

INSTRUCTION FOR THE MAINTENANCE AND ADJUSTMENT

AUTOMATIC TRANSMISSION



2000 SALOON



This publication contains instructions for the maintenance and setting of the automatic gearbox ZF 3HP-12, which is an optional extra on the 2000 Saloon.

The necessary operations have been fully described and illustrated to ensure that they can be carried out easily and quickly.

When filling the automatic gearbox with oil, only lubricants recommended by Alfa Romeo should be used.

In addition, this publication should always be kept up-to-date with the data and information issued by means of the "Information Sheets" and "Up-dating Instructions", both issued by our Technical Service Department.

Service Department

Alfa Romeo



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GENERAL REMARKS

The automatic gearbox, model 3 HP-12, manufactured by ZAHNRADFABRIK FRIEDRICHSHAFEN AG and fitted as an optional extra to the 2000 Saloon replaces the conventional manual gearbox with five forward and one reverse gears, using a clutch assembly and clutch pedal. The selector lever is used to select the required ratio, all other operations being carried out automatically by the gearbox.

Acceleration, gear selection and driving speed are obtained by operating the accelerator. The driver is never controlled by the automatic gearbox, and can override it at any time by altering the position of the selector lever.

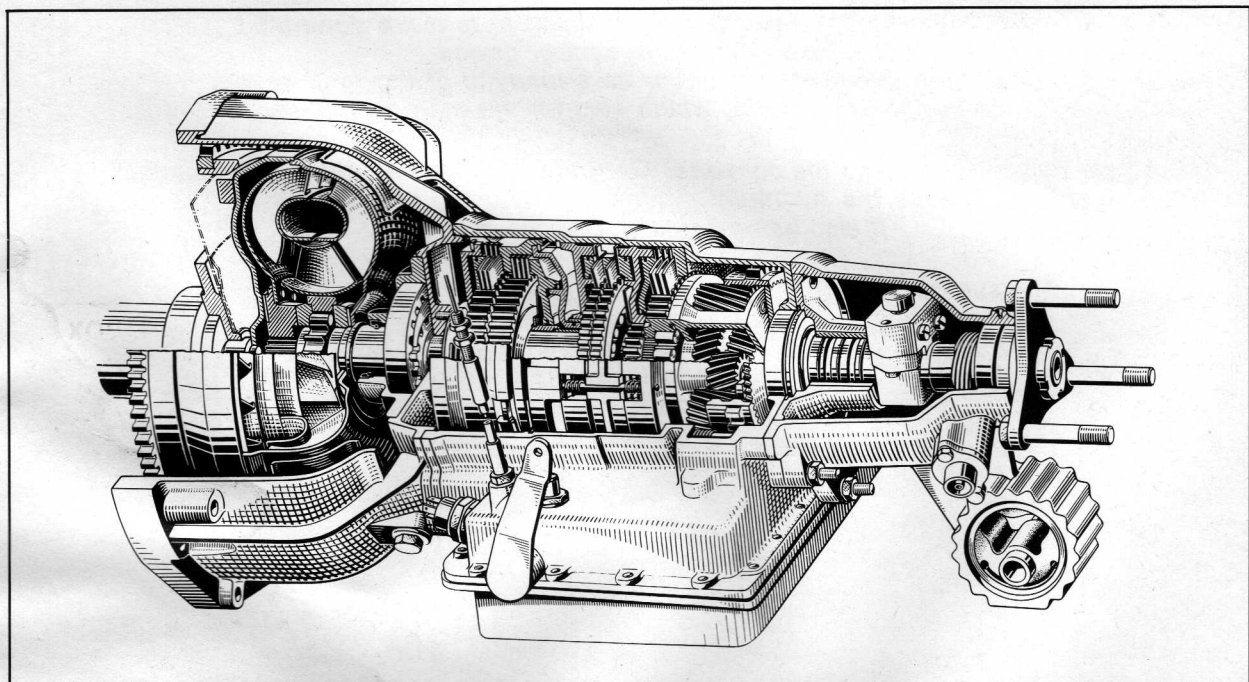
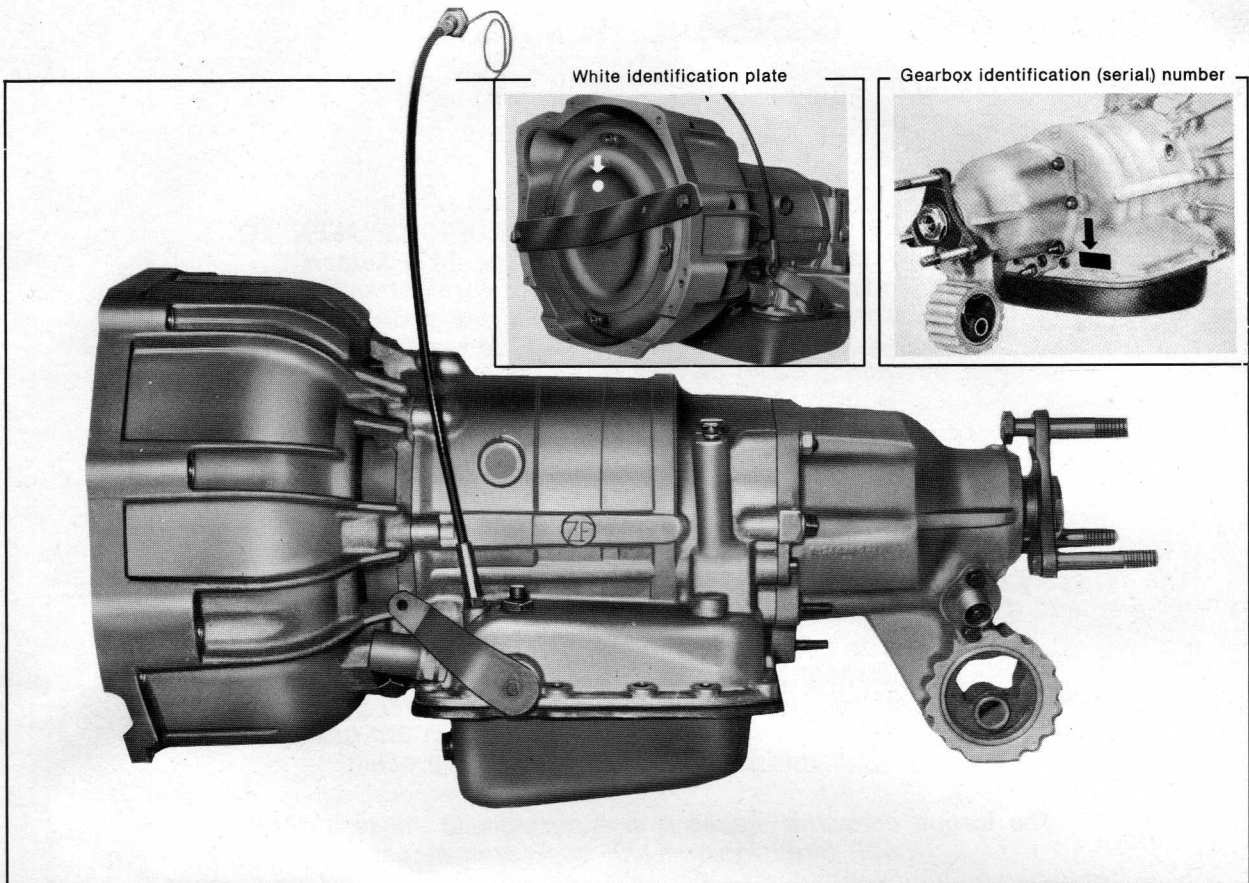
The assembly consists of a torque converter which is always in operation in all the ratios.

The converter allows good acceleration without manual control of the gearbox, by selecting the most suitable ratio. It also provides greater operating flexibility which allows driving at low speeds, even in 3rd gear, and facilitates parking manoeuvres appreciably.

The torque converter makes it also possible to utilise a gearbox with three forward and one reverse gear, obtained by means of an epicyclic gear train arranged behind the gearbox. It is connected to the engine by means of multi-disc clutches, hydraulically operated by servos which in turn are controlled by an automatic control device, either by a centrifugal governor as a function of the road speed, or by the accelerator, which acts on the butterfly valves.

A gear pump mounted on the converter housing and driven directly by the engine, feeds the hydraulic control unit and the converter. It also lubricates the epicyclic gear train.

The sun gear which engages with the three secondary planetary gears of the epicyclic train is toothed on its outside periphery. A pawl controlled by the selector lever ("P" position) engages in these teeth and locks the gearbox output shaft and thus the driving wheels of the car.





TECHNICAL DATA

Hydromatic FICHTEL & SACHS torque converter, FÖTTINGER system.

Three-speed epicyclic gearbox, RAVIGNEAUX system.

Automatic gearchange by means of hydraulically controlled multi-disc clutches.

Selector lever positions:

- P** = Parking (locked transmission)
- R** = Reverse
- N** = Neutral
- D** = Drive (normal position)
- 2** = For moderate gradients
- 1** = For steep gradients

Gear ratios:

1st	2nd	3rd	Reverse
2.56	1.52	1.0	2.0

Weight	{	Gearbox	32.5 kg
		Converter	9.5 kg
		Total, incl. oil	49.0 kg

Oil capacity (initial filling) 7 litres (12.25 pints)

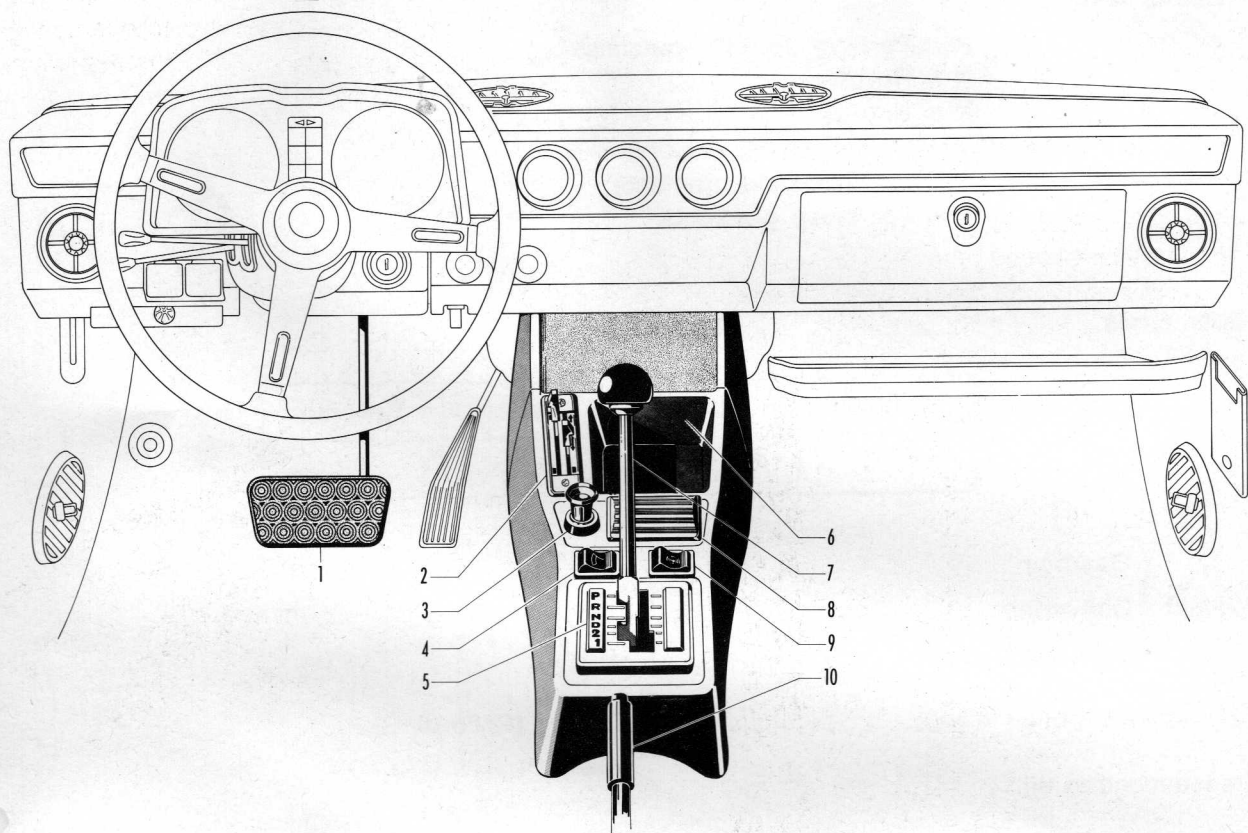
Recommended oil { AGIP F1 ATF DEXRON
SHELL "DEXRON" S 7541

COMPARISON BETWEEN AUTOMATIC AND MANUAL GEARBOX

AUTOMATIC GEARBOX			MANUAL GEARBOX
Ratios in "D"	Torque converter ratio	Torque converter ranges	Ratios with manual synchromesh gearbox
1st 2.56 : 1.	2.1 — 1.0	1st 5.37 — 2.56	1. : 3.30
2nd 1.52 : 2.		2nd 3.20 — 1.52	2. : 1.99
3rd 1.0 : 3.		3rd 2.1 — 1.0	3. : 1.35
			4. : 1.00
			5. : 0.79



DRIVING CONTROLS



1 Brake pedal

2 Heater controls

3 Cigar lighter

4 Two-speed wiper control

5 Indicator plate

6 Tray

7 Selector lever

8 Ash tray

9 Two-speed electric fan

10 Hand brake lever



SELECTOR LEVER

The gearbox can be controlled by automatic or manual selection.

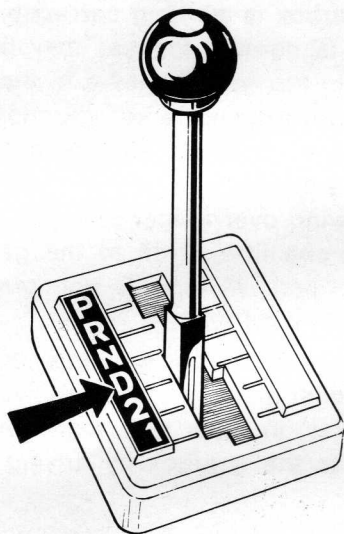
For this purpose the driver operates the selector lever on the transmission tunnel, which offers six selector positions.

These are as follows:

P - R - N - D - 2 - 1

— Position **D** is used for the automatic selection of the gears.

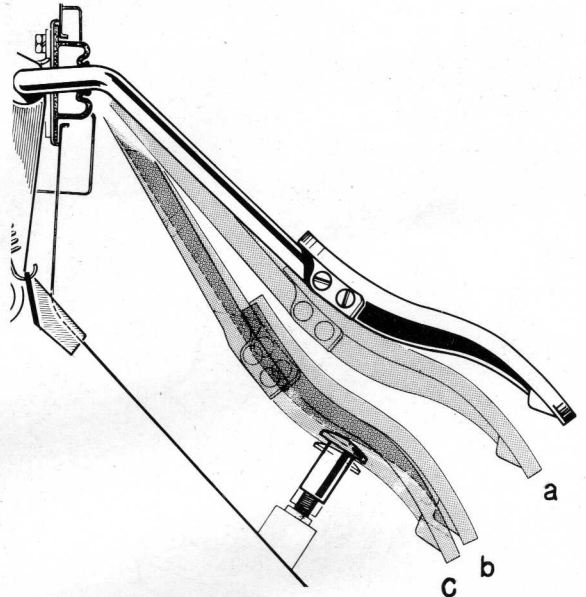
— Positions **P, R, N, 2, 1** are used only for the manual selection and offer further scope for overriding the automatic gear selection.



Automatic gear selection

With the selector lever in the **D** position, all gear changes, either up or down, take place automatically and progressively, according to the car's speed. This is due to the operation of valves controlled by the centrifugal governor according to speed and the torque converter under the various driving conditions.

With a small throttle opening, i.e. with the accelerator in position **a**, the up-change takes place at a low speed, whilst by depressing the accelerator fully, thus opening the butterflies completely, i.e. position **b**, the gear changes take place at high speeds. By depressing the accelerator to position **c**, the gear changes take place at the maximum permissible speed.



This last position, which is known as the "Kick-down" position, is used to obtain better acceleration by means of a rapid down change. The change down in the "Kick-down" position does not occur above certain speeds: 125 kph (78 mph) in 2nd gear and 65 kph (40 mph) in 1st gear.

Manual selection

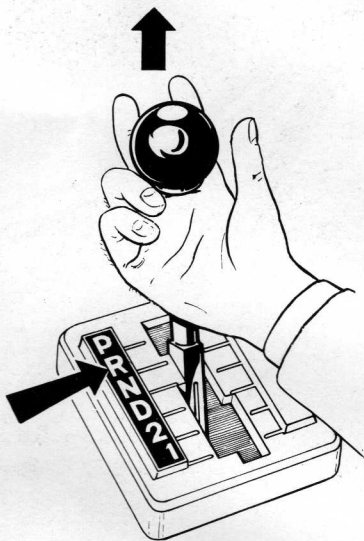
Manual selection can be obtained by moving the selector lever to the required position **P, R, N, D, 2, 1**.



Starting the engine

The engine can be started only with the selector lever in positions **P** or **N**. For safety reasons the hand brake must always be applied before starting the engine.

To move the selector lever to position **R** (Reverse) or **P** (Parking) it is necessary to lift the sleeve below the knob. **This must be done when the car is stationary.**



Moving off

With the engine idling, move the selector lever to one of the required positions. Release the handbrake **and after having heard gear engage**, depress the accelerator.

Position **D** (Drive) is generally used for normal driving. Gear changes take place automatically, according to the position of the accelerator and the road speed of the car.

Always release the accelerator when selecting gears. **When changing the direction of movement, apply the handbrake and stop the car before selecting the gear.**

Stopping the car

To stop the car, depress the brake pedal. If, with the engine idling and a gear is engaged, the car tends to creep on a level surface, it will be necessary to apply the handbrake.

Towing the car

It is not possible to tow start the car.

If the gearbox is working correctly, and the oil level is normal, the car may be towed by placing the selector lever in the **N** position. Do not exceed 50 kph (30 mph).

The towing distance should not exceed 50 km (30 miles).

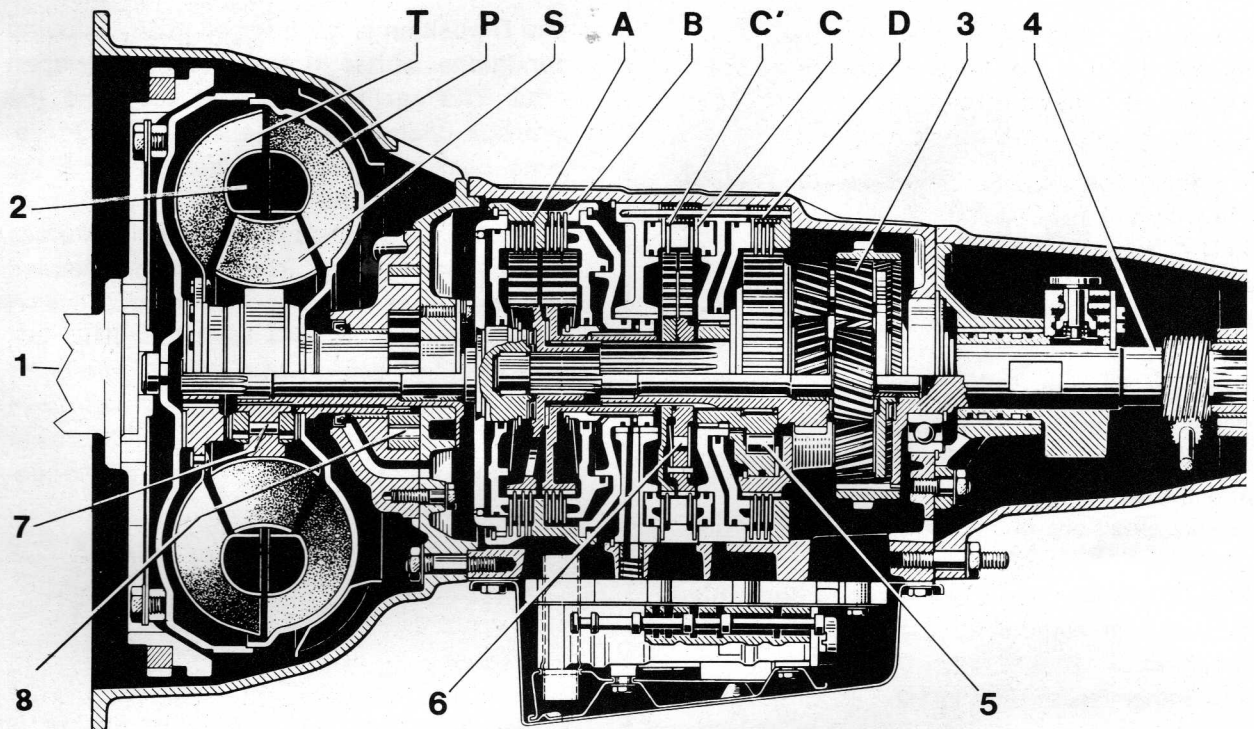
When towing over longer distances, the addition of one litre of oil to the gearbox is recommended. If this is not practicable, disconnect the propeller shaft.

If the gearbox is not working, disconnect the propeller shaft or place the rear wheels on a trolley, in order to prevent any further damage to the gearbox by driving the rear wheels.

After repair, ensure the gearbox oil level is in accordance with the normal recommendation.



ANALYSIS OF GEAR SELECTION AND DIAGRAMS SHOWING THE POWER FLOW



Cross section through automatic gearbox

1 Input shaft — 2 Hydrodynamic torque converter (P pump, S stator, T turbine) — A-B Multidisc clutches — C'-C-D Multidisc clutches — 3 Epicyclic gear train — 4 Output shaft — 5-6-7 Free wheels — 8 Lubrication pump

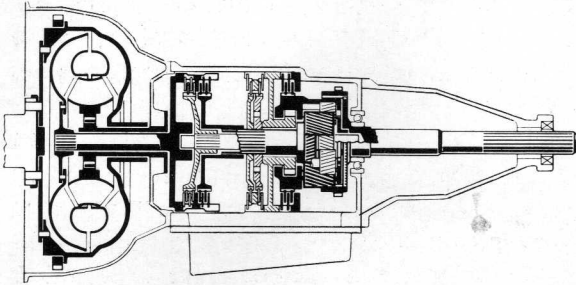
P. PARKING

In this position all clutches are released. The epicyclic gear train is disconnected from the converter and the engine, if it is running does not transmit any power to the rear wheels. The gearbox output shaft is mechanically locked to the housing by means of a pawl engaging in the outer teeth of the sun gear of the epicyclic gear train

and therefore, as it cannot rotate in either direction, it holds the car stationary.

The parking position must be used when the car is left on an incline or when carrying out adjustments or setting up the engine, as well as when parking the car under normal conditions.

With the selector lever in the P-position it is possible to start the engine. **Do not select the P-position with the car in motion.**

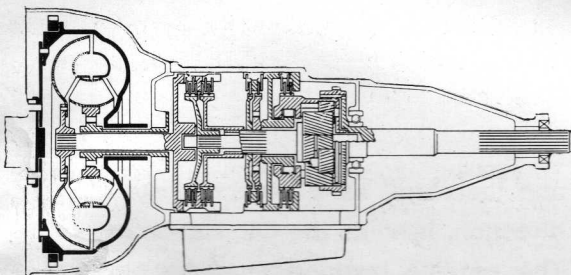
**R - REVERSE**

Reverse must be selected only when the car is stationary and the accelerator pedal is fully released, i.e. with the engine idling, and the brake pedal is depressed.

In this position, clutch **B** and brake **D** are applied.

The planet carrier is locked and thus the direction of rotation of the output shaft is reversed.

The transmission ratio is 1:2.

N - NEUTRAL

In the neutral position all clutches are released. The epicyclic gear train is disconnected from the torque converter and the engine transmits no drive to the rear wheels.

With the selector lever in the **N** - position, it is possible to start the engine.

D - DRIVE

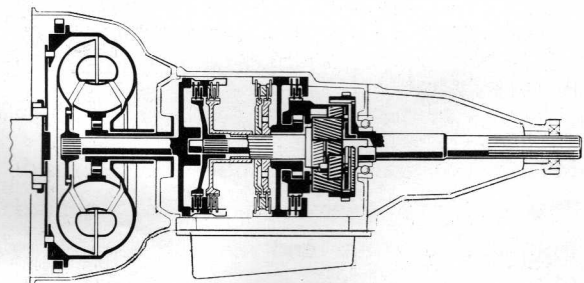
The D-position is used for all normal driving conditions, either in town or on the open road. The car starts in first gear and the gearbox changes automatically up into second gear and into third, according to the road speed and the accelerator position.

When the car's speed decreases, it changes automatically down from third to second and from second to first. Also, by depressing the accelerator beyond the full throttle position to the "kick-down position", the gearbox changes from third to second and down to first, provided the car's speed is lower than the predetermined maximum change-down values.

1st GEAR

Clutch **A** is applied. When the engine is pulling, the planet carrier reacts on the freewheel **5**, whilst on the overrun the latter frees itself.

When the selector lever is in position **1** or **2**, the first gear clutch **D** is also applied to make use of the engine braking effect. The transmission ratio is 1:2.56.



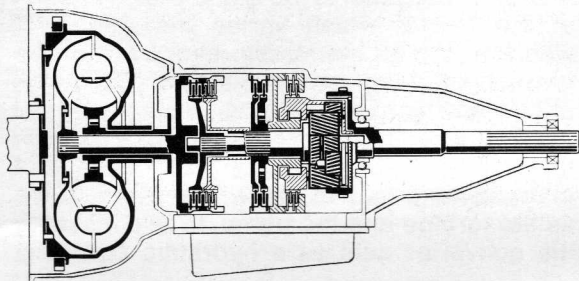


2nd GEAR

Clutches **A**, **C'** and **C** are applied.
Freewheel **5** frees itself.

The primary planetary gear shaft is locked to the input shaft. The secondary planetary gear shaft is locked.

The transmission ratio is 1:1.52.

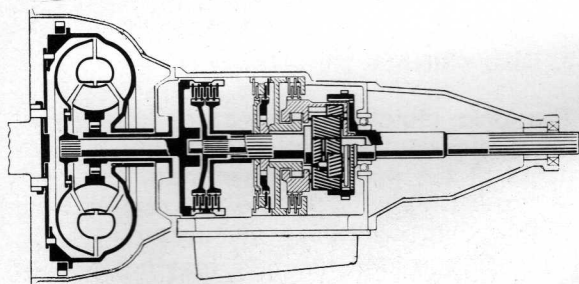


3rd GEAR

Clutches **A**, **B** and **C** are applied.

Freewheels **5** and **6** free themselves

The entire epicyclic gear train rotates as a unit, giving a 1:1 transmission ratio.



POSITION 2

Designed for moderate gradients

The use of the '2' position is particularly recommended for mountain roads, for moderate gradients, and where the engine braking effect can be used.

Position **2** can be selected at any speeds below 120 to 130 kph (75-80 mph) and at any accelerator position. At higher speeds the selection of the '2' position must be made with the accelerator fully released. In the '2' position the car starts in 1st gear, and as the speed increases, the gearbox changes up into 2nd automatically. The gearbox then remains in second gear, that is, there is no automatic up-change into 3rd gear, irrespective of vehicle speed and accelerator pedal position.

With the selector lever in this position, it is also possible to produce a change from 2nd to 1st gear by using "kick-down" in order to obtain faster acceleration without exceeding the predetermined maximum change speeds.

POSITION 1

Designed for steep gradients

This position is particularly recommended for use under difficult driving conditions or on steep gradients.

The **1** position can also be selected at any speed below 65 to 75 kph (40-47 mph) irrespective of the accelerator position. At higher road speeds, however, the '1' position can only be selected with the accelerator fully released.

The car starts in first gear and remains in first gear, irrespective of the road speed or the accelerator position, i.e. no automatic up-change into 2nd or 3rd gear is possible. The use of position **1** enables the constant use of the high engine braking effect available.



DESCRIPTION OF GEARBOX COMPONENTS

The gearbox consists of the following main components:

1. Torque converter
2. Lubrication pump
3. Multi-disc clutches
4. Epicyclic gear train
5. Valve block
6. Centrifugal governor

1. Torque converter

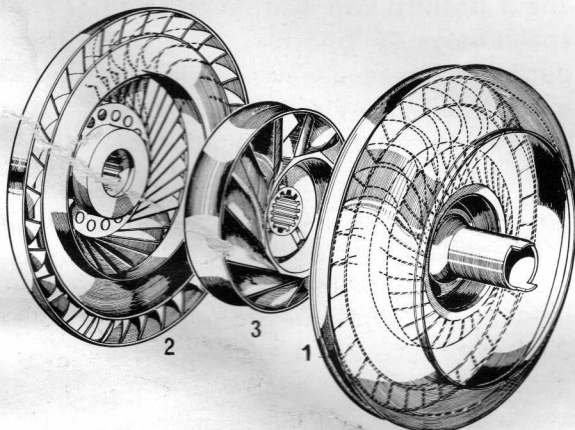
The torque converter provides a hydraulic coupling and torque multiplication for the engine power.

It consists of the following three main components: Pump, turbine and stator.

— **The pump 1**, which is fixed to the input shaft, constitutes the outer casing of the torque converter. Blades are provided on its inside, which direct the fluid to the turbine.

— **The turbine 2**, which is located inside the converter body, and is splined to the primary shaft, receives the motion from the pump and transmits it to the gearbox.

— **The stator 3**, which is mounted on a freewheel, is arranged between the turbine and pump and allows a variable multiplication of the speed in relation to the pump and the turbine.



The pump, which is driven by the crankshaft, transforms the engine power into kinetic energy. The fluid, which is being circulated by the pump, is directed onto the turbine blades and returns to the pump via the stator blades. The shape of these blades has been designed in order to achieve a well defined change in direction of the flow of the fluid, when a differential in speed exists between pump and turbine, in accordance with the road speed. This change in direction makes it possible to obtain a multiplication of the torque which varies between 2.1:1 with the turbine stationary, and 1:1 with the turbine reaching approximately 80% of the speed of the pump blades. At this speed the angle of the fluid flow at the exit from the turbine is such that the stator is rotated in the same direction and at the same speed as the turbine and the pump. In this instance the converter acts as a hydraulic coupling.

2. Lubrication pump

The lubrication pump 8 (see page 9), which is located within the converter housing, is driven only by the engine. It is a gear pump and supplies the valve block, the converter, the centrifugal governor with fluid and additionally lubricates the epicyclic gear train.

3. Disc clutches

The disc clutches connect or disconnect the torque converter to or from the planetary gears of the epicyclic gear train. They are of the multi-disc type and are operated by hydraulically controlled plungers.

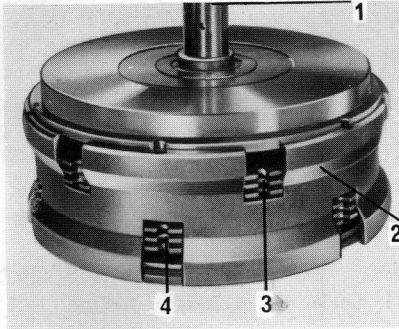
According to their function, they are divided into:

- rotating discs
- braking discs

Rotating discs (see Page 9)

The rotating discs **A** and **B** are fixed to the turbine.

Clutch **A** controls the primary planetary gear. Clutch **B** controls the secondary planetary gear.



1. Input shaft
2. Clutch housing
3. Rotating disc clutch A
4. Rotating disc clutch B

Disc clutches (see page 9)

The multi-disc clutches are shown at C', C and D. Their outer discs are secured to the gearbox casing.

The multi-disc clutches C' and C lock the secondary planetary gear. Multi-disc clutch D locks the planetary gear carrier of the epicyclic gear train.

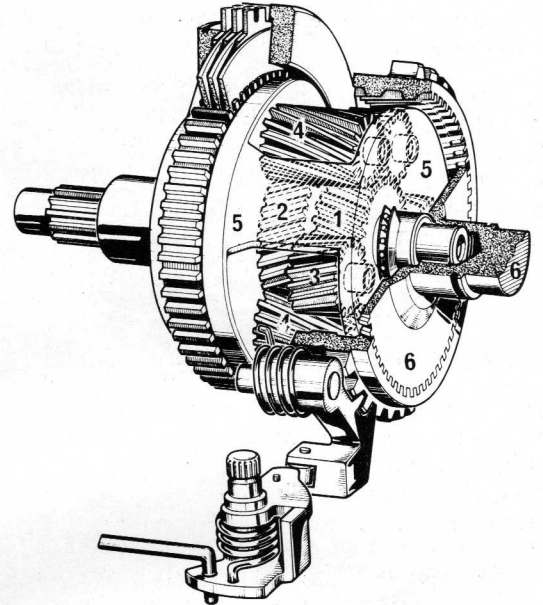
4. Epicyclic gear train

The gear train for transmitting the drive is of the epicyclic type and consists of two sun wheels and six planetary gears. This layout provides for three forward and one reverse gear.

The epicyclic gear train consists of the following components:

1. Primary sun gear (25 teeth)
2. Secondary sun gear (32 teeth)
3. Three primary planetary gears (each with 15 teeth)
4. Three secondary planetary gears (each with 15 teeth)
5. Planetary gear carrier
6. Ring gear, connected to the output shaft (64 teeth)

Drive is transmitted through the primary sun gear for the forward speeds, and through the secondary sun gear for reverse. From the sun gears the drive is transmitted to the planetary gears and from these to the ring gear.



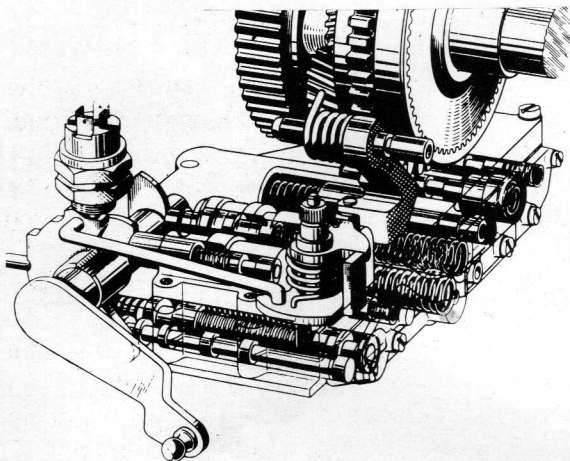
The planetary gears can rotate freely around their own axis and around the sun gear. The various ratios at the output shaft are obtained by combining or isolating these two movements, according to the driving conditions. In reverse, only one set of planetary gears is operative, so that the ring gear rotates in the direction opposite to that of the secondary sun gear. In the forward speeds, both sets of planetary gears are in use, so that the ring gear rotates in the same direction as the primary sun gear.

5. Hydraulic valve block

The valve block is housed at the bottom of the gearbox. It distributes the flow of oil in accordance with the gear selected, in order to ensure the full use of the available driving torque.

The valves contained within the block operate the clutches which in turn control the epicyclic gear train, according to:

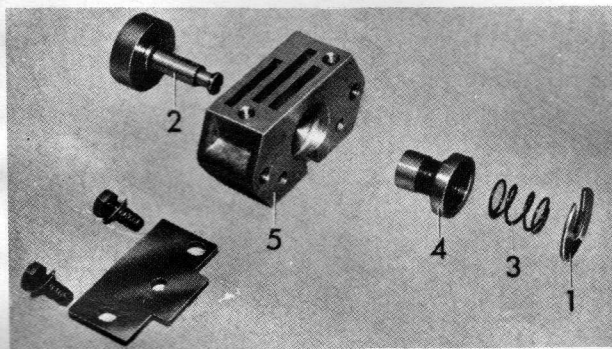
- position of selector lever
- accelerator position.



— road speed of car.

6. Centrifugal governor

The centrifugal governor is connected to the gearbox output shaft. It ensures that the control valves operate the clutches at the correct moment. It therefore determines the automatic gear change in accordance with the road speed. Due to its location, the change speeds are set according to the output shaft speed.



1. Locking plate - 2. Governor piston -
3. Spring - 4. Bush - 5. Governor body.

REFILLING

The recommended fluid is:

AGIP F1 ATF DEXRON
SHELL "DEXRON" S 7541

Amount required for initial filling: **7 litres**
(12.25 pts).

Check fluid level every **6000 km (3750 miles)**.

Subsequent quantities when changing fluid every **36,000 km (22,500 miles)** **4.5 litres**
(7.8 pts).

NOTE: The amount of transmission fluid required for subsequent refilling is less than that for the initial filling owing to the fact that the torque converter cannot be completely drained, except by dismantling the unit.

Checking oil level

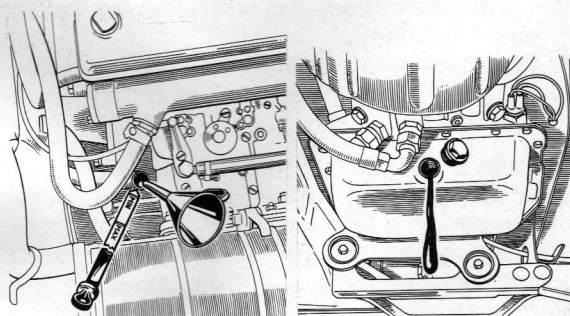
— Place the car on a level surface. Apply the handbrake. Place the selector lever in the **P (Park)** position and run the engine at idling speed until the fluid is warm.

— Withdraw dipstick and wipe it with a nylon rag.

— Check level **with the engine running at idling speed**.

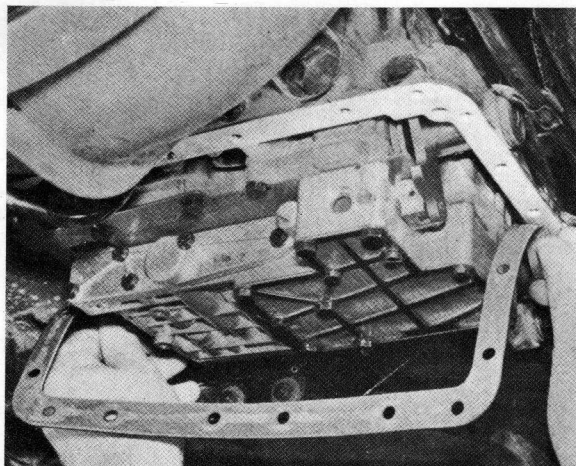
— If necessary, top up whilst the engine is idling, until the level reaches a point on the dipstick that is two thirds between the two marks.

A quantity of 0.5 litre (0.8 pts) raises the fluid level from the lower to the upper marking. Fill the gearbox through the dipstick orifice.

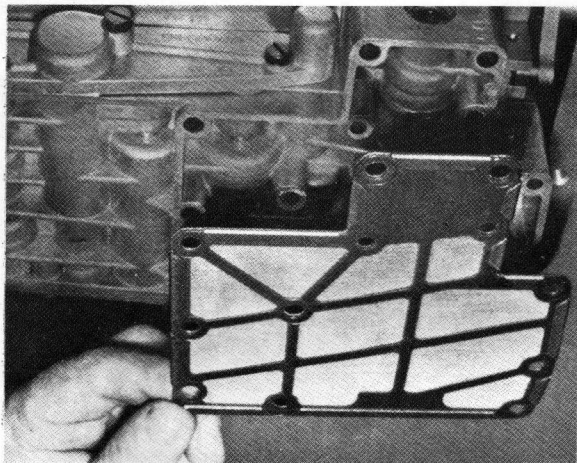




Oil leaks at the sump joint faces should be rectified by replacing the gasket with a genuine replacement gasket.



At the same time, check cleanliness of filter. If necessary, clean with compressed air, after having previously removed it from the valve block.



Changing transmission fluid

When checking and refilling, ensure that the utmost cleanliness is observed in respect of the containers used for changing the oil. On new gearboxes, the fluid should be changed after the first 36,000 km (22,500 miles).

Change fluid as follows:

With the gearbox warm, place the car on a level surface.

Apply handbrake, place selector lever in the **P** (Park) position and stop the engine.

Unscrew the drain plug and, after all the fluid has drained away, replace and tighten to 3.5 kgm.

WARNING: Should the old oil be blackish in appearance and have a burnt smell, the gearbox should be dismantled to ascertain the cause. If the fluid has a changeable grey colour, this is due to the presence of aluminium swarf which cannot be eliminated magnetically.

Add **2 litres (3.5 pts)** of transmission fluid.

Start engine and run at idling speed. Continue adding fluid until the level is up two thirds between the two marks on the dipstick.

Quantity of fluid required for refilling: Approx. 4.5 litres (7.8 pints).

WARNING: In order to prevent damage to the gearbox components, the indicated quantities should be strictly adhered to when topping up or refilling the gearbox.



CHECKING GEAR CHANGE SPEEDS

Engine speed: 850 to 950 rpm.

CHANGE SPEEDS WITH GEARBOX IN:

• Automatic (D) (Fig. A)

Accelerator position	Gear change	Road speed	
		kph	mph
Throttle fully open	1 - 2	70 - 75	43 - 47
	2 - 3	120 - 130	75 - 82
Kick-down	2 - 1	60 - 65	37 - 40
	3 - 2	120 - 125	75 - 80

• Positions "2" and "1" (fig. B)

Accelerator position	Gear change	Road speed	
		kph	mph
Released *	3 - 2	120 - 130	75 - 82
	2 - 1	65 - 75	40 - 47

* The gear change speeds are obtained with the throttle released by placing the selector lever in positions 1 and 2.
 NOTE: Any speedometer errors or tachometer errors are not taken into account in the above figures.

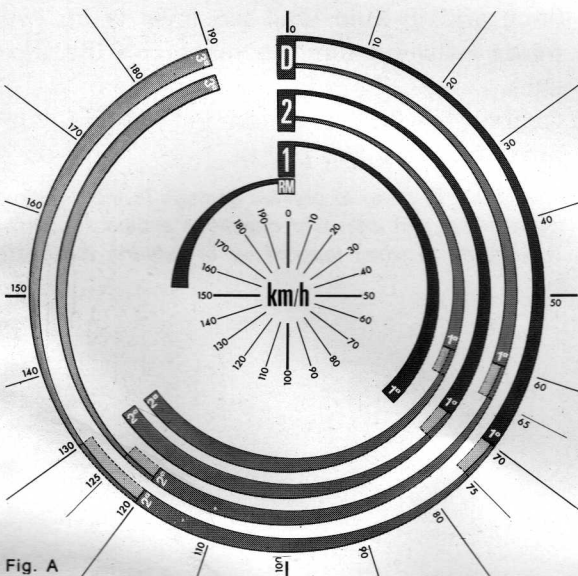


Fig. A
 ■ Gear change speed with accelerator in full throttle position
 ■ Gear change speed with accelerator in kick-down position
 ■ Gear change points

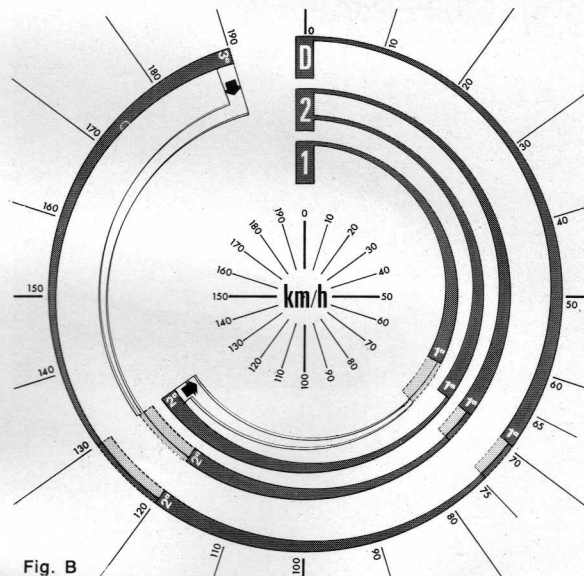
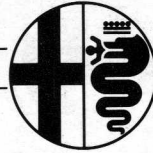


Fig. B
 ■ Engine braking effect
 ■ Gear change points
 □ Gearbox in neutral position



ADJUSTMENTS

Adjustments of the gearbox, which may become necessary when operational defects are in evidence due to incorrect settings or when the gearbox has been removed from the vehicle, must be carried out by following the operations detailed below, as required:

- Check oil level (see "Refilling").
- Adjust linkage to selector lever.
- Adjust cable connected to the accelerator linkage (downshift cable).
- Adjust starter inhibitor switch and reverse light switch.

Adjusting selector linkage

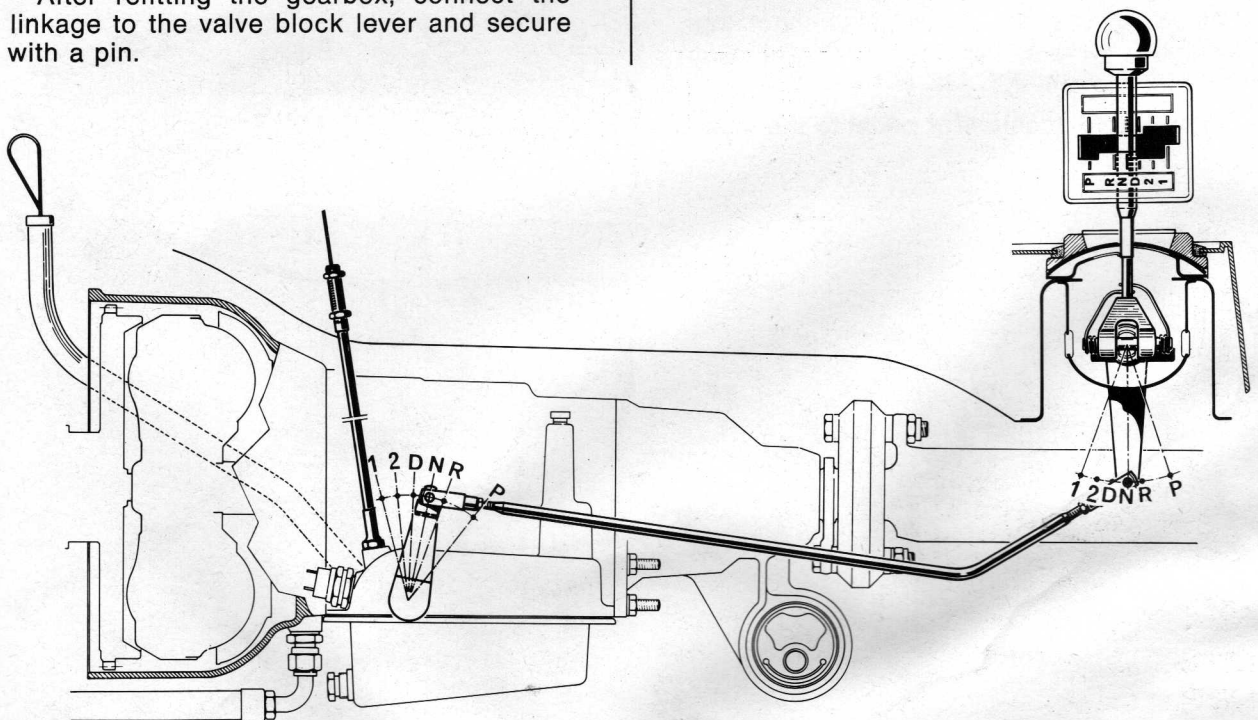
Adjustment of the selector lever linkage must be carried out, as previously indicated, every time the gearbox has been removed and refitted, whilst a check of such an adjustment is required when difficulties in selecting gears are experienced.

The required operations must be carried out in the following manner:

- After refitting the gearbox, connect the linkage to the valve block lever and secure with a pin.

- When checking the adjustment, disconnect the clevis pin from the selector lever.
- Place selector lever in the **N** position.
- Move the valve block lever to its neutral position, which can be determined by moving the lever three clicks from the left or two clicks from the right.
- Connect the linkage clevis to the selector lever and ensure that the pin enters easily. If necessary, adjust the length of the linkage by turning the locknuts on the clevis.
- Check that the engine can be started with the linkage and selector lever in this position.
- Repeat the alignment check of the clevis pin holes in all other selector lever positions. Misalignment of the holes in one of the positions is due to the distortion of the control levers or of the linkage. In such a case the correct alignment of the holes must be restored.

The selector lever must never be forced in any way into position. It is important that in positions **1** or **D** a clearance of 0.5-1 mm. is maintained between the selector lever and the indicator plate.





Adjustment of accelerator (downshift) cable

As previously indicated, the adjustment of the downshift cable must be carried out every time the gearbox has been removed and refitted, whilst this adjustment must also be checked when difficulties with the gearshift are experienced.

Adjust as follows:

- Disconnect operating-rod **A** and the downshift cable from linkage lever **B**.
- Check that the distance **C** relating to the position of the accelerator pedal stop is 60-66 mm. Adjust position, if necessary.
- Depress accelerator pedal until it touches the stop and hold it in that position.
- Manually operate the throttle lever **E** until the butterflies are fully open.
- Adjust the length of operating-rod **A** by turning the adjustment nuts, until the ball joint can be freely connected.
- Check, whilst still depressing the accelerator pedal against the stop, that the throttle lever **E** still has a 1-2 mm clearance in respect of the stop.
- Release accelerator pedal.
- When refitting the gearbox, connect the downshift cable to the linkage **B** and lock it so that it is taught, but not stressed.
- Depress the accelerator pedal to the kick-

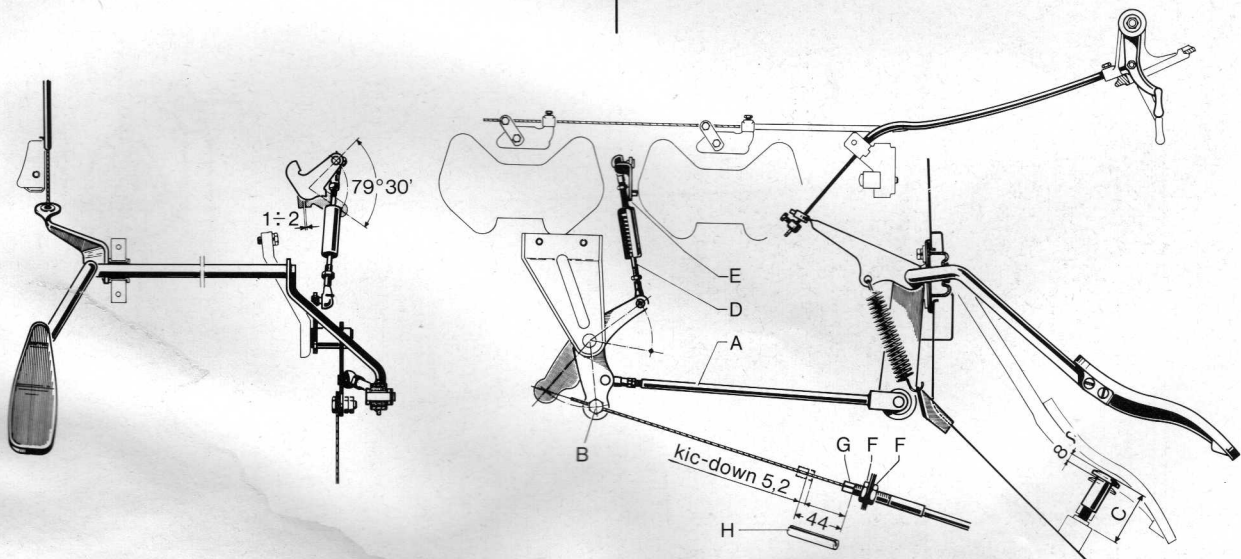
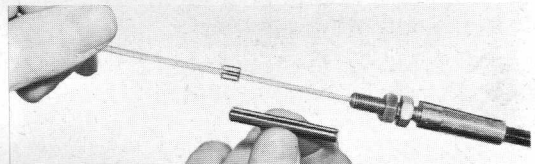
down position and check whether the crimp on the cable moves by 44 mm, which equals the total cable movement. (See illustration).

Even if a small difference is found (up to 0.5 mm), adjust by means of nuts **F**. Should greater discrepancies be in evidence, adjust the length of the flexible tie rod **D** at the ball ends. Subsequently repeat the above adjustments.

The total accelerator pedal movement corresponds to a downshift cable movement of 44 mm. The last 5.2 mm of the movement (equivalent to a movement of the stop under accelerator pedal of 8 mm.) constitutes the kick-down stage. Should the crimp **G** be missing, fit it as follows:

- Pull out cable to its maximum.
- Using tool **H** (A.4.0130), fit the crimp at a distance of 44 mm (see illustration) and secure it in position.

Note: Should the downshift cable break, the accelerator must not be depressed beyond the half throttle position.





Adjusting starter inhibitor and reverse light switch

After the gearbox has been refitted, it is necessary to reconnect the electric wires to the starter inhibitor switch and also to the reverse light switch taking into account the following instructions. It is also important to check that the engine can only be started with the selector lever in the **P** and **N** position.

Check all other positions to ensure that the starter motor is inoperative. In the case of defects check the starter motor inhibitor and reverse light switch on the left-hand side of the gear box.



Switch 1 has two functions: Two contact blades are to ensure that the starter motor

is inoperative in selector lever positions **R**, **D**, **2** and **1** and are identified by the figure 50 (grey and grey/black cables), whilst the other contact blades are for the reverse light switch. These are identified by the figure 15 (white and yellow/black cables).

Connect a test lamp to the contacts for each circuit in turn. When checking the inhibitor switch circuit, the lamp will light up only in positions **P** and **N**. When checking the reverse light switch, it will light up only in the **R** position and should remain extinguished in all other positions.

Should this not be obtained, adjust the switch setting by using a thinner washer.

Tighten switch to 3.5 mkg. If the results are still not satisfactory, replace the switch.



ROAD TEST

Introduction

All tests must be carried out with engine and transmission at normal working temperatures.

Do not test the gearbox by simultaneous acceleration and braking whilst in gear, as there is a danger of overheating.

Check gear change speeds only on level roads.

Check that starting is possible only when the selector lever is in the **N** or **P** position.

In the event of fault, check the starter motor inhibitor switch (see page 19).

Ensure that the engine idles smoothly and at the recommended speed.

The oil level must be checked only with the engine running at idling speed and with the selector lever in the **N** or **P** position.

NOTE: If the oil is cold, the level must be above the minimum level by about 1/4 of the distance between the two marks on the dipstick. When warm, the oil level may even climb above the maximum level, according to the oil temperature.

An incorrect oil level causes the following faults:

Oil level too low:

- The engine runs without load on corners
- Valve flutter owing to air bubbles in the system
- Development of general operating faults. Restore oil level.

Should a further drop of the oil level be noticed, check for leaks.

Oil level too high:

- Danger of heavy fluid losses due to vehicle movement.

— Frothing of fluid

— Severe temperature increase at high speed.

Drain excess oil to correct level.

During the road test check the following:

1. Gearbox does change down (accelerator in full throttle or kick-down position).

Check whether down-changes take place in the kick-down position at the specified speeds (see data) where this does not occur, check downshift cable adjustment (see page 18).

2. Incorrect change speeds.

Check linkage adjustment (see Page 17).

3.* Slip during gear changes

4.* Gearbox fails to carry out one or more gear changes.

5.* Noise.

* Replace gearbox.



FAULT DIAGNOSIS

In order to facilitate the fault finding and the compilation of defect reports, the following chart should provide a guide in respect of the more probable faults and their causes.

It should be remembered that the rectification should be limited to adjustments only (see relevant Chapter).

DEFECT	CAUSE
1. Failure to engage forward and reverse gears	<ul style="list-style-type: none"> — Oil level too low — Incorrect selector linkage adjustment — Oil pressure too low — Torque converter not full — Oil pump not rotating
2. Operates only in 1st gear	<ul style="list-style-type: none"> — Governor bush seized — Valve block: 1st and 2nd gear shift valve seized or 1st and 2nd gear pistons seized
3. Operates only in 2nd gear	<ul style="list-style-type: none"> — Valve block: 1st-2nd and 2nd-3rd gear shift valves or pistons seized.
4. Operates only in 1st and 2nd gears	<ul style="list-style-type: none"> — Valve block: 2nd-3rd gear shift valve and pistons seized. — Clutch B: worn oil rings on suction side, insufficient oil pressure for clutch operation. — Obstructed oil pipes
5. Operates only in 3rd gear	<ul style="list-style-type: none"> — Valve block: 1st-2nd and 2nd-3rd gear shift valves and pistons seized. — Governor bush seized.
6. Operates in N position	<ul style="list-style-type: none"> — Incorrect selector linkage adjustment — Valve block: 2nd-3rd gear shift valve seized.
7. Failure to engage reverse	<ul style="list-style-type: none"> — Clutch B. Sealing ring has excessive axial clearance. Clutch does not operate due to insufficient pressure. — Incorrect selector linkage adjustment
8. Failure to engage 3rd gear	<ul style="list-style-type: none"> — Clutch B: The sealing ring has excessive axial clearance. Clutch does not operate due to insufficient pressure.
9. Slip during gear changes (gear changes drag)	<ul style="list-style-type: none"> — Disconnected downshift cable — Oil pressure too low



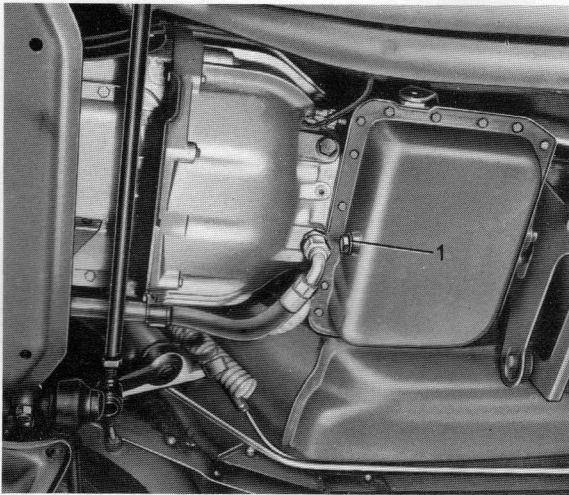
10. Slip when changing from 1st to 2nd	<ul style="list-style-type: none"> — Clutches C and C' slip — Oil pressure too low — Obstructed oil pipes — Free wheel does not operate
11. Slip when changing from 2nd to 3rd	<ul style="list-style-type: none"> — Clutch B slips (see item 8) — Obstructed oil pipe
12. Failure to change gear in kick-down position	<ul style="list-style-type: none"> — Incorrect throttle cable adjustment — Accelerator travel too short
13. Failure to obtain engine braking in 1st gear with selector lever in 1 or 2 position	<ul style="list-style-type: none"> — Clutch D slips — Valve to clutch D blocked
14. Violent change from 2nd to 1st	<ul style="list-style-type: none"> — Valve for clutch obstructed
15. Engine runs without drive in 1st gear with selector lever in D position	<ul style="list-style-type: none"> — 1st gear free wheel inoperative
16. Selector lever does not move to P position	<ul style="list-style-type: none"> — Locking mechanism for parking pawl inoperative — Incorrect selector linkage adjustment
17. Selector lever does not move to R position	<ul style="list-style-type: none"> — Incorrect selector linkage adjustment — Contact pin on starter block seized
18. Gear change speeds too high	<ul style="list-style-type: none"> — Incorrect downshift cable adjustment — Governor: Sealing rings not tight. Losses in pipes. Pressure of reducing valve too high. — Piston of reducing valve seized
19. Change speeds too low	<ul style="list-style-type: none"> — Incorrect downshift cable adjustment — Governor bush seized — Reducing pressure too low
20. Engine can be started with selector lever in positions R, D, 2 and 1 and the reversing light is "on" in the P, N, D, 2 and 1 positions	<ul style="list-style-type: none"> — Incorrect starter motor inhibitor and reverse light switch adjustment

NOTE: For reference to clutches, see illustration on page 9.

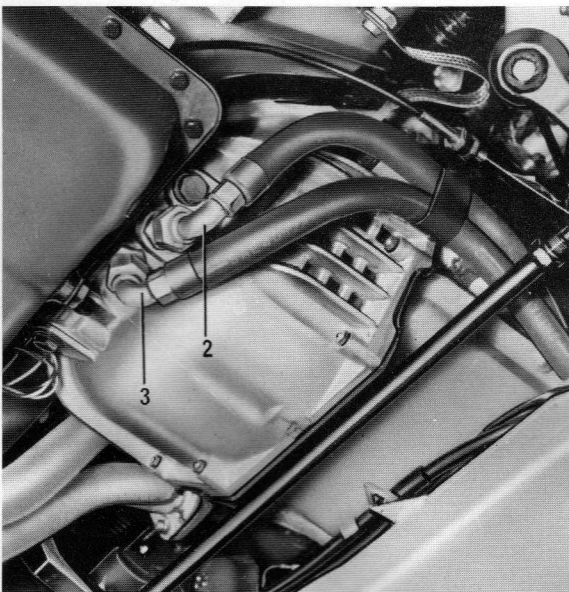


REMOVING GEARBOX AND REFITTING TO CAR

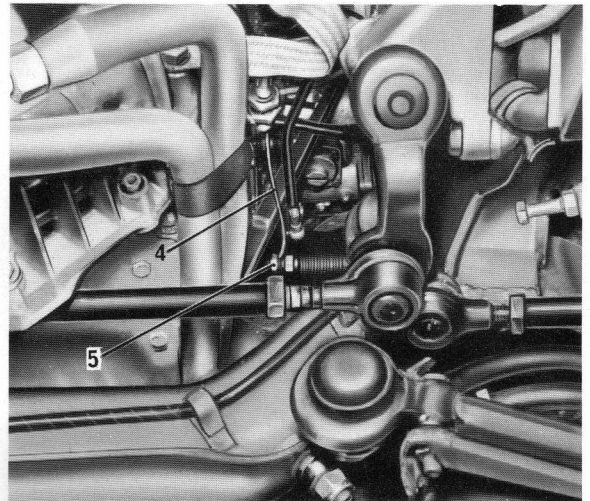
- Disconnect battery earth connection.
 - Drain gearbox fluid into a suitable container, by unscrewing plug **1** from the sump.
- Refit drain plug after all the fluid has drained away, and tighten to 3.5 kgm.



- Disconnect the delivery and return hose - Connections **2** and **3**.



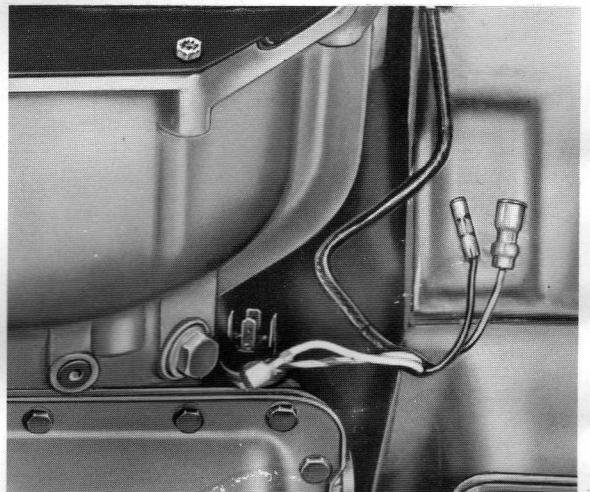
- Disconnect cable **4** from the accelerator linkage by unscrewing fixing nut **5**.



- Disconnect the four electric cables from the starter motor inhibitor and reverse light switch.

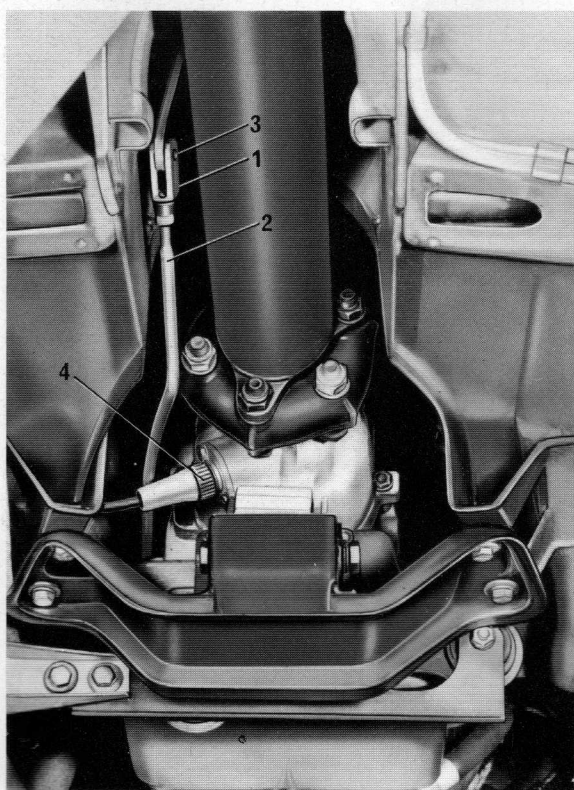
The switch has four terminal blades:

- The two terminal blades diametrically nearer to each other for the grey and grey/black cables (starter motor) are identified by the figure 50.
- The other two terminal blades for the white and yellow/black cables (reverse light) are identified by the figure 15.





- Disconnect the clevis 1 on the control rod 2, by removing the clevis pin 3.
- Disconnect the flexible cable 4 from the speedometer drive by unscrewing the retaining ring nut.



- Disconnect the rear half of the propeller shaft from the front half near the differential, by unscrewing fixing nuts 5 after having previously marked the parts to facilitate the correct assembly. Unscrew cover nut 6 to allow the propeller shaft to be withdrawn from the universal joint.

- Remove from car body the centre bearing crossmember by unscrewing the retaining nuts 7.

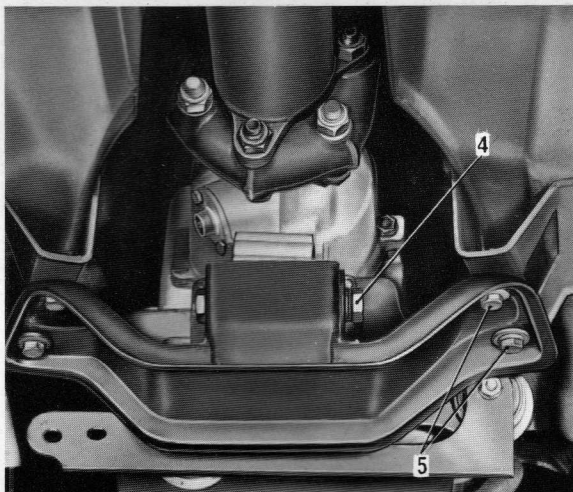




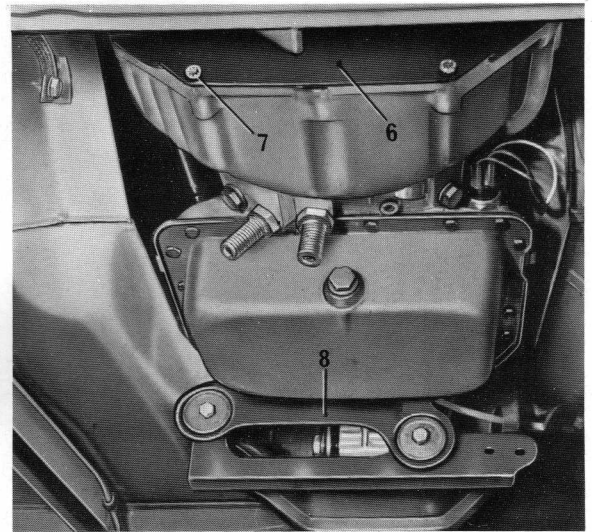
- Disconnect and remove the centre cross-member after removal of retaining bolts **1**.
- Disconnect the exhaust pipe from the support bracket secured to the gearbox, by removing screws **2** and from the exhaust manifold by unscrewing the fixing bolts **3**. Withdraw exhaust pipe.



- Slacken bolt **4** securing the gearbox flexible mounting to the crossmember. Unscrew and remove bolts **5** securing the gearbox cross member to the vehicle floor. Remove the previously slackened flexible mounting bolt and remove crossmember.



- Remove protection plate **6** secured to the converter housing by means of retaining bolts **7**.
- Remove from the gearbox the exhaust pipe support bracket **8** by unscrewing the three fixing nuts.

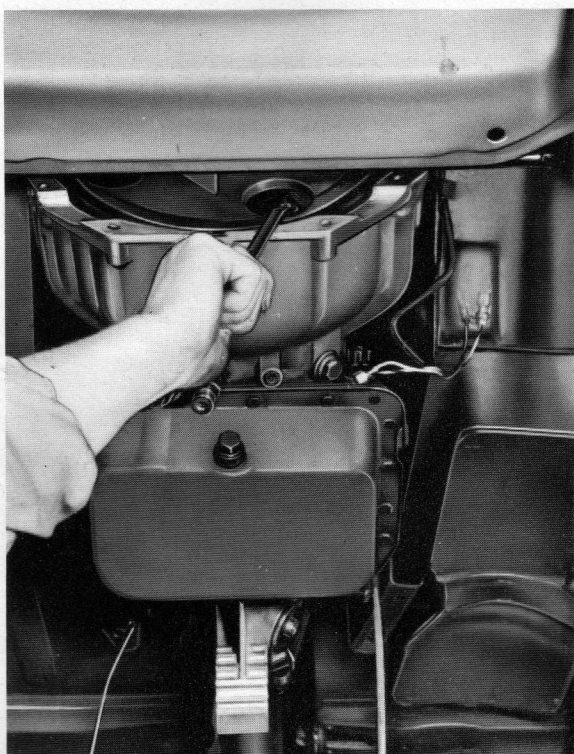


- Disconnect the gearbox tie rod **10** by removing the clevis pin **9** from the valve block control lever.



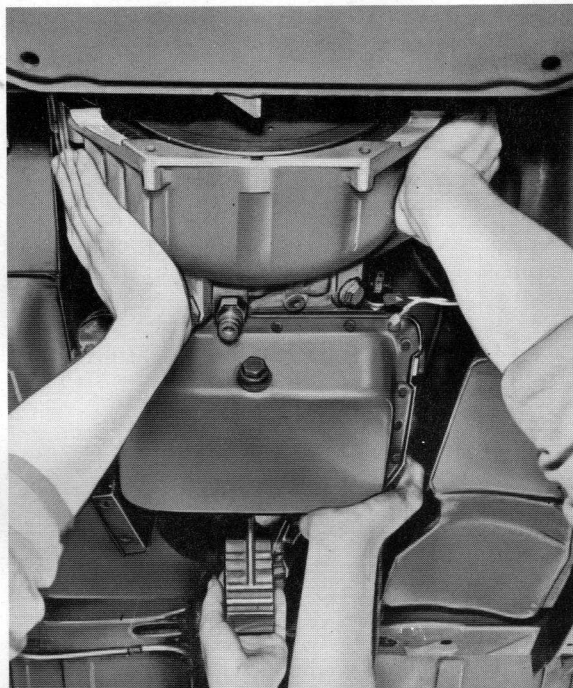


– Remove the four bolts securing the converter to the torsional damper plate which in turn is attached to the flywheel, by inserting the spanner in the holes provided in the flywheel after having rotated it so that the spanner can be inserted.



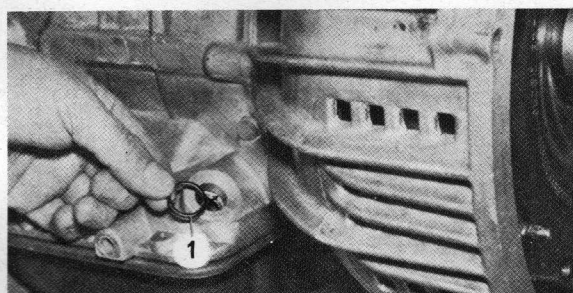
– Remove in turn the gearbox fixing nuts located on the periphery of the converter housing.

Having completed these operations, disconnect the gearbox from the engine, together with the front half of the propeller shaft, taking care to hold in place the torque converter on its seat, to prevent damage to the oil seal on the pump side or the converter from dropping.



Disconnection of unit is prevented by the dipstick and filler tube. Removal of this may be carried out in two ways:

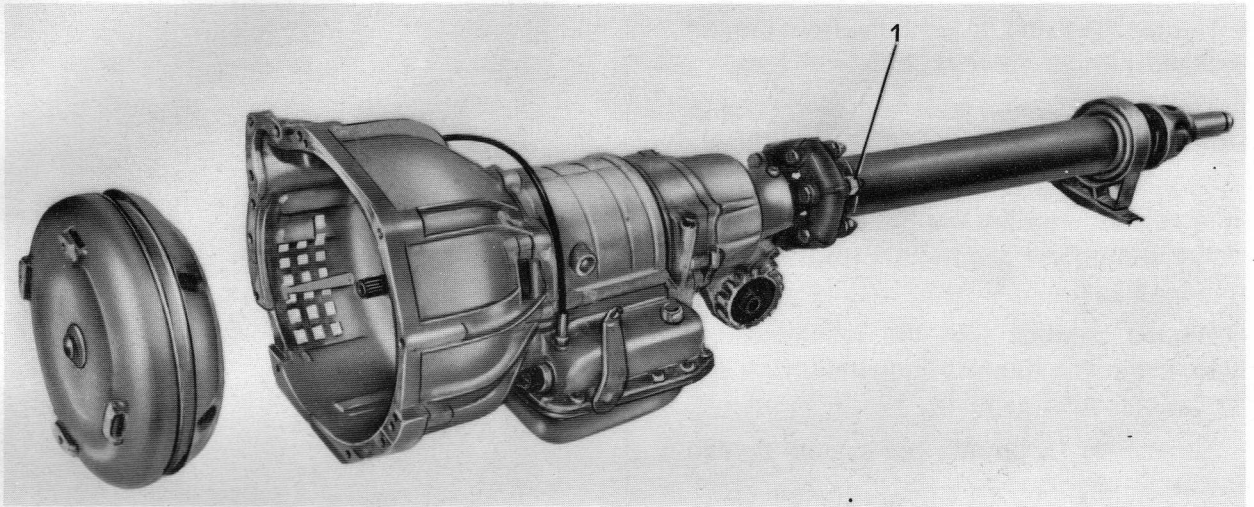
- a. Suitably move the unit in order to prevent any interference with components underneath the car body.
- b. Withdraw the oil filler tube from the gearbox. An "O" - ring 1 is provided at the end of the tube, this should be replaced on assembly to prevent any loss of fluid.





– Lower the gearbox and disconnect the front half of the propeller shaft from the joint, by unscrewing bolts 1.

The converter fitted to the 2000 model **has a white paint identification mark** (see arrow). When replacing the converter care should be taken not to fit one that is intended for

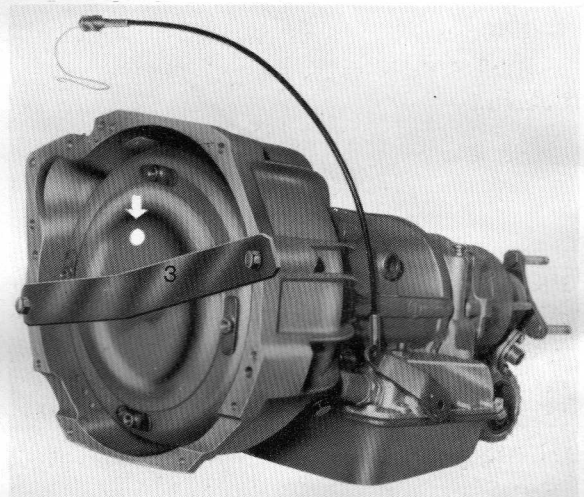
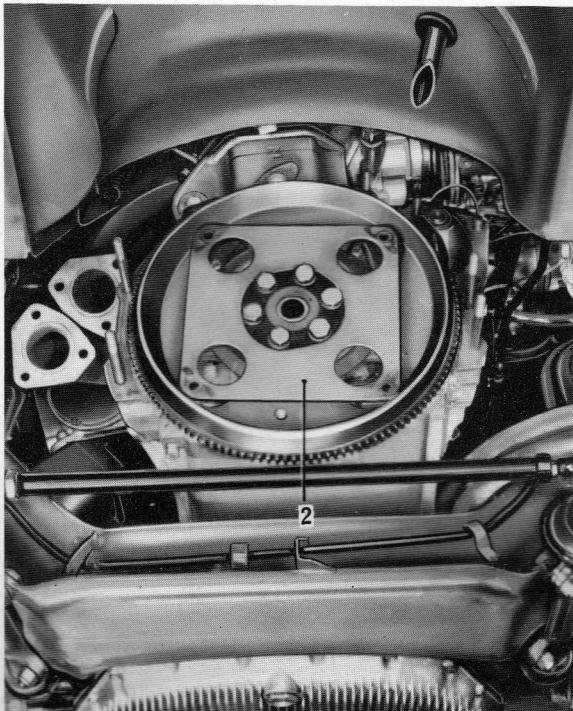


– Check whether the torsion plate 2 shows any signs of cracking and replace as required.

1750 models, which is identified by a green paint mark.

The difference between the two types of converters lies in the pitch angle of the blades.

WARNING: For despatch, the converter should be secured to the housing by means of the special bar 3 provided with each unit.





REFITTING THE GEARBOX

Refit the gearbox in reverse order, noting the following points:

- Clean carefully with petrol or paraffin all areas affected by each operation.
- Tighten the fixing bolts for the front propeller shaft flexible coupling to 5,5-5,7 kgm.
- Tighten the torsion plate retaining bolts to 2.8-3.0 kgm.
- Reconnect the rear propeller shaft to the front section, aligning the previously applied marks and tighten the bolts **5** (see page 24) to 3.2-3.5 kgm.
- Fill the gearbox with the recommended fluid, using the quantity indicated. Proceed as indicated on page 14.
- Reconnect downshift cable and tighten fixings **5** (see page 23).

Carry out adjustments outlined on page 17.

Alfa Romeo

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