24 Automatic transmission

Specifications

3 HP 12 – 10 automatic transmission

Model		2002 A	
Transmission manufacturer		Zahnradfabrik Friedrichshafen (ZF)	
Code on transmission cover		028	
Number of ratios		3 forward	1 reverse
Ratios, mechanical	1st	2.56:1	
	2nd	1.52:1	
	3rd	1.0:1	
	Reverse	2.0:1	
	Speedometer drive	2.5:1	
Converter diameter	mm (in)	240 (9.45)	
Converter code		white spot and code No. 204	
Stall speed		1930 ± 50 rpm at 145 Nm (14.5 mkp) (105 lb/ft) torque	
Starting ratio		2.12:1	
Permissible imbalance	cmp	15	
Permissible plane runout of weld tags	mm (in)	0.3 (0.012)	
Oil capacity (initial filling)	litres (Imp. pints/US qts)	4.65 (8.2/4.9); with oil coller 5.2 (9.4/5.3)	
Oil changes		after 30000 km (20000 miles) and each subsequent 30000 (20000 miles); engine running and warm, selector at P.	
Adding oil	litres (Imp. pints /US qts)	app. 1.75 (3.1/1.8)	
Oil content between dipstick marks	litres (Imp. pints /US qts)	0.2 (0.35/0.21)	
Shift points Selector position A		1st – 2nd	
Accelerator position		Full throttle	Kickdown
Shift speed km/h (mile/h) [1]	Upward	40 ± 3 (25 ± 2)	62 ± 3 (39 ± 2)
	Downward	34 ± 3 (21 ± 2)	58 ± 3 (36 ± 2)

[1]) actual speed, disregarding speedometer error

3 HP 12 – 10 automatic transmission

Specifications

Model		2002 A	
Shift points Selector position A		2nd – 3rd	
Accelerator position		Full throttle	Kickdown
Shift speed km/h (mile/h)[1]	Upward	100 ± 3 (62 ± 2)	109 ± 3 (68 ± 2)
	Downward	65 ± 3 (41 ± 2)	107 ± 3 (67 ± 2)
Selector movement		from A to 2 (3rd – 2nd)	
Downshift[2] at km/h (mile/h)		125 (78)	
Selector movement:		from 2 to 1 (2nd – 1st)	
Downshift[2] at km/h (mile/h)		70 (44)	
Primary pressure Throttle cable detached in position Idle	bar (lb/in^2)	12 (171)	
Kickdown	bar (lb/in^2)	18 (256)	
Clutch A Throttle cable detached in position Idle	bar (lb/in^2)	4.9 ... 5.5 (70 ... 78)	
Kickdown	bar (lb/in^2)	7.4 ... 8.0 (105 ... 114)	
Converter pressure Throttle cable detached in position Idle	bar (lb/in^2)	3.5 ... 4.0 (50 ... 57)	
Kickdown	bar (lb/in^2)	5.0 ... 6.0 (71 ... 85)	
Shift restrictor pressure Throttle cable detached in position Idle	bar (lb/in^2)	1.1 ... 1.2 (16 ... 17)	
Kickdown	bar (lb/in^2)	3.6 ... 3.9 (51 ... 55)	
Regulator pressure at road speed 50 km/h (31 mile/h)	bar (lb/in^2)	1.4 ... 1.6 (20 ... 23)	

[1]) actual speed, disregarding speedometer error
[2]) downshift point cannot be exceeded

Specifications

3 HP 12 — 10 automatic transmission

Model		2002 A
Trailer load, braked without oil cooler	kg (lb)	800 (1764)
with oil cooler	kg (lb)	1200[3] (2648)
Towing away up to a distance of		50 km (31 miles)
max. permissible speed		50 km/h (31 mile/h)
in excess of 50 km (31 miles) or 50 km/h (31 mile/h)		Add a further 1 litre (1.1 US quart/1.8 Imp. pint) to specified transmission oil content[4] or disconnect propeller shaft from final drive and tie up.
Clearance to be set between control unit housing and throttle pressure piston	mm (in)	2.6 (0.1024)
Axial clearance between outer ring of grooved ball bearing and transmission housing cover	mm (in)	0.05 ... 0.1 (0.0019 ... 0.0039)
Axial clearance between clutch units A and B	mm (in)	0.15 ... 0.25 (0.0059 ... 0.0098)
Axial clearance between centring disc and spring ring	mm (in)	0.15 (0.0059)
Radial clearance between driven impeller and housing	mm (in)	0.072 ... 0.19 (0.0028 ... 0.0074)
Axial clearance between impellers and housing	mm (in)	0.03 ... 0.05 (0.0012 ... 0.0019)
Accelerator cable Cable length	mm (in)	650[1] (25.59)
Sleeve length	mm (in)	478[2] (18.82)

[1]) Previously 640 mm (25.19 in)
[2]) Previously 468 mm (18.42 in)
[3]) BMW touring 2002 A: 1000 kg (2205 lb)
[4]) After repairing vehicle, **always** restore transmission oil content to correct (lower level)

Specifications

3 HP 12 – 10 automatic transmission

Model					2002 A		

Factory-approved oil grades

Initial filling of new or exchange transmissions, subsequent filling

Description		Supplier
AGIP F. 1 ATF Dexron	B-11 297	Agip
BP AUTRAN DX	B-11 026	BP
Chevron ATF	B-11 061	Chevron
ESSO AUTOM. TRANSM. FLUID (D)	B-10 102	Esso
ESSO AUTOM. TRANSM. FLUID (D)	B-10 696	Esso
Mobil ATF 220	B-10 467	Mobil Oil
Shell ATF Dexron	B-10 378	Shell
Shell ATF Dexron	B-10 709	Shell
Sunamatic ATF Dexron	B-10 492	Sunoil
Sunamatic 128	B-10 107	Sunoil
Texamatic Fluid 6673	B-10 101	Texaco

Subsequent filling only

Description		Supplier
AERO-LINE ATF Dexron	B-10 492	Prinz-Schulte
Amalte ATF DEXRON	B-10 162	Usoco
Amoco ATF DEXRON	B-10 690/B-10 595	Amoco
ANTAR DEXRON	B-10 968	Antar
ARAL Getriebeöl ATF Dexron	B-11 499	Aral
ASEOL DEXRON 16-712	B-11 094	Aseol
Autol – DEXRON	B-10 812	Autol-Werke
Austromatic B DEXRON	B-10 945	Elan
AVIA FLUID ATF 68 DEXRON	B-11 045	Avia
Aviation ATF/DEXRON	B-10 334/B-10 844	Finke
BayWa Automatic TF 25	B-10 653	BayWa
BECHEM Fluid-Getriebeöl ATF DEXRON	B-10 752	Bechem
BEVEROL DEXRON ATF	B-10 614	Beverol
CALTEX Texamatic Fluid 6673	B-10 190	Caltex
CALYPSOL Fluid ATF-AA Dexron	B-10 752	Calypsol
CASTROL TQ Dexron	B-10 658/B-11 020	Castrol
DOFRATATIC DEXRON	B-10 619	Cofran
CONDOR FLUID B-Getriebeöl (DEXRON)	B-10 752	Condor
Deltinol Getriebeöl ATF Dexron	B-10 752	Merk
DEUTZ OEL Dexron	B-10 797	Deutzer Öl
DIVINOL Fluid Dexron	B-10 752	Zeller + Gmelin
Duckham D-MATIC	B-10 793	Duckham
ECUMATIC Dexron	B-10 947	Wenzel Weidmann
ELFMATIC G	B-11 607	Elf Union
ELLMO Fluid Dexron	B-10 334	Eller
ESA AUTOMATIC TRANSMISSION FLUID Dex.	B-10 653	Esa
ESSO AUTOM. Transm. Fluid (D.)	B-11 276	Esso
ETERNA Transmatic ATF D	B-10 467	Eterna
EXACTOL HFL DEXRON	B-10 752	Minera
FANAL ATF Dexron	B-10 755	Stinnes
FINA DEXRON ATF	B-10 572/ B-11 137	Fina
FLEET MATIC CB	B-10 794	Duckham
FLUID B 2846	B-10 492	Condat
FRONTOL Getriebeöl DXS Dexron	B-11 026	Schindler
FUCHS AUTOMATIC TF 25	B-10 653	Fuchs
GIROMATIC DEXRON	B-10 752	Martin
Golden Fleece Dexron	B-10 314	Golden Fleece Petr.
Gulf ATF DEXRON	B-10 486	Gulf
HAFA TRANSMATIC	B-10 611	Sofra
HOMBERG-Getriebe-Fluid	B-11 081	Homberg
IROKAL Dexron	B-11 081	Mineralölwerk Osnabrück
Kendall ATF DEXRON	B-10 166	Kendall
LABO DEXRON	B-10 647	Labo
Lubrication-Engineers Dexron ATF	B-11 033	Lubrication Eng.

Specifications

3 HP 12 — 10 automatic transmission

Model					2002 A		

Description		Supplier
MTHAG ATF DB 1140	B-10 653	Mihag
Mobil ATF 220	B-10 104	Mobil Oil
MOTOREX ATF DEXRON	B-10 494	Bucher
MOTUL AUTOMATIC B-DEXRON	B-10 608	Motul
NYNÄS ATF Dexron	B-11 219	Nynäs
ÖMV Austromatic Dexron	B-10 848	ÖMV
OEST ATF DEXRON	B-10 752	Oest
Optimol Dexron B 92 Fluid	B-10 631	Optimol
ORVEMATIC	B-10 588	Orvema
Pennzoil Hydra Flo Dexron	B-11 493/B-11 583	Pennzoil-Oil City
	B-11 510/B-11 643	
Quaker State Dexron ATF	B-11 336	Quaker St.-Oil City

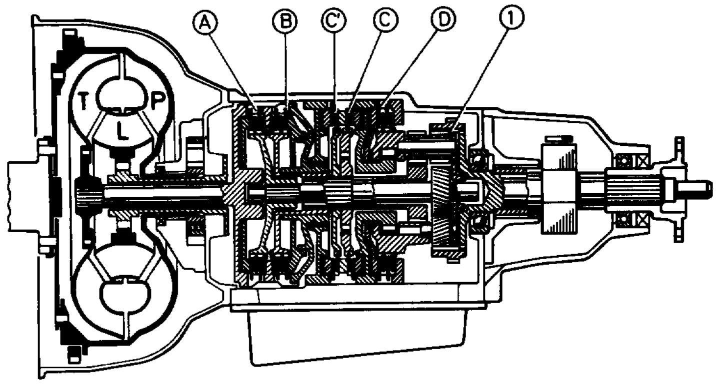
Description			Supplier
Selectol Fluid Getriebeöl, Dexron B 334		B-11 051	Käppler
Sonol "Dexron"		B-10 574	Sonol
Texamatic Fluid 6673	B-10 844/	B-10 334	Texaco
TOTAL "Dexron"		B-10 631	C. F. P.
UNI-MATIC DEXRON		B-10 787	Unil-Beauvais
Valvomatic ATF Type B Dexron		B-10 756	Valvoline
Veedol ATF Dexron		B-10 579	Veedol
WESTFALEN Getriebeflüssigkeit ATF Dexron		B-10 752	Sauerstoffwerk
WEVAG Automatic Getr.-Oel Dexron		B-11 026	Weva
VACCO ATF DEXRON		B-10 666	Vacco

Tightening torques in Nm (mkp) (lb.ft)

Stud in transmission housing	5 ... 6 (0.5 ... 0.6) (3.6 ... 4.3)	Hollow bolt for inflow and return pipes	40 ... 45 (4.0 ... 4.5) (28.9 ... 32.5)
Hexagon nut, stop sleeve	15 (1.5) (10.8)	Speedometer bush locking bolt	10 (1) (7.2)
Headless screw on accelerator cable	15 (1.5) (10.8)	Hexagon nut on bearing flange and transmission extension	23 (2.3) (16.6)
Hexagon nut for parking lock	10 (1) (7.2)	Cheese-head bolts on centrifugal governor-M6	10 (1) (7.2)
M10 x 1 locking bolt in transmission housing	15 (1.5) (10.8)	Cheese-head bolts on centrifugal governor-M5	6 (0.6) (4.3)
Converter housing and transmission extension	23 (2.3) (16.6)	Collar nut on output side	100 ... 120 (10...12) (72.3 ... 86.7)
Starter locking switch and reverse light switch	35 (3.5) (25.3)	Hexagon nut for fastening converter housing	23 (2.3) (16.6)
M 18 x 1.5 locking bolt in converter housing	35 (3.5) (25.3)	Hexagon bolt for fastening control unit	8 (0.8) (57.8)
Hexagon head bolt on support shaft	10 (1) (7.2)	Hexagon bolt for fastening oil sump	10 (1) (7.2)
Hexagon head bolt for fastening oil pump	10 (1) (7.2)	Oil drain plug	35 (3.5) (25.3)

Neutral

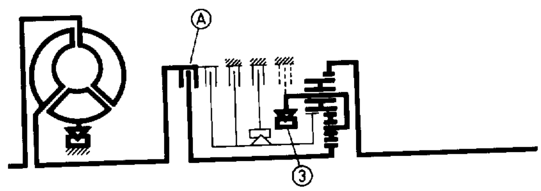
The rotating clutches A, B and the fixed clutches C', C and D are open. All pinions in the planetary gear train (1) rotate freely on their axes.



1st Gear

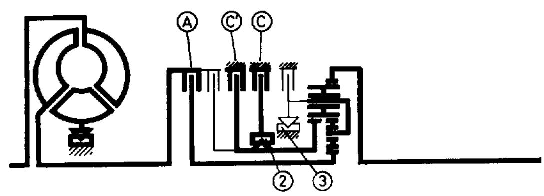
The clutch A is closed. The planetary gear carrier is supported via the free wheel 3 in the case of pull, it is overridden in the case push.

In the selector lever position 1 and 2 the clutch D is also closed in 1st gear in order to be able to brake with the engine.



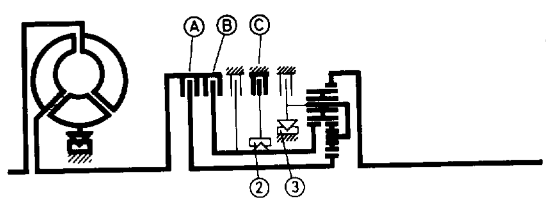
2nd Gear

The clutches A, C' and C are closed. The free wheel 3 is overridden. The hollow shaft is supported by the free wheel 2. The two sun wheels are held in this way.



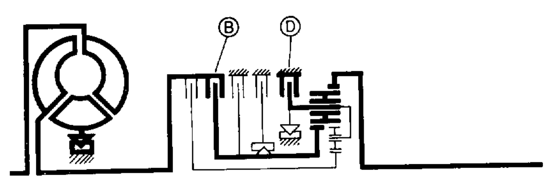
3rd Gear

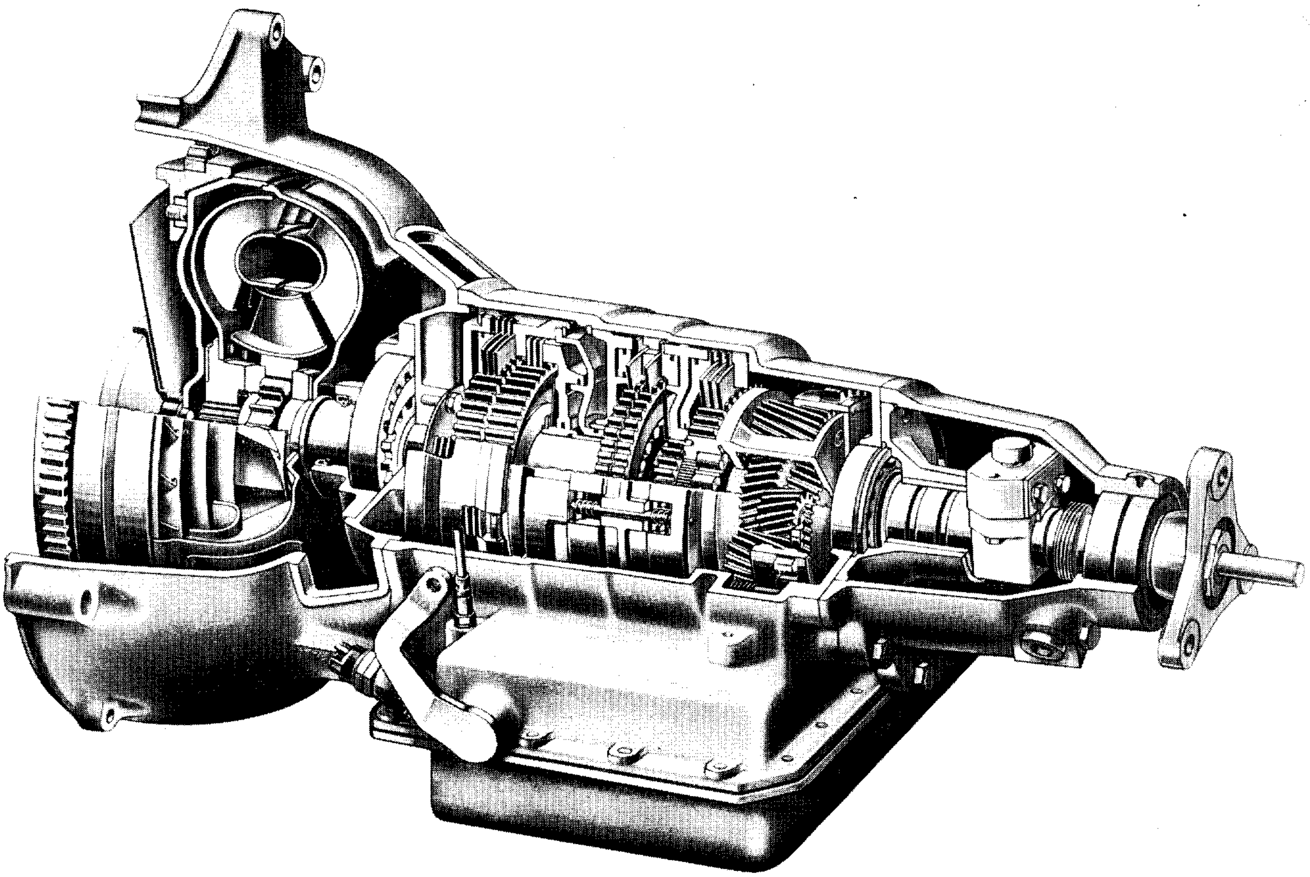
The clutches A, B and C' are closed. The free wheels 2 and 3 are overidden. The whole planetary gear train runs as a block with the ratio 1:1.

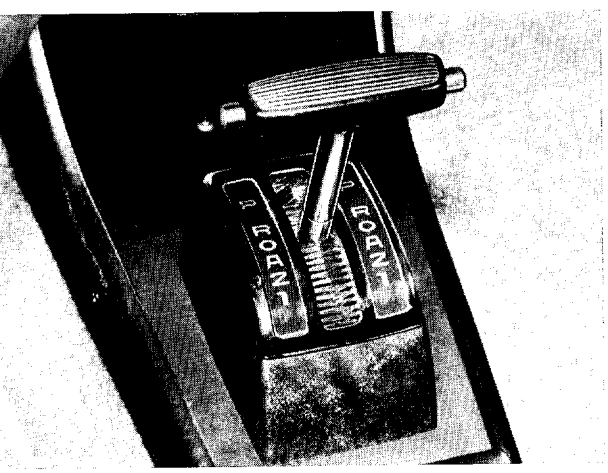


Reverse gear

The clutches B and D are closed. A reversal of the direction of rotation of the output shaft is effected via the locked planetary gear carrier.







The 3 HP 12 transmission is fully automatic and equipped with a torque converter and a Ravigneaux planetary gear unit.

Selector lever positions:

P Park
R Reverse
O Neutral
A 1st, 2nd and 3rd gear
2 1st and 2nd gear - 3rd gear locked
1 1st gear, 2nd and 3rd gear locked

In selector lever position P the gearbox output shaft is mechanically blocked by the lock pawl.

R — Reverse gear

The engine is started in the selector lever positions O or P.

There is no transmission of power to the rear wheels in this case.

The selector lever position A is used under normal driving conditions in order to achieve good fuel consumption figures.

Premature down changes can be effected by operating the kickdown.

In selector lever position 2 it is ensured that constant undersireable gear changes from 2 to 3 are avoided on gradients. Moreover, the braking action of the engine is more efficient.

The speed range 1 is provided particularly for a constant braking action through the engine on gradients.

The speed ranges 1 or 2 can be engaged at any required speed.

Changing up into the next highest gear is then simply omitted.

The torque converter acts as a fluid coupling and a torque booster. The pump impeller P turns at engine speed and scoops the oil in a clockwishe direction into the turbine wheel (T). When a speed range is engaged the turbine wheel is connected to the planetary gear unit with the dirve shaft via the clutches. As the engie speed increases the oil – determined by the shape of the turbine blades – is diverted in an anti-clockwise direction out of the turbine wheel into the guide wheel (L), which is supported against the direction of rotation of the engine, and thus redirected to the pump impeller practically turbulence free. The back-pressure occurring during the redirection effects the increase in torque. The greatest increase in torque takes place when the pump impeller is driven at full throttle, while the vehicle is stationary, and must drive the stationary turbine wheel.

As the road speed increases the rpm difference between pump impeller and turbine wheel drops to the speed ration 1:1. Now the guide wheel no longer supports itself via the free wheel, but runs in the oil flow of the pump impeller and turbine wheel. As the road speed continues to increase and when the vehicle pushes, the torque converter works as a fluid coupling. Thus, in the case of push the braking force of the engine can also be utilized.

The primary pump is driven by the torque converter at engine speed. Its object is to supply oil to the converter, selector unit and the clutches.

Explanation regarding hydraulic control unit.

The primary valve determines the pressure level in the hydraulic control unit.
As the feed quantity increases the superflous oil is fed back to the suction bore of the primary pump.

The converter valve has the object of preventing excess pressure in the converter.

The selector slide valve is mechanically operated with the selector lever. The oil pressure in the selector unit is directed to the required speed ranges with the selector slide valve.

The accelerator control valve is connected to the accelerator linkage and determines the gearchange points with the governor, dependent on the throttle butterfly position.

The locking valves have the object of actuating down changes to the respective gears independent of the throttle butterfly position. Furthermore, the locking valves prevent further gears from being automatically selected in Position 1 or 2.

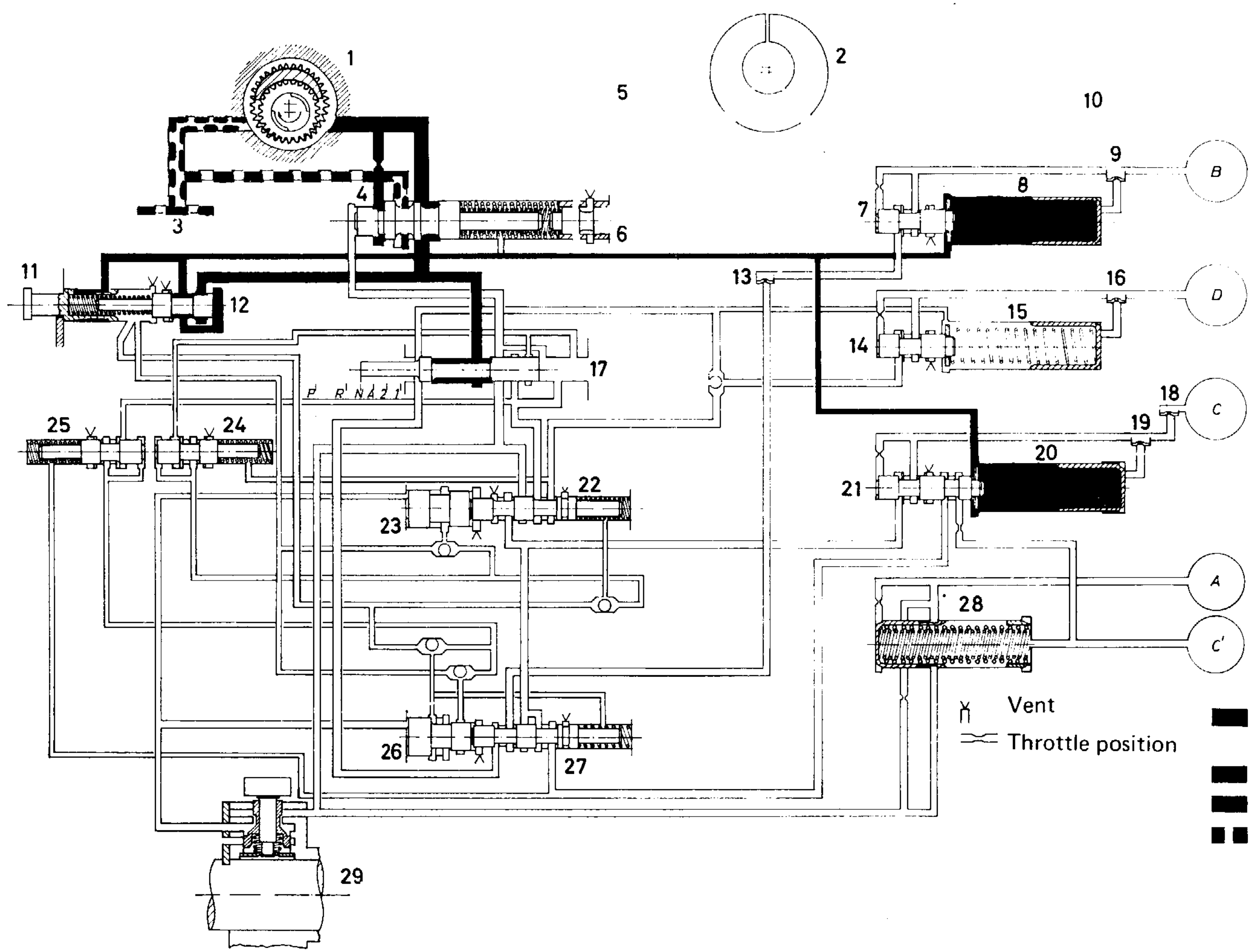
The gear-shift valves determine which gear is engaged. If the spring pressure in the gear-shift valve is overcome by the governor pressure, the oil pressure reaches the clutch valves and closes the corresponding clutches. When the kick-down is operated the spring pressure is in addition assisted by throttle pressure. Because of this the engine must turn at higher revolutions in order that the governor pressure exceeds the spring and throttle pressure.

The clutch valves and accumulators are designed to make the gear shifts as pleasant as possible.

The governor determines with the gear-shift valves the gearchange points dependent on the throttle pressure. The governor pressure is generated in relation to the speed of the output shaft.

The oil flows from the selector slide valve to the bore (1). During acceleration the piston (A), governor bush (B), spring (C) and slotted disc (D) are displaced outwards by the centrifugal force, in which case the upper control edge of the governor piston overrides the bore (1) and allows the oil to flow into the bore (2). Because of the balance surface (Y) on the governor piston the pressure in the bore (2) is greater than the centrifugal force of the piston for a moment. In this way the governor bush is pushed back and the lower control edge frees the bleed bore (3) for as long as necessary until the pressure in bore (2) maintains equilibrium with the parts subject to centrifugal force. The speed related governor pressure now prevails in the bore (2), the governor bush oscillating to and fro between the bores (1) and (3).

Hydraulic control 3 HP 12



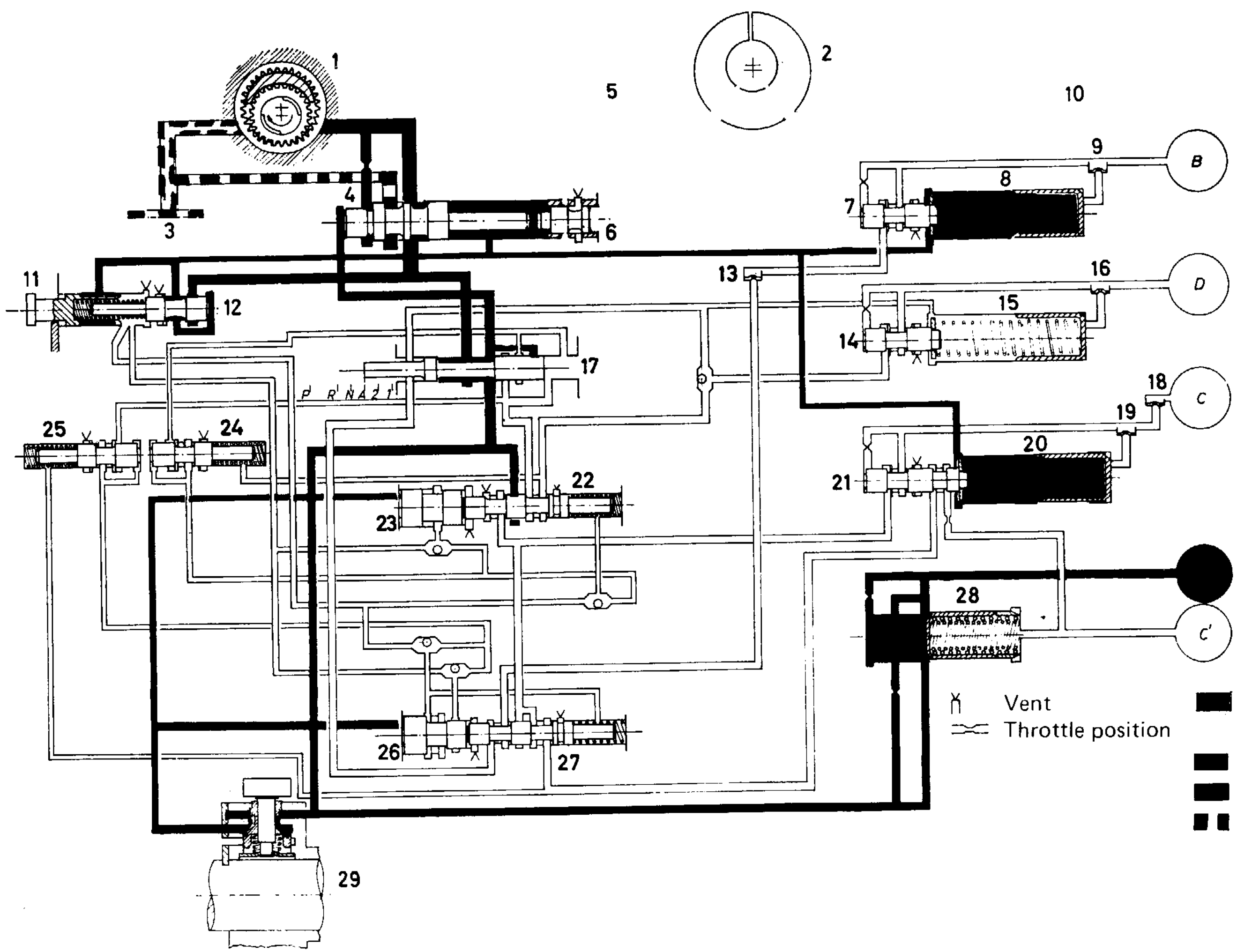
1 Primary pump
2 Torque converter
3 Oil strainer
4 Primary valve
5 Cooler
6 Converter valve
7 Clutch valve B
8 Clutch accumulator B
9 Valve orifice plate B
10 Lubrication, planetary gear unit
11 Accelerator control piston
12 Accelerator control valve
13 Return orifice plate B
14 Clutch valve D
15 Clutch accumulator D
16 Valve orifice plate D
17 Selector slide valve
18 Return orifice plate C
19 Valve orifice plate C
20 Clutch accumulator C
21 Clutch valve C
22 Gear-shift valve 1 - 2
23 Gear-shift piston 1 - 2
24 Locking valve 1
25 Locking valve 2
26 Gear-shift piston 2 - 3
27 Gear-shift valve 2 - 3
28 Clutch accumulators A and C'
29 Governor C'

A, B, C, and D are clutches

Primary pressure
Converter input pressure
Throttle pressure
Governor pressure
Locking valve pressure

Neutral position — with engine running

Hydraulic control 3 HP 12



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5 Cooler
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8 Clutch accumulator B
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10 Lubrication, planetary gear unit
11 Accelerator control piston
12 Accelerator control valve
13 Return orifice plate B
14 Clutch valve D
15 Clutch accumulator D
16 Valve orifice plate D
17 Selector slide valve
18 Return orifice plate C
19 Valve orifice plate C
20 Clutch accumulator C
21 Clutch valve C
22 Gear-shift valve 1 - 2
23 Gear-shift piston 1 - 2
24 Locking valve 1
25 Locking valve 2
26 Gear-shift piston 2 - 3
27 Gear-shift valve 2 - 3
28 Clutch accumulators A and C'
29 Governor C'

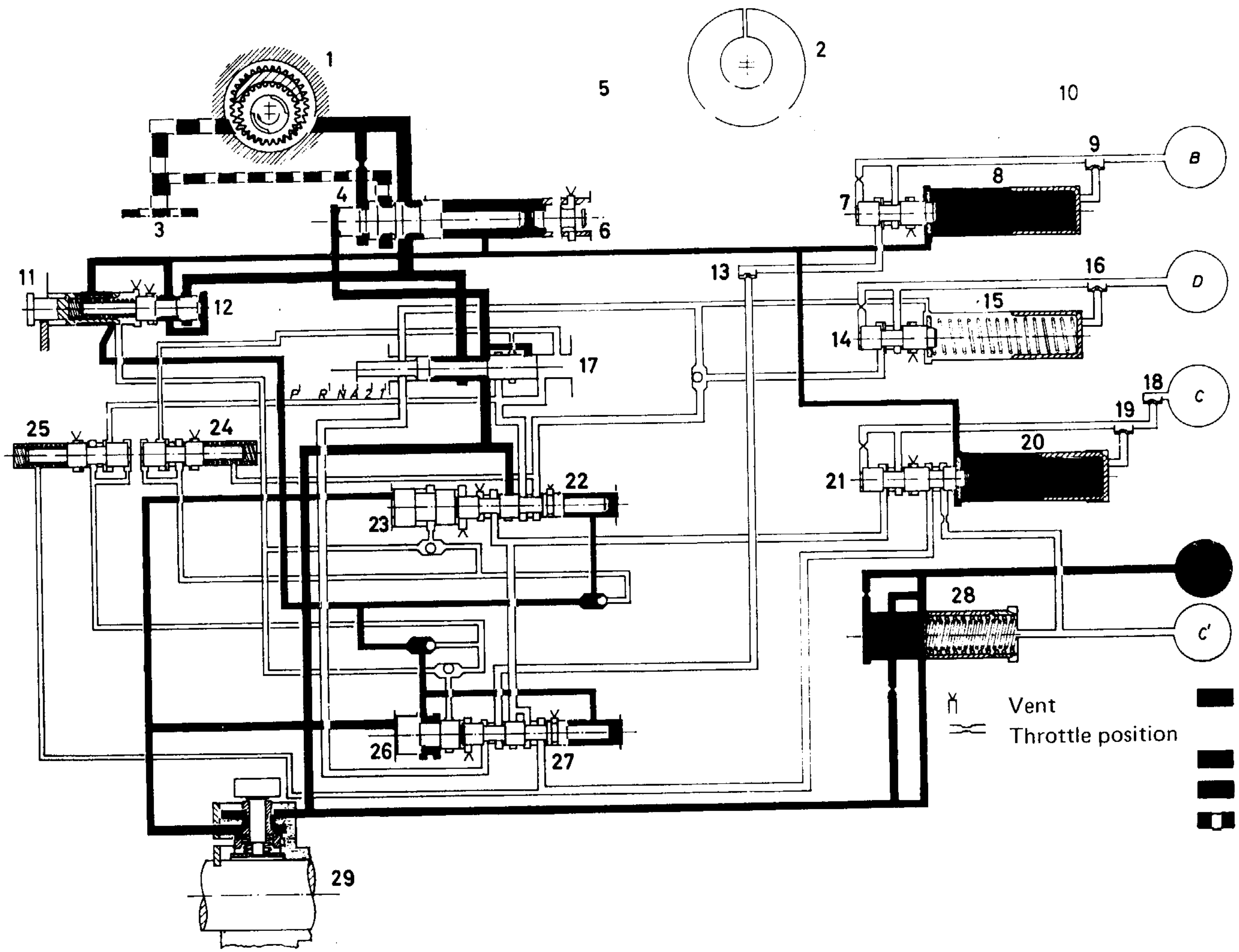
A, B, C, and D are clutches

Vent
Throttle position

Primary pressure
Converter input pressure
Throttle pressure
Governor pressure
Locking valve pressure

Position A: 1st Gear

Hydraulic control 3 HP 12



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3 Oil strainer
4 Primary valve
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6 Converter valve
7 Clutch valve B
8 Clutch accumulator B
9 Valve orifice plate B
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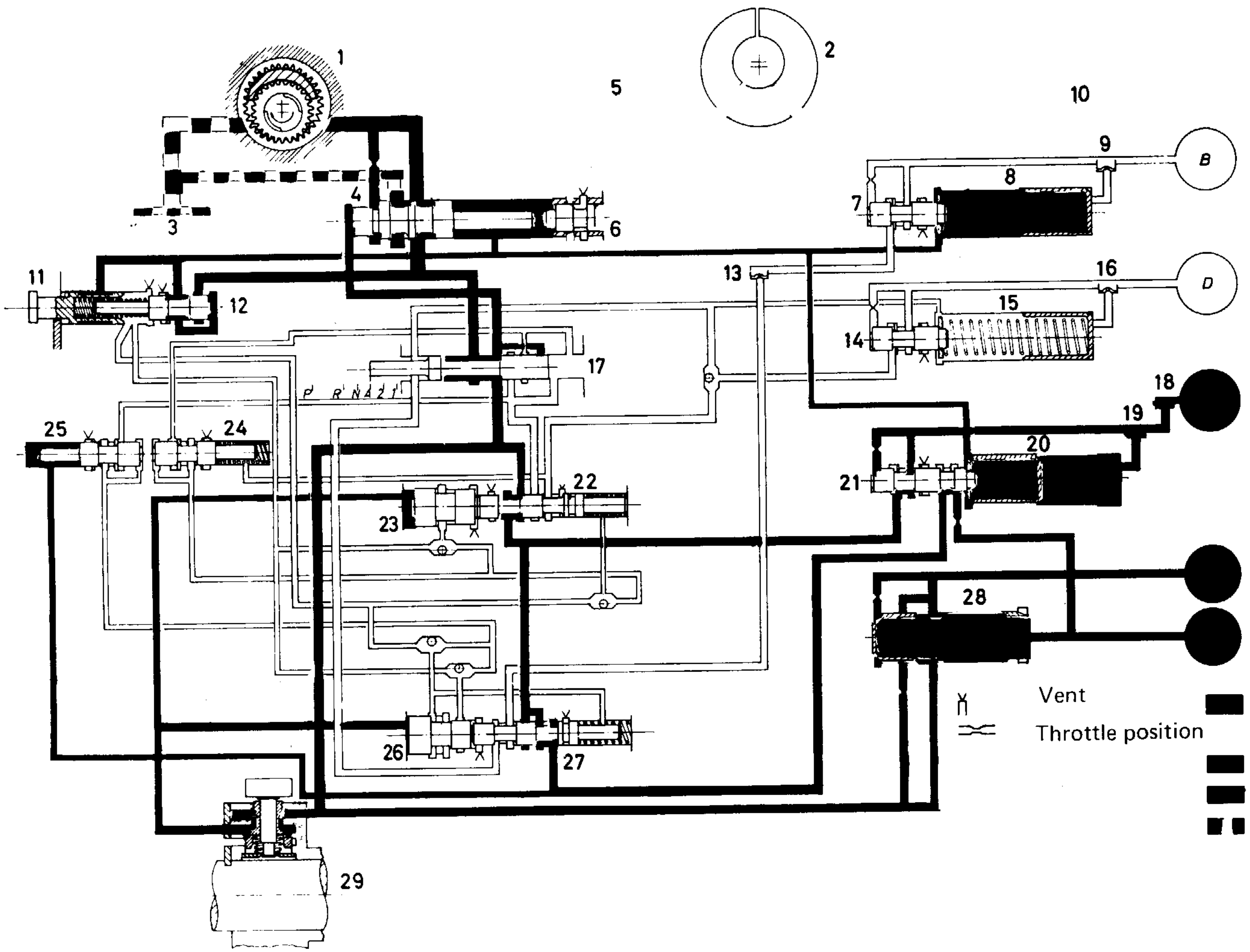
11 Accelerator control piston
12 Accelerator control valve
13 Return orifice plate B
14 Clutch valve D
15 Clutch accumulator D
16 Valve orifice plate D
17 Selector slide valve
18 Return orifice plate C
19 Valve orifice plate C
20 Clutch accumulator C
21 Clutch valve C
22 Gear-shift valve 1 - 2
23 Gear-shift piston 1 - 2
24 Locking valve 1
25 Locking valve 2
26 Gear-shift piston 2 - 3
27 Gear-shift valve 2 - 3
28 Clutch accumulators A and C'
29 Governor C'
A, B, C, and D are clutches

Primary pressure
Converter input pressure
Throttle pressure
Governor pressure
Locking valve pressure

Position A: 1st gear (full load)

Hydraulic control 3 HP 12



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2 Torque converter
3 Oil strainer
4 Primary valve
5 Cooler
6 Converter valve
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8 Clutch accumulator B
9 Valve orifice plate B
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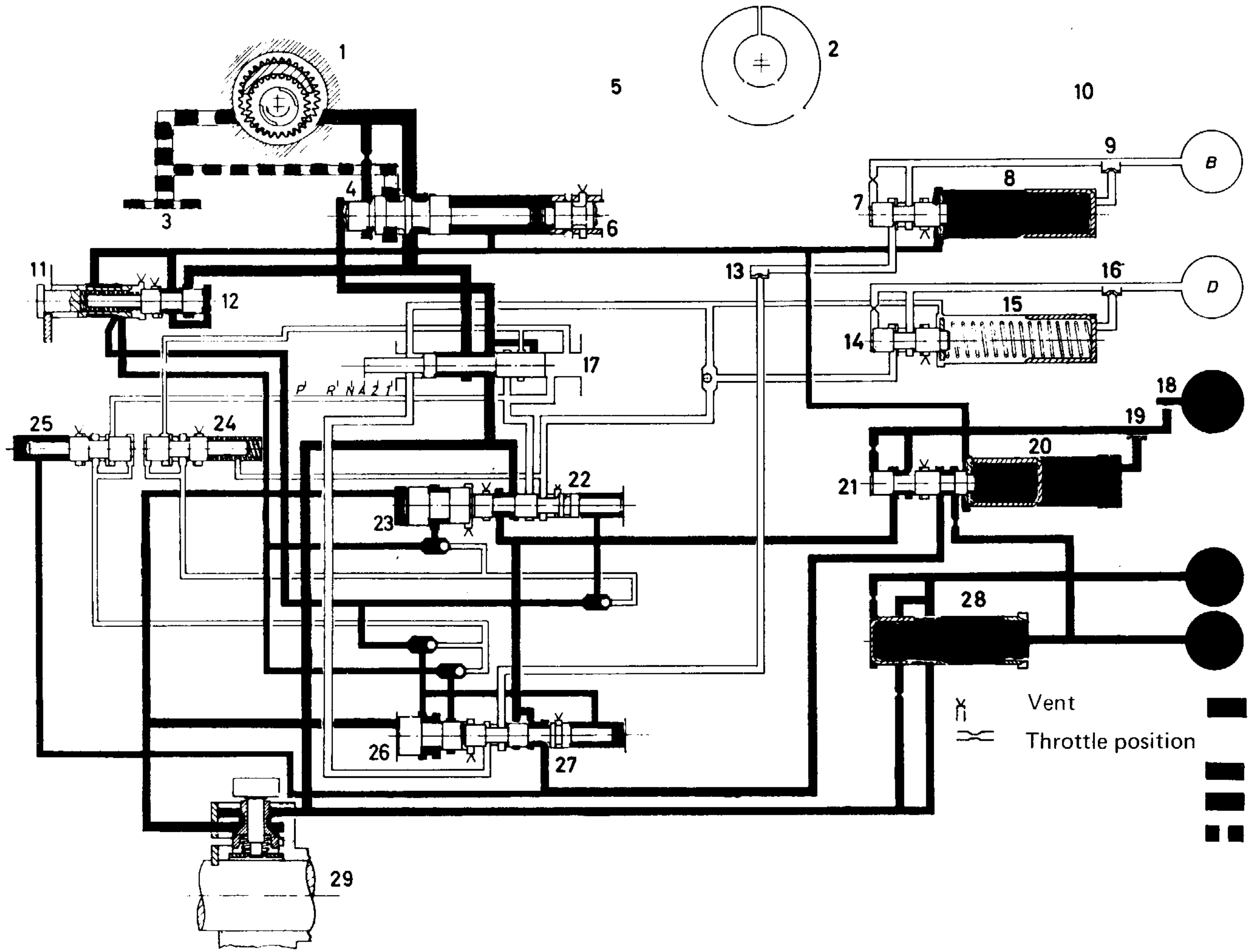
11 Accelerator control piston
12 Accelerator control valve
13 Return orifice plate B
14 Clutch valve D
15 Clutch accumulator D
16 Valve orifice plate D
17 Selector slide valve
18 Return orifice plate C
19 Valve orifice plate C
20 Clutch accumulator C
21 Clutch valve C
22 Gear-shift valve 1 - 2
23 Gear-shift piston 1 - 2
24 Locking valve 1
25 Locking valve 2
26 Gear-shift piston 2 - 3
27 Gear-shift valve 2 - 3
28 Clutch accumulators A and C′
29 Governor C′
A, B, C, and D are clutches

Vent
Throttle position

Primary pressure
Converter input pressure
Throttle pressure
Governor pressure
Locking valve pressure

Position A 2nd gear

Hydraulic control 3 HP 12



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2 Torque converter
3 Oil strainer
4 Primary valve
5 Cooler
6 Converter valve
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8 Clutch accumulator B
9 Valve orifice plate B
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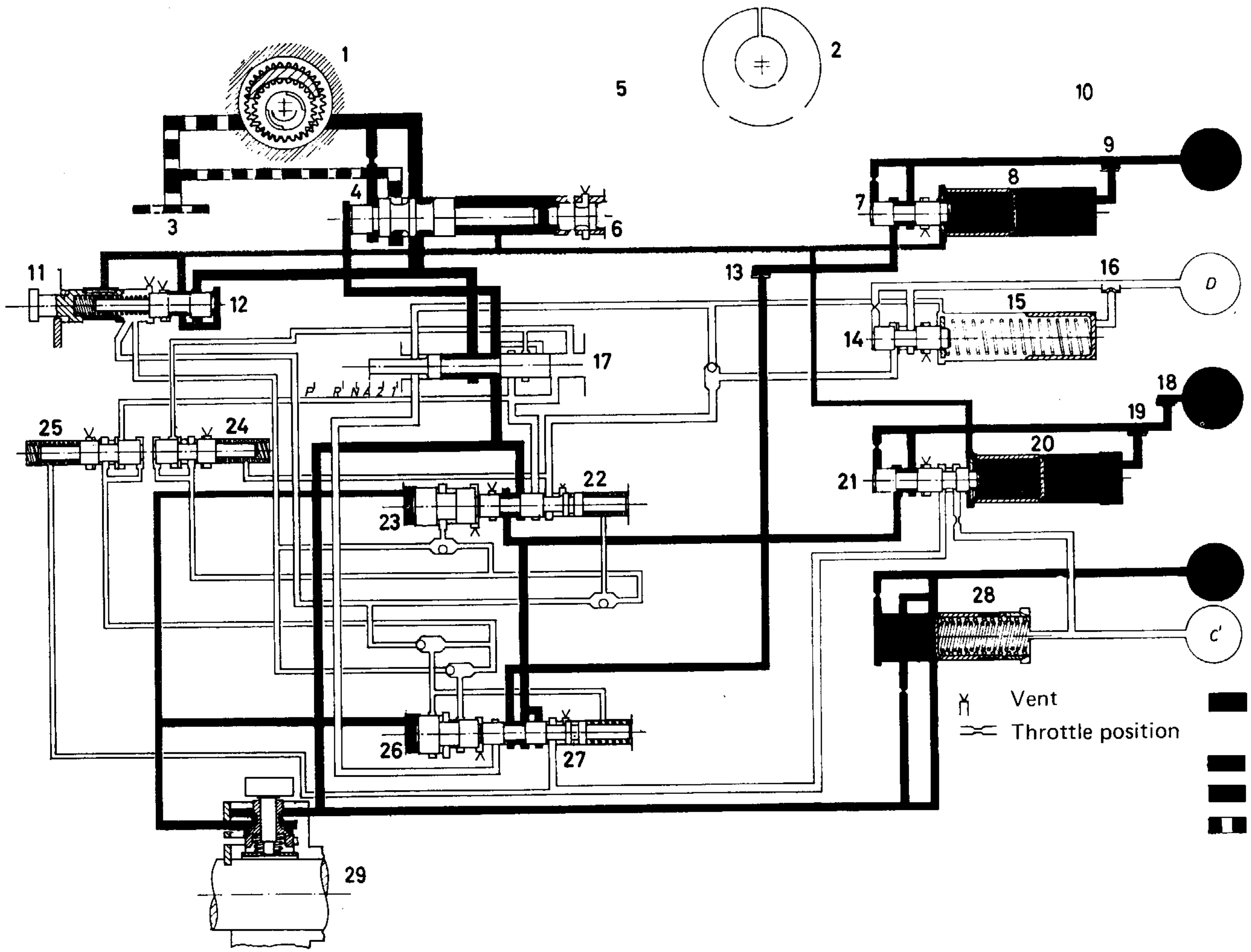
11 Accelerator control piston
12 Accelerator control valve
13 Return orifice plate B
14 Clutch valve D
15 Clutch accumulator D
16 Valve orifice plate D
17 Selector slide valve
18 Return orifice plate C
19 Valve orifice plate C
20 Clutch accumulator C
21 Clutch valve C
22 Gear-shift valve 1 - 2
23 Gear-shift piston 1 - 2
24 Locking valve 1
25 Locking valve 2
26 Gear-shift piston 2 - 3
27 Gear-shift valve 2 - 3
28 Clutch accumulators A and C'
29 Governor C'
A, B, C, and D are clutches

Vent
Throttle position

Primary pressure
Converter input pressure
Throttle pressure
Governor pressure
Locking valve pressure

Position A: 2nd gear (kickdown)

Hydraulic control 3 HP 12



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2 Torque converter
3 Oil strainer
4 Primary valve
5 Cooler
6 Converter valve
7 Clutch valve B
8 Clutch accumulator B
9 Valve orifice plate B
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11 Accelerator control piston
12 Accelerator control valve
13 Return orifice plate B
14 Clutch vlave D
15 Clutch accumulator D
16 Valve orifice plate D
17 Selector slide valve
18 Return orifice plate C
19 Valve orifice plate C
20 Clutch accumulator C
21 Clutch valve C
22 Gear-shift valve 1 - 2
23 Gear-shift piston 1 - 2
24 Locking valve 1
25 Locking valve 2
26 Gear-shift piston 2 - 3
27 Gear-shift valve 2 - 3
28 Clutch accumulators A and C'
29 Governor C'

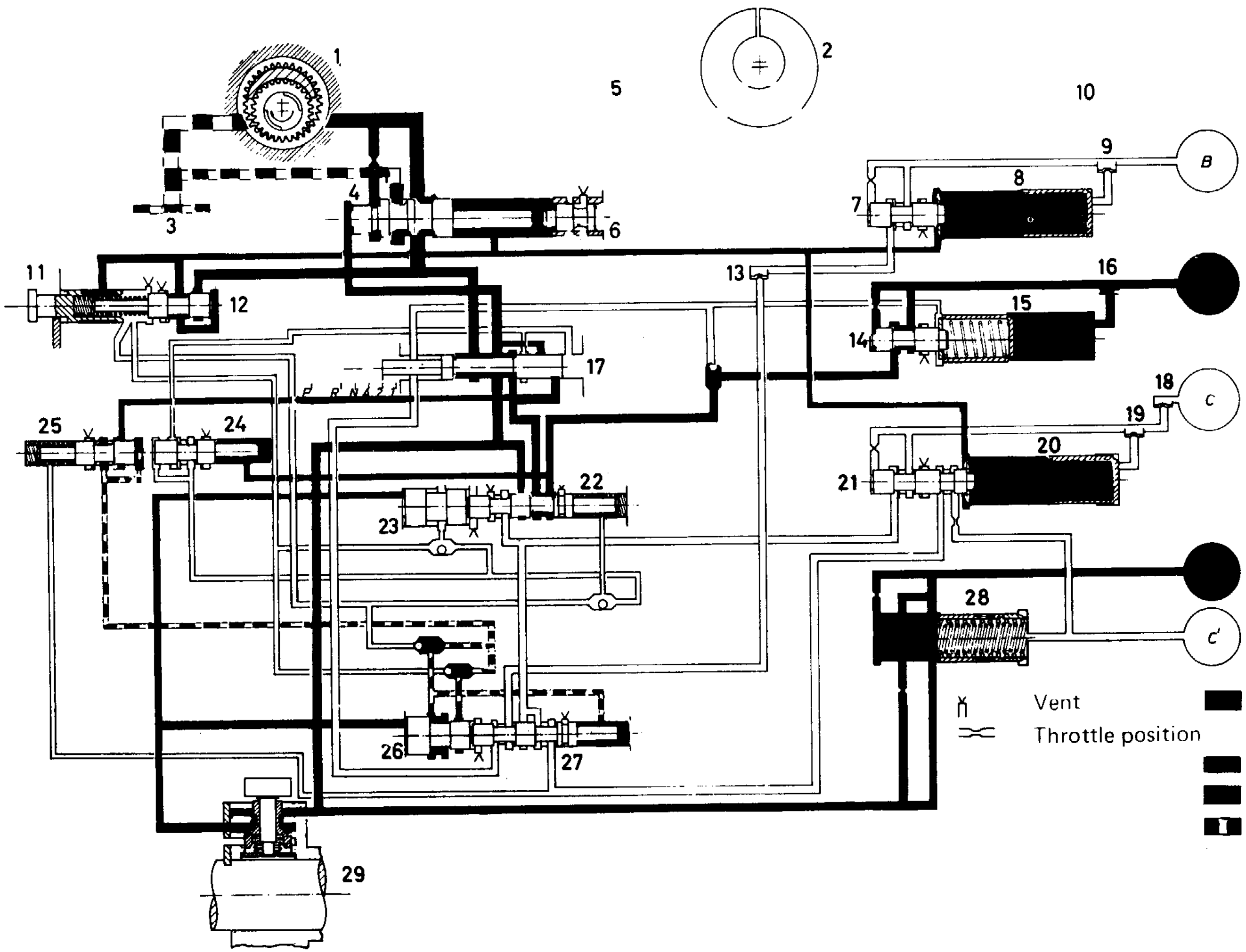
A, B, C, and D are clutches

Vent
Throttle position

Primary pressure
Converter input pressure
Throttle pressure
Governor pressure
Locking valve pressure

Position A: 3rd gear

Hydraulic control 3 HP 12



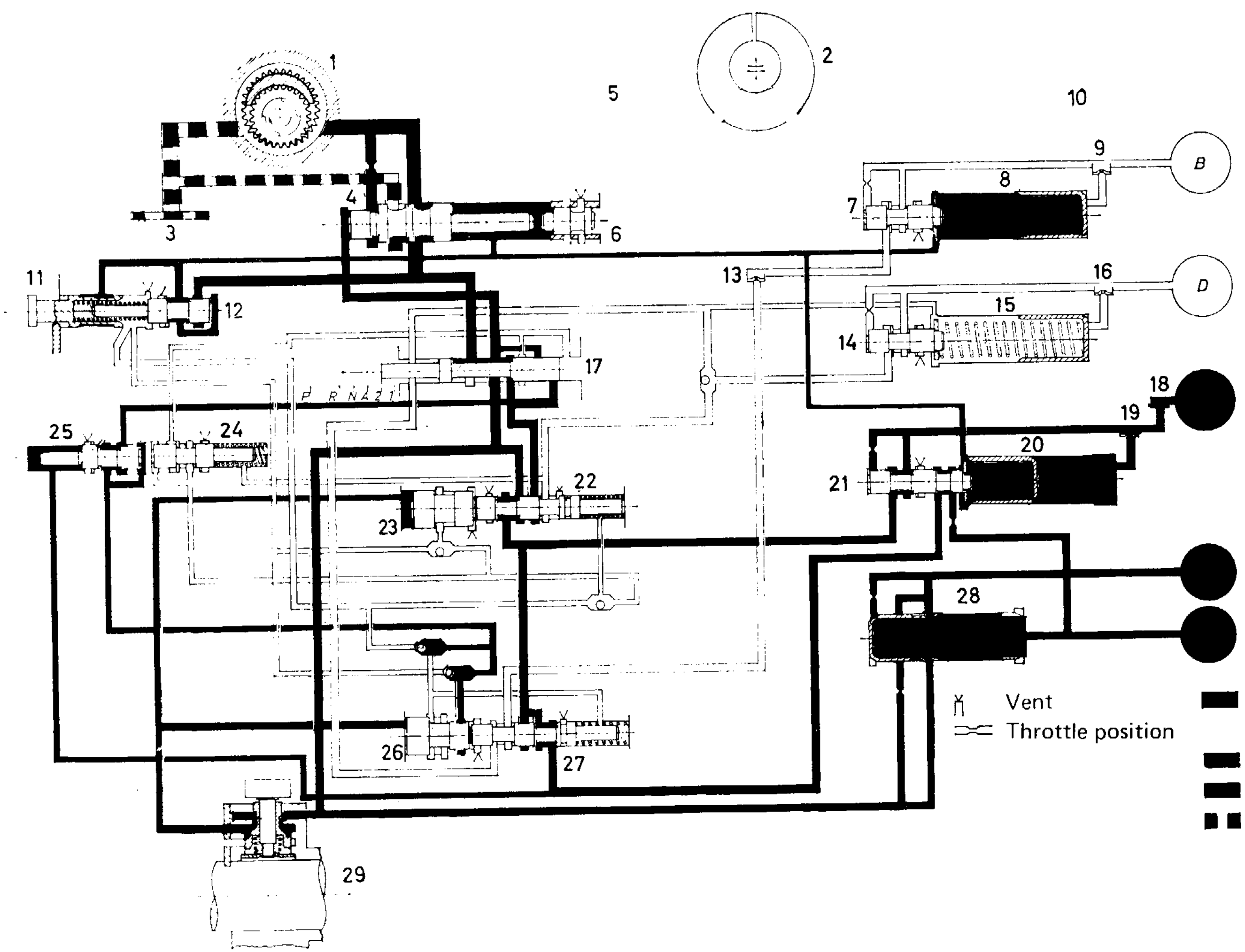
1 Primary pump
2 Torque converter
3 Oil strainer
4 Primary valve
5 Cooler
6 Converter valve
7 Clutch valve B
8 Clutch accumulator B
9 Valve orifice plate B
10 Lubrication, planetary gear unit
11 Accelerator control piston
12 Accelerator control valve
13 Return orifice plate B
14 Clutch valve D
15 Clutch accumulator D
16 Valve orifice plate D
17 Selector slide valve
18 Return orifice plate C
19 Valve orifice plate C
20 Clutch accumulator C
21 Clutch valve C
22 Gear-shift valve 1 - 2
23 Gear-shift piston 1 - 2
24 Locking valve 1
25 Locking valve 2
26 Gear-shift piston 2 - 3
27 Gear-shift valve 2 - 3
28 Clutch accumulators A and C'
29 Governor C'

A, B, C, and D are clutches

Primary pressure
Converter input pressure
Throttle pressure
Governor pressure
Locking valve pressure

Position 2: 1st gear

Hydraulic control 3 HP 12

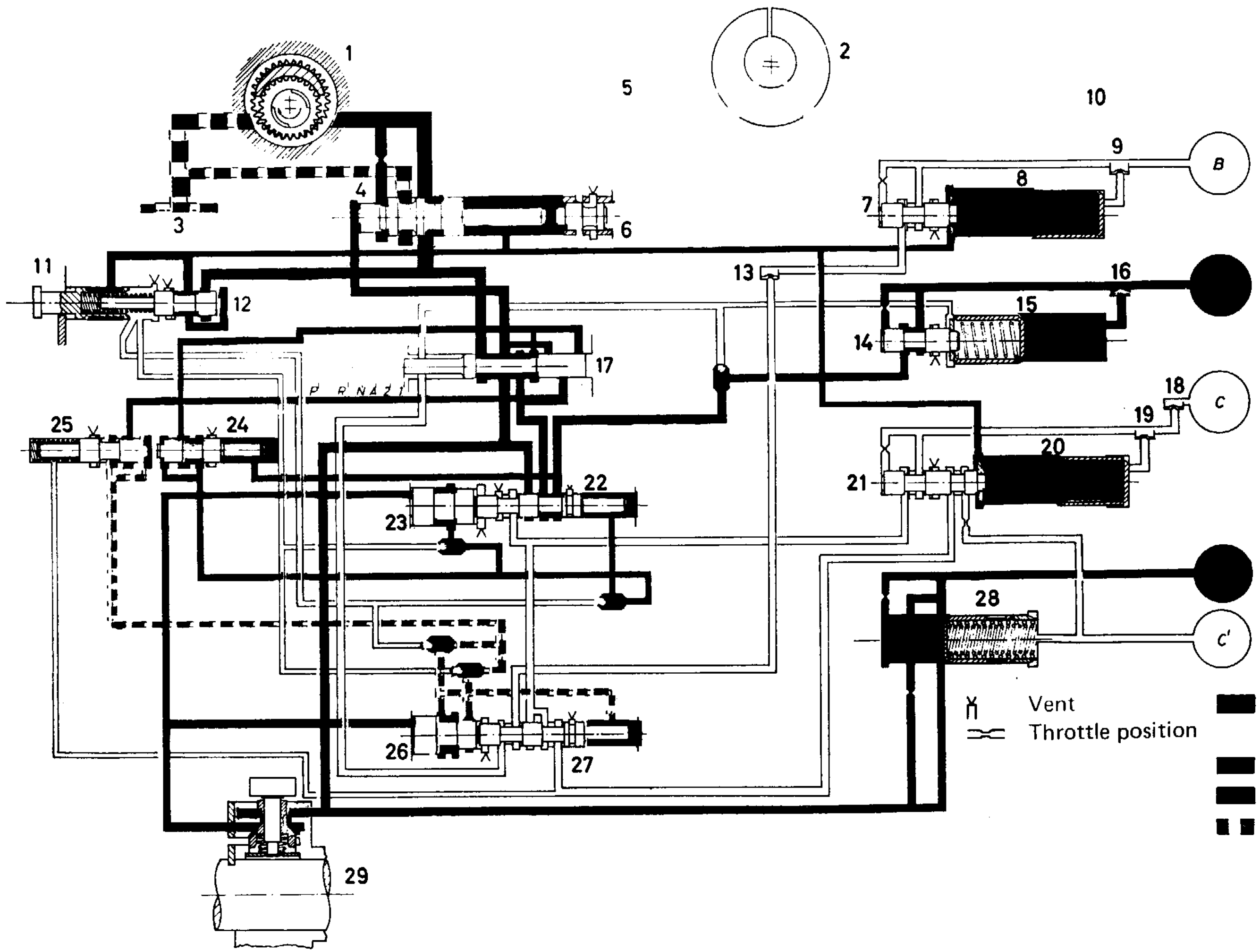


1 Primary pump
2 Torque converter
3 Oil strainer
4 Primary valve
5 Cooler
6 Converter valve
7 Clutch valve B
8 Clutch accumulator B
9 Valve orifice plate B
10 Lubrication, planetary gear unit
11 Accelerator control piston
12 Accelerator control valve
13 Return orifice plate B
14 Clutch valve D
15 Clutch accumulator D
16 Valve orifice plate D
17 Selector slide valve
18 Return orifice plate C
19 Valve orifice plate C
20 Clutch accumulator C
21 Clutch valve C
22 Gear-shift valve 1 - 2
23 Gear-shift piston 1 - 2
24 Locking valve 1
25 Locking valve 2
26 Gear-shift piston 2 - 3
27 Gear-shift valve 2 - 3
28 Clutch accumulators A and C'
29 Governor C'
A, B, C, and D are clutches

Primary pressure
Converter input pressure
Throttle pressure
Governor pressure
Locking valve pressure

Position 2: 2nd gear

Hydraulic control 3 HP 12

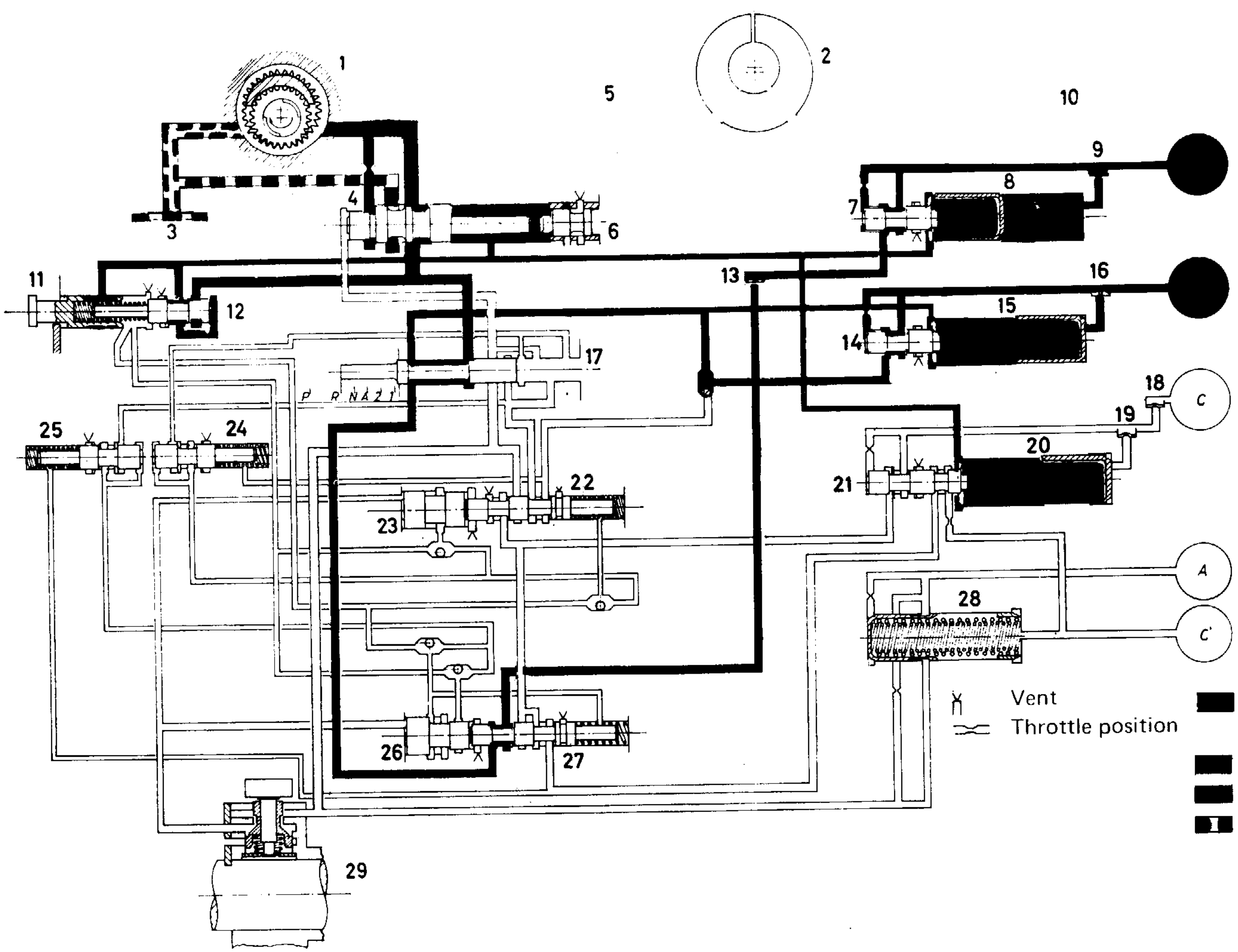


1 Primary pump
2 Torque converter
3 Oil strainer
4 Primary valve
5 Cooler
6 Converter valve
7 Clutch valve B
8 Clutch accumulator B
9 Valve orifice plate B
10 Lubrication, planetary gear unit
11 Accelerator control piston
12 Accelerator control valve
13 Return orifice plate B
14 Clutch valve D
15 Clutch accumulator D
16 Valve orifice plate D
17 Selector slide valve
18 Return orifice plate C
19 Valve orifice plate C
20 Clutch accumulator C
21 Clutch valve C
22 Gear-shift valve 1 - 2
23 Gear-shift piston 1 - 2
24 Locking valve 1
25 Locking valve 2
26 Gear-shift piston 2 - 3
27 Gear-shift valve 2 - 3
28 Clutch accumulators A and C'
29 Governor C'
A, B, C, and D are clutches

Primary pressure
Converter input pressure
Throttle pressure
Governor pressure
Locking valve pressure

Position 1: 1st gear

Hydraulic control 3 HP 12



1 Primary pump
2 Torque converter
3 Oil strainer
4 Primary valve
5 Cooler
6 Converter valve
7 Clutch valve B
8 Clutch accumulator B
9 Valve orifice plate B
10 Lubrication, planetary gear unit
11 Accelerator control piston
12 Accelerator control valve
13 Return orifice plate B
14 Clutch valve D
15 Clutch accumulator D
16 Valve orifice plate D
17 Selector slide valve
18 Return orifice plate C
19 Valve orifice plate C
20 Clutch accumulator C
21 Clutch valve C
22 Gear-shift valve 1 - 2
23 Gear-shift piston 1 - 2
24 Locking valve 1
25 Locking vlave 2
26 Gear-shift piston 2 - 3
27 Gear-shift valve 2 - 3
28 Clutch accumulators A and C'
29 Governor C'

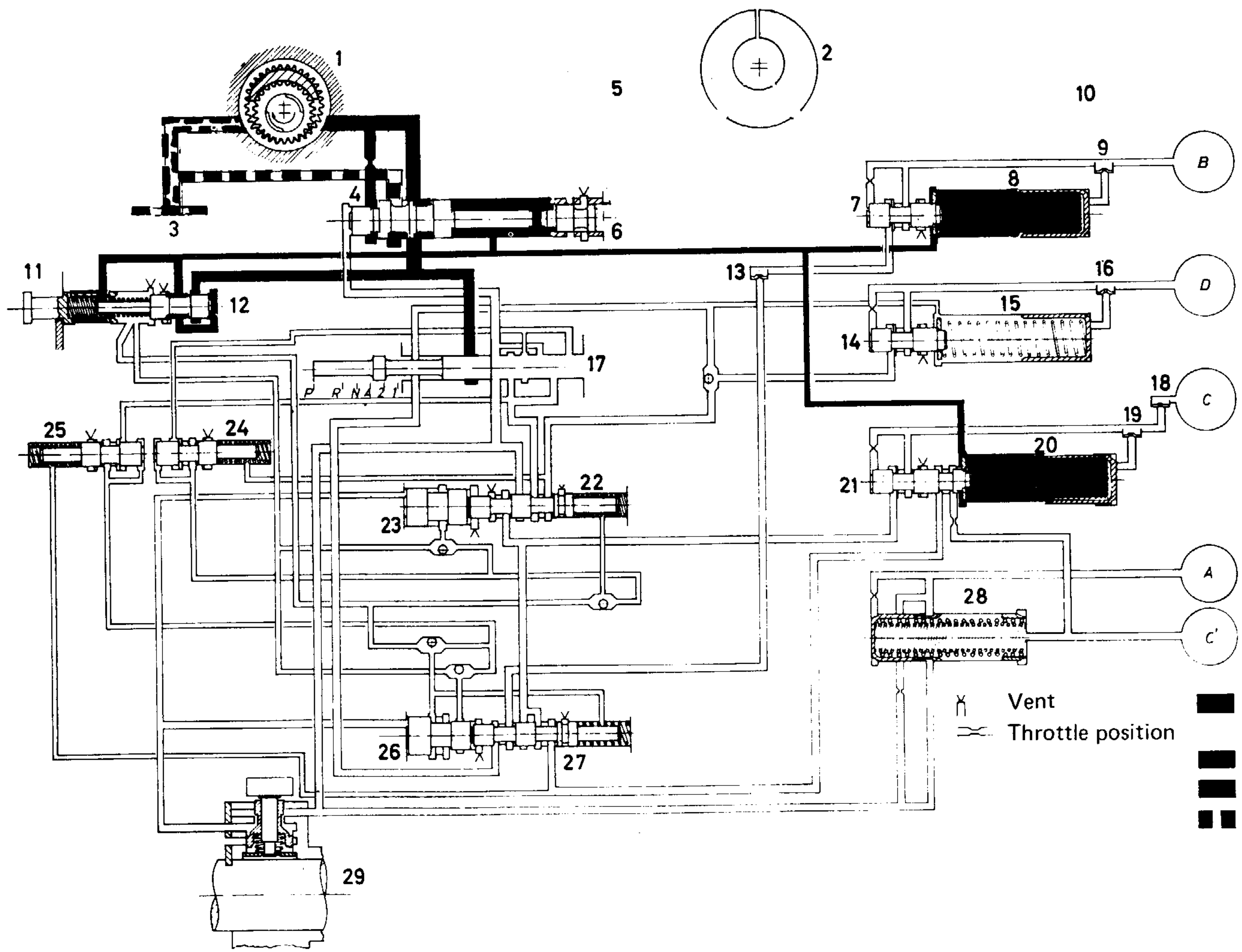
A, B, C, and D are clutches

Vent
Throttle position

Primary pressure
Converter input pressure
Throttle pressure
Governor pressure
Locking valve pressure

Position: Reverse gear

Hydraulic control 3 HP 12



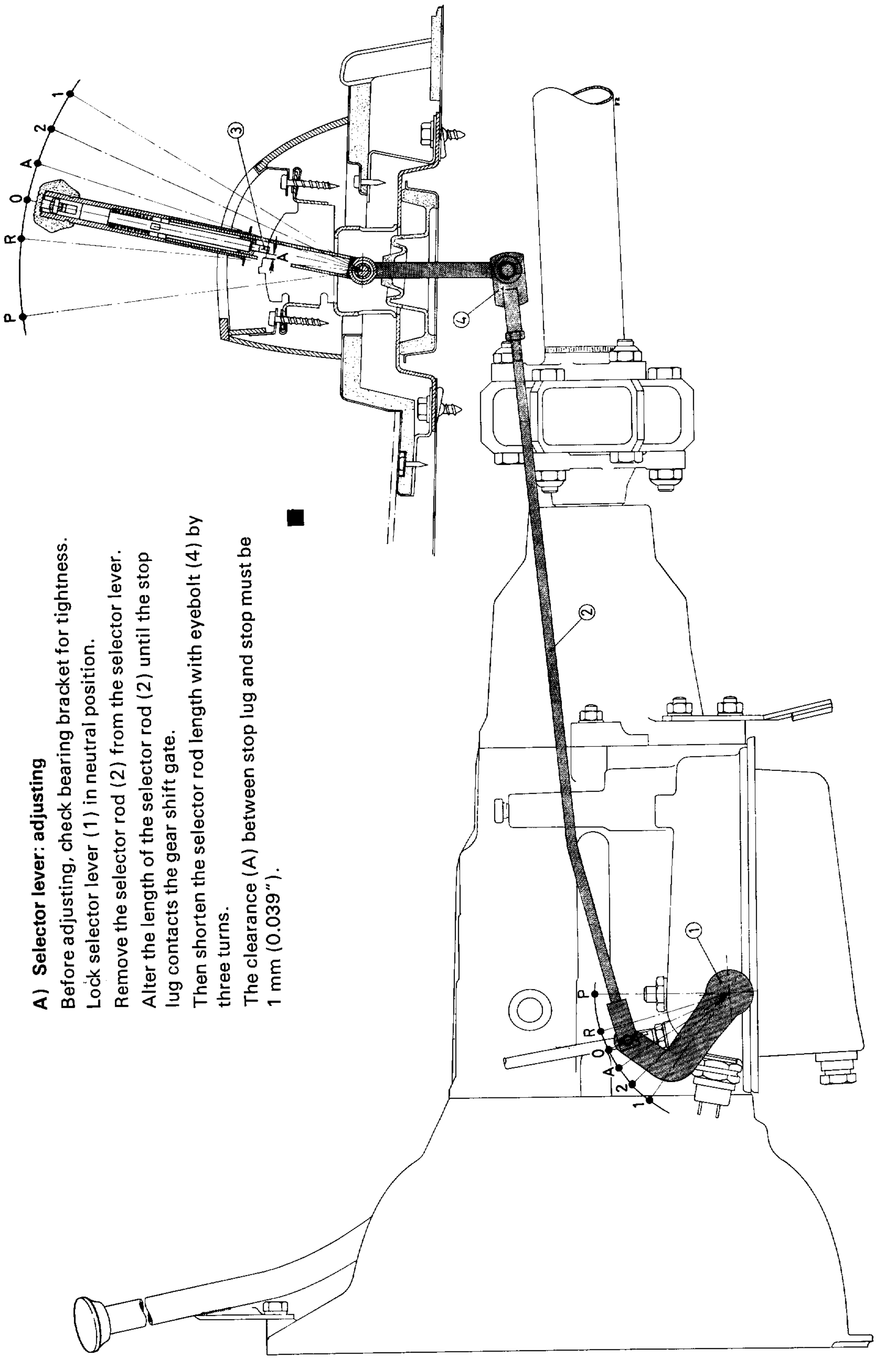
1 Primary pump
2 Torque converter
3 Oil strainer
4 Primary valve
5 Cooler
6 Con verter valve
7 Clutch valve B
8 Clutch accumulator B
9 Valve orifice plate B
10 Lubrication, planetary gear unit
11 Accelerator control piston
12 Accelerator control valve
13 Return orifice plate B
14 Clutch valve D
15 Clutch accumulator D
16 Valve orifice plate D
17 Selector slide valve
18 Return orifice plate C
19 Valve orifice plate C
20 Clutch accumulator C
21 Clutch valve C
22 Gear-shift valve 1 - 2
23 Gear-shift piston 1 - 2
24 Locking valve 1
25 Locking valve 2
26 Gear-shift piston 2 - 3
27 Gear-shift valve 2 - 3
28 Clutch accumulators A and C'
29 Governor C'

A, B, C, and D are clutches

Primary pressure
Converter input pressure
Throttle pressure
Governor pressure
Locking valve pressure

Position: Parking with engine running

24 00 004 Selector lever, accelerator linkage and cable: adjusting



A) Selector lever: adjusting

Before adjusting, check bearing bracket for tightness.

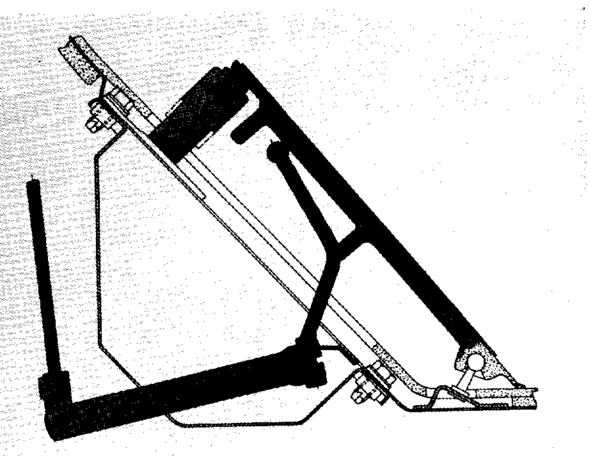
Lock selector lever (1) in neutral position.

Remove the selector rod (2) from the selector lever.

Alter the length of the selector rod (2) until the stop lug contacts the gear shift gate.

Then shorten the selector rod length with eyebolt (4) by three turns.

The clearance (A) between stop lug and stop must be 1 mm (0.039").



B) Accelerator linkage: adjusting

Remove air cleaner.

Remove accelerator cable.

Press accelerator pedal down to the kick-down stop into full acceleration position.

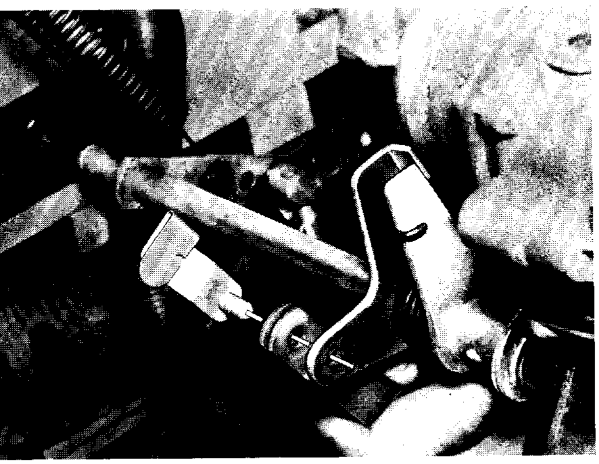
In this position the throttle valve must be fully open, that is to say that the throttle valve must not extend beyond the vertical position.

When adjusting, bend the stop.

The kick-down stop must not have lifted.

Adjust the length of the accelerator linkage using the eyebolt.

■



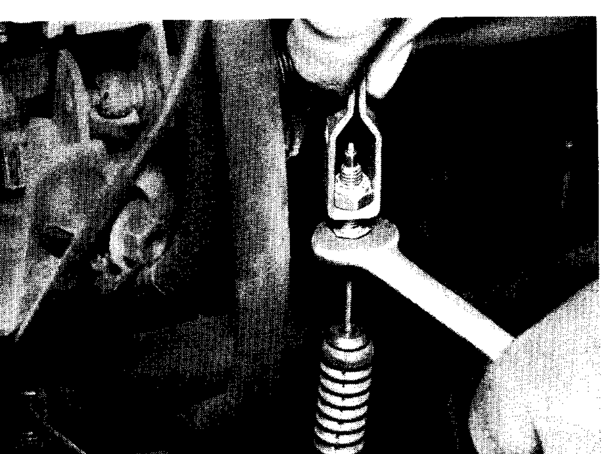
C) Accelerator cable: adjusting

Remove the accelerator cable from the rotary shaft.

Press down accelerator linkage to full acceleration position.

Determine the full acceleration position by repeatedly pulling the accelerator cable. The holes in the fork head must now coincide with the hole on the rotary selector so that the bearing pin can be inserted with correct alignment.

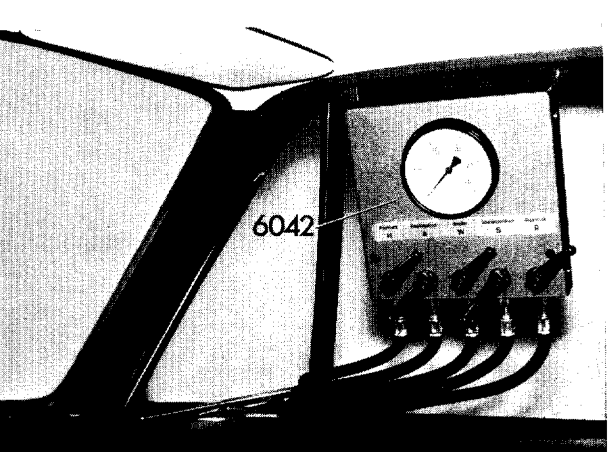
■



Adjustment of the accelerator cable length is done by turning the fork head.

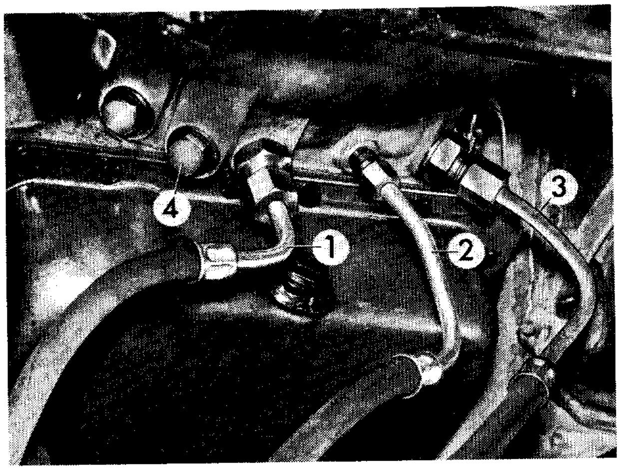
■

24 00 009 Hydraulic pressures: checking

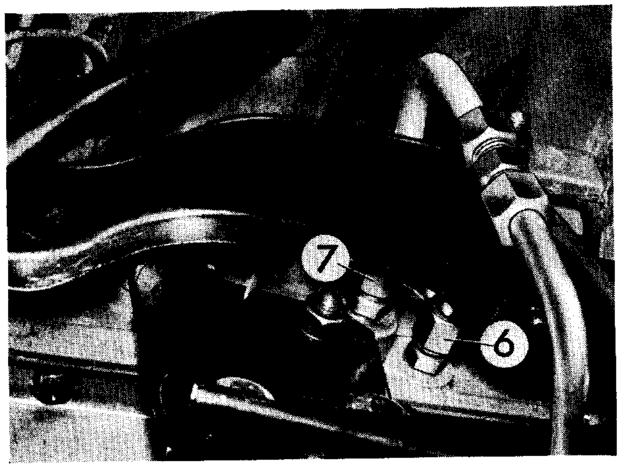


Attach test apparatus 6042 to the door window.

■

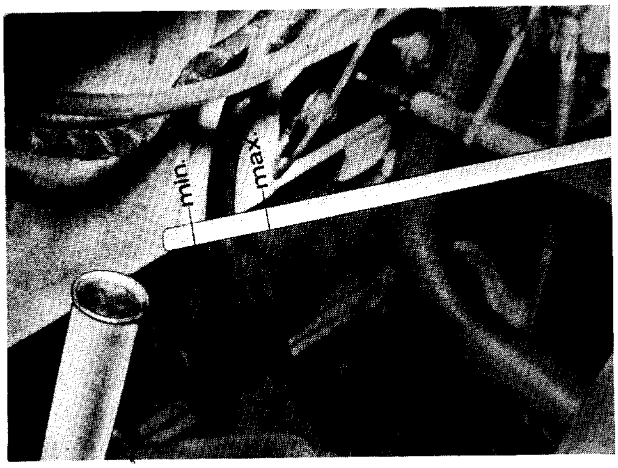


Connect high pressure hoses.
Converter pressure (1), clutch A (2), main pressure (3), connection for oil cooler (1) and (4), return flow (1), feed (4). ■



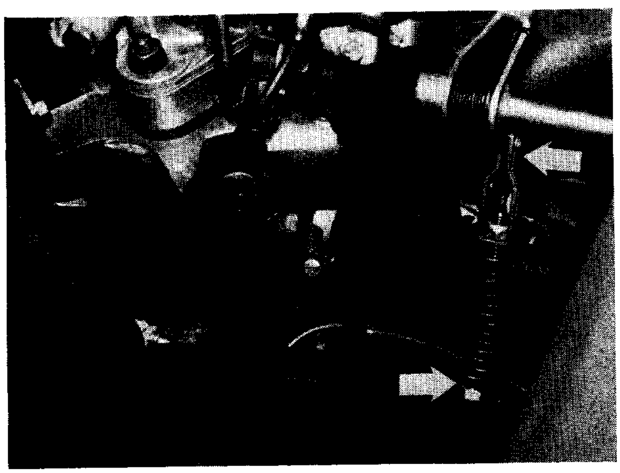
Check reduced shift pressure (6) and governing pressure (7). ■

Method: Disconnect accelerator cable; set engine speed to 1500 rev/min	Selector lever position	Accelerator cable position
Converter pressure[1]	0	(1) idle (2) pulled to kickdown
Clutch A[1]	A	brake pedal pressed down, handbrake on (1) idle (2) pulled to kickdown
Main pressure[1]	0	(1) idle (2) pulled to kickdown
Reduced shift pressure[1]	0	(1) idle (2) pulled to kickdown
Governing Pressure[1]	A	set to a road speed of 50 km/h (31 mile/h)



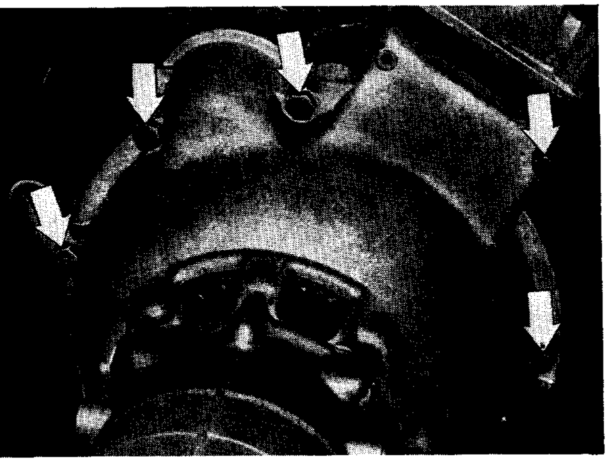
Note when fitting: Top up oil with selector lever in position P, transmission at normal operating temperature and engine idling.
Park car on flat, level surface.
When the oil is cold, the oil level must be approx. 1/4 above the min. mark on the dipstick.
Amount of oil between min. and max. marks approx. 0.6 litres (1.06 Imp. pints/0.63 US quart).
Important: If too much oil is added, this will cause foaming, oil will be lost and the temperature will rise at high speeds.
If there is not enough oil, valve chatter will be heard, foam will be formed and the engine will suddenly speed up when driving round bends. ■

24 00 020 Removal and fitting of transmission



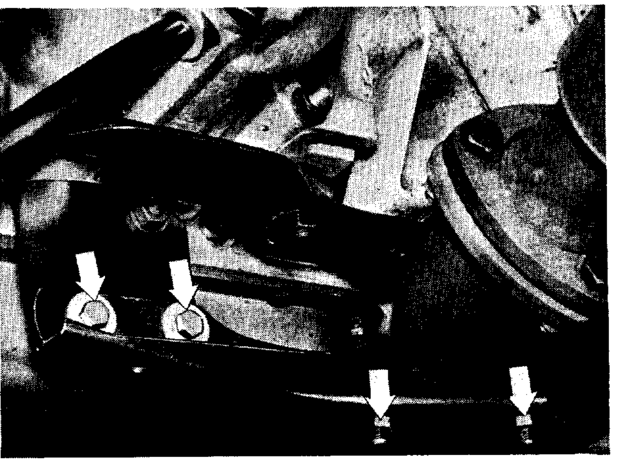
Disconnect negative lead from battery.
Disconnect accelerator cable and remove from counter bearing.
Note when fitting: Adjust accelerator cable (see 24 00 004). ■

[1] See specifications



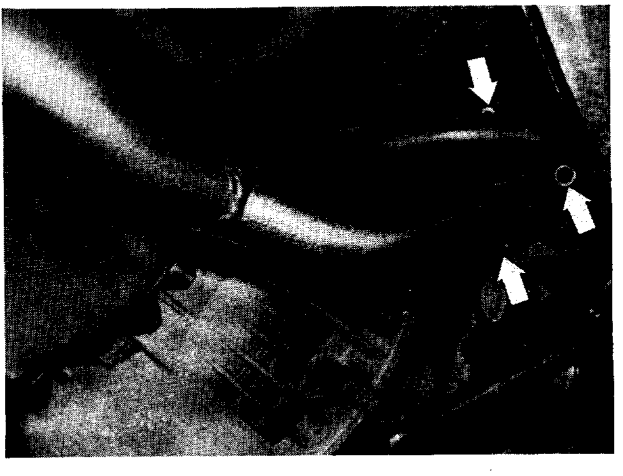
Remove oil filler tube – 24 11 020.
Plug aperture.
Unscrew all fastening bolts for the automatic transmission that can be reached from above.
Drain oil.
Important: Do not use oil again.

Note when fitting: If the oil smells burnt and is black in colour, dismantle the transmission. If the oil has a shiny grey colour, it contains aluminium or iron abraded particles.
Unlike iron, aluminium abrasion cannot be trapped magnetically.
■



Detach exhaust support from transmission.
The support clamp should be loosened only.

Note when fitting: Fit exhaust support without trapped stresses, as the exhaust will otherwise vibrate and cause a drumming noise.
■

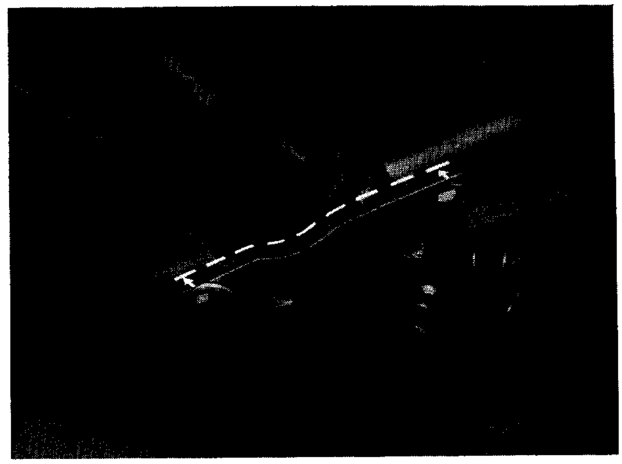


Disconnect exhaust pipe from manifold.
Turn steering wheel to full left lock.
■

Detach propeller shaft.

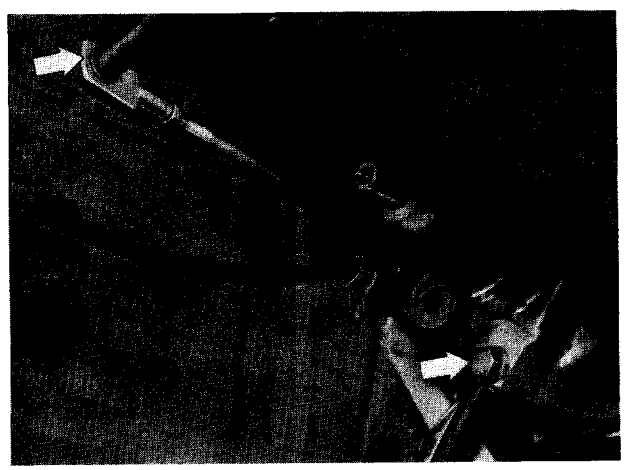
Note when fitting: Do not turn bolts.
Check centering for freedom of movement and apply Longterm 2 grease if necessary.
■

Dismantle centre bearing support.
Installing instructions: Tighten centre bearing support with 2 mm (0.08 in) preload in forward direction. ■

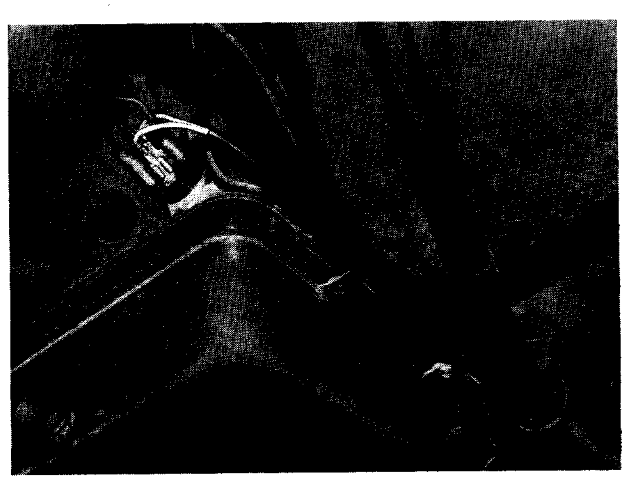


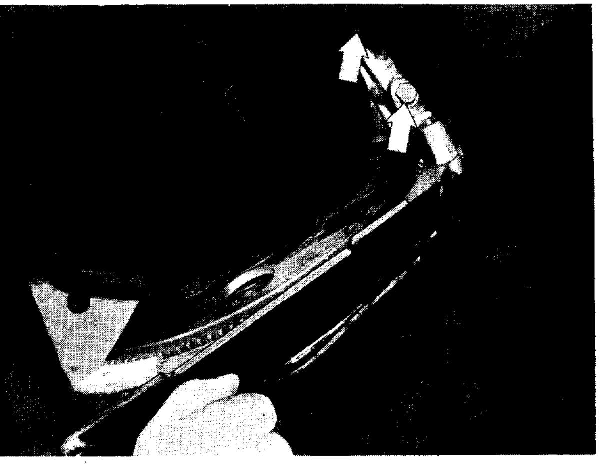
Hinge the propeller shaft downwards and remove from the centering journal. ■

Detach speedometer drive shaft and selector rod. ■



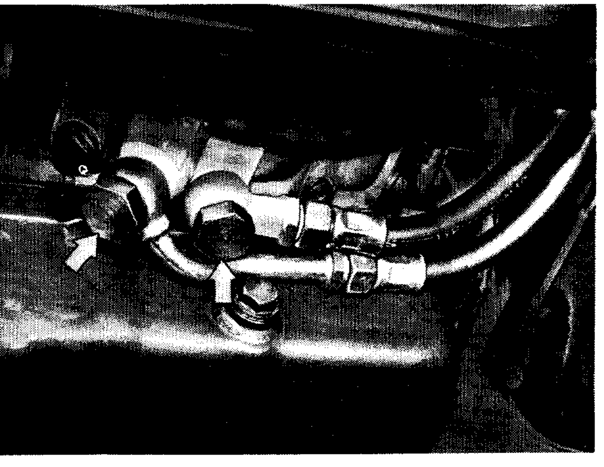
Remove cable from starter inhibit switch.
Installation instructions: Green/white, blue/black terminal 15, brown/black, brown terminal 50. ■





Loosen thrust bracket (if installed) and detach cover plate.

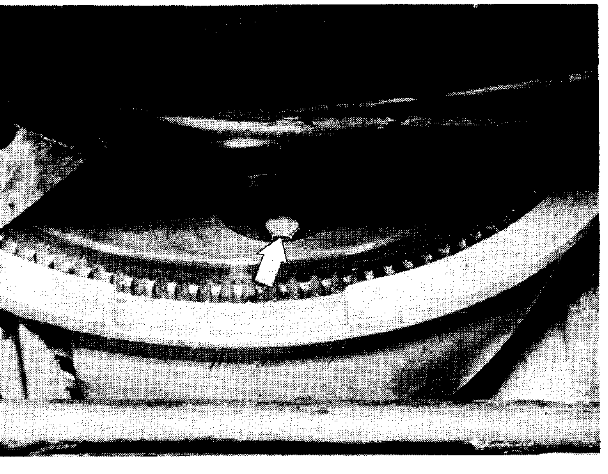
■



On version with oil cooler:
detach oil lines at transmission.

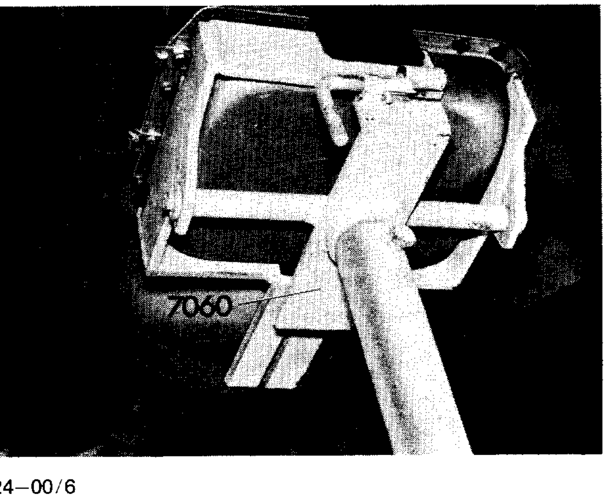
When installing: Check condition of gaskets and renew if necessary.

■



Disconnect the torque converter from the drive plate at four points.

■

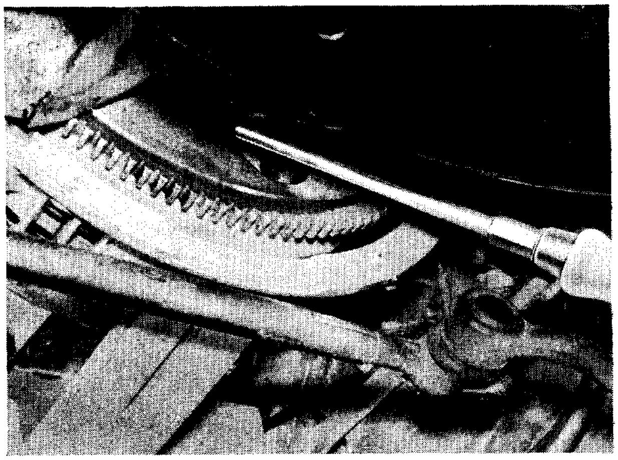


Support transmission with special tool 7060.
Dismantle cross-member from body.
Remove the remaining transmission attachment bolts.

■

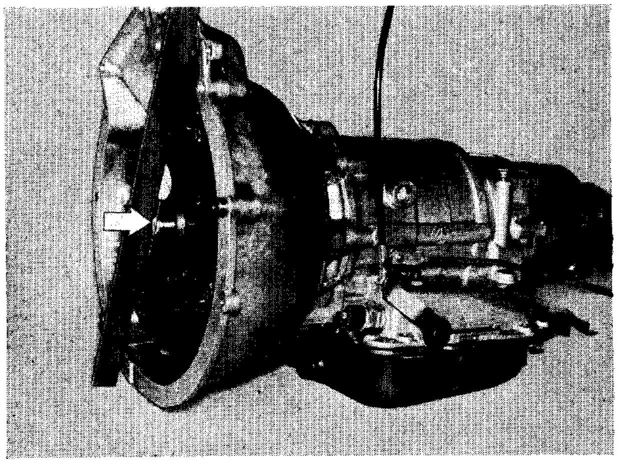
Pull transmission away from engine, together with the torque converter.

■



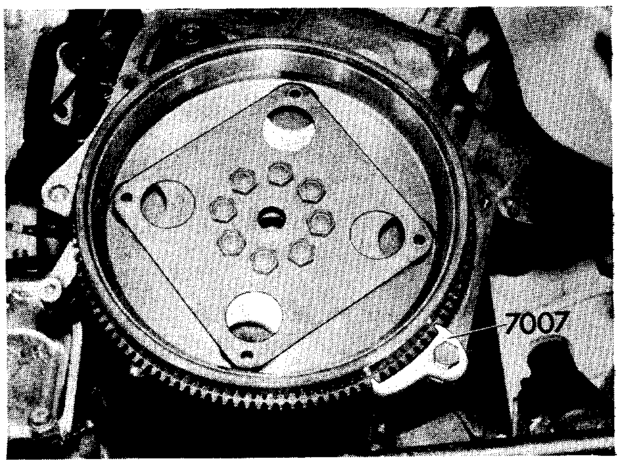
Installation instructions: The torque converter is in the correct position for installing when the guide journal is situated below the rim of the casing.
If this is not the case, insert the torque converter into the primary pump while turning gently.

■



Installation instructions: Check the drive plate for cracks, and renew if necessary.
Prevent flywheel from turning with holder 7007.

■

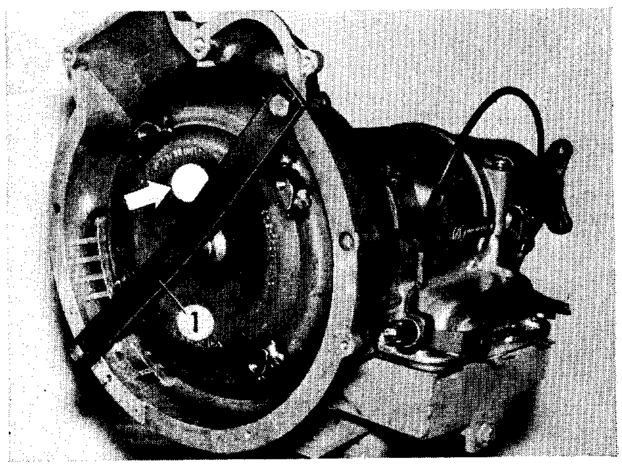


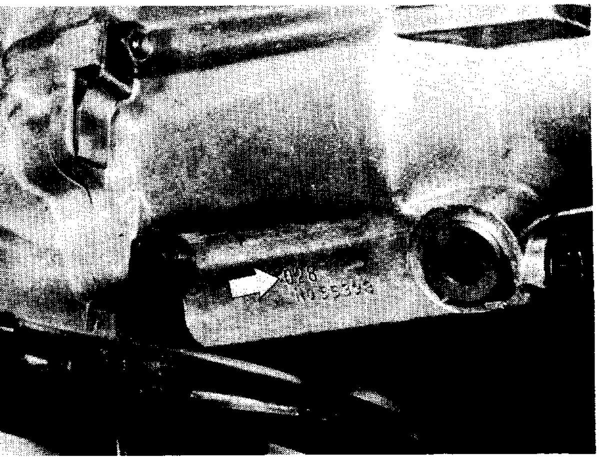
24 00 040 Exchange transmission – installing

Dismantle transmission – 24 00 020.

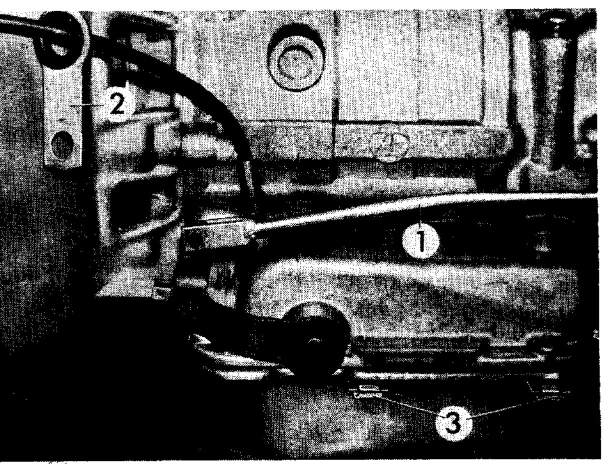
Warning: on version with oil cooler:
When installing an exchange transmission, always flush out the oil cooler and hoses thoroughly with cleaning grade gasoline (petrol), petroleum spirit or ATF.
BMW 2002 A torque converter: white dot.
Remove transit bar (1).

■

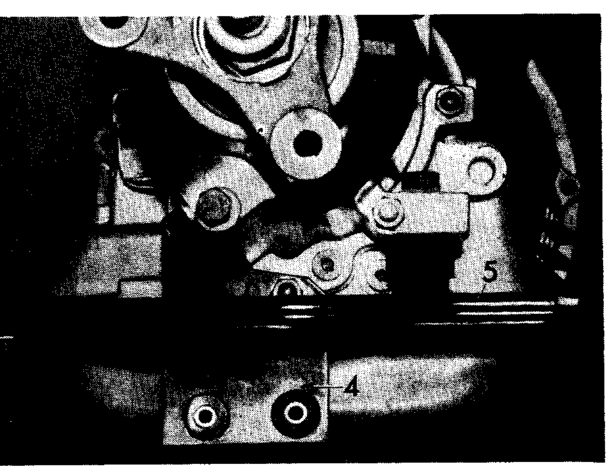




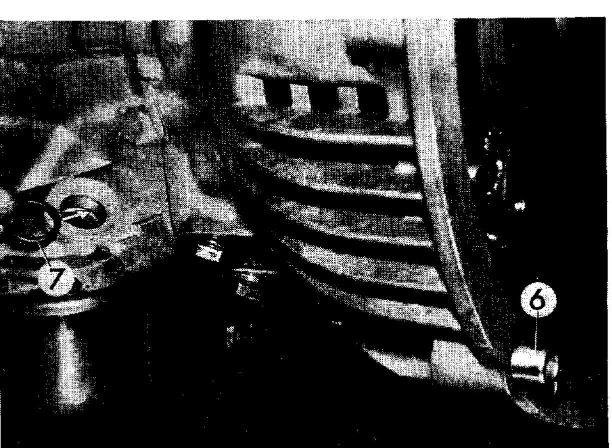
Transmission identification number on BMW 2002 A transmission cover: 028.
The number below is the transmission serial number.
■



Install linkage (1), accelerator cable holder (2) and clips (3) on new transmission.
■

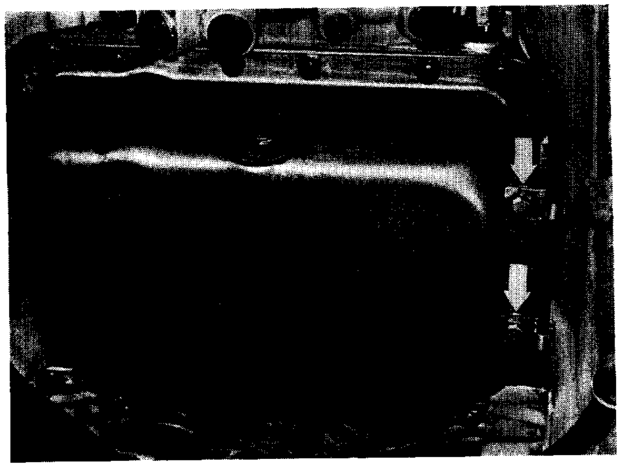


Transfer the exhaust pipe holder (4), transmission mounting and cross-member (5).
■



Transfer fitting sleeve (6) for engine-transmission centering.
Install O-ring (7).
■

24 11 000 Transmission oil sump: removing and installing



Drain off oil.

Warning: Drained oil must not be re-used.

Installation instructions: If the oil smells of burning and has a dark colour, the transmission must be dismantled. If the oil is opalescent grey, this means that aluminium or iron particles are present.

Aluminium particles are not attracted magnetically as are iron particles.

Place car on level surface.

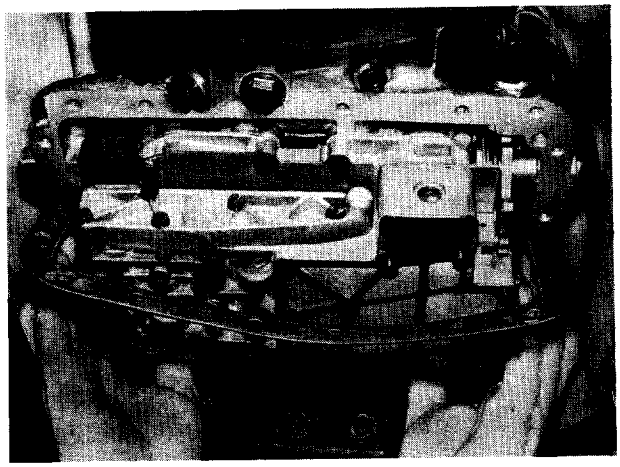
Top up oil with selector lever in position P, transmission at normal working temperature and at idling speed.

With cold oil the oil level must lie about 1/4 above the minimum mark on the dip stick.

Quantity of oil between the min. and max. marks is about 0.6 liters (1 Imp. pint, 0.63 US quarts).

Oil level too high if: heavy foam forms, splash losses occur or temperature increases when travelling at speed.

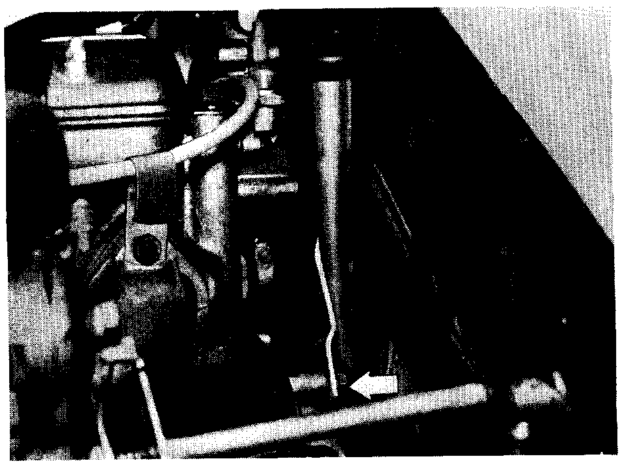
Oil level too low if valve "chatter" occurs, foam forms or the engine overspeeds.



Dismantle oil sump.

Installation instructions: Attach brackets and spacer washer at the side.

■

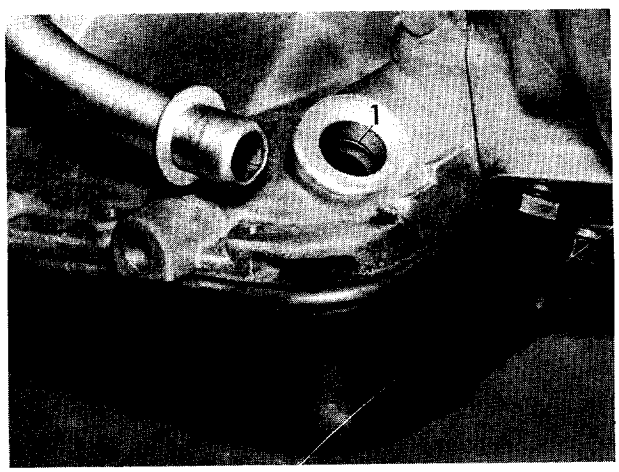


Always renew gasket.

Only use genuine BMW gaskets.

■

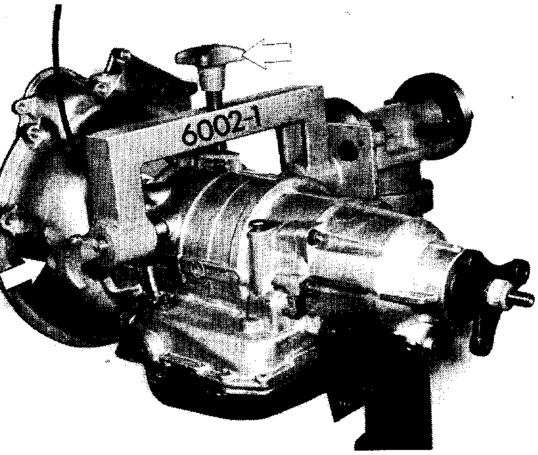
24 11 020 Oil filler pipe: removing and installing



Disconnect oil filler attachment bolts.

Remove oil filler pipe from the transmission.

■



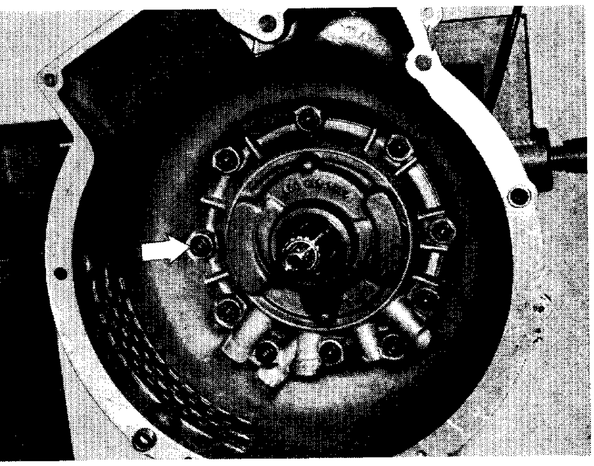
24 11 030 Converter dome: removing and installing

Remove torque converter 24 40 000.

Attach transmission to clamp 6002-1.

Warning: Only tighten the clamp bolts lightly, so that the transmission housing is not deformed.

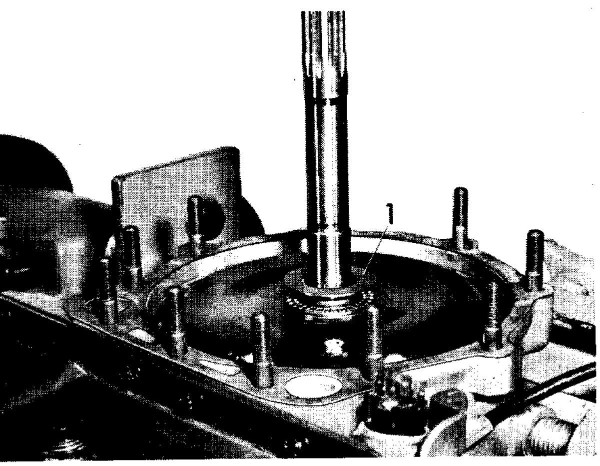
■



Unscrew nuts.

Lift out convertor dome.

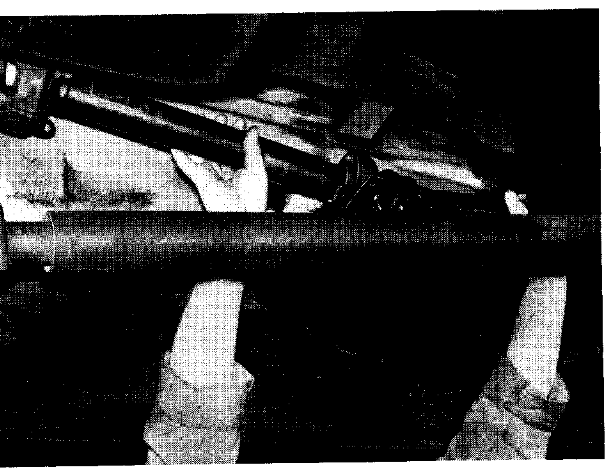
■



Installation instructions: Only install genuine seals.

The axial ring (1) must lie on the needle cage.

■



24 11 050 Transmission cover: removing and installing

Disconnect exhaust at triangular flange.

Dismantle the propeller shaft from the output flange and centre mounting bracket. The Giubo coupling is left on the propeller shaft.

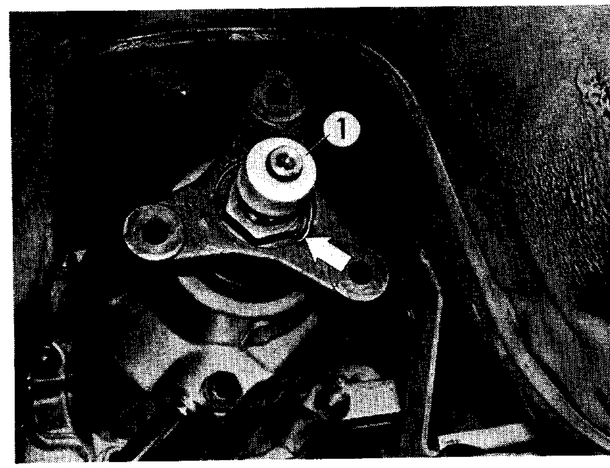
Pull propeller shaft downwards and remove from centering journal.

Installation instructions: Tighten centre bearing bracket with 2 mm (0.08 in.) preload in forward direction.

■

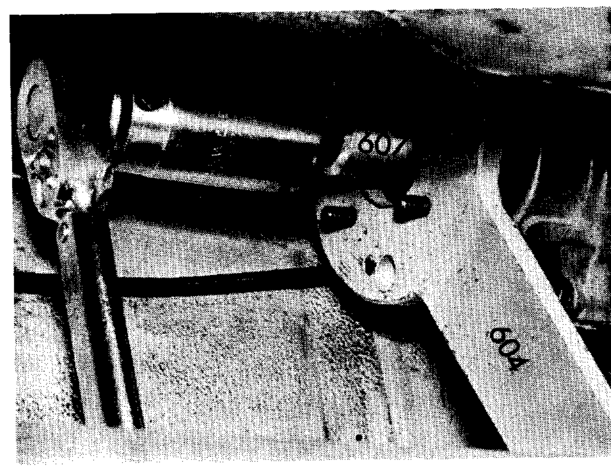
Remove stop pad (1).
Lift out lock plate.
Installation instructions: When in position force the lock plate into the output flange groove.

■



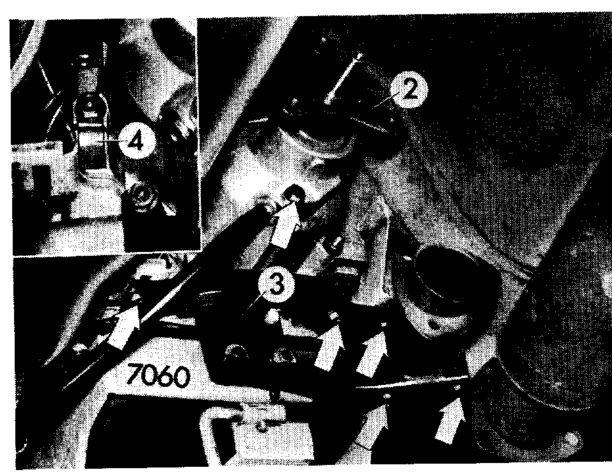
Hold the output flange in position with retainer wrench 604.
Fit the centering bush 607 on the centering journal.
Unscrew collar nut.

■



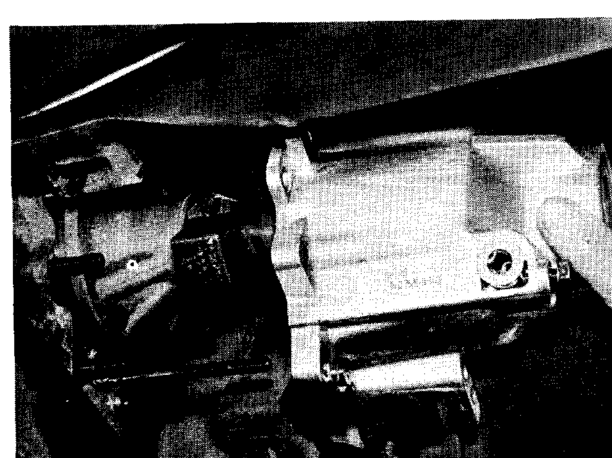
Remove output flange (2).
Support transmission with tool 7060.
Remove the speedometer drive shaft.
Dismantle transverse member.
Loosen holder bracket and remove holder plate for exhaust mounting (3).
Installation instructions: Note the installation position of the cover plate (4) for the pawl.

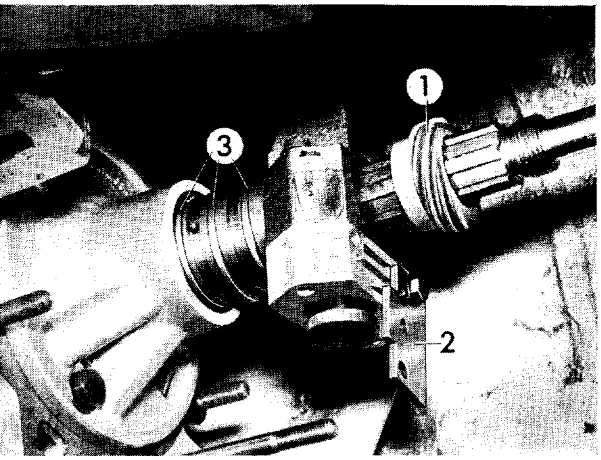
■



Remove transmission cover.

■





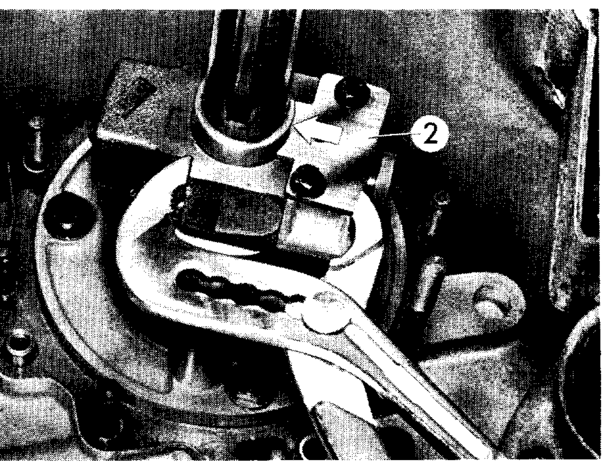
Remove speedometer worm gear (1).

Installation instructions: Speedometer worm gear collar points towards the centrifugal governor.

Unscrew drive plate (2) and after swivelling it out remove centrifugal governor.

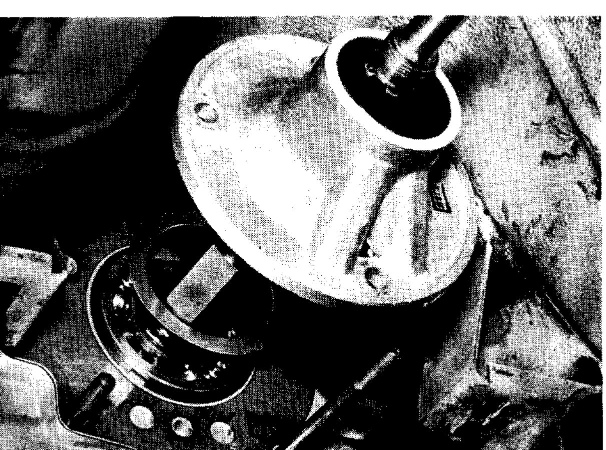
Oil the rectangular rings well.

■



Warning: Press the drive plate (2) firmly into the groove in the output shaft and then tighten.

■



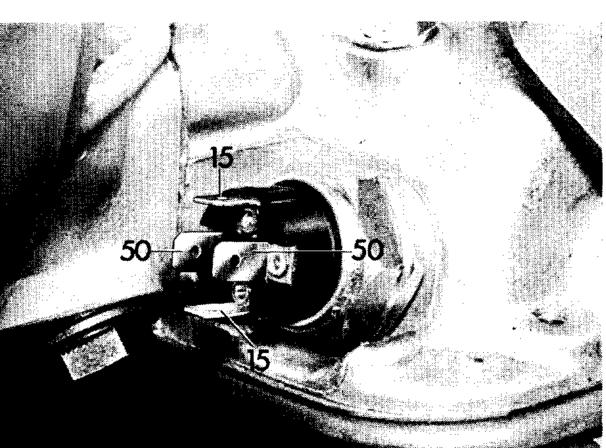
Dismantle bearing flange.

Renew seal.

Warning: When installing, coat compensating shim with grease to retain in mounting flange.

■

24 11 101 Starter lock and reversing lamp switch: renewing

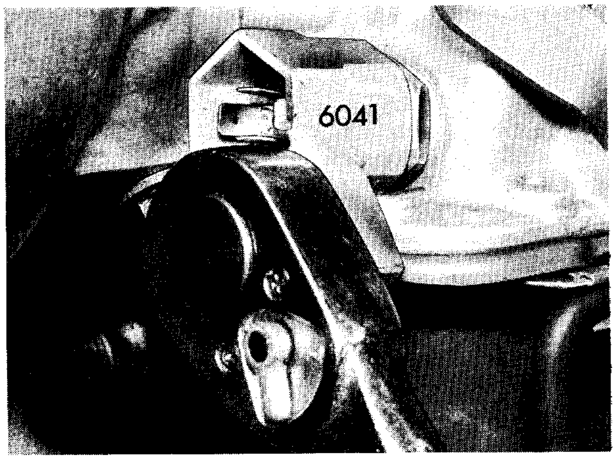


Remove all cables.

Installation instructions: Green/white, blue/black cables on terminal 15. black/brown, brown cables on terminal 50.

■

Unscrew switch using wrench 6041
Installation instructions: The switch can be adjusted using correspondingly thicker seals.
See 'Starter lock switch: checking'.



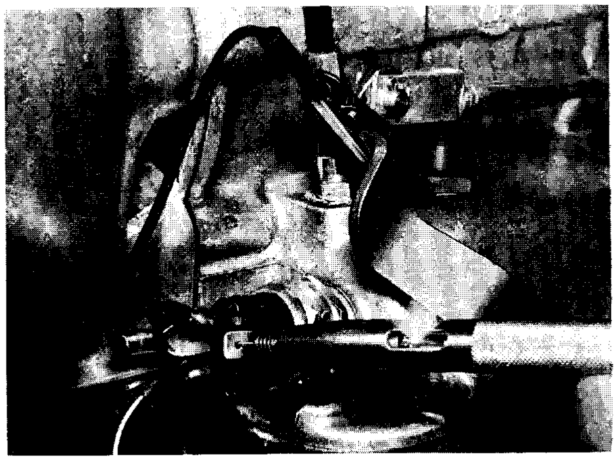
Check reversing light switch.

Remove cable from terminal 15.

Earth one terminal tag.

Connect test lamp to the positive terminal and the second terminal tag.

The test lamp should now light up with the selector lever in position R.



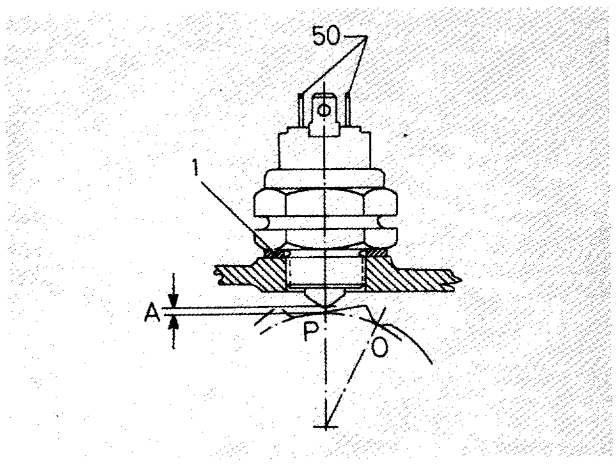
Starter locking switch: checking

Remove cable from terminal 50.

Earth one terminal tag. Connect test lamp to the positive terminal and the second terminal tag.

The test lamp should now light up with the selector lever in position P od O, if the switch and seal are correctly adjusted.

Clearance (A about 0.5 mm = 0.02") must exist between the locking pawl and the contact pin.



24 12 011 Radial seal for output flange: renewing

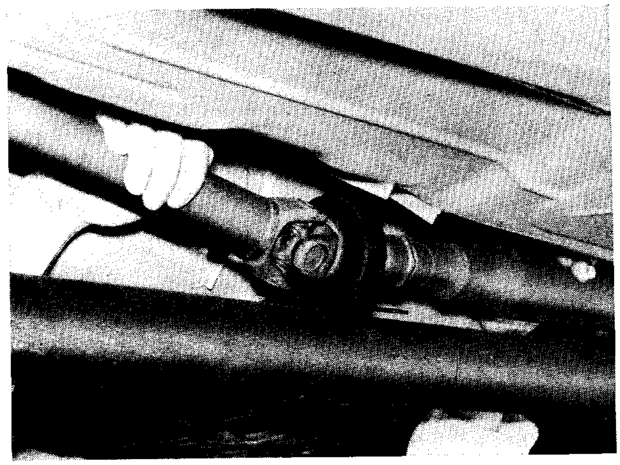
Remove exhaust pipe from the triangular flange.

Dismantle the propeller shaft from the output flange and center bearing support. The Giubo coupling remains on the propeller shaft.

Pull the propeller shaft downwards and remove from the centering journal.

Installation instructions: Tighten centre bearing support with 2 mm (0.08 in.) preload in forward direction.

■

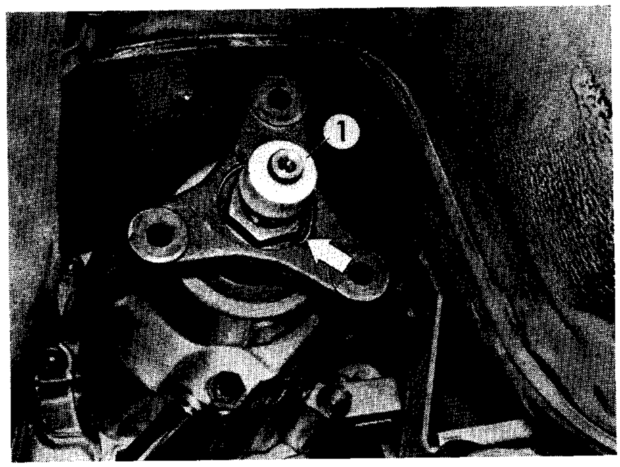


Remove stop pad (1).

Lift out keeper plate.

Installation instructions: When in position force lock-plate into the output flange groove.

■



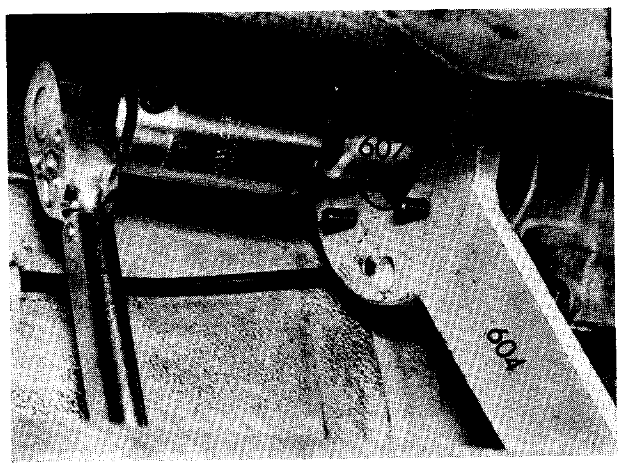
Support output flange with holder wrench 604.

Insert centering bush 607 into centering journal.

Remove collar nut.

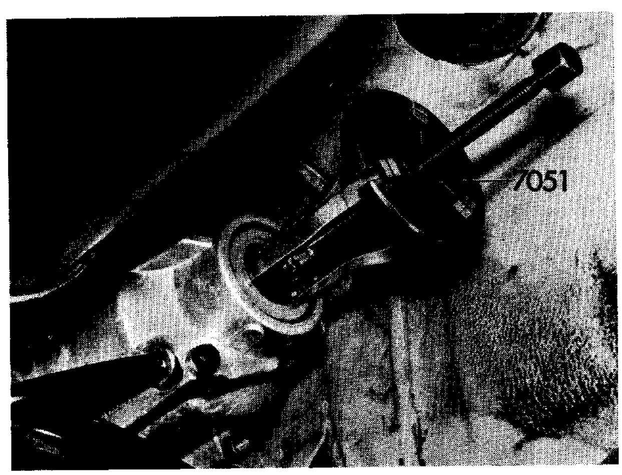
Remove output flange.

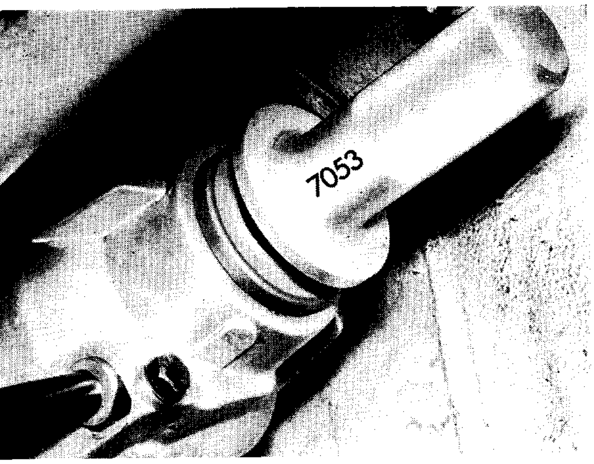
■



Remove radial seal: Use puller 7051.

■

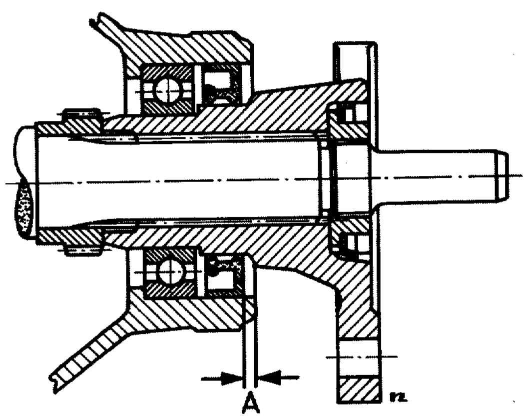




Installation instructions: Insert radial seal using mandrel 7053.

The mandrel is designed so that the radial seal is correctly positioned when installed.

■

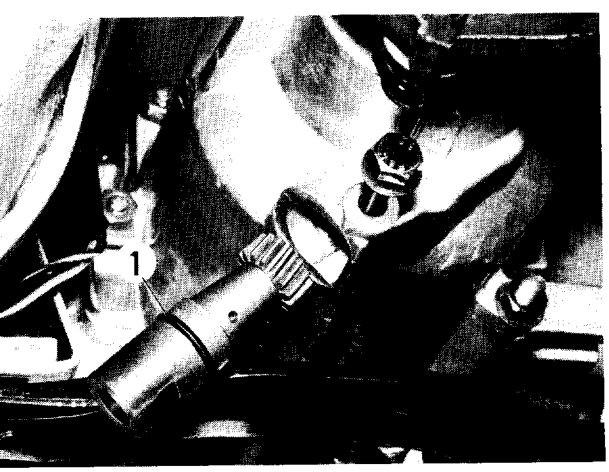


Fill the cavity between the packing washers with brand-name grease.

Warning: If the radial seal is not inserted with mandrel 7053, then clearance A = 3 mm (0.118") must be adhered to without fail.

■

24 12 031 O-ring for speedometer bushing: renewing

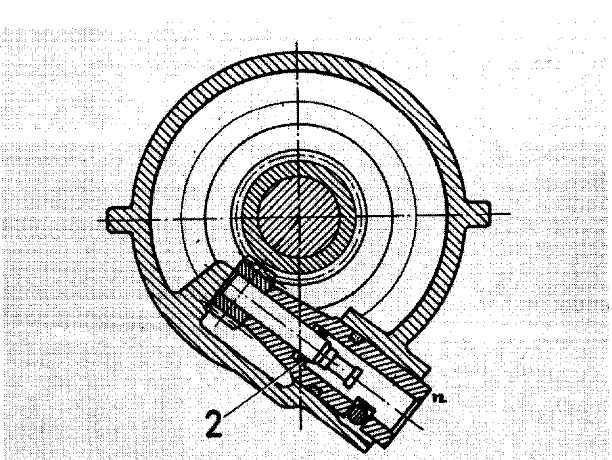


Dismantle speedometer drive shaft.

Remove speedometer bushing.

Renew O-ring (1).

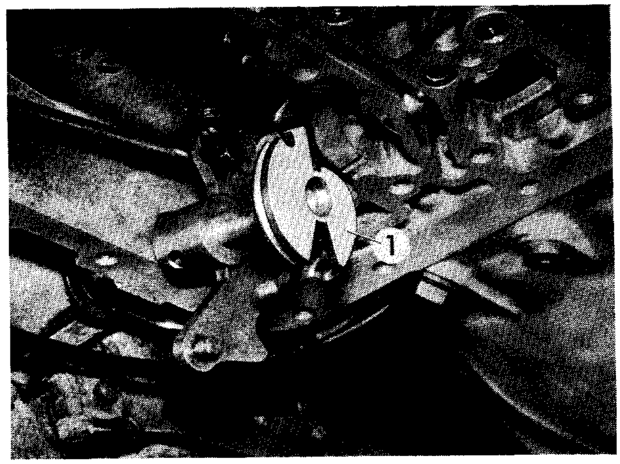
■



If the radial seal (2) is leaking, the speedometer bushing must be renewed.

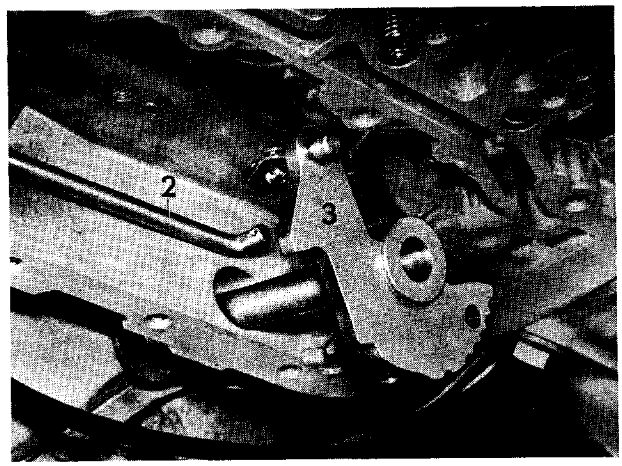
■

24 12 051 O-ring for transmission selector lever: renewing



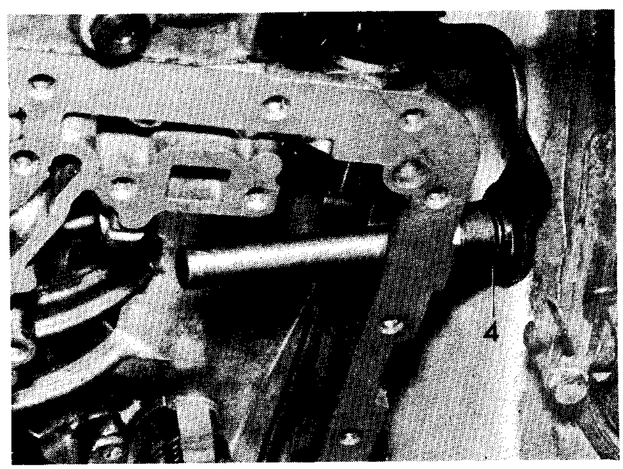
Dismantle spring 24 34 701.
Remove accelerator cable.
Remove accelerator cam (1) from transmission selector lever.

■



Dismantle linkage (2) from locking pawl.
Remove locking pawl from transmission selector lever.

■

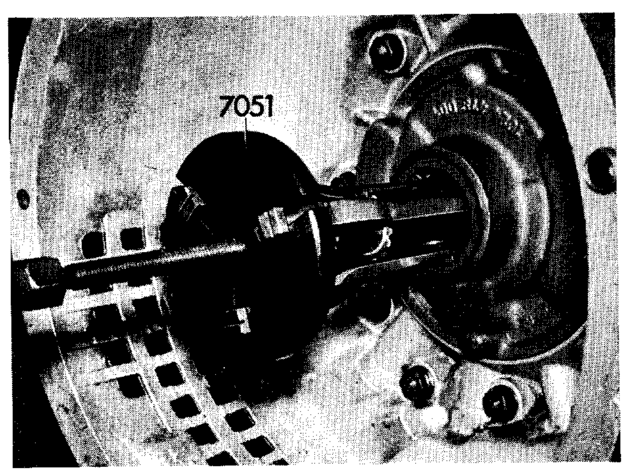


Lift out O-ring (4).
Install the new O-ring through the hole on to the transmission selector lever.

■

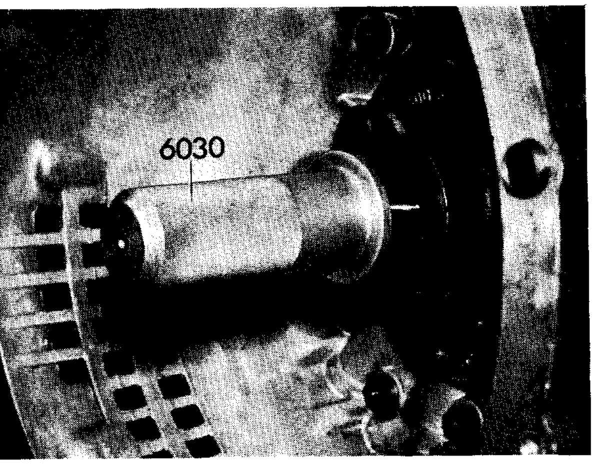
24 12 501 Radial seal for torque converter: renewing

— torque converter dismantled —



Remove radial seal using extractor 7051 and pressure pad.

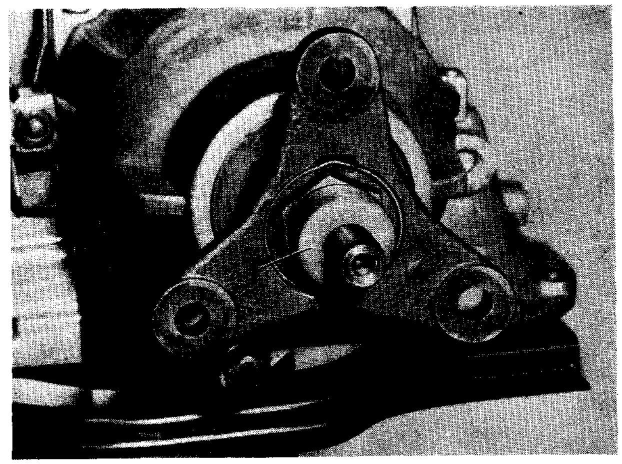
■



Insert radial seal until firmly seated using special tool 6030.

■

24 21 500 Output shaft: removing and installing



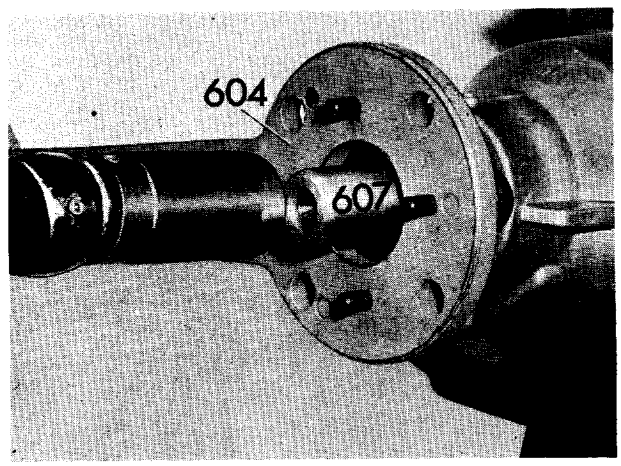
Dismantle multi-plate clutches and brakes.
24 23 703.

Remove stop pad (1).

Lift out locking plate.

Installation instructions: When in position, force locking plate into the output flange groove.

■



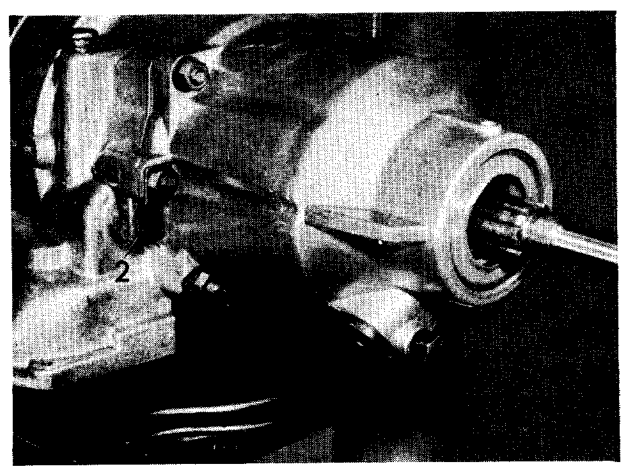
Insert centering bush 607 into centering journal.

Support output flange using holder wrench 604.

Unscrew collar nut.

Remove output flange.

■

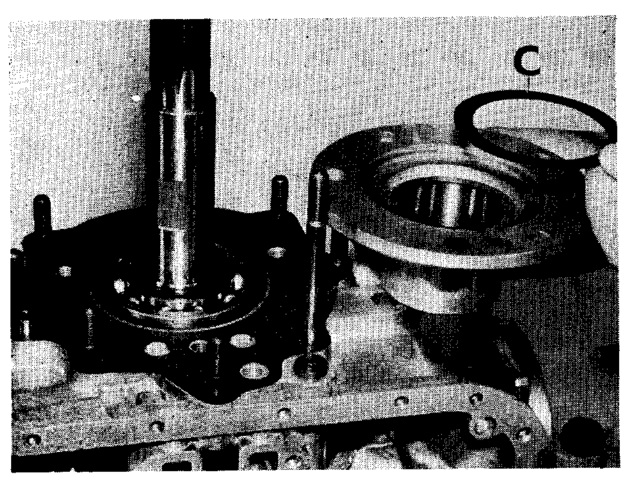


Unscrew transmission cover attachment nuts.

Installation instructions: Ensure correct installed position of the pawl cover plate (2).

Remove cover.

■



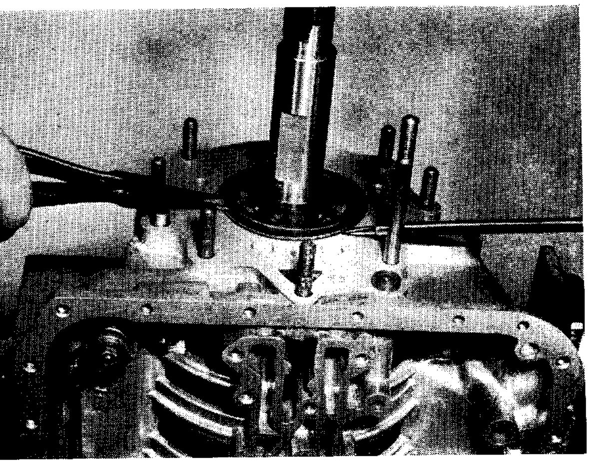
Dismantle centrifugal governor and governor boss.
24 32 000.

Dismantle bearing flange.

Renew seal.

Warning: When installing, coat compensating shim (C) with grease to retain in bearing flange.

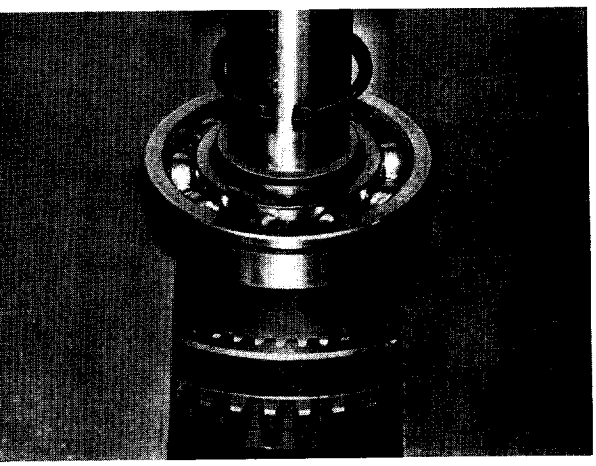
■



Lift out circlip.

Force the output shaft and grooved ball bearing out of the transmission housing.

■



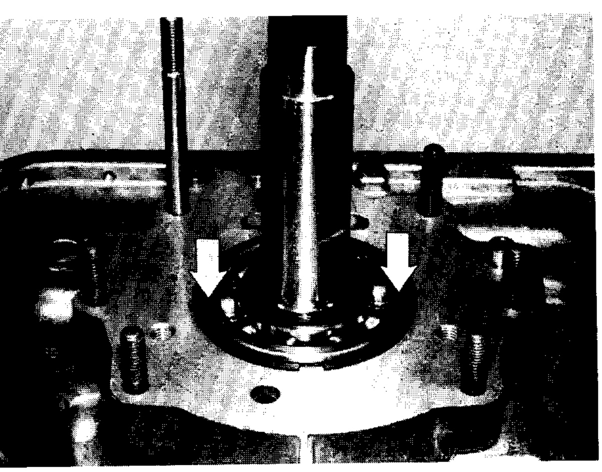
24 21 411 Grooved ball bearing for output shaft: renewing

— output shaft dismantled —

Lift out Seeger circlip.

Press out grooved ball bearing.

■



Installation instructions: Press on grooved ball bearing cold.

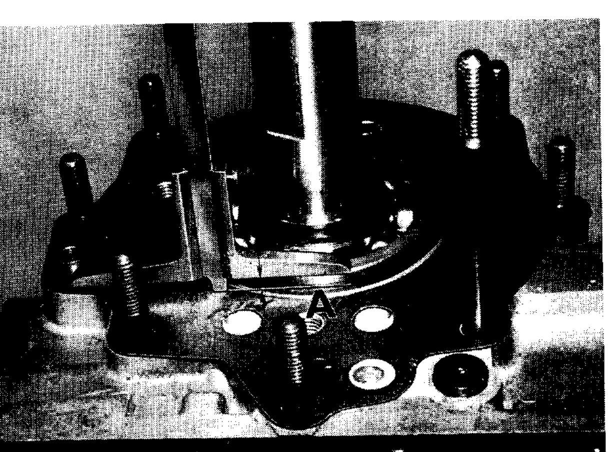
Insert Seeger circlip.

Press the grooved ball bearing into the casing with the annular groove facing the output side.

Install circlip.

Warning: There must be no clearance between the grooved ball bearing and the housing.

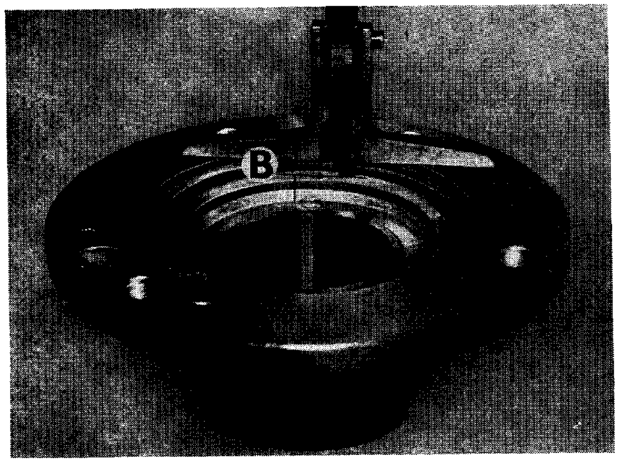
■



Measure clearance A - from the bearing outer ring to the seal.

■

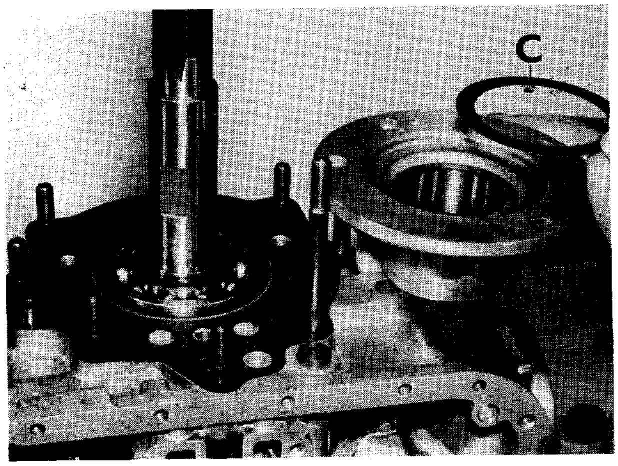
Measure clearance B — from flange to seat.



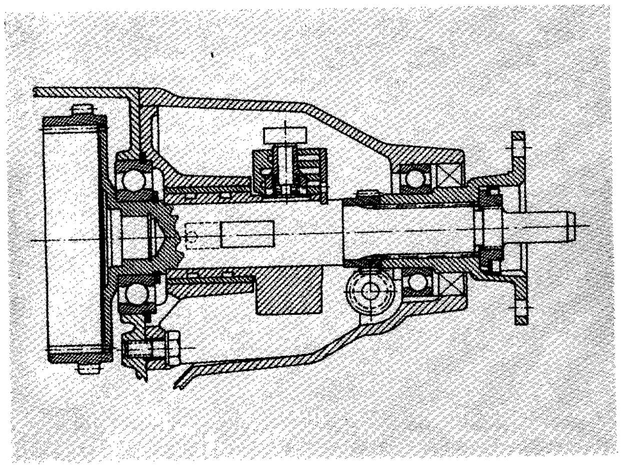
Determine thickness of shim C.

Example:	B 4.7 mm (0.185 in.)	
	—A 4.5 mm (0.177 in.)	
	0.2 mm (0.008 in.)	measured installation clearance [1]
	—0.1 mm (0.004 in.)	permissible installation clearance. [1]
	C 0.1 mm (0.004 in.)	shim thickness

Coat shim with grease and install in bearing flange.



Output shaft layout.

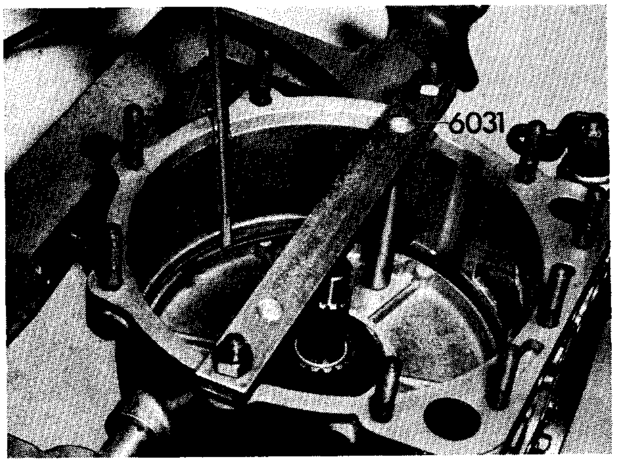


[1]) See technical data.

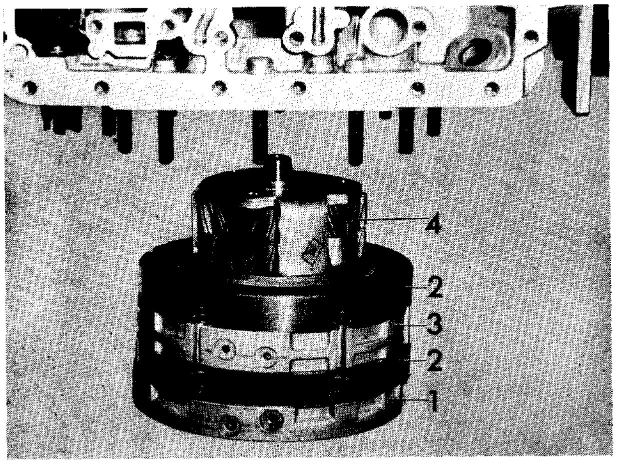
24 22 550 Planetary gear set: removing and installing

— Clutches A and B dismantled —

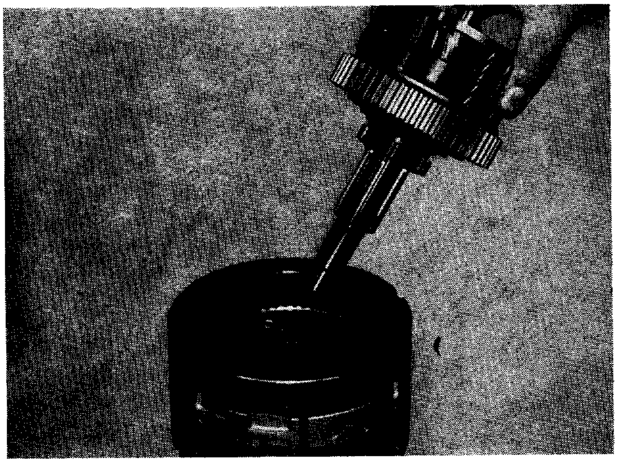
Using clamp 6031, press the centering plate downwards until the circlip can be lifted out.



Rotate the transmission housing until the centering plate (1) and the disc carrier (2) cylinder (3) and planetary gear set (4) can slide out of the housing.

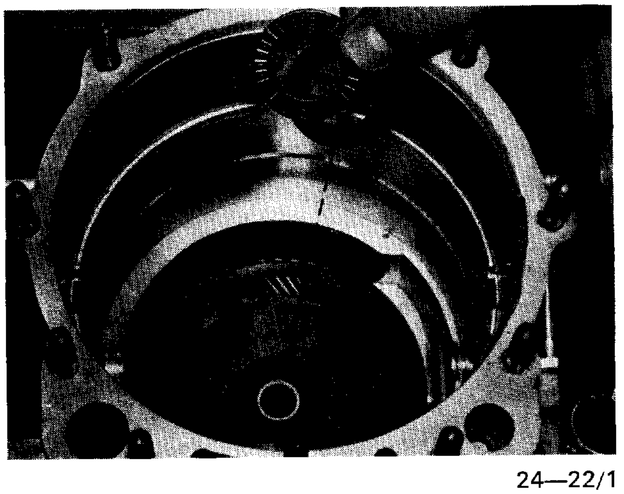


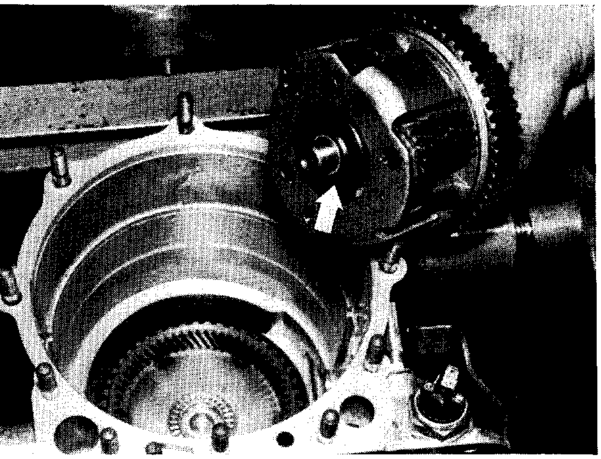
Lift out planetary gear set.



Installation instructions: lubricate planetary gear set generously.

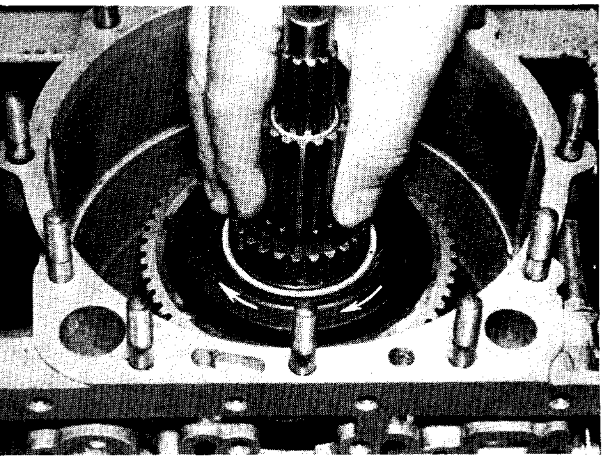
Insert the axial washer and axial needle cage into the output shaft.





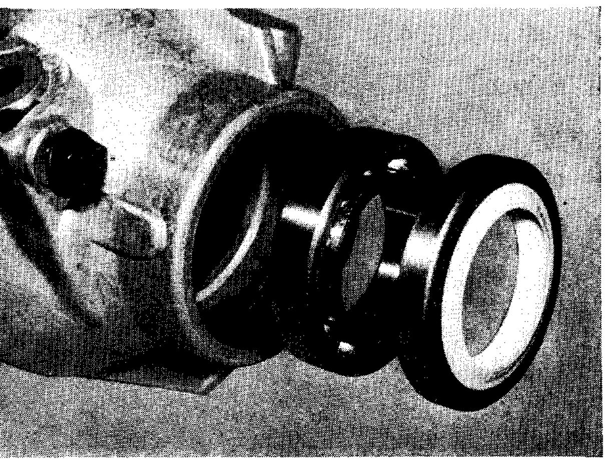
Coat the second axial washer with grease and attach to the planetary gear carrier.

■



Screw the planetary gear set on to the output shaft.

■



24 22 551 Grooved ball bearing in the transmission extension: renewing
— transmission extension dismantled —

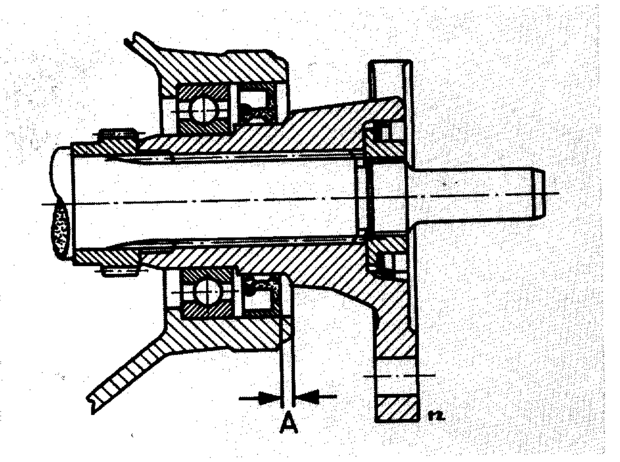
Press out grooved ball bearing and radial seal.

■

Installation instructions: Install radial seal using mandrel 7053. Fill cavity between packing washers with multi-purpose grease.

■

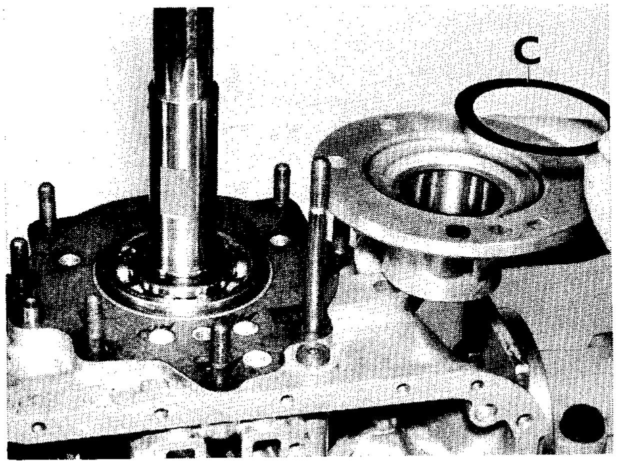
Clearance A = 3 mm (0.118") must be maintained.



Dismantle bearing flange.

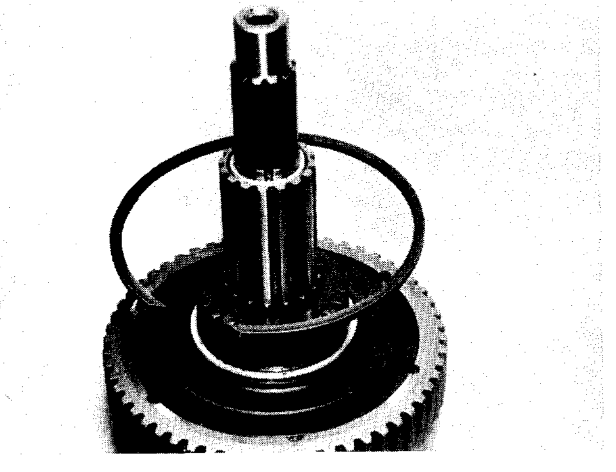
Renew seal.

Warning: Coat compensating shim (C) with grease and insert into bearing flange.



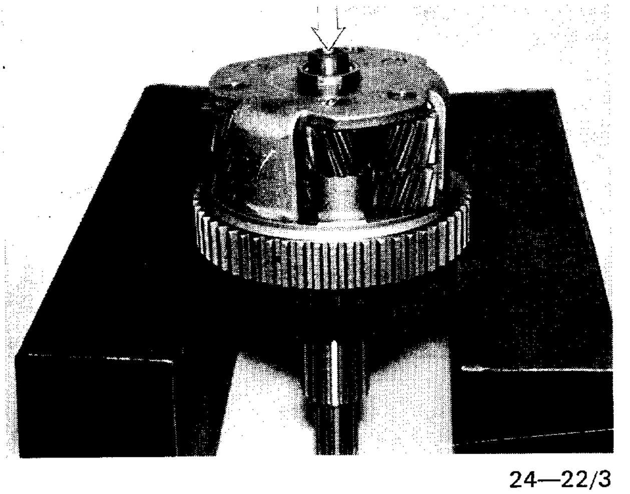
24 22 633 Planetary gear set: dismantling and assembling

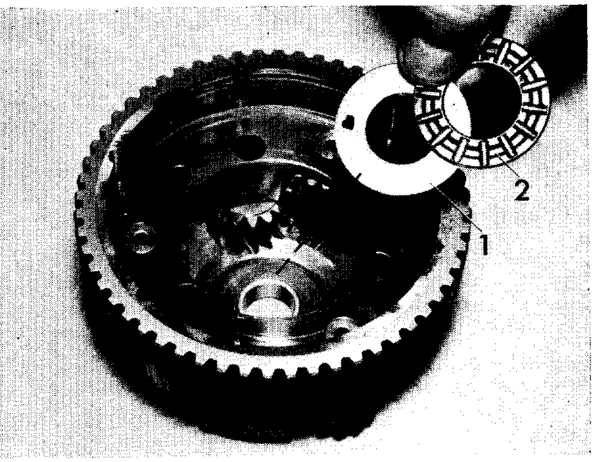
Lift out circlip.



Press sun wheel out of planetary gear carrier.

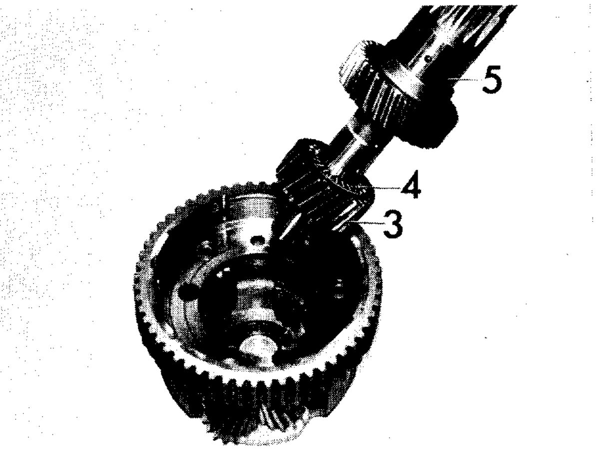
Warning: danger of parts falling out.





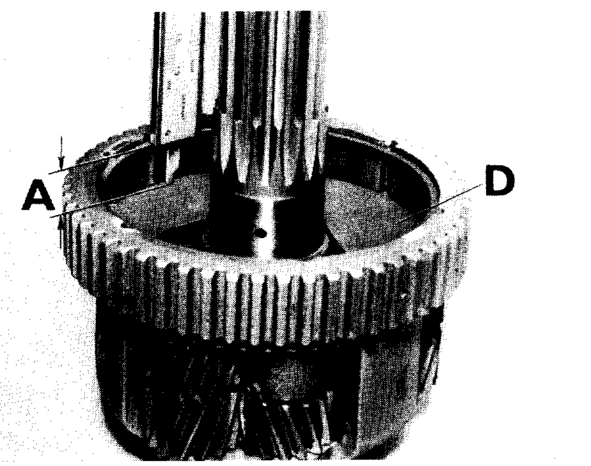
Installation instructions. Insert axial washer (1) and axial bearing (2).

■



Install sun wheel (3), axial needle cage (4) and spacer shaft (5) into the planetary gear carrier.

■



The axial clearance between the freewheel outer race and the circlip is adjusted by means of the thrust washer (D).

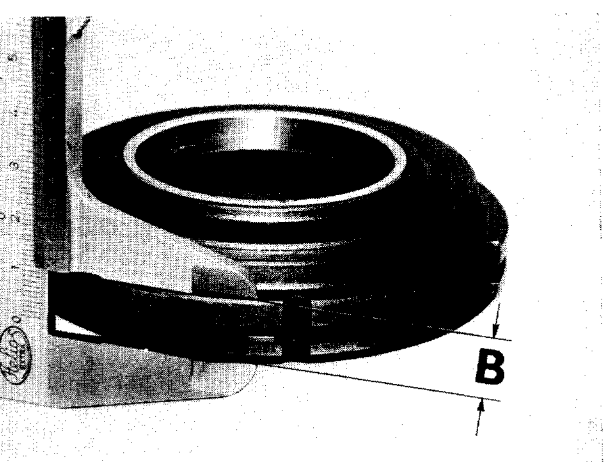
The permissible axial clearance must not exceed 0.1 mm (0.0039").

Insert the thrust washer.

Insert circlip.

Measure distance A between circlip and thrust washer.

■



Determine thickness of freewheel race (B).

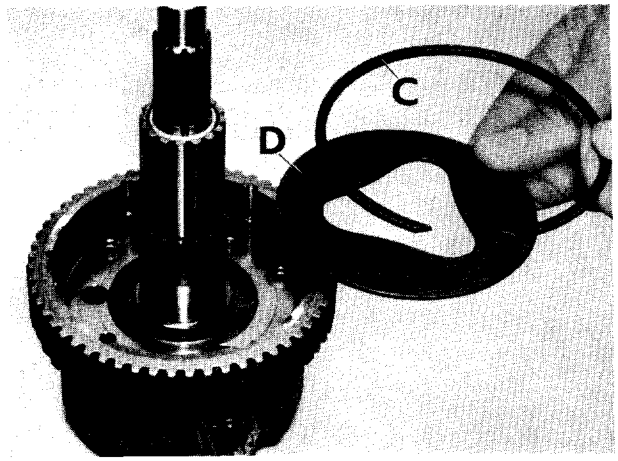
■

Measure circlip thickness C and determine the thickness of the thrust washer.

Example:		
	B 12.5 mm (0.492 in.)	
	+C 2.5 mm (0.098 in.)	
	15.0 mm (0.590 in.)	
	—A 14.7 mm (0.578 in.)	
	0.3 mm (0.12 in.)	
	— 0.1 mm (0.04 in.)	max. axial play
	D= 0.2 mm (0.08 in.)	

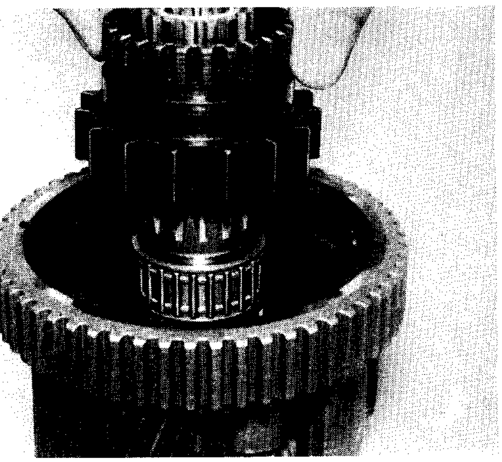
In this example a thrust washer 0.2 mm (0.08 in.) thicker must be installed.

■



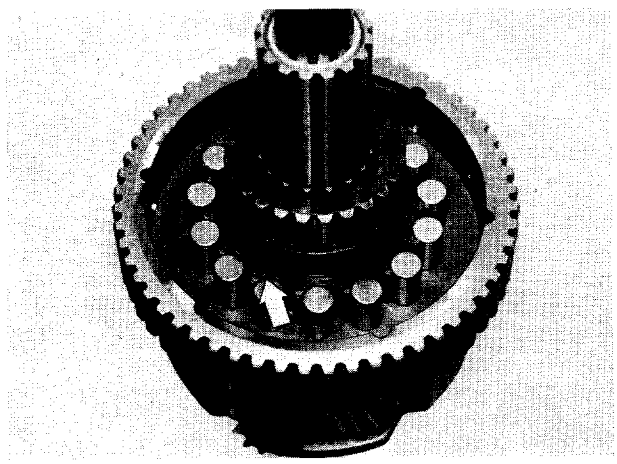
Insert the needle cage and freewheel inner race.

■



Ensure all roller bearings are seated correctly in the freewheel inner race pockets.

■

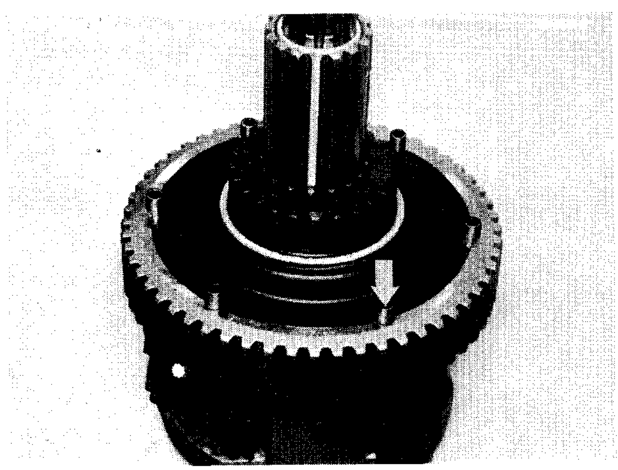


Install freewheel outer race.

Insert spiral pins until stops are contacted.

Insert circlip.

■



24 23 703 Disassembly and assembly of multiple-plate friction clutches and brakes

— with transmission removed —

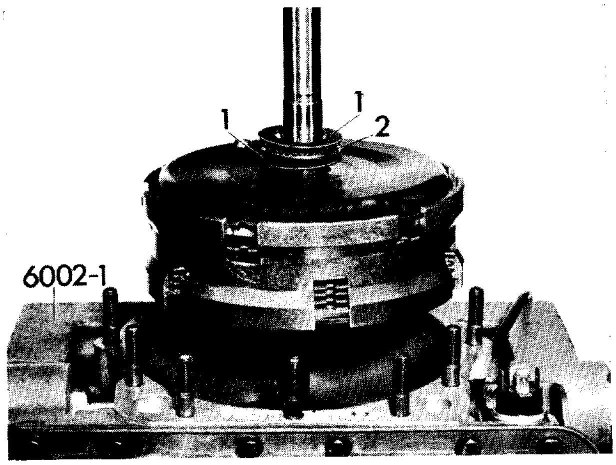
(A) Multiple-plate friction clutches A und B

Fasten transmission to support 6002-1.

Important: Screw on locking bolt a bit but do not tighten, as otherwise the transmission housing might be damaged.

Remove converter housing cf. 24 11 030.
Remove drive shaft with axial discs (1), axial bearing (2) and clutches A und B.

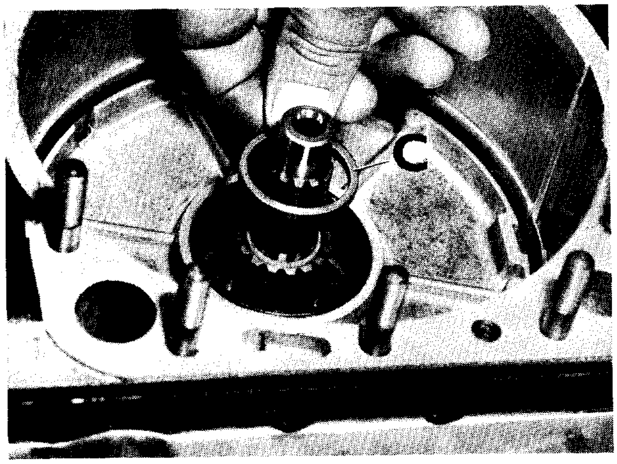
■



Important: Measure axial play[1]) only when replacing transmission parts (with the exception of the multiple-plates) and adjust by means of spacer ring C.

See page 24—23/7.

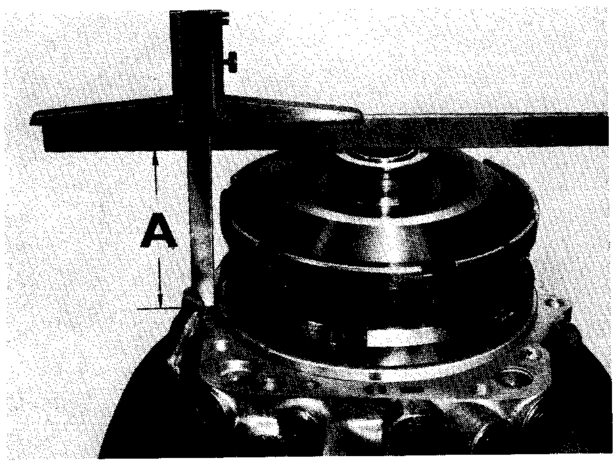
■



For adjusting axial play[1]), insert drive shaft into converter housing together with axial discs and axial bearing.

Measure distance A from the converter housing to the upper hub.

■



Using a brass punch and a hammer, force multiple-plate support into position until it is free of play.

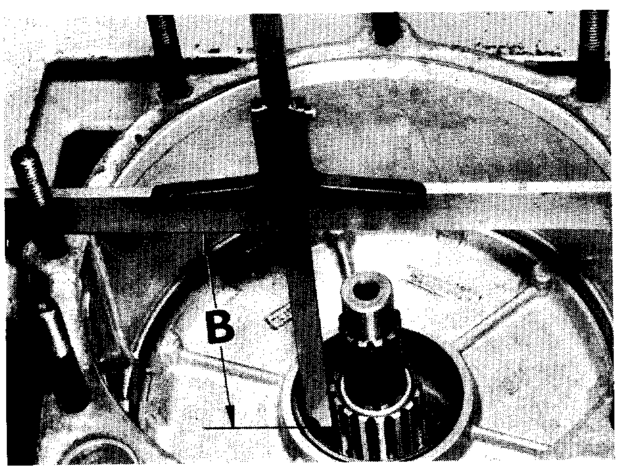
Then place seal in position.

Measure gap B between the multiple-plate support and the seal.

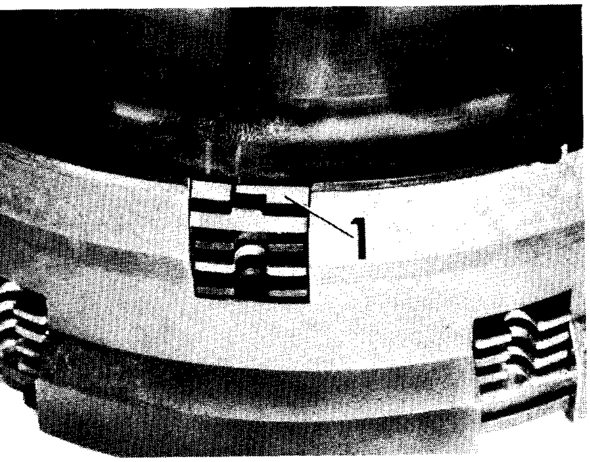
Measure thickness of spacer ring C.

Example:	B =	101.4 mm (3.9921")	
	—A =	97.3 mm (3.5720")	
		4.1 mm (0.1614")	axial play measured
		—0.2 mm (0.00787")	axial play prescribed[1])
	C	3.9 mm (0.1535")	thickness of spacer ring

■



[1]) see Specifications

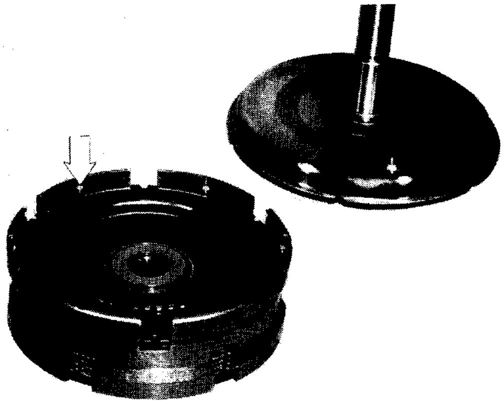


Remove spring ring (1).

Note when fitting: If there is any axial play, use a spring ring (1) with a thickness of 2.7 mm (0.1063") to compensate.

The blunt end of spring ring (1) should be located in the middle of a sight hole.

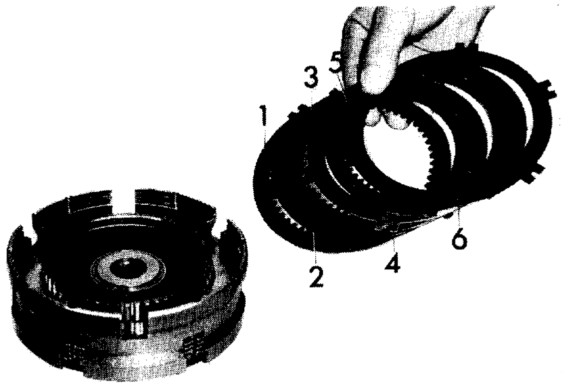
■



Take off drive shaft.

Note when fitting: Make sure that cylinder rollers are in position.

■

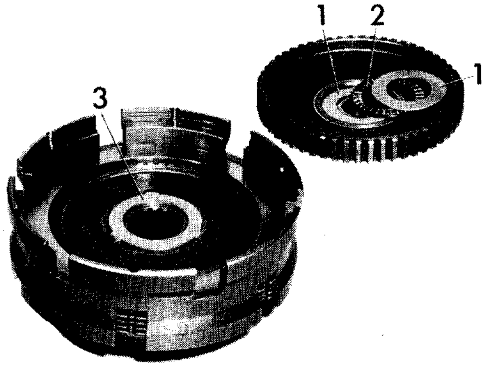


Remove multiple-plates.

Note when fitting: Note correct position of plates from bottom to top:

1 top dog non-metallic plate
2 corrugated outer plate
3 top dog non-metallic plate
4 flat outer plate
5 top dog non-metallic plate
6 corrugated outer plate

■

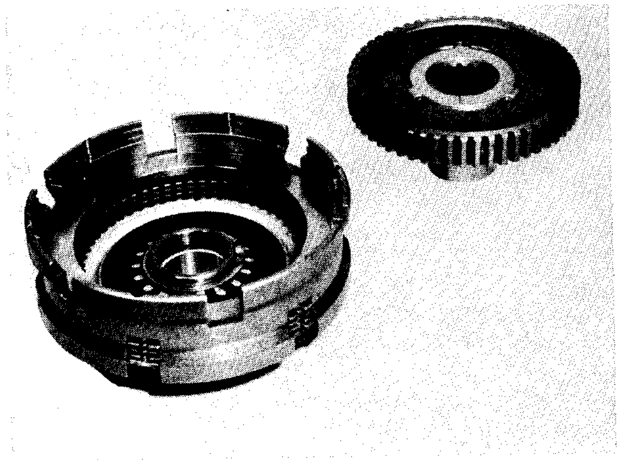


Place new top dog plates for about 20 minutes in ATF oil at a temperature of 70° C (158°F). Remove multiple-plate friction clutch carrier with axial discs (1) and axial bearing (2).

Note when fitting: Check contact disc (3) for wear. Oil before assembling.

■

Remove multiple-plate friction clutch carrier for clutch B.



Turn clutch member round.

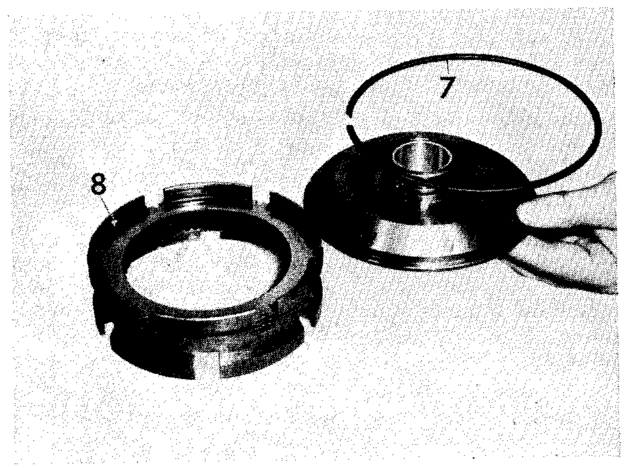
Take out spring ring (7).

Remove clutch hub.

Note when fitting: If there is any axial play, fit spring ring (7) with a thickness of 2.7 mm (0.1063") to compensate.

Make sure that the blunt end of spring ring (7) is located in the middle of a sight hole.

Make sure that cylinder roller (8) is in position.

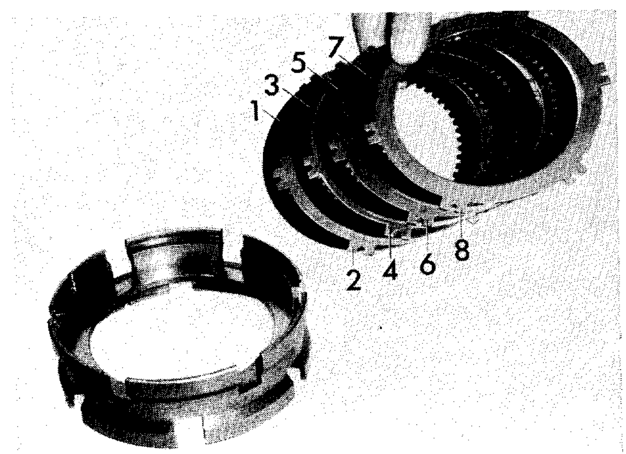


Take out multiple plates.

Note when fitting: Make sure that clutch units are in correct position from bottom to top:

1 non-metallic plate
2 outer plate
3 non-metallic plate
4 outer plate
5 non-metallic plate
6 outer plate
7 non-metallic plate
8 outer plate

Place new non-metallic plates in warm ATF oil about 20 minutes (temperature of oil 70° C/158° F).



Multiple-plate friction clutches A and B
— with metal clutch units —

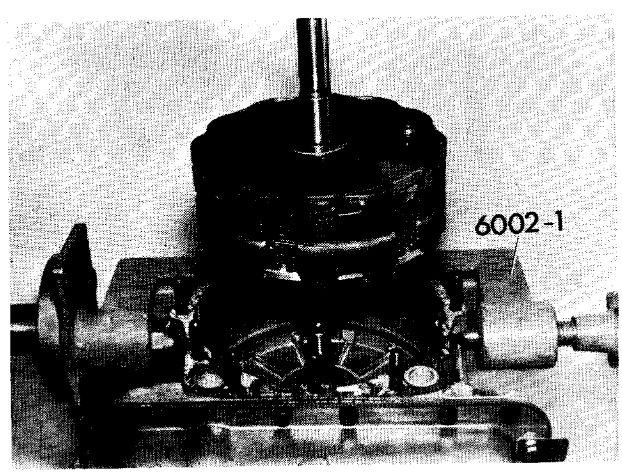
Fasten transmission to support bracket 6002-1.

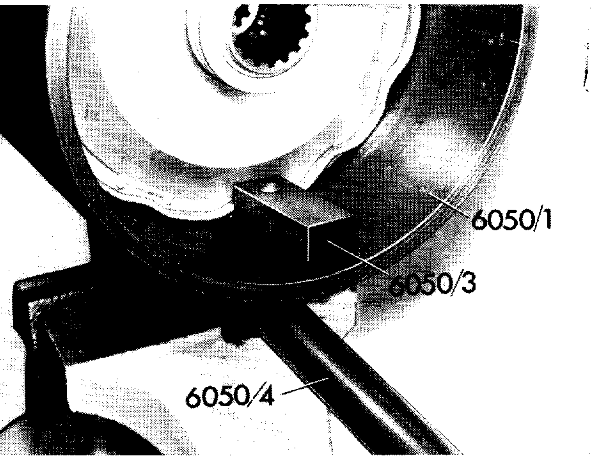
Important: Screw on locking bolts a bit but do not tighten as otherwise the transmission housing might be damaged.

Remove converter housing cf. 24 11 030.

Remove clutches A and B.

Take out axial discs and axial bearing.





Secure support bracket 6050/1 in vice.

Using tools 6050/3 and 6050/4, bend back projecting bars.

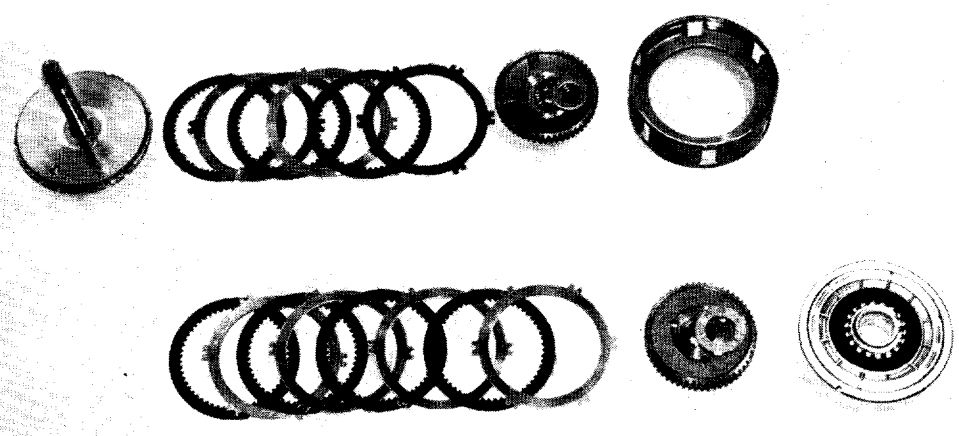
When bending back again into position, turn clutch by means of the drive shaft.

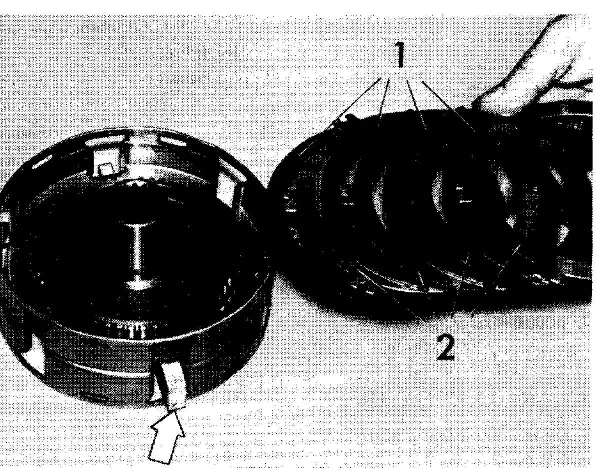
Important: Do not use clutch unit more than once.

■

Assembly sequence of individual parts.

■



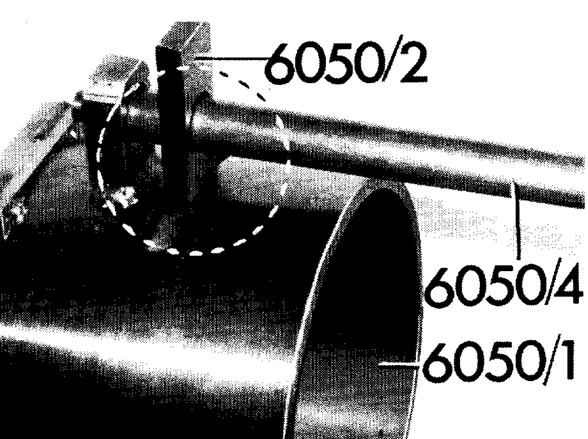


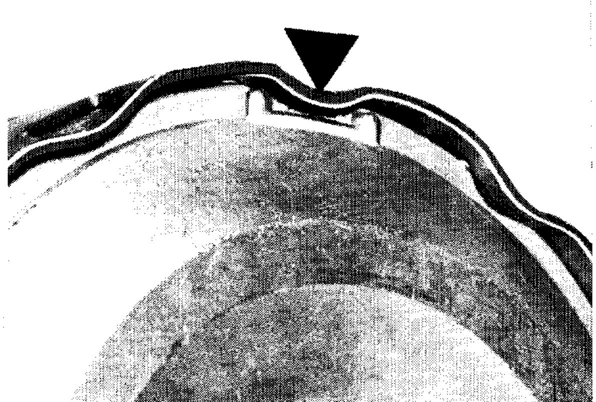
Note when fitting: Stick a piece of wood or something similar into the new clutch unit and place multiple-plate friction clutch carrier into position.

inner plate — smooth surface	1
outer plate	2
inner plate — smooth surface	1
outer plate	2
inner plate — smooth surface	1
outer plate	2
inner plate — smooth surface	1
outer plate	2

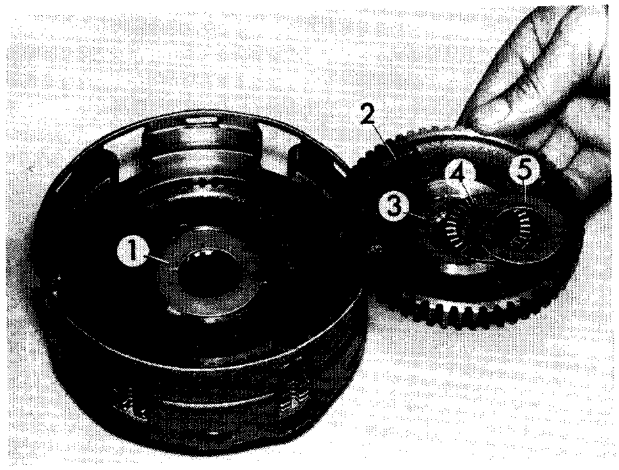
Important: Place new non-metallic plates in ATF oil for about 20 minutes (temperature of oil 70° C/158° F).

■



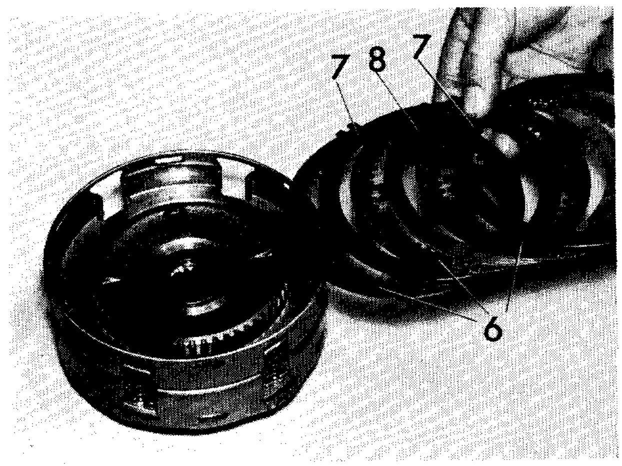


Fit in contact disc (1), multiple-plate friction clutch carrier (2), axial disc (3), axial bearing (4) and axial disc (5).

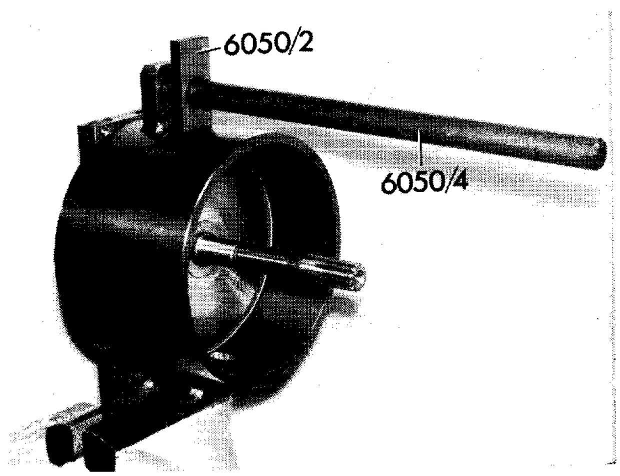


Fit in
inner plate — TOP DOG 6
outer plate — corrugated 7
inner plate — TOP DOG 6
outer plate — smooth 8
inner plate — TOP DOG 6
outer plate — corrugated 7

Important: Place new non-metallic plates in ATF oil for about 20 minutes (temperature of oil 70° C/158° F).



Fit drive shaft and secure in slots in clutch body by using tools 6050/2 and 6050/4 alternatively.

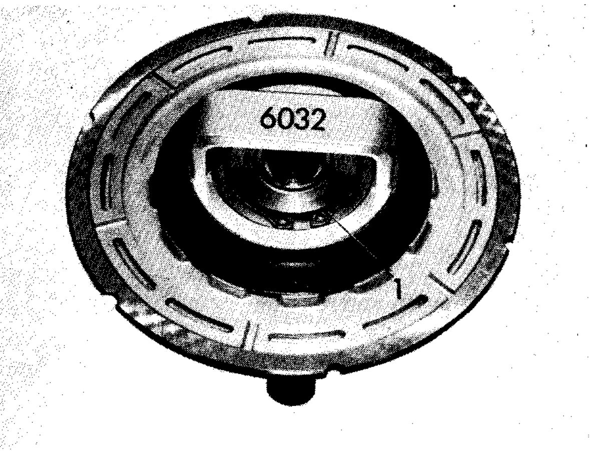


(B) Sealing rings

Check sealing rings.

When replacing, press one end of the sealing ring onto the bottom of the hub.

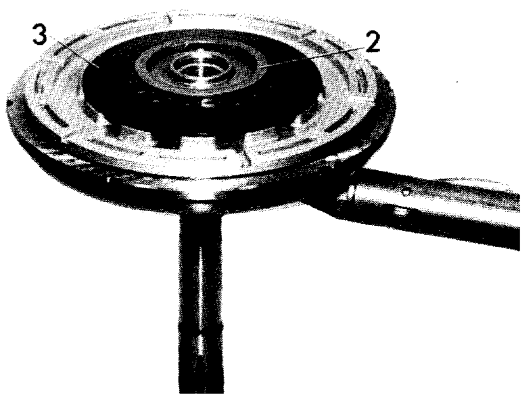
Working from this point, move along sealing ring until it becomes loose.



(C) Clutch A piston

Using clamp tool 6032, press plate spring together until safety ring (1) can be removed.

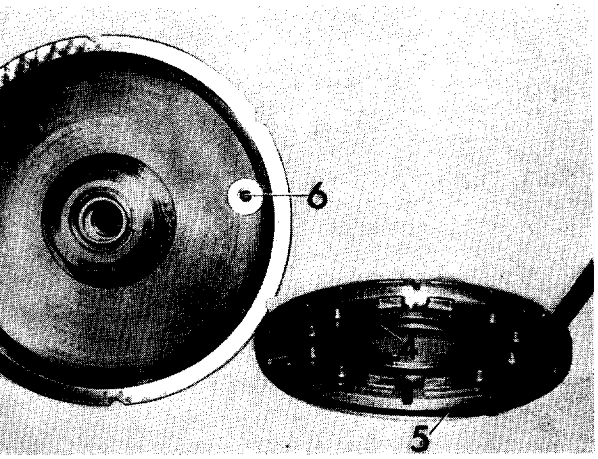
■



Remove intermedicate disc (2) and plate spring (3).

Using pressurized air, force piston out of drive shaft.

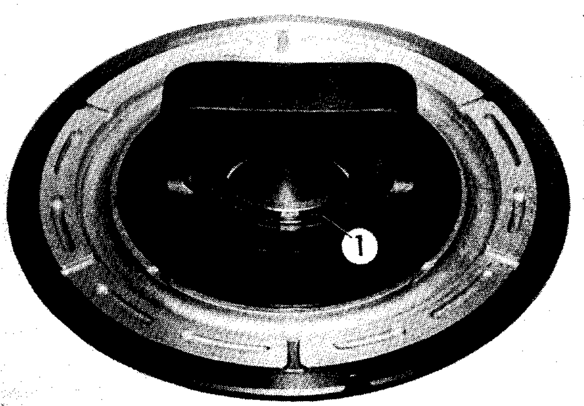
■



Using a metal sheet with 0.25 mm (0.0098") thickness, remove rectangular rings (4) and (5).

Note when fitting: Make sure that air venting valve (6) has freedom of movement.

■



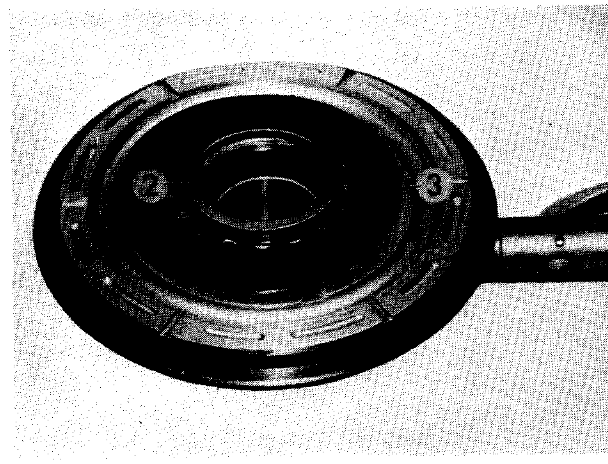
(D) Clutch B piston

Using clamp tool 6032, press plate spring together until safety ring (1) can be removed.

■

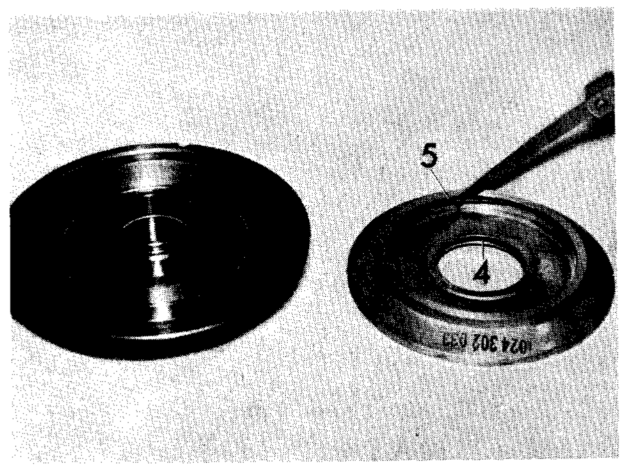
Take out intermediate disc (2) and plate spring (3).
Using pressurized air, force piston out of clutch hub.

■



Using a metal sheet of 0.25 mm (0.0098") thickness, take out rectangular rings (4) and (5).

■



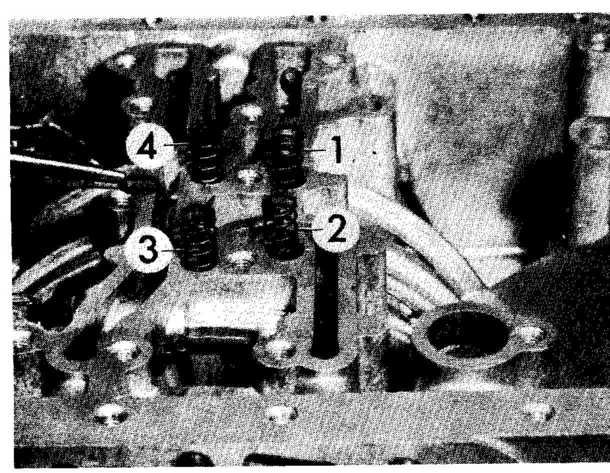
(E) Multiple-plate brakes C, C' and D

Removal of shifting assembly cf. 24 30 000.

Take out safety rings.

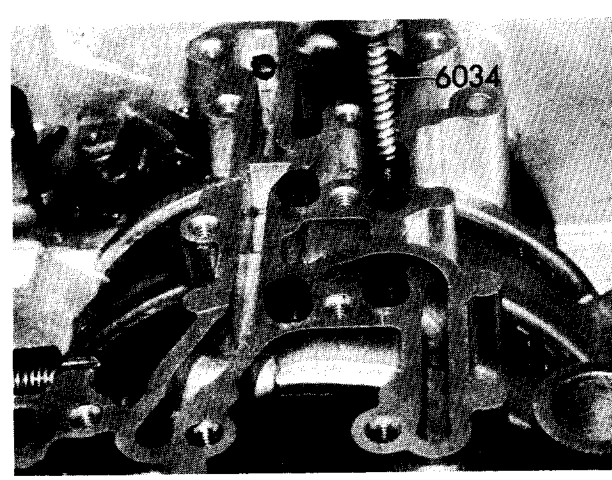
Remove pressure springs (1 ÷ 4).

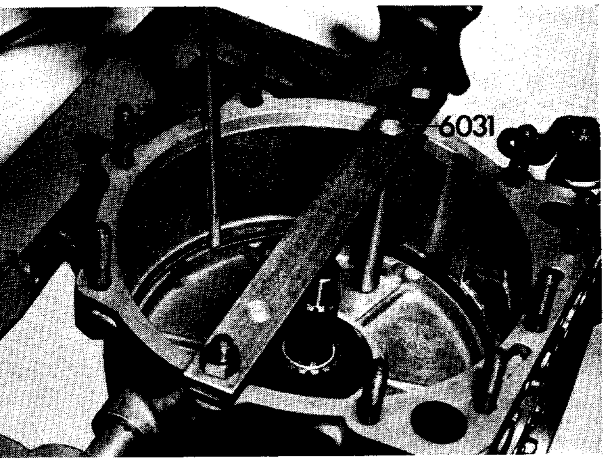
Note when fitting: Length of pressure springs (1) and (2) without tension: 29 mm (1.1417")
Length of pressure springs (3) and (4) without tension: 25 mm (0.9843")



Using pulling tool 6034, pull out sealing sleeves.
Note when fitting: Force in sealing sleeves until they reach stop.

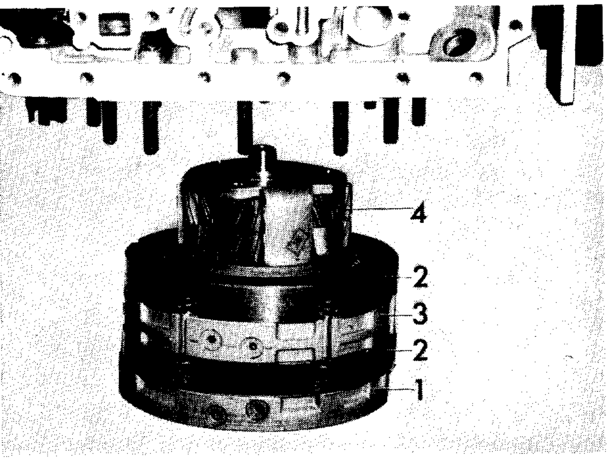
■





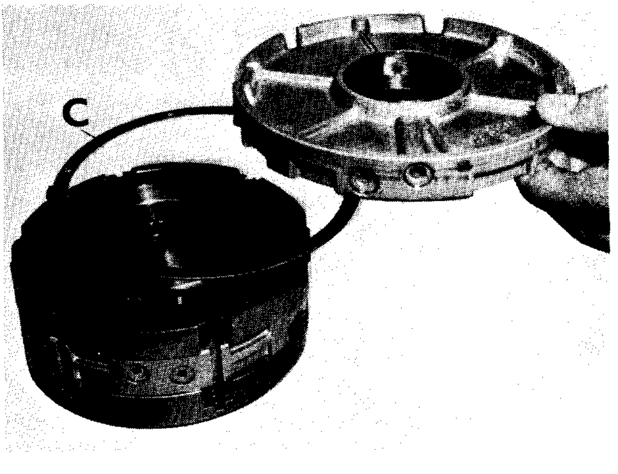
Using clamping tool 6031, press centering plate down until spring ring can be removed.

■



Turn transmission housing until centering plate (1) comes out of housing with multiple-plate friction clutch carriers (2), cylinder (3) and planetary gears (4).

■



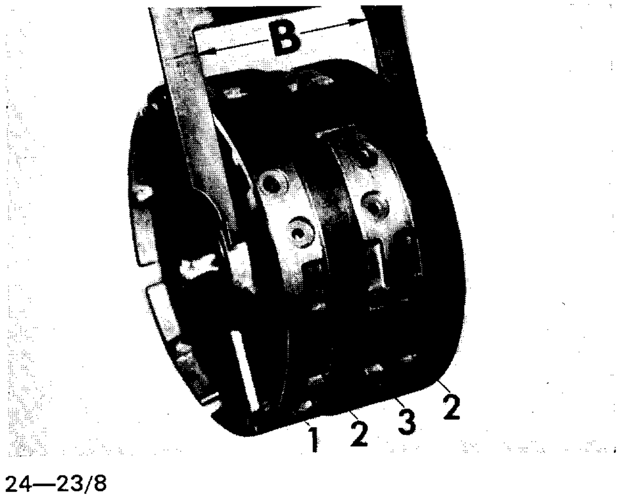
Important:

Note when fitting: Always try to fit individual parts between housing and spring ring without play.

Axial play of up to max. 0.15 mm (0.0059") is permissible.

If there is any axial play between the centering plate and the multiple-plate friction clutch carrier, compensate by means of spacer ring C.

■



When fitted together, measure width of centering plate (1), multiple-plate friction clutch carriers (2) and cylinder (3) (B).

■

Measure thickness of spring ring (4) and note.

Fit in spring ring (4).

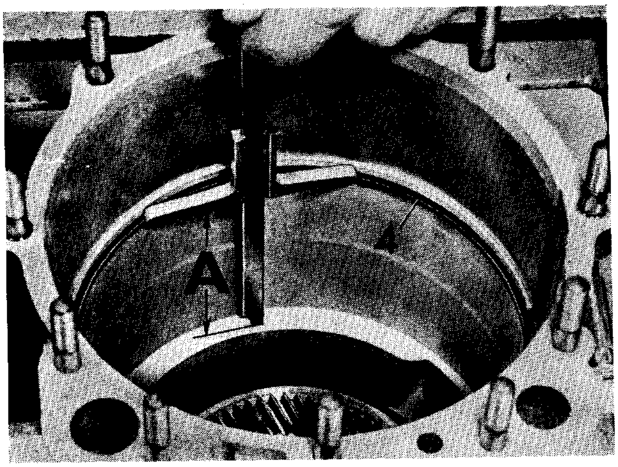
Measure distance A from contact surface to upper edge of spring ring and find out how thick spacer ring C must be.

Example: A = 85.0 mm (3.3465")
—B = 81.5 mm (3.2087")

3.5 mm (0.1378")
—2.5 mm (0.09843") thickness of spring ring

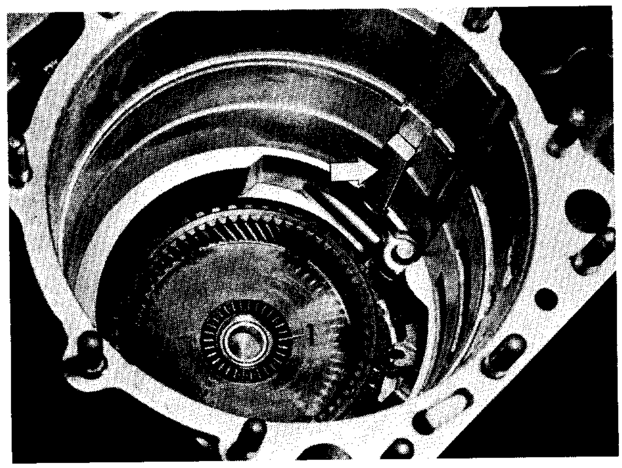
C = 1.0 mm (0.03937") thickness of spacer ring

For position of spacer ring C between centering plate and outer multiple-plate carrier see page 24—23/10, picture 1.



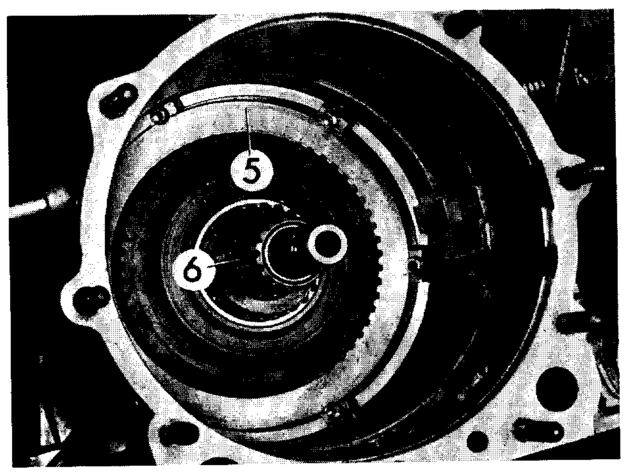
Note when fitting: Fit in axial bearing (1).

Fit the long adjustment springs into the grooves.



Place outer multiple-plate carrier (5) on housing contact surface.

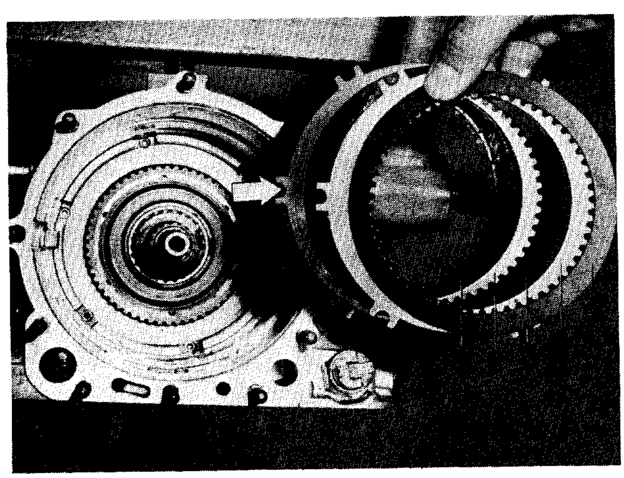
Applying slight pressure, fit in planetary gear set (6).

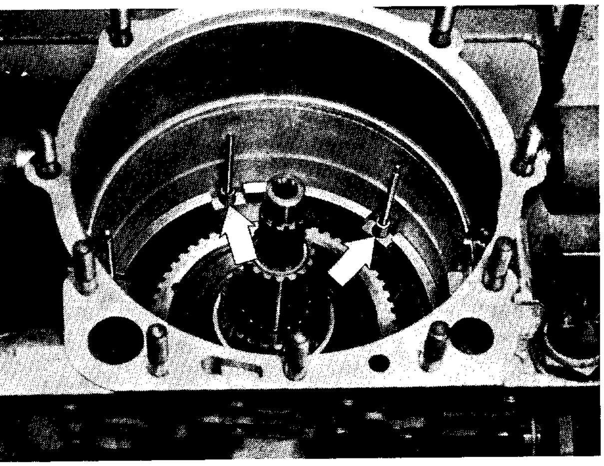


Fit multiple plates into multiple-plates carriers.

1 non-metallic plate
2 outer plate — large recess
3 non-metallic plate
4 outer plate — large recess
5 non-metallic plate

Place new non-metallic plates in ATF oil for about 20 minutes (temperature of oil 70° C/158° F).

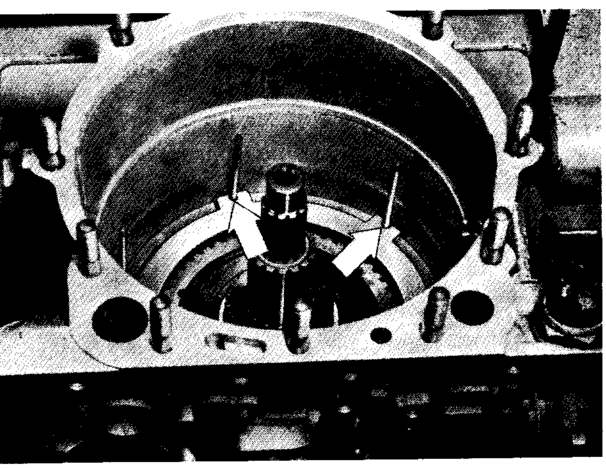




Insert guide pins into the multiple-plate carriers with the points facing upwards.

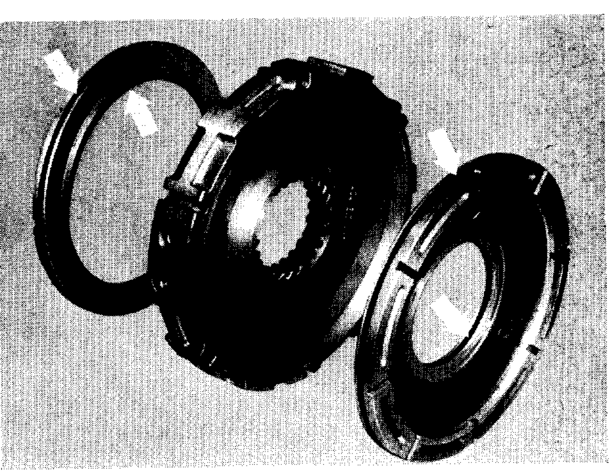
Fit on pressure springs.

■



Fit outer plate with small recesses into position.

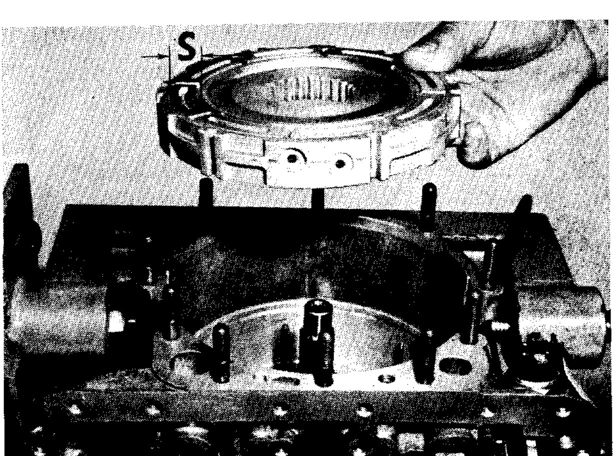
■



Using pressurized air, press both pistons out of cylinder. With the help of a metal sheet of 0.25 mm (0.0098") thickness, remove rectangular rings.

Check rectangular rings and replace if necessary.

■

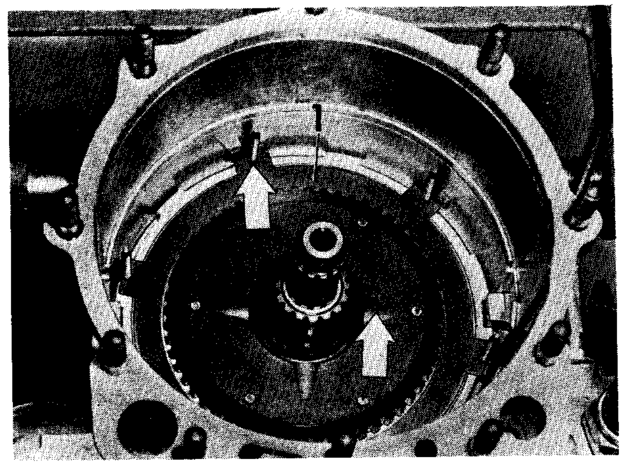


Fit in cylinder with the narrow piston end (S) facing upwards.

Important: Make sure that the oil feed holes are exactly flush with the holes in the housing.

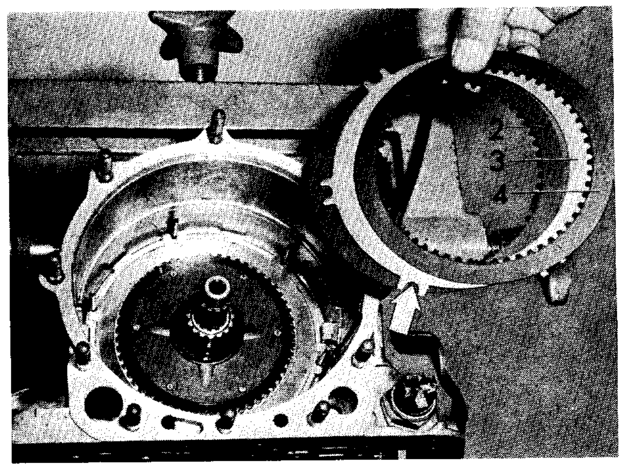
■

Insert freewheel with oil sprockets on top and outer plate (1) with small cutouts.



Insert friction plate (2). outer plate with large cutouts, 2.5 mm (0.098") thick and friction plate (4).

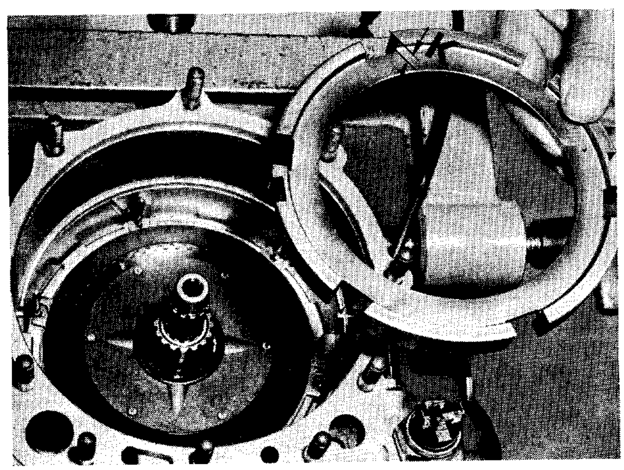
Immerse new friction plates in ATF oil about 20 minutes at about 70° C (158° F).



Insert compression springs.

Insert plate carrier with the short collar on top.

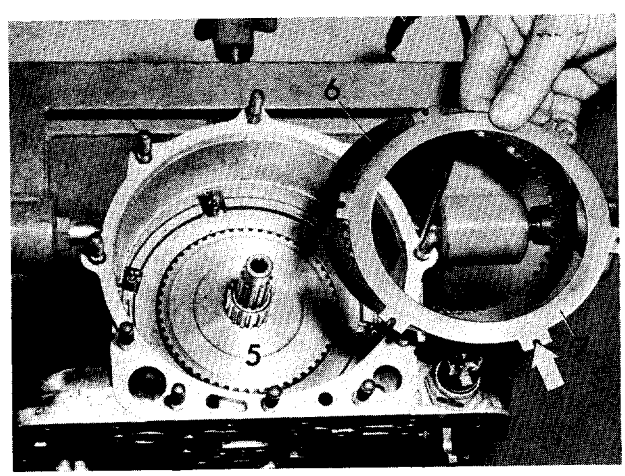
Warning: Allow both the small grooves on the plate carrier to slide over the keys.

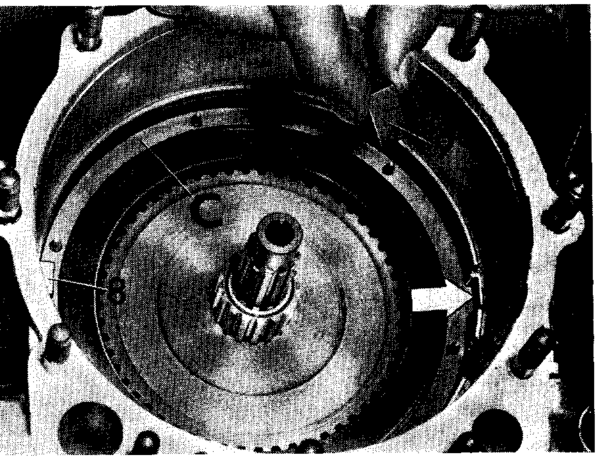


Insert the plate carrier (5) with the machined side on top.

Insert the friction plate (6) and outer plate with small cutouts (7).

Immerse new friction plates in ATF oil for about 20 minutes at 70° C (158° F).

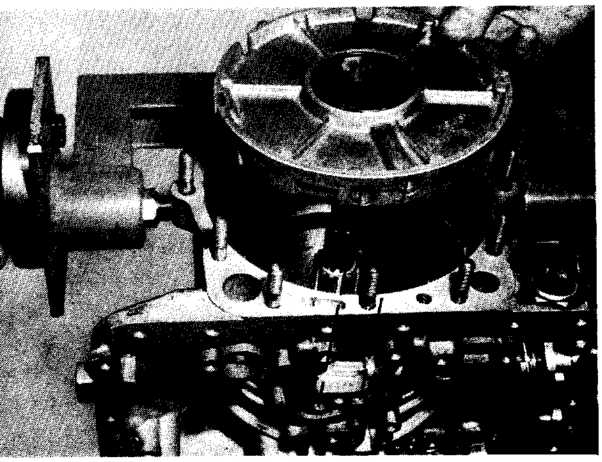




Insert the spacer washer C so that the two lugs are in the transmission housing grooves.

Insert keys (8 and 9) into the grooves.

■



Piston side of the centering plate points downwards.

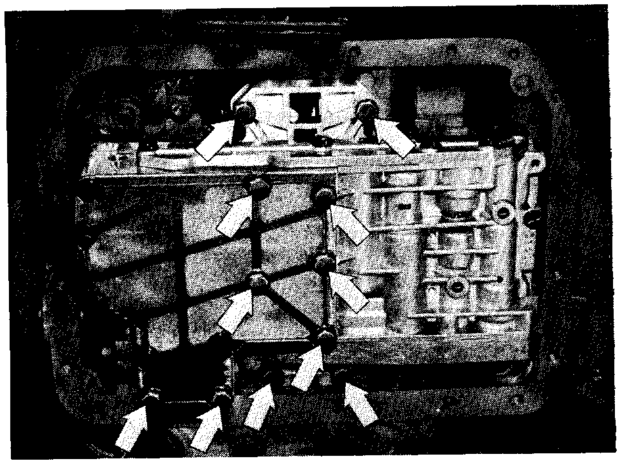
Oil holes in the centering plate must coincide with the holes in the housing.

■

24 30 000 Control unit: removing and installing

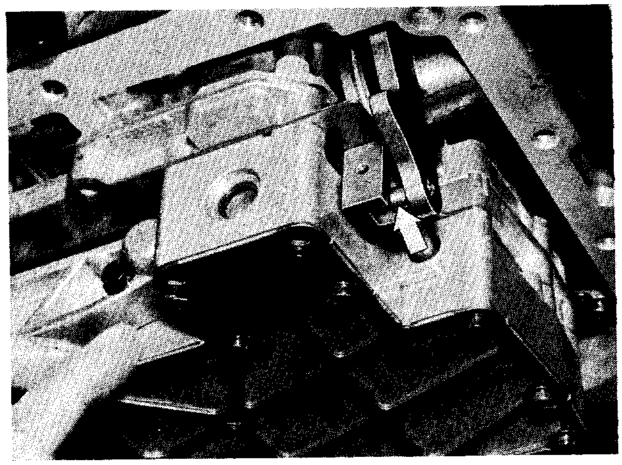
Remove oil sump 24 11 000
Dismantle control unit.

■



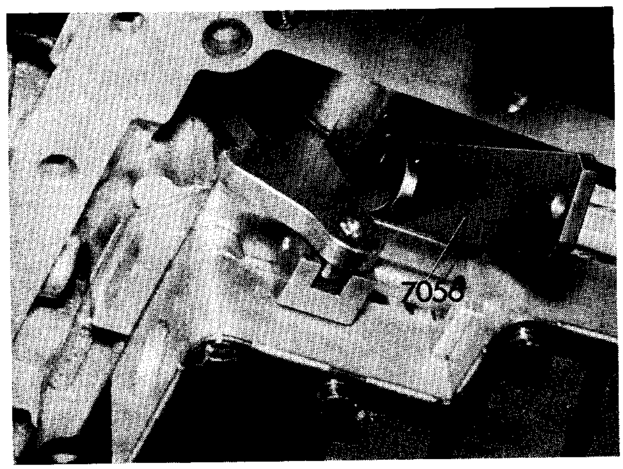
Installation instructions: Place the shift control piston against the accelerator cam. Insert pawl spindle into the selector calve groove.

■



Installation instructions: Using the accelerator pedal, move the shift control piston to full speed position.
Move the control unit until gauge 7056 fits exactly between the control unit housing and the shift control piston with no clearance.
Tighten the control unit in this position.

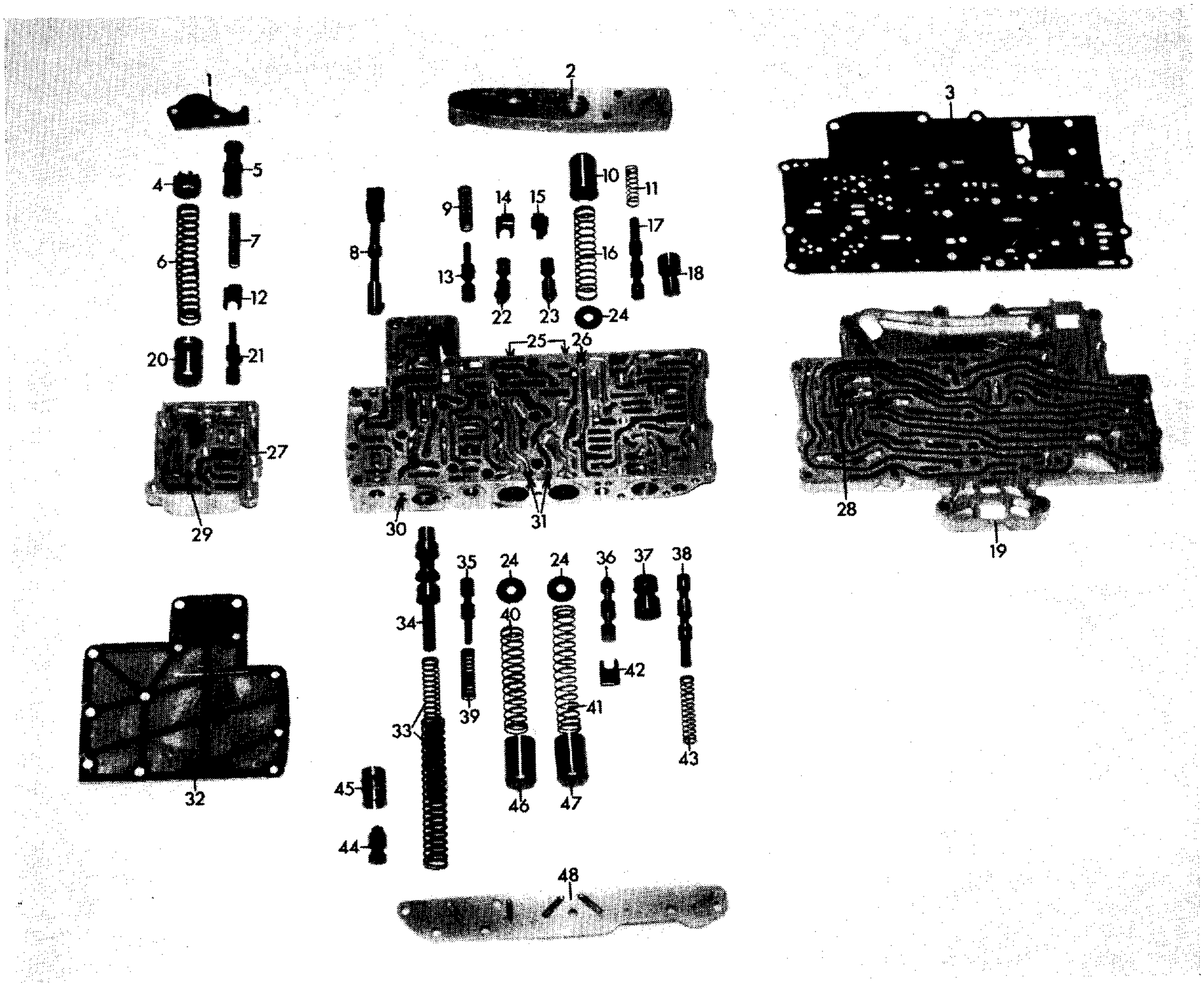
■



24 30 001 Control unit: renewing

The sequence is the same as for dismantling control unit 24 30 000.

■

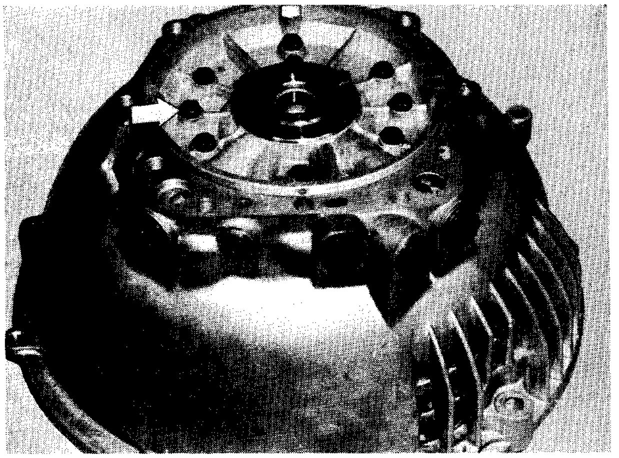


Hydraulic control unit

1 Cover plate
2 Cover plate
3 Spacer plate
4 Guide sleeve
5 Throttle control piston
6 Clutch damper spring A + C
7 Throttle control piston spring 1
8 Selector valve
9 Lock-valve spring
10 Clutch damper B
11 Selector valve spring 1-2
12 Stop plate
13 Lock-valve 1
14 Stop plate
15 Stop plate
16 Clutch damper spring C
17 Selector valve 1-2
18 Selector piston 2-3
19 Duct plate
20 Clutch damper A + C
21 Throttle control valve
22 Clutch valve B
23 Clutch valve D
24 Washer
25 Throttle shutter
26 Valve shutter
27 Throttle control valve housing
28 Balls
29 Throttle shutter
30 Throttle shutter
31 Valve shutter
32 Oil strainer cpte
33 Master control valve spring
34 Master control valve
35 Lock-valve 2
36 Clutch valve C
37 Selector piston 2-3
38 Selector piston 2-3
39 Lock-valve spring 2
40 Clutch damper spring B
41 Clutch valve spring D
42 Stop plate
43 Selector valve spring 2-3
44 Converter control valve
45 Bushing
46 Clutch damper B
47 Clutch damper D
48 Cover plate

24 31 510 Primary pump: removing and installing
— Converter dome dismantled —

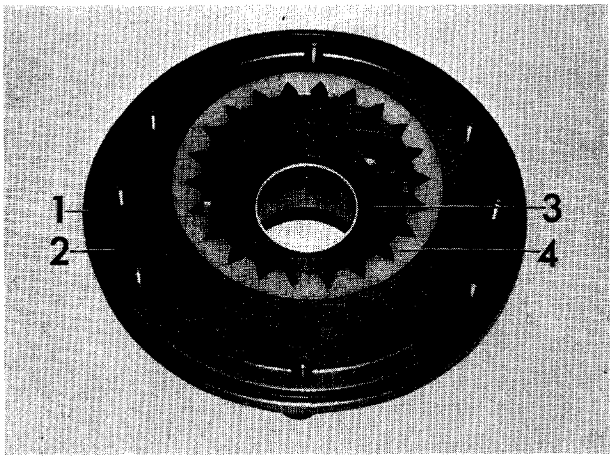
Disconnect primary pump from converter dome. ■



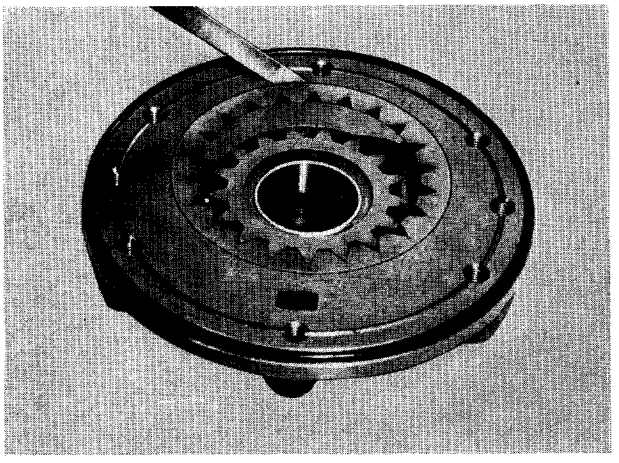
Lift out primary pump.

Installation instructions: The primary pump consists of the pump housing (2), annular gear (3) and pump impeller (4) and can only be renewed as a complete unit.

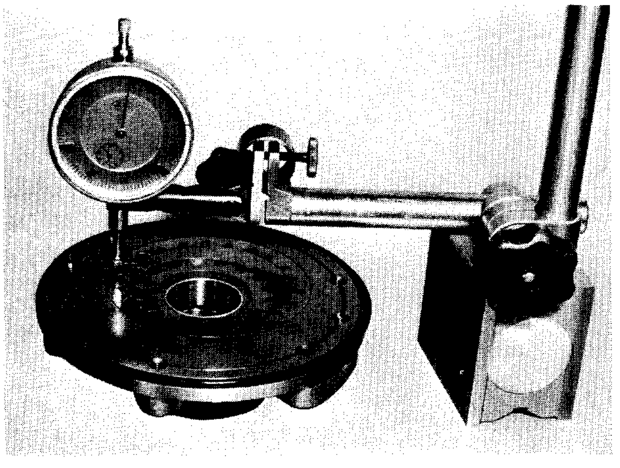
Check O-ring (1) and renew if necessary. ■



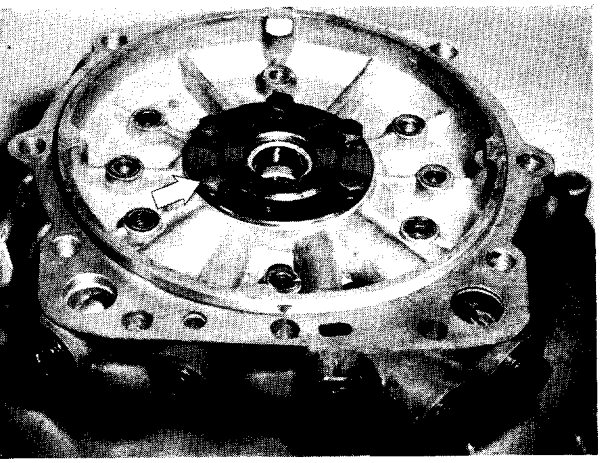
Check radial clearance [1]) between the driven gear and the pump housing. Also turn the impeller through 360°. ■



Check axial clearance [1]) of both gear wheels in relation to the faces using a gauge. ■



[1]) See technical data

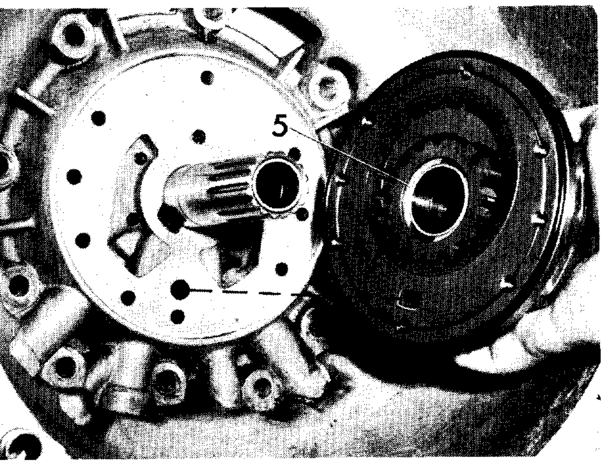


When renewing the primary pump the support pins must be inspected without fail. Any heavily worn support pin near the impeller must be renewed.

Unscrew attachment bolts.

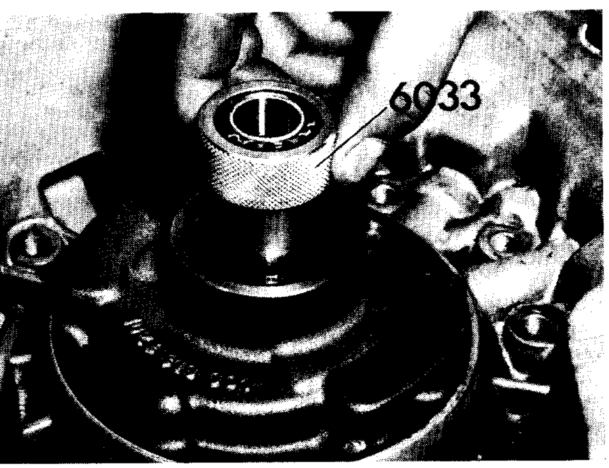
Heat converter dome to about 60° C (140° F).

■



The annular duct (5) in the pump impeller faces the converter dome. The oil return duct in the primary pump housing must coincide with the return flow passage in the converter dome.

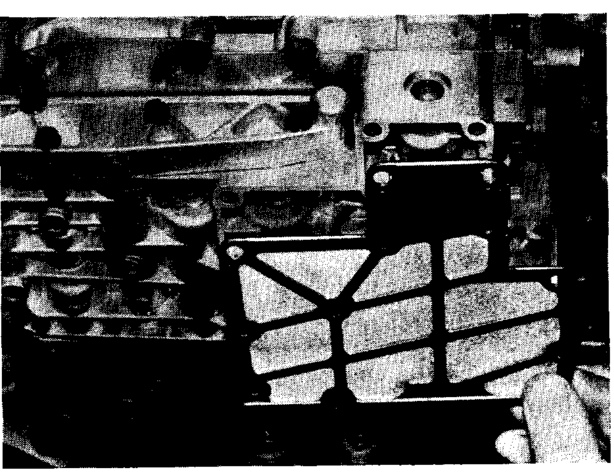
■



Check primary pump for freedom of movement using drive flange 6033.

This test is to be done again after attaching the converter dome.

■



24 31 650 Oil strainer at control unit: removing and installing

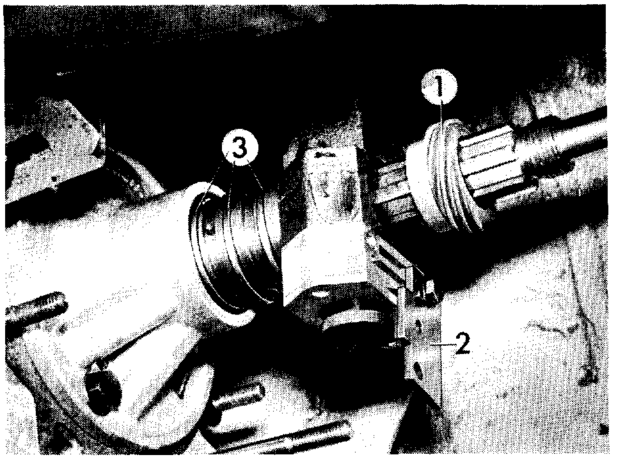
Remove oil sump 24 11 000
Remove oil strainer.

Installation instructions: Clean oil strainer.

Renew oil strainer if clogging commences — brownish burned sediment.

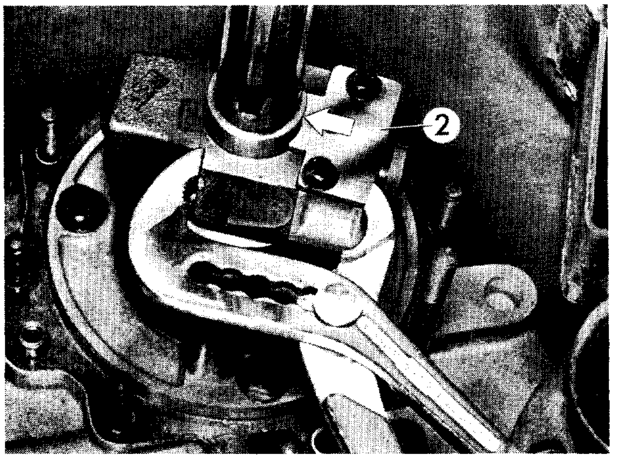
■

24 32 000 Centrifugal governor and governor boss: removing and installing



Remove transmission cover 24 11 050
Remove speedometer worn gear (1).
Installation instructions: The speedometer worm gear collar faces the centrifugal governor.
Disconnect drive-plate (2) and after swivelling out, remove centrifugal governor boss.
Installation instructions: Lubricate rectangular rings (3) thoroughly.

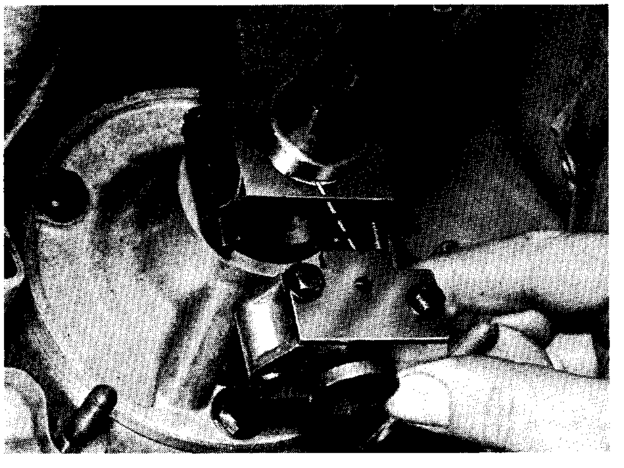
■



Warning: Press drive plate (2) firmly into the groove in the output shaft and then tighten.

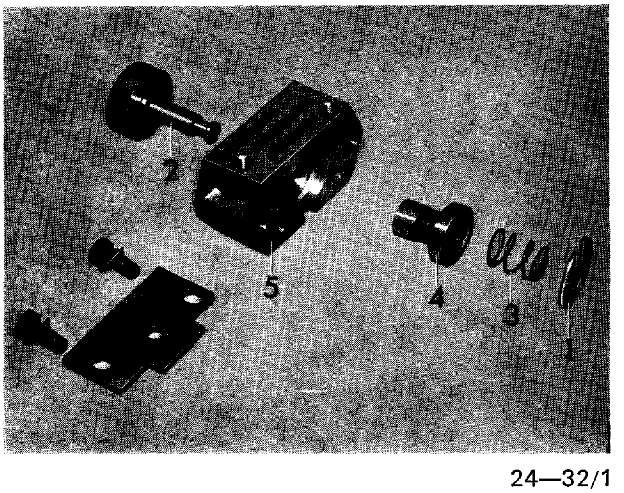
■

24 32 503 Centrifugal governor: dismantling and assembling



Remove transmission cover. 24 11 050.
Remove centrifugal governor from the governor boss.
Warning: Press drive plate firmly into the groove in the output shaft and then tighten.

■



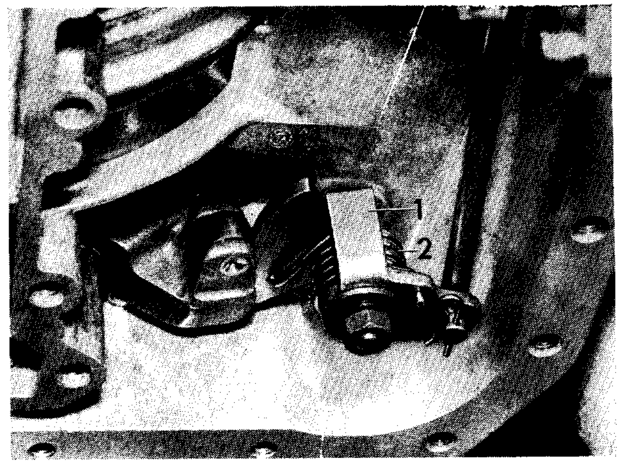
Lift out washer (1) from governor piston (2).
Remove spring (3), governor bushing (4) and governor piston (2) from the housing (5).
Installation instructions: Governor piston must move easily in the governor bushing.

■

24 34 001 Pawl for parking lock: renewing

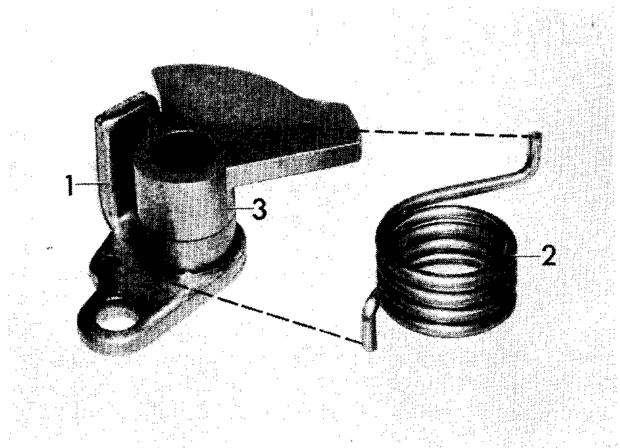
Dismantle control unit 24 30 000
Remove lever (1) and spring (2).

■



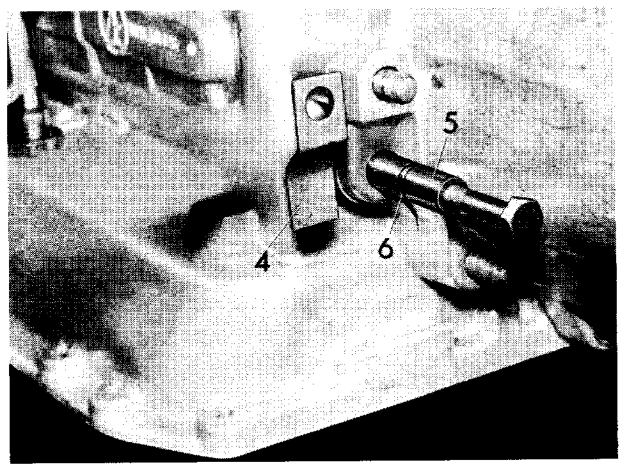
Installation instructions: Note the installation position of lever (1), spring (2) and cam (3).

■



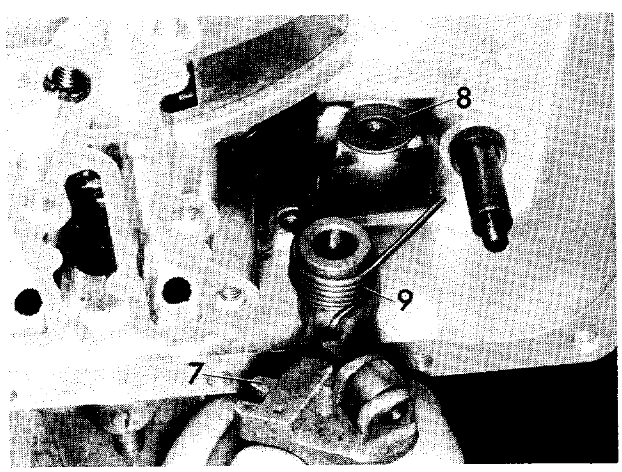
Remove cover plate (4).
Remove bolt (5) and nut (M6) from housing.
Installation instruction: Renew O-ring (6).

■

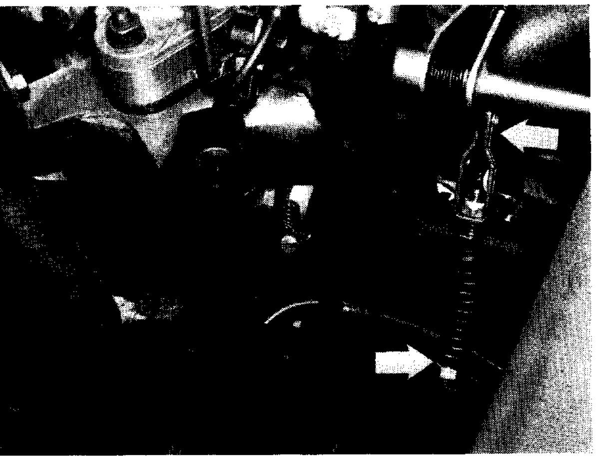


Remove pawl (7) washer (8) and spring (9).

■



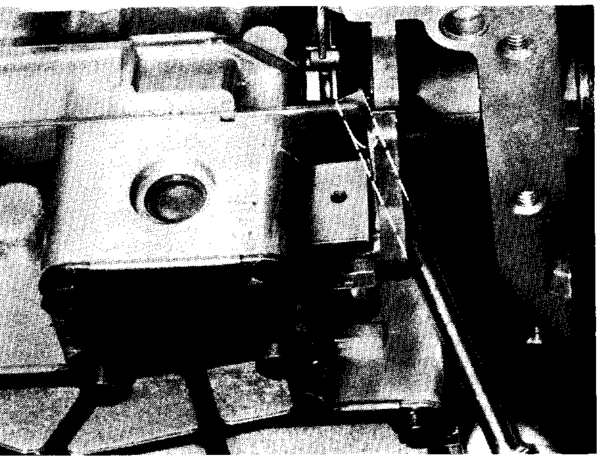
24 34 101 Accelerator cable: renewing



Remove tensioner bracket.

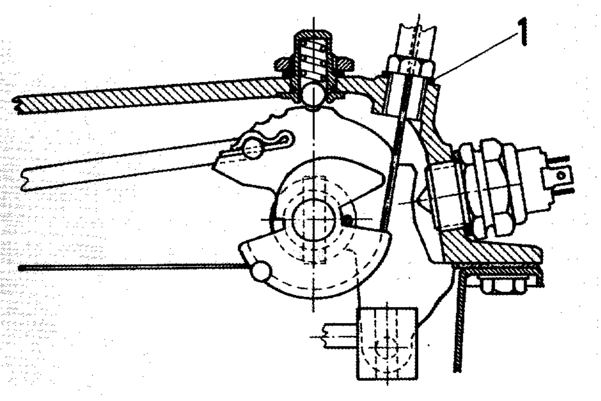
Remove accelerator cable from thrust bracket.

Installation instructions: Adjust accelerator cable 24 00 004 B).



Place selector lever in position O.

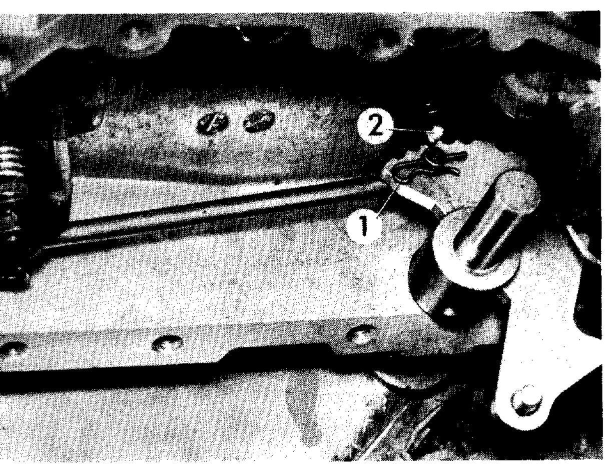
Press accelerator can forward and remove cable.



Unscrew the accelerator cable from housing.

Installation instructions: Renew seal (1).

24 34 690 Index pawl: removing and installing



Remove spring 24 34 701

Remove accelerator cable.

Withdraw accelerator cam.

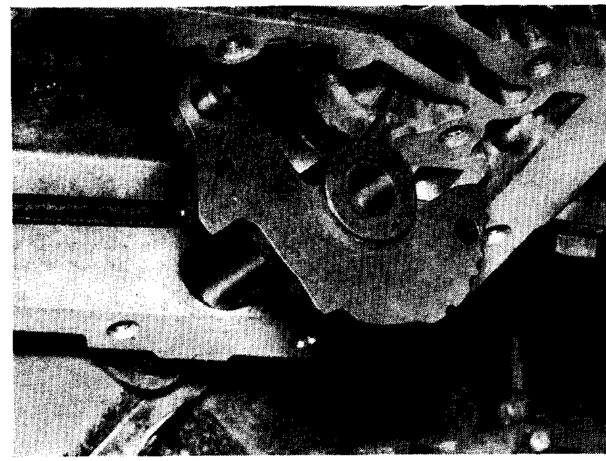
Remove spring clip (1).

Remove pawl from connector rod.

Installation instructions: Check ball (2) in index sleeve for freedom of movement.

Selector positions are determined through the notches in the pawl.

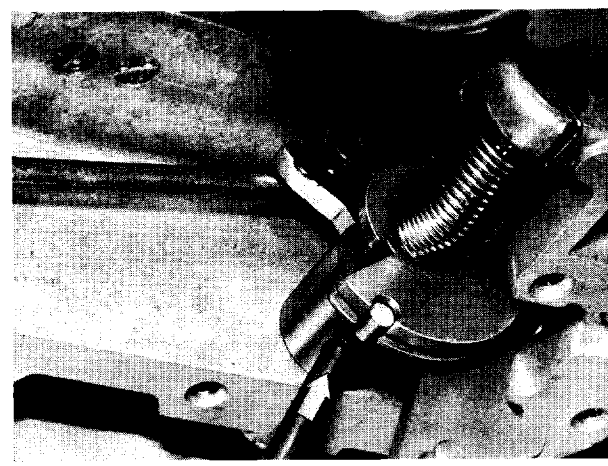
Pull of index pawl.



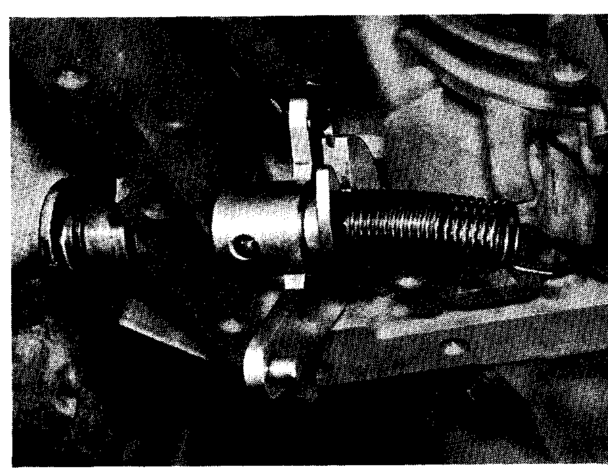
24 34 701 Shaft spring for accelerator cable: renewing

— control unit dismantled —

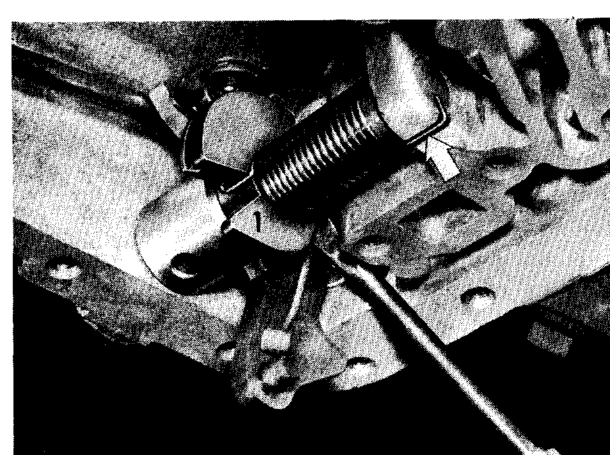
Remove tension pin in position 0.

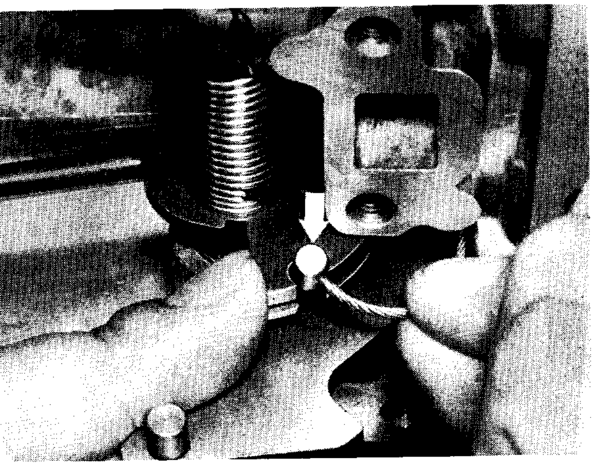


Press out selector lever as far as transmission tunnel.



Installation instructions: Remove accelerator cable.
Attach short arm of spring at accelerator cam (1).
The head of the accelerator cam (1) faces to the rear in direction of travel. Place the long arm of the spring in the groove at the housing.
Install selector lever.





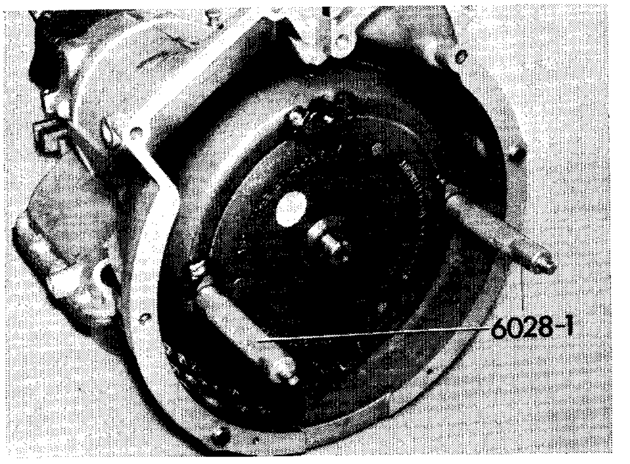
Turn accelerator cam anti-clockwise until accelerator cable can be installed.

■

24 40 000 Removal and fitting of torque converter

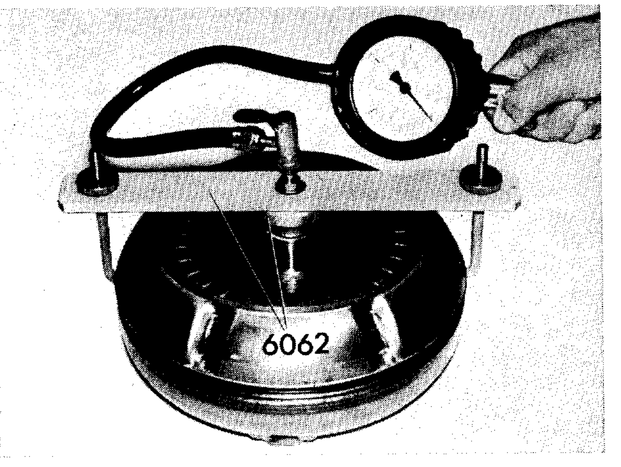
Removal and fitting of transmission – 24 00 020.
Using assembly clamps 6028-1, carefully pull torque converter out of primary pump.
Important: Note that this will cause the transmission oil to run out.

■



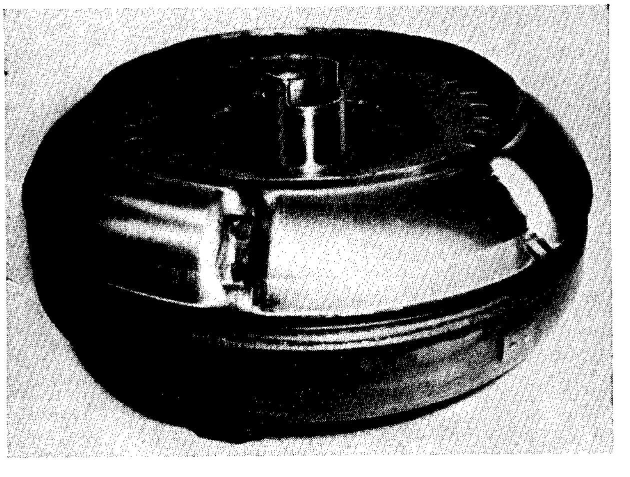
Note when refitting: Using tool 6062, and applying an air pressure of 0.5 atm (7.1 lb/in²), check torque converter for leaks.
Important: Always use support bracket, as otherwise there is an accident risk.

■



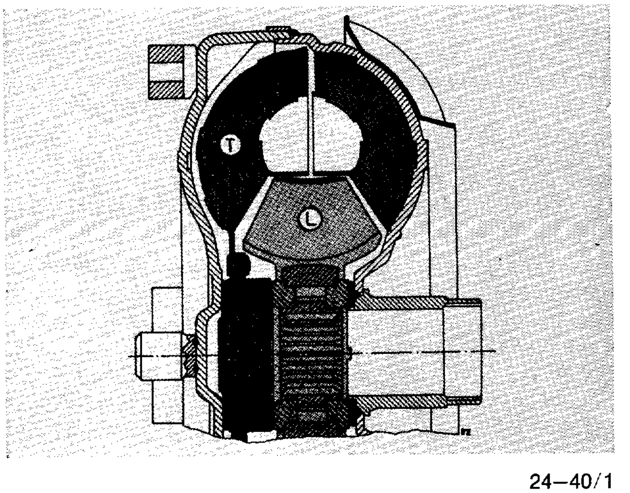
If the converter shaft support surface is damaged, or the tabs driven by the shaft are broken, always replace torque converter.

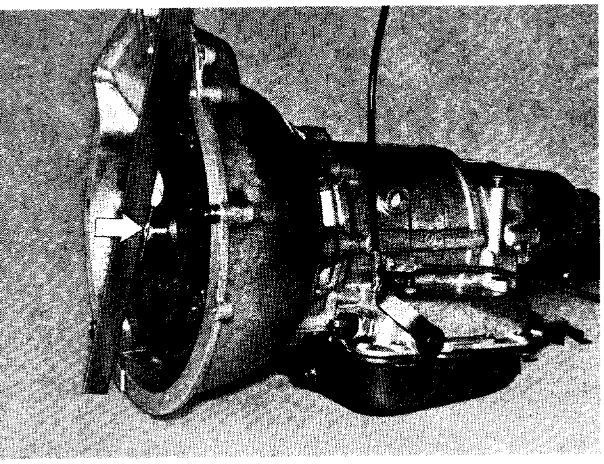
■



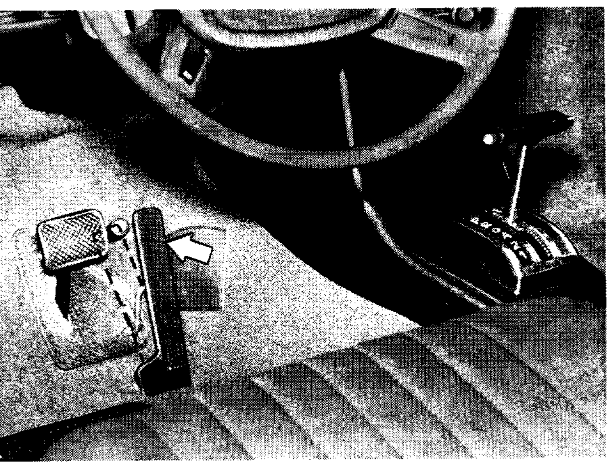
If impeller (L) or turbine rotor (T) cannot be turned by hand, always replace torque converter.

■





Turn the two driving dogs and guide the torque converter into the slots on the primary pump. The torque converter is positioned correctly when the guide journal is below the level of the edge of the housing.
■

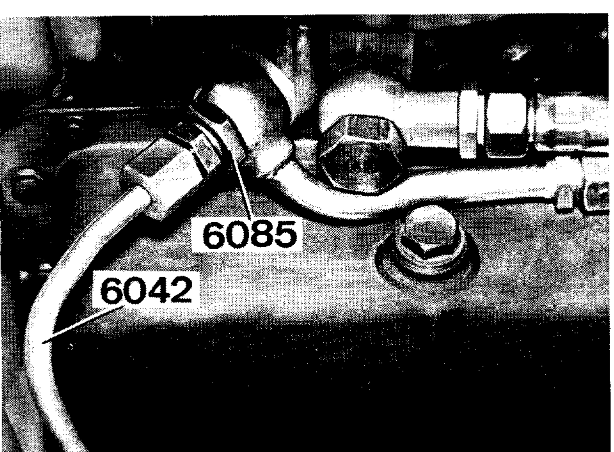


24 40 001 Torque converter – renewing

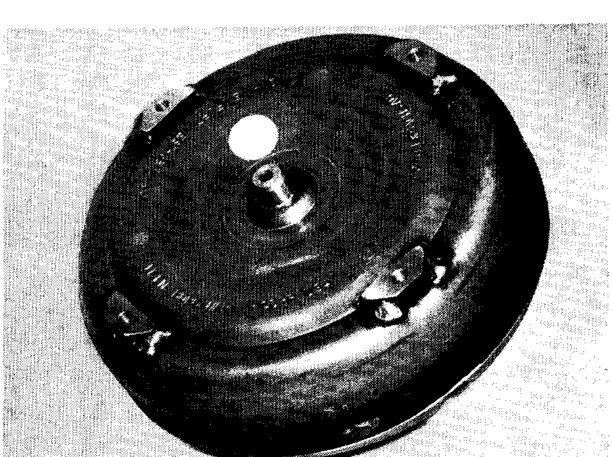
Check the torque converter before removing:
Engine and transmission oils must be at normal operating temperature.
Engine must develop its full power output.
Start the engine.
Apply the handbrake and depress the brake pedal firmly.
Select R or 1 at the transmission selector lever and open the throttle fully by depressing the accelerator.
Read off the stall speed[1]) on the revolution counter.

Warning: There is a risk of overheating if the stall speed is held for more than 10 seconds.

If the stall speed is much higher than the specified value[1]):
a) Torque converter is not filled with fluid to correct level – add more ATF.
b) Clutches are slipping – check condition of clutches.
If stall speed is much lower than specified value[1]):
a) Guide wheel freewheel is not engaging – renew torque converter.
■



If the converter pressure is to be determined with the 6042 tester, threaded union 6085 must be installed in the oil cooler feed line.
■

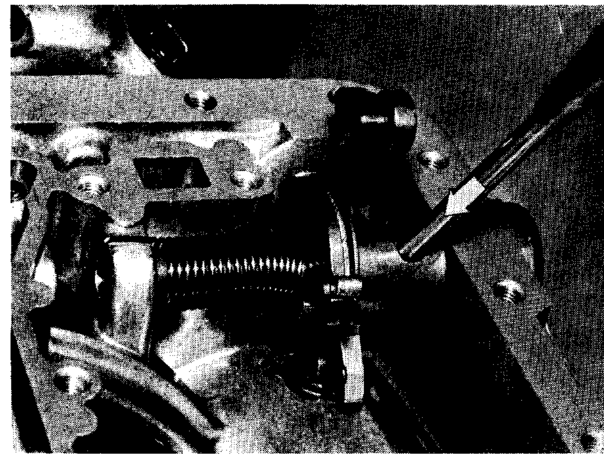


Remove the torque converter – 24 40 000.
Note that the torque converter cannot be cleaned with the products available to the ordinary workshop, and must be renewed if the transmission is damaged or the oil strainer torn.
Torque converter for BMW 2002 = white paint spot.
■

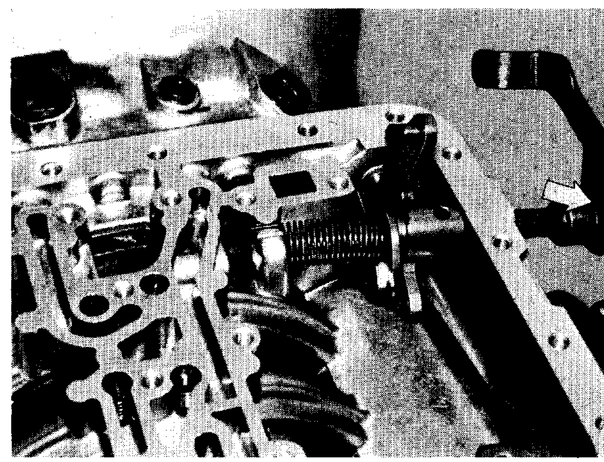
[1]) See specifications

24 51 000 Transmission selector lever: removing and installing

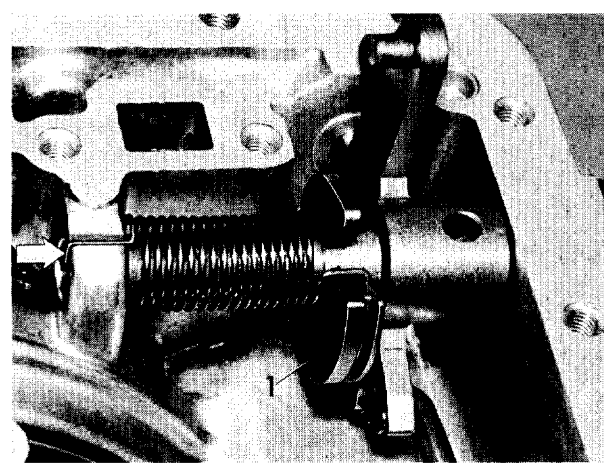
Dismantle transmission 24 00 020.
Attach transmission to support bracket 6002-1.
Remove control unit 24 30 000.
Force out tension pin in postion O.



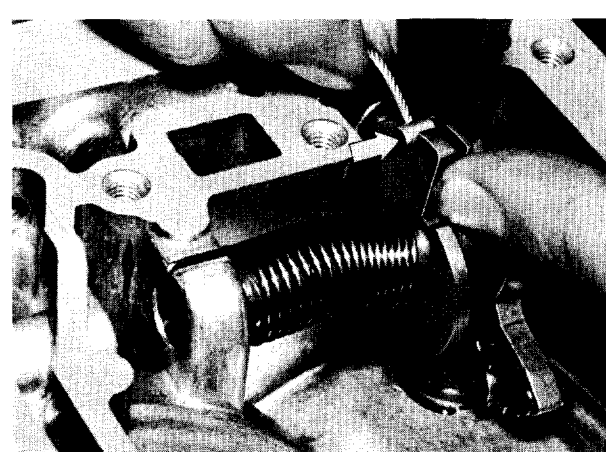
Remove transmission selector lever.
Installation instructions: Check O-ring and renew if necessary.



Remove accelerator cable.
Remove short arm of spring at accelerator cam (1).
The head of the accelerator cam (1) faces to the rear in direction of travel.
Place long arm of the spring in the groove at housing
Install transmission selector lever.



Turn the accelerator cam anti-clockwise until the accelerator cable can be inserted.



24 71 001 Rubber bush for transmission mounting: renewing

Support transmission with special tool 7060.

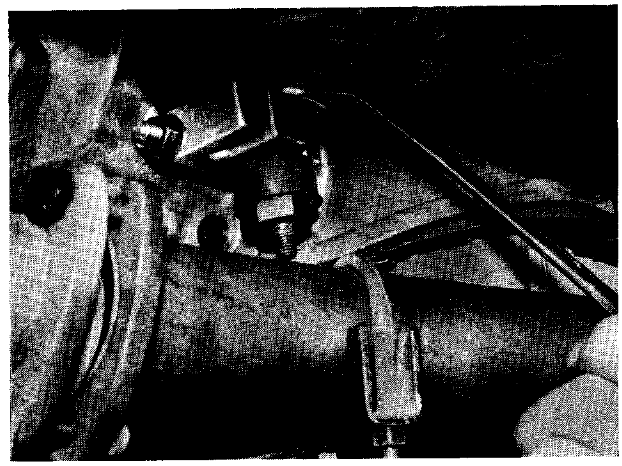
Remove transverse mumber —
Remove exhaust pipe at triangular flange.

Remove propeller shaft centre bearing.

Installation restructions: Preload centre bearing 2 mm (0.079") forward.

Lower transmission until rubber bush can be removed using an angled open ended wrench.

■



Fault finding: Automatic transmission 3 HP – 12

Fault	Cause	Remedy
Shift points [1] too high	a) Accelerator cable incorrectly adjusted b) Governor bush jammed c) Excessive axial clearance at governor piston rings d) Shift control valve not working correctly	a) Adjust accelerator cable b) Free both governor bush and piston c) Renew piston rings d) Exchange control unit
Shift points [1] too low	a) Accelerator cable incorrectly adjusted b) Governor bush jammed c) Shift control valve not working correctly	a) Adjust accelerator cable b) Free both governor bush and piston c) Exchange control unit
No kickdown reaction	a) Accelerator cable incorrectly adjusted b) Shift control valve stuck	a) Adjust accelerator cable b) Exchange control unit
Selector lever cannot be placed in position P	a) Control linkage incorrectly adjusted b) Locking mechanism defective	a) Adjust control linkage b) Overhaul locking mechanism
Selector lever cannot be placed in position R	a) Control linkage incorrectly adjusted	a) Adjust control linkage
No forward or reverse movement	a) Oil quantity too small b) Drive lug on converter broken c) Oil pressure too low	a) Correct oil level b) Renew converter c) Dismantle transmission
Only 1st gear in position A	a) Control valve and control pistons 1 and 2 jammed b) Governor bush jammed	a) Exchange control unit b) Free both governor bush and piston
Only 1st and 2nd gear in position A	a) Control valve and control pistons 2 and 3 jammed b) Excessive axial clearance at rectangular rings for clutch B c) Clutch valve and clutch damper B not working d) Centering plate bush warped	a) Exchange control unit b) Renew rectangular rings c) Renew control unit d) Renew bush and/or centering plate
Moves only in 2nd gear	a) Control valves and control pistons 1, 2 and 3 jammed	a) Exchange control unit
Moves only in 3rd gear	a) Control valves and control pistons 1, 2 and 3 jammed b) Governor bush jammed	a) Exchange control unit b) Free both governor bush and pistons
No movement in reverse	a) Control linkage incorrectly adjusted b) Clutch valve and clutch damper B not working c) Excessive axial clearance at rectangular rings for clutch B	a) Adjust control linkage b) Dismantle transmission c) Renew rectangular rings
Transmission slipping	a) Accelerator cable disconnected b) Oil quantity too low c) Shift control valve jammed	a) Attach accelerator cable b) Correct oil level c) Exchange control unit
Transmission shift from 1st to 2nd gear slipping	a) Clutches C and C′ slipping b) Clutch valve and clutch damper C not working c) Accelerator cable disconnected d) Oil quantity too low e) Shift control valve jammed	a) Dismantle transmission b) Dismantle transmission c) Attach accelerator cable d) Correct oil level e) Exchange control unit

[1] See technical data

Fault finding: Automatic transmission 3 HP – 12

Fault	Cause	Remedy
'ransmission slipping during shift 'om 2nd to 3rd gear	a) Clutch B slipping b) Excessive axial clearance at rectangular rings for clutch B c) Centering plate bush warped d) Accelerator cable disconnected e) Oil quantity too low f) Oil pressure too low g) Shift control valve jammed	a) Dismantle transmission b) Renew rectangular rings c) Renew bush and/or centering plate d) Attach accelerator cable e) Correct oil level f) Dismantle transmission g) Exchange control unit
rd gear slipping	a) Clutch B slipping b) Excessive axial clearance at rectangular rings c) Accelerator cable disconnected d) Oil quantity too low e) Oil pressure too low f) Shift control valve jammed	a) Dismantle transmission b) Renew rectangular rings c) Attach accelerator cable d) Correct oil level e) Dismantle transmission f) Exchange control unit
lo power transmitted in 1st gear n position A when kickdown used	a) 1st gear freewheel defective	a) Renew freewheel
n position 2 change from 2nd to st very rough	a) Clutch valve and clutch damper D not working	a) Exchange control unit
lo brake effect in 1st gear in ositions 2 and 1	a) Clutch valve and clutch damper D defective b) Clutch D defective	a) Exchange control unit b) Renew clutch D
lo brake effect in 2nd gear in ositions 2 and 1	a) Clutch C' defective	a) Renew clutch C'
ligh pitched whine depending on peed and load cycle	a) Propeller shaft centre bearing defective	a) Renew centre bearing
Rattling noise when idling	a) Drive plate broken b) Welded lugs broken away from converter	a) Renew drive plate b) Renew converter
Buzzing noise when idling. Disappears with acceleration in position 0	a) Valve vibrating in control unit	a) Correct oil level
Whistling noise depending on gear	a) Planetary gear set noisy	a) Renew planetary gear
Converter dome oiling up	a) Shaft seal defective b) O-ring defective at primary pump housing c) Converter leaking at weld seams d) Plugs leaking	a) Renew shaft seal b) Renew O-ring c) Renew converter d) Renew seal
Output flange oiling up	a) Shaft seal defective	a) Renew shaft seal
Filler pipe losing oil	a) O-ring defective or missing	a) Renew O-ring
Loss of oil at vent	a) Oil level incorrect	a) Correct oil level
Speedometer drive oiling up	a) O-ring defective	a) Renew speedometer bushing