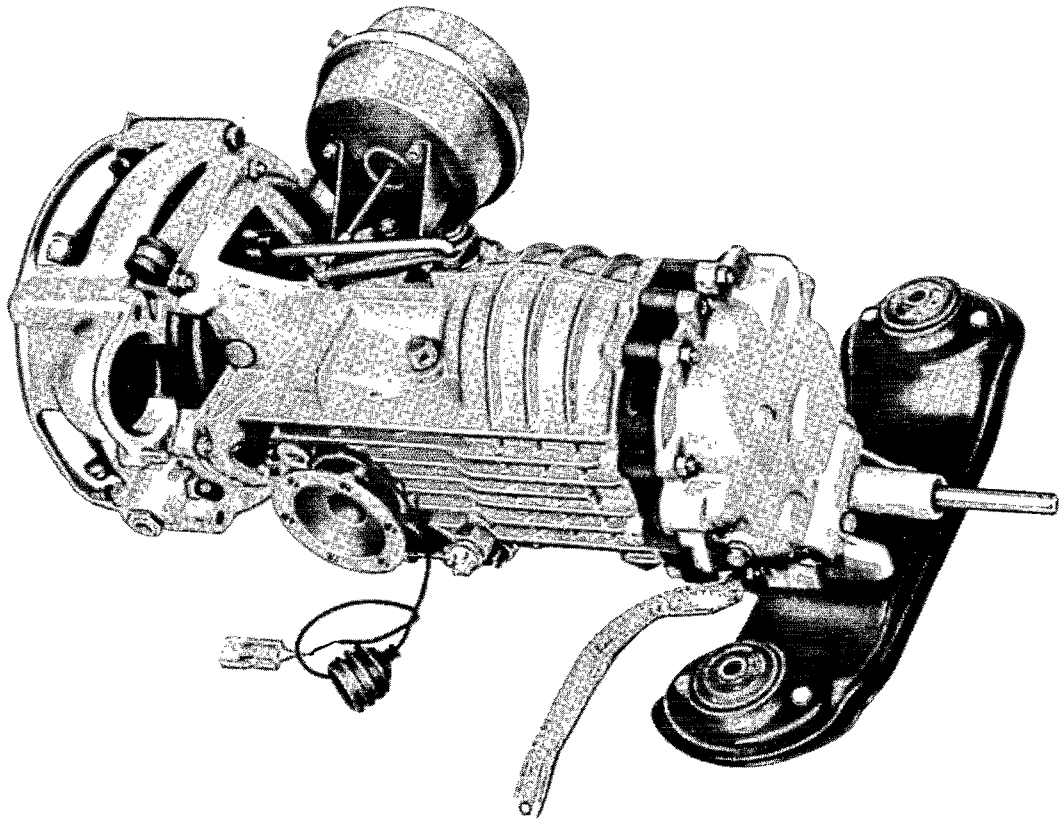
1 - Speedometer drive gear
2 - Front transmission cover
3 - Flanged nut
4 - Reverse gear
5 - Main shaft
6 - Ball bearing
7 - Intermediate plate
8 - 2nd gear (22:29 M)
9 - 3rd gear (27:25 V)
10 - Transmission case
11 - 3rd gear shift fork
12 - 3rd gear shift sleeve guide
13 - Spacer
14 - Washer
15 - Release lever
16 - Oil seal
17 - Turbine shaft
18 - Oil seal
19 - Torque converter housing
20 - Torque converter
21 - Speedometer drive shaft
22 - Four-point ball bearing
23 - Clamping plate
24 - Roller bearing
25 - Inner shift lever
26 - Roller bearing
27 - Anchor block
28 - O-ring
29 - Needle bearing
30 - Ball bearing
31 - Stator support

SPORTOMATIC 925 (1976 MODEL)



From 1976 models all cars can be delivered with a 3-speed sportomatic transmission as optional extra equipment. For engines with a swept volume of 2.7 liters transmission 925/09 (mechanical speedometer drive) and 925/12 (electronic speedometer transmitter) are installed.

The 3 liter Carrera engine requires a more powerful servo motor with a modified clutch linkage (Type 925/13). The torque converter has 4 additional drive shells.

SPORTOMATIC TRANSMISSION 925 (1976 MODEL)

The following transmissions are available from 1976 Models.

Transmission	No. of Speeds	For Model
925/09 (mech. speedometer)	3	911
925/12 (electronic speedometer)	3	911 and 911 S USA
925/13 (stronger converter drive)	3	Carrera 3.0

SPORTOMATIC TRANSMISSION 925 (1977 Models)

From 1977 Models the following transmission types are installed.

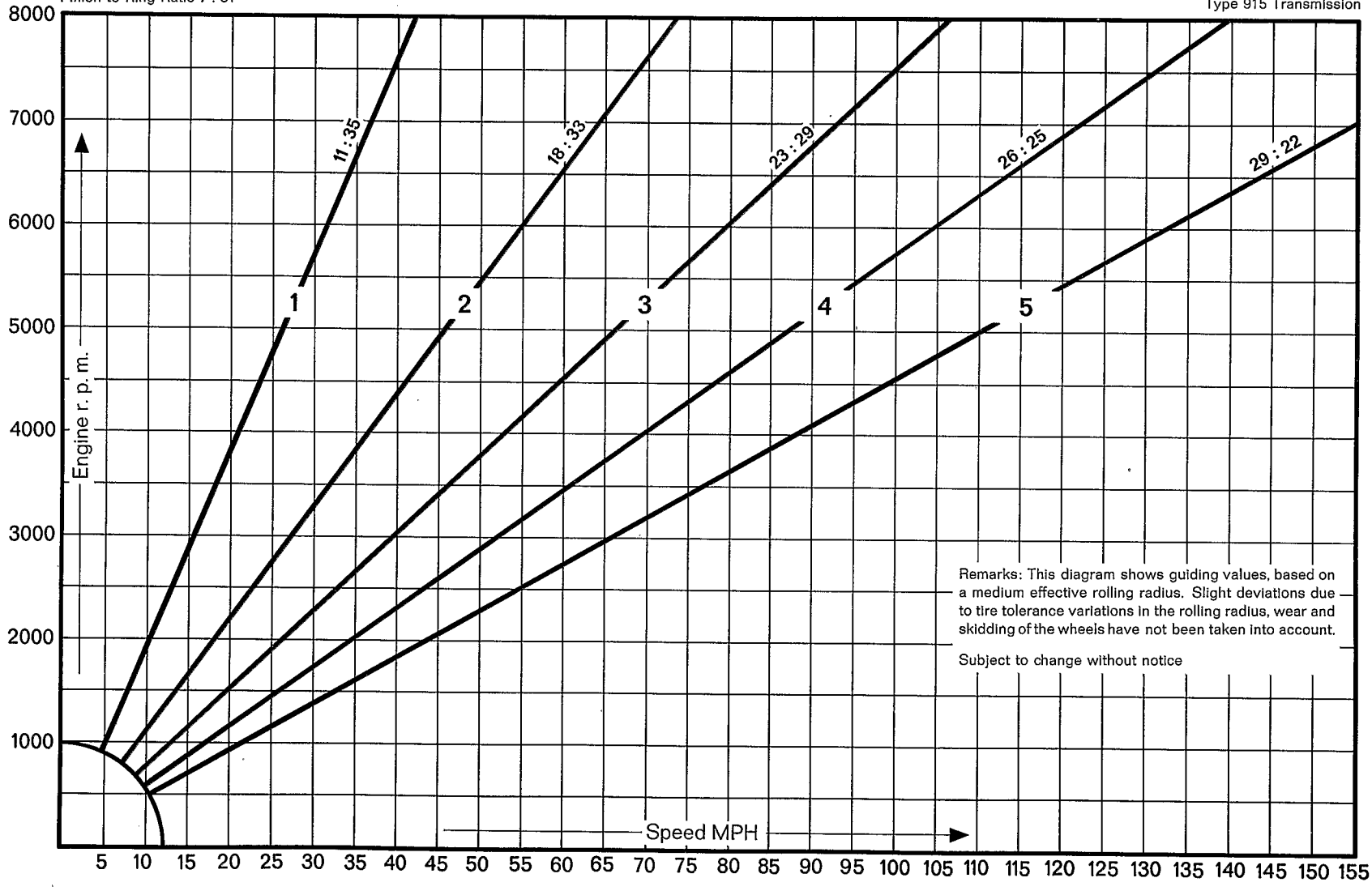
Transmission Type	No. of Gears	Installed in
925/15	3	911
925/16	3	Carrera 3.0
925/17	3	911 S USA and 911 S Japan

Transmission Diagram

5-speed-transmission

Pinion to Ring Ratio 7 : 31

Type 915 Transmission

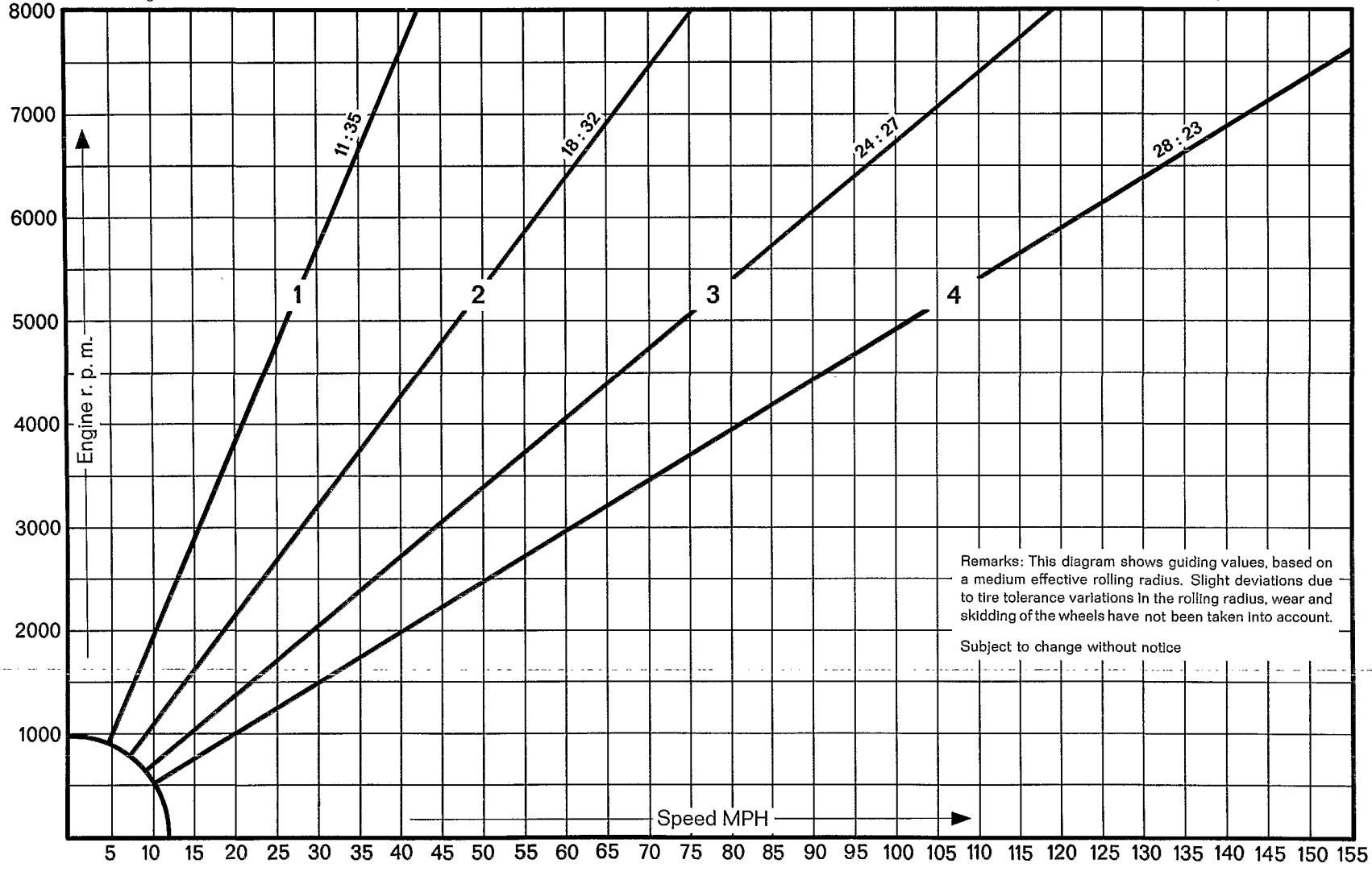


Transmission Diagram

4-speed-transmission

Pinion to Ring Ratio 7 : 31

Type 915 Transmission

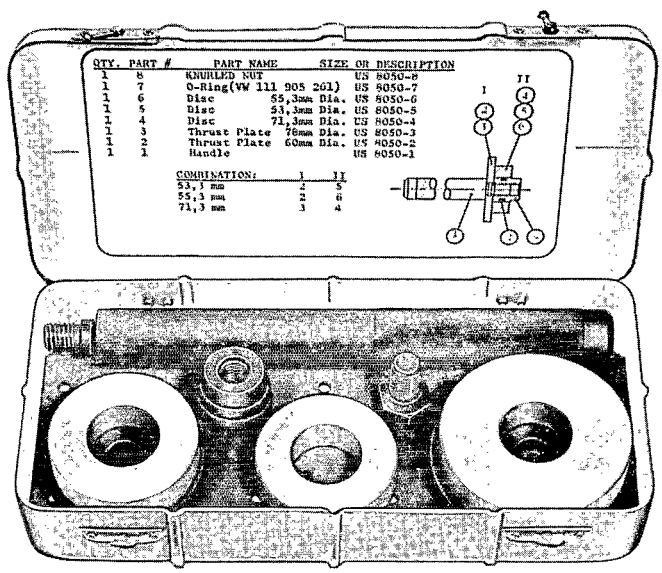


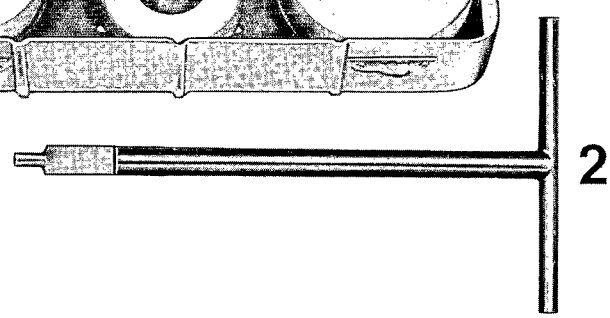
Remarks: This diagram shows guiding values, based on a medium effective rolling radius. Slight deviations due to tire tolerance variations in the rolling radius, wear and skidding of the wheels have not been taken into account.

Subject to change without notice

DISASSEMBLING AND ASSEMBLING TRANSMISSION HOUSING

TOOLS





1

2

Nr.	Description	Special Tool	Remarks
1	Driver Set	US 8050	
2	T-handle	P 366	

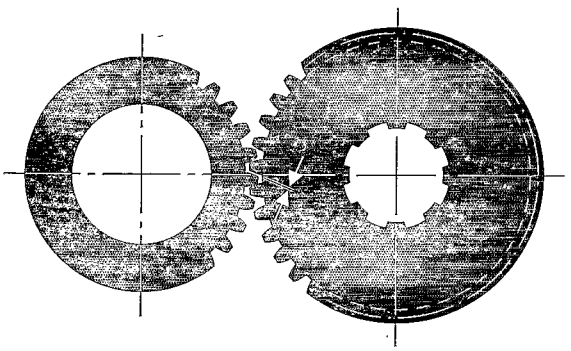
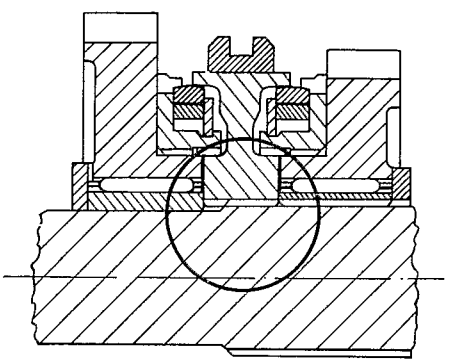
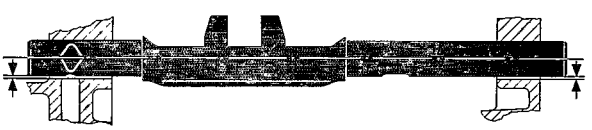
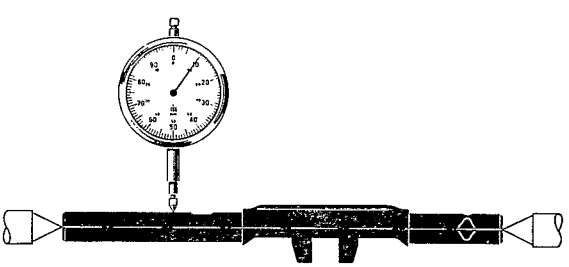
TIGHTENING TORQUES

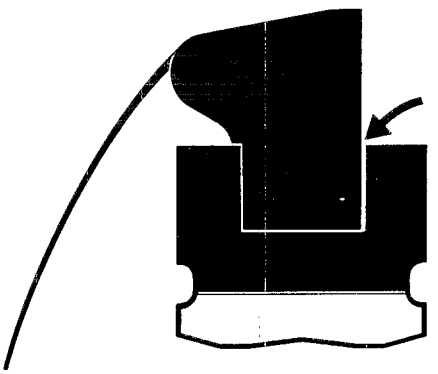
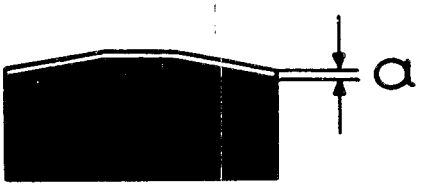
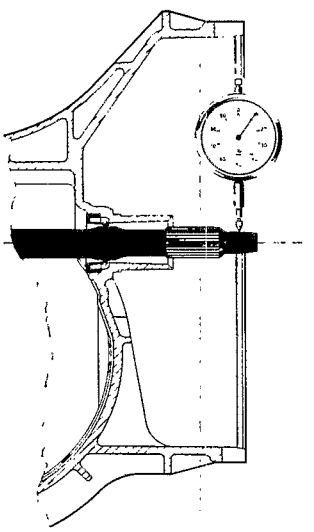
Location	Description	Thread	Grade	Nm	ft lbs
Transmission housing (Oil drain)	Magnetic plug	M24 Tapered	St 37	20 - 25	14.5 - 18.1
Transmission housing (oil filler)	Oil filler plug	M 24 Tapered	St 37	20 - 25	14.5 - 18.1
Transmission housing - side and front cover, guide fork cover	Nut, center lock type	M 8 x 1.25	x 12 CrNi 18-8	22 - 25	15.9 - 18.1
Front cover	Backup light switch	M 18 x 1.5	Ms	25 - 35	18.1 - 25.3
Input shaft	Flange nut	M 30 x 1.5	8.8	160 - 180	115.7 - 130.2
Input shaft	Castellated nut	M 18 x 1.5	6.8	120 - 140	86.8 - 101.3
Retaining plate and transmission support attachment	Nut	M 8 x 1.25	8	21 - 23	15.2 - 16.6
Pinion shaft	Flange nut	M 24 x 1.5	8	240 - 260	173,6-188,1
Guide fork, shifting	Nut	M 6 x 1.0	8	8 - 9	5.8 - 6.5
Shift detent, transmission housing	Nut	M 10 x 1.5	8.8	15 - 18	10.8 - 13.0
Transmission housing	Breather	M 16 x 1.5	9 S 20 K	20 - 30	14.5 - 21.7
Shift forks	Nut	M 8 x 1.25	8.8	24 - 26	17.4 - 18.8
Ring gear (differential)	Bolt	M 12 x 1.25	11.9	115 - 120	83.2 - 86.8
Ring gear (self-locking differential)			11.9 12.9	140 - 150 150 - 160	101.3-108.5 108.5-115.7
Axle flange	Expansion bolt/ Bolt	M 10 x 1.5	8.8	26 - 30/ 39 - 46	18.8 - 21.7/ 28.2 - 33.3
Starter	Nut	M 10 x 1.5	8	46 - 48	33.3 - 34.7
Pressure line (input shaft)	Bolt, M 6x35	M 6 x 1.0	8.8	8 - 9	5.8 - 6.5
Front cover	Plug for pressure relief valve	M 12 x 1.5	9 S 20 K	22 - 25	15.9 - 18.1
Oil pump cover	Self-locking nut	M 6 x 1.0	x 12 CrNi 18.8	9 - 10	6.5 - 7.2
Pickup tube	Allen bolt M 6 x 15	M 6 x 1.0	8.8	8 - 9	5.8 - 6.5
Pressure line	Bolt, M 6 x 12	M 6 x 1.0	8.8	8 - 9	5.8 - 6.5
Guide tube release bearing	Phillips head ctsk. screw	M6x1.0	8.8	8 - 9	5.8 - 6.5

General Specifications	Type 915 Transmission			
	911 T	911 E	911 S	Carrera 2.7
Gear Ratios				
1st gear		11/35 = 3.182		11/35 = 3.182
2nd gear		18/32 = 1.778		20/32 = 1.600
3rd gear		24/27 = 1.125		25/26 = 1.040
4th gear		28/23 = 0.821		29/22 = 0.759
Reverse		12/21 / 20/38 = 3.325		12/21 / 20/38 = 3.325
1st gear		11/35 = 3.182		11/35 = 3.182
2nd gear		18/33 = 1.834		18/33 = 1.834
3rd gear		23/29 = 1.261		23/29 = 1.261
4th gear		26/25 = 0.962		27/25 = 0.925
5th gear		29/22 = 0.759		29/21 = 0.724
Reverse		12/21 / 20/38 = 3.325		12/21 / 20/38 = 3.325
Climbing Ability (calculated) Vehicle Weight: empty according to DIN + 1/2 load				
1st gear	84 %	92 %	100 %	> 100 %
2nd gear	37 %	39 %	41 %	43.5%
3rd gear	20 %	20.5 %	21.5 %	23 %
4th gear	12 %	12 %	12 %	12.5 %
1st gear	84 %	92 %	100 %	> 100 %
2nd gear	38.5%	41 %	43 %	52.5%
3rd gear	23.5%	24.5%	26 %	30.5%
4th gear	16 %	16 %	17 %	20 %
5th gear	10.5%	10.5%	10.5%	12.5%

General Specifications	Type 915 Transmission			
	911 T	911 E	911 S	Carrera 2.7
Rear Axle Drive	Spiral bevel gears, differential			
Final drive ratio	7/31 = 4.429			
Power transfer	double-joint drive shafts, to rear wheels			
Transaxle Weight				
4-speed transmission	54 kg, ready with oil and starter			
5-speed transmission	56 kg, ready with oil and starter			
Filling Capacities				
Transmission and differential	approx. 3 ltr. (6.3 US pints) SAE 90 transmission oil, MIL-L 2105 B or MIL-L 2105 specification			

Table of Tolerances for Type 915 Transmission

Measuring point	Installed tolerances (new) mm	Wear Limit mm	
1. Backlash between Gear I and II 1st gear 2nd gear 3rd gear 4th gear 5th gear	0.06-0.12	0.22	
2. Free gears on pinion and input shafts 1st gear 2nd gear 3rd gear 4th gear 5th gear	 0.3-0.4 0.2-0.3 0.2-0.3 0.2-0.3 0.2-0.3	 0.5 0.4 0.4 0.4 0.4	
3. Shift rods a. Side play in bushings	0.195 - 0.236	0.4	
b. Runout	--	0.10	

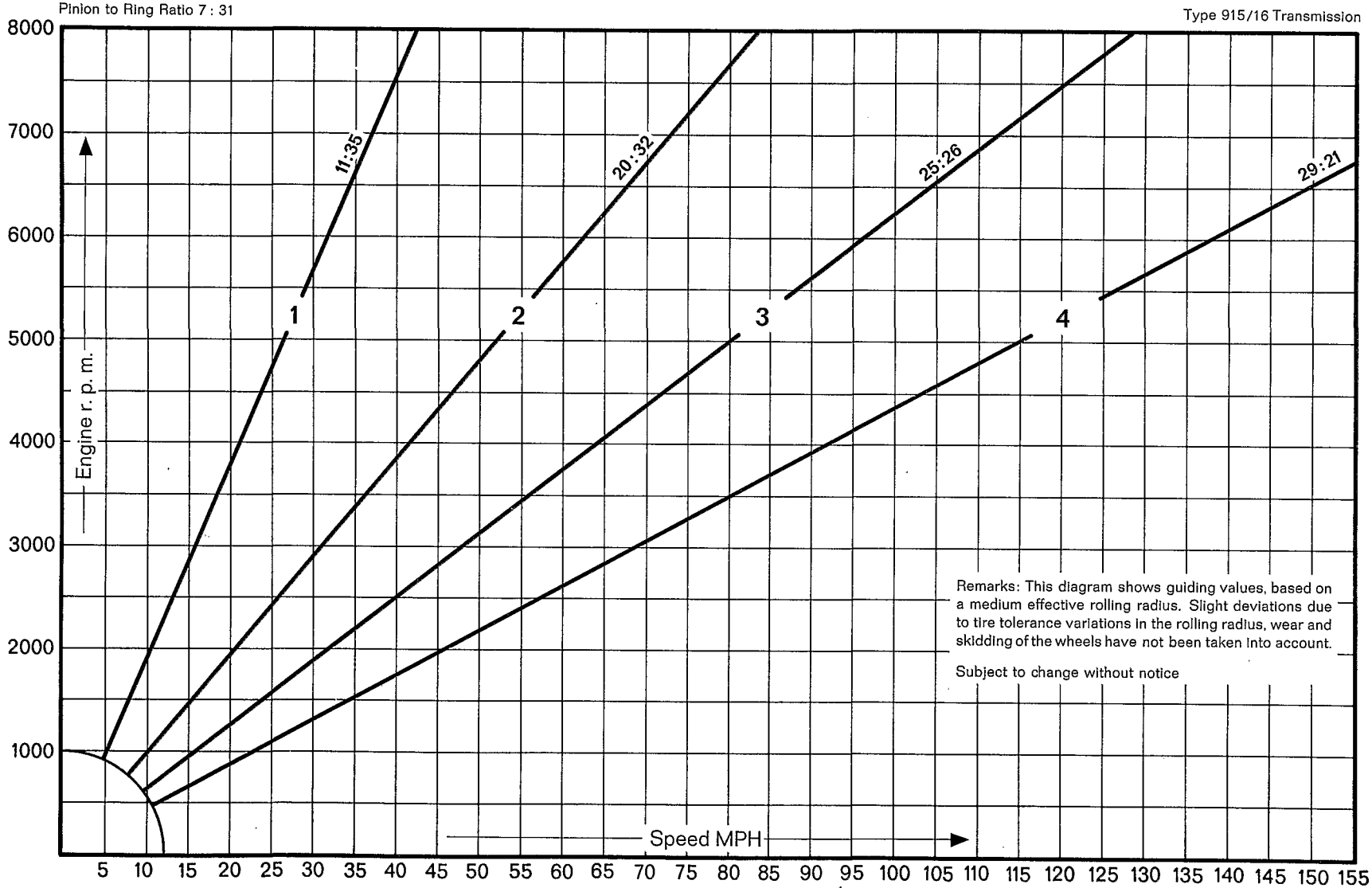
Measuring point	Installed tolerances (new) mm	Wear Limit mm	
4. Side-play between shift fork and shift sleeve:			
5th and reverse gear	0.1-0.3	0.5	
1st and 2nd gear	0.1-0.3	0.5	
3rd and 4th gear	0.1-0.3	0.5	
5. Outside diameter of synchronizing rings: (installed)			
1st gear	86.37 ± 0.17	When molyb-	
2nd gear	86.37 ± 0.17	denum coat	
3rd gear	76.3 ± 0.18	(a) is worn	
4th gear	76.3 ± 0.18	off at any	
5th gear	76.3 ± 0.18	point	
6. Input shaft			
a. Runout at the pilot journal	0.1 max.	0.1 max. (straighten)	

Transmission Diagram

4-speed-transmission

Pinion to Ring Ratio 7 : 31

Type 915/16 Transmission



Remarks: This diagram shows guiding values, based on a medium effective rolling radius. Slight deviations due to tire tolerance variations in the rolling radius, wear and skidding of the wheels have not been taken into account.

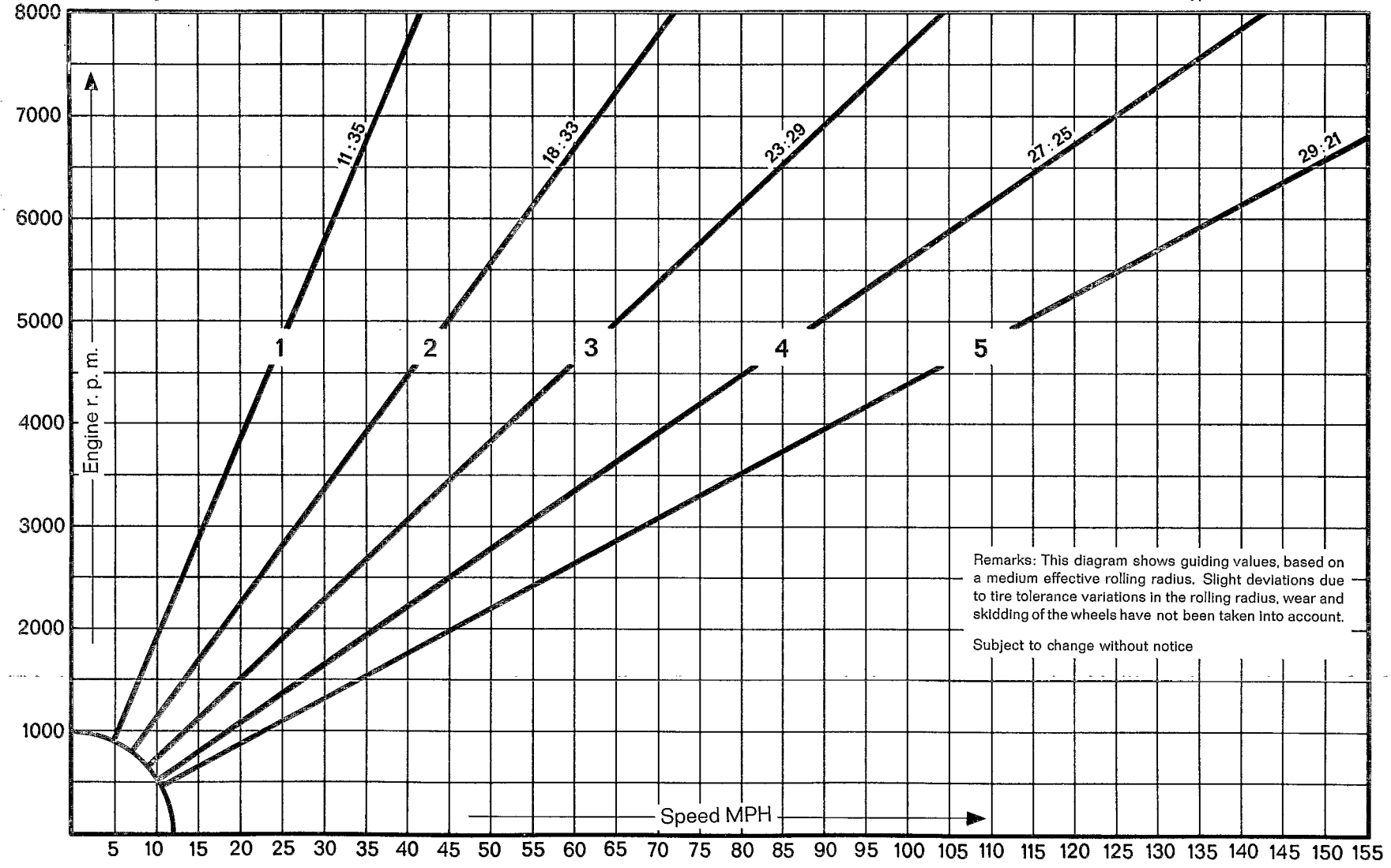
Subject to change without notice

Transmission Diagram

5-speed-transmission

Pinion to Ring Ratio 7 : 31

Type 915/06 Transmission



Remarks: This diagram shows guiding values, based on a medium effective rolling radius. Slight deviations due to tire tolerance variations in the rolling radius, wear and skidding of the wheels have not been taken into account.

Subject to change without notice

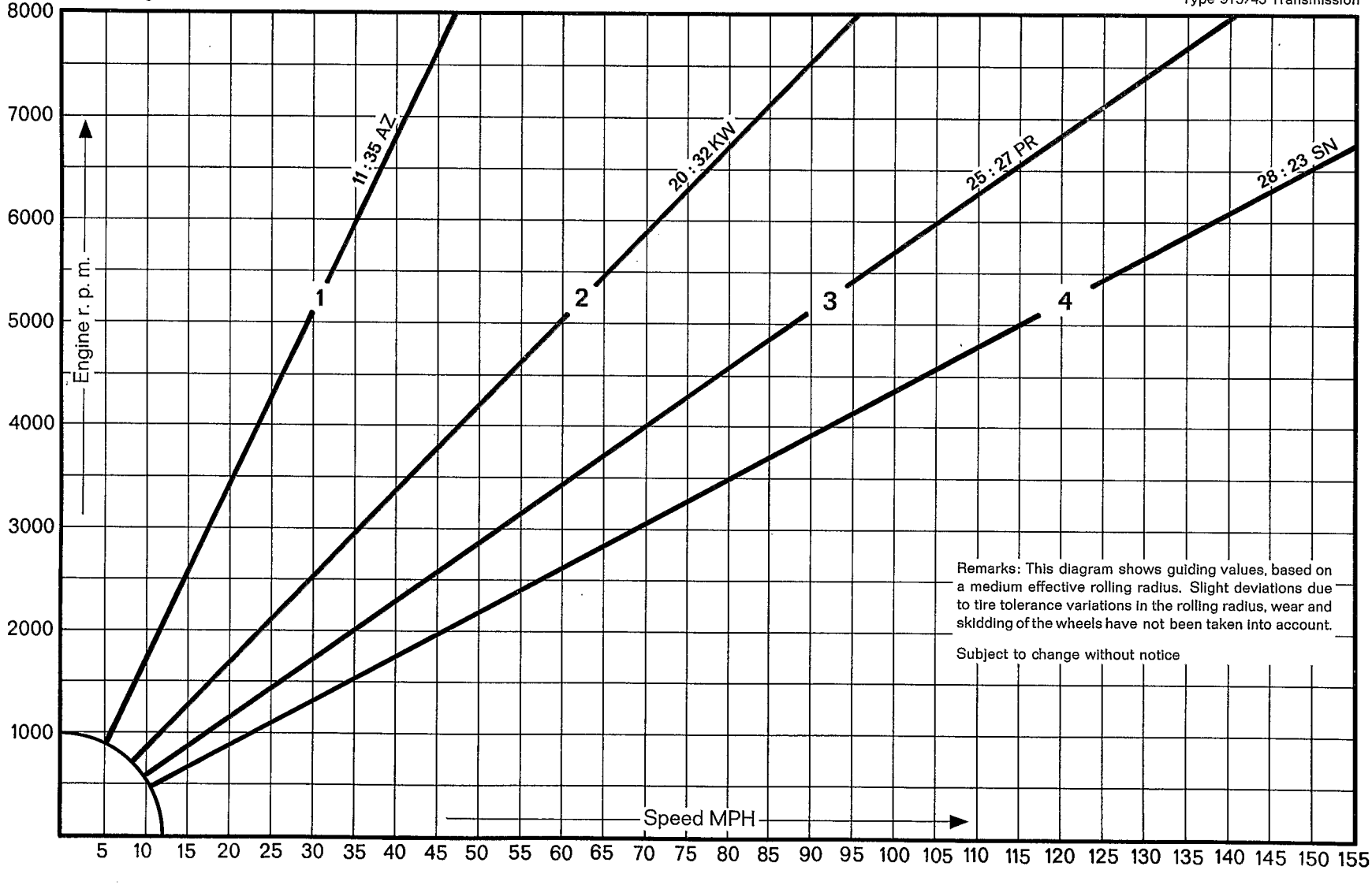
General Data	Type 915 Transmission (1974 model)		
	911	911 S	Carrera
Gear Ratios			
Type 915/16 transmission:			
1st gear	AZ 11/35 = 3.182		
2nd gear	KW 20/32 = 1.600		
3rd gear	PQ 25/26 = 1.040		
4th gear	TL 29/21 = 0.724		
Reverse gear	12/21 × 20/38 = 3.325		
Type 915/06 transmission:			
1st gear	AZ 11/35 = 3.182		
2nd gear	HX 18/33 = 1.834		
3rd gear	RP 23/29 = 1.261		
4th gear	TL 27/25 = 0.926		
5th gear	29/21 = 0.724		
Reverse gear	12/21 × 20/38 = 3.325		
Climbing Ability			
(calculated) Vehicle Weight: empty according to DIN + 1/2 load			
1st gear	>100 %	>100 %	>100 %
2nd gear	40 %	39 %	43 %
3rd gear	22 %	22 %	23 %
4th gear	12 %	11 %	11 %
1st gear	>100 %	>100 %	>100 %
2nd gear	48 %	47 %	52 %
3rd gear	29 %	29 %	30 %
4th gear	19 %	18 %	19 %
5th gear	12 %	11 %	11 %

General Data	Type 915 Transmission (1974 model)		
	911	911 S	Carrera
Rear axle drive	spiral bevel gears, differential		
Final drive ratio	7/31 = 4.429		
Power transfer	double-joint half-axles, to rear wheels		
Transaxle Weight			
4-speed transmission	54 kg (119 lb), ready with oil and starter		
5-speed transmission	55 kg (121 lb), ready with oil and starter		
Filling Capacities			
Transmission and differential	approx. 3 ltr. (3.17 US gts.) SAE 90 transmission oil, MIL-L 2105 or MIL-L 2105 B specification		
Transmission and differential, limited slip	approx. 3 ltr. (3.17 US gts.) SAE 90 transmission oil, M 2 C 119 A		

Transmission Diagram 911 S — 4-speed-transmission

Pinion to Ring Ratio 8:31

Type 915/45 Transmission



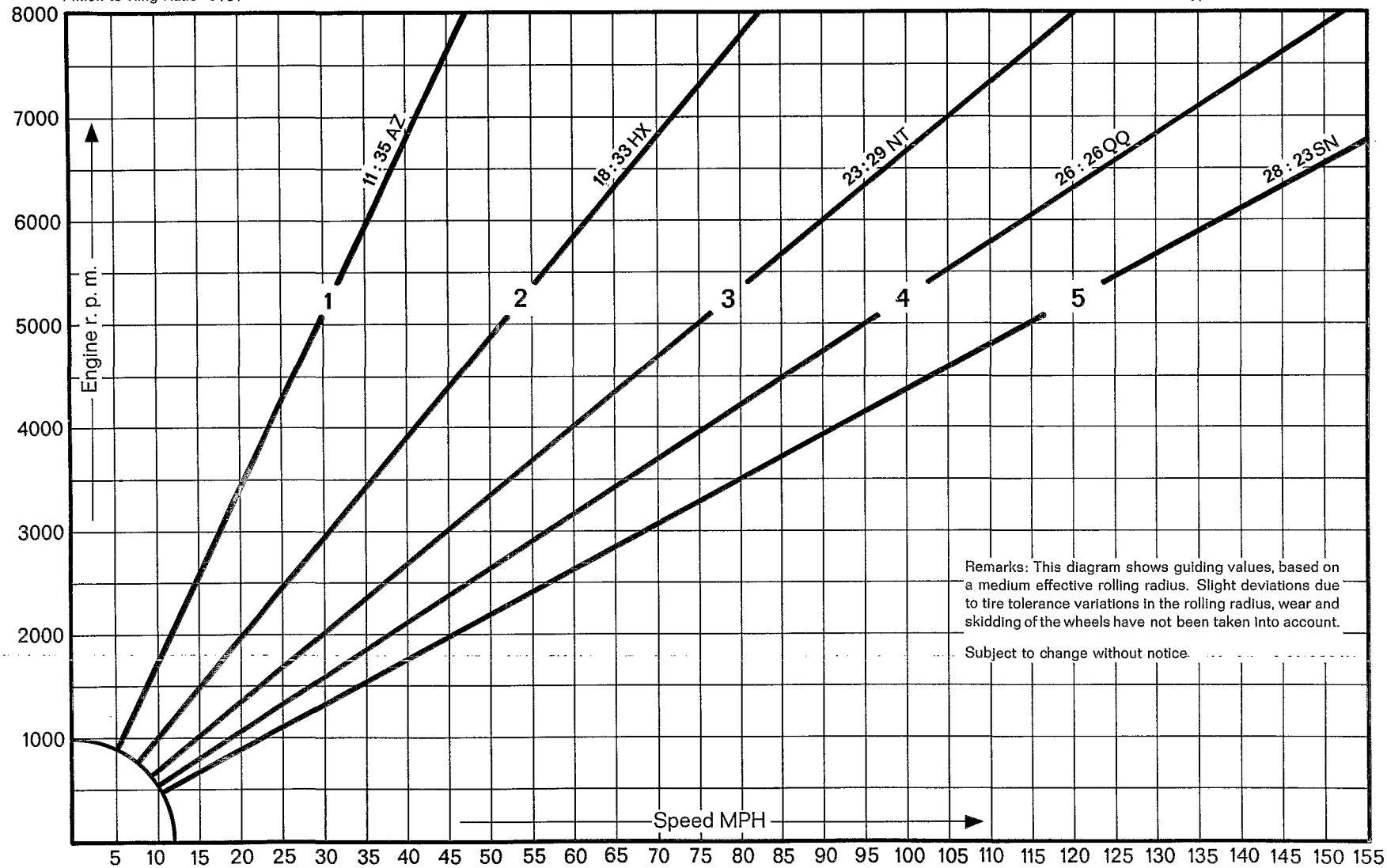
Remarks: This diagram shows guiding values, based on a medium effective rolling radius. Slight deviations due to tire tolerance variations in the rolling radius, wear and skidding of the wheels have not been taken into account.

Subject to change without notice

Transmission Diagram 911 S 5-speed-transmission

Pinion to Ring Ratio 8 : 31

Type 915/40 Transmission



Remarks: This diagram shows guiding values, based on a medium effective rolling radius. Slight deviations due to tire tolerance variations in the rolling radius, wear and skidding of the wheels have not been taken into account.

Subject to change without notice.

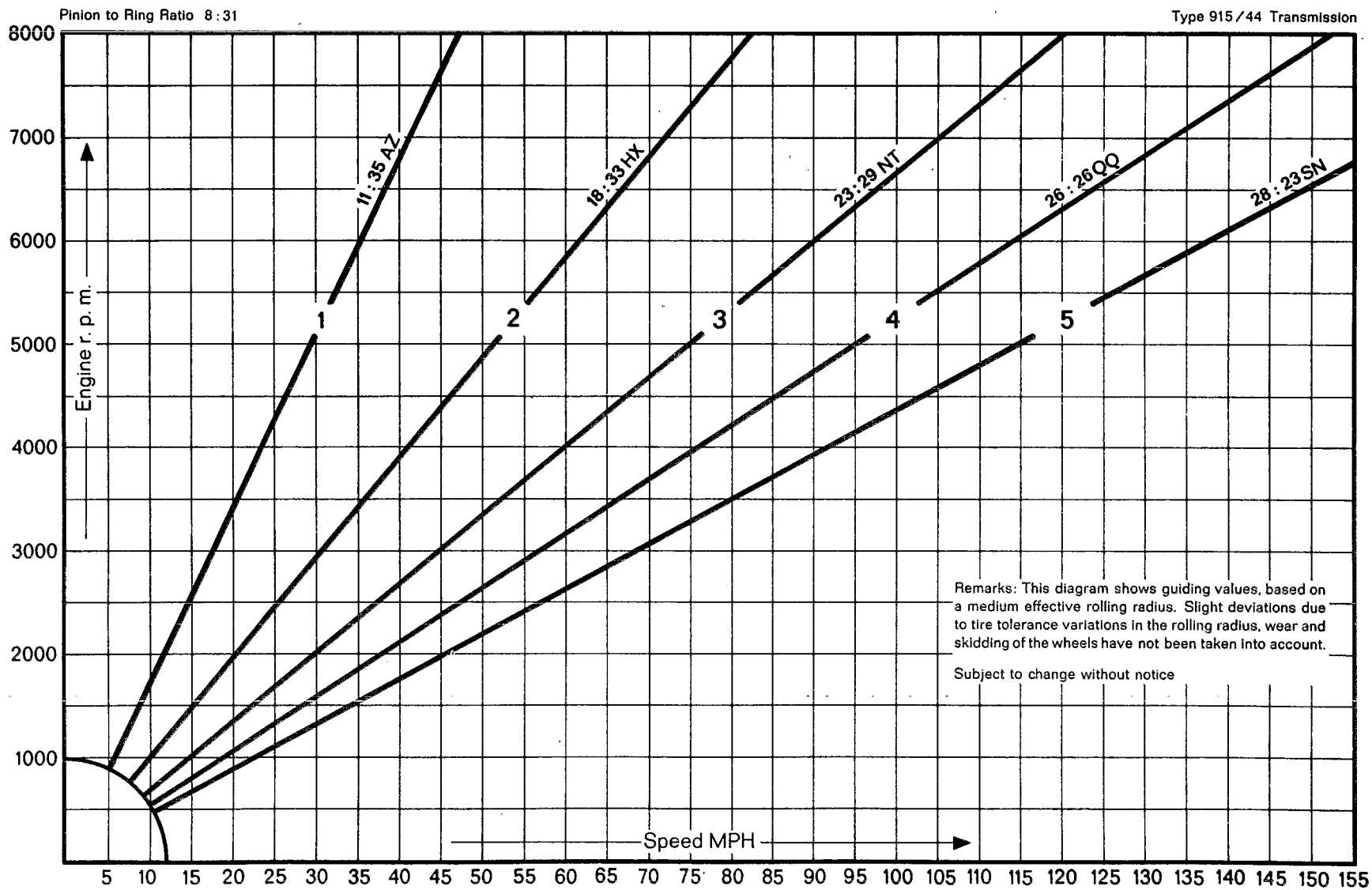
General Data	Manual Transmission 915 (1975 Models)
	911 S, Carrera
Ratios	
1st gear	AZ 11/35 = 3.181
2nd gear	KW 20/32 = 1.600
3rd gear	PR 25/27 = 1.080
4th gear	SN 28/23 = 0.821
Reverse	$\frac{12/21}{20/38}$ = 3.325
1st gear	AZ 11/35 = 3.181
2nd gear	HX 18/33 = 1.833
3rd gear	NT 23/29 = 1.261
4th gear	QQ 26/26 = 1.000
5th gear	SN 28/23 = 0.821
Reverse	$\frac{12/21}{20/38}$ = 3.325
Final drive	8/31 = 3.875
Capacities	
Transmission and differential	Approx. 3 liters (3.17 US gt.) of SAE 90 transmission oil meeting Specifications MIL-L-2105 or MIL-L-2105 B

General data	Manual transmission 915 - 1976, 1977, 1978 and 1979 models
Ratios	915/44 915/61
1st gear	AZ 11 : 35 = 3.181
2nd gear	HX 18 : 33 = 1.833
3rd gear	NT 23 : 29 = 1.261
4th gear	QQ 26 : 26 = 1.000
5th gear	SN 28 : 23 = 0.821
Reverse	12 : 21 x 20 : 38 = 3.325
Final drive ratio	8 : 31 = 3.875
Capacity	approx. 3 ltr./3.15 US qt of SAE 90 transmission oil meeting API Classification GL 5 (or MIL-L 2105 B)
Transmission weight	56 kg/123 lb ready for installation with oil and starter

General data	Manual transmission 915 - 1980 model and 1981 models
Ratios	915/63
1st gear	11 : 35 = 3.181
2nd gear	18 : 32 = 1.778
3rd gear	23 : 29 = 1.261
4th gear	26 : 26 = 1.000
5th gear	28 : 23 = 0.821
Reverse	12 : 21 x 20 : 38 = 3.325
Final drive ratio	8 : 31 = 3.875
Capacity	approx. 3 ltr./3.15 US qt of SAE 90 transmission oil meeting API Classification GL 5 (or MIL-L 2105 B)
Transmission weight	56 kg/123 lb ready for installation with oil and starter

Transmission Diagram

5-speed-transmission

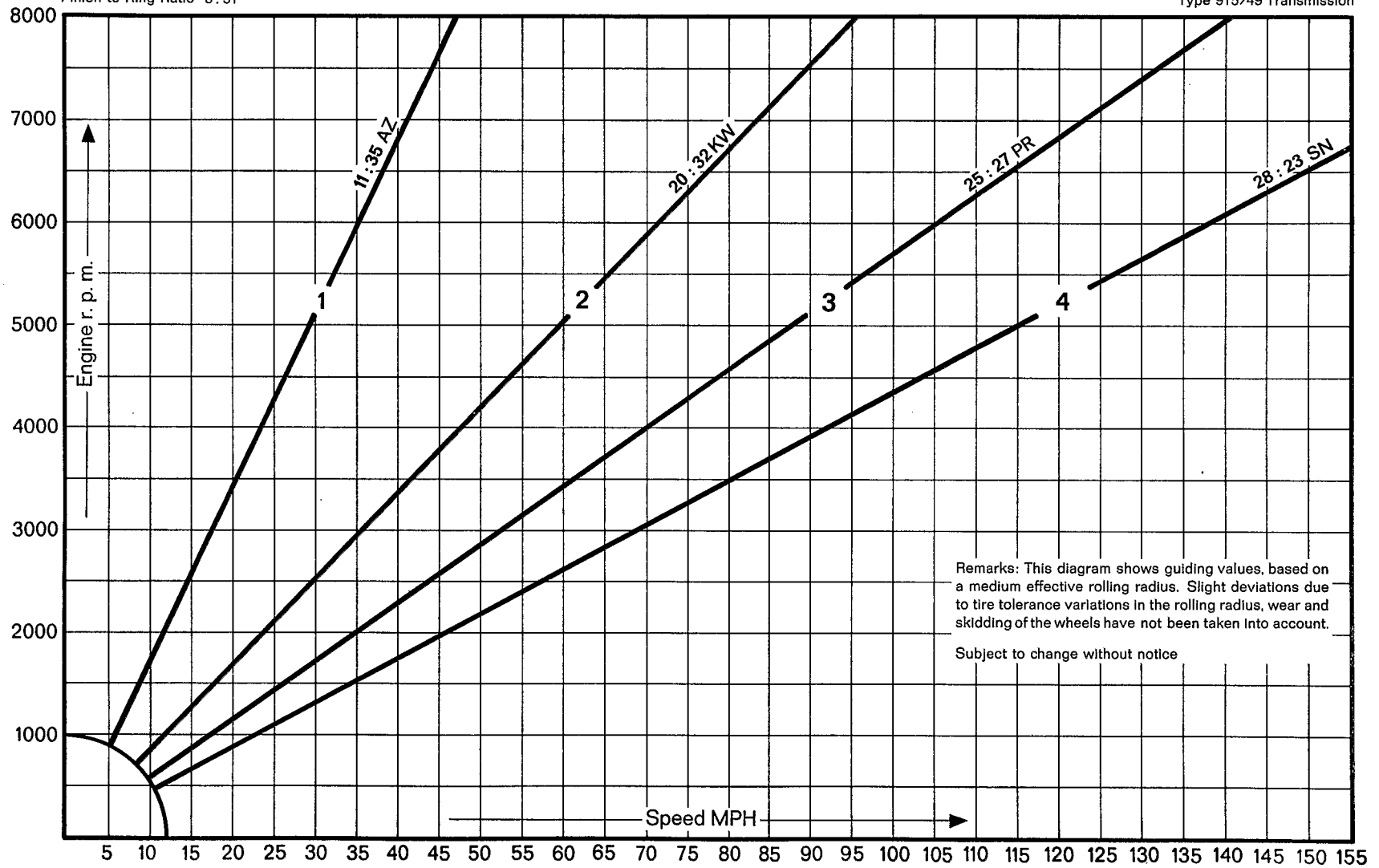


Transmission Diagram

4-speed-transmission

Pinion to Ring Ratio 8 : 31

Type 915/49 Transmission



Remarks: This diagram shows guiding values, based on a medium effective rolling radius. Slight deviations due to tire tolerance variations in the rolling radius, wear and skidding of the wheels have not been taken into account.

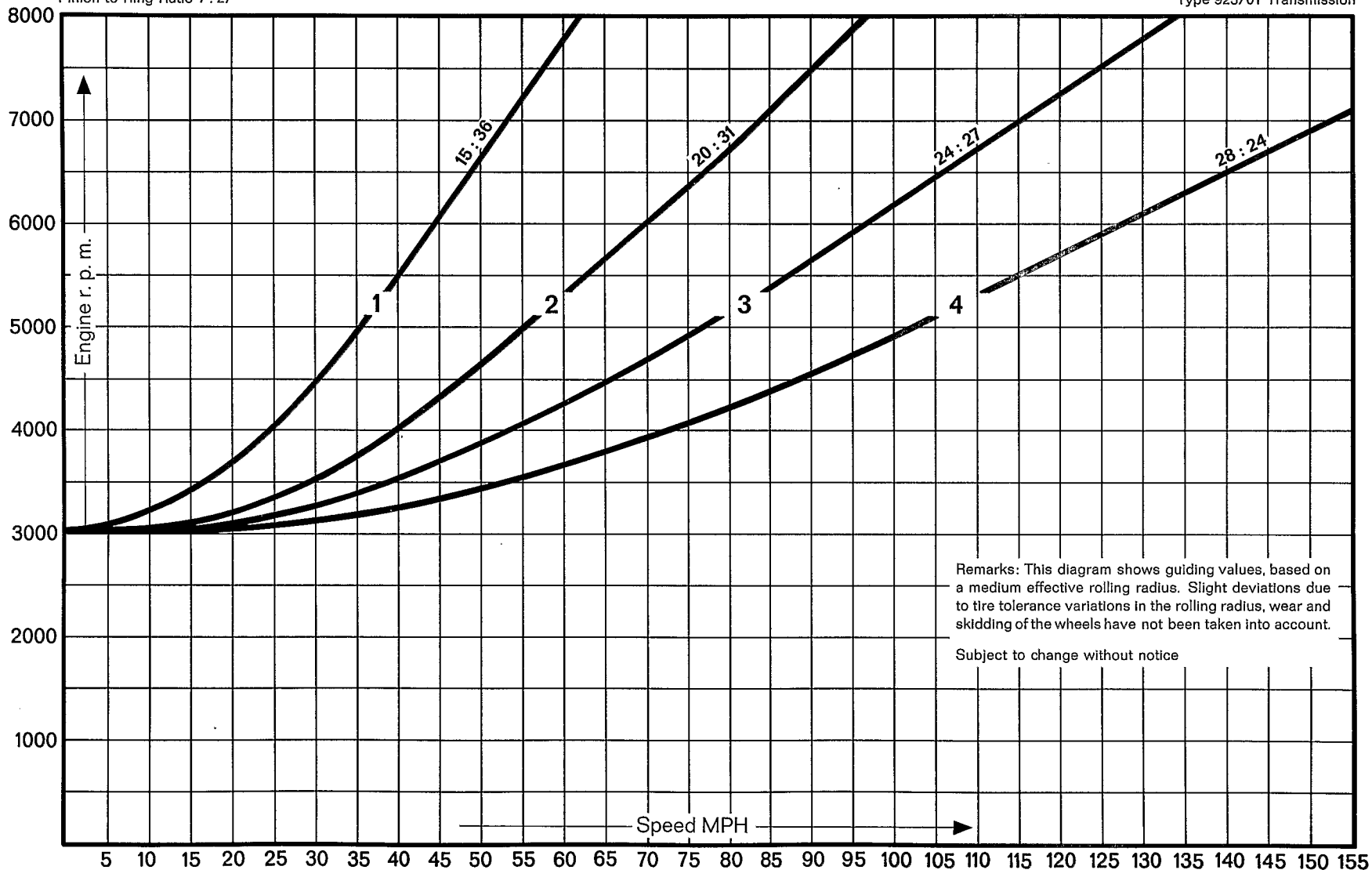
Subject to change without notice

Transmission Diagram

Sportomatic

Pinion to Ring Ratio 7 : 27

Type 925/01 Transmission



Remarks: This diagram shows guiding values, based on a medium effective rolling radius. Slight deviations due to tire tolerance variations in the rolling radius, wear and skidding of the wheels have not been taken into account.

Subject to change without notice

General Data	925/00 911 T	925/00 911 E	925/01 911 S
Gear rations *			
1st gear	(15/36) = 2.400 : 1		
2nd gear	(20/31) = 1.550 : 1		
3rd gear	(24/27) = 1.125 : 1		
4th gear	(28/24) = 0.858 : 1		
Reverse gear	(15/21 - 21/38) = 2.533 : 1		
Torque converter ratio	2.19 : 1		2.1 : 1
Final drive ratio *	(7/27 = 3.857 : 1		
Filling Capacities Transmission and differential	Approx. 3.0 ltr (3.17 US qts) SAE 90 transmission oil, specification Mil-L 2105 or Mil-L 2105B		
Engine	approx. 10 ltr. (10.5 US qts)		approx. 11 ltr (11.6 US qts) w/oil cooler
Two-start speed in L-range	approx. 35 kmh (22 mph)		
Stallspeed	2500 - 2700 rpm		2900 - 3100 rpm

* In parenthesis; number of teeth

TIGHTENING TORQUES - SPORTOMATIC 925

Location	Description	Thread	Grade	mkp	ft.lbs.
Transmission housing (at stud for side and front cover, and fork piece)	Nut	M8 x 1.25	6.8	2.1-2.3	15.2-16.6
	Mid grip nut	M8 x 1.25	x12 CrNi 18.8	2.2-2.5	15.9-18.1
Transmission housing (oil filler plug)	Plug	M24 x 1.5 (1:16 taper)	St 37	2.0-2.5	14.5-18.1
Transmission housing (oil drain plug)	Plug with magnet	M24 x 1.5 (1:16 taper)	St 37	2.0-2.5	14.5-18.1
Transmission housing (breather)	Breather	M14x1.5 (1:16 taper)	9S 20K	2.0-3.0	14.5-21.7
Transmission housing	Backup light switch	M18x1.5	Ms	3.5-4.0	25.3-28.9
Transmission housing	Bypass switch	M18x1.5	Ms	3.5-4.0	25.3-28.9
Transmission housing (starter attachment)	Nut	M10x1.5	8.8	4.6-4.8	33.3-34.7
Transmission housing (vacuum servo unit carrier and attachment)	Nut	M8x1.25	6.8	2.1-2.3	15.2-16.6
Torque converter housing (attachment to transmission housing)	Nut	M8x1.25	6.8	2.1-2.3	15.2-16.6
	Nut	M10x1.5	8.8 (SW15)	4.6-4.8	33.3-34.7
Torque converter housing (attachment of freewheeling support)	Allen-head bolt	M6x1.0	10.9	1.2-1.4	8.7-10.1
Torque converter housing	Threaded coupling	M24x1.5	6 S	3.0-3.5	21.7-25.3
Torque converter housing	Temperature sensor	M14x1.5	Ms	2.5-3.0	18.1-21.7
Torque converter housing	Temperature switch	M14x1.5	Ms	2.5-3.0	18.1-21.7
Torque converter housing (clutch pressure plate)	Allen-head bolt	M6x1.0	10.9	1.2-1.4	8.7-10.1
Torque converter coupling plate	2-point bolt	M8x1.25	8.8	2.4-2.6	17.4-18.8

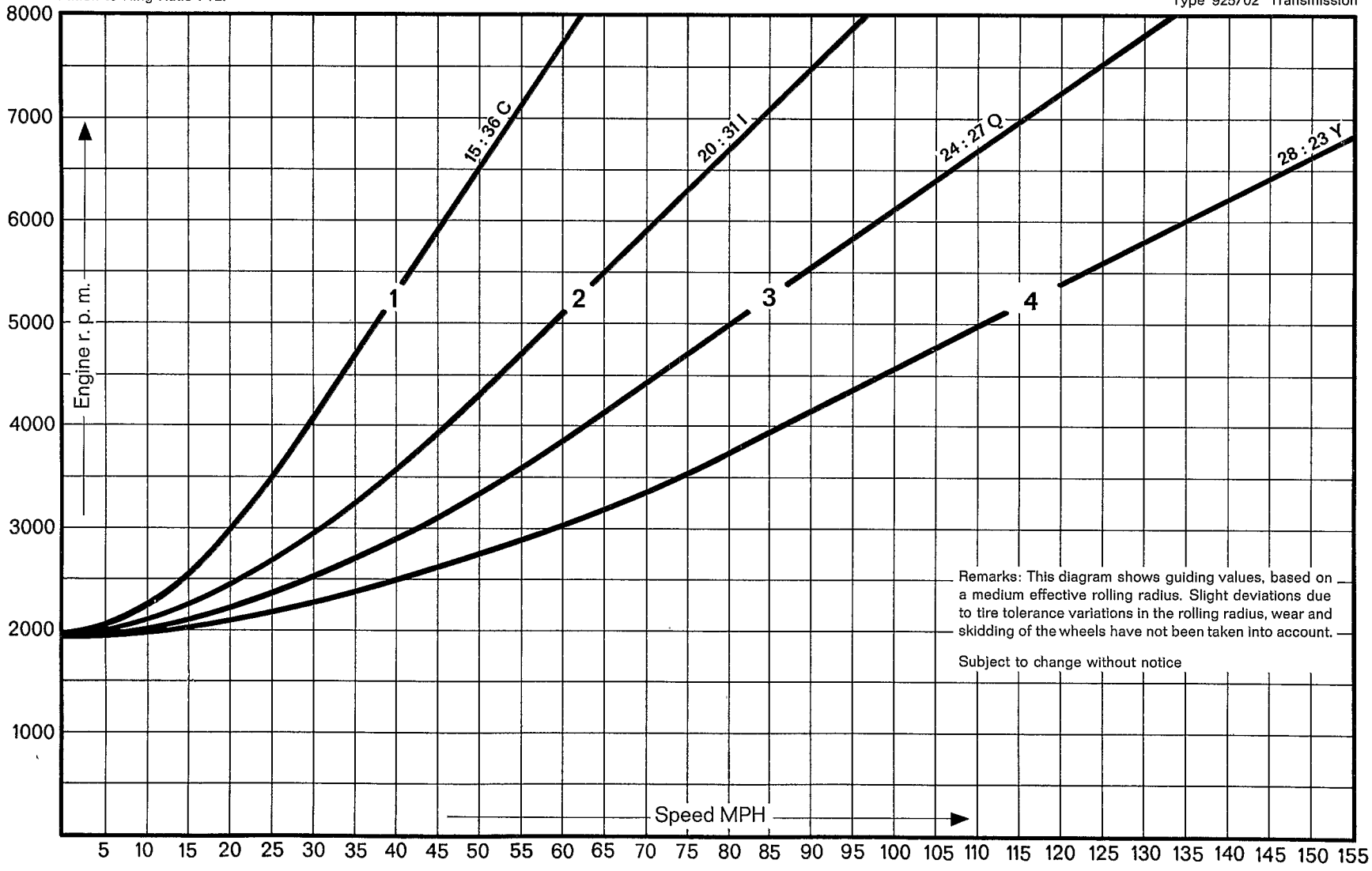
Location	Description	Thread	Grade	mkp	ft. lbs.
Intermediate plate (clamping plate)	Bolt	M8x1.25	8.8	2.1-2.3	15.2-16.6
Intermediate plate	Bellcrank shaft	M8x1.25	9 S 20 K	2.1-2.3	15.2-16.6
Intermediate plate (shift detent)	Cover plug	M14x1.5	4.6	2.2-2.5	15.9-18.1
Transmission front cover (speedometer drive retainer)	Bolt	M8x1.25	8.8	1.6-1.8	11.6-13.0
Transmission front cover (9 mm dia ball - parking lock)	Cover plug	M12x1.5	5.8	3.0-3.5	21.7-25.3
Angular drive in retaining bushing	Hollow bolt	M24x1.5	6.8	2.2-2.4	15.9-17.4
Input shaft	Nut	M24x1.5	6.9	10-12	72.3-86.8
Input shaft	Flanged nut	M18x1.5	5.8	11-13	79.6-94.0
Pinion shaft	Stretch bolt	M12x1.5	10.9	11-12	79.6-86.8
Selector forks	Bolts	M8x1.25	8.8	2.2-2.6	15.9-18.8
Differential (ring gear attachment)	Bolt	M12x1.25	11.9	11.5-12	83.2-86.8
U-joint flange (in differential)	Stretch bolt	M10x1.5	8.8	3.5-4.0	25.3-28.9
Transmission front cover (transmission carrier attachment)	Nut	M8x1.25	6.8	2.1-2.3	15.2-16.6

Transmission Diagram

Sportomatic

Pinion to Ring Ratio 7 : 27

Type 925/02 Transmission



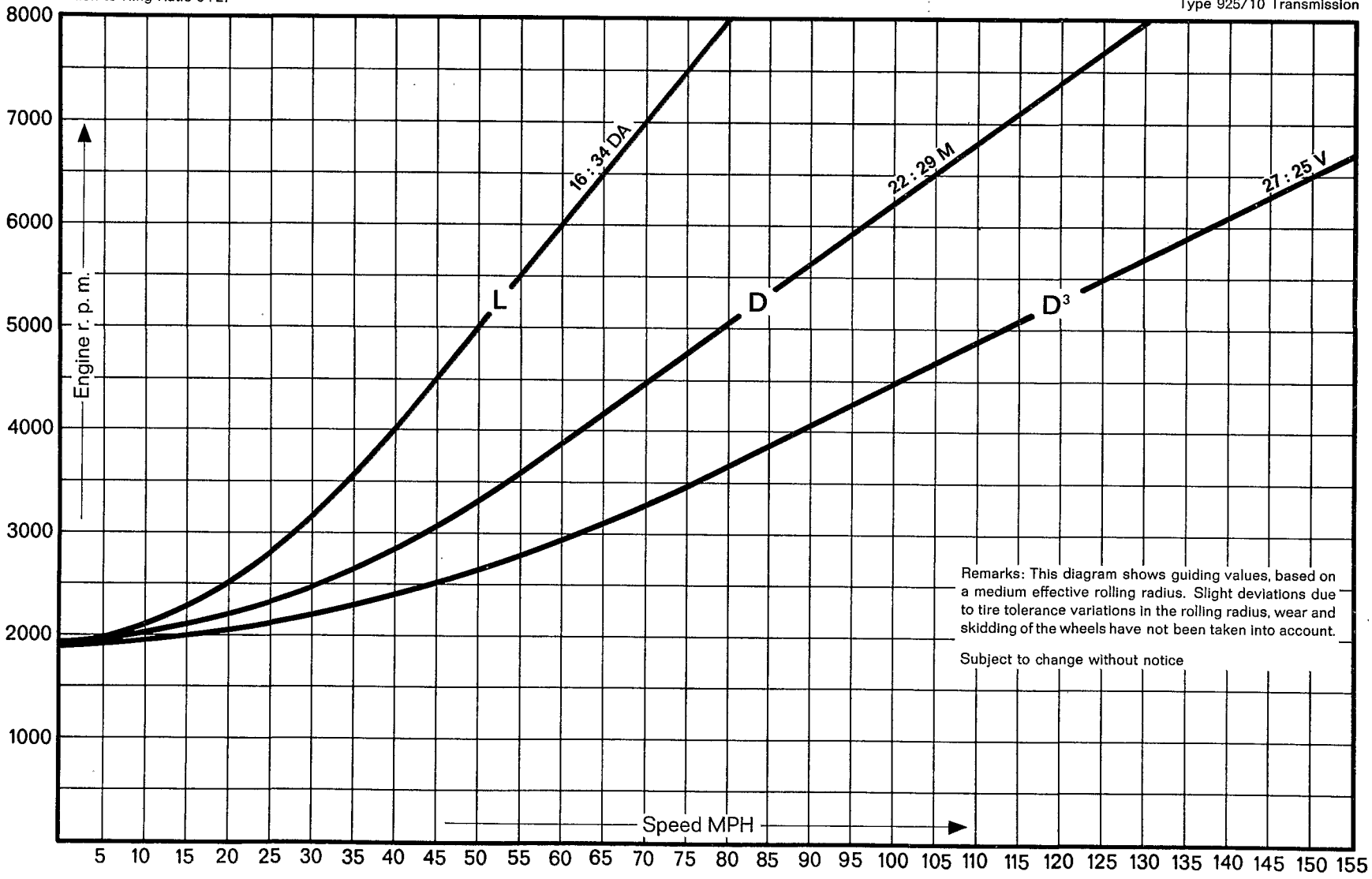
General Data	Sportomatic (1974 model)	
Climbing ability - percent	925/02	
	911	911 S
1st gear	57 (73)	56 (67)
2nd gear	32 (40)	32 (39)
3rd gear	21 (28)	20 (27)
4th gear	12 (19)	11 (19)
	( ) in parentheses: brief climbing ability	
Gear Ratios		
1st gear	15/36 = 2.400	
2nd gear	20/31 = 1.550	
3rd gear	24/27 = 1.125	
4th gear	12/21 = 0.821	
Reverse gear	12/21 / 21/38 = 2.534	
Torque converter ratio	1.7 - 1.9	
Final drive ratio	7/27 = 3.857	
Filling Capacities:		
Transaxle	approx. 2.5 ltr. (2.6 US gts.) SAE 90 transmission oil MIL-L 2105 or MIL-L 2105 B	
Engine	approx. 13 ltr. (13.7 US gts.)	
Tow-start speed in "L" (Low)	approx. 35 kmh (22 mph)	
Stall speed	1850 - 2250	1750 - 2150
Clutch speed (at full power)	3250 $\pm$ 200	3080 $\pm$ 200

Transmission Diagram

Sportomatic

Pinion to Ring Ratio 8 : 27

Type 925/10 Transmission



Remarks: This diagram shows guiding values, based on a medium effective rolling radius. Slight deviations due to tire tolerance variations in the rolling radius, wear and skidding of the wheels have not been taken into account.

Subject to change without notice

General Data	Sportomatic 925 (1975 Models)	
Ratios	925/10	
1st gear 2nd gear 3rd gear	DA 16/34 = 2.125 M 22/29 = 1.318 V 27/25 = 0.926	
Reverse	$\frac{15/21}{21/38} = 2.534$	
Converter	1.7 - 1.9	
Final drive	8/27 = 3.375	
Capacities Transmission with final drive	Approx. 2.5 liters (2.65 US gt.) of SAE 90 transmission oil meeting Specifications of MIL-L-2105 or 2105 B	
Towing speed in range "L" to start	Approx. 22 mph	
Stall speed (rpm)	1900 ± 200	California 1850 ± 200
Clutch speed (rpm)	3100 ± 200	3000 ± 200

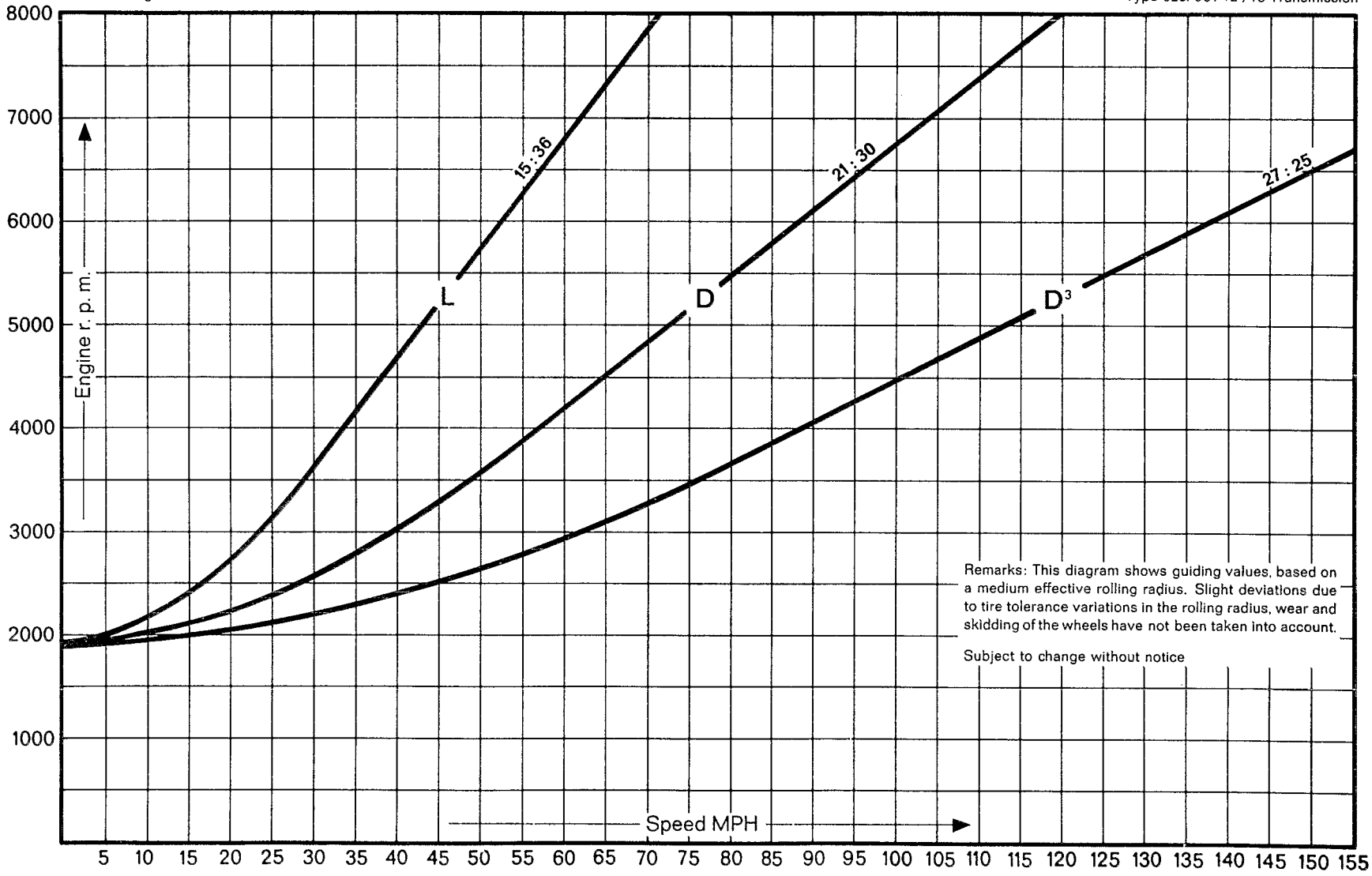
General Data	Sportomatic 925 1976 and 1977 Models	
Ratios	925/12 1976 Mod.	925/17 1977 Mod.
1st speed 2nd speed 3rd speed Reverse	C 15 : 36 = 2.400 K 21 : 30 = 1.429 V 27 : 25 = 0.926 15 : 21 x 21 : 38 = 2.534	
Final Drive Ratio	8 : 27 = 3.375	
Gearbox and Final Drive Capacity	about 2, 5 ltr. / 2, 6 U.S. qt of SAE 90 Gear Lube meeting Specifications MIL-L 2105 or MIL-L 2105 B	
Speedometer	Electronic	
Converter Ratio	1, 9	
Tow-Start Speed in Range "L"	about 25 mph	
Stall Speed (rpm)	1900 $\pm$ 200	
Transmission Weight (ready for installation with converter, starter and oil)	about 71 kg/156 lb	
Contact Pressure of Pressure Plate	7845 - 8630 N (800 - 880 kp)	6400 - 7100 N (652 - 724 kp)

Transmission Diagram

Sportomatic

Pinion to Ring Ratio 8 : 27

Type 925/09-/12 /13 Transmission



Remarks: This diagram shows guiding values, based on a medium effective rolling radius. Slight deviations due to tire tolerance variations in the rolling radius, wear and skidding of the wheels have not been taken into account.

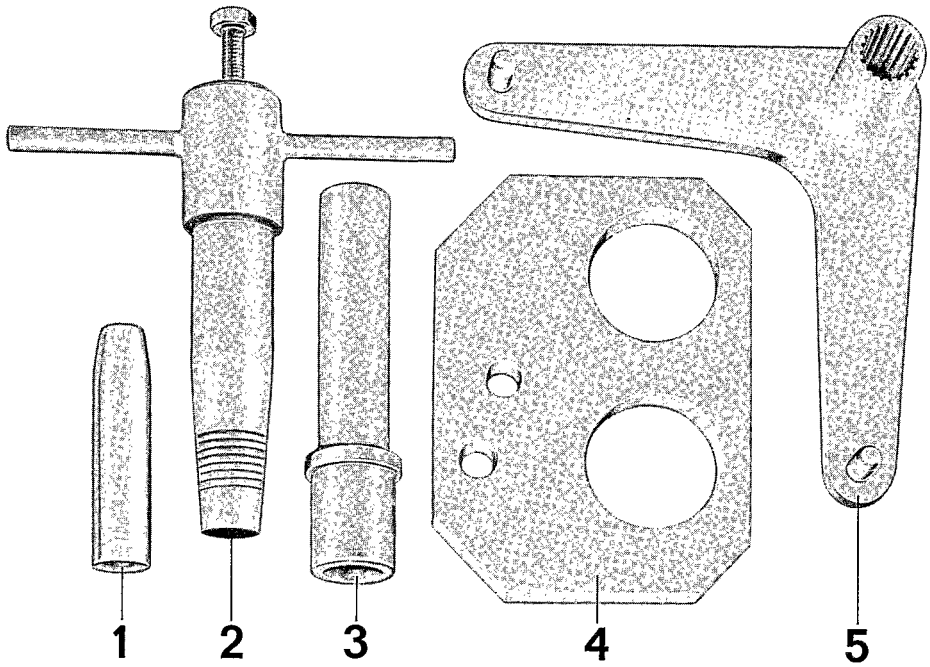
Subject to change without notice

SPECIAL TOOLS - SPORTOMATIC

P 361	Mandrel
P 362	Mandrel
P 358 a	Installer
P 370	Centering mandrel
P 359	Installer
P 351	Assembly plate
P 37	Input shaft holder
P 353 a	Remover
P 260	Support plate
P 218	Mandrel
P 262	Pilot mandrel
P 371	Thrust piece
P 372	Centering mandrel
P 360	Installer
P 364	Assembly sleeve
P 254	Puller and installer
P 256 a	Input shaft lock
P 252	Socket, 32 mm
P 255	Guide sleeve
P 265 b	Thrust piece
P 263	Thrust piece
P 264 b	Installer
P 258	Mandrel
P 258 b	Bushing
P 258 c	Gauge block
P 357 a	Holder
P 357	Dial gauge holder, spacer, feeler tip (w/o clamping adapter)
VW 401	Press plate
VW 402	Press plate
VW 412	Thrust piece
VW 426	Thrust sleeve
VW 405	V-block
VW 407	Thrust piece
=	New special tools

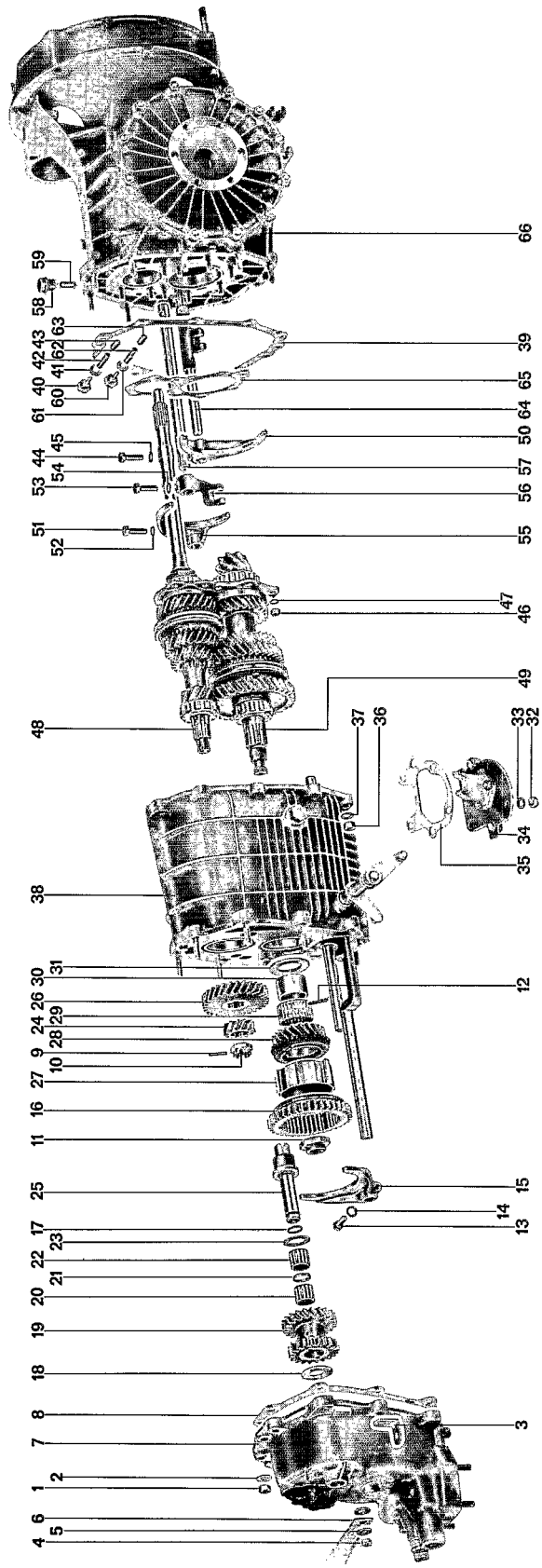
TRANSMISSION

TOOLS



No.	Description	Special Tool	Remarks
1	Sleeve	P 382	
2	Puller	P 386	
3	Driver	P 381	
4	Shift rod holder	P 260 a	
5	Input shaft holder	P 37 a	

Disassembling and Assembling Manual Transmission



Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
1	Self-locking nut	8		Replace if necessary, torque to specification.	
2	Washer	7			
3	Clutch cable bracket	1			
4	Self-locking nut	1		Replace if necessary, torque to specification.	
5	Washer	2		Place one on each side of ground strap.	
6	Ground strap	1			
7	Front transmission cover	1			
8	Gear housing gasket	1		Replace.	
9	Roll pin	1	Drive out.	Replace if necessary.	
10	Castellated nut	1		Torque to specification.	3.1-1/13
11	Flange nut	1		Replace, torque to specification.	3.1-1/13
12	Roll pin	1	Drive out.	Replace if necessary.	
13	Bolt	1		Torque to specification.	
14	Spring washer	1		Replace if necessary.	
15	Shift fork, 5th and reverse gear	1		Readjust.	3.1-2/2

Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
16	Sliding gear, 5th and reverse gear	1		Check for wear.	
17	O-ring	1		Replace, oil lightly.	
18	Thrust washer	1			
19	5th and Reverse idler gear	1		Check for wear.	
20	Needle bearing cage	1		Check for wear.	
21	Intermediate ring	1			
22	Needle bearing cage	1		Check for wear.	
23	Thrust needle bearing cage	1		Check for wear.	
24	Reverse speed, Gear I	1		Replace in pairs only.	
25	Shaft for 5th and Reverse idler gear	1	Remove together with fixed Gear I of 5th speed.	Install together with fixed Gear I of 5th speed.	
26	Gear I, fixed, 5th speed	1		Small flange faces gear housing. Replace in pairs only.	
27	Guide sleeve	1		Check for wear.	
28	Gear II, free, 5th speed	1		Check synchronization. Replace in pairs only.	3.1-8/4
29	Needle bearing cage	1	Mark position for installation.	Install with same gear.	
30	Bushing	1	Mark position for installation.	Install with same gear.	

Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
31	Thrust washer	1			
32	Self-locking nut	4		Replace if necessary, torque to specification.	
33	Washer	4			
34	Cover with guide fork	1			
35	Gasket	1		Replace.	
36	Self-locking nut	10		Replace if necessary, torque to specification.	
37	Washer	10			
38	Gear housing	1	Move selector fork rod for 5th speed and reverse into neutral and remove.		
39	Gasket	1		Replace.	
40	Nut	1		Torque to specification.	
41	Seal	1		Replace.	
42	Spring	1			
43	Short detent	1		Check for free movement.	
44	Nut	1		Torque to specification.	
45	Spring washer	1		Replace if necessary.	
46	Nut	10		Torque to specification.	
47	Lock washer	10		Replace.	

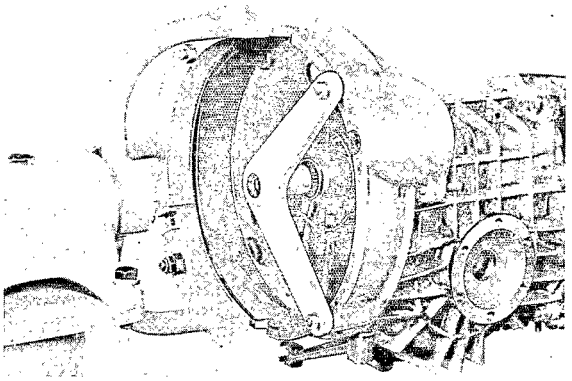
Nr.	Description	Qty	Note when Removing	Note when Installing	Special instructions see
48	Input shaft	1	Remove together with pinion shaft, 1st and 2nd speed selector fork, and complete 3rd and 4th speed shift rod.		3.1-1/10
49	Pinion shaft	1			
50	1st and 2nd speed selector fork	1		Check for wear, readjust.	3.1-2/1
51	Bolt	1		Torque to specification.	
52	Spring washer	1		Replace if necessary.	
53	Bolt	1		Torque to specification.	
54	Spring washer	1		Replace if necessary.	
55	3rd and 4th speed selector fork	1		Check for wear, readjust.	
56	Shift guide	1		Check for wear, readjust.	
57	3rd and 4th speed shift rod	1			
58	Plug	1		Torque to specification.	
59	Short detent	1		Check for free movement.	
60	Bolt	1		Torque to specification.	

Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
61	Seal	1		Replace.	
62	Spring	1			
63	Short detent	1		Check for free movement.	
64	1st and 2nd speed selector fork rod	1			
65	Shim	X	Note thickness and quantity.	Recompute if necessary.	
66	Transmission housing	1			

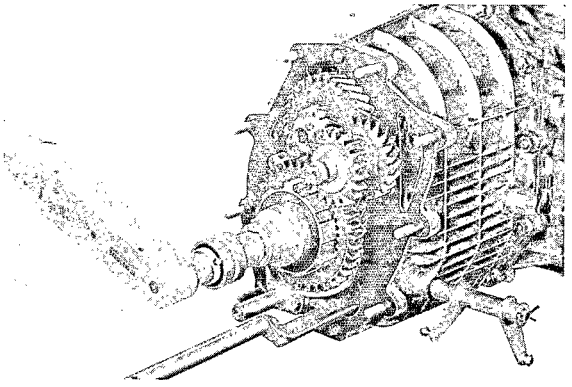
DISASSEMBLING AND ASSEMBLING MANUAL TRANSMISSION

Disassembling

1. Block input shaft with special tool P 37a, engage 5th gear.

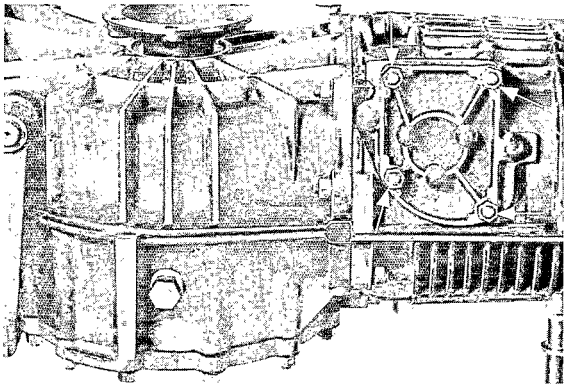


2. Remove castellated nut from input shaft, and flange nut from pinion shaft.



3. Mark needle bearing of 5th speed free gear; it must be reassembled with same gear.

4. Remove guide fork cover with gasket.



5. Remove nuts from gear housing. Pull housing and selector fork rod (5th and reverse speed), and selector fork rod with selector shaft off the studs (tap lightly with a plastic mallet, if necessary).

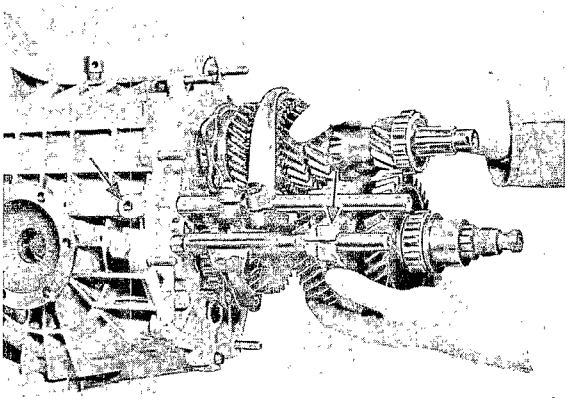
Note
Selector fork rod for 5th and reverse speed must be in neutral. Otherwise the gear housing will bind against the rod and cannot be removed.

6. Remove shift detent plug (3rd and 4th gear). Take out spring and detent.

7. Remove bolt from selector fork of 1st and 2nd gear, gently spread clamping piece with screwdriver.

8. Remove retaining plates for input and pinion shafts.

9. Take input and pinion shafts with complete selector fork rod (3rd and 4th speed) and selector fork (1st and 2nd gear) out of their seats.



10. Remove detent.

11. Remove plug from shift detent (1st and 2nd gear) and take out spring and detent.

12. Take out selector fork rod 1st and 2nd gear.

13. Note the number and thickness of shims between transmission housing and retaining plates for reinstallation.

Assembling

1. Place the same number and thickness of shims on the transmission housing studs as noted during disassembly or as determined while adjusting the pinion.

2. Insert 1st and 2nd speed selector fork rod.

3. Insert 1st and 2nd speed shift detent and spring.

4. Torque bolt to specification.

5. Insert pinion shaft with 1st and 2nd speed selector fork so that the pinion comes barely to rest in the bearing race of the transmission housing.

Note
To keep the selector fork from binding on the selector fork rod, slightly open the selector fork clamping piece with a screwdriver.

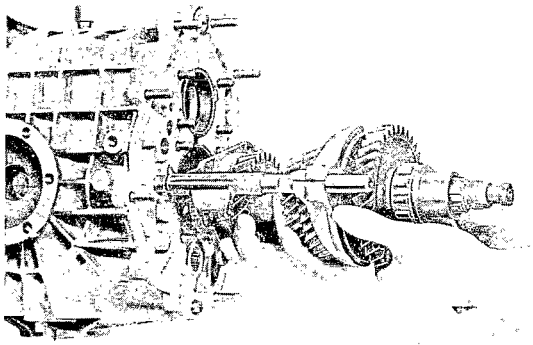
6. Insert input shaft and push into place together with the pinion shaft.

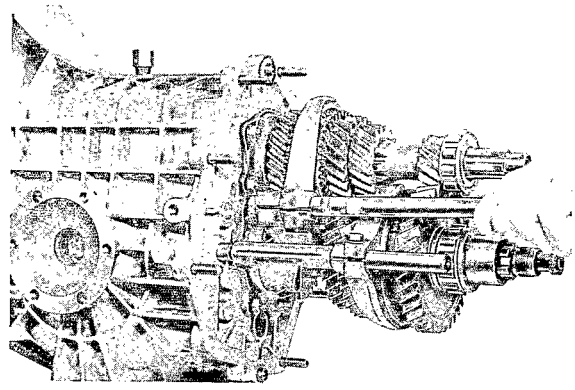
7. Torque clamping plate nuts to specification.

8. Lightly tighten selector fork bolt (1st and 2nd speed).

9. Insert detent from the top.

10. Unscrew bolts for 3rd and 4th speed selector fork and fork clamping piece. Push fork and clamping plate back so that the selector fork and rod can be installed.





11. Lightly tighten selector fork and fork piece bolts.

12. Insert shift detent and spring, torque plug to specification.

13. Adjust selector forks (see 3.1-2/1).

14. Place transmission housing gasket on the studs.

15. Install gear housing together with selector fork rod (5th speed and reverse) and selector shaft. Tighten to correct torque.

16. Push selector fork rod in the ball sleeve, and selector shaft into the shift pawl guides.

17. Install guide fork cover and gasket. Tighten to correct torque.

18. Install idler gear shaft turning the shaft until the pin in the gear housing prevents it from turning.

19. Install reverse speed Gear I and start castellated nut on threads.

20. Install thrust washer for 5th speed free gear.

21. Install needle bearing with 5th speed free gear.

22. Install guide sleeve for 5th and reverse speed, start flange nut on threads.

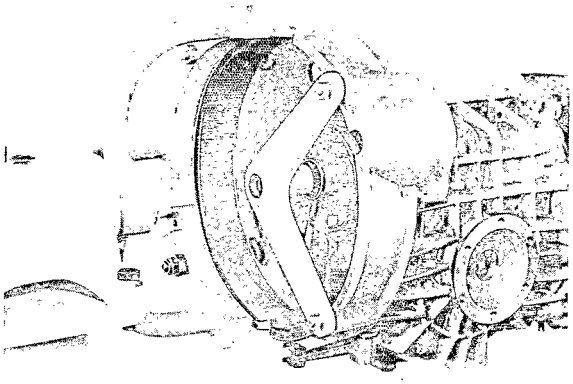
23. Install thrust needle bearing cage, idler gear with needle bearing cages and intermediate piece and thrust washer on the idler shaft.

24. Slide 5th speed and reverse sliding gear with selector fork on guide sleeve and selector fork rod. Slightly open the selector fork clamping piece for easier assembly.

25. Lightly tighten selector fork bolt.

26. Apply light coat of oil to the O-ring and install.

27. Block input shaft with special tool P 37a, and engage 5th gear. Tighten input shaft castellated nut and pinion shaft flange nut to correct torque.



28. Adjust 5th and reverse speed selector fork (see page 3.1-2/2).

29. Secure castellated nut with roll pin; and flange nut by notching.

30. Insert actuating pin for backup light switch with recessed end toward switch.

31. Place gear housing gasket on studs. Install front transmission cover, and tighten nuts to correct torque.

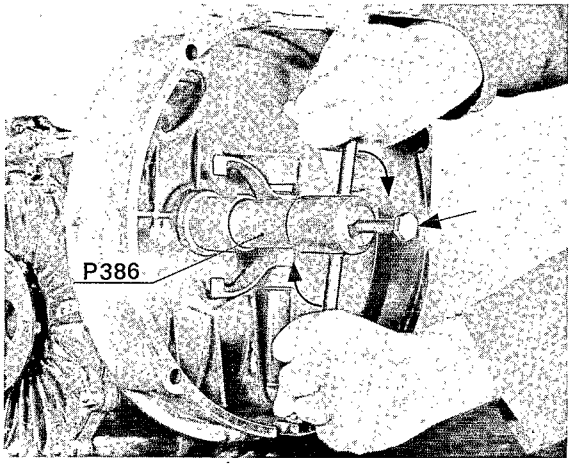
Effective with the listed transmission numbers, the input shaft oil seal can be replaced without the need for disassembling the transmission.

Transmission Type	from transmission No.
915/02	733 7375
915/12	723 0507
915/08	783 0838
Special transmissions	793 1031

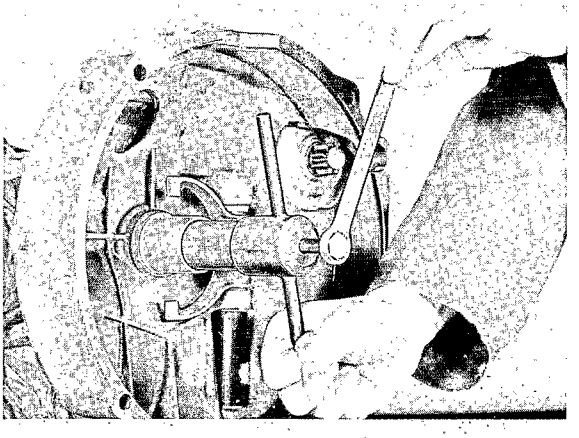
Removal

1. Remove transaxle and detach transmission from engine.

2. Screw puller P 386 firmly into the oil seal.



3. Pull oil seal out by turning the hex. bolt in the puller.

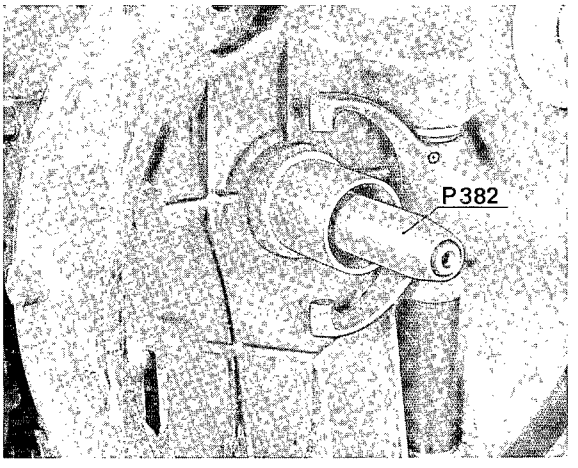


NOTE:

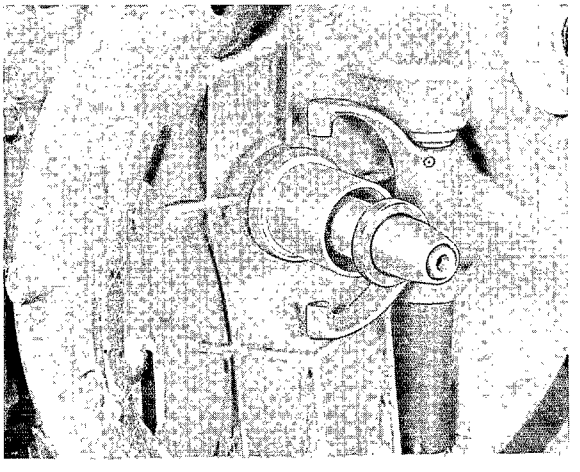
If the (garter) spring should slide off during removal of the seal, pull it off the input shaft with the aid of a wire hook.

Installation

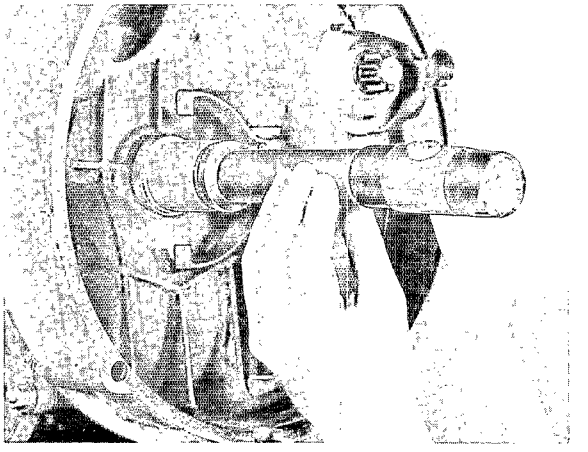
1. Push installation sleeve P 382 onto the input shaft splines.



2. Lightly oil the sealing lip of the oil seal and push the seal onto the installation sleeve.



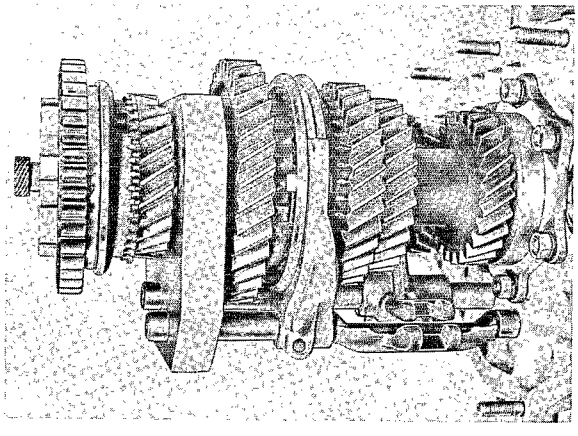
3. Drive oil seal into its seat with the aid of driver P 381.



ADJUSTING SELECTOR FORKS

Note
Tighten input shaft flange nut to correct torque before adjusting selector forks.

1. Install mounting plate P 260a. Install 5th speed synchro hub and 5th and reverse speed sliding gear.



2. Block input shaft with P 37a and engage 5th speed. Tighten input shaft flange nut to correct torque.

3. Turn selector fork rod of 1st and 2nd speed left (in driving direction) to stop, then turn slightly back until the unmachined flat inner surface is almost vertical.

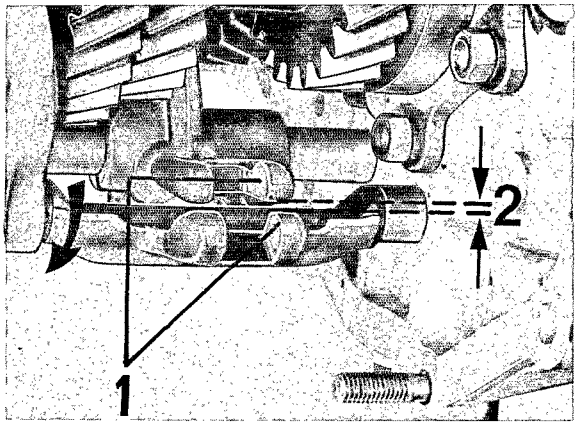
Note

Do not turn it back beyond the middle point or all the way to the right stop.

4. Position the 1st and 2nd speed selector fork so that the shift sleeve is exactly in the middle between the synchronizing rings. Tighten bolt to correct torque.

5. Adjust 3rd and 4th speed selector fork in the same way as 1st and 2nd speed. Tighten bolt to correct torque.

6. Position 3rd and 4th speed shift guide flush with the selector fork. Make sure there is 2-3 mm (0.8-0.12 in.) clearance between the 3rd and 4th speed shift guide and the 1st and 2nd speed shift guide. They must not touch. (see illustration).



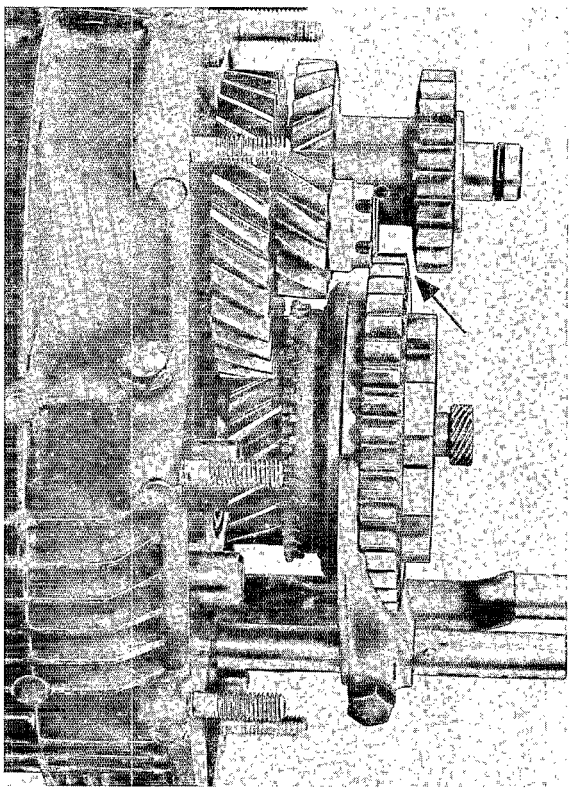
1 - Install aligned

2 - 2 to 3 mm play

7. To ensure proper synchronization, check ease of shifting. Readjust if necessary.

Adjusting 5th and Reverse Speed Selector Fork

1. Push the idler gear on shaft against fixed gear I of 5th speed. Adjust clearance between idler gear and sliding gear in neutral position. Clearance should be 1 mm (0.04 in.).

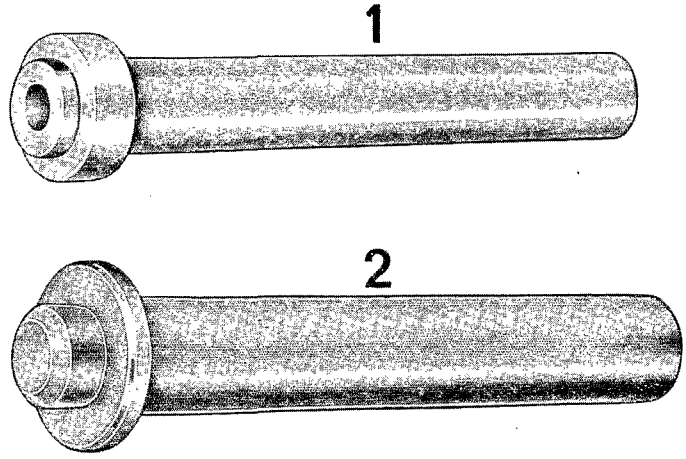


Caution
Push the idler gear gently in direction of travel; there should be no play between the shift fork and the sliding gear groove. This eliminates the possibility of the sliding gear hitting the idler gear in cases of tolerance build-up.

2. Tighten selector fork bolt to correct torque.

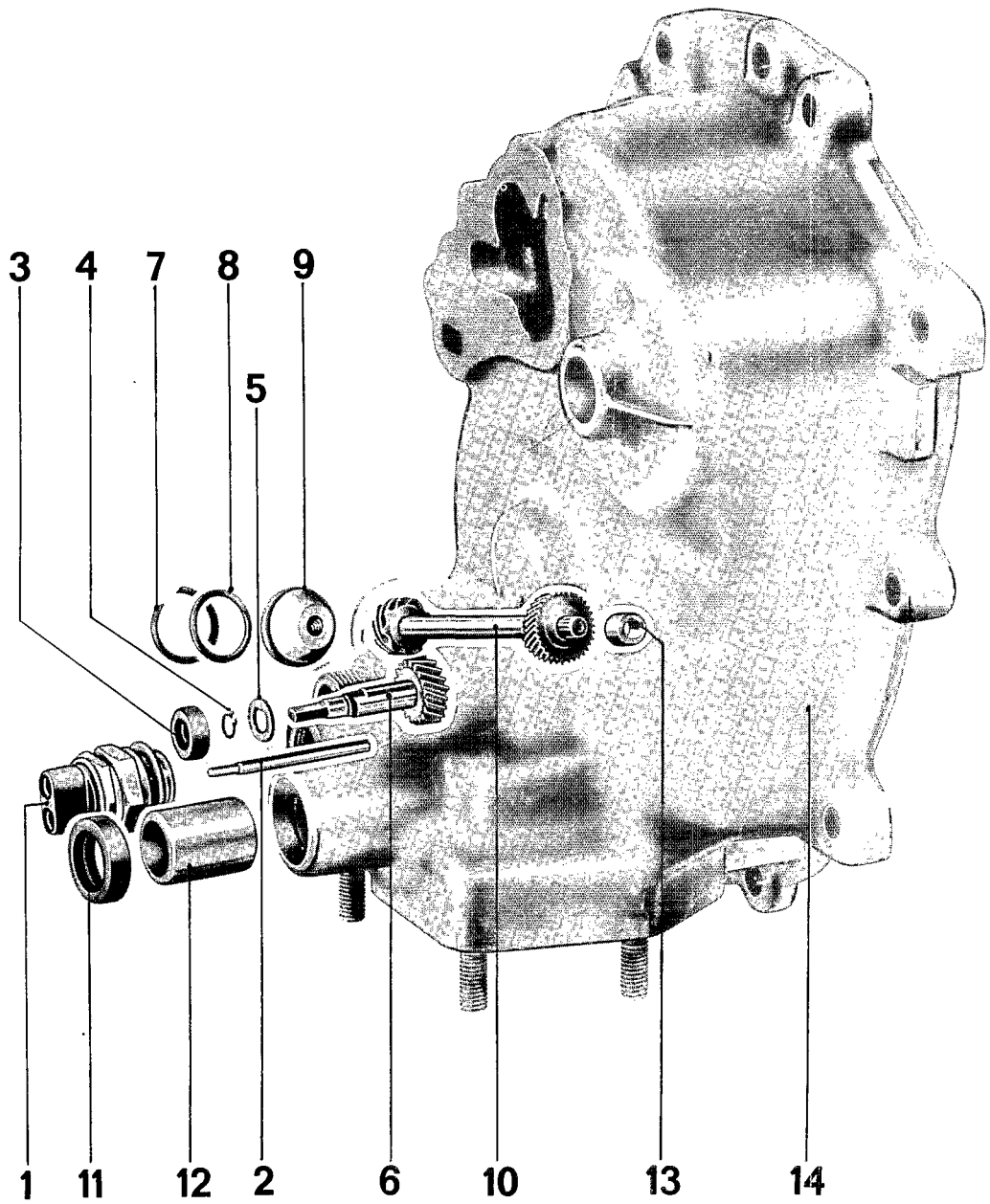
DISASSEMBLING AND ASSEMBLING FRONT COVER

TOOLS



Nr.	Description	Special Tool	Remarks
1	Mandrel	P 374	
2	Mandrel	P 369	

Disassembling and Assembling Front Cover



Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
1	Backup light switch	1		Torque to specification.	
2	Actuating pin	1		Position properly.	3.1-1/13
3	Seal	1	Press out with small screwdriver.	Drive fully into seat with P 374.	3.1-3/4
4	Retainer	1		Replace if necessary.	
5	Thrust washer	1			
6	Speedometer drive	1			
7	Retainer	1		Seat properly.	
8	O-ring	1		Oil lightly.	
9	Positioning piece	1			
10	Worm shaft	1			
11	Seal	1	Pry out with screwdriver.	Drive in with P 369 until fully seated.	3.1-3/4
12	Shift rod bushing	1		Replace.	
13	Bushing	1	Heat the cover to approx. 120°C (250°F) on hot plate then pull out; drill out if necessary.	Heat the cover to approx. 120°C (250°F) on hot plate. Drive on with suitable mandrel.	
14	Transmission front cover	1			

DISASSEMBLING AND ASSEMBLING

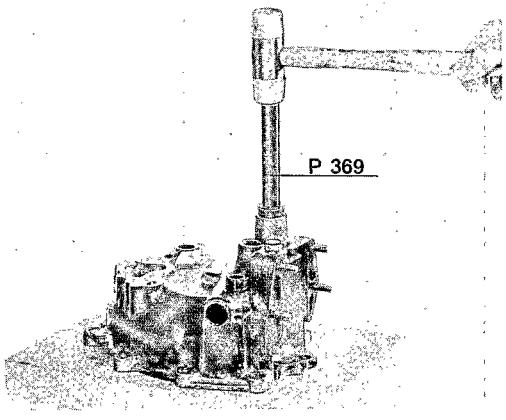
Disassembling

1. Heat transmission cover to approximately 120°C (250°F) and pull speedometer gear shaft bushing out; drill out, if necessary.

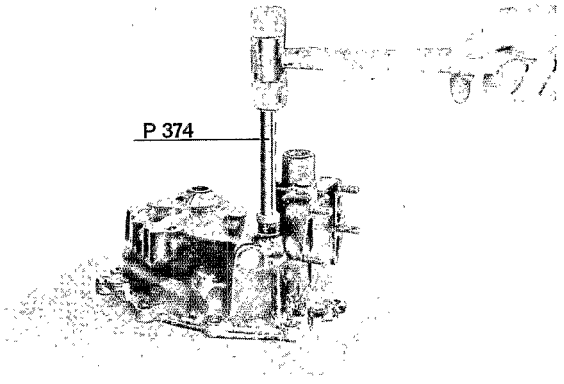
Assembling

1. Heat transmission cover to approximately 120°C (250°F) and drive gear shaft bushing in with a suitable mandrel.

2. Drive on seal for shift rod with special tool P 369.

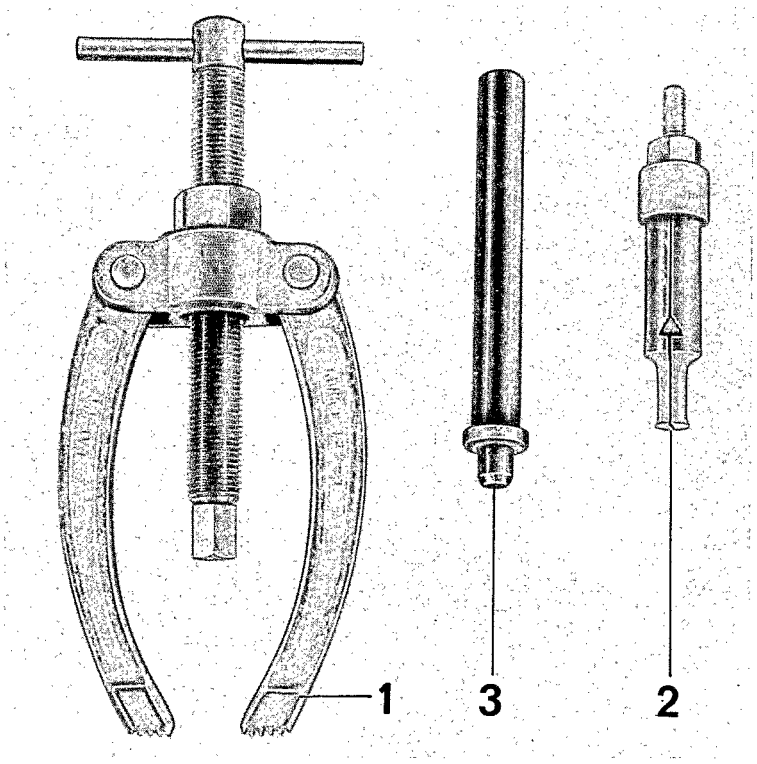


3. Drive on seal for speedometer drive with special tool P 374.



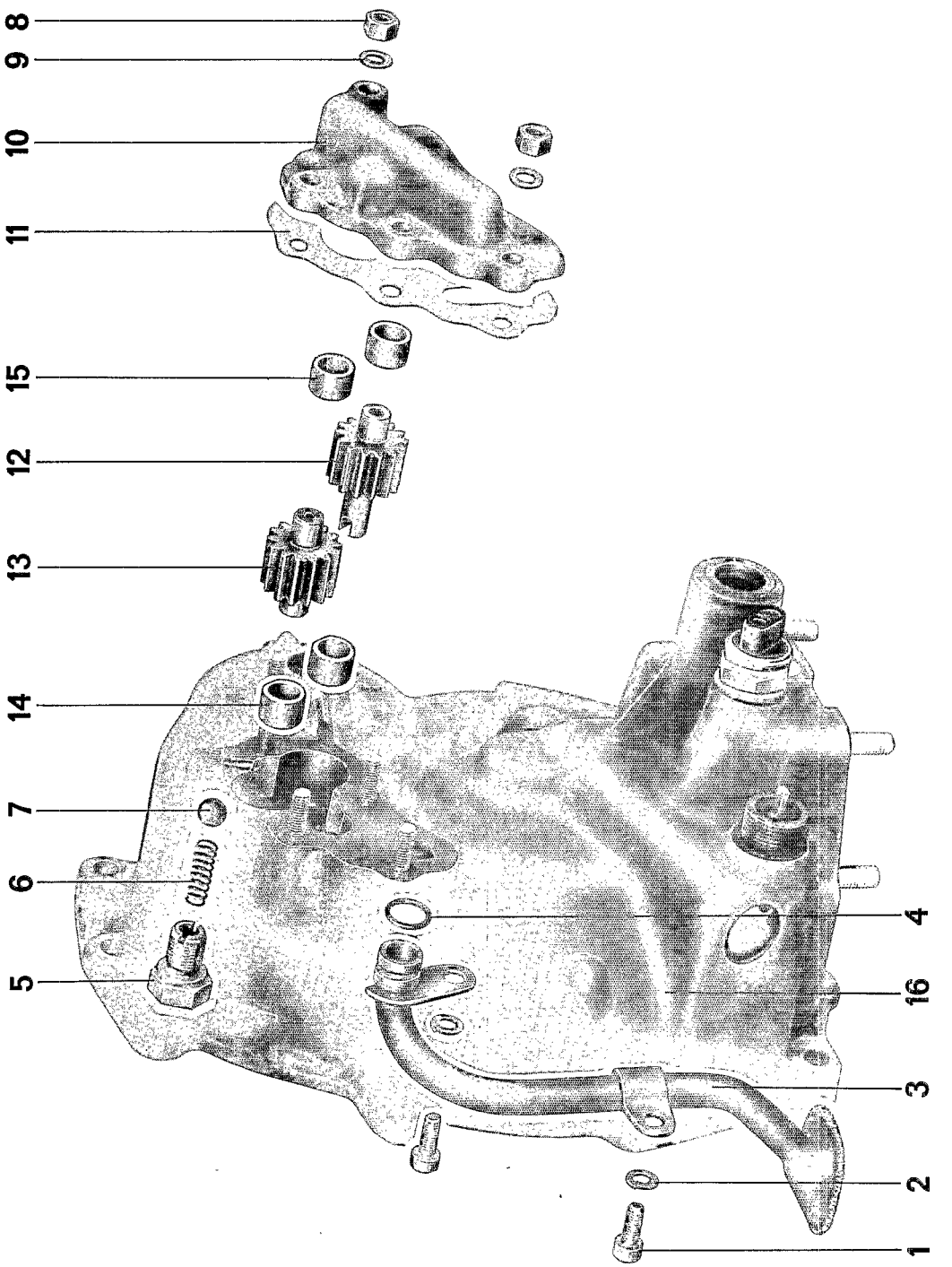
DISASSEMBLING AND REASSEMBLING OIL PUMP

TOOLS



No.	Description	Special Tool	Remarks
1	Support	-	Commercial, KUKKO Nr. 22-1
2	Inside puller	-	Commercial, KUKKO Nr. 21-02
3	Drift	P 368	

Disassembly and Reassembly



No.	Description	Qty	Note when removing	Note when installing	Special instructions see
1	Allen bolt	2		Torque to specification.	
2	Lock washer	2		Replace.	
3	Pickup tube	1			
4	O-ring	1		Replace. Oil lightly.	
5	Plug for pressure relief valve	1	Ball and spring can fall out.	Torque to specification.	
6	Spring	1			
7	Ball	1			
8	Self-locking nut	5		Tighten cross-wise to specified torque. Check oil pump gears for free movement.	3.1 - 3/9
9	Washer	5			
10	Oil pump cover	1			
11	Gasket	X	Note number and thickness for reassembly.	Recalculate thickness, if necessary.	3.1 - 3/9
12	Oil pump gear I	1		Check freedom of movement. End play approx. 0.05 mm.	
13	Oil pump gear II	1		Check freedom of movement. End play approx. 0.05 mm.	
14	Bushing	2	Drive out with proper punch.	Drive in, properly oriented, with P 368.	3.1 - 3/9
15	Bushing	2	Pull out with KUKKO inside puller.	Drive in, properly oriented, with P 368.	3.1 - 3/8
16	Transmission front cover	1			

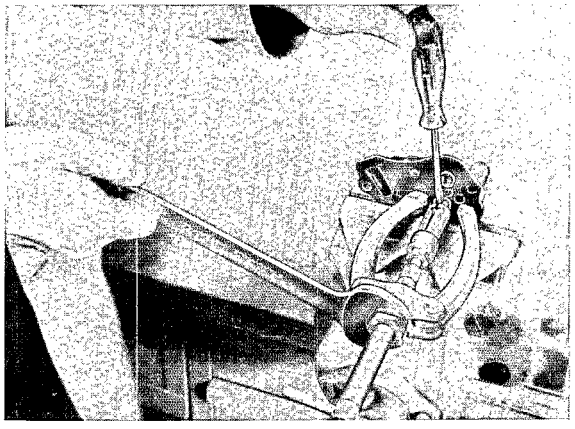
INSTRUCTIONS FOR DISASSEMBLY AND REASSEMBLY

Disassembly

1. Note the thickness and number of gaskets when removing the oil pump cover to simplify reassembly.

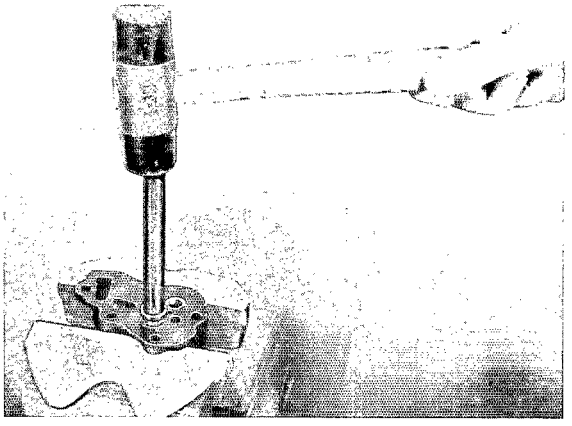
2. Note proper orientation of the bushings. Mark lubricating hole.

3. Use a KUKKO inside puller to remove bushings of oil pump gears from oil pump cover. Place a protector between the puller and the cover to avoid damage to the sealing surface.

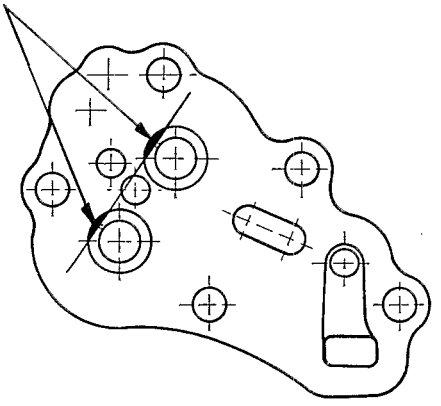


Reassembly

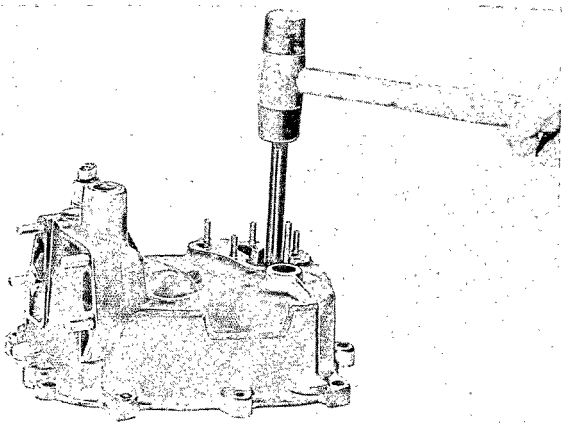
1. Drive bushings into oil pump cover with special tool P 368, making sure that they are properly positioned and fully in. The milled ends of the oil pockets must point towards the pressure chamber or oil pump gears, respectively.



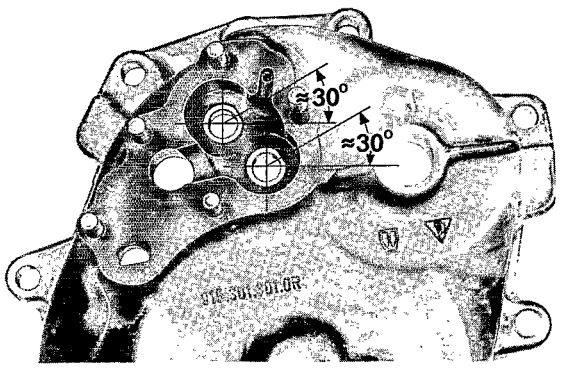
See sketch for exact location.



2. Drive bushings into transmission front cover with special tool P 368, making sure that they are properly positioned and fully in. The milled ends of the oil pockets must point towards the pressure chamber or oil pump gears, respectively.



See illustration for exact location.



3. Install gaskets in same thickness as noted during disassembly.

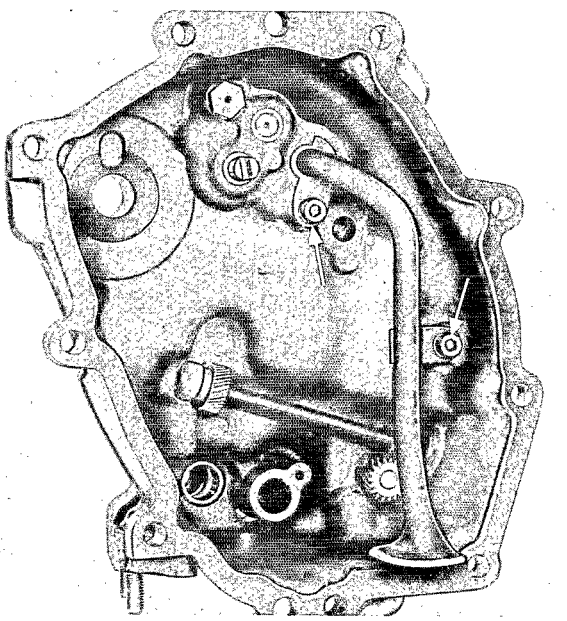
4. Install oil pump cover and tighten self-locking nuts cross-wise to specified torque. Keep checking if the pump gears remain free. If necessary, remove cover again and insert gaskets as appropriate.

NOTE
End play of oil pump gears should be 0.05 mm.

5. Tighten plug of pressure relief valve to specified torque.

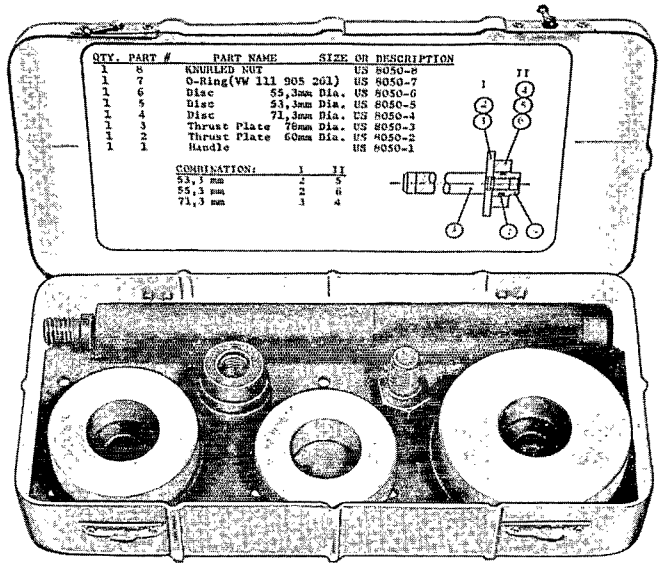
6. Lightly oil the O-ring for pickup tube.

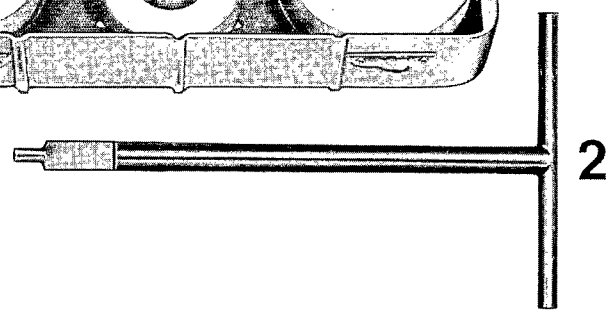
7. Install Allen bolts for pickup tube, using new lock washers, and tighten to specified torque.



DISASSEMBLING AND ASSEMBLING TRANSMISSION HOUSING

TOOLS



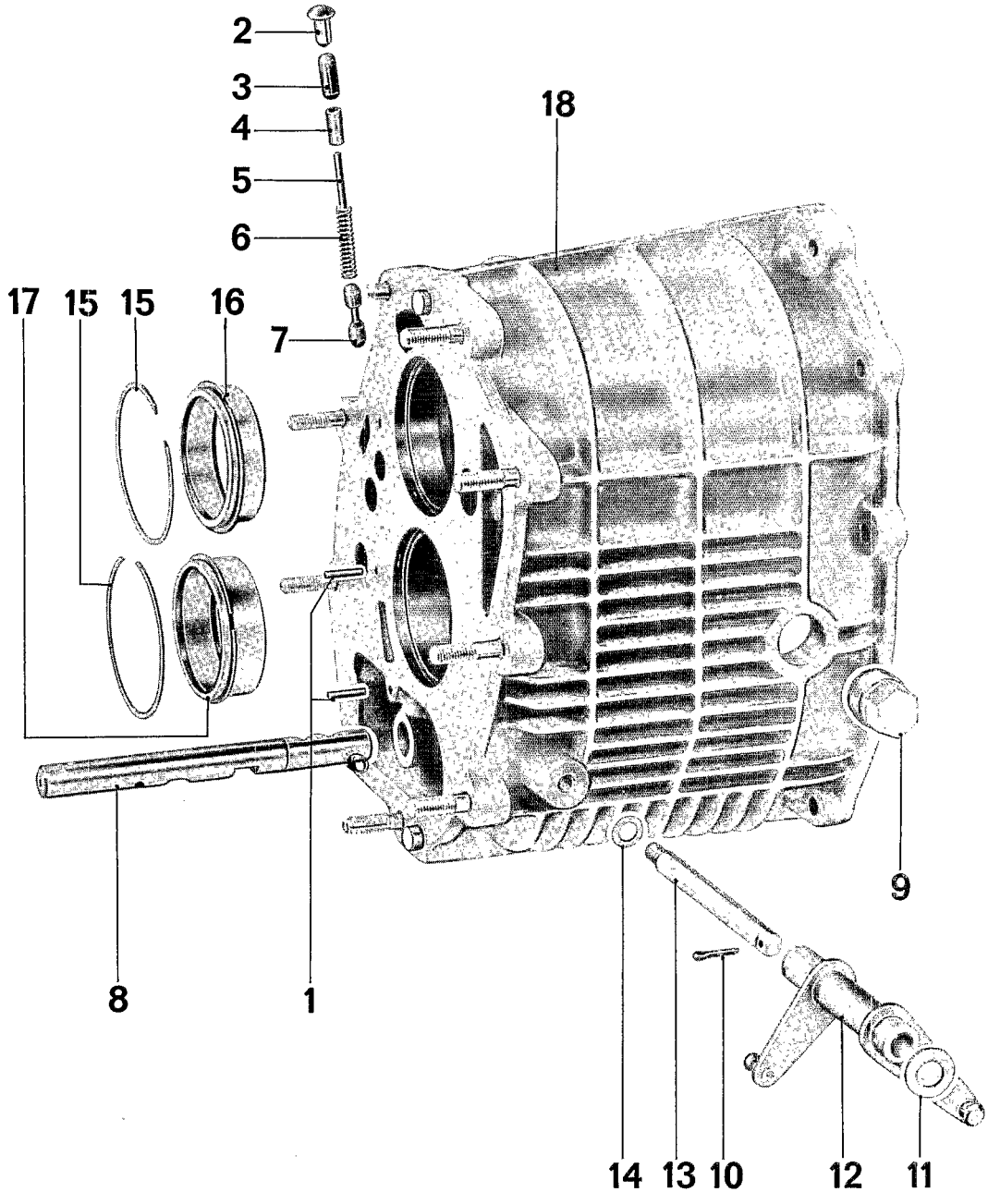


1

2

Nr.	Description	Special Tool	Remarks
1	Driver Set	US 8050	
2	T-handle	P 366	

Disassembling and Assembling Transmission Housing



Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
1	Roll pin	2	Drive out.	Tension spring with P 366 and drive in.	3.1-4/5
2	Plug	1	Drive out with flat chisel.	Replace if necessary.	
3	Short detent	1			3.1-4/5
4	Sleeve	1			
5	Pin	1			
6	Spring	1			
7	Long detent	1			
8	5th and reverse speed selector (shift) rod	1			
9	Plug	1		Torque to specification.	
10	Cotter pin	1		Replace.	
11	Washer	1			
12	Bellcrank for accelerator linkage	1			
13	Shaft	1			
14	Washer	1			
15	Retainer ring	2	Take out with small screwdriver.		
16	Bearing outer race	1	Heat gear housing to approx. 120°C (250°F) and drive out with special tool US 8050.	Heat gear housing to approx. 120°C (250°F) and drive in with special tool US 8050.	
17	Bearing outer race	1	Heat gear housing to approx. 120°C (250°F) and drive out with special tool US 8050	Heat gear housing to approx. 120°C (250°F) and drive in with special tool US 8050	
18	Gear housing	1			

DISASSEMBLING AND ASSEMBLING

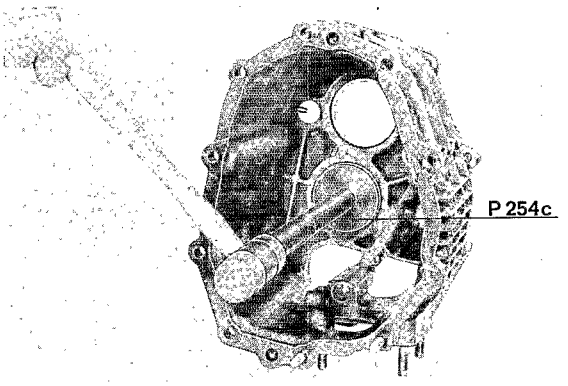
Disassembling

1. Drive shift detent securing roll pins out.

2. Drive half-round dowel pin out.

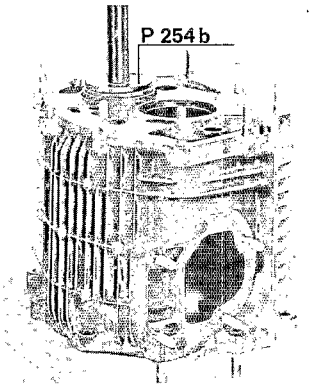
   Note
   Detent components are under spring tension. Therefore, always remove the roll pin first, then the half-round dowel pin.

3. Heat gear housing to approximately 120°C (250°F) and drive bearing outer races out using special tool US 8050.


P 254c

Assembling

1. Heat housing to approximately 120°C (250°F) and drive bearing outer races in with special tool US 8050.

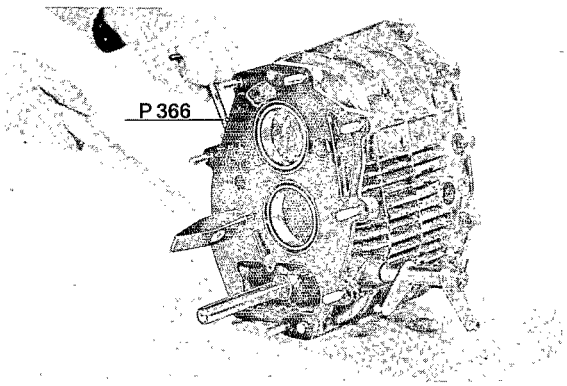

P 254b

Caution
The bearing outer races differ in inside diameter. The race with the larger inside diameter belongs to the pinion shaft (lower shaft).

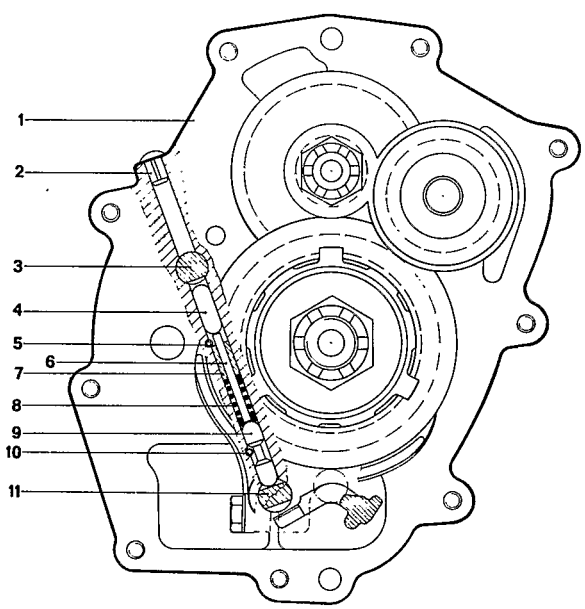
2. Install 5th and reverse speed shift rod.

3. Insert long detent and drive roll pin in.

4. Install spring and sleeve, tension both with special tool P 366, and drive roll pin in.



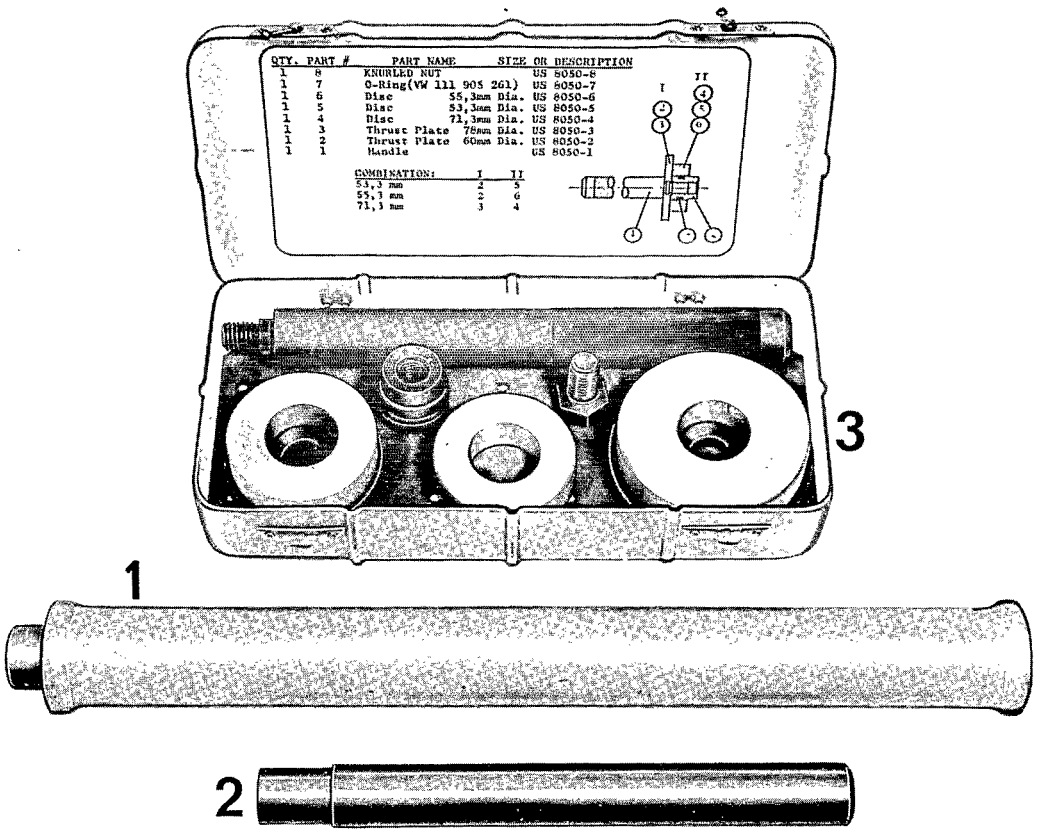
5. Insert pin and detent (short), then drive the plug in.



1 - Gear housing
2 - Half-round dowel pin
3 - 3rd and 4th speed selector fork(shift) rod
4 - Short detent
5 - Roll pin
6 - Pin
7 - Sleeve
8 - Spring
9 - Long detent
10 - Roll pin
11 - 5th and reverse speed selector fork (shift) rod

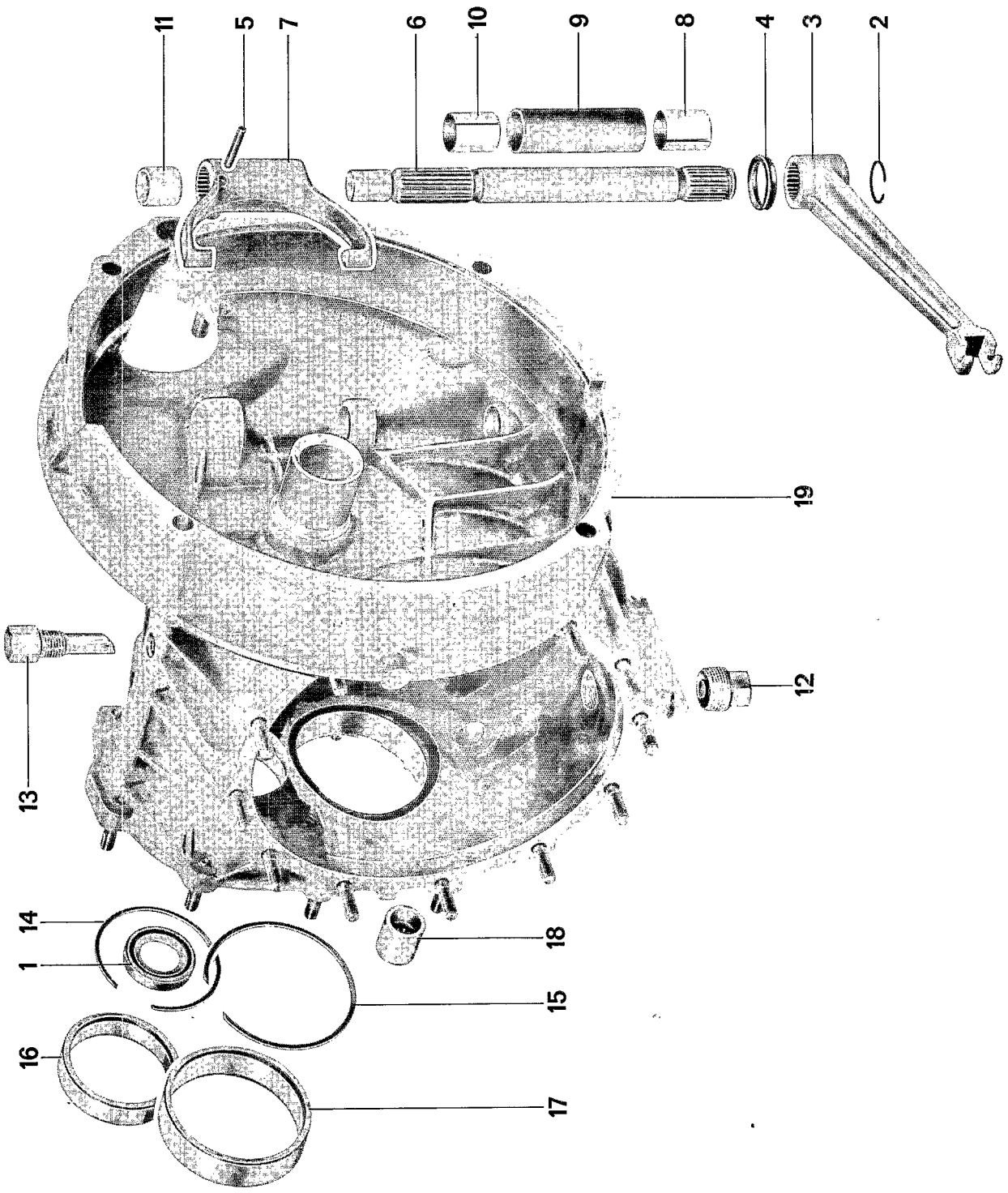
FINAL DRIVE HOUSING

TOOLS



Nr.	Description	Special Tool	Remarks
1	Mandrel	P 360a	
2	Mandrel	P 375	
3	Driver Set	US 8050	

Disassembling and Assembling Final Drive Housing



Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
1	Input shaft oil seal	1	Drive out in direction of bell housing with an appropriate punch.	Install with P 360a. Sealing lip faces bell housing.	3.1-5/7
2	Snap ring	1		Replace.	
3	Throwout lever	1	Mark lever position on shaft to ensure proper reinstallation.	Readjust if necessary.	3.1-5/7
4	Seal	1		Replace if necessary.	
5	Roll pin	1	Drive out.	Replace if necessary.	
6	Lever shaft	1			
7	Throwout fork	1		Readjust.	
8	Bushing	1	Drive out with P 375.	Drive in with P 375.	3.1-5/7
9	Cover tube	1			
10	Bushing	1	Drive out with P 375.	Drive in with P 375.	
11	Bushing	1			
12	Plug	1		Clean and torque to specification.	
13	Breather	1		Position properly, torque to specification.	3.1-5/6
14	Snap ring	1		Make sure it is properly seated.	

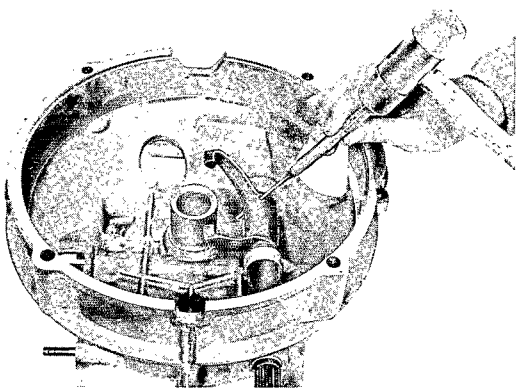
Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
15	Snap ring	1		Note proper seating.	3.1-5/6
16	Bearing outer race	1	Heat transmission housing to 120°C (250°F) on a hot-plate and drive out with US 8050.	Heat transmission housing to 120°C (250°F) on hotplate and drive in with US 8050.	
17	Bearing outer race	1	Heat transmission housing to 120°C (250°F) on hotplate and drive out with US 8050.	Heat transmission housing to 120°C (250°F) on hotplate and drive in with US 8050.	
18	Needle bearing/ bushing	1	Drive out with appropriate mandrel.	Drive in with appropriate mandrel.	
19	Transmission housing	1			

DISASSEMBLING AND ASSEMBLING FINAL DRIVE HOUSING

Disassembling

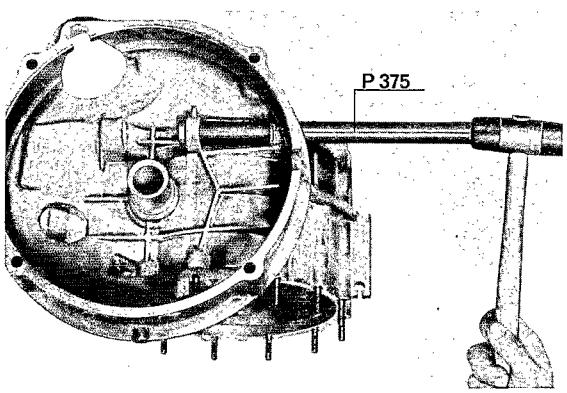
1. Drive out input shaft seal in direction of bell housing with an appropriate mandrel.

2. Drive roll pin out.



Caution
Mark throwout lever and shaft to ensure proper position when installing.

3. Drive out lever shaft bushings with special tool P 375.

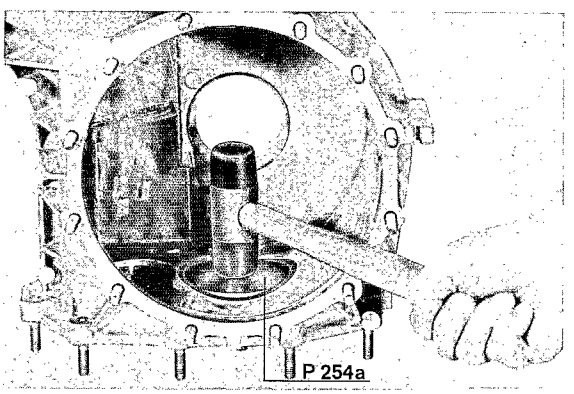


4. Remove bushing.

5. Using a small screwdriver, remove both snap rings from the housing for input shaft and pinion shaft bearings.

Note
The retaining rings are pressed against the housing by the bearing outer races. For this reason, first loosen the bearing racer from the snap rings with a punch.

6. Heat housing to approximately 120°C (250°F) on a hotplate and drive out both bearing outer races with special tool US 8050.



7. Drive out shift rod needle bearing/bushing from inside of housing using an appropriate mandrel.

Assembling

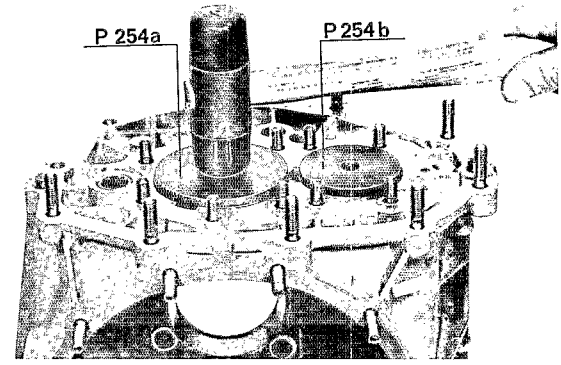
Caution
When cleaning the final drive housing, do not use corrosive cleaning materials as they will damage the magnesium alloy.

1. Clean housing and check for wear, external damage, and cracks. If repair is due to broken pinion shaft of ring gear, check for damage in center web bearing bores. Replace the housing if necessary.

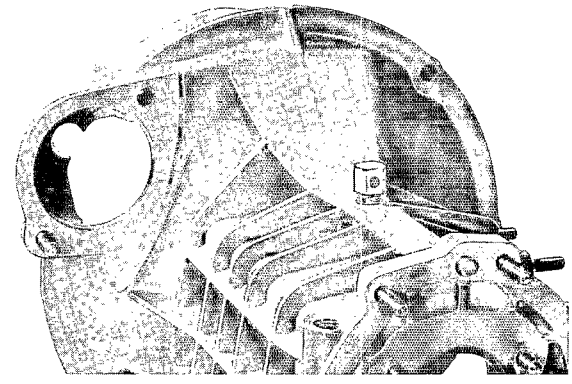
2. Install bearing outer race snap rings in housing grooves.

Note
Position the large snap ring so that its gap will rest in the groove in the housing. In no case should the snap ring gap appear at the sides where the groove is interrupted by a machined cut.

3. Heat housing to approximately 120°C (250°F) on a hotplate and drive both bearing outer races in with special tool US 8050.

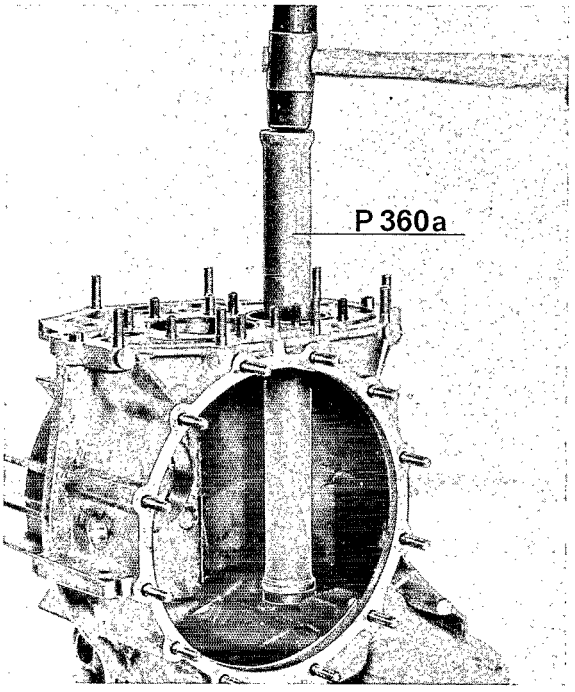


4. Install breather and torque to specification.

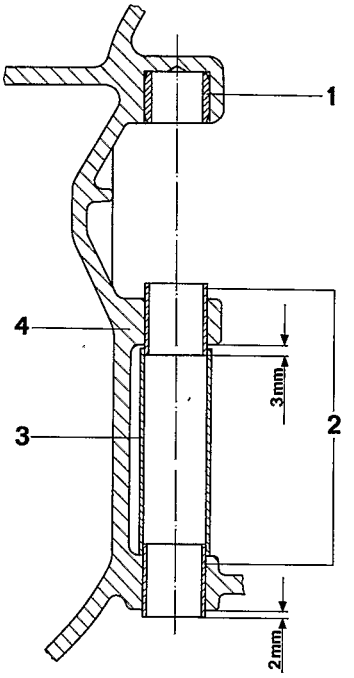


Note
The opening in the hex part of the breather must face forward in direction of travel (toward transmission front cover).

5. Install input shaft seal with P 360a. Sealing lip faces bell housing.



6. Drive in bushings for lever shaft with Special Tool P 375 (see drawing) and coat with grease having a lithium or silicone base.



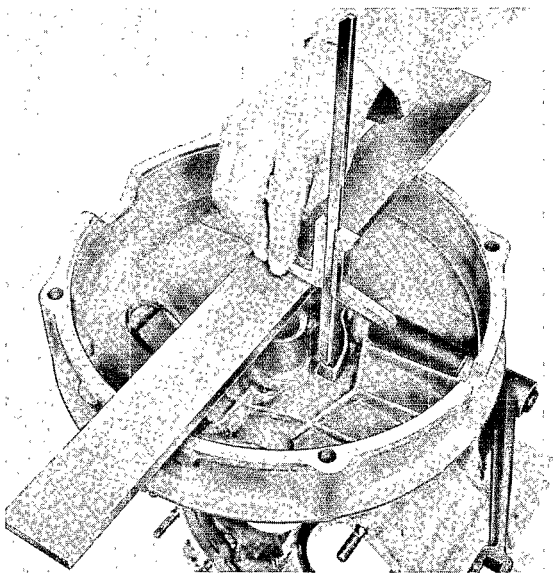
1 - Bushing
2 - Lever shaft bushing
3 - Cover tube
4 - Transmission housing

7. Assemble clutch controls.

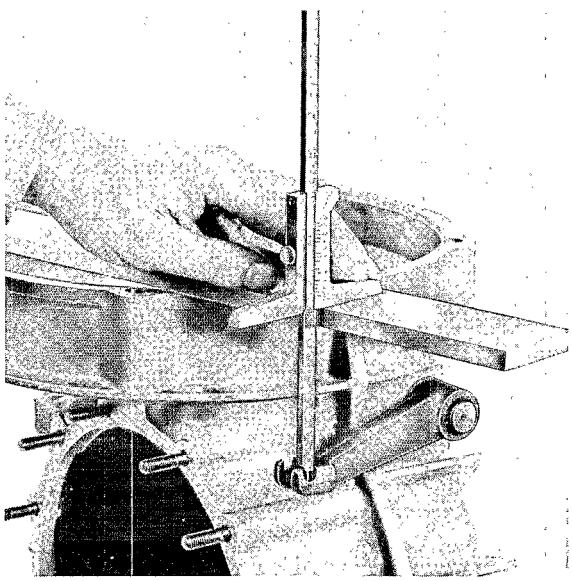
Note
Throwout fork and throwout lever must be adjusted on the lever shaft splines in order to attain proper lever travel.

Important
8. After making repairs to transmission, apply new protective undercoating to the entire outside of the housing.

The adjustment dimensions are:
From top edge of the bell housing to the tip of the throwout fork = 70 mm



From top edge of bell housing to the bottom throwout lever cut-out = 79 mm



Modified Clutch Release Lever - 1975 Models

The shape of the clutch release lever for transmission types 915/40/45 has been modified due to the location of the pipes of the new exhaust system. This makes it impossible to detach or attach the transmission without first removing the release lever.

After attaching the engine and transmission together, the new release lever must be installed so that it runs parallel to the clutch cable sleeve flange.

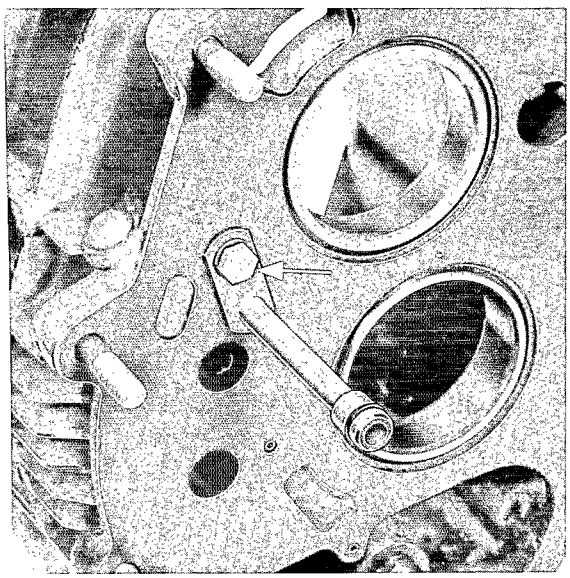
Adjustment of the release fork and release lever as in the past is omitted.

NOTE

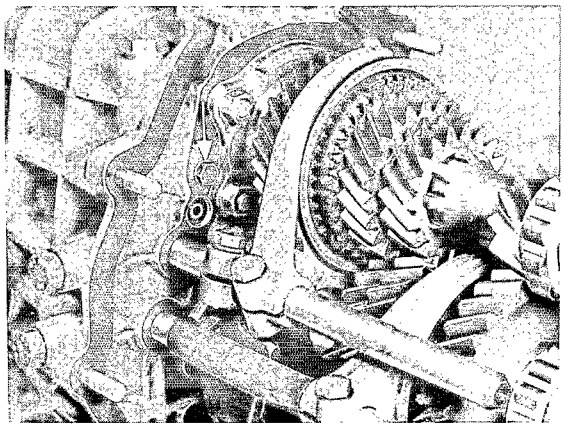
Due to the simple attachment of the pressure lines, they can be replaced without removal of the gears.

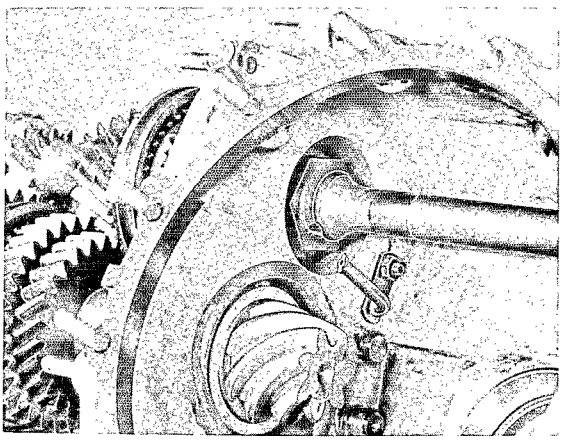
Removal

1. Remove pressure line retaining bolt from gear housing and pull pressure line out.



2. Remove retaining bolt of pressure line (spray nozzle for ring and pinion gears) from differential housing and pull the pressure line out.





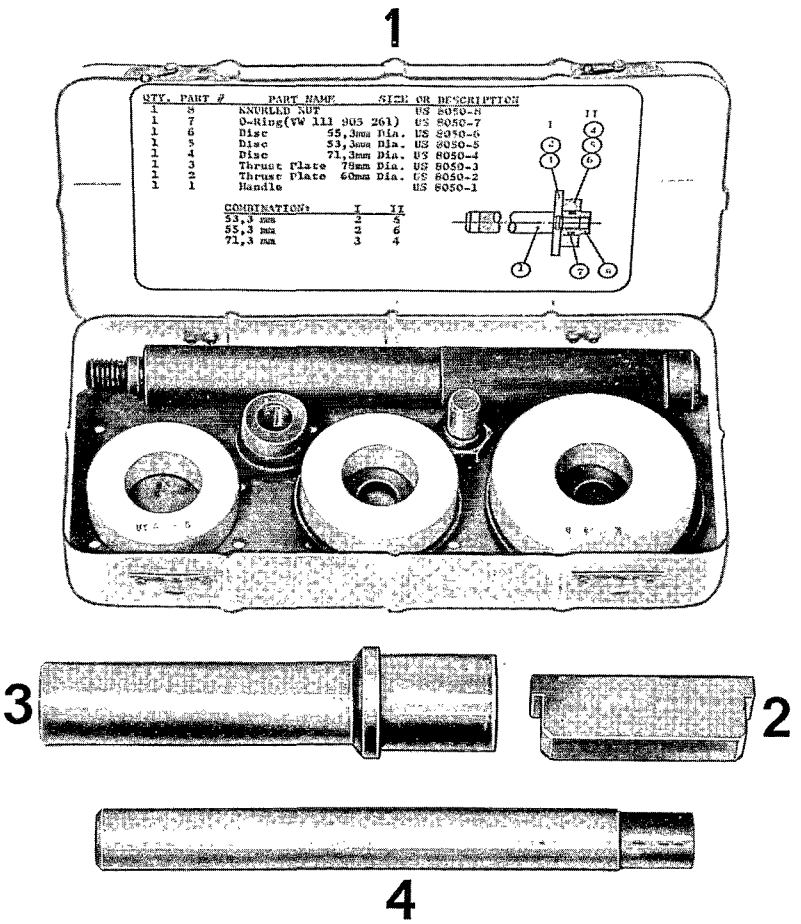
Installation

1. Install new O-rings and oil lightly.

2. Tighten retaining bolts to specified torque.

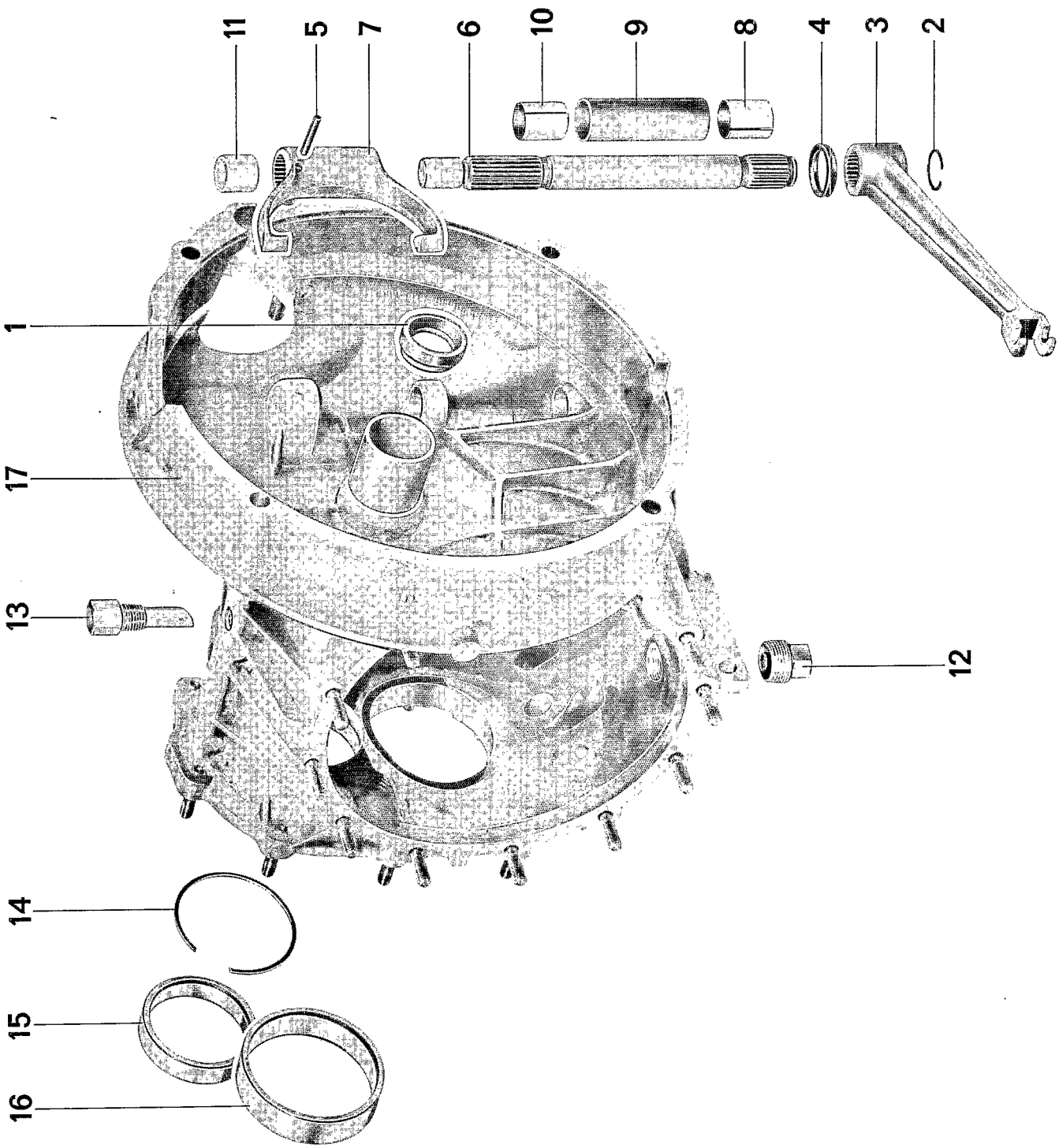
TRANSMISSION HOUSING WITH GUIDE TUBE FOR THROWOUT BEARING

TOOLS



No.	Description	Special Tool	Remarks
1	Driver Set	US 8050	
2	Thrust piece	P 254 d	
3	Sleeve	P 381	
4	Mandrel	P 375	

Disassembling and Reassembling Differential Housing



No.	Description	Qty	Note when: removing	installing	Remarks
1	Input shaft oil seal	1	Drive out inward with fitting pipe piece	Drive into seat with P 381	
2	Snap ring	1		Replace if necessary	
3	Throwout lever	1	Mark lever position on shaft for reassembly	Readjust if necessary	3.1 - 5/18
4	Seal	1		Replace if necessary	
5	Roll pin	1	Drive out with proper punch	Replace if necessary	
6	Lever shaft	1			
7	Throwout fork	1	Mark fork position on shaft for reassembly	Readjust if necessary	3.1 - 5/17
8	Bushing	1	Drive out with P 375	Drive in with P 375 in proper position	3.1 - 5/17
9	Cover tube	1			
10	Bushing	1	Drive out with P 375	Drive in with P 375 in proper position	3.1 - 5/17
11	Bushing (DELRIN)	1	Pry out with angular screwdriver by pressing around sides	Replace if necessary	
12	Drain plug	1		Clean, torque to specification	

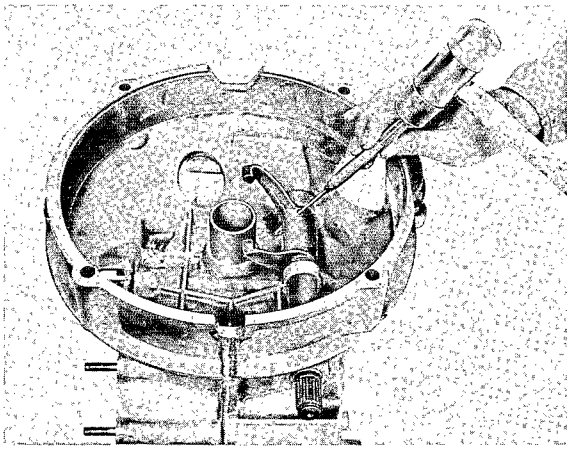
No.	Description	Qty	Note when: removing	Note when: installing	Remarks
13	Breather	1		Position properly and torque to specification	3.1 - 5/16
14	Snap ring	1	Remove with small screwdriver	Make sure it is properly seated	
15	Bearing outer race	1	Heat differential housing to approx. 120° C (248° F) and drive race out with US 8050	Heat differential housing to approx. 120° C (248° F) and drive race in with US 8050	3.1 - 5/16
16	Bearing outer race	1	Heat differential housing to approx. 120° C (248° F) and drive race out with US 8050	Heat differential housing to approx. 120° C (248° F) and drive race in with US 8050	3.1 - 5/15 3.1 - 5/16
17	Differential housing	1			

DISASSEMBLING AND REASSEMBLING DIFFERENTIAL HOUSING

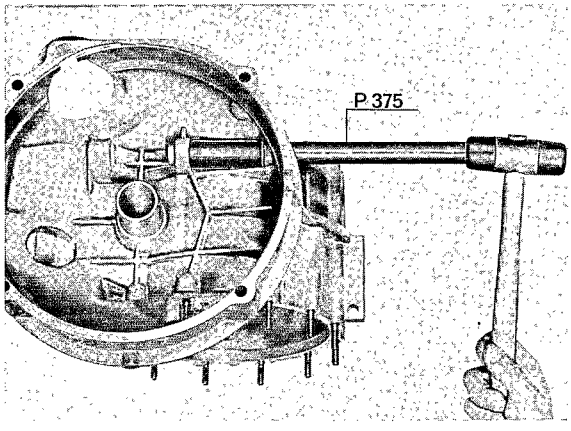
Disassembly

1. Drive input shaft oil seal inward with the aid of a fitting pipe section.

2. Drive roll pin out with an appropriate punch.



3. Drive out lever shaft bushings with P 375.

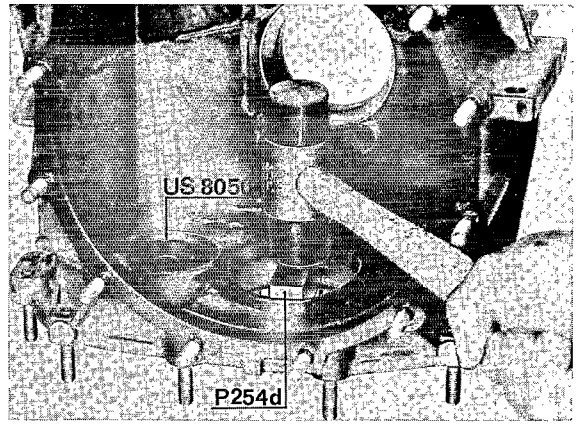


4. Using a small screwdriver, remove snap ring of input shaft bearing race.

NOTE:

The snap ring is pressed against the housing by the bearing race. It is necessary to first drive the bearing race away from the snap ring with the aid of a punch.

5. Heat differential housing to approx. 120° C (248° F) and drive both bearing races out with thrust pieces US 8050 and P 254 d.



Reassembly

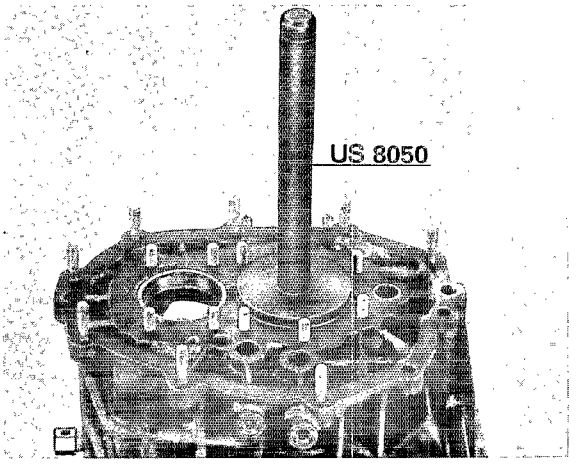
1. Clean differential housing and check for wear, external damage, and cracks. If the repair is due to a damaged pinion shaft or ring gear (such as metal fracturing), check for possible damage to center web bearing bores. Replace the housing if necessary.

NOTE

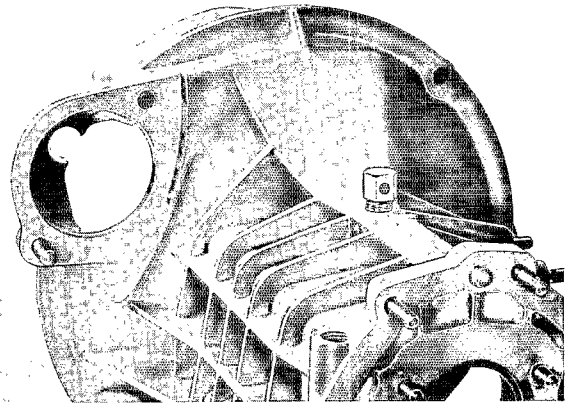
Pressure-cast housings must not be cleaned with corrosive liquids since these damage magnesium alloys. In addition, cleaned pressure castings must be treated with seasonal corrosion preservatives of bitumen or wax base, such as TECTYL, following transmission repairs to restore the corrosion proofing.

2. Install snap ring securing the input shaft bearing race in the groove in housing.

3. Heat differential housing to approx. 120° C (248° F) and drive both bearing outer races into place with the aid of US 8050.



4. Install breather in proper position and torque to specification.

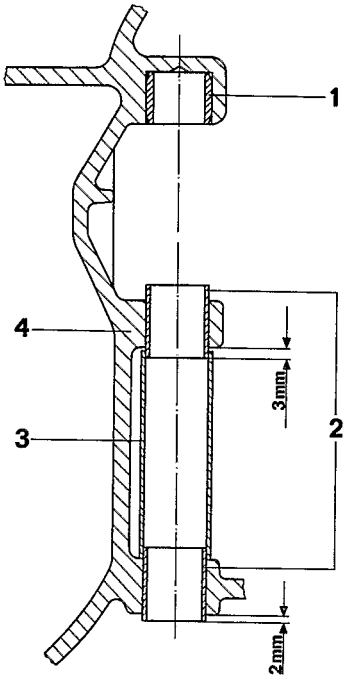


NOTE

The hole in the hex. head of the breather must face forward in direction of travel (toward transmission front cover).

5. Drive input shaft oil seal into place with P 381.

6. Drive in bushings for lever shaft with Special Tool P 375 (see drawing) and coat with grease having a lithium or silicone base.



1 - Bushing
2 - Lever shaft bushing
3 - Cover tube
4 - Differential housing

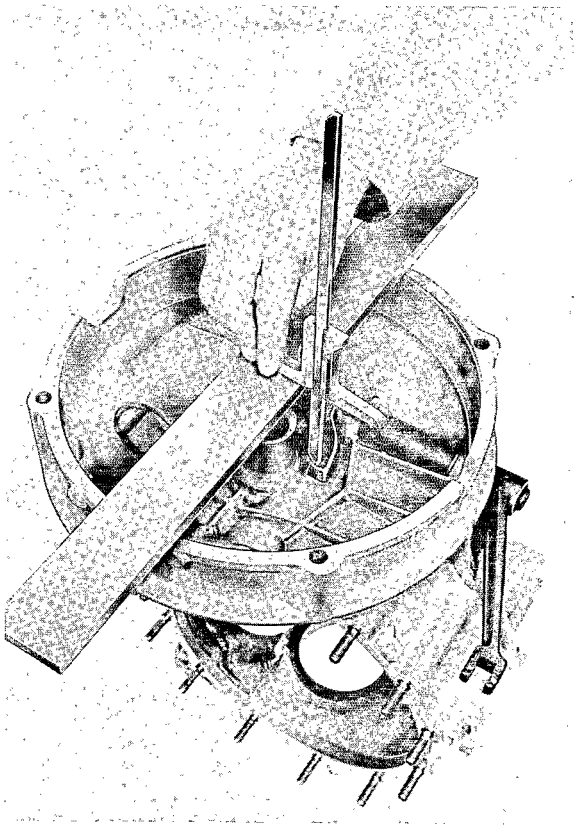
7. Install clutch controls.

NOTE

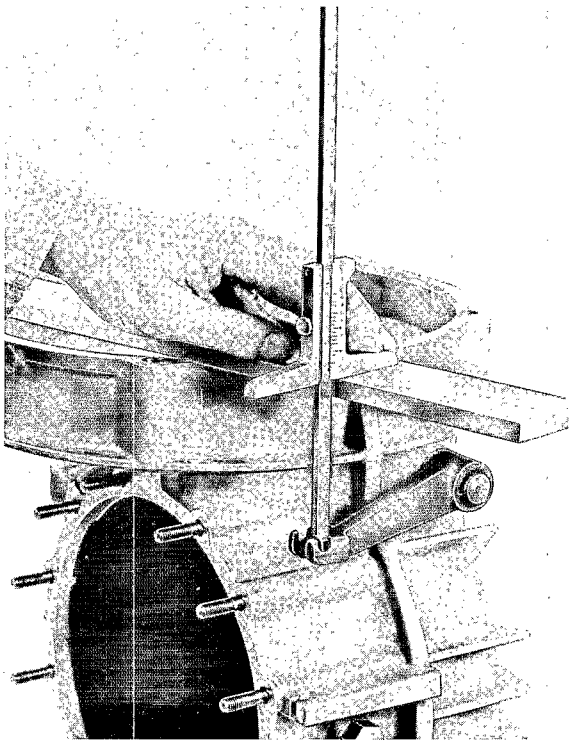
Throwout fork and throwout lever must be adjusted on the lever shaft splines to attain proper clutch lever travel.

The dimensions are:

From top edge of bell housing to the tip of the throwout fork = 70 mm.



From top edge of the bell housing to the root of the claw in the throwout lever = 79 mm.



8. Coat guide tube for throwout bearing with MoS_2 multipurpose grease.

Modified Clutch Release Lever - 1975 Models

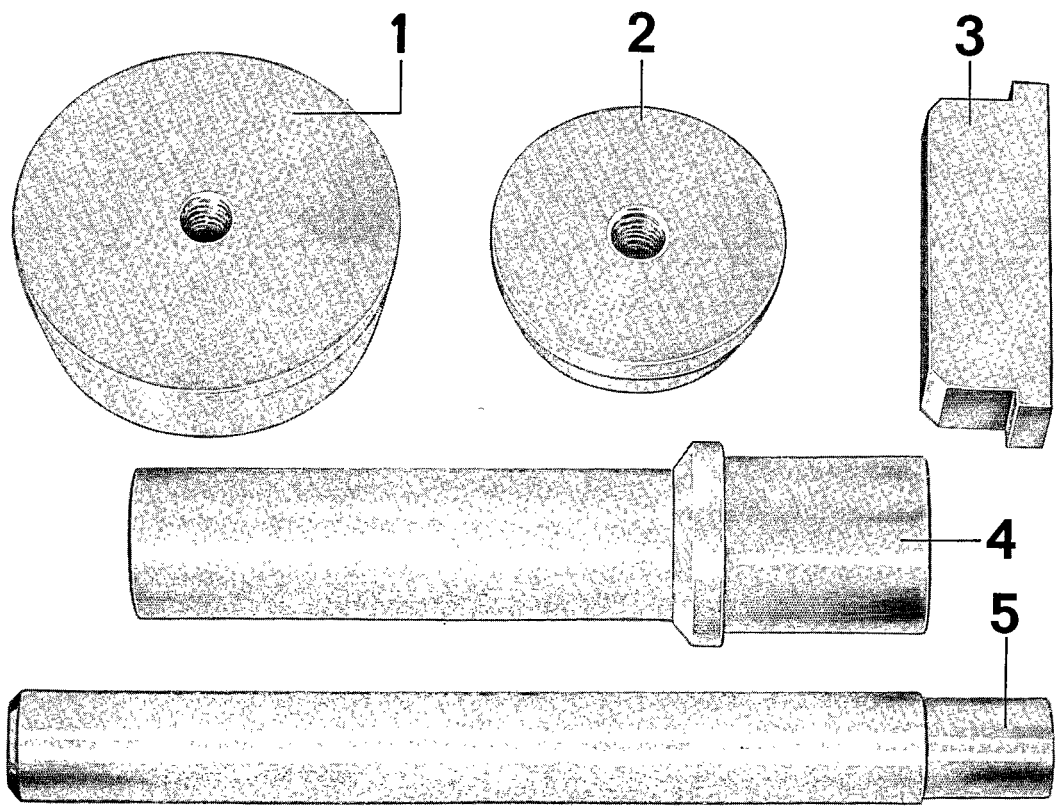
The shape of the clutch release lever for transmission types 915/40/45 has been modified due to the location of the pipes of the new exhaust system. This makes it impossible to detach or attach the transmission without first removing the release lever.

After attaching the engine and transmission together, the new release lever must be installed so that it runs parallel to the clutch cable sleeve flange.

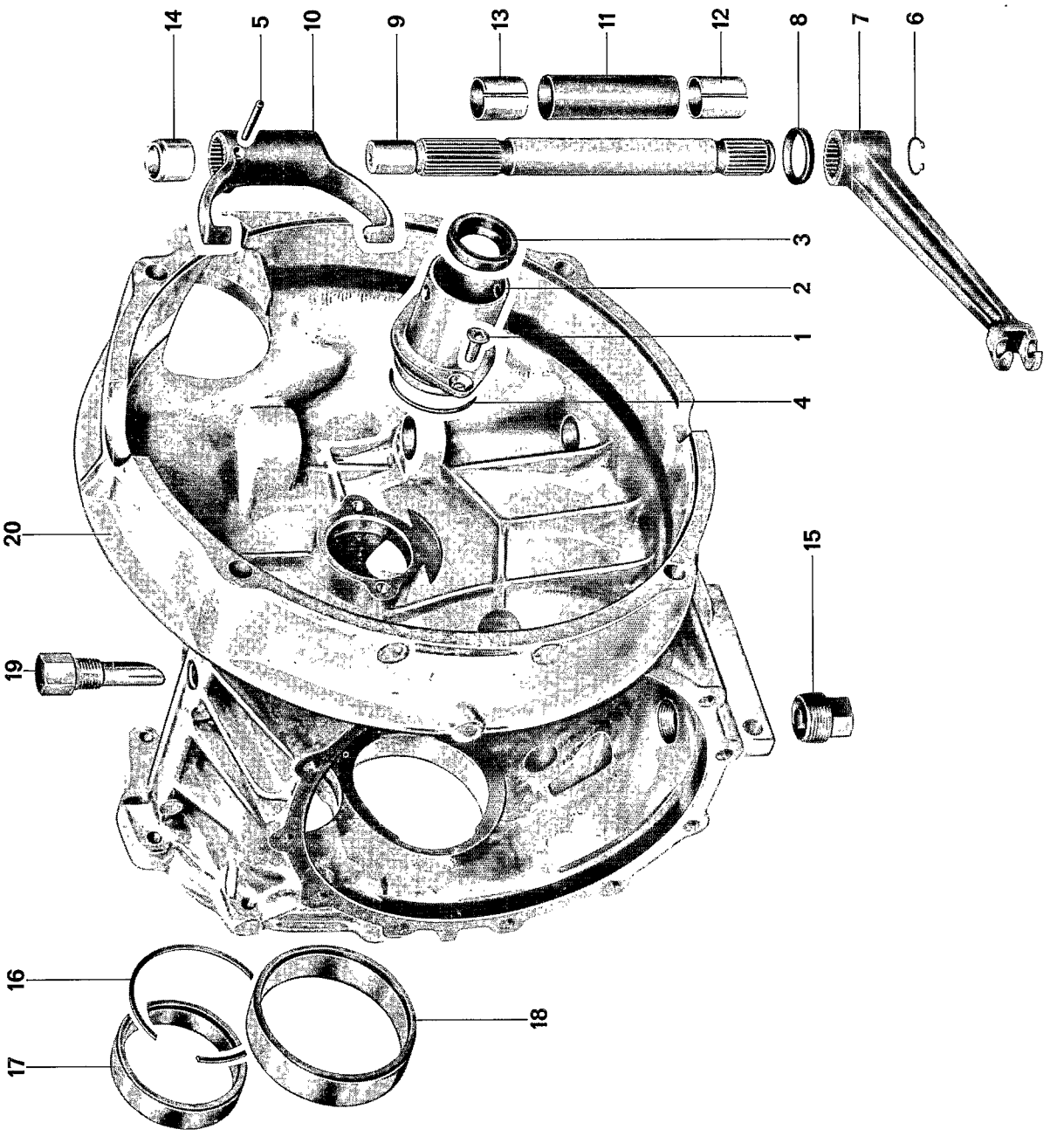
Adjustment of the release fork and release lever as in the past is omitted.

TRANSMISSION CASE WITH BOLTED GUIDE TUBE FOR RELEASE BEARING

TOOLS



No.	Description	Special Tool	Remarks
1	Thrust plate	US 8050	
2	Thrust plate	US 8050	
3	Thrust plate	US 8050	
4	Mandrel	P 381	
5	Mandrel	P 375	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No.	Description	Qty.	Note when Removing	Note when Installing	Special instructions see
1	Phillips ctsk. screw	2		Torque to specifications	
2	Guide tube	1	Use hook to remove	Install with MoS2 additive lubricant	
3	Seal, drive shaft	1	Drive out with P 381	Press in with P 381	
4	O-ring	1		Replace, lubricate	
5	Pin	1	Drive out with appropriate drift	Replace if necessary	
6	Circlip	1		Replace if necessary	
7	Release lever	1	Mark for reinstalling with lever shaft	Adjust, if necessary	
8	Seal	1		Replace if necessary	
9	Lever shaft	1			
10	Release fork	1	Mark for reinstalling with lever shaft	Replace if necessary	
11	Cover tube	1			
12	Bushing	1	Drive out with P 375	Drive in with P 375	
13	Bushing	1	Drive out with P 375	Drive in with P 375	
14	Bushing (Delrin)	1	Use angled screwdriver on both sides to pry out	Replace, if necessary	
15	Plug	1		Clean and torque to specifications	
16	Snap ring	1	Remove with small screwdriver	Install correctly	

No.	Description	Qty.	Note when Removing	Note when Installing	Special instructions see
17	Bearing outer race	1	Heat case to approx 120°C / 248°F and drive out with US 8050	Heat case to approx 120°C / 248°F and drive in with US 8050	
18	Bearing outer race	1	Heat case to approx 120°C / 248°F and drive out with US 8050	Heat case to approx 120°C / 248°F and drive in with US 8050	
19	Breather	1		Position correctly and torque to specifications	
20	Transmission case	1		Check for damage	

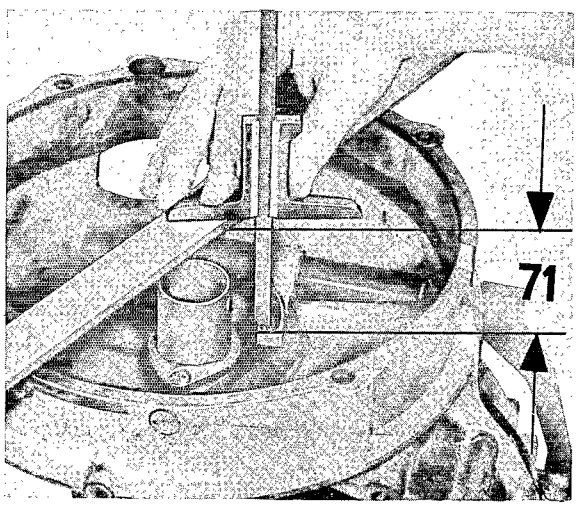
DISASSEMBLING AND ASSEMBLING INSTRUCTIONS

On the 1976 model manual transmission 915 the clutch release lever can be preassembled and adjusted.

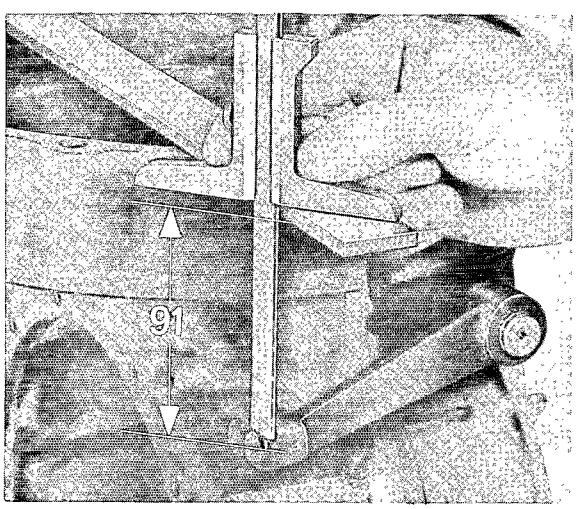
Assembling Clutch Release Components

To assure perfect clutch operation, release fork and release lever must be matched with each other on the lever shaft splines.

Specifications are:
Approx. 71 mm from clutch bell housing flange surface to upper edge of release bearing surface on fork.



Approx. 91 mm from clutch bell housing flange surface to depression in lever.



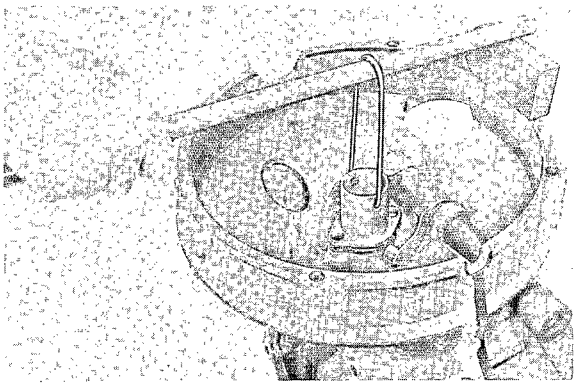
REMOVING AND INSTALLING DRIVE SHAFT SEAL - 1976 MODEL

The drive shaft seal of 1976 model manual transmission 915 can be replaced without having to disassemble the transmission.

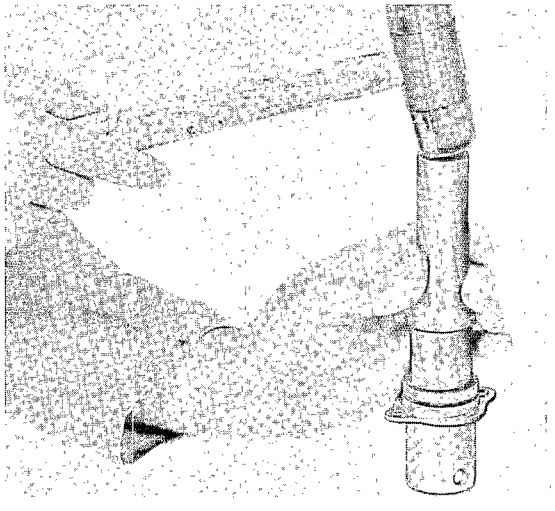
Removing

1. Remove engine/transmission assembly and separate transmission from engine.

2. Remove both Phillips countersunk bolts on guide tube. Pull out guide tube for drive shaft seal with a locally manufactured hook.



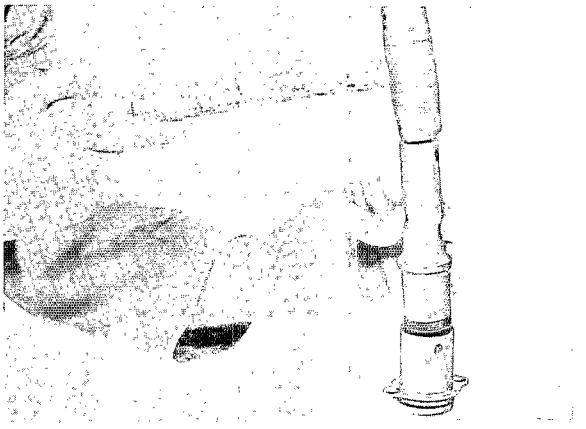
3. Remove seal with an appropriate mandrel or screwdriver. Special tool P 381 can be applied.



Installing

1. Drive new seal in guide tube with special tool P 381.

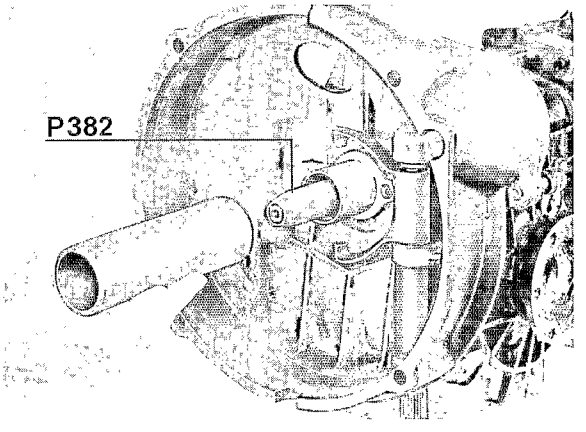
2. Place new rubber O-ring on neck of guide tube.



3. Slide special tool P 382 over splines of drive shaft.

4. Apply a light coat of lubricant to sealing lip of seal in guide tube and rubber O-ring on guide tube neck.

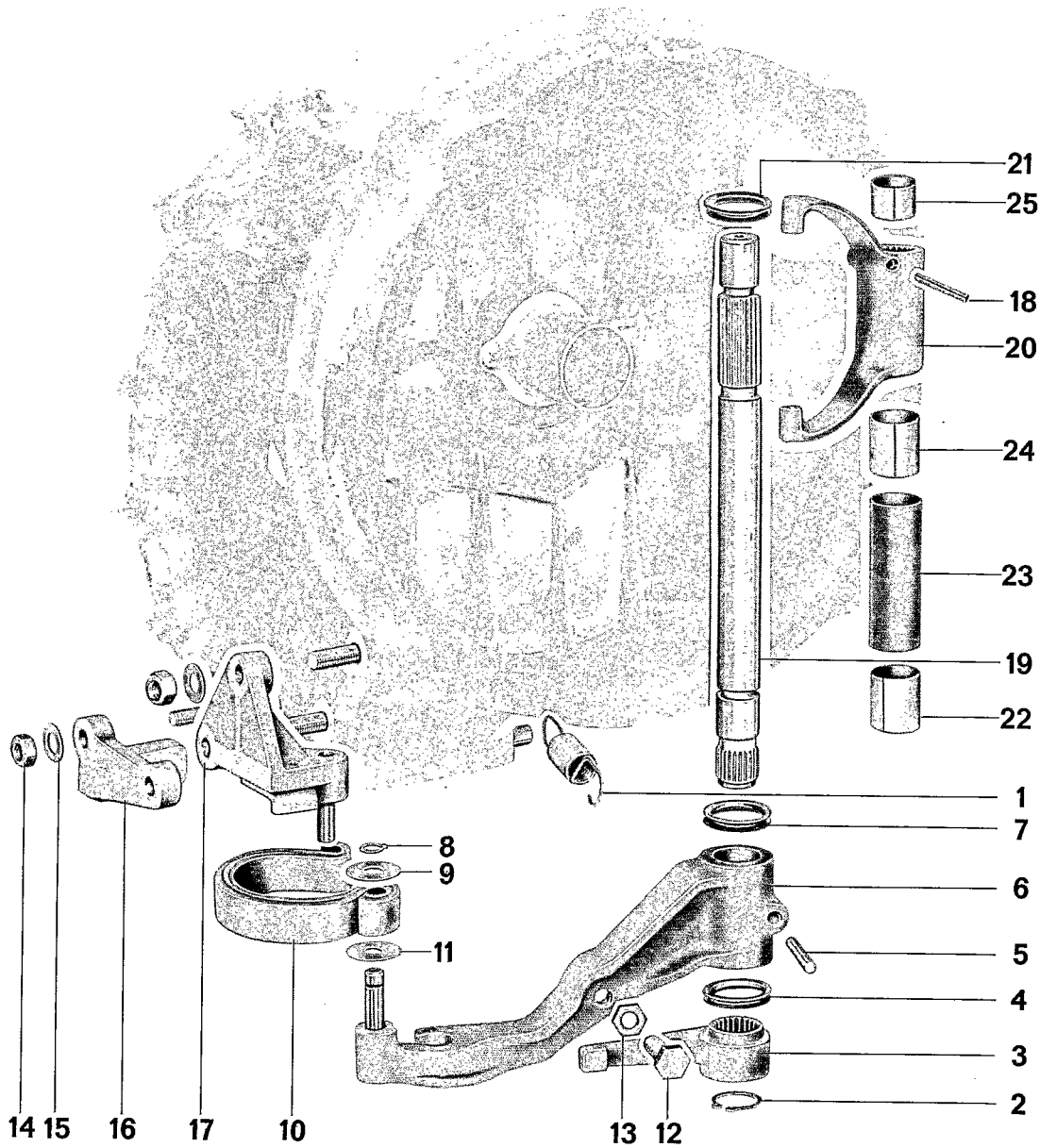
5. Drive in guide tube until positioned correctly.



6. Install mounting bolts and torque to specifications.

7. Coat release bearing guide tube with MoS2 paste.

TRANSMISSION CASE WITH AUXILIARY CLUTCH SPRING (1977 MODELS)



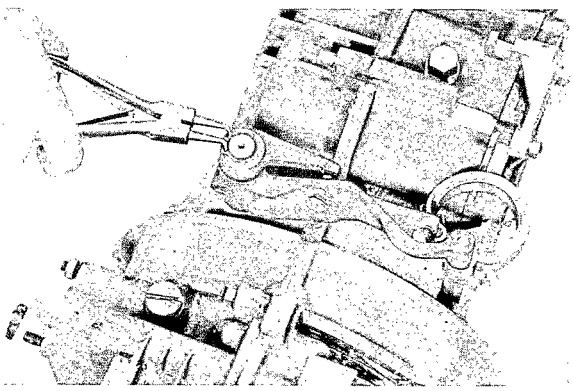
No.	Description	Qty.	Note when removing	Note when installing	Remarks
1	Spring	1			
2	Circlip	1		Replace, if necessary	
3	Adjusting lever	1		Adjust	
4	Seal	1		Replace, if necessary	
5	Round pin	1			omitted from March, 1979
6	Clutch release lever	1		Coat pin for spring with all-purpose lube containing MoS_2	
7	Seal	1		Replace, if necessary	
8	Circlip	1		Replace, if necessary	
9	Washer	1			
10	Auxiliary spring	1			
11	Washer	1			
12	Adjusting bolt	1			
13	Nut	1		Torque to specifications	
14	Nut	4		Torque to specifications	
15	Washer	4		Replace, if necessary	
16	Holder	1			
17	Base	1		Coat pin for spring with all-purpose lube containing MoS_2	
18	Spring pin	1		Replace, if necessary	
19	Lever shaft	1			

No.	Description	Qty.	Note when removing	Note when installing	Remarks
20	Release fork	1			
21	Seal	1		Replace, if necessary	
22	Bushing	1	Drive out with P 375	Drive in with P 375 until positioned correctly	3.1 - 5/28
23	Cover tube	1			
24	Bushing	1	Drive out with P 375	Drive in with P 375 until positioned correctly	3.1 - 5/28
25	Bushing	1		Replace, drive in	

DISASSEMBLING AND ASSEMBLING INSTRUCTIONS

Disassembling

1. Disengage spring for adjusting lever and remove circlip.



2. Pull adjusting lever off of lever shaft.

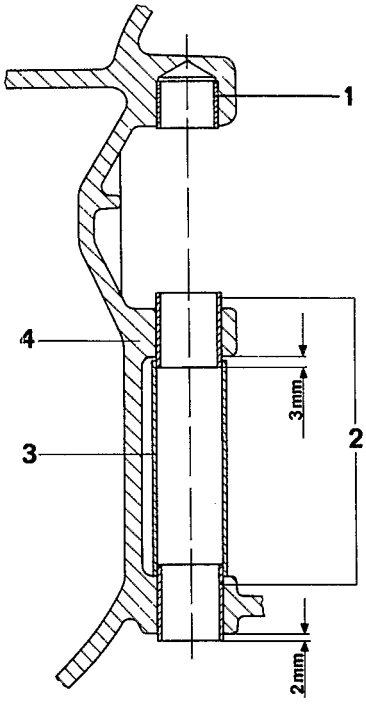
3. Release auxiliary spring. This requires pressing clutch release lever toward front transmission cover with an appropriate tool.

Note

When reaching the "dead point" the auxiliary spring will snap forward on its own.

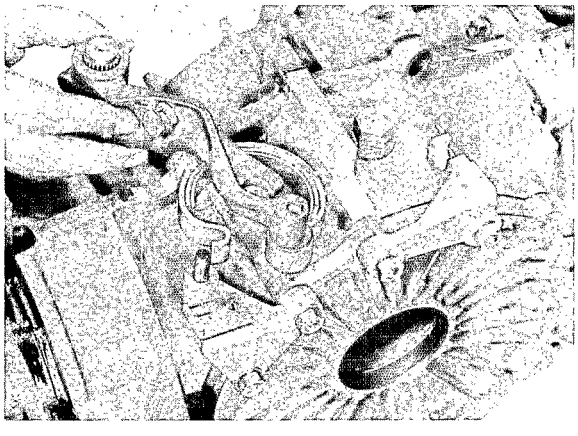
Assembling

1. Drive in bushings for lever shaft with Special Tool P 375 (see drawing) and coat with grease having a lithium or silicone base.

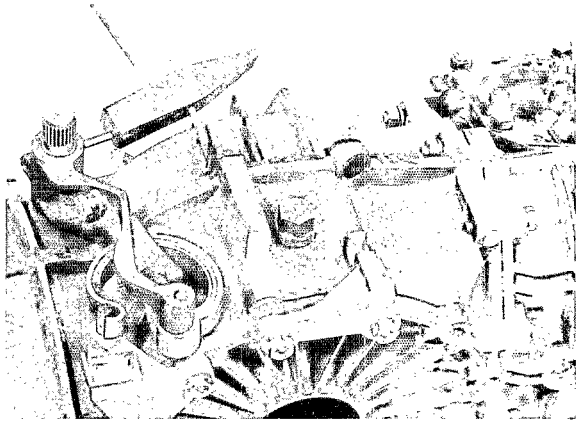


1 - Bushing
2 - Bushing, lever shaft
3 - Cover tube
4 - Transmission case

2. Install clutch release lever with spring and adjusting screw on splines of lever shaft.



3. Locate clutch release lever with a round pin.

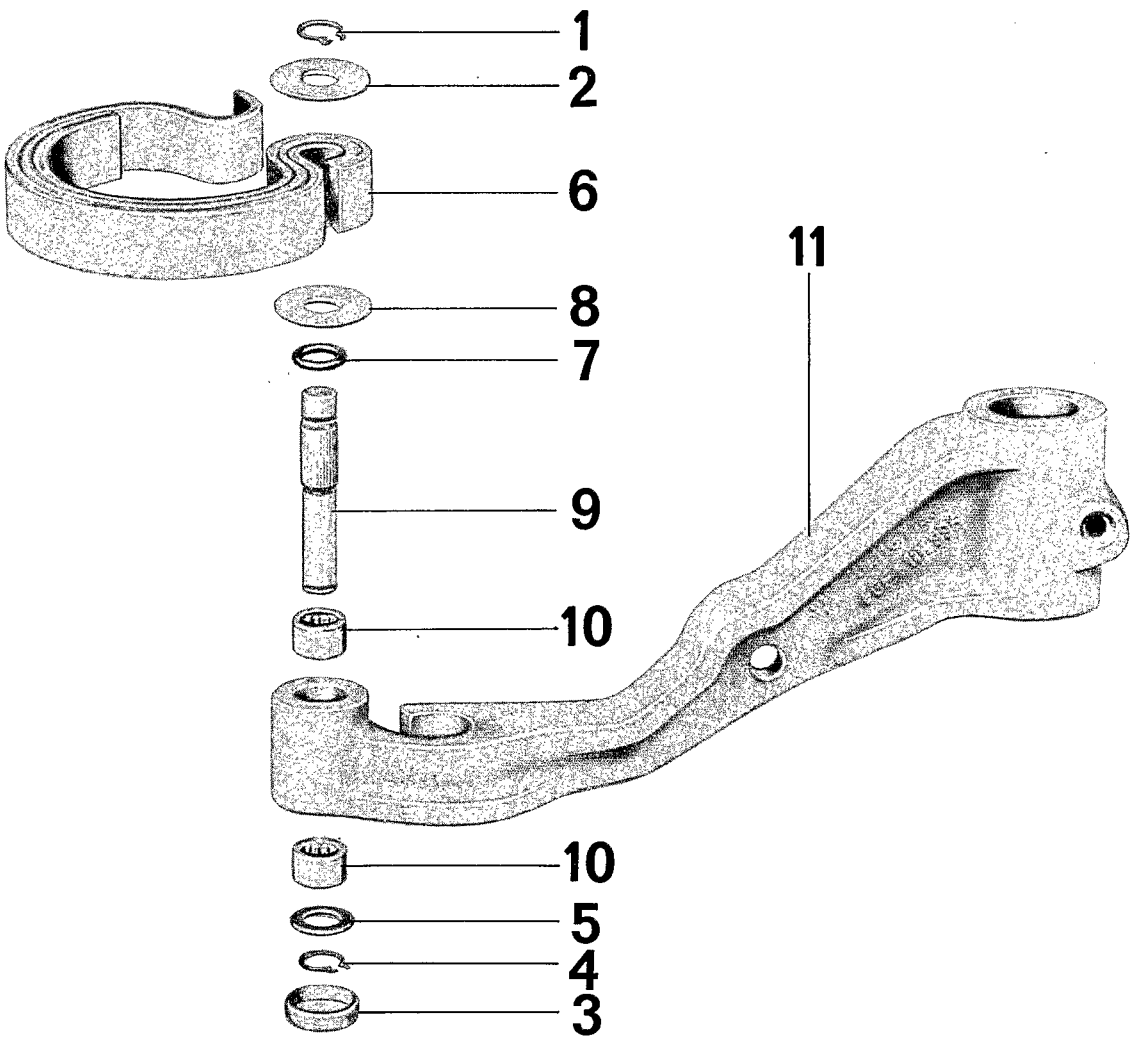


4. Tension auxiliary spring (must snap past the dead point to stop pin).

Note

Only install adjusting lever after engine/transmission lever is installed in car.

RELEASE LEVER - 1978 MODELS



No.	Description	Qty.	Note When Removing	Note When Installing	Special Instructions
1	Circlip	1		Replace, if necessary	
2	Washer	1			
3	Cover	1		Replace	
4	Circlip	1		Replace, if necessary	
5	Washer	1			
6	Auxiliary spring	1			
7	O-ring	1		Replace	
8	Washer	1		Replace	
9	Pin	1			
10	Needle bushing	2	Drive out with Tool No. 9153	Drive in to correct position with Tool No. 9153	3.1 - 5/31
11	Release lever	1			

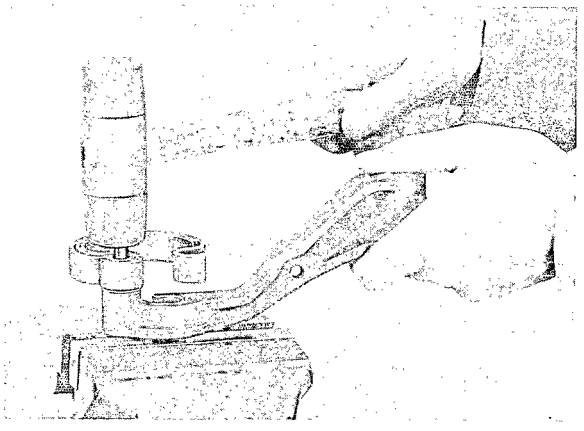
DISASSEMBLING AND ASSEMBLING INSTRUCTIONS

Disassembling

1. Remove upper circlip and drive pin down until cover falls out.

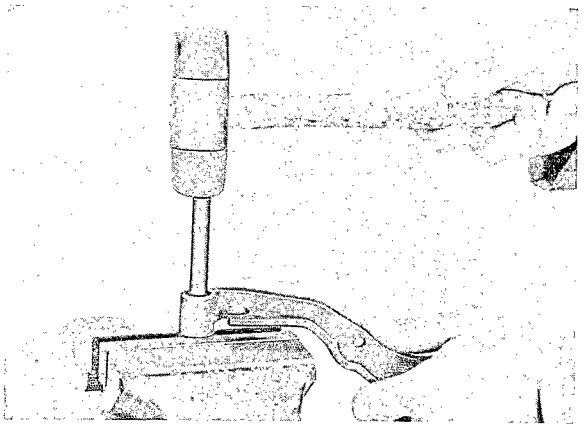
Note

This will deform the washer (item 8).



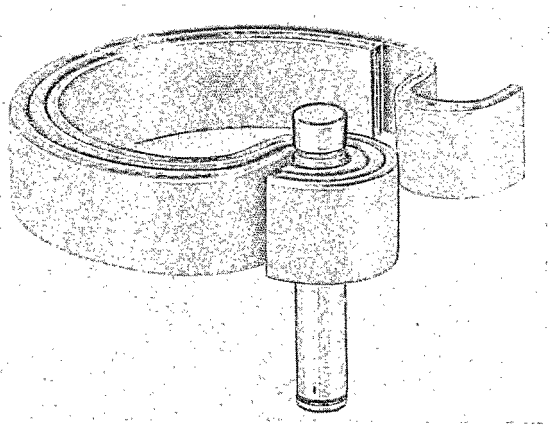
2. Remove lower circlip and pull out pin with spring.

3. Drive out needle bearings with Special Tool No. 9153.



Assembling

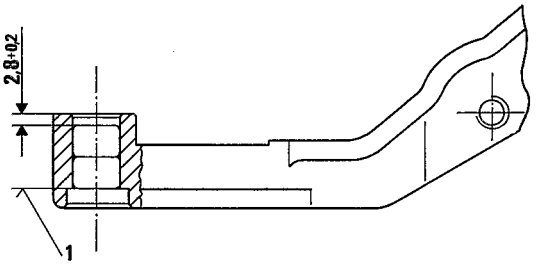
1. Drive pin into spring so that washer and circlip can just be installed.



2. Drive in needle bearings to correct position with Special Tool No. 9153.

Note

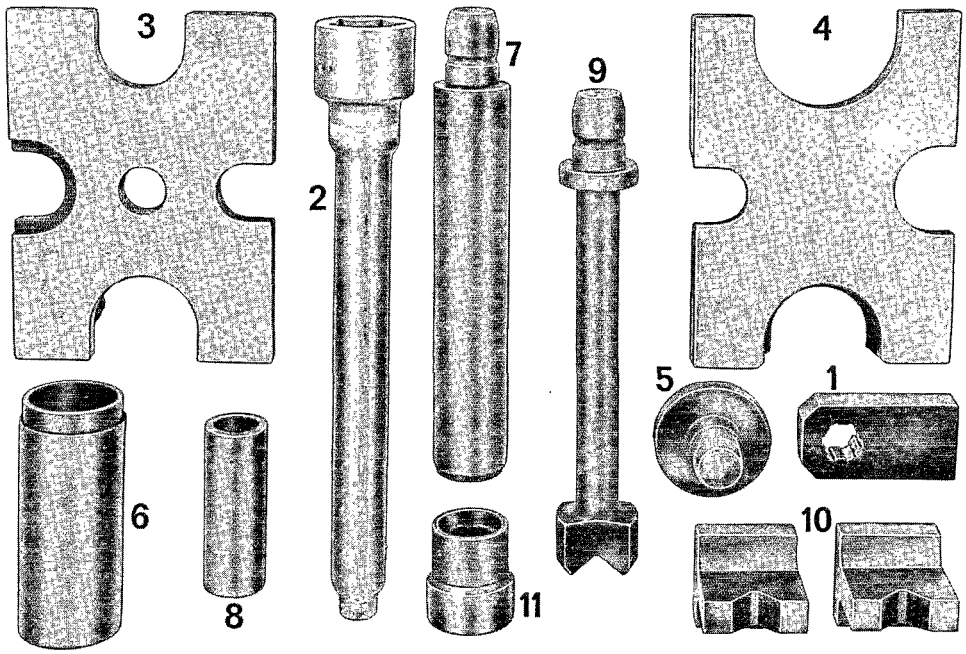
Lubricate needle bearings and bore of release lever with a waterproof lubricant (silicone or lithium-based) before installation.



1 - Flush

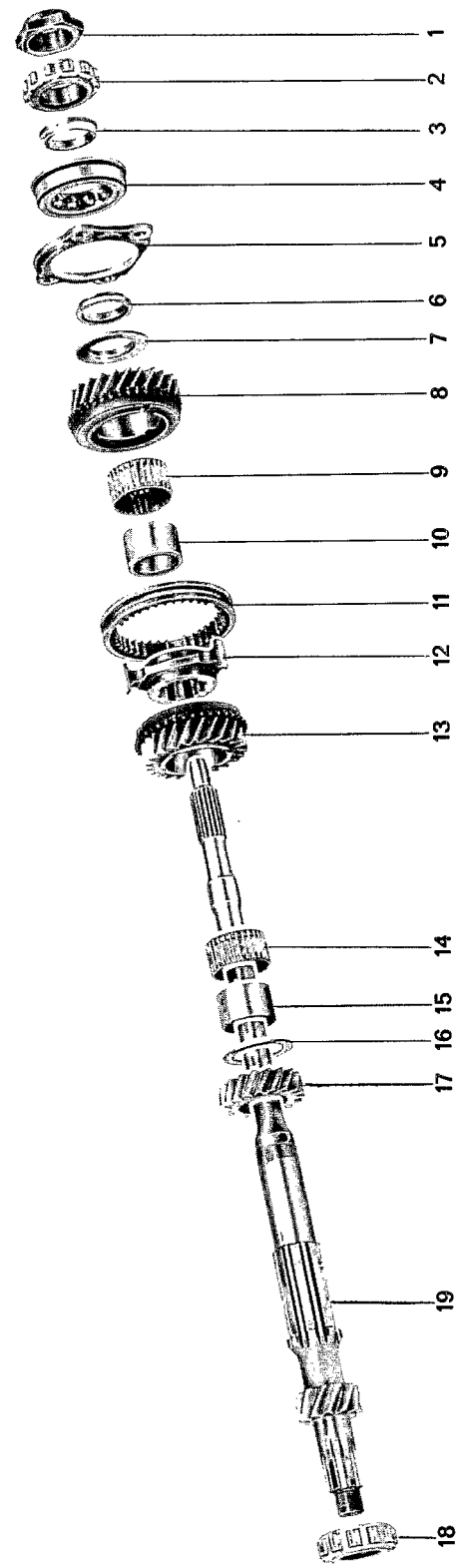
DISASSEMBLING AND ASSEMBLING INPUT SHAFT

TOOLS



Nr.	Description	Special Tool	Remarks
1	Support plate	P 355a	
2	Socket	P 252a	
3	Thrust plate	VW 401	
4	Thrust plate	VW 402	
5	Thrust disc	VW 412	
6	Thrust tube	VW 415a	
7	Press punch	VW 407	
8	Thrust tube	VW 416b	
9	Press punch	VW 405	
10	V-blocks	VW 406	Two each
11	Thrust tube	VW 454	

Disassembling and Assembling Input Shaft



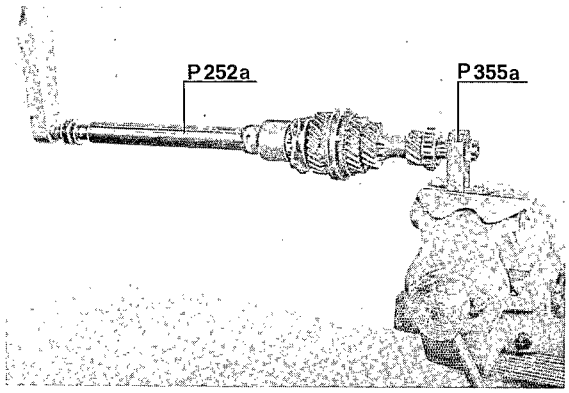
Nr.	Description	Qty.	Note when		Special instructions see
			Removing	Installing	
1	Flange nut	1	Remove with P 252a	Torque to specification, secure with center punch.	3.1-6/6
2	Roller bearing	1	Press off with VW 401, VW 402, and VW 412.	Press in with VW 401, VW 454, and VW 407.	
3	Bearing inner race	1	Keep together with bearing to ensure correct installation position.	Install as a matched set only. Heat to approx. 120°C (250°F) and drive on.	
4	Four-point bearing	1			
5	Bearing clamping plate	1			
6	Bearing inner race	1		Install as a matched set only. Heat to approx. 120°C (250°F) and drive on.	
7	Thrust washer	1			
8	4th speed	1		Check synchronization. Replace in pairs only.	3.1-8/4
9	Needle bearing	1	Fasten to respective gear and race with mechanic's wire.	Make sure bearings have not been interchanged.	
10	Needle bearing race	1	Fasten to respective gear and bearing with mechanic's wire.	Make sure races have not be interchanged.	
11	Shifting sleeve	1		Check for wear.	
12	Spider	1		Check for wear.	
13	3rd speed	1		Check synchronization. Replace in pairs only.	3.1-8/4

Nr.	Description	Qty.	Note when		Special instructions see
			Removing	Installing	
14	Needle bearing	1	Fasten to respective gear and race with mechanic's wire.	Make sure bearings have not been interchanged.	
15	Needle bearing race	1	Fasten to respective gear and bearing with mechanic's wire.	Make sure races have not been interchanged.	
16	Thrust washer	1			
17	2nd speed	1		Check for wear. Replace in pairs only.	
18	Roller bearing	1	Press off with VW 415a and VW 407	Press on with VW 416b and VW 412	
19	Input shaft	1		Check for runout.	3.1-6/7

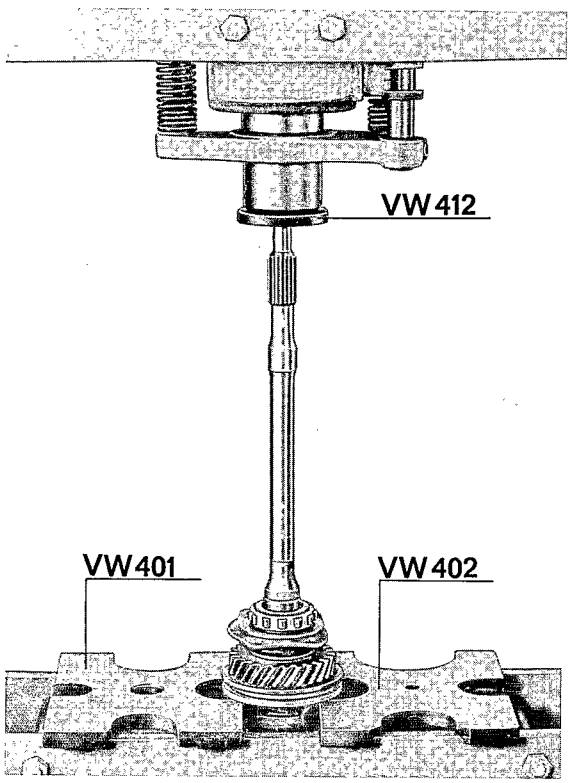
DISASSEMBLING AND ASSEMBLING INPUT SHAFT

Disassembling

1. Mount support plate P 355a in a vise. Insert input shaft and remove flange nut with special tool P 252a.

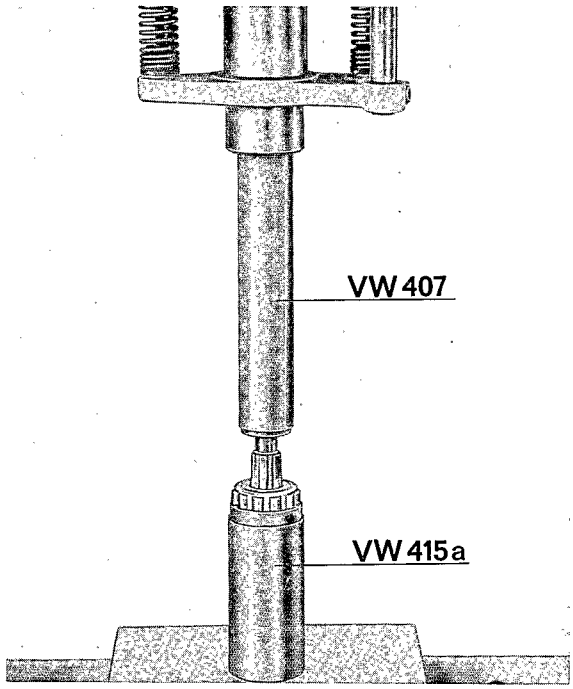


2. Press roller bearing off input shaft with thrust plates VW 401 and VW 402, and thrust disc VW 412.



3. When removing other parts, wire needle bearings races, and respective gears together for correct reinstallation.

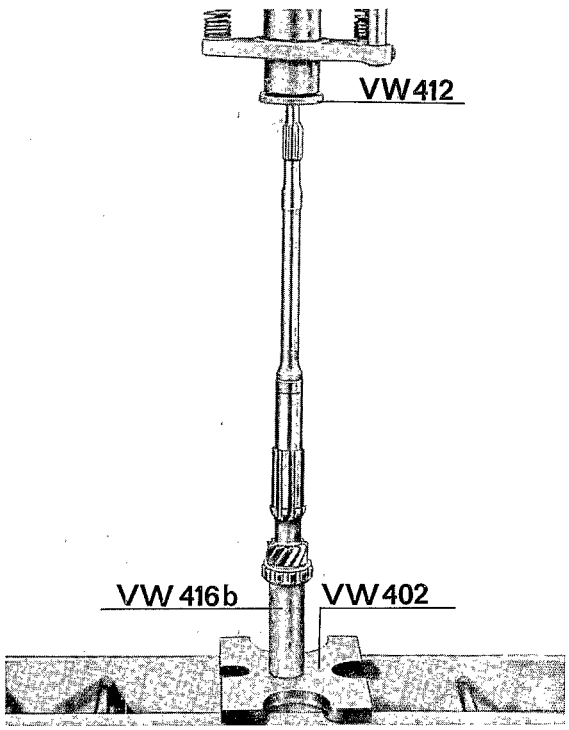
4. Press roller bearing off input shaft with thrust tube VW 415a and press punch VW 407.



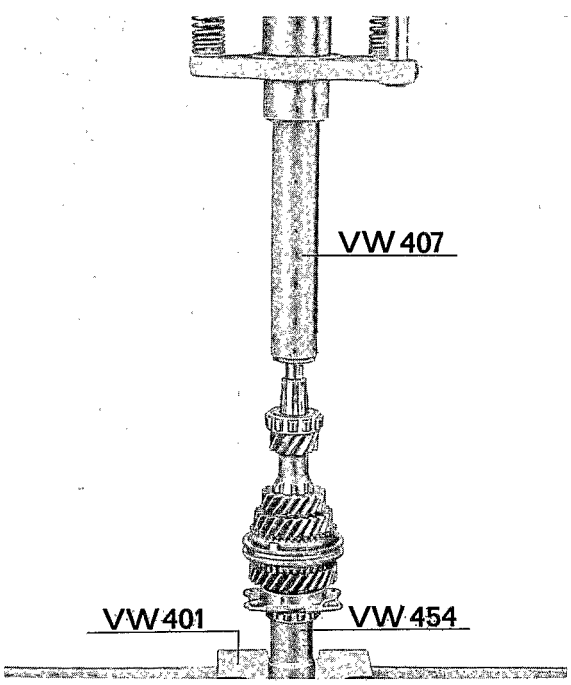
Assembling

Caution
Assemble all input shaft parts dry. Make sure oil does not enter between the contact surfaces.

1. Press roller bearing on with thrust disc VW 412 and press thrust tube VW 416b.



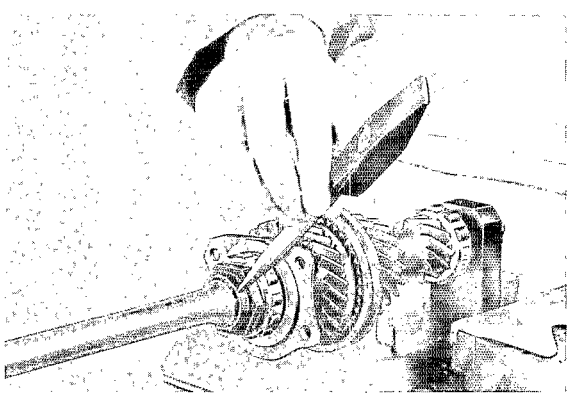
2. Press roller bearing on with thrust plate VW 401 and thrust tube VW 454 and press punch VW 407.



Caution
When reinstalling needle bearings and races, make sure they are not interchanged with those of another gear.

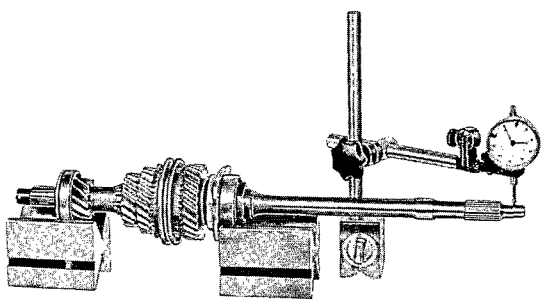
3. Torque flange nut to specification with special tool P 355a and P 252a.

4. Rock flange nut in place with center punch.



Always check input shaft for runout when it is fully assembled and the flange nut torqued to proper specification.

1. Remove the input shaft outer bearing races from the transmission and final drive housings and place them on the pinion shaft (substitute bearings can be used).

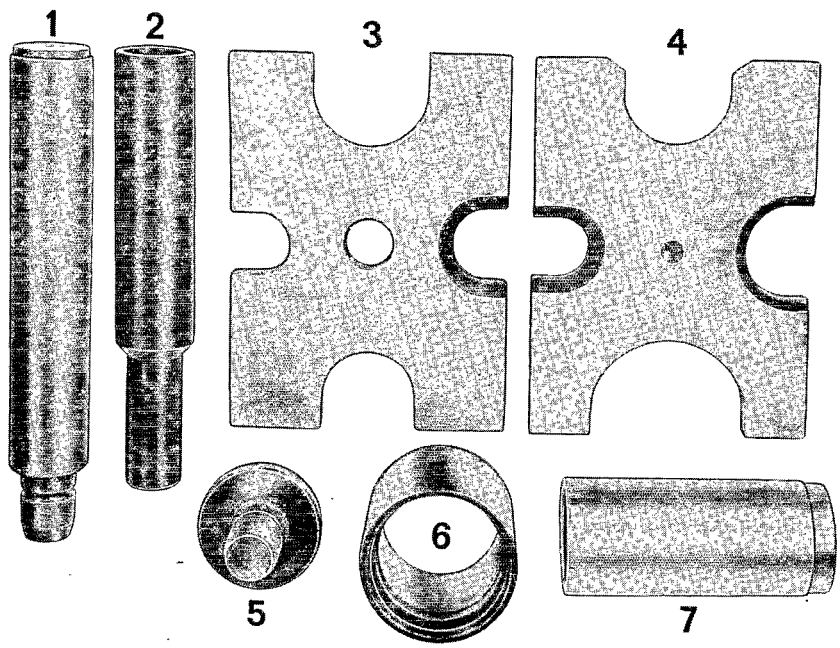


2. Place assembled pinion shaft with bearing outer races on V-blocks VW 406. Check for runout as shown in illustration. Maximum runout = 0.1 mm (0.004 in.).

3. The input shaft can be straightened while cold if the runout does not exceed 0.3 mm (0.012 in.). Use press with V-blocks VW 406 and press punch VW 405.

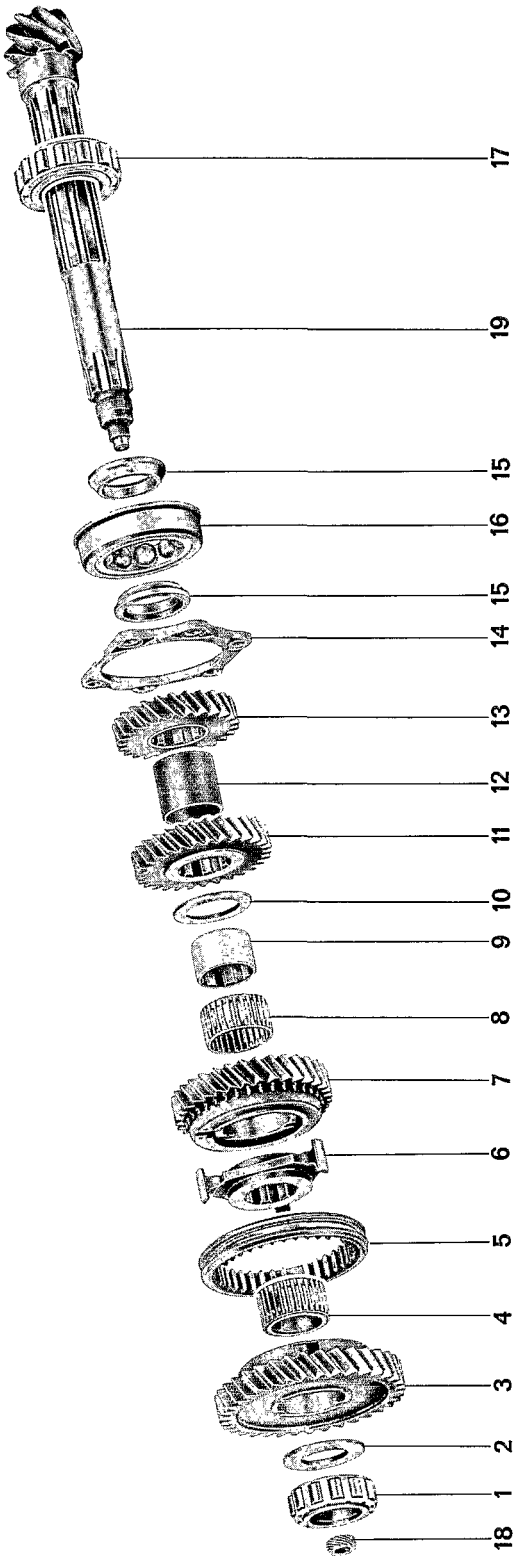
DISASSEMBLING AND ASSEMBLING PINION SHAFT

TOOLS



Nr.	Description	Special Tool	Remarks
1	Press punch	VW 407	
2	Thrust sleeve	VW 244b	
3	Thrust plate	VW 401	
4	Thrust plate	VW 402	
5	Thrust disc	VW 412	
6	Thrust tube	P 255a	
7	Thrust tube	VW 415a	

Disassembling and Assembling Pinion Shaft



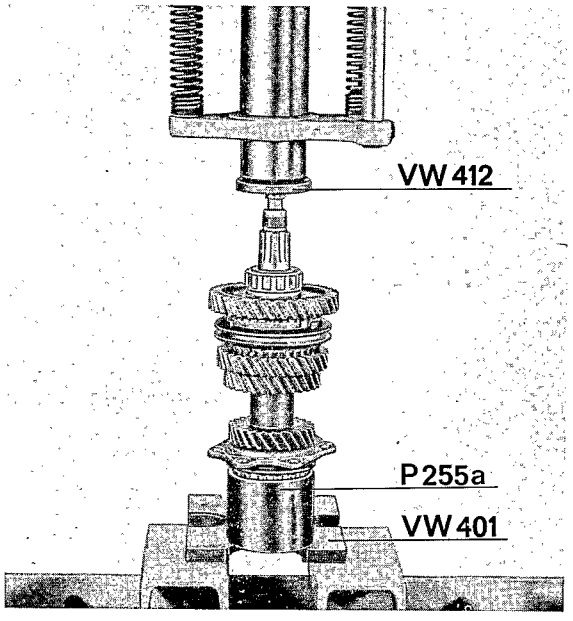
Nr.	Description	Qty.	Note when Removing	Note when Installing	Special instructions see
1	Roller bearing	1	Press off pinion shaft with VW 401, VW 412, and P 255 a.	Press on with VW 407 and VW 415 a.	
2	Thrust washer	1			
3	1st speed	1		Check synchronization. Replace only in pairs.	From 1977 Models with asymmetric tooth point of clutch body
4	Needle bearing	1	Fasten to respective gear with mechanic's wire.	Make sure bearings have not been interchanged.	
5	Shift sleeve	1		Check for wear..	From 1977 Models with asymmetric tooth point of 1st gear. Note direction of installation (see Page 3.1-7/6)
6	Synchro hub	1		Check for wear.	From 1977 Models reinforced
7	2nd speed	1		Check synchronization. Replace only in pairs.	3.1 - 8/4
8	Needle bearing	1	Fasten to respective gear and race with mechanic's wire.	Make sure bearings have not been interchanged.	
9	Needle bearing race	1	Fasten to respective gear and bearing with mechanic's wire.	Make sure races have not been interchanged.	
10	Thrust washer	1			
11	3rd speed	1		Large, smooth surface must face thrust washer. Replace only in pairs.	
12	Spacer bushing	1			

Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
13	4th speed	1		Large, smoothly ground surface faces four-point bearing. Replace only in pairs.	
14	Clamping plate	1			
15	Bearing inner race	2	Press off with VW 401, VW 412, and P 255a.	Heat to approx. 120°C (250°F) and drive on.	
16	Four-point bearing	1		Check for wear.	
17	Roller bearing	1	Press off with VW 401, VW 412, and P 255a.	Press on with VW 407 and VW 415a.	3.1-7/5
18	Speedometer drive, Gear I	1	Remove with puller.	Heat to approx. 120°C (250°F) and drive on.	3.1-7/5
19	Pinion shaft	1		Readjust if necessary.	5.1-4/1

DISASSEMBLING AND ASSEMBLING PINION SHAFT

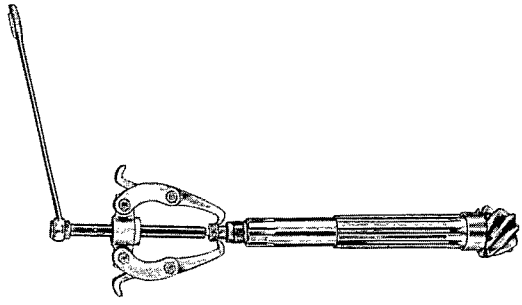
Disassembling

1. Press roller bearing off pinion shaft with thrust plate VW 401, disc VW 412, and tube P 255a.



2. Remove components from pinion shaft. Wire needle bearings and races to respective gears to prevent interchanging of parts during re-assembly.

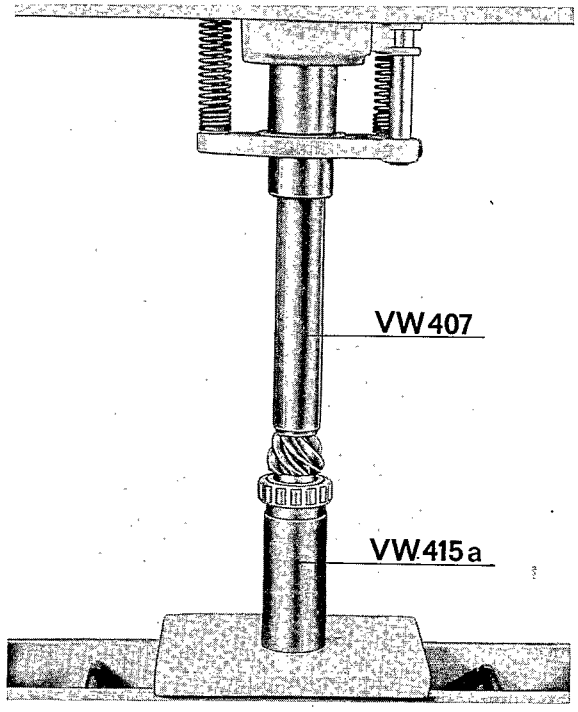
3. Remove speedometer drive Gear I.



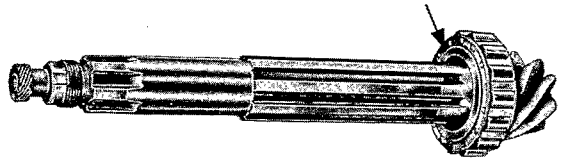
Assembling

Assemble all pinion shaft parts dry. Make sure that no oil enters between the contact surfaces. Pinion shaft and ring gear are marked with paired numbers. Check that these numbers match before assembling.

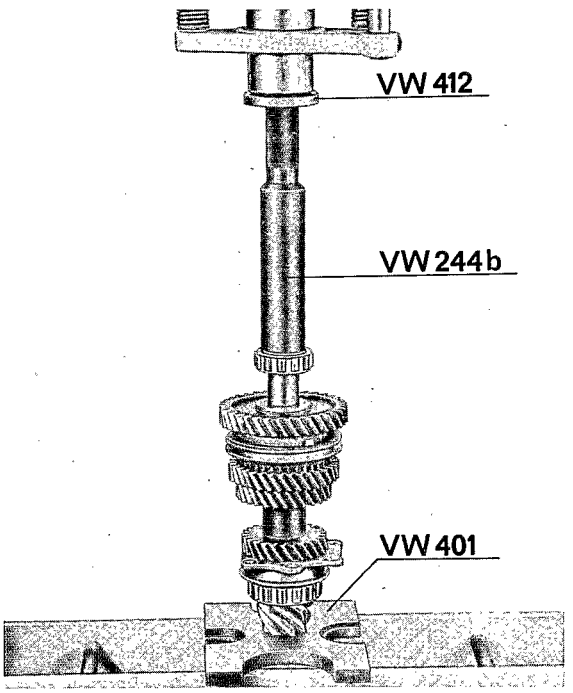
1. Press roller bearing on with press punch VW 407 and tube 415a.



Note
Install bearing so that the ring of the two part roller cage faces the gears.



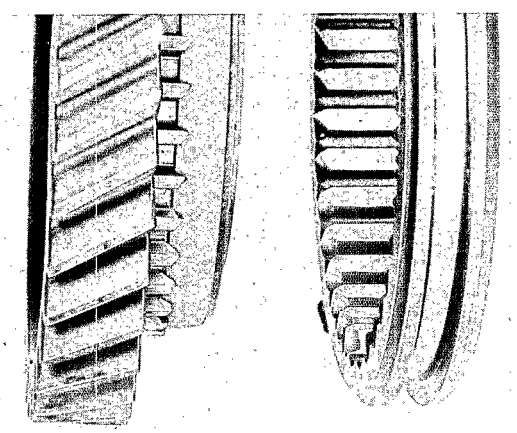
2. Press small roller bearing on pinion shaft using thrust disc VW 412 and thrust sleeve VW 244b.



3. Heat speedometer drive gear I to 120°C (250°F) and drive on.

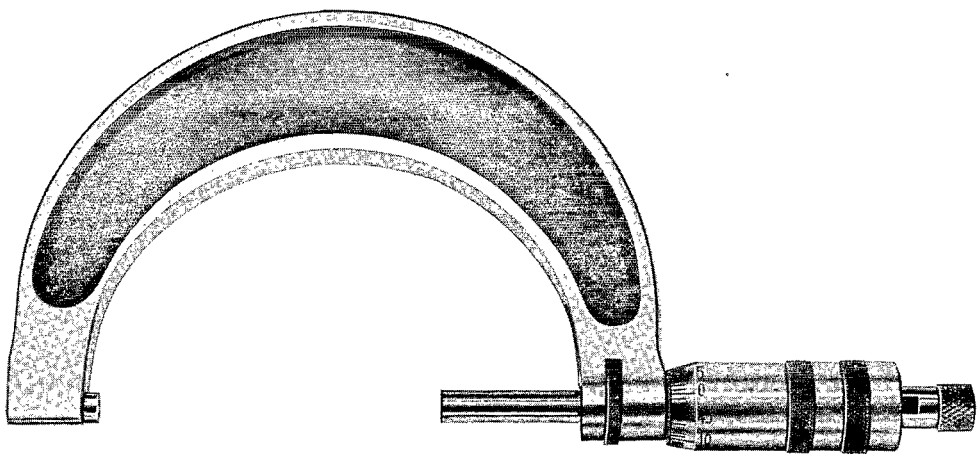
Modifications from 1977 Models

The asymmetrical pointed teeth of 1st/2nd gear operating sleeve must face toward 1st gear wheel.



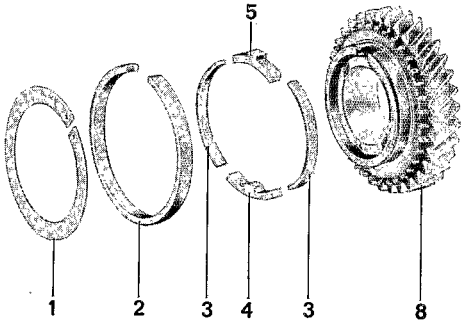
DISASSEMBLING AND ASSEMBLING SYNCHRONIZERS

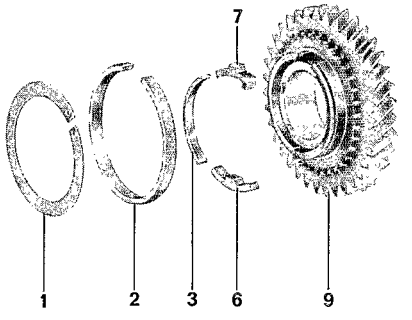
TOOLS



Nr.	Description	Special Tool	Remarks
	Micrometer	-	Size: 75-100 mm

Disassembling and Assembling Synchronizers



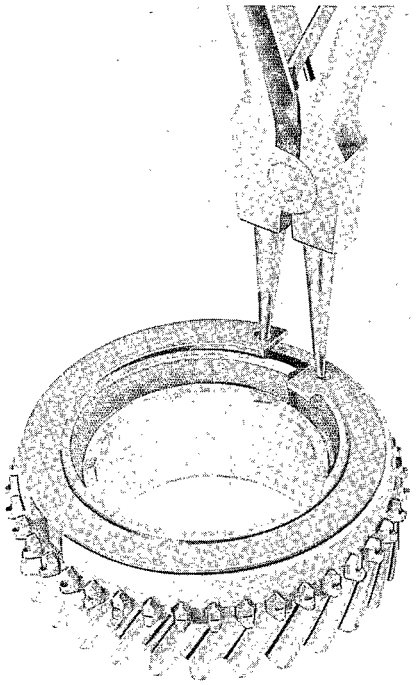


Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
1	Circlip	1	Remove with pliers.	Install with pliers.	
2	Synchronizing ring	1		Check for wear.	
3	Brake band, only 1 for 1st speed	2		Place on proper side in 1st speed.	3.1-8/3
4	Brake band anchor block, 2nd speed	1			
5	Thrust block, 2nd speed	1			
6	Brake band anchor block, 1st speed	1		Position properly.	3.1-8/3
7	Thrust block, 1 st speed	1		Position properly.	3.1-8/3
8	Gear, 2nd speed	1			
9	Gear, 1st speed	1			

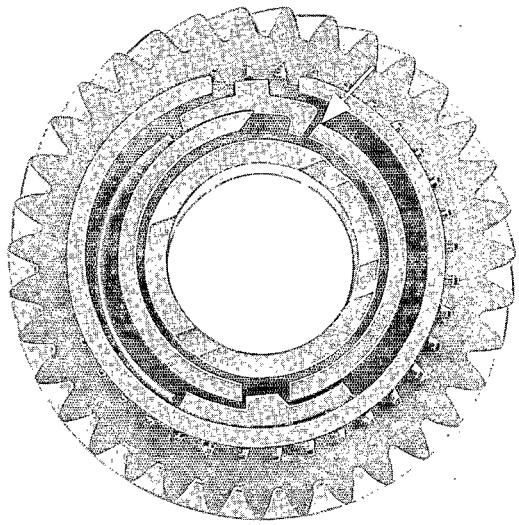
DISASSEMBLING AND ASSEMBLING SYNCHRONIZERS

Disassembling

1. Remove the circlip from the gear. Check all parts for wear and damage and replace as necessary.

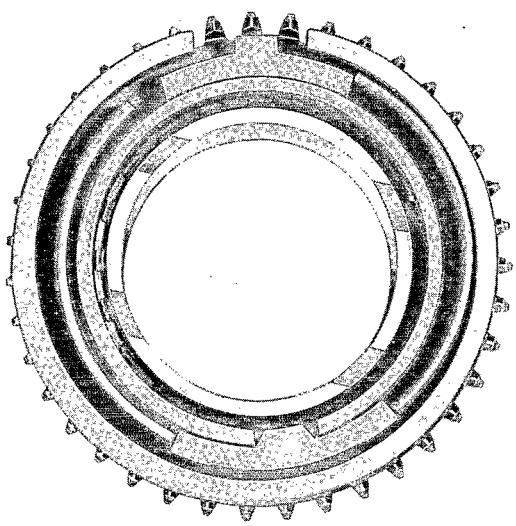


2. When assembling the 1st gear synchronizer, make sure to install only one brake band (see illustration).



Assembling

1. Place synchronizing ring on clutch carrier. Make sure rough ring surface faces the shift sleeve. Insert thrust block, anchor block, and brake band(s).

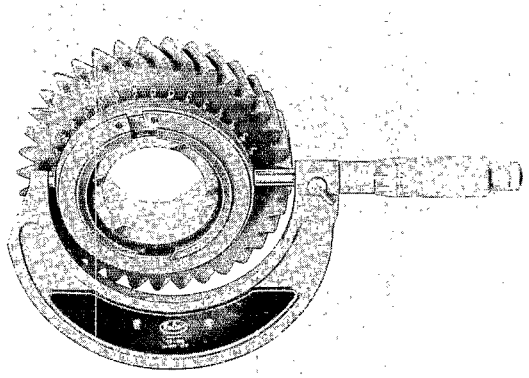


Note
Clutch carrier and brake band energizer have matching contour and must be installed in such positions (see arrow).

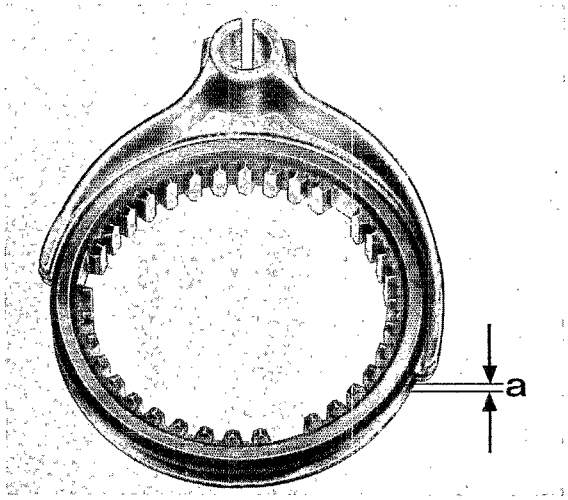
3. Install retaining ring with retaining ring plier.

Checking

1. Using a micrometer, check diameter of installed synchronizing ring. Place micrometer at the highest point of the synchronizing ring.



2. Maximum clearance between selector fork and shifting sleeve of 1st through 5th speed: Dimension a = 0.5 mm (0.02 in.).



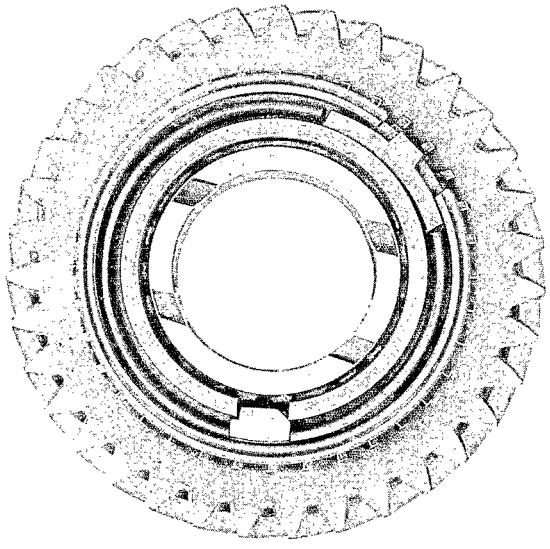
Diameter:

3rd, 4th, and 5th speed = 76.3 ± 0.18 mm
1st and 2nd speed = 86.37 ± 0.17 mm

MODIFICATIONS - 1977 MODELS

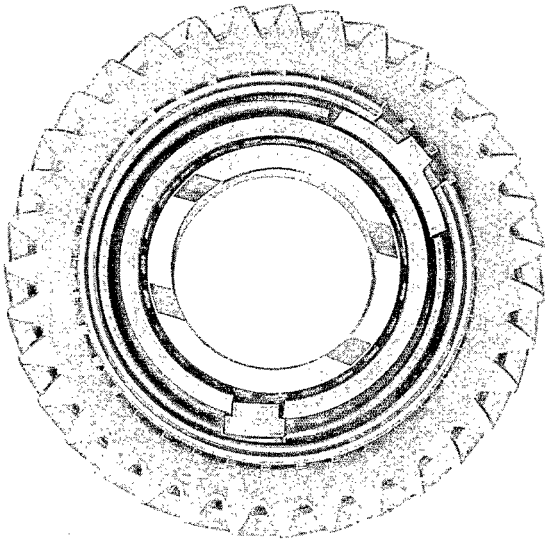
The synchronization for 1st and 2nd gears has been modified on the 1977 Models.

1. 1st gear synchronizing parts.

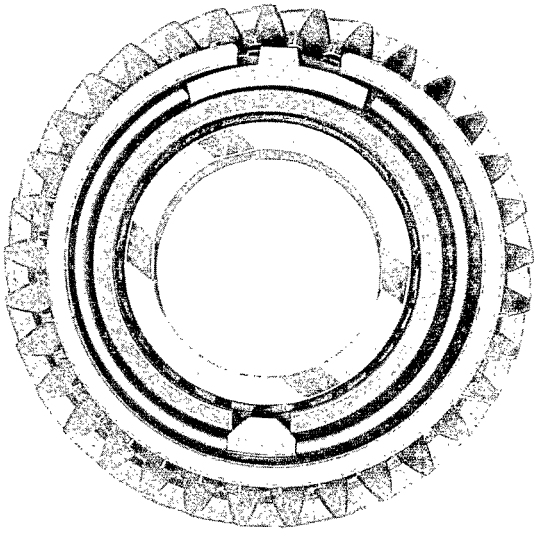


Note

An altered anchor block (see photo) will be introduced later for 1st gear.



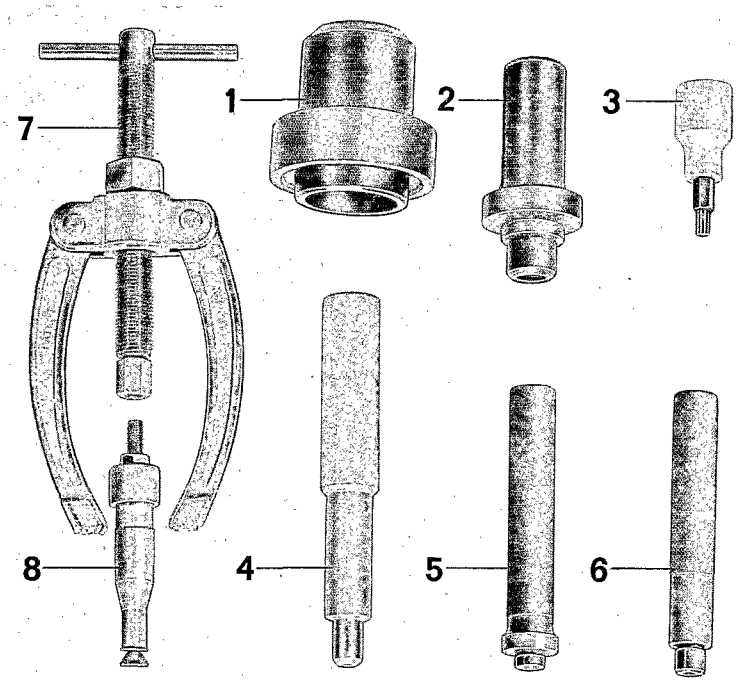
2. 2nd gear synchronizing parts.



3. The installation diameter of the synchronizing rings has not been changed (see Page 3.1 - 8/4).

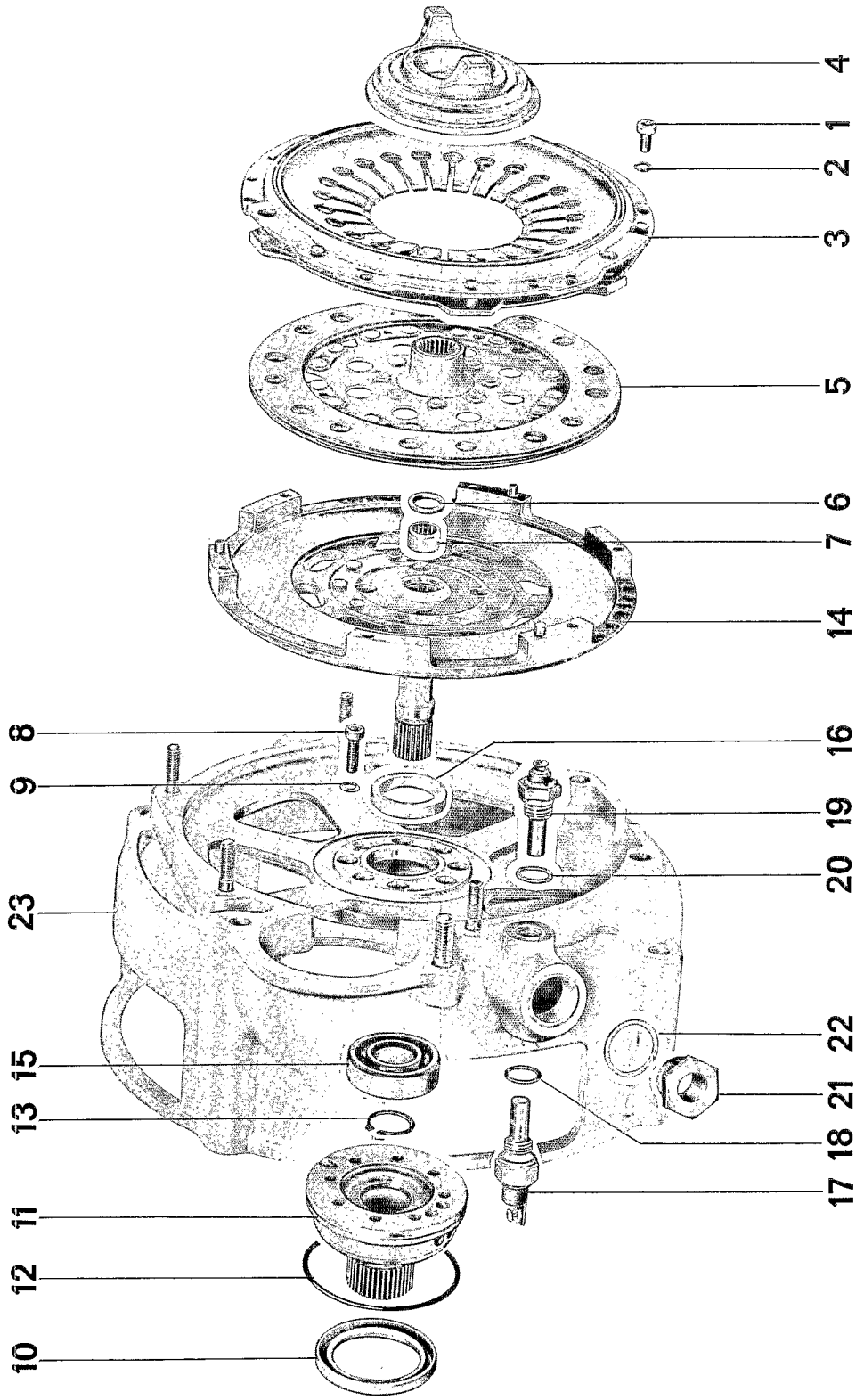
DISASSEMBLING AND ASSEMBLING TORQUE CONVERTER HOUSING

TOOLS



Nr.	Description	Special Tool	Remarks
1	Installer	P 358 a	
2	Installer	P 359	
3	Socket, 6 mm, 12-point	US 103 C	
4	Centering mandrel	P 370	
5	Mandrel	P 362	
6	Mandrel	P 361	
7	Support	---	Local purchase item
8	Internal puller	---	Local purchase item

Disassembling and Assembling Torque Converter Housing

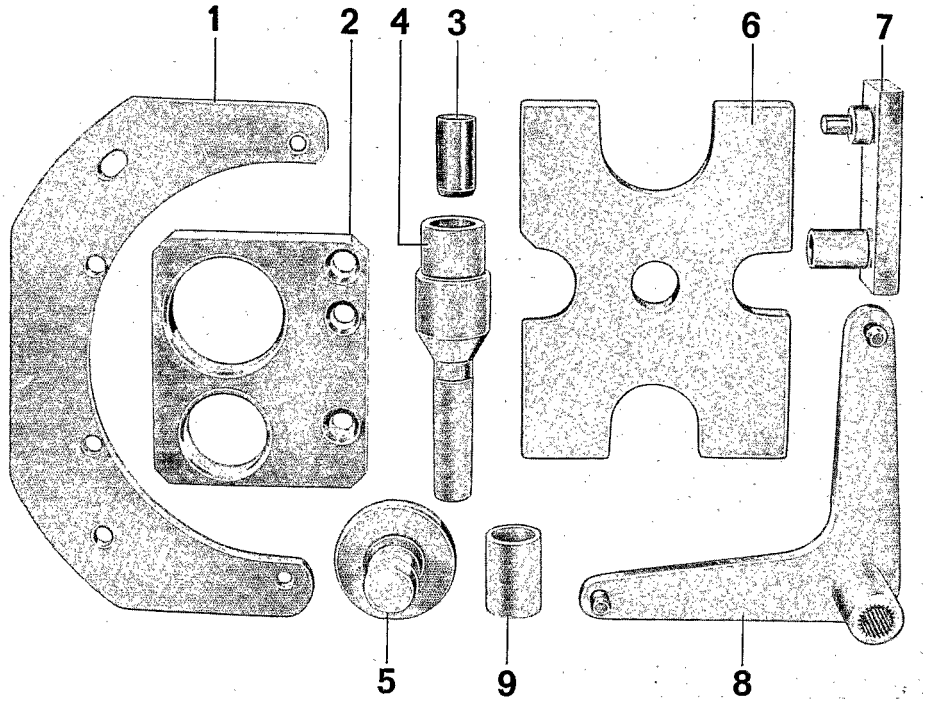


Nr.	Description	Qty.	Note when removing	Note when installing	Special instructions see
1	Socket-head bolt	6	loosen evenly in criss-cross pattern	Tighten evenly in criss-cross pattern to specified torque.	
2	Lock washer	6		Replace if necessary.	
3	Pressure plate	1		Check wear.	
4	Throwout bearing	1		Do not wash in solvents, only dry wipe.	
5	Clutch disc	1		Check wear, check free movement on splines between clutch plate and input shaft.	
6	Oil seal	1	Remove with puller	Install with P 362.	
7	Needle bearing	1	Remove with puller	Install with P 362, lubricate with a mixture of multi-purpose grease and Molykote type lubricant.	
8	Socket-head bolt	8		Tighten evenly to specified torque.	
9	Oil seal	8		Replace.	
10	Oil seal	1	Remove together with freewheeling support	Oil torque converter seating surface, drive in with P 358a.	
11	Stator support	1		Using two (6x60) bolts, drive out with alternating forces applied from turbine shaft side.	
12	0-ring	1		Oil lightly	
13	Snap ring	1		Replace. Check seating.	
14	Turbine shaft	1	Drive out. Assure firm support under torque converter housing.	Check wear.	
15	Ball bearing	1	Drive out with punch.	Heat torque converter housing to 120°C, drive in with P 359.	

Nr.	Description	Qty	Note when removing	Note when installing	Special instructions see
16	Oil seal	1	Push out with screwdriver.	Oil torque converter seating surface, drive in with P 359.	
17	Temperature switch	1		Tighten to correct torque.	
18	Oil seal	1		Replace	
19	Temperature sender	1		Tighten to correct torque.	
20	Oil seal	1		Replace	
21	Threaded coupling	1		Tighten to correct torque.	
22	Oil seal	1		Replace	
23	Torque converter housing	1			

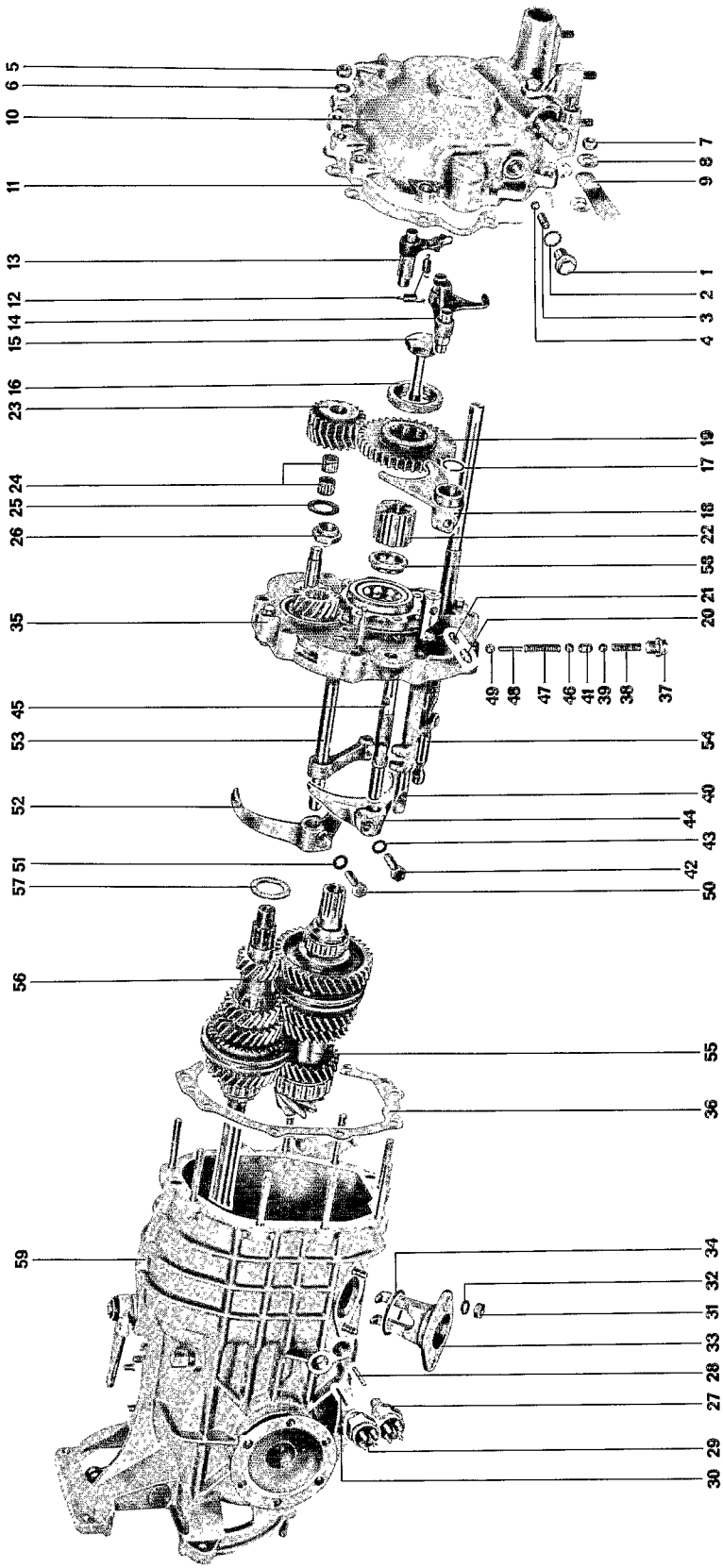
DISASSEMBLING AND ASSEMBLING TRANSMISSION

TOOLS



Nr.	Description	Special Tool	Remarks
1	Assembly plate	P 351	
2	Holding plate	P 260	
3	Sleeve	P 364	
4	Installer	P 360	
5	Thrust piece	VW 412	
6	Press plate	VW 401	
7	Remover	P 353a	
8	Input shaft holder	P 37	
9	Thrust sleeve	VW 426	

Disassembling and Assembling Transmission



Nr.	Description	Qty	Note when removing	Note when installing	Special instructions see
1	Cap screw	1		Tighten to correct torque.	
2	Oil seal	1		Replace	
3	Spring	1			
4	Ball, 9 mm	1			
5	Lock nut	9		Replace if necessary. Tighten to correct torque.	
6	Washer	9			
7	Lock nut	2		Replace if necessary. Tighten to correct torque.	
8	Washer	2		Place on ahead and one behind the ground strap.	
9	Ground strap	1			
10	Transmission front cover	1			
11	Gasket	1		Replace	
12	Spring	2			
13	Parking lock lever	1			
14	Parking lock pawl	1			
15	Expansion bolt	1	Engage 4th gear, block input shaft with P 37.	Oil contact surface. Tighten to correct torque. Ensure correct seating of speedometer drive gear.	4.1 - 2/9
16	Speedometer drive gear	1		Must still have clearance after expansion bolt has been tightened.	
17	Lock ring	1		Replace	

Nr.	Description	Qty	Note when removing	Note when installing	Special instructions see
18	Shift fork for reverse gear	1	Push detent pin in. Remove with selector gear.	Check wear.	4.1 - 2/9
19	Reverse selector	1		Check wear.	
20	Detent pin	1		Small end faces out.	
21	Spring	1			
22	Splined bushing	1		Speedometer drive groove faces expansion bolt head.	
23	Reverse idler gear assembly	1		Check wear.	
24	Needle bearing cage	2		Check wear.	
25	Thrust needle bearing	1		Check wear.	
26	Flange nut	1		Tighten to correct torque, secure with center punch.	
27	Bypass bridging	1		Tighten to correct torque.	
28	Plunger	1			
29	Backup light switch	1		Tighten to correct torque.	
30	Plunger	1			
31	Nut	2		Tighten to correct torque.	
32	Spring washer	2		Replace.	
33	Fork piece	1		Insert only when no gear is engaged.	
34	0-ring	1		Oil lightly.	
35	Immediate plate	1	Pull off studs with components in items 37-58.		

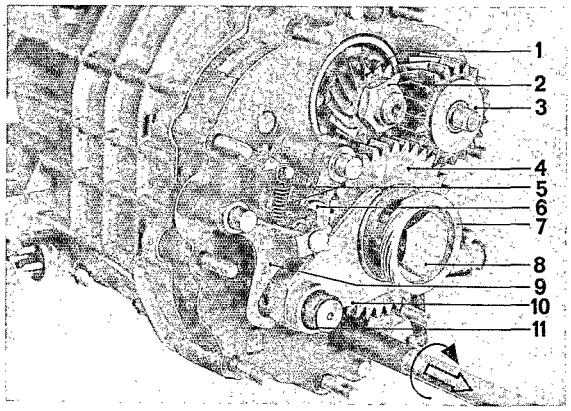
Nr.	Description	Qty	Note when removing	Note when installing	Special instructions see
36	Gasket	X	Note quantity and thickness.	Recalculate if necessary.	
37	Plug	1		Tighten to correct torque.	
38	Spring	1			
39	Ball, 9 mm	3			
40	Reverse gear shift rod	1			
41	Detent	1			
42	Bolt	2		Tighten to correct torque	
43	Spring washer	2		Replace.	
44	Shift fork, 1st and 2nd gear	1	Mark for reassembly	Check wear.	
45	Shift rod, 1st and 2nd gear	1		Adjust.	
46	Ball, 9 mm	3			
47	Spring	1		Insert large detent with some grease, install spring and pin together with spring.	
48	Detent (large)	1			
49	Ball, 9 mm	3			
50	Bolt	2		Tighten to correct torque.	
51	Spring washer	1		Replace.	
52	Shift fork, 3rd and 4th gear	1	Mark for reassembly.	Check wear, readjust.	
53	Shift rod, 3rd and 4th gear	1		Adjust.	
54	Shift fork rod and selector lever	1		Insert before installing intermediate plate.	

Nr.	Description	Qty	Note when removing	Note when installing	Special instructions see
55	Pinion shaft	1	Press out of intermediate plate with P 353a.		
56	Input shaft	1			
57	Spacer	1			
58	Bearing inner race half	1		Press in with VW 401, 412 and 426.	4.1 - 2/8
59	Transmission housing	1			

DISASSEMBLING AND ASSEMBLING TRANSMISSION

Disassembling

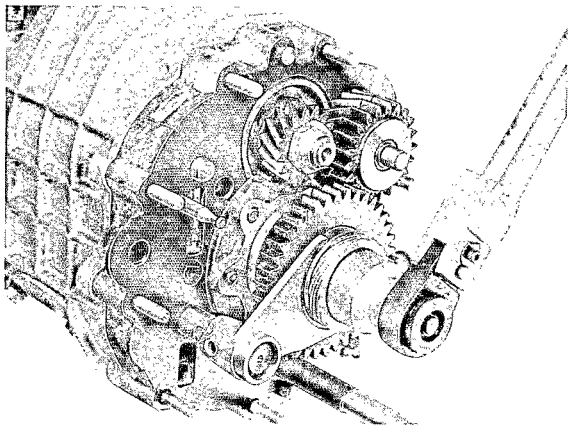
1. Engage 4th gear (turn shift rod to the right and pull outward).



1. Gear I, reverse gear
2. Flanged nut
3. Reverse idler gear assembly
4. Reverse selector gear
5. Parking lock springs
6. Speedometer drive gear
7. Speedometer drive gear
8. Expansion bolt
9. Parking lock lever
10. Shift fork, reverse gear
11. Snap ring

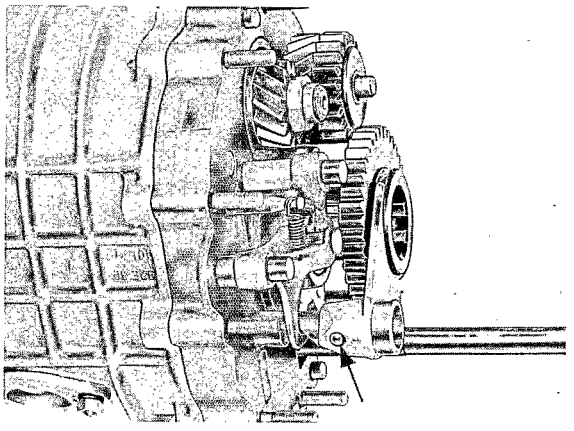
2. Detach parking lock springs, remove pawl and lever.

3. Lock input shaft with P 37 holder. Loosen pinion shaft expansion bolt and remove together with speedometer drive gear.



4. Remove snap ring from reserve gear shift rod and parking lock.

5. Remove selector gear and shift rod for reverse gear; this requires pushing the detent pin in.



6. Remove splined bushing.

7. Remove reverse idler gear assembly together with needle bearing cages and thrust needle bearing cage.

8. Remove input shaft flanged nut.

9. Remove bypass (bridging) switch and backup light switch. Pull out both contact plungers.

10. Withdraw gear assembly and intermediate plate from transmission housing.

Caution

Note the quantity and thickness of gaskets for proper reassembly.

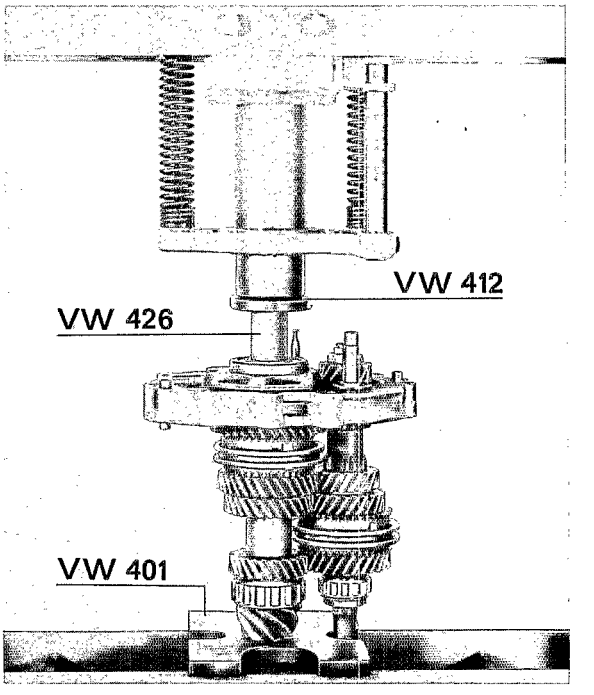
11. Using special tool P 353a, press pinion and input shafts out of the intermediate plate at the same time.

Assembling

1. Insert input shaft spacer, slide pinion and input shafts into the bearings of the intermediate plate and splines of Reverse Gear I respectively.

2. Hand tighten input shaft flanged nut.

3. Press bearing inner race half of the four-point bearing into position using special tool VW 401, VW 412 and VW 426.



4. Engage 4th speed.

5. Slide intermediate plate and gear assembly into transmission housing. Then using four spacer bushings on four of the studs, tighten intermediate plate in a criss-cross pattern.

6. Block input shaft with P 37 holder, slide splined bushing into place, and tighten expansion bolt (without speedometer drive gear) to correct torque.

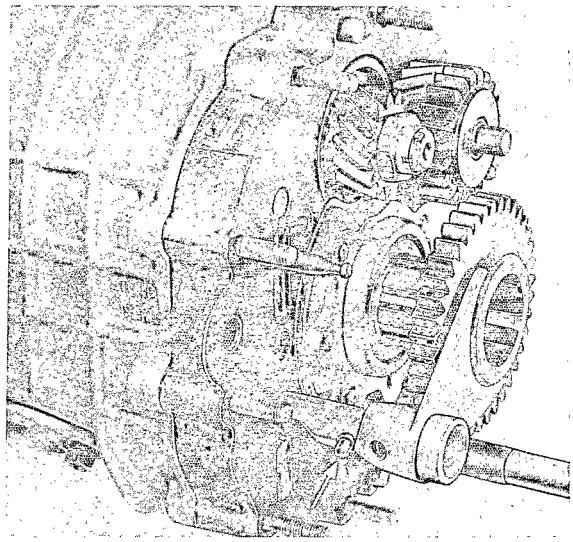
Note

The expansion bolt is later removed when installing selector gear and shift forks.

7. Remove intermediate plate with the assembled gears in order to install and adjust shift forks.

8. Assemble selector lever. Tapered hole in the shift rod must point in same direction as the selector lever.

9. Install reverse selector gear and shift fork. Detent pin in shaft rod for reverse gear and parking lock must be pushed in.



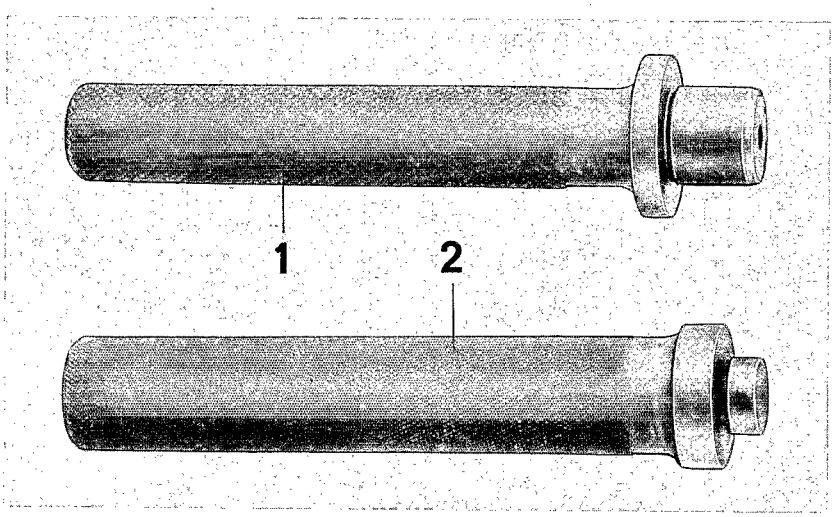
10. Remove pinion shaft expansion bolt and oil bolt head contact surface. Install bolt together with the speedometer drive gear. Make sure that the speedometer drive gear is properly seated on the end of the splined bushing.

11. Lightly coat the 0-ring for the selector lever guide fork with oil.

12. Place special tool P 364 on the input shaft. Position the oil seal so the sealing lip is toward the transmission. Then drive the seal in place with special tool P 360 until the tool bottoms.

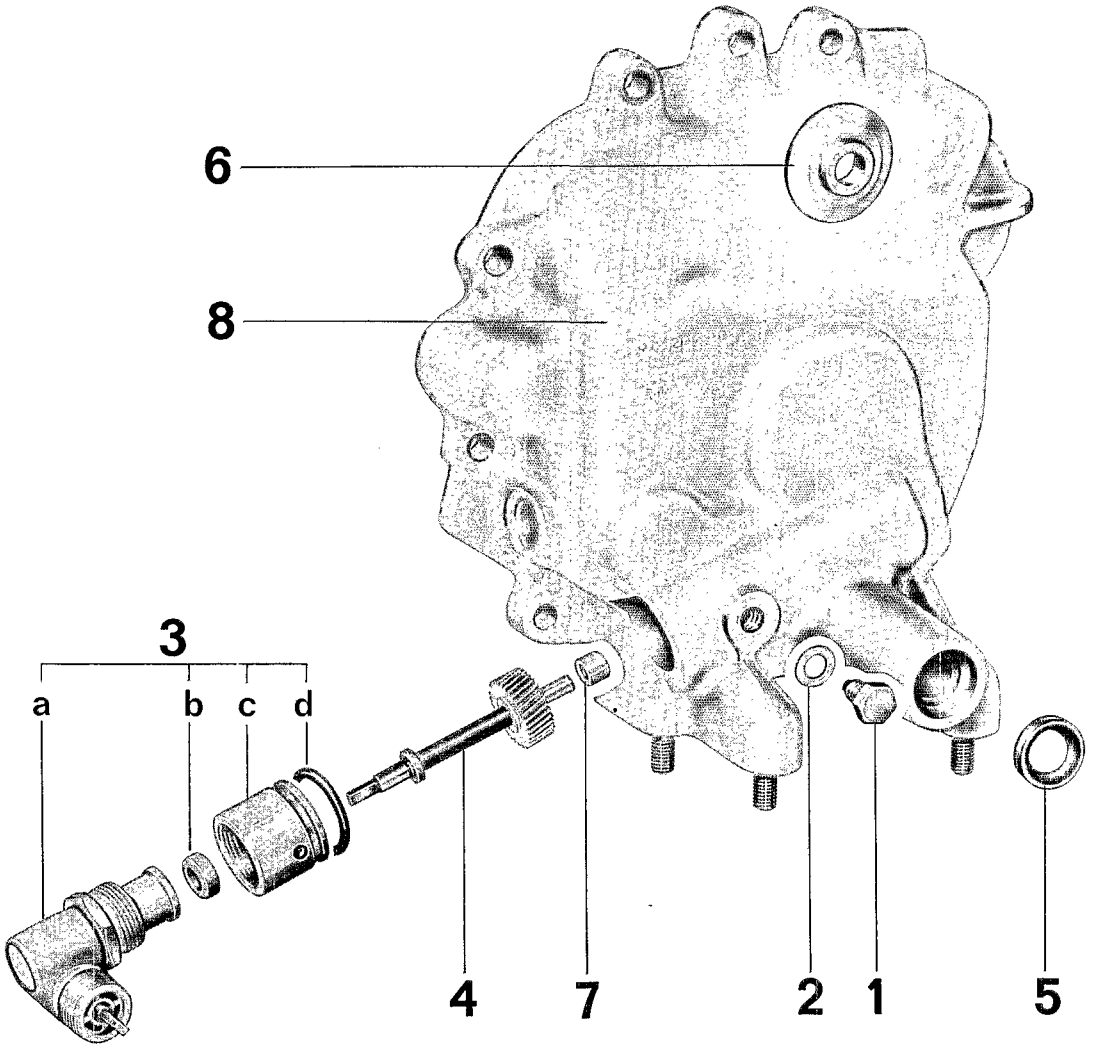
DISASSEMBLING AND ASSEMBLING TRANSMISSION FRONT COVER

TOOLS



Nr.	Description	Special Tool	Remarks
1	Mandrel	P 218	
2	Mandrel	P 362	

Disassembling and Assembling Transmission Front Cover

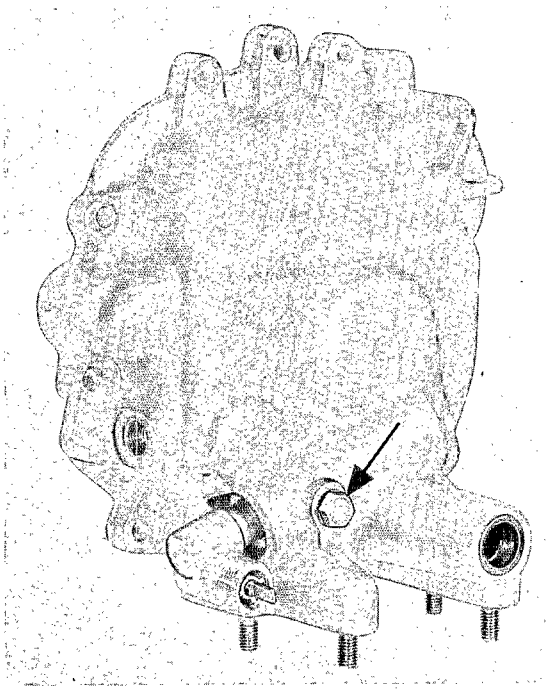


Nr.	Description	Qty	Note when removing	Note when installing	Special instructions see
1	Speedometer drive retaining bolt	1		Tighten to specified torque.	
2	Washer	1			
3	Speedometer drive (complete)	1		Blind hole in guide bushing lines up with hole in cover.	
3a	Elbow adapter	1			
3b	Seal	1		Replace if necessary.	
3c	Guide bushing	1			
3d	0-ring	1		Oil lightly.	
4	Gear shaft	1			
5	Seal	1		Drive in with P 218.	4.1 - 3/5
6	Thrust washer	1	Heat cover to approx. 120° C (250° F) on a hot plate and pry out.	Drive in to bottom with P 362.	
7	Bushing	1	Heat cover to approx. 120° C (250° F) on a hot plate and pull out. Drill out if necessary.	Heat cover to approx. 120° C (250° F) and drive in with an appropriate mandrel.	
8	Transmission front cover	1			

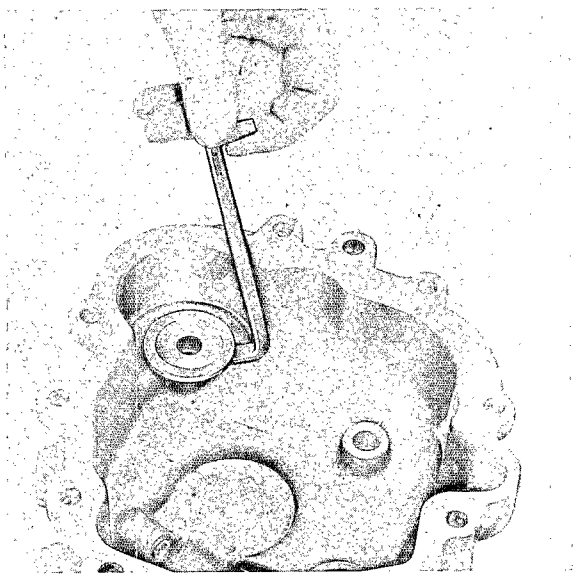
DISASSEMBLING AND ASSEMBLING

Disassembling

1. Remove speedometer drive retaining bolt, pull out elbow adapter and gear shaft.



2. Pry out thrust washer for reverse idler gear assembly by prying on both sides.

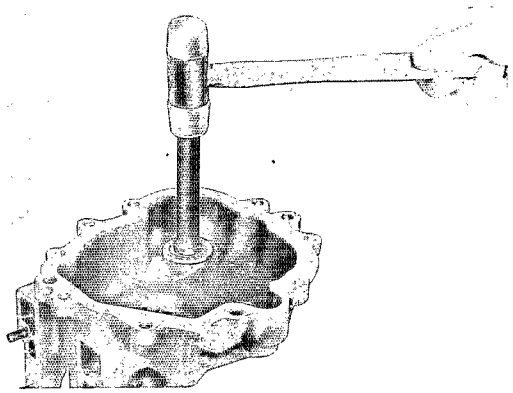


3. Heat transmission cover to approx. 120° C (250° F) on a hot plate. Pull out or drill out the gear shaft bushing.

Assembling

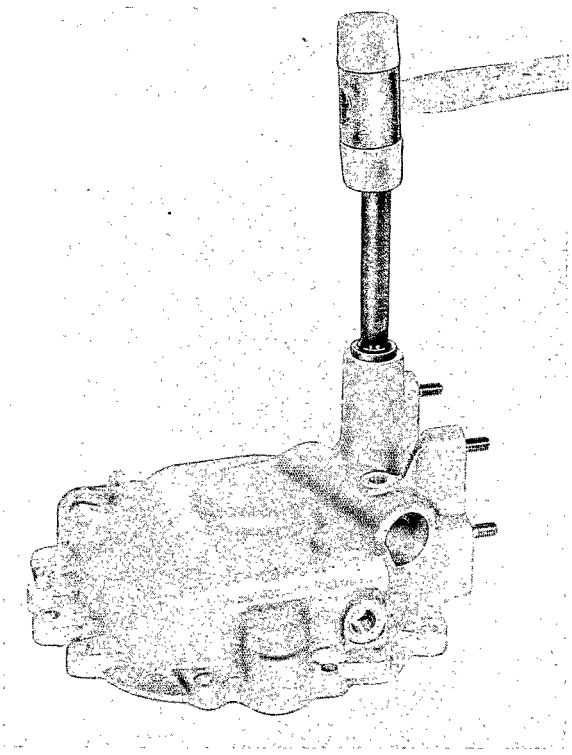
1. Heat transmission cover to approx. 120° C (250° F) on a hot plate, drive gear shaft bushing in.

2. Drive the thrust washer for reverse idler gear in to bottom with special tool P 362.



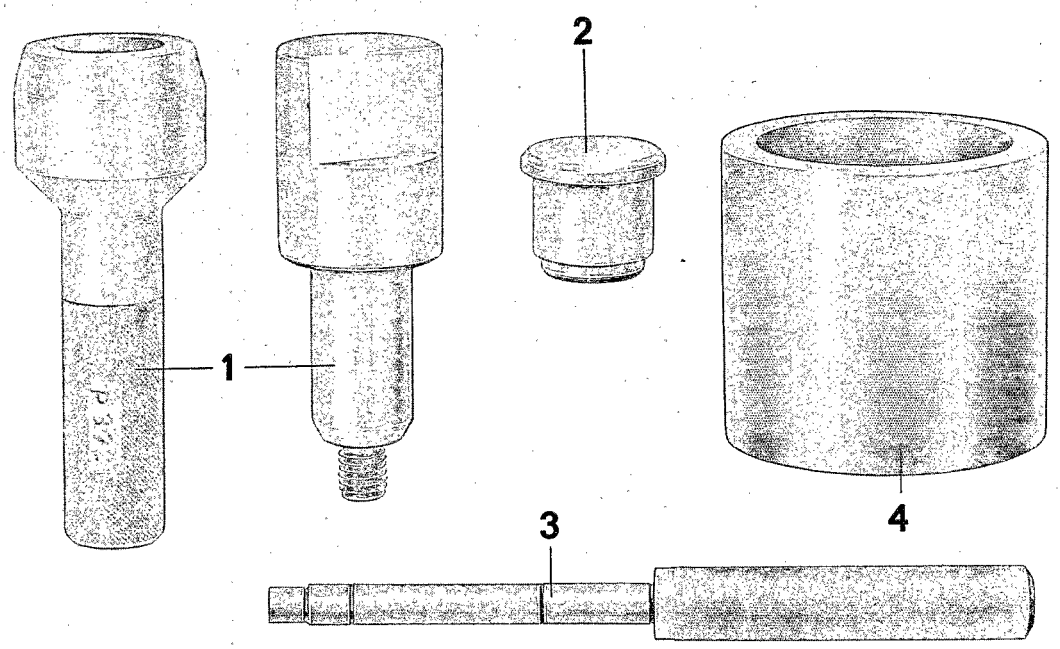
3. Insert elbow adapter. Blind hole in guide bushing must line up with hole in cover.

4. Install shift rod seal with special tool P 218.



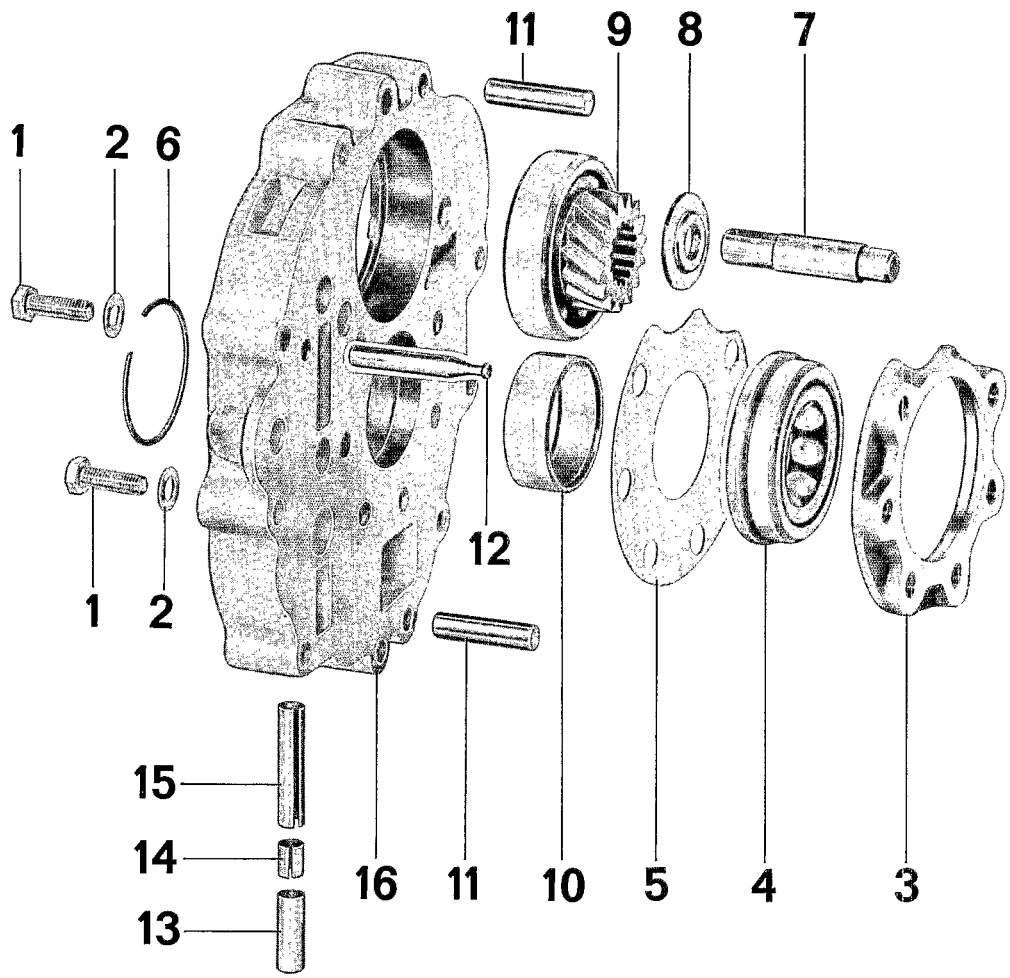
DISASSEMBLING AND ASSEMBLING INTERMEDIATE PLATE

TOOLS



Nr.	Description	Special Tool	Remarks
1	Centering mandrel	P 372	In 2 parts.
2	Thrust piece	P 371	
3	Installation arbor	P 262	
4	Guide sleeve	P 255	

Disassembling and Assembling Intermediate Plate



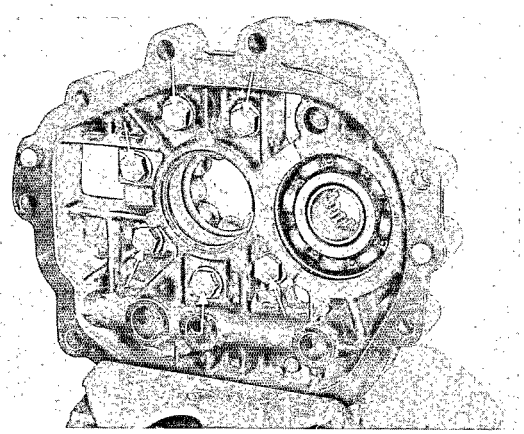
Nr.	Description	Qty.	Note when removing	Note when installing	Special instructions see
1	Bolt	6		Tighten to specified torque.	
2	Washer	6			
3	Clamping plate	1		Check helicoil inserts.	
4	Four-point ball bearing	1		Check wear. Align center with P 372.	4.1 - 4/6 4.1 - 4/7
5	Support plate	1		Position properly when installing.	
6	Snap ring	1	Remove with small screwdriver.		4.1 - 4/5
7	Shaft for reverse idler gear assembly	1	Heat intermediate plate to approx. 120° C (250° F) and press out.	Heat intermediate plate to approx. 120° C (250° F) and press in shaft. Make sure it is properly seated.	
8	Thrust washer	1		Stepdown side faces front cover.	
9	Grooved ball bearing with Gear I for reverse gear	1	Heat intermediate plate to approx. 120° C (250° F) and drive out with appropriate pipe section.	Heat intermediate plate to approx. 120° C (250° F) and drive in with appropriate pipe section.	
10	Roller bearing outer race	1	Heat intermediate plate to approx. 120° C (250° F) and drive out with appropriate pipe section.	Heat intermediate plate to approx. 120° C (250° F) and drive in with appropriate pipe section.	
11	Dowel	2	Heat intermediate plate to approx. 120° C (250° F) and press out.	Heat intermediate plate to approx. 120° C (250° F) and press in.	4,1 - 4/6
12	Spring anchor stud	1			

Nr.	Description	Qty.	Note when removing	Note when installing	Special instructions see
13	Bushing	1		Drive in with P 262.	4.1 - 4/6
14	Bushing	1		Drive in with P 262.	4.1 - 4/6
15	Bushing	1		Drive in with P 262.	4.1 - 4/6
16	Intermediate plate	1			

DISASSEMBLING AND ASSEMBLING INTERMEDIATE PLATE

Disassembling

1. Remove clamping plate retaining bolts (arrows).



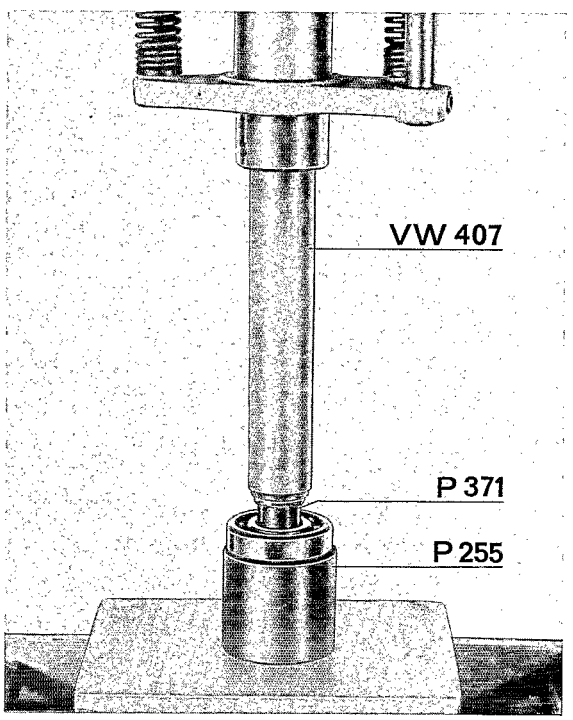
2. Using a small screwdriver, remove snap ring which retains roller bearing outer race.

Note

The snap ring may bind in the groove. Therefore, relieve binding pressure by tapping the bearing outer race away from the snap ring.

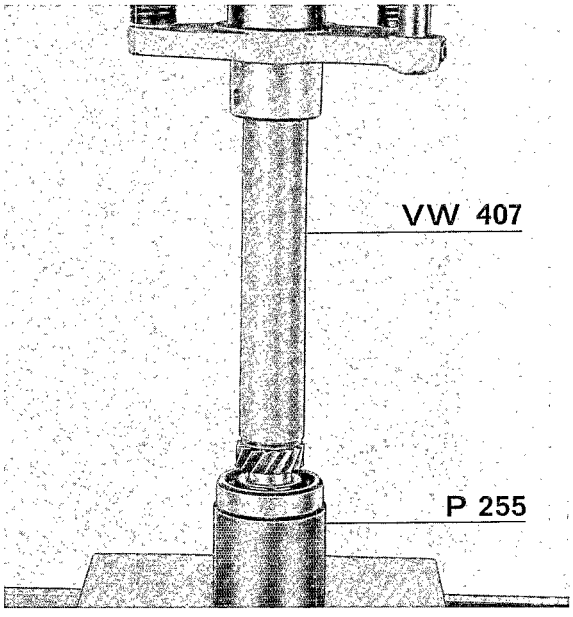
3. Heat intermediate plate to approx. 120° C (250° F) and press or drive the parts out.

4. Using special tools P 371 and P 255, press Gear I for reverse gear off grooved ball bearing.



Assembling

1. Using special tools VW 407 and P 255, press Gear I for reverse gear into grooved ball bearing.



Note

When installing the bushings, make sure, the bushings do not protrude into the guide bores of shift rods.

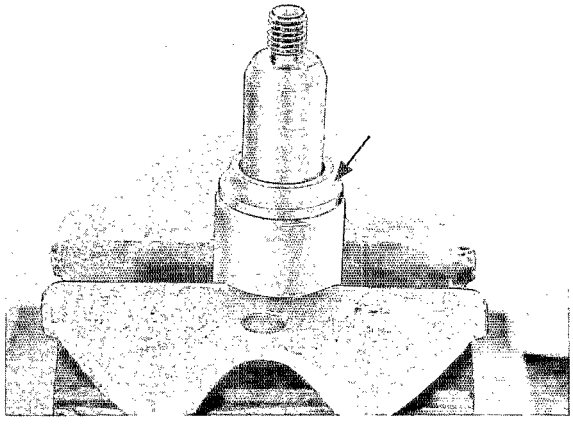
2. Using special tool P 262, drive bushings for shift detents in.
   a) Drive long bushing in until mandrel bottoms.
   b) Drive short bushing in to the second mark on the mandrel.
   c) Drive the medium size bushing in to the first mark on the mandrel.

3. Heat intermediate plate to approx. 120° C (250° F) and press or drive the parts in.

4. Press dowel pins in. They must protrude approx. 5.5 mm (0.22 in.) on each side of the intermediate plate.

5. Install clamping plate together with four-point bearing and support plate.

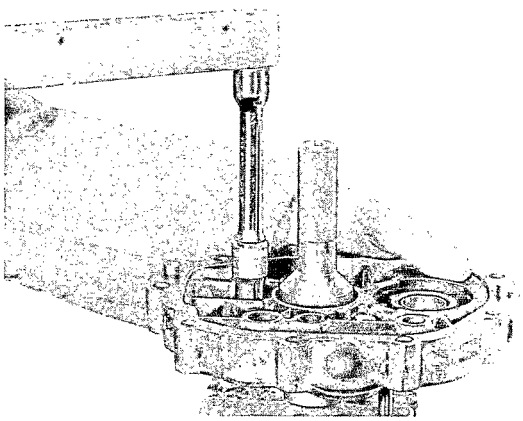
6. Mount receptacle from special tool P 372 in vise and place bearing inner race of four-point bearing on it.



Note

To center the bearing, use bearing inner race of the four-point bearing which should be pressed off the pinion shaft. A spare bearing inner race can be used for this purpose.

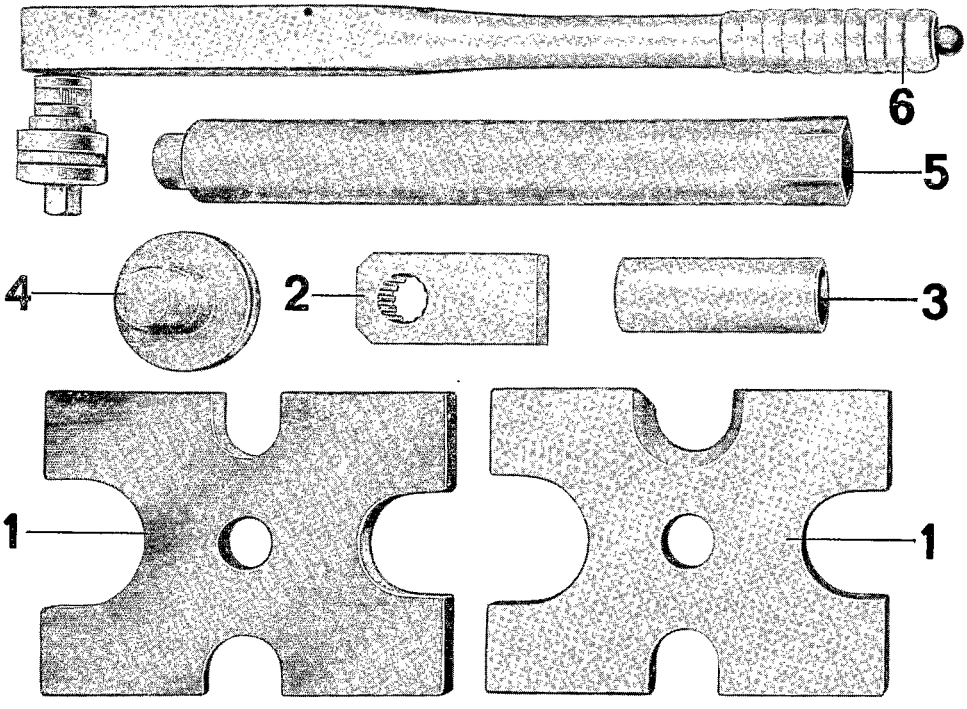
7. Place intermediate plate on top, insert second bearing inner race, and center four-point bearing with P 372.



8. Tighten bolts to correct torque.

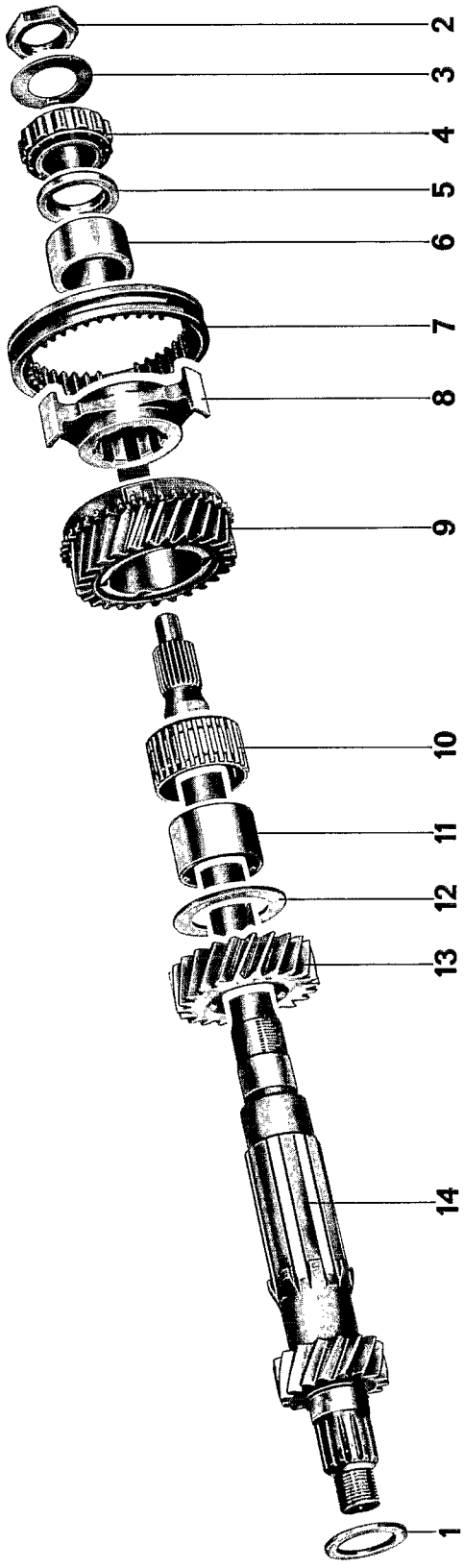
MAIN SHAFT

TOOLS



No.	Description	Special Tool	Remarks
1	Plate	VW 401	
2	Holder	P 376	
3	Thrust tube	VW 416 b	
4	Thrust disc	VW 412	
5	Socket wrench	P 252	
6	Torque wrench	-	Local purchase

DISMANTLING AND ASSEMBLING

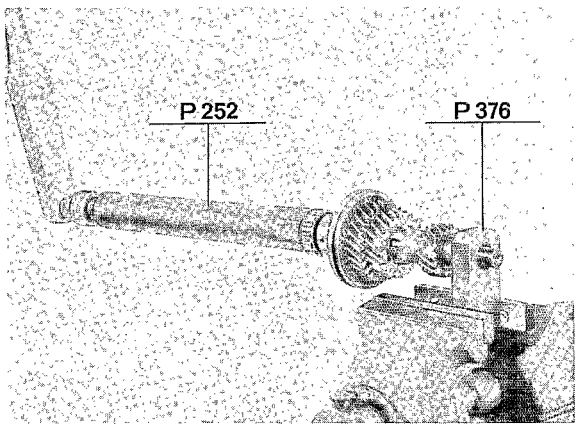


No.	Description	Qty.	Notes		Remarks
			Removal	Installation	
1	Spacer (2.6 mm thick)	1			
2	Nut	1	Unlock and loosen with P 252	Torque to specifications	
3	Lockplate	1		Replace	
4	Roller bearing	1	Press off VW 401 and VW 412	Install with VW 412, VW 416 b and VW 401	
5	Washer	1		Install correctly, bevel faces roller bearing	
6	Spacer	1			
7	Shift sleeve	1		Check for wear	
8	Shift sleeve guide	1		Check for wear	
9	3rd gear 27:25 V	1		Check synchronization; replace in pairs only	
10	Needle bearing	1	Mark for installation	Install with same gear	
11	Race, needle bearing	1	Mark for installation	Install with same gear	
12	Thrust washer (2 mm thick)	1			
13	2nd gear 22:29 M	1		Check for wear; replace in pairs only	
14	Main shaft with 1st gear 16:34 DA	1		Check runout, replace if necessary	

DISMANTLING AND ASSEMBLING INSTRUCTIONS

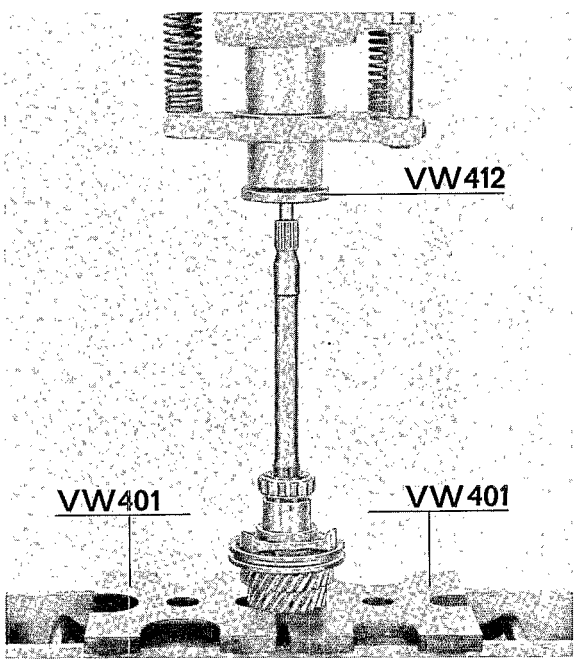
Dismantling

1. Clamp holder P 376 in a vise, install shaft and unlock nut.



2. Loosen nut with special tool P 252.

3. Remove roller bearing from shaft with special tools VW 401 and VW 412.

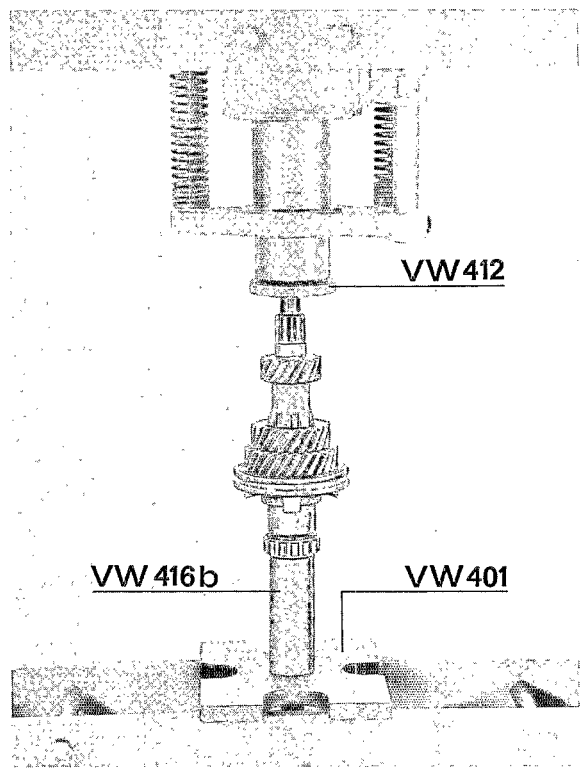


Assembling

Note

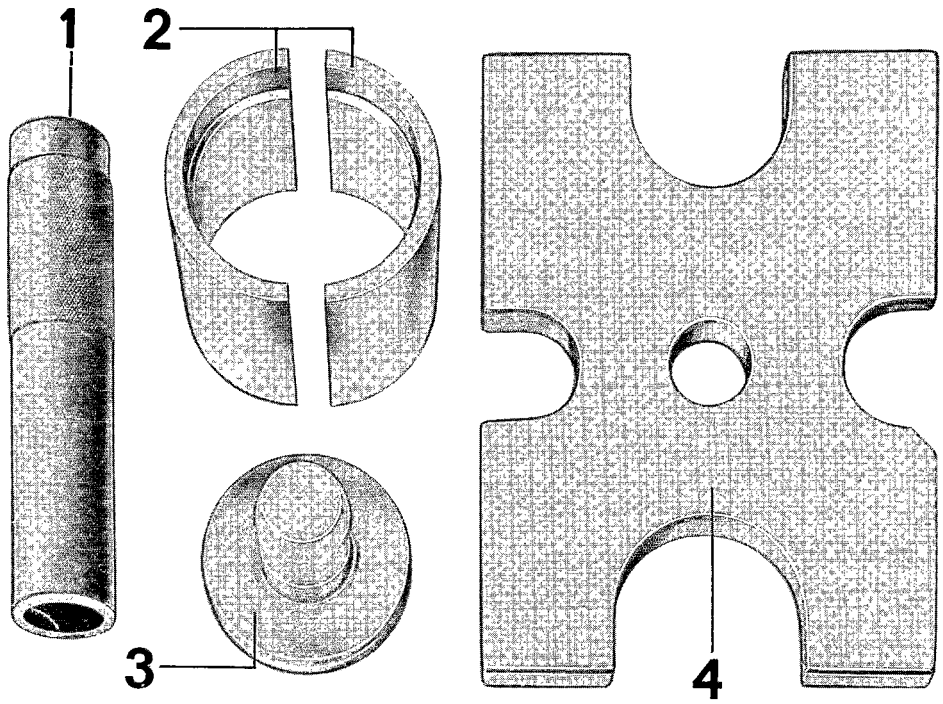
Before assembling, clean all shaft parts and dry.

1. Install roller bearing with special tools VW 412, VW 416 b and VW 401.



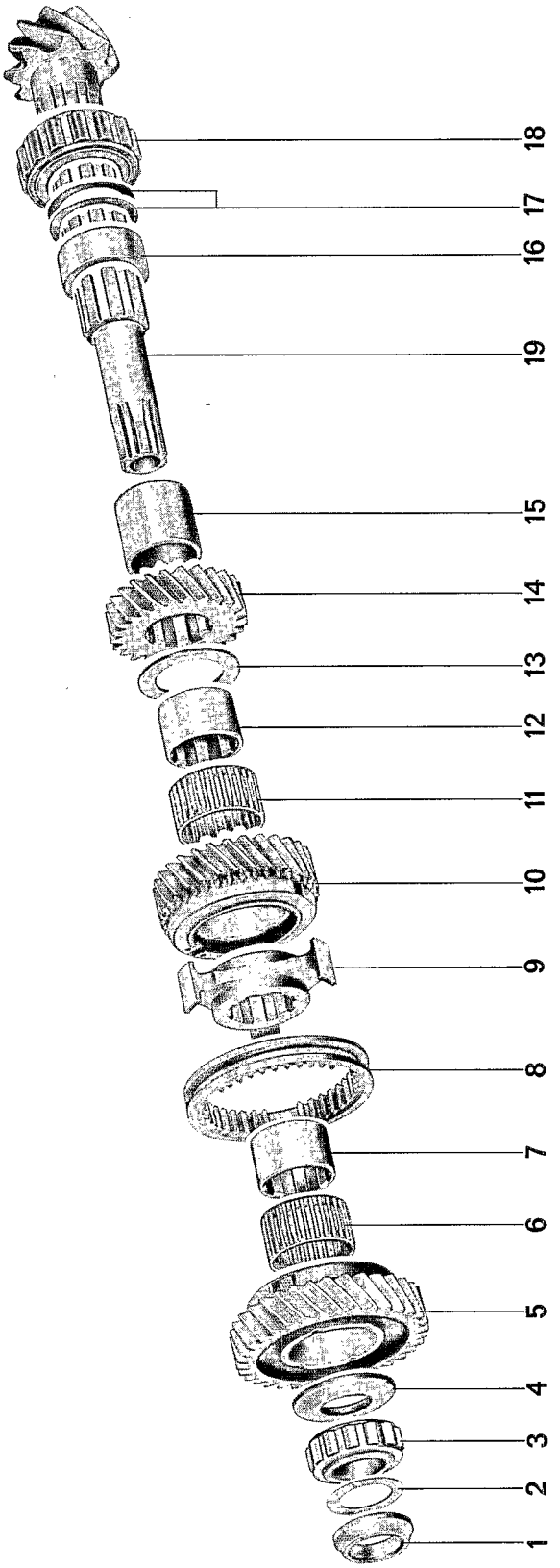
PINION SHAFT

TOOLS



No.	Description	Special Tool	Remarks
1	Drive sleeve	VW 244	
2	Guide	No. 9100	Consists of 2 pieces
3	Thrust disc	VW 412	
4	Plate	VW 401	

DISMANTLING AND ASSEMBLING



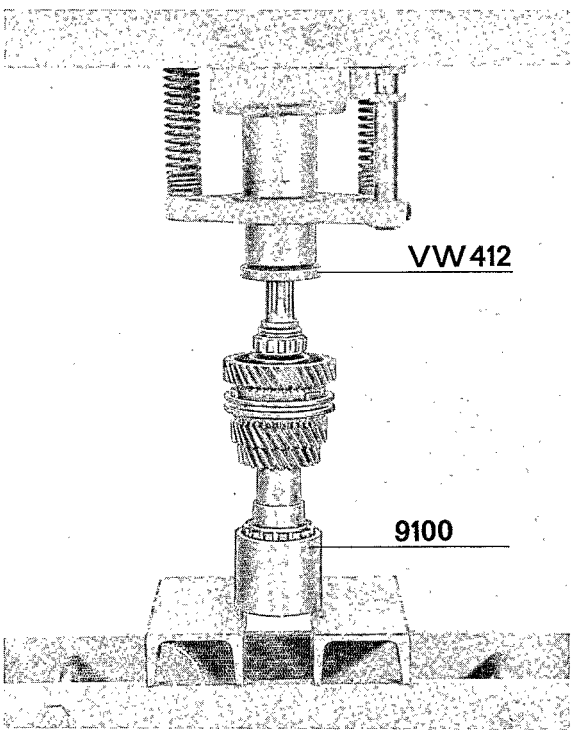
No.	Description	Qty.	Notes		Remarks
			Removal	Installation	
1	Bearing inner race	1		Install with correct adapter	
2	Spacer (1 mm thick)	1			
3	Roller bearing	1	Remove from pinion shaft with VW 412 and 9100	Install with VW 412, VW 244 and VW 401	
4	Thrust washer	1		Flat side faces needle bearing	
5	1st gear 16:34 DA	1		Check synchronization; replace in pairs only	From 1977 Models with asymmetrical pointed teeth of clutch body
6	Needle	2	Mark for installation	Install with same gear	
7	Race, needle bearing	2	Mark for installation	Install with same gear	
8	Shift sleeve	1		Check for wear	From 1977 Models with asymmetrical pointed teeth for 1st gear. Note direction of installation (see Page 3.1-7/6)
9	Shift sleeve guide	1		Check for wear	
10	2nd gear 22:29 M	1		Check synchronization; replace in pairs only	
11	Needle bearing	2	Mark for installation	Install with same gear	
12	Race, needle bearing	2	Mark for installation	Install with same gear	
13	Thrust washer (2 mm thick)	1			
14	3rd gear 27:25 V	1		Check for wear; replace in pairs only	
15	Spacer	1			

No.	Description	Qty.	Notes		Remarks
			Removal	Installation	
16	Spacer	1			
17	Shim	X	Note number and thickness for installation	Recalculate if necessary	
18	Roller bearing	1	Remove from pinion shaft with VW 412 and 9100	Install with correct adapter	
19	Pinion shaft	1		Check for wear; measure thickness of shims again if necessary	

DISMANTLING AND ASSEMBLING INSTRUCTIONS

Dismantling

1. Remove roller bearing from pinion shaft with special tools VW 412 and 9100.



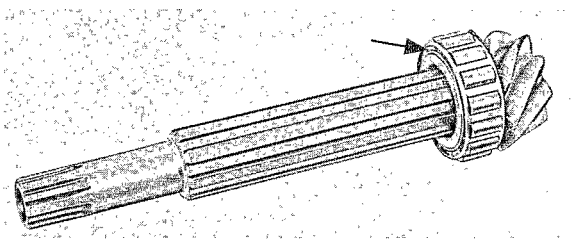
Assembling

Pinions and ring gears are matched. Pair numbers must agree with each other when installing.

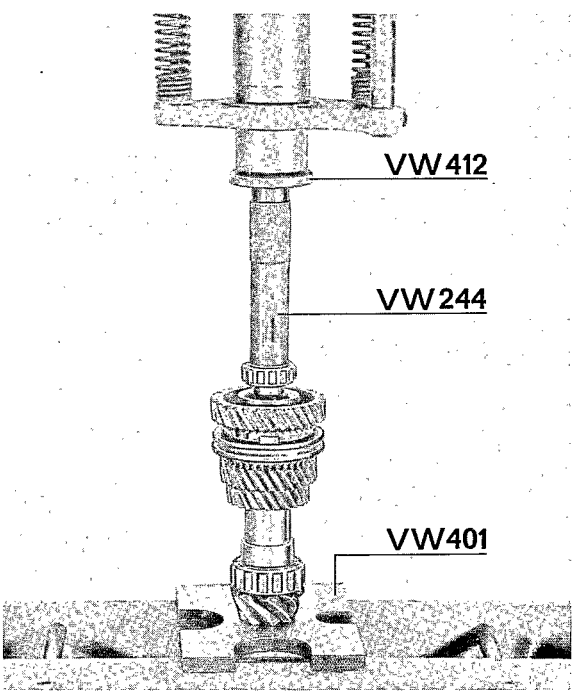
Note

Before installing, clean all pinion shaft parts and dry.

1. Install roller bearing on pinion shaft with appropriate adapter. The two-part roller cage with ring faces the gears.



2. Install small roller bearing with special tools VW 412, VW 244 and VW 401.



CHECKING CLUTCH PLAY

Engine/transmission assembly installed

1. Raise car.

2. Press accelerator linkage operating lever on transmission toward full throttle (bleeds servo). Use left hand to press clutch intermediate lever toward right rear wheel. Travel of about 5 to 7 mm must be felt on the clutch intermediate lever. If there is not enough travel, remove engine/transmission assembly and adjust clutch (basic adjustment 12 to 15 mm).

Engine/transmission assembly removed

1. Remove engine/transmission assembly.

2. Remove cotter pin from clevis pin for actuating rod and intermediate lever and pull out clevis pin.

3. Pull out actuating rod mounted on servo up to stop and at the same time press intermediate lever toward servo to stop.
In this position the actuating rod clevis must be located so that its bore is 12 to 15 mm above the intermediate lever bore.