

Removing and Installing Rear Axle and Transmission

Special Tools:

- P 30 Puller for brake drum
- P 35a Gauge for adjusting clutch release bearing
- P 36 Brake drum holder and wrench guide for P 42, P 44, P 44a and P 36a
- P 36a Special tool for brake drums with knock-off wheels
- P 42 Torque wrench 360 ft. lb. (50 mkg)
- P 44 36 mm socket
- P 44a Extension for P 44
- P 53 Radius arm compressor

Removal

1. Jack up automobile.
2. Disconnect battery lead, close fuel tap.
3. Loosen rear wheel nuts, remove rear wheels.
4. Remove Engine (1 EN).
5. Remove floor tunnel cover in rear of driver compartment.

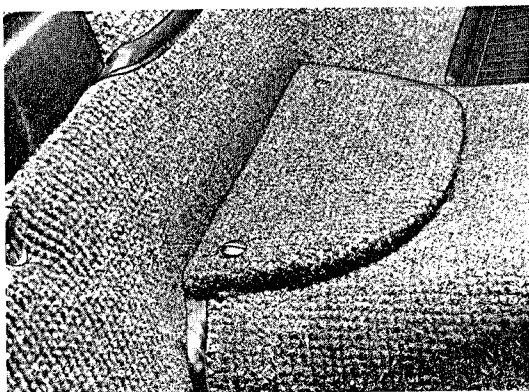


Fig. 18

6. Push rubber bellows in tunnel forward. Loosen locking bolt on shift rod and remove shift rod from flexible connector (RA 21).

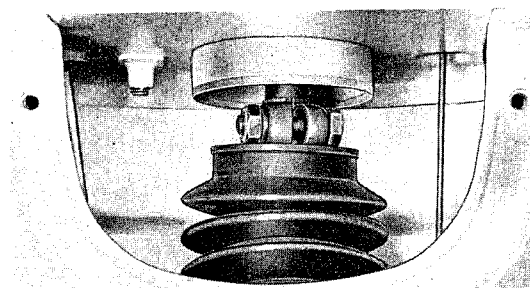


Fig. 19

7. Remove cotter key from rear axle nut and remove rear axle nut using P 36, P 36a, P 42 and P 44a.

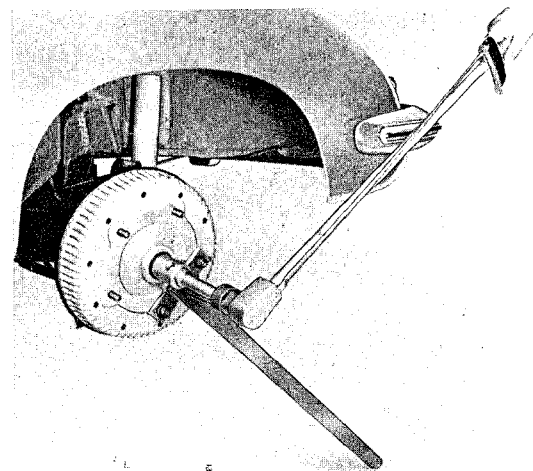


Fig. 20

8. Remove brake drums using puller P 30.
9. Remove brake shoes, springs, and push rod (8 TI).
10. Remove brake line on brake cylinder and cover with bleeder cap.

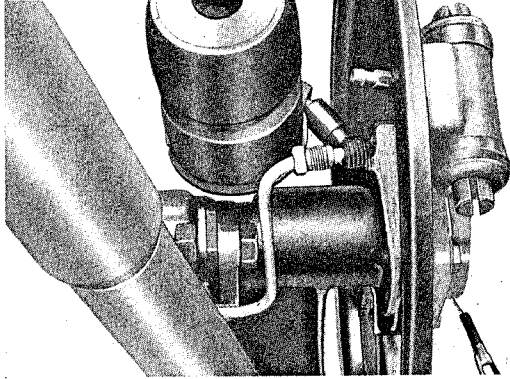


Fig. 21

11. Remove brake hose clamp on axle tube.
12. Loosen bracket for hand brake cable and remove hand brake cable.

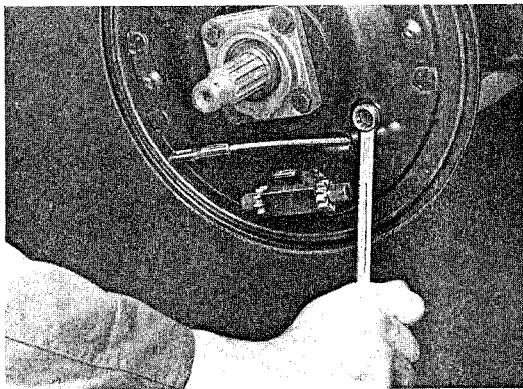


Fig. 22

13. Remove bolts from rear wheel bearing cap. Caution! Transmission oil will run out.

Remove brake backing plate and replace bearing cap and spacer temporarily.

14. Lift radius arms with tool P 53 and remove shock absorbers.

15. Remove mounting bolts from axle tube suspension flange. The front bolt is an adjustable stop and should not be disturbed. Remove angle bracket and rubber buffer.

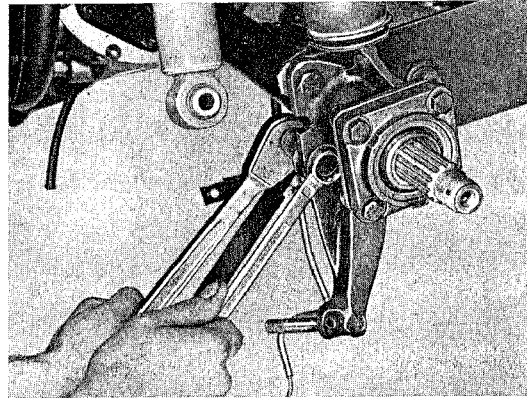


Fig. 23

16. Remove nuts from front transmission mount.

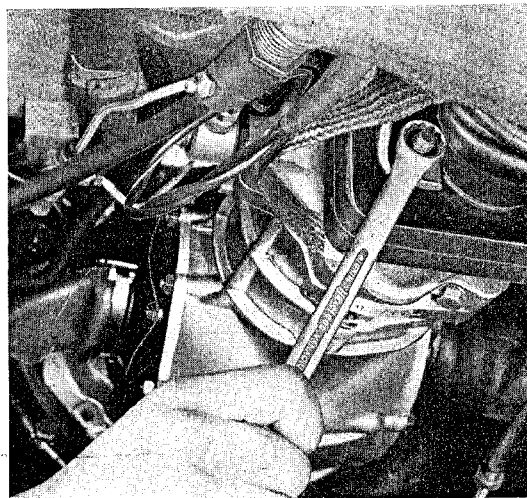


Fig. 24

17. Remove ground strap.

18. Disconnect throttle linkage.

19. Remove torque rod.

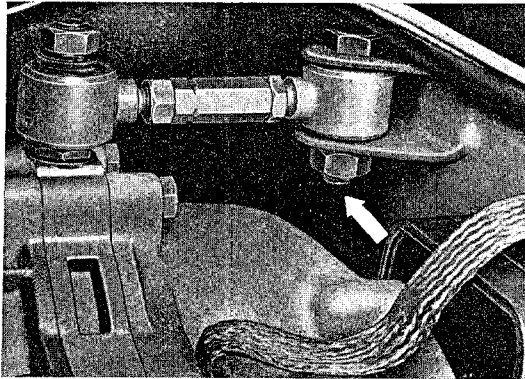


Fig. 25

20. Disconnect starter cable. Remove plug for back-up light switch.

21. Remove clevis from clutch release lever by removing clevis pin.

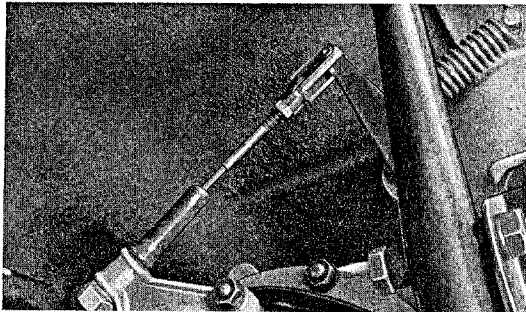


Fig. 26

22. Remove both cover plates from transmission mount bolts. Remove mounting bolts, then remove rear axle and transmission.

If the cable bracket is not slotted, the clevis end of the clutch cable must be unscrewed so that the cable can be pulled through the cable bracket.

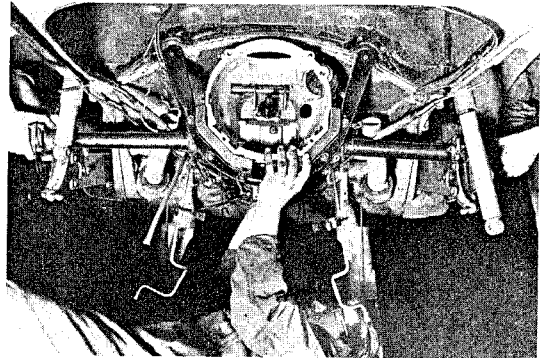


Fig. 27

23. Remove starter.

24. Remove shift rod connector and bellows from selector shaft.

Removed Rear Axle with Transmission

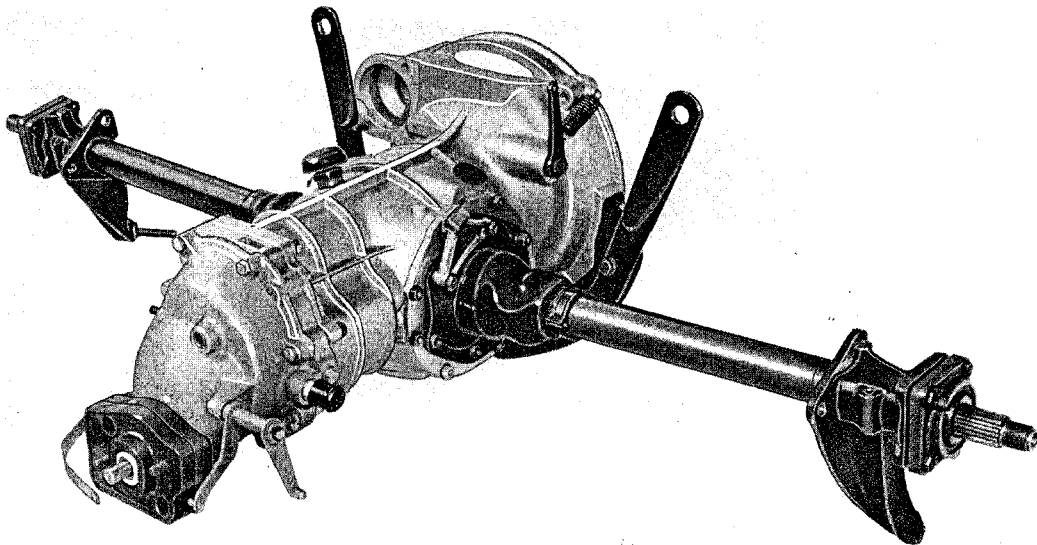


Fig. 28

Installation

The installation is accomplished in the reverse order of removal observing the following points:

1. To prevent damaging the axle boots during installation of the rear axle assembly, the axle tubes should not be turned, in their sockets.

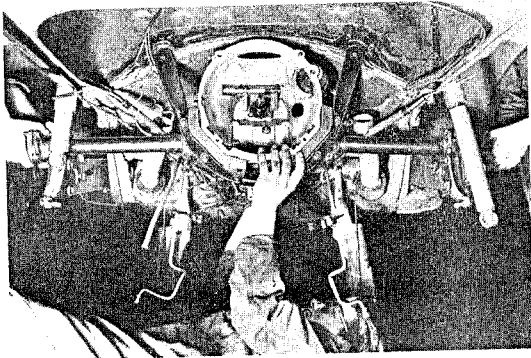


Fig. 29

2. Connect starter and generator cable to starter solenoid. To avoid loosening terminal studs from the insulators, do not tighten terminal nuts more than necessary.
3. The torque rod should be adjusted so that there is no force between the transmission and mount. Adjust if necessary.

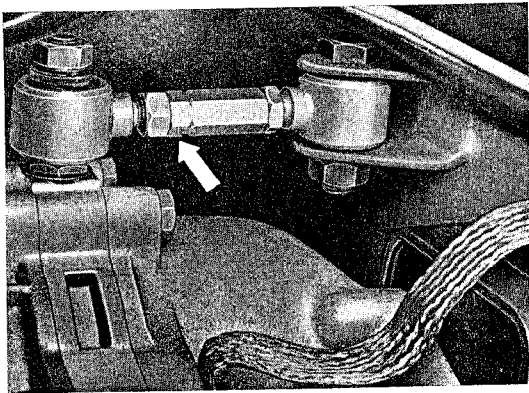


Fig. 30

4. Adjust gear shift linkage as follows: Place shift lever in second gear position. Engage second gear in the gearbox and connect shifting rod to selector shaft without preload. Tighten clamp nuts and test shifting (21 RA).

5. The clutch cable housing should be bowed between the chassis and cable bracket on the transmission (preload approx. 15 to 20 mm, $\frac{5}{8}$ to $\frac{3}{4}$ in.).

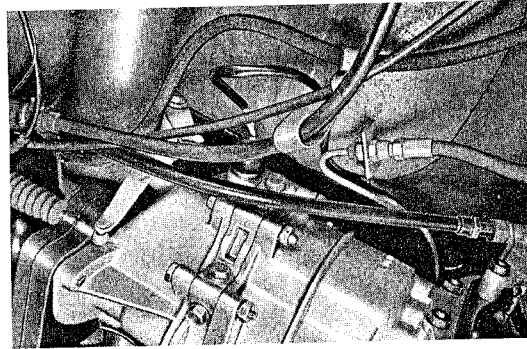


Fig. 31

6. After installing engine adjust clutch play (64 EN).

7. Adjust service and hand brake. Bleed brakes (13 and 16 TI).

8. Tighten rear axle nuts to 55 mkg (400 ft. lb.) torque and insert cotter key.

9. Tighten rear wheel nuts to 13 mkg (95 ft. lb.).

10. Fill transmission with 3.5 l (7.5 pts.) gear oil.

11. After road test, adjust rear axle on optical measuring device (3 WA).

Remarks:

Exchange transmission-rear axle assemblies are supplied without brake backing plates and brake drums.

To prevent damage to the main shaft, a removed transmission should not be placed on its flange.

After the road test make sure that there is no tension on the torque rod. If necessary adjust. This should be done with the rear wheels on the ground.

Disassembling and Assembling Transmission

Special Tools:

- | | | | |
|-------|---|----------|--|
| P 31a | Guide ring used with tool P 31 to tighten castle nut of pinion shaft. | P 64 | Mandrel for installing outer bushing of clutch pivot shaft. |
| P 36 | Holder for brake drum and guide for axle nut wrench. | P 65 | Plate for removing inner roller bearing race from main shaft. |
| P 37 | Holder for main shaft for tightening castle nuts of main and pinion shafts. | P 66 | Puller for selector rod lock bushings. |
| P 42 | Torque wrench 50 mkg (360 ft. lb.) for rear axle nuts (used with P 44). | P 67 | Press guide for removing roller bearing from pinion shaft. |
| P 44 | Socket 36 mm with extension (used with P 42). | P 68 | Selector rod guide for adjusting shift forks. |
| P 46 | Socket 32 mm for castle nut of pinion shaft. | VW 118 | Torque wrench (6 mkg, 44 ft. lb.) general application. |
| P 55 | Stand, to press main and pinion shafts into intermediate plate. | VW 222 | Drift for starter shaft bushing. |
| P 56 | Stand, to press main and pinion shaft out of intermediate plate. | VW 228 | Puller for removing starter bushing with engine installed. |
| P 57 | Short guide pin for installing selector rod lock bushing (1st, 2nd and reverse gear). | VW 246 | Limit gauge for starter shaft bushing. |
| P 58 | Long guide pin for installing selector rod lock bushing (3rd and 4th gear). | VW 291 b | Press stand for installing oil seal. |
| P 59 | Puller to remove roller bearing races from transmission housing. | VW 308 | Assembly stand for transmission. |
| P 60 | Mandrel for installing roller bearing race in transmission housing (pinion shaft). | VW 400 | Hydraulic press. |
| P 61 | Mandrel for installing roller bearing race in transmission housing (main shaft). | VW 401 | Frame for various press operations. |
| P 62 | Drift for clutch pivot shaft bushing. | VW 407 | Arbor, general application. |
| P 63 | Puller for inner bushing of clutch pivot shaft. | VW 408 | Arbor, general application. |
| | | VW 409 | Arbor, general application. |
| | | VW 415 | Tube, 57 mm dia. for general application and differential ball bearings in transmission side covers. |
| | | VW 433 | Press accessory, general application. |
| | | VW 438 | Guide (cylindrical) general application. |

General

Due to high precision machining of transmissions all cast parts are interchangeable. If it becomes necessary to replace the transmission housing; the ring and pinion clearance must be computed as well as the preload on the ball bearings (11 RA). Should the intermediate plate or the double ball bearing of the pinion be exchanged; computations and new adjustments are necessary (10 RA).

Disassembly

1. Mount transmission with rear axle on special tool VW 308.
2. Remove transmission drain plug and drain oil.
3. Remove starter.
4. Remove clutch release bearing and clutch pivot shaft if necessary (20 RA).

5. Remove transmission mount.

6. Remove axle tubes (17 RA).

7. Remove transmission housing end cover with selector rod.

8. Remove reverse idler II from reverse gear shift fork.

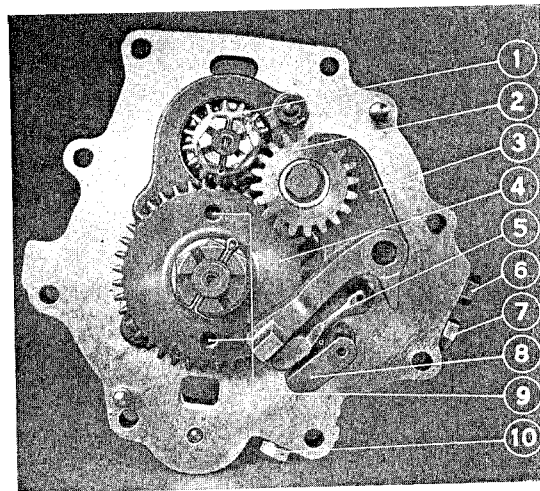


Fig. 33

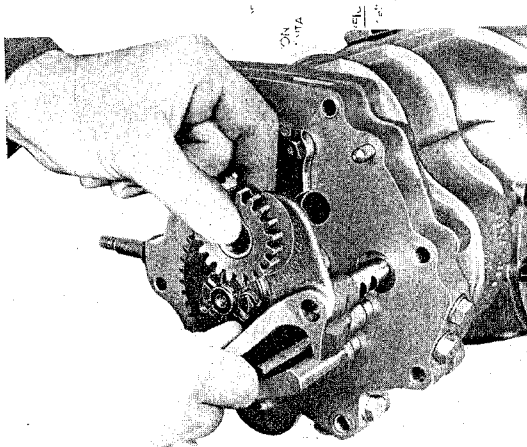


Fig. 32

9. Install main shaft holder P 37 (Fig. 47).

10. Engage 4th gear. Remove cotter key from pinion shaft castle nut. Loosen nut on pinion shaft using P 42 and P 46, and remove reverse gear III and key from main shaft.
Should the gear be excessively tight on the pinion shaft, insert bolts in the two holes in the gear and pull off evenly.

11. After removing cotter key and nut from main shaft, remove reverse gear I and key.

① Reverse gear I (on main shaft).

② Reverse gear II (held by selector fork).

③ Selector rod for reverse gear.

④ Reverse gear III (mounted on pinion shaft).

⑤ Selector rod, 1st and 2nd gear.

⑥ Plug for selector rod lock, reverse gear.

⑦ Plug for selector rod lock, 1st and 2nd gear.

⑧ Selector rod 3rd and 4th gear.

⑨ Tapped holes to extract gear.

⑩ Plug for selector rod lock, 3rd and 4th gear.

12. Remove intermediate plate with main and pinion shafts from transmission housing. For reassembly note thickness of gaskets used. The two dowel pins should remain in the intermediate plate.

13. Hold intermediate plate in vise using soft jaws.

14. Remove three plugs from selector rod locks (Fig. 45, ⑥, ⑦, and ⑩).

Note

One ball and spring fits into each of the shift lock bores of the first and second gears and the reverse gear. A ball and spring followed by a spacer tube fits into the shift lock bore of the 3rd and 4th gears (Fig. 45).

15. Remove bolts holding shift forks and pull shift rods out of intermediate plate.

Note

As seen in Fig. 45 interlock pins are located in the connecting passage between the shift rods for reverse and 1st and 2nd gear and between the shift rods for 1st and 2nd gear and 3rd and 4th gear.

Upon disassembly all locks should be removed from the bores so that the correct installation procedure may be followed at assembly.

16. Using tools P 56 and VW 407 remove pinion and main shaft simultaneously from intermediate plate. The dowel pins must be pushed to one side so that the plate will lie flat on the press.

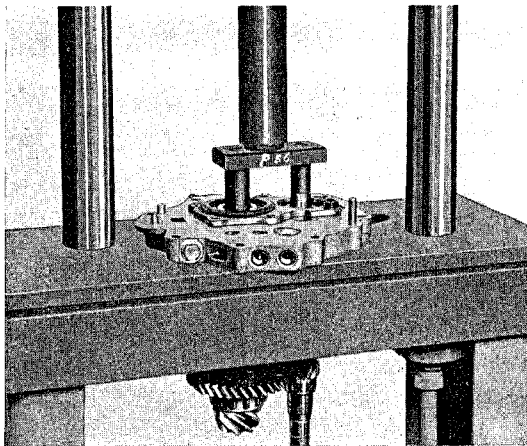


Fig. 34

17. Disassemble intermediate plate (9 RA).

Note

Should it become necessary to install a new intermediate plate, the adjustment of the ring and pinion as well as the preload on the double row ball bearing must be redetermined (12 and 13 RA).

18. Remove rear axle drive assembly (8 RA).

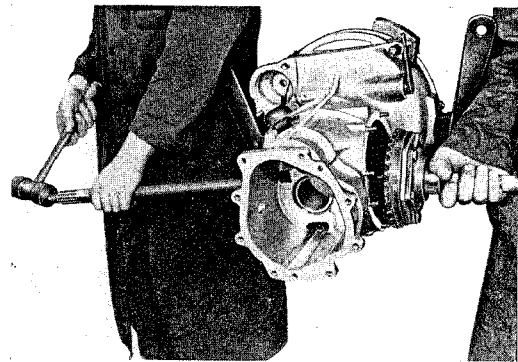


Fig. 35

19. Remove both lock rings from the bearing race of the main shaft and the lock ring inside the gear box from the bearing race of the pinion shaft (Fig. 38 and 39).

20. Remove main shaft bearing from transmission housing using tool P 59 (complete with rollers and cage).

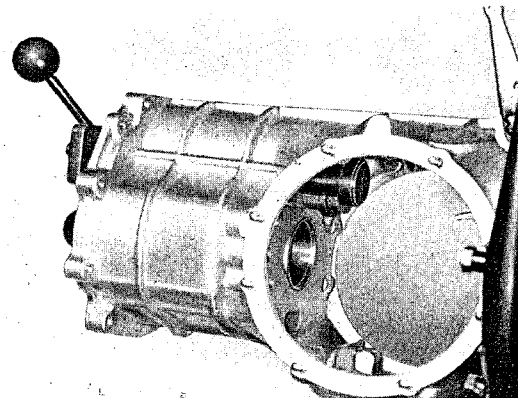


Fig. 36

21. Remove bearing race from pinion shaft using tool P 59.

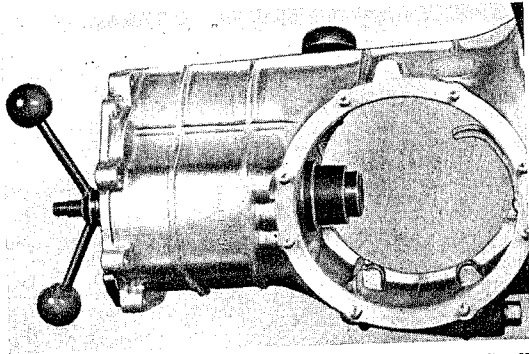


Fig. 37

Note

For easier removal of the races, the housing may be heated to 212° to 240° F (100 to 120° C).

22. Remove oil deflector plate from differential housing.

23. If necessary remove main shaft oil seal (19 RA).

4. Check roller bearings of main and pinion shafts for wear or damage. Replace if necessary.
5. Check main shaft for runout (7 RA).
6. Install outer lock ring of pinion shaft bearing.

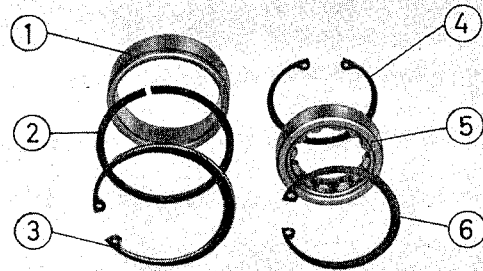


Fig. 38

- ① Roller bearing outer race for pinion shaft
- ② Lock ring (installed on bearing race)
- ③ Lock ring
- ④ Lock ring
- ⑤ Roller bearing outer race with cage and rollers for main shaft
- ⑥ Lock ring

7. Install rear lock ring for main shaft bearing using special pliers.

Assembly

The assembly is accomplished in the reverse order of disassembly observing the following points:

1. Clean transmission housing and inspect for wear, external damage, or cracks. In case of severe damage (e. g. ring or pinion fracture) check whether the bearing seats have also been damaged. If necessary replace transmission housing.
2. Inspect wear of starter bushing using tool VW 246. Install new bushing using tool VW 222 if required.
3. Inspect clutch pivot shaft bushings for wear. Replace if necessary (20 RA).

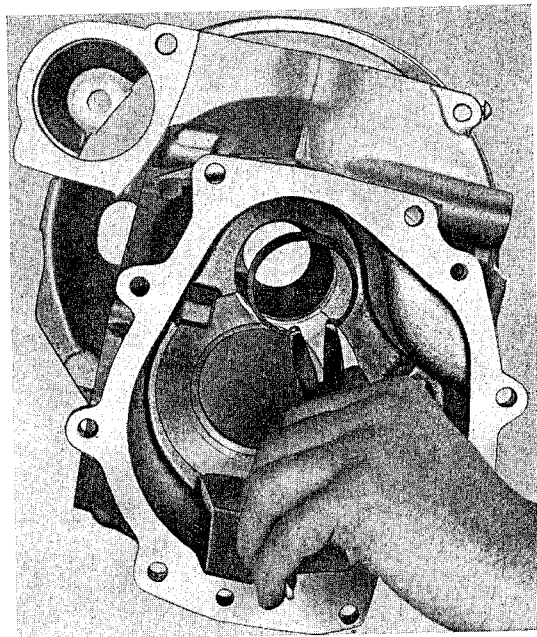


Fig. 39

8. Heat transmission housing to 212 to 230° F (100 to 110° C) and install bearing races using tool P 60 and P 61.
For main shaft: Outer race with cage and rollers.

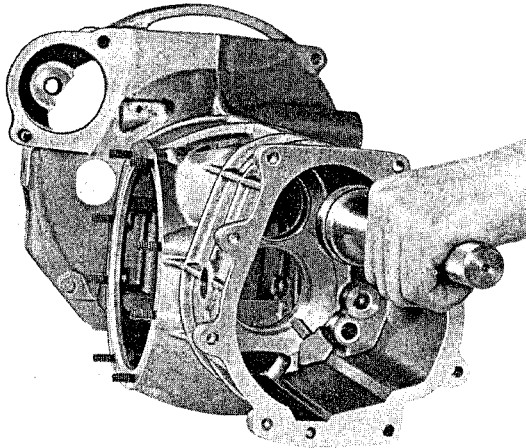


Fig. 40

For pinion shaft: Outer race with mounted lock ring.

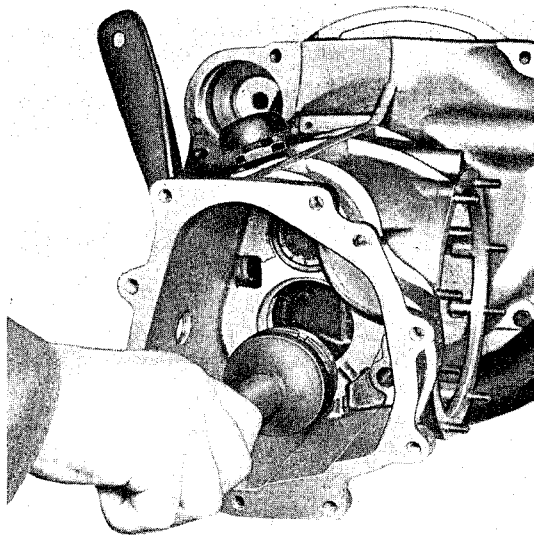


Fig. 41

9. Install lock rings on both bearings (Fig. 38 and 39).

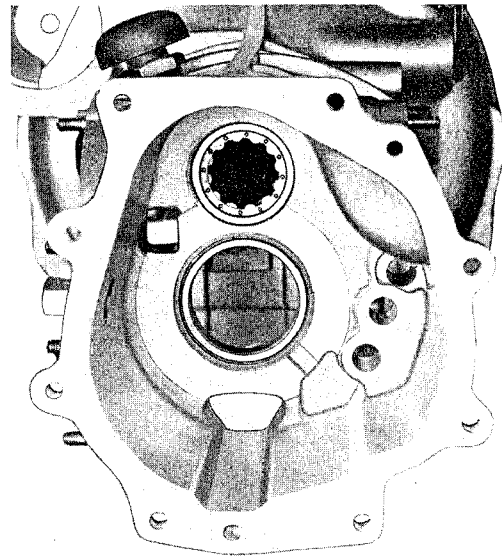


Fig. 42

10. Install oil deflector plate and secure with copper lock washer.

11. Install main shaft seal.

12. Insert main and pinion shafts in special tool P 55 and adjust height with adjusting screw until the faces of the fourth gears of both shafts are flush.

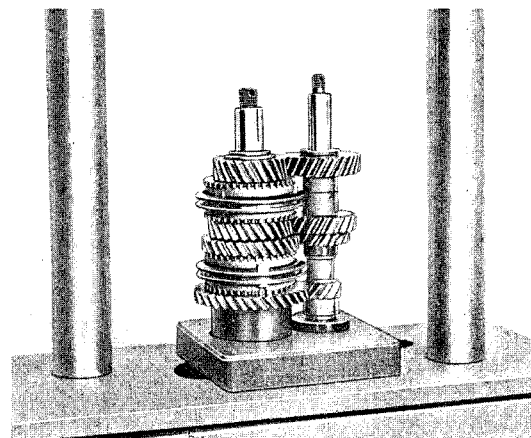


Fig. 43

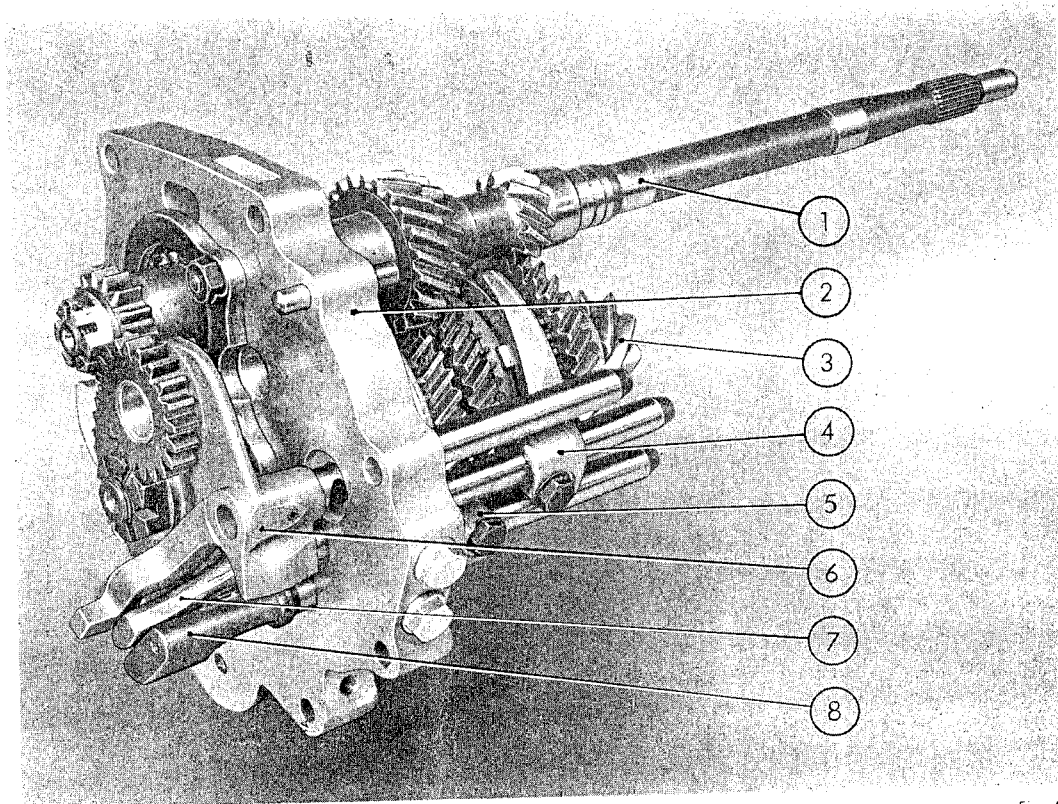


Fig. 44

- ① Main shaft
- ② Intermediate plate
- ③ Pinion gear
- ④ Selector fork 1st and 2nd gear

- ⑤ Selector fork 3rd and 4th gear
- ⑥ Shift rod with fork for reverse gear
- ⑦ Shift rod for 1st and 2nd gear
- ⑧ Shift rod for 3rd and 4th gear

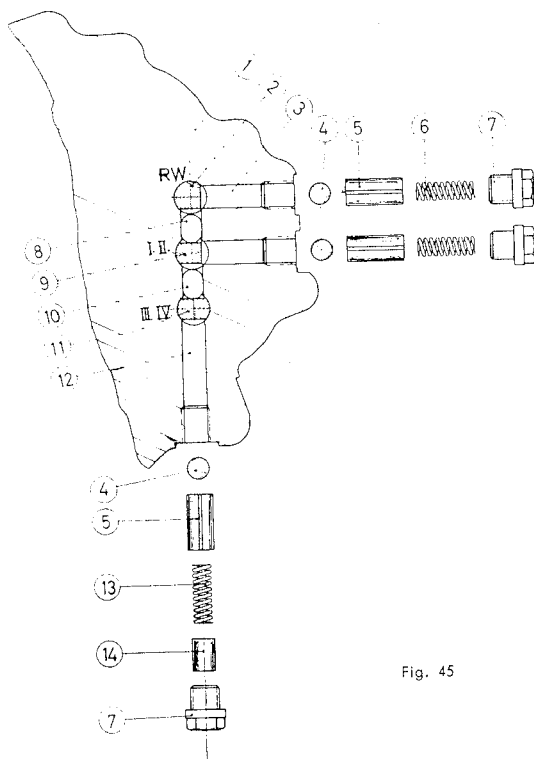


Fig. 45

Arrangement of Selector Interlocks

- ① Intermediate plate
- ② Shift rod for reverse gear
- ③ Bore for reverse gear interlock (seat for part 5)
- ④ Locking ball
- ⑤ Guide bushing
- ⑥ Reverse gear lock spring (free length 25.7 mm, 1.012 in.)
- ⑦ Retaining plug
- ⑧ Interlock pin
- ⑨ Shift rod for 1st and 2nd gear
- ⑩ Interlock pin
- ⑪ Shift rod for 3rd and 4th gear
- ⑫ Bore for 3rd and 4th gear interlock
- ⑬ Lock spring for 3rd and 4th gear (free length 23.2 mm, .913 in.)
- ⑭ Spacer plug

13. Using tool P 55 press main and pinion shafts into intermediate plate simultaneously. There should be at least 0.2 mm (.079 in.) clearance between the upper faces of the 4th gears of both shafts and the surface of the intermediate plate.

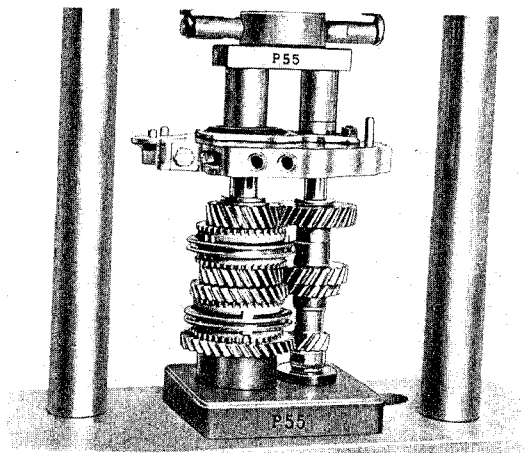


Fig. 46

17. Inspect springs of gear shift locks. Replace damaged springs. The correct free length for reverse gear is 25.7 mm (1.012 in.), minimum 25.2 mm (.992 in.). Free length for forward gear springs is 23.2 mm (.915 in.), minimum 22.7 mm (.895 in.).

18. Install a locking ball and spring in each of the three gear lock bores using the correct spring for reverse gear (Fig. 45).

19. Install spacer plug in the 3rd and 4th gear lock bore.

20. Install three retaining plugs.

21. Install intermediate plate with main and pinion shafts in gear box. The dowel pins must fit tight in the intermediate plate.

22. Install tool P 37 to hold main shaft.

23. Secure intermediate plate to transmission housing.

24. Engage 1st gear using a screwdriver.

25. Install gear I of reverse gear on main shaft and tighten castle nut to 2.5 mkg (18 ft. lb.) torque.

14. Hold intermediate plate with main and pinion shafts in a vise using soft jaws.

15. Install shift rods and selector forks in the following order:

- a) Reverse gear selector rod.
- b) Insert first interlock pin.
- c) 1st and 2nd gear selector rod and fork.
- d) Insert second interlock pin.
- e) 3rd and 4th gear selector rod and fork.

16. If the bushings for the selector rod locks have been removed (using tool P 66) or if a new intermediate plate is used, the bushings must be installed in the three bores using tools P 57 and P 58.

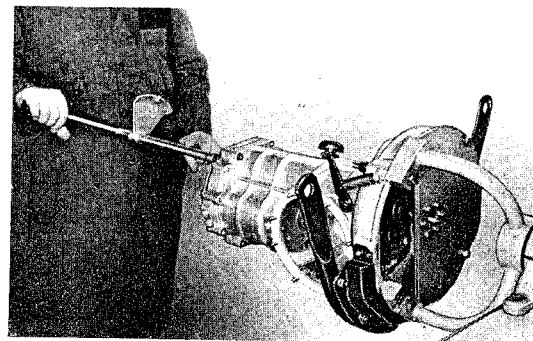


Fig. 47

26. Install reverse gear III on pinion shaft and tighten castle nut using torque wrench P 42 and socket P 46 to 20 mkg (145 ft. lb.) torque.
27. Loosen castle nut and re-tighten to 10 mkg (70 ft. lb.) torque.
28. With selector forks free on shafts check locking of selector rods. As soon as a gear is engaged, the other rods must be locked in position, i. e. after selecting 1st or 2nd gear the other selector rods must be locked in position.
29. In cases where the intermediate plate, the transmission housing or pinion have been exchanged, the ring and pinion adjustment must be performed (10 and 11 RA).
30. Remove intermediate plate with main and pinion shafts from transmission housing and secure in vise using soft jaws.
31. Install gear II of reverse gear in selector fork.
32. Insert shaft for reverse idler through reverse idler into intermediate plate. This will provide a proper guide for the reverse gear selector rod and assure the proper position for adjusting selector forks for forward speeds (Fig. 48).
33. Install selector rod guide P 68.
34. The selector forks should be so adjusted that the sliding sleeve in a neutral position is exactly centered between the synchronizing rings. This adjustment must be exact to insure proper gear synchronization.
35. After completion of fork adjustment, tighten clamping bolts to 2.5 mkg (18 ft. lb.) torque. Insure that the selector rod heads are in the proper position, i. e. parallel to each other.

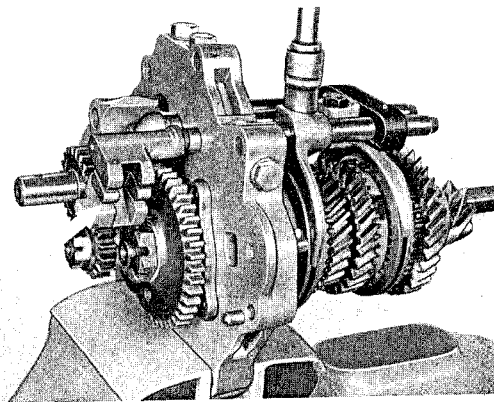


Fig. 49

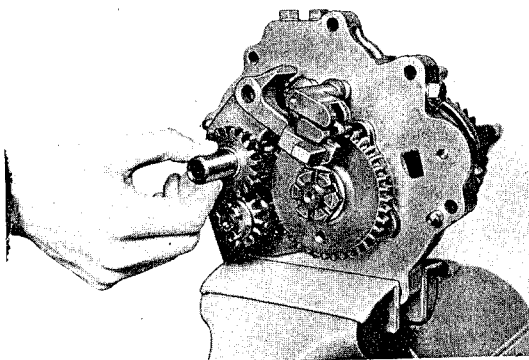


Fig. 48

36. After the proper shims for ring and pinion clearance have been determined, install intermediate plate in transmission housing.
37. Secure pinion and drive shaft castle nuts with cotter keys.

RECONDITIONING PINION SHAFT

3 RA

Disassembling Pinion Shaft

Special Tools:

- | | | | |
|-------|--|--------|---|
| P 31 | Holder for pinion shaft while tightening castle nut | P 67 | Press guide for removing roller bearing from pinion shaft |
| P 31a | Guide ring used with tool P 31 to tighten castle nut of pinion shaft | VW 400 | Hydraulic press |
| P 39 | Pinion shaft collar | VW 401 | Plate for various press operations |
| P 41 | Assembly ring for roller bearings on pinion shaft | VW 409 | Arbor, general application |
| P 42 | Torque wrench | VW 410 | Arbor, general application |
| P 46 | Socket used with P 42 to tighten castle nut on pinion shaft | VW 412 | Arbor, general application |
| | | VW 421 | Tube, 28 mm dia. 100 mm long, general application |

Disassembly

1. Disassemble transmission (2 RA).
2. Press pinion shaft out of complete gear train using tools VW 400, VW 401 and VW 410.
3. Remove spacer 4 mm and washer 2 mm from 4th gear with needle bearing and bushing.
4. Remove sliding sleeve and spider.
5. Remove third gear with needle bearing and bearing sleeve.
6. Remove washer between 2nd and 3rd gear.
7. Remove 2nd gear, rollers, cage and bearing sleeve.
8. Remove sliding sleeve and spider.
9. Remove 1st gear, rollers, and cage.
10. Press bearing sleeve, thrust washer, and roller bearing from pinion shaft using tools P 67, VW 400, VW 401, and VW 402.
11. Note the number and thickness of spacers between roller bearing and thrust washer.

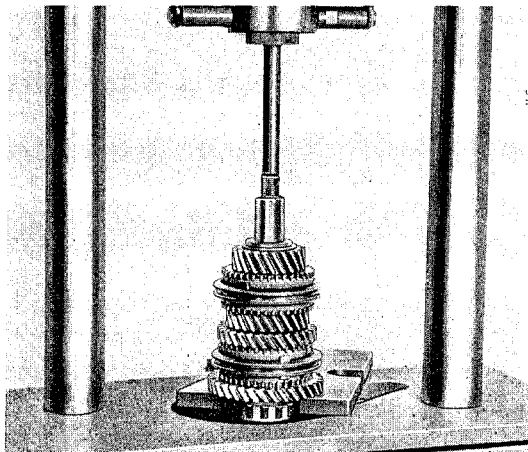


Fig. 50

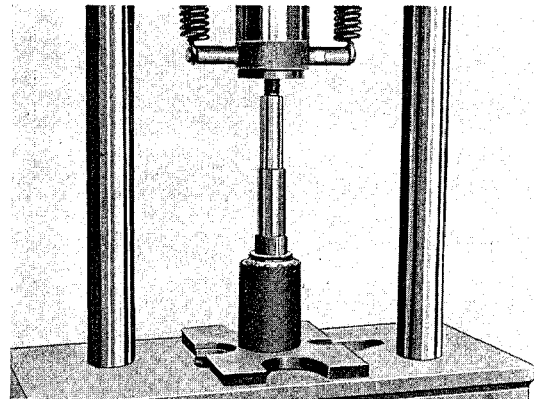


Fig. 51

Inspection

1. Inspect pinion (especially teeth) for wear and damage. Make sure that both parts have the same set number.
2. Inspect roller bearing and double-row ball bearing. Replace if necessary.
3. Inspect gears for wear and damage. If necessary replace (2nd, 3rd and 4th gear in pairs only).
4. Inspect all synchronizing parts for wear.

Determining Shims

4 RA

Provisional determination of shims between roller bearing and thrust washer for 1st gear on pinion shaft.

For differential ring and pinion ratio 7:31, the **setting dimension** is etched either into the face of the pinion or the outside of the ring gear. This dimension gives the correct distance R between the centerline of the differential drive and the face of the pinion when assembled (Fig. 52).

Example (gear ratio 7:31)

Basic dimension	59.80 mm
Setting dimension	59.25 mm
Difference	0.55 mm
Shims required:	1 shim 0.30 mm
	1 shim 0.10 mm
	1 shim 0.15 mm

Use the next larger size for shim values above 0.05 mm.
Use the next lower size for shim values below 0.05 mm.

The basic size for the dimension R, before fitting shims, is given as 59.80 mm (2.354 in.) for the gear ratio 7:31.

The difference between this basic size and the setting dimension marked on the gears has to be made up with shims. The shims are available in thicknesses of 0.10 mm, 0.15 mm, 0.30 mm. These shims are placed between the roller bearing inner race and the thrust washer for the 1st gear.

The shim combination is best chosen in such a manner that it is possible, in case additional adjustment is required, to add or subtract the smallest possible value of 0.05 mm by a change of one shim.

Note

For the foregoing determination of the required shims, it is advisable to assume the basic dimension too high rather than too low, i. e. to fit too thick a shim pack rather than too thin, since an error on the plus side can be corrected by installing gaskets at the intermediate plate. Removal from the intermediate plate and dismantling of the pinion subassembly can thus be avoided.

R = Distance between centerline of differential and face of pinion

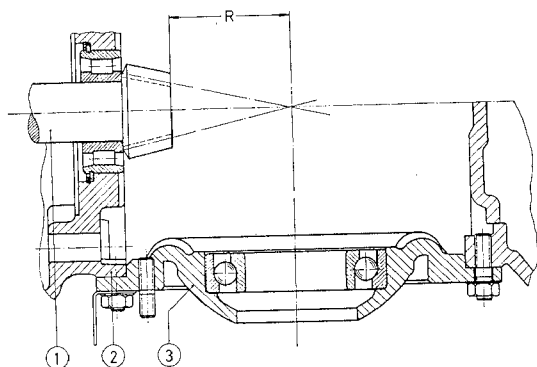


Fig. 52

- ① Pinion and shaft
- ② Transmission housing
- ③ Differential cover plate, left side

Assembling Synchronizing Mechanism

Disassembly

1. Remove lock ring using lock ring pliers.
2. Clean all parts thoroughly.
3. Check all parts for wear and damage. If synchronization no longer functions properly, install new synchronizing ring.
4. Remove sharp edges from the long ends of the stops with an oil stone. Replace brake bands in which a ridge (approx. 18 mm, 11/16 in. from one end) has formed where the end of the stop contacts the inside of the brake band.

3. When assembling the synchronizing mechanism of the 1st gear, note that only one brake band is installed as shown in Fig. 54.

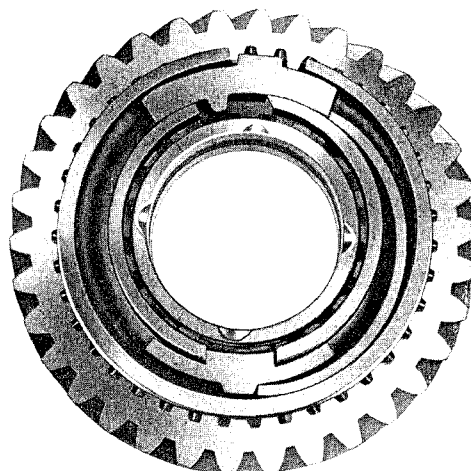


Fig. 54

Assembly

1. Place synchronizing ring on toothed ring with the grooved side out.
2. Install slider, stop, and brake bands.

4. Install lock ring using lock ring pliers.

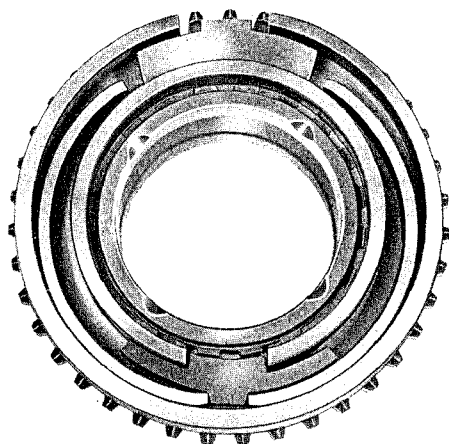


Fig. 53

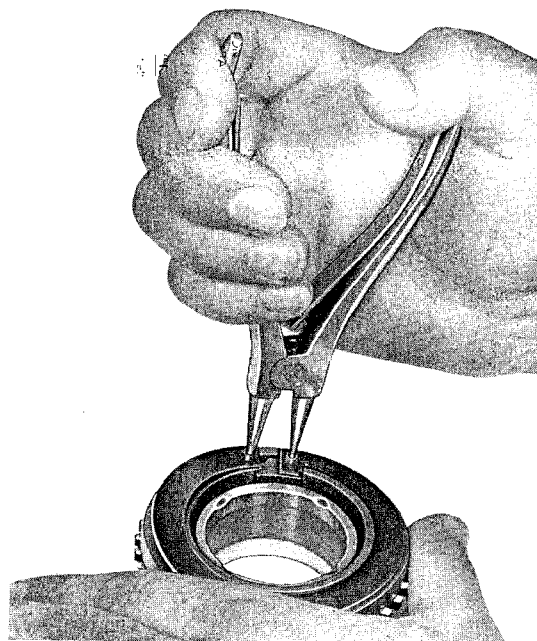


Fig. 55

5. Check installed synchronizing ring with micrometer for correct diameter (76.44 ± 0.20 mm).

Section View of Pinion Shaft

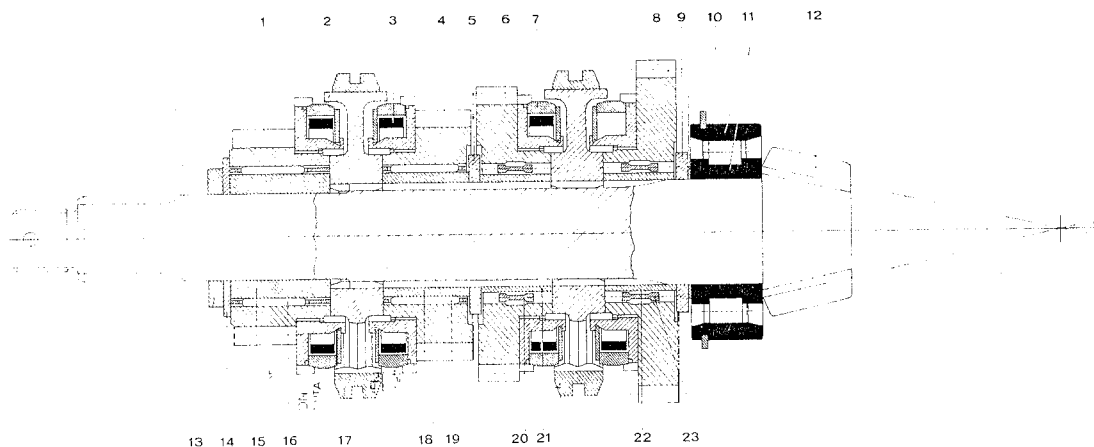


Fig. 56

- | | |
|----------------------|----------------------------------|
| ① 4th gear | ⑬ Spacer |
| ② Spider | ⑭ Thrust washer |
| ③ Brake band | ⑮ Needle bearing sleeve 4th gear |
| ④ 3rd gear | ⑯ Needle bearing |
| ⑤ Thrust washer | ⑰ Sliding sleeve |
| ⑥ 2nd gear | ⑱ Needle bearing sleeve 3rd gear |
| ⑦ Synchronizing ring | ⑲ Needle bearing |
| ⑧ 1st gear | ⑳ Roller cage, 2nd gear |
| ⑨ Thrust washer | ㉑ Roller bearing sleeve 2nd gear |
| ⑩ Shim | ㉒ Roller bearing sleeve 1st gear |
| ⑪ Roller bearing | ㉓ Roller cage, 1st gear |
| ⑫ Pinion gear | |

Exploded View of Pinion Shaft



Fig. 57

5. Install 1st gear.

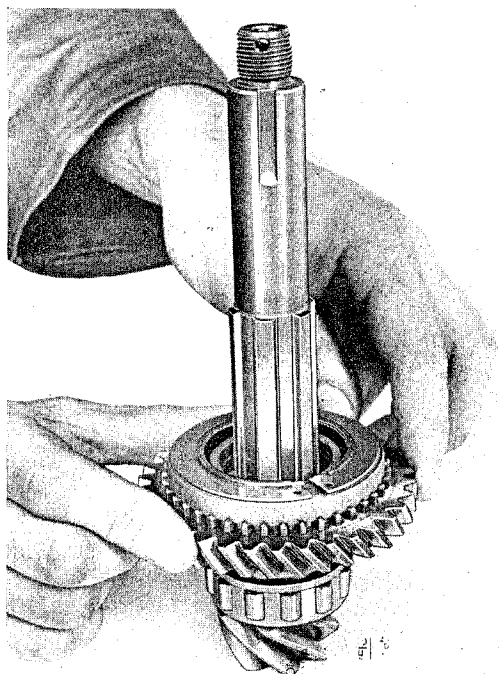


Fig. 62

6. Install shorter splined roller bearing sleeve and roller cage with rollers.

7. Install sliding sleeve.

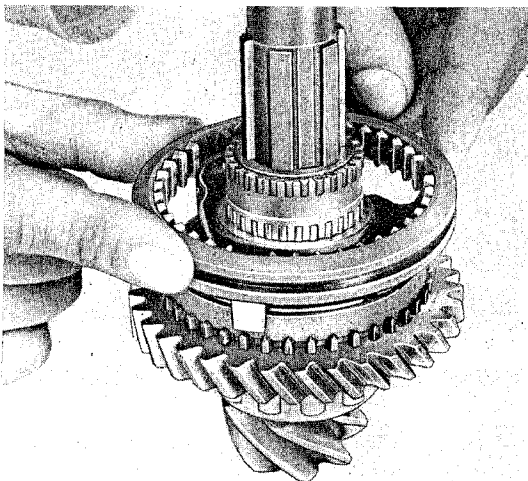


Fig. 63

8. Install 2nd gear.

9. Install thrust washer (Fig. 64).

10. Install splined needle bearing sleeve for 3rd gear (24 mm, .945 in. wide) (Fig. 64).

11. Install needle bearing for 3rd gear.

12. Install 3rd gear.

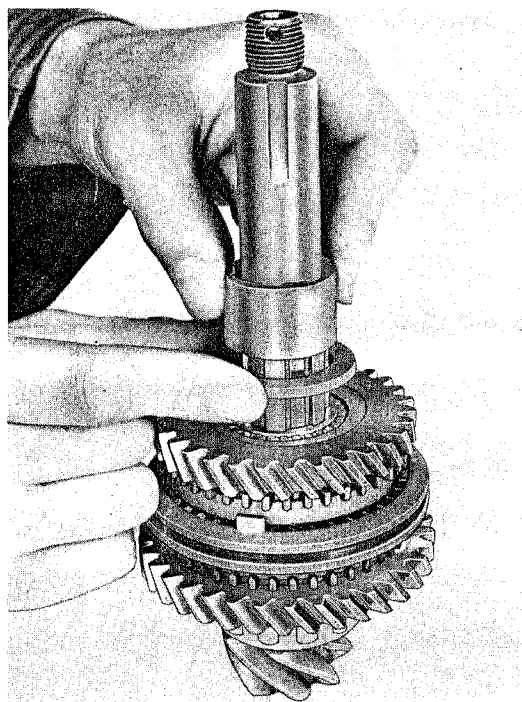


Fig. 64

13. Install spider.

14. Install needle bearing sleeve for 4th gear (28 mm, 1.102 in. wide).

15. Install needle bearing so that needles lie under center of gear teeth (Fig. 65).

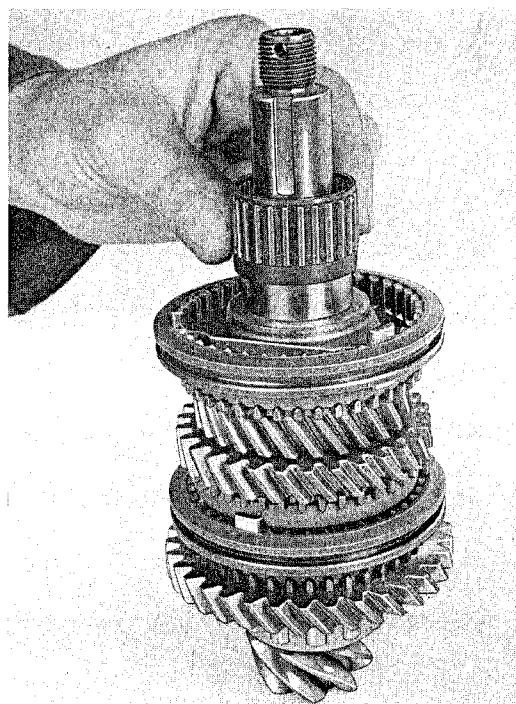


Fig. 65

16. Install 4th gear.
17. Install thrust washer 2 mm.
18. Install spacer 4 mm.

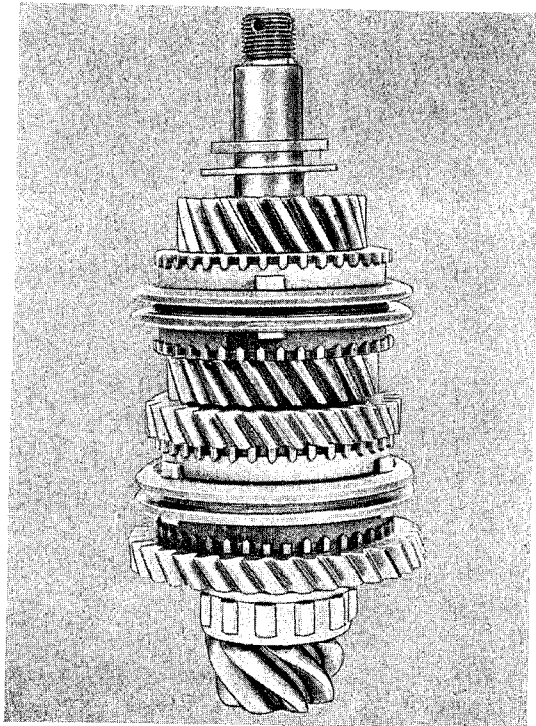


Fig. 66

19. Place assembled pinion shaft in stand P 31, using P 31a and P 40 tighten castle nut to 16 mkg (11.5 ft. lb.) torque. Loosen nut.

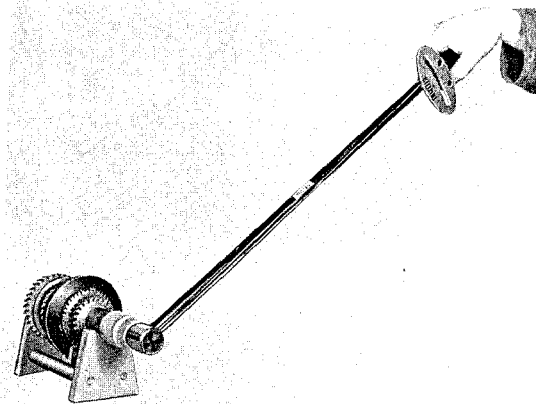


Fig. 67

20. Install sliding sleeve for 3rd and 4th gear.

Note

1st and 2nd gears each have double row caged roller bearings. The 3rd and 4th gears employ single row needle bearings. The 4th gear needle bearing is offset so that the needles are centered under the gear teeth while the 3rd gear needle bearing is symmetrical. Correct end play:

1st gear 0.25 to 0.35 mm (.0098 to .0138 in.). 2nd, 3rd, 4th gear 0.20 to 0.30 mm (.0079 to .0118 in.).

Arrangement of Reverse Gears

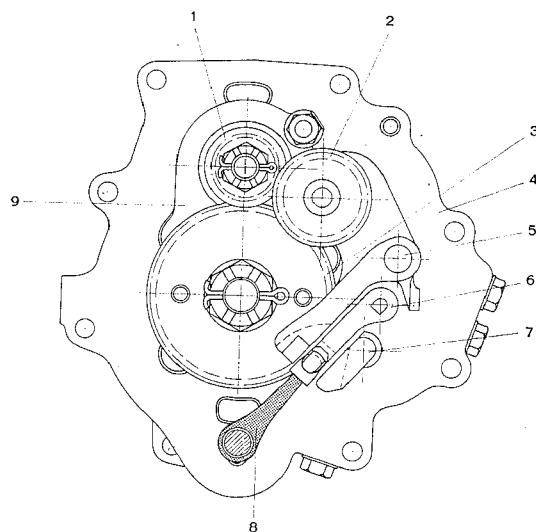


Fig. 68

- ① Gear I with 15 teeth, on the main shaft (one key)
- ② Gear II double gear with 10 and 20 teeth is on a separate shaft
- ③ Gear III 40 teeth on the pinion shaft has two keys
Ratio of reverse gear: 1:3.56
- ④ Intermediate plate
- ⑤ Selector rod for reverse gear
- ⑥ Selector rod for 1st and 2nd gear
- ⑦ Selector rod for 3rd and 4th gear
- ⑧ Selector finger
- ⑨ Bearing cover plate

Reconditioning Main Shaft

Special Tools:

7 RA

P 45	Tube to press gears on main shaft	VW 405	V-block arbor
P 65	Press plate for removing inner roller bearing race from main shaft	VW 406	V-block (two)
VW 400	Hydraulic press	VW 408	Arbor, general use
VW 401	Plate for various press operations	VW 409	Arbor, general use
		VW 412	Arbor, general use

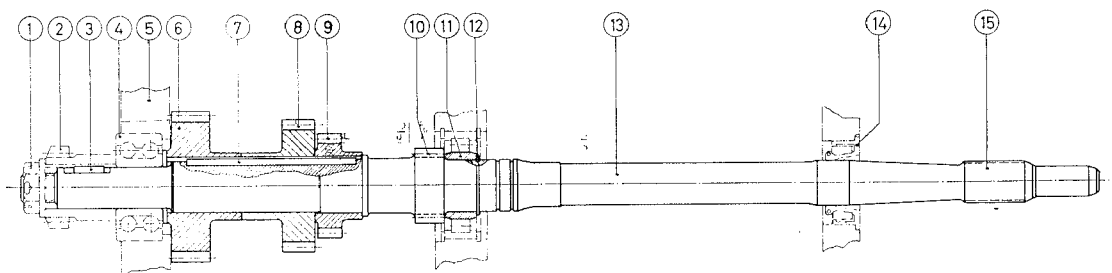


Fig. 69

- | | |
|---------------------------|----------------------------|
| ① Castle nut | ⑨ 2nd gear |
| ② Reverse gear | ⑩ 1st gear |
| ③ Key | ⑪ Inner bearing race |
| ④ Double-row ball bearing | ⑫ Lock ring |
| ⑤ Intermediate plate | ⑬ Main shaft |
| ⑥ 4th gear | ⑭ Oil seal |
| ⑦ Key | ⑮ Splines for clutch plate |
| ⑧ 3rd gear | |

To remove the main shaft the transmission must be partially disassembled but the differential may remain undisturbed.

Removal

1. Remove front cover and intermediate plate with main and pinion shafts (2 RA).

Caution

Note size and number of gaskets between transmission housing and intermediate plate.

2. Remove main shaft and pinion from intermediate plate (2 RA, Fig. 34).
3. Remove spacer between 4th gear and double-row ball bearing.
4. Clean main shaft.

Inspecting

To inspect the main shaft it is necessary to remove the double-row ball bearing from the intermediate plate and the outer roller bearing race from the transmission housing. The check can also be made with other available bearings of the same type.

The double-row ball bearing should be pressed on the shaft lightly to insure easy removal after examination with tool VW 401.

1. Inspect main shaft for wear and damage.
 - a) Inspect pilot bearing surface for wear.
 - b) Inspect splines for clutch disc for wear (loose fit in clutch disc).
 - c) Inspect oil seal surface for wear.
 - d) Check gears for wear and damage. Excessive wear or damage require replacement of the main shaft. Badly worn 2nd, 3rd, or 4th gears must be replaced in matched pairs.
2. Check main shaft for alignment (place shaft with installed bearing on V-blocks and check shaft on gears using a dial indicator). Permissible run-out: Maximum 0.03 mm (.0012 in.). Excessive run-out up to 0.2 mm (.0079 in.) may be corrected using tools VW 400, VW 405, and VW 406.

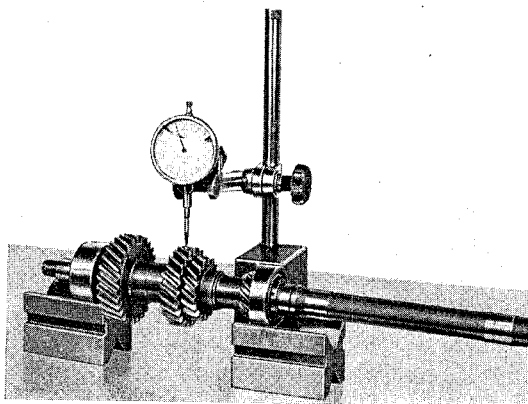


Fig. 70

Note

Check run-out of main shaft in fully assembled condition on pilot bearing surface. Maximum permissible run-out: 0.1 mm (.004 in.).

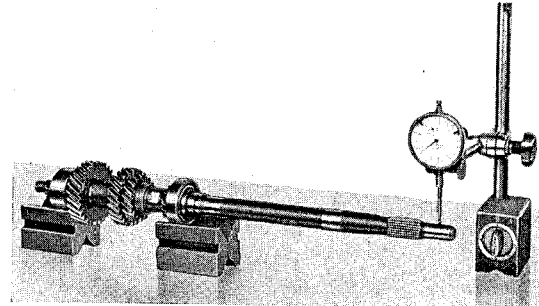


Fig. 71

3. Check double-row bearing and roller bearing for wear. Replace if necessary.

Disassembly

1. Remove lock ring for inner bearing race.
2. Remove inner bearing race using press VW 400 and VW 412.

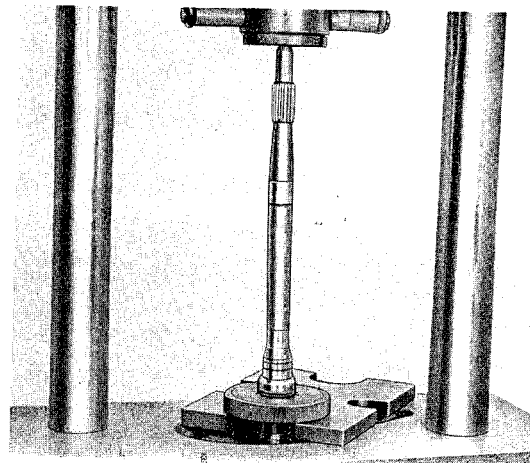


Fig. 72

3. Remove 4th gear using press VW 400 with VW 401 and tools P 65, VW 401, and VW 412.

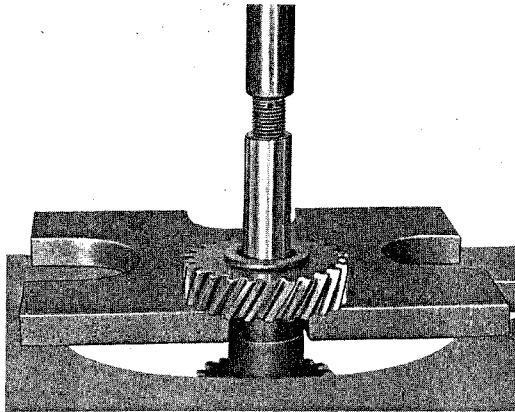


Fig. 73

Assembly

The assembly is accomplished in the reverse order of disassembly observing the following points:

Note

Heat gears in oil bath to 150° C (300° F). Ball bearings and gears must have a press fit.

1. Install key for gears.
2. Install heated gears in the following order: 2nd, 3rd, and 4th, and press tight using P 45 and VW 400.

4. Remove 2nd and 3rd gear.

3. Install inner ball bearing race using press VW 400 with VW 401 and VW 409.

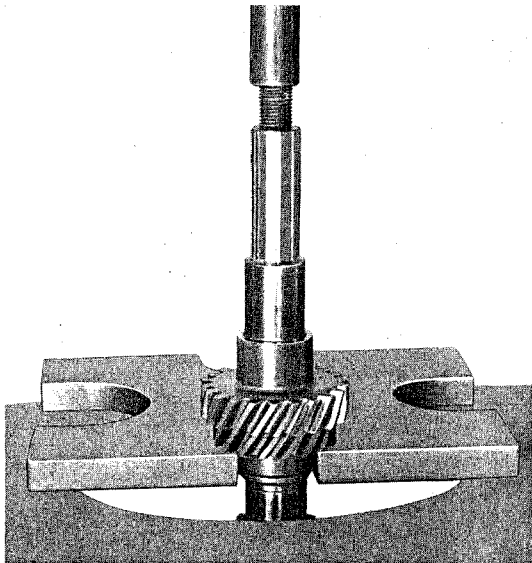


Fig. 74

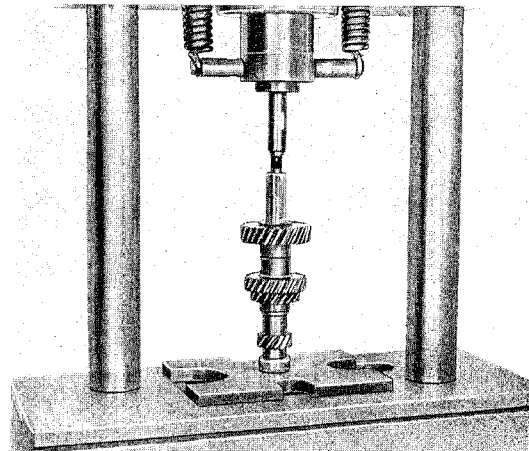


Fig. 75

4. Install lock ring.

Note

Gears for 2nd, 3rd, and 4th speed can only be exchanged in pairs.

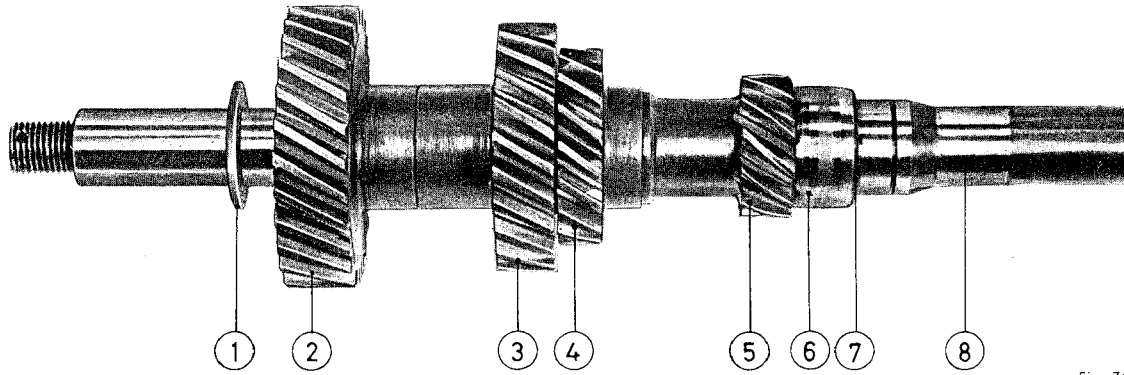


Fig. 76

- ① Spacer
- ② 4th gear
- ③ 3rd gear
- ④ 2nd gear

- ⑤ 1st gear
- ⑥ Inner race of roller bearing
- ⑦ Lock ring
- ⑧ Main shaft

REAR AXLE DRIVE

Reconditioning Differential

Special Tools:

VW 400 Hydraulic press
VW 405 V-block arbor
VW 406 V-blocks (two)

8 RA

Transmission in assembled condition. The two side transmission covers as well as the axle tube flanges are held in position by studs and nuts.

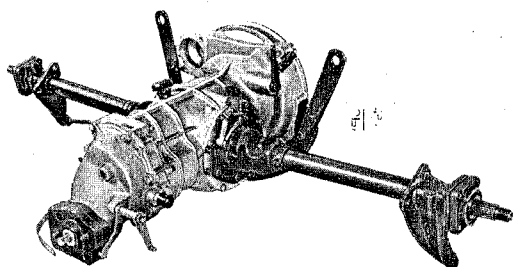


Fig. 77

If work is limited to the differential, (bent axles, defective pinion gears etc.) the differential may be disassembled in the following order.

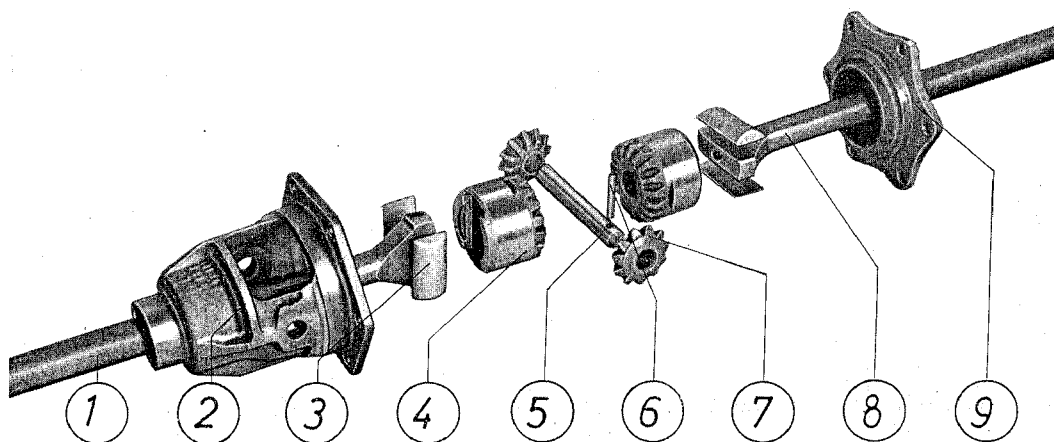


Fig. 78

- ① Half-axle, right
- ② Differential carrier
- ③ Fulcrum plate
- ④ Differential side gear
- ⑤ Differential pinion shaft

- ⑥ Pin
- ⑦ Differential pinion gear
- ⑧ Half-axle, left
- ⑨ Cover

Disassembly

1. Remove brake backing plates and axle tubes (16 RA).

2. Remove left transmission side cover.

3. Remove entire differential with axles from the left opening of transmission housing.

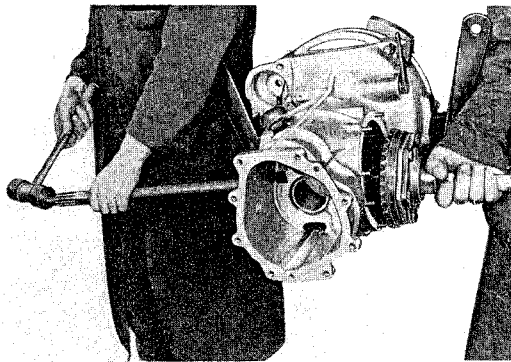


Fig. 79

4. Hold differential in a vise and remove bolts from ring gear.

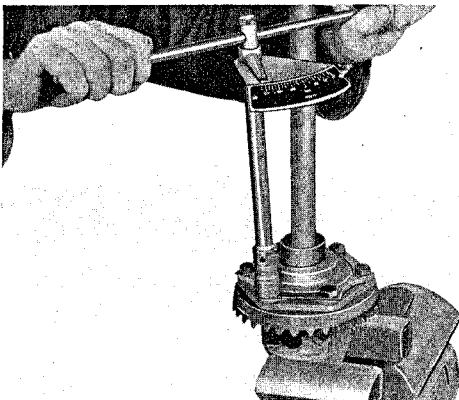


Fig. 80

5. Remove differential carrier cover and rear axle with gear and fulcrum plates.

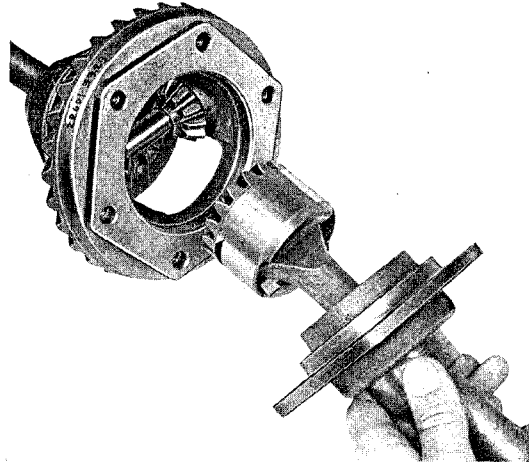


Fig. 81

6. Remove ring gear.

7. Remove lock pin from differential pinion shaft.

8. Drive out pinion shaft using a drift pin.

9. Remove rear axle with gear and fulcrum plates from differential carrier.

10. If necessary remove ball bearings from transmission side cover plates using VW 400, VW 409, VW 415, and VW 433.

Inspection

1. Inspect the differential carrier for wear on the bearing surfaces of the pinions and side gears. Replace if necessary.

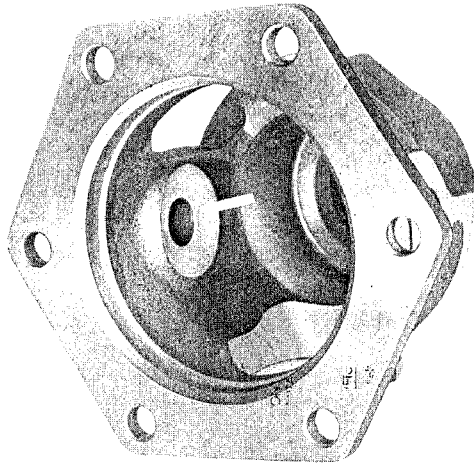


Fig. 82

2. Check rear axles and differential gears for wear and damage. Replace if necessary.

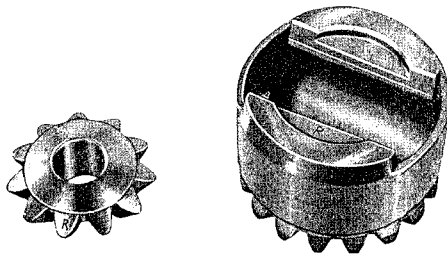


Fig. 83

Note

The number of teeth on the differential gears are as follows:

Side gear 17 teeth
Pinion 11 teeth

3. Inspect rear axle alignment. Small deviations may be corrected using press VW 400 with VW 405 and VW 406. Permissible run-out measured on ball bearing seat: 0.03 mm (.0012 in.).

4. Inspect ring gear for wear and damage. If necessary replace together with the pinion.

Note

The differential gears are supplied in pairs and may only be exchanged as such. The rear axle shafts and differential gears must have the same color markings.

Rear axle shafts and differential gears are divided into 3 groups:

Color marking	Differential side Gear Int. dia.	Half-axle Ext. dia.
Blue	59.97—60.00 mm (2.3610—2.3621 in.)	59.90—59.94 mm (2.3586—2.3598 in.)
Pink	60.01—60.04 mm (2.3626—2.3638 in.)	59.95—59.97 mm (2.3602—2.3610 in.)
Green	60.05—60.07 mm (2.3642—2.3650 in.)	59.98—60.00 mm (2.3614—2.3622 in.)

The marking on the differential side gear is a dot in the recess of the bearing surface, while the marking on the axle shaft is a complete ring around the axle, approximately 6 inches from the flat end.

The assembly tolerance of the rear axle (measured on the large diameter of the flat end) is 0.03 to 0.10 mm (.0012 to .0039 in.).

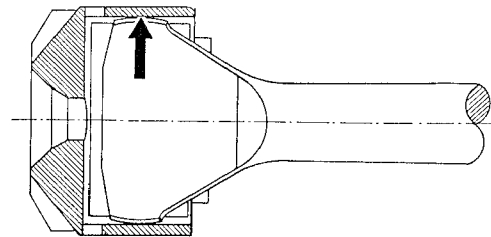


Fig. 84

Excessive clearance may cause objectionable rear axle noises.

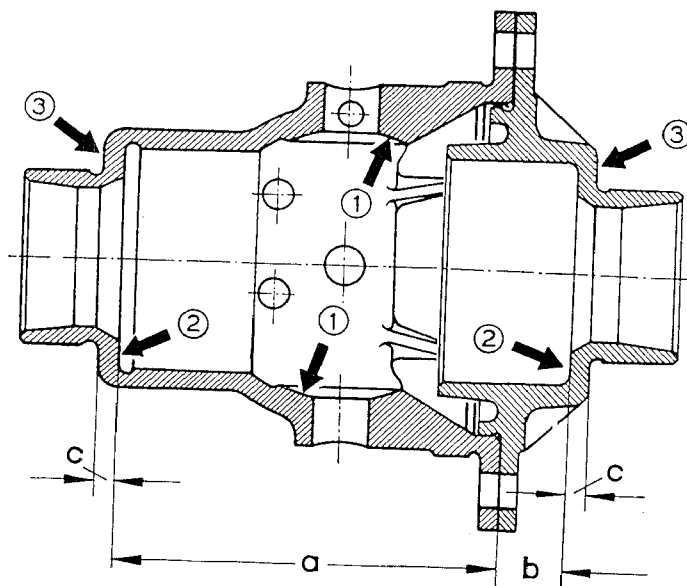


Fig. 85

- ① Bearing surface for differential pinion
- ② Bearing surface for side gear
- ③ Surface for spacer ring

- a) Depth of differential carrier 109 mm (4.290 in.)
- b) Depth of differential carrier cover 19 mm (.750 in.)
- c) Minimum wall thickness 4.0 mm (.157 in.)

Assembly

The assembly is accomplished in the reverse order of disassembly observing the following points:

1. Lubricate and assemble cleaned parts.
2. Check rear axle clearance, fulcrum plates and rear axle gear. Should excessive play exist, use over-size fulcrum plates. Permissible clearance: 0.05 mm (.002 in.).

3. Secure differential pinion shaft by peening locking pin.

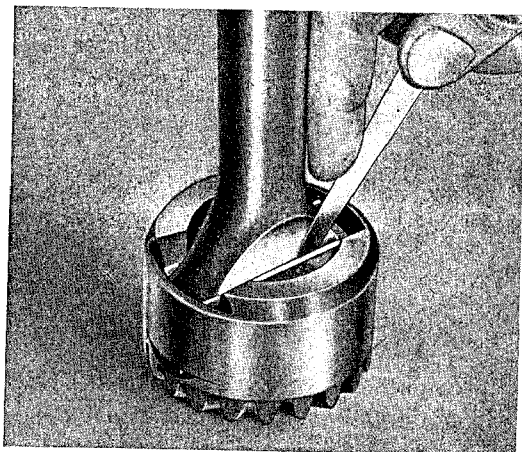


Fig. 86

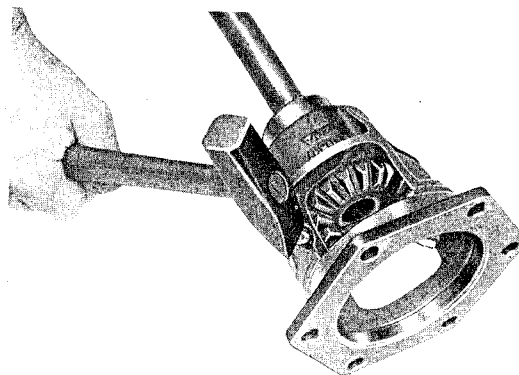


Fig. 87

4. Clean surfaces on differential carrier and ring gear before installing.
5. Install bolts with locking plates (use safety wire after gearbox no. 39645).
6. Tighten bolts to 6 mkg (43.5 ft. lb.) torque and bend over locking plates. Secure safety wire for gearboxes after no. 39645 in such a way that wire tends to tighten bolts.

Disassembling and Assembling Intermediate Plate

Special Tools:

9 RA

- P 57 Guide pin (short) for selector lock bushings R, 1st and 2nd gears
- P 58 Guide pin (long) for selector lock bushings 3rd and 4th gears
- P 66 Puller for selector lock bushing

Note

In the event that the intermediate plate, the bearing retaining plate, or the ball bearings show any sign of damage, the intermediate plate assembly must be completely dismantled in order to replace the defective parts.

Disassembly

1. Remove screws securing bearing retaining plate after removing lock tabs:

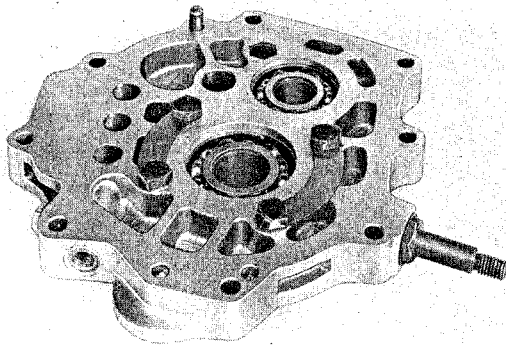


Fig. 88

2. Remove double-row bearing for pinion and main shafts using suitable arbors.
Should the bearings be excessively tight, heat intermediate plate to approx. 212 to 230° F (100 to 110° C) and remove.
3. Remove dowel pin from intermediate plate.
4. If necessary remove bushing for selector rod locks using P 66.

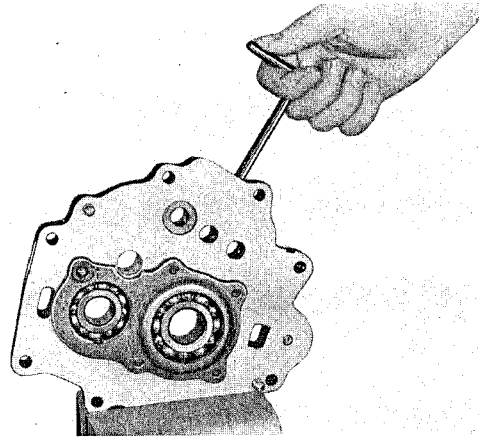


Fig. 89

Assembly

1. Clean all parts thoroughly and check for wear.
2. Heat intermediate plate to approx. 212 to 230° F (100 to 110° C).
3. Insert double-row bearings for pinion and main shafts in their respective bores.

Note

The two double-row bearings must be installed in such a manner that the cutouts in the outer bearing races face the bearing retaining plate (preferably positioned nearest each other).

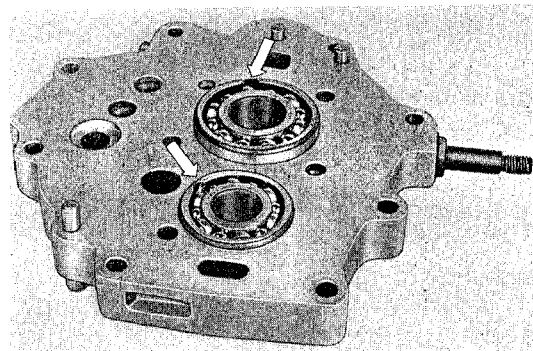


Fig. 90

Insure that bearings are fully seated. The insertion of the double-row bearings can be made using press VW 400.

4. Determine preload between retaining plate and intermediate plate.

R 51

The measurements should be made with a depth micrometer (or depth gauge).

Measurement A: Measure depth of recess in bearing retaining plate and record.



Fig. 91

Measurement B: Measure height of bearing above intermediate plate and record.

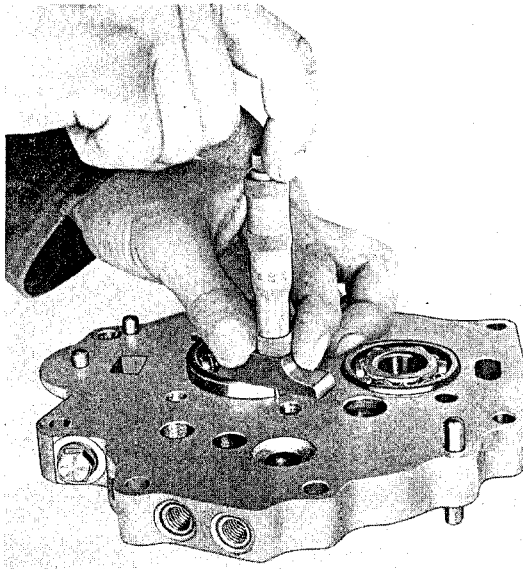


Fig. 92

The difference $A - B$ should be adjusted with shims so that the required preload of 0.03 to 0.13 mm (.0012 to .0051 in.) on the double-row bearing of the pinion shaft is obtained.

Example

Measurement B	8.445 mm
Measurement A	- 8.245 mm
Difference	0.20 mm
Preload 0.03 to 0.13 or 0.08 ± 0.05	- 0.08 mm
Thickness of gasket	0.12 mm
practically	0.10 mm

Since a gasket of 0.12 mm is not available, the next lower one of 0.10 mm will be used. The effective preload is therefore 0.10 mm, which is within the tolerance.

A — Depth of seat for the double-row bearing in the bearing retaining plate

B — Height of double-row bearing for pinion above intermediate plate

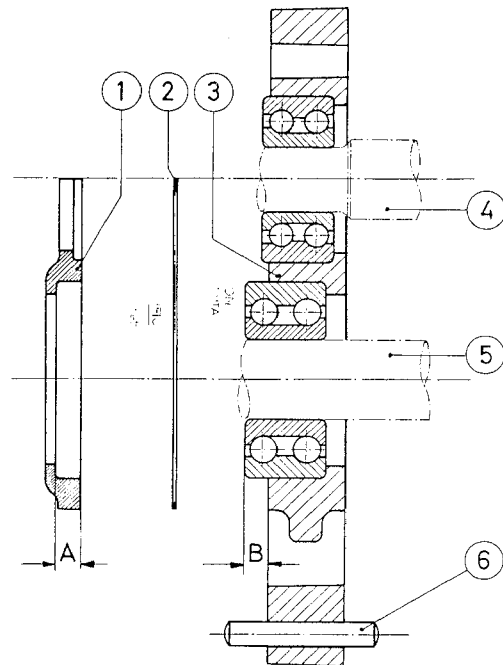


Fig. 93

- | | |
|---------------------------|----------------|
| ① Bearing retaining plate | ④ Main shaft |
| ② Gasket | ⑤ Pinion shaft |
| ③ Intermediate plate | ⑥ Dowel pin |

Note

The bearing retaining plate is installed with a preload of 0.03 to 0.13 mm (.0012 to .0051 in.). By selecting the proper amount of paper gaskets the correct preload can be obtained. The paper gaskets have a thickness of 0.10 mm (.0039 in.).

5. Install bearing retaining plate with gaskets required for correct preload.

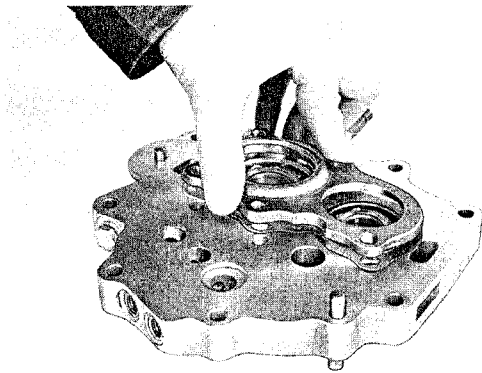


Fig. 94

6. Bolt down cap screws of retaining plate and tighten to 2 mkg (14.5 ft. lb.) torque and lock.

7. Install dowel pins.

8. Insert three bushings for selector rod lock using tools P 57 and P 58.

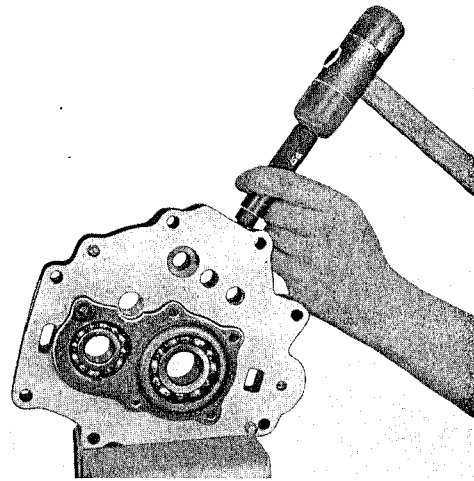


Fig. 95

9. Install selector rod locks (2 RA, Fig. 45).

Adjusting Ring and Pinion Gears

General

The accurate adjustment of the ring and pinion gears is the decisive factor affecting the life and silent running of the rear axle. The ring and pinion gears are therefore matched during their manufacture and are tested on special machines to insure proper tooth contact and silent operation. The position where the least noise is generated is determined by varying the position of the two gears with respect to each other. The variation from the theoretical normal position and the optimum tooth contact is measured and the adjustment is then marked on both gears. Each ring and pinion set is marked with a pair number and must be replaced only as a complete unit.

The object of adjusting the ring and pinion gears is to reproduce the setting which generates the least noise according to the factory tests. This can be accomplished by accurately obtaining the setting which is marked on the gears.

When this adjustment is correctly carried out, the distance of the ring gear from the axis of the pinion gear and the distance of the pinion gear from the center of the ring gear will correspond to the predetermined settings. Instructions for these adjustments are given in the following section.

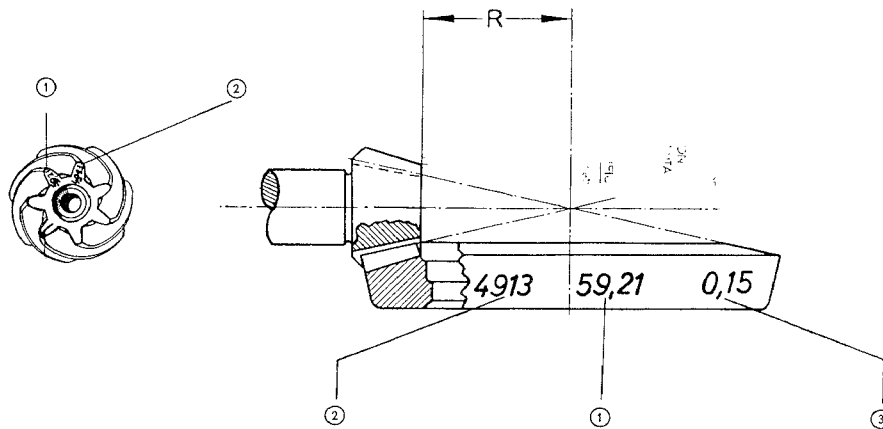


Fig. 96

- ① Setting dimension "R" for ring and pinion gears ③ Backlash for the ring pinion gears at setting "R"
 ② Matching set number R Distance between ring gear centerline and face of pinion

Method of Ring Gear Adjustment

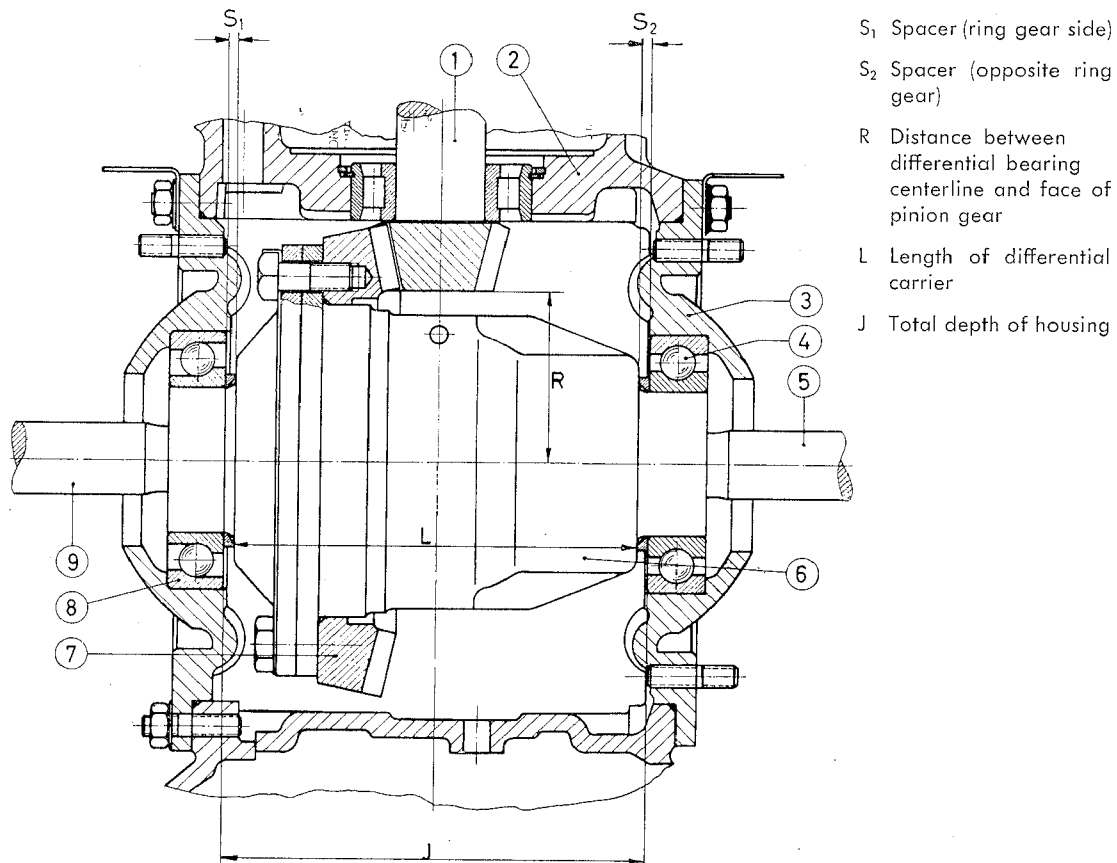
The ring gear is bolted to the differential carrier and is positioned in the housing by spacer rings placed on either side of the differential carrier. The amount of spacers required is determined from the measurement made on the assembled housing and re-checked by measuring the backlash of the assembled unit after the pinion gear has been adjusted.

To determine the thickness of the spacer rings "S₁" and "S₂" the following dimensions must be measured:

Example	Nominal
"J" Total depth of housing	145.21 mm
"L" Length of differential carrier	138.00 mm

All dimensions should be measured with an accuracy of 0.01 mm (.0004 in.).

The preload on the differential carrier bearings should be 0.13 to 0.17 mm.



- S₁ Spacer (ring gear side)
- S₂ Spacer (opposite ring gear)
- R Distance between differential bearing centerline and face of pinion gear
- L Length of differential carrier
- J Total depth of housing

- ① Half-axle, right
- ② Pinion shaft
- ③ Bearing wall in transmission housing
- ④ Transmission side cover, right
- ⑤ Ball bearing 6210

- ⑥ Differential carrier
- ⑦ Ring gear
- ⑧ Thrust bearing 7210 behind ring gear (Install on correct side)
- ⑨ Half-axle, left

Adjusting Ring Gear

Special Tools:

P 33 Gauge for adjusting ring and pinion gears

General

To insure that the measurements are made accurately it is essential that the bearing surfaces for the measuring instruments are absolutely clean and undamaged. The ball bearings for the differential must be parallel and properly seated.

Measuring

1. Install left transmission housing cover with paper gasket 0.20 mm (.008 in.) thick.
2. Install dial gauge on measuring device P 33 and zero dial gauge using ring master.
3. Insert gauge P 33 in the inner race of the ball bearing in the left half of the housing.

4. Install right transmission housing cover with paper gasket 0.20 mm (.008 in.) thick.

5. Secure dial gauge with holder to one of the studs for axle tube bearing cover and set to zero.

6. Turn the transmission housing so that the gauge moves axially and rests with its own weight on the inner race of the ball bearing in the right half of the housing. The value shown on the dial gauge must be added to the length of gauge P 33 (marked on gauge body) to give the total depth "J" of the housing (Fig. 98).

Note

As mentioned above the exact length "F" is marked on gauge P 33.

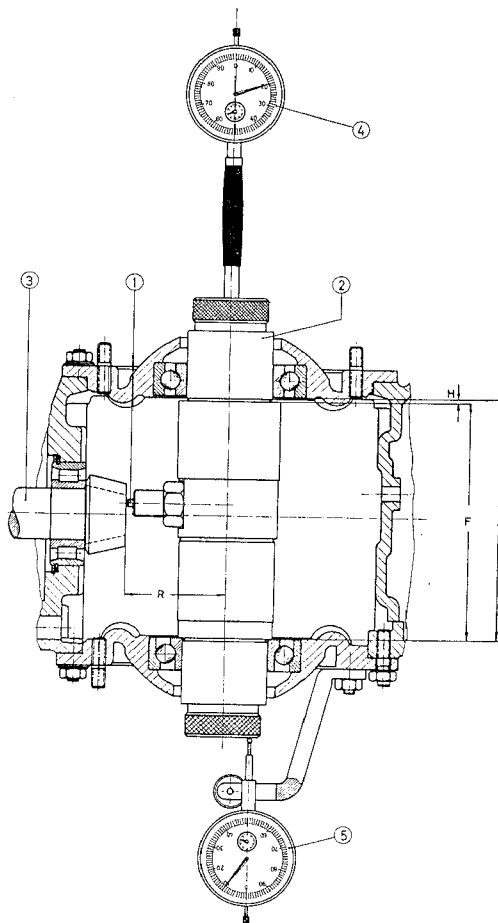


Fig. 98

- ① Feeler
- ② Gauge
- ③ Pinion
- ④ Dial gauge measures R
- ⑤ Dial gauge measures H

R Distance between differential bearings centerline and face of pinion

H Free end play of gauge in differential bearings

F Length of gauge

J Total depth of housing

Computing Thickness for Differential Spacers

Special Tools:

VW 287 Gauge for differential carrier

12 RA

Determine distance between differential carrier bearings using tool P 33 (see Fig. 98 and the following example) and record.

Example:
 $F = 143.50 \text{ mm}$
 $+ H = 1.71 \text{ mm}$
 $J = 145.21 \text{ mm}$

Example

J Total depth of housing
 L Length of differential carrier

	145.21
	-137.85
Difference	7.36
Preload	+ 0.15

Necessary thickness of spacers
 $S_1 + S_2$

7.51

Measuring the differential carrier length "L".

1. Adjust gauge VW 287 on master gauge.
2. Measure differential carrier and add or subtract from measurement on master gauge.

Thickness of spacer $S_2 =$	7.51 mm	= 3.755
	2	- 0.10
		3.655

Thickness of spacer $S_1 =$	7.51 mm	= 3.755
	2	+ 0.10
		3.855

Nominal dimension for L	=	138.00 mm
Reading	=	- 0.15 mm
Length of differential carrier L	=	137.85 mm

General

The spacers are available in thicknesses from 2.90 mm to 4.50 mm in 0.10 mm increments.

A shim 0.25 mm thick makes it possible to vary spacers within 0.05 mm. The calculated measurements for spacers should be selected so that shims "S₁" and "S₂" and the preload on the ball bearings for the differential are within the tolerance of 0.13 to 0.17 mm.

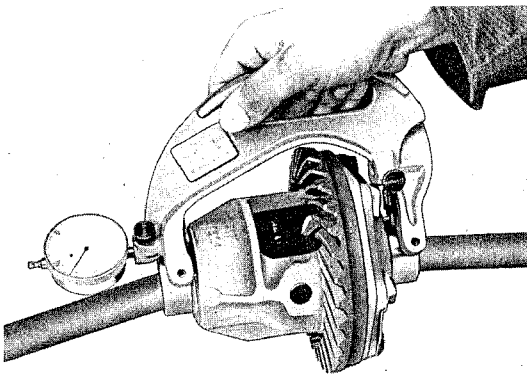


Fig. 99

Example:

Calculated thicknesses

$$S_1 + S_2 = 3.655 + 3.855 = 7.510 \text{ mm}$$

Selected thicknesses

$$S_1 + S_2 = 3.65 + 3.85 = 7.50 \text{ mm}$$

To obtain the proper clearance between ring and pinion, spacer "S₁" will be 0.10 mm thinner than spacer "S₂" (Fig. 97).

Measure spacers with micrometer at four different places around the circumference. Permissible deviation: 0.02 mm. Make sure before measuring that burrs have been removed.

Transmission Side Covers

The transmission side covers should be heated to approx. 212 to 230° F (100 to 110° C) for insertion of the ball bearings. Due to the thrust loads different ball bearings are employed. Thrust bearing No. 7210 DIN 628 is installed in the left cover (**ring gear side**).

Make sure that the ball bearing is correctly installed, i.e. the outer race should be so inserted as to transmit the thrust towards the outside (Fig. 100).

Bearing No. 6210 DIN 625 is installed in the right side. Insure that the proper gasket 0.20 mm is installed between transmission housing and transmission side covers prior to assembly.

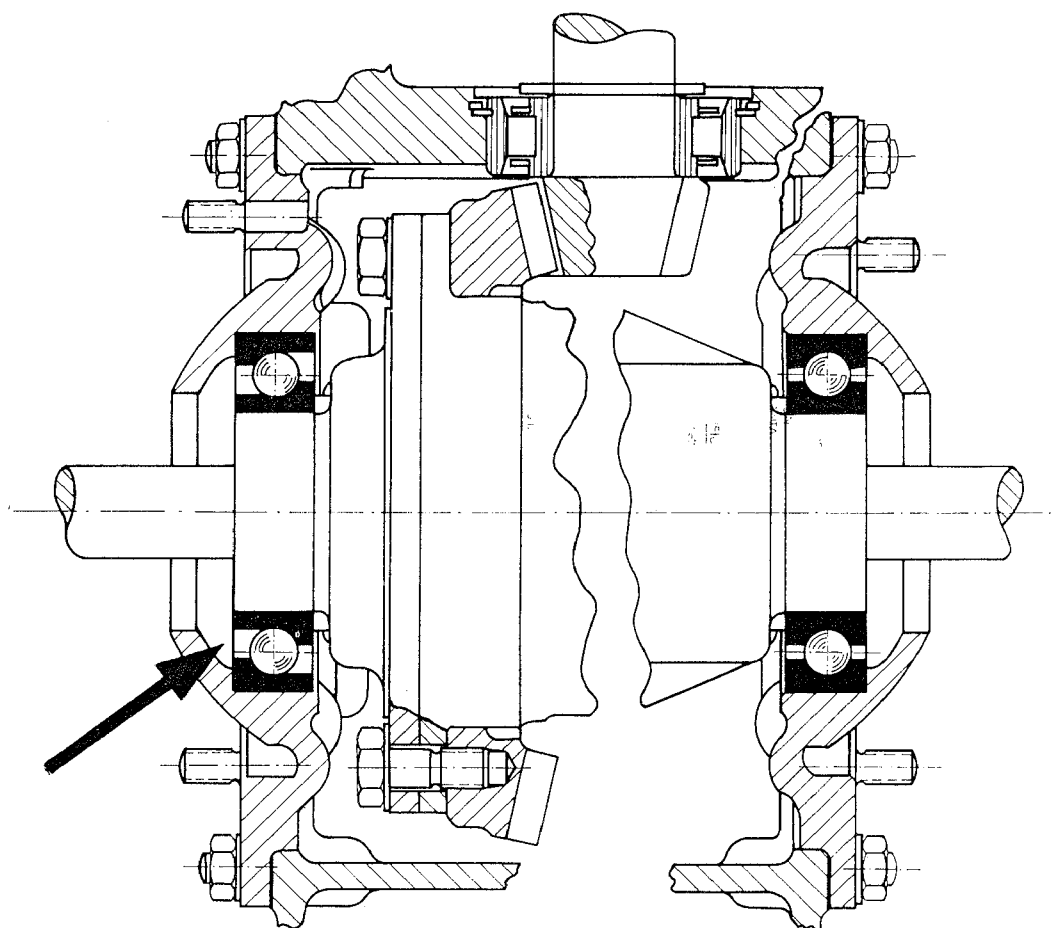


Fig. 100

Adjusting Pinion Gear

Special Tools:

13 RA

P 33 Gauge for adjusting ring and pinion
VW 400 Hydraulic Press with accessories

General

The provisional adjustment of the pinion has been made prior to assembly (see section 4 RA reconditioning pinion).

Measure distance "R" after measuring distance "J" using tool P 33 (11 RA).

Preparation

Install assembled intermediate plate (without paper gasket) in transmission housing and secure.

Zero the dial gauge in P 33 using adjusting ring. The inscribed diameter of the adjusting ring should be divided and recorded, i.e. 118 mm gives 59.00 mm.

Measuring

1. Install P 33.
2. Turn until feeler contacts face of pinion gear.
3. Turn gauge shaft left and right and record the observed minimum reading.

First Example

Dial gauge adjustment	59.00 mm
Reading	59.06 mm
Required dimension R	59.24 mm
Difference	- 0.18 mm

i.e. the pinion has to be moved away from ring gear center axis 0.18 mm. This is possible by inserting a paper gasket of 0.2 mm between the intermediate plate and the transmission housing. (Adjust differences to the nearest gasket thickness available.)

Second Example

Dial gauge adjustment	59.00 mm
Reading	59.45 mm
Required dimension R	59.31 mm
Difference	+ 0.14 mm

i.e. the pinion has to be moved 0.14 mm towards the center axis of the ring gear. Disassemble pinion and insert required shims on pinion shaft (Fig. 96, 97, 98).

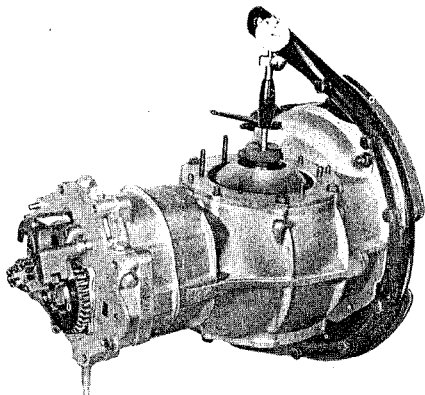


Fig. 101

Note

In order to move the pinion gear away from the ring gear center, paper gaskets available in sizes 0.10 mm, 0.15 mm, and 0.20 mm may be installed between the intermediate plate and the transmission housing.

In order to move the pinion gear closer to the ring gear center it is necessary to disassemble the pinion shaft and install shims which are available in sizes 0.10 mm, 0.15 mm, and 0.30 mm.

Verifying Adjustment of Ring Gear

Special Tools:

P 34a Pinion shaft holding clamp
VW 288b Backlash gauge

General

The correct adjustment of the ring gear is checked by measuring the backlash.

Preparation

Install assembled intermediate plate with previously determined paper gaskets into transmission housing.

1. Secure intermediate plate with two bolts.
2. Install right transmission cover with 0.20 mm paper gasket and secure.
3. Install assembled differential with previously determined spacers.

Measuring backlash

1. Remove standard 8 mm feeler from VW 288b and replace with a longer feeler 20 mm of the same shape.

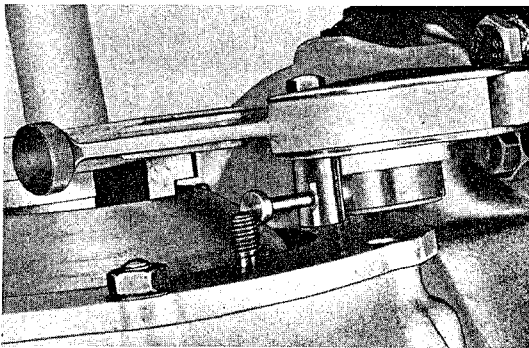


Fig. 102

2. Insert and clamp the backlash gauge VW 288b into the axle opening in such a manner that the long indicator point contacts one of the axle flange studs in the side plate.

3. Clamp castle nut of the pinion shaft with special tool P 34a.

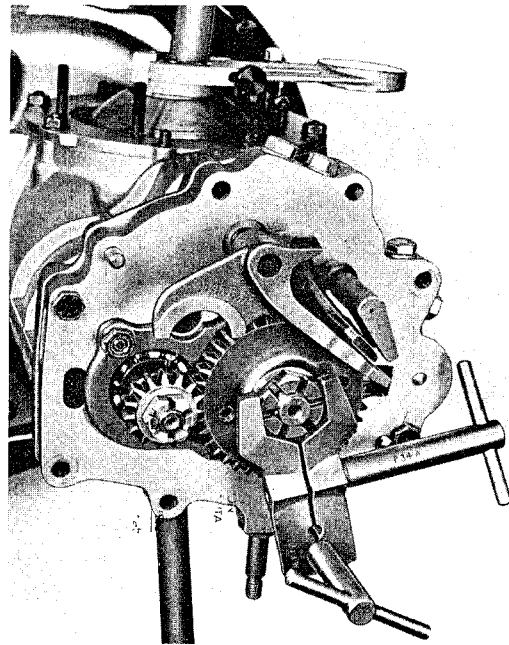


Fig. 103

4. Move the gauge lightly in both directions until it stops and read the indicator movement.
5. Turning the ring gear each time through approx. 90°, repeat the measurement. The indicated values of the four measurements must not differ by more than 0.05 mm. Compare the mean value with that marked on the gears (Fig. 96).
6. If the backlash is not within the tolerance, rearrange spacers S_1 and S_2 until the correct adjustment is obtained.

Removing and Installing Transmission Cover

15 RA

Removal

1. Remove front transmission mount by removing two allen screws.
2. Remove transmission cover bolts and remove cover. Use plastic hammer to free tight cover.
3. Remove paper gasket.
4. The reverse idler shaft in the transmission cover must be secured with a roll pin. The hollow shaft must be closed with an aluminum plug and installed as in Fig. 105.

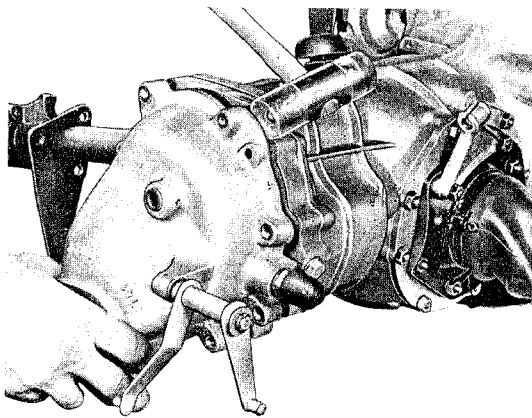


Fig. 104

3. Remove paper gasket.

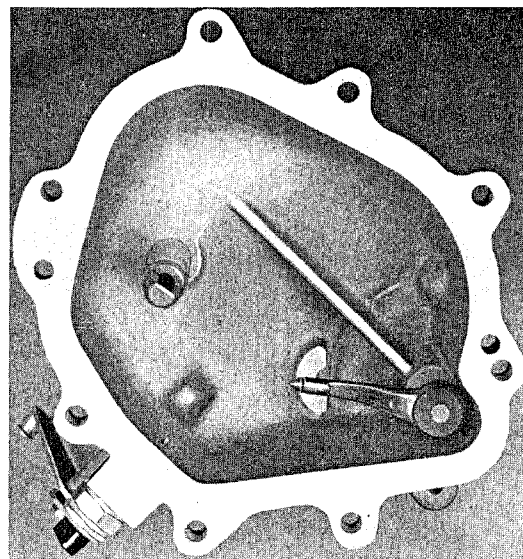


Fig. 105

Note

Before removing selector rod from cover, remove burrs on selector rod to prevent damaging its bore in the transmission cover.

Installation

The installation is accomplished in the reverse order of removal observing the following points:

1. Clean sealing surfaces of intermediate plate and cover.
2. Renew gasket (thickness 0.20 mm).
3. Inspect selector rod bore in cover as well as reverse idler and shaft for wear and renew worn parts.
4. Inspect oil seal for selector rod in cover and renew if necessary.
5. Before installing the cover, lubricate selector rod forks and reverse idler shaft with graphite grease.
6. Insure that selector finger is engaged in selector rods. The reverse idler shaft must be inserted into the hole of reverse idler and properly guided into opening of intermediate plate. Check proper seat of gasket.
7. Tighten cover bolts to 2 mkg (14.5 ft. lb.) torque.
8. Check for proper engagement of each gear.

REAR WHEEL BEARINGS AND AXLE TUBES

16 RA

Replacing Rear Wheel Bearings and Seals

Special Tools:

VW 241a	Puller for rear wheel bearing
VW 230	Mandrel for replacing rear axle seal
VW 400	Hydraulic press
VW 401	Plate for various press operations
VW 441	Arbor for pressing in rear axle seal
VW 442	Arbor for pressing in rear axle seal

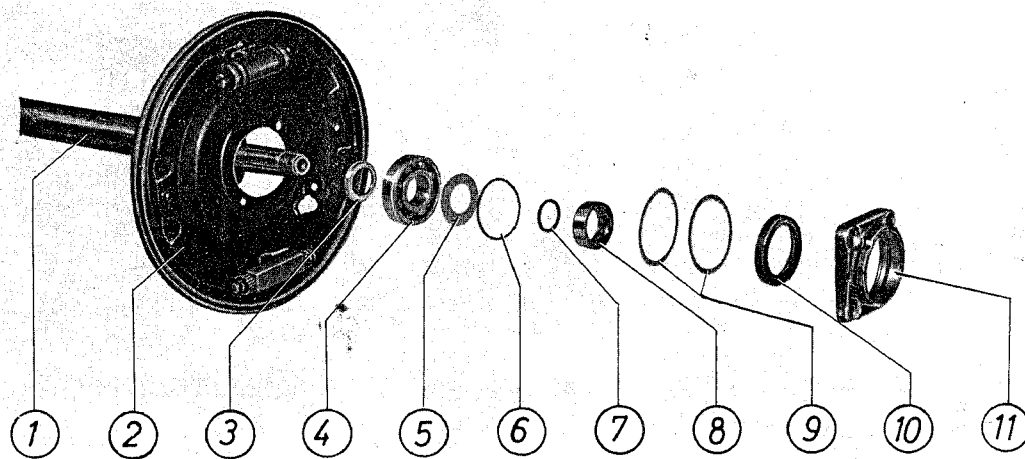


Fig. 106

- ① Axle tube
- ② Brake backing plate
- ③ Spacer ring, inner
- ④ Ball bearing
- ⑤ Washer
- ⑥ Seal

- ⑦ Seal
- ⑧ Spacer ring, outer
- ⑨ Shims
- ⑩ Oil seal
- ⑪ Bearing cover

Disassembly

1. Remove brake drums and brake shoes (1 RA).
2. Remove bearing cover and oil seal.
3. Remove brake backing plate.
4. Remove outer spacer ring, both oil rings and washer from axle.
5. Remove rear wheel bearing and inner spacer using puller VW 241a.

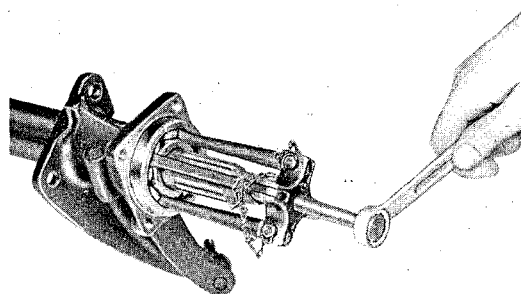


Fig. 107

Removing and Installing Seal in Bearing Cover

1. Remove damaged seal from bearing cover using VW 230 or hydraulic press with VW 401, VW 408, VW 441, and VW 442.
2. Lubricate wheel bearing seal and install in bearing

cover using VW 230 or hydraulic press with VW 401, 408, 441 and 442.

The seal ring should be inserted so that the outer surface is flush with the bearing cover plate.

3. Check parallel seat of seal with straight edge.

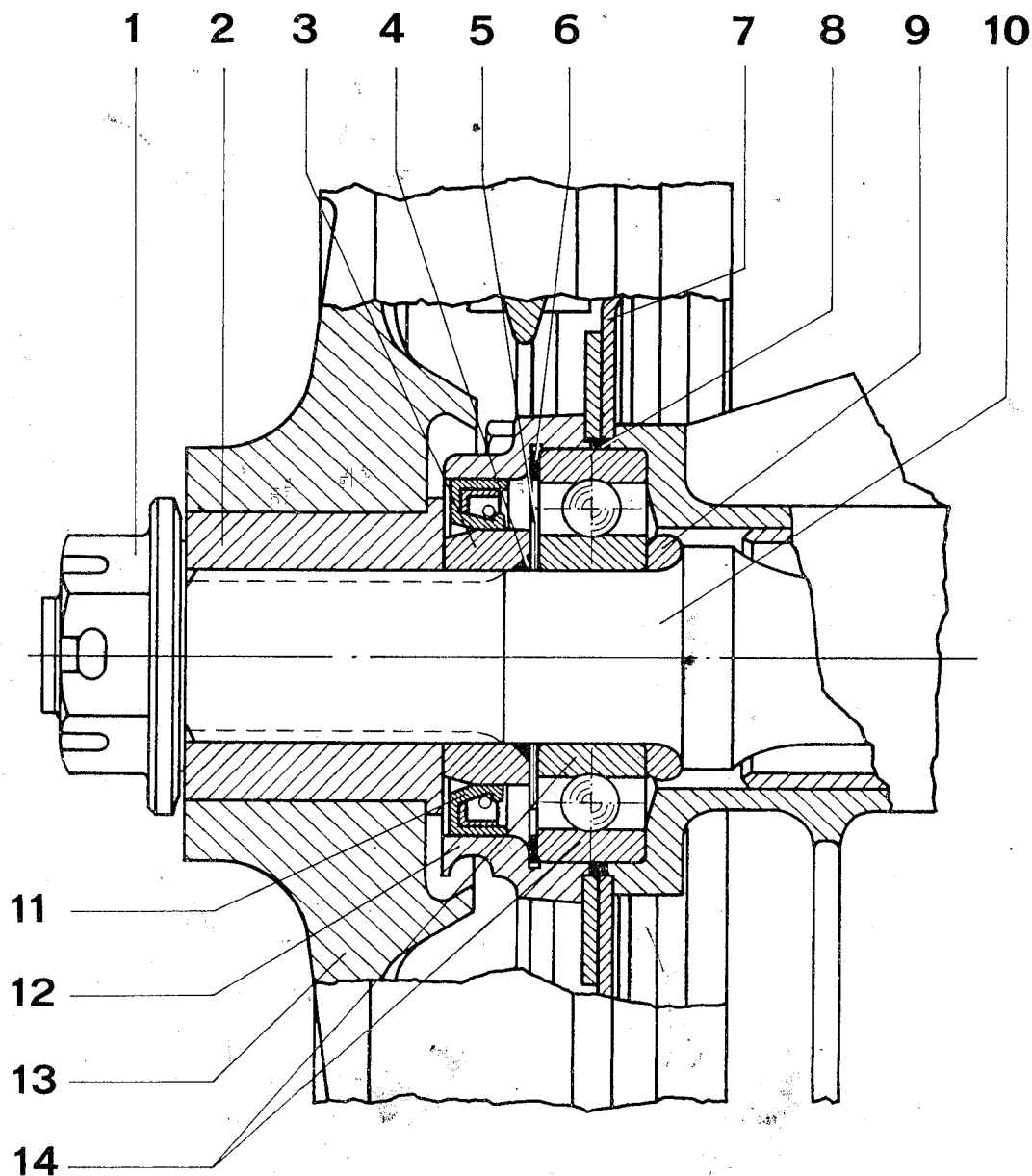


Fig. 108

- | | |
|----------------------------------|--------------------|
| ① Castle nut for rear axle shaft | ⑧ Rubber seal ring |
| ② Internally splined sleeve | ⑨ Spacer ring |
| ③ Spacer ring | ⑩ Rear axle shaft |
| ④ Rubber seal ring | ⑪ Oil seal |
| ⑤ Washer | ⑫ Bearing cover |
| ⑥ Shims (as required) | ⑬ Brake drum |
| ⑦ Brake backing plate | ⑭ Ball bearing |

Installation

1. Inspect ball bearing and replace if necessary.
2. Renew seal ring between spacer and ball bearing as well as seal for rear axle bearing cover.
3. Adjust end play or rear axle bearing as follows:

Note

The ball bearing on the axle shaft is partially recessed into the bearing flange of the axle tube. The brake backing plate is installed over the ball bearing followed by a rubber sealing ring and is held by the bearing cover. To prevent excessive movement of the rear axle bearing and to insure proper preload as well as securing the brake backing plate, shims (0.1 mm thick) are installed. The determination of these shims is as follows.

Measurement "s"

Determine thickness of brake backing plate. Burrs should first be removed. Measure the thickness at several points.

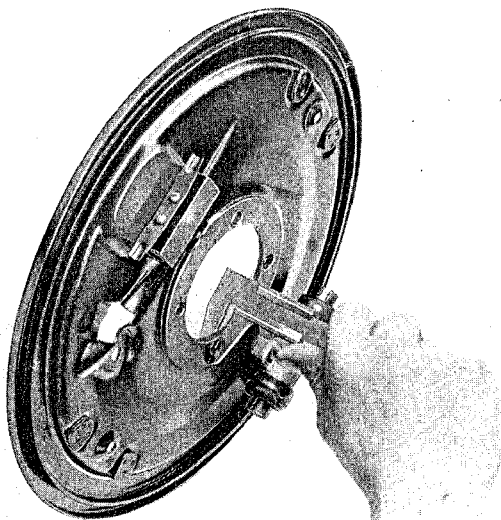


Fig. 109

Install bearing cover with seal ring and tighten.

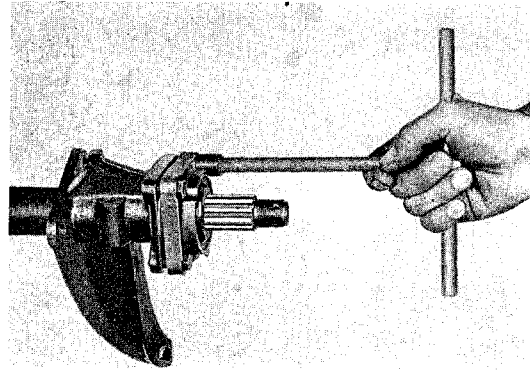


Fig. 110

Measurement "r"

Determine distance between rear axle bearing flange and rear axle bearing cover.

To avoid incorrect measurements all components should be installed with the exception of spacers.

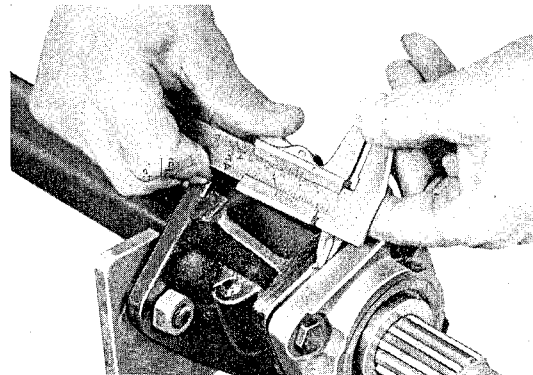


Fig. 111

Example

Measurement "s"	5.0 mm (.197 in.)
Measurement "r"	4.5 mm (.177 in.)

Difference	0.5 mm (.020 in.)
Preload	0.1 mm (.004 in.)
Thickness of spacers	0.4 mm (.016 in.)

To obtain the correct bearing play four spacers of 0.1 mm (.004 in.) each must be installed.

4. Install bearing cover with the oil drain hole facing downward.
5. The spacer should not show any sign of wear, cracks, or rust and should be lubricated prior to installation to prevent damaging the oil seal. Cleanliness is essential for this operation.

Removing and Installing Rear Axle Tubes

Special Tools:

17 RA

VW 202 Puller used with VW 202b and 202h
VW 202b Extractor hooks
VW 202h Spacer
VW 240a Arbor for bearing flange

VW 400 Hydraulic press
VW 401 Plate for various press operations
VW 407 Arbor, general use
VW 433 Press accessory, general use

Removal

1. Remove brake drums and brake backing plates (1 RA).
2. Loosen nuts on bearing cover of axle tube.
5. Remove bearing flange from axle tube using extractor VW 202, with VW 202b and VW 202h, or press VW 400 with VW 407 and VW 401.
6. Loosen clamps and remove boot and bearing cover from axle tube.

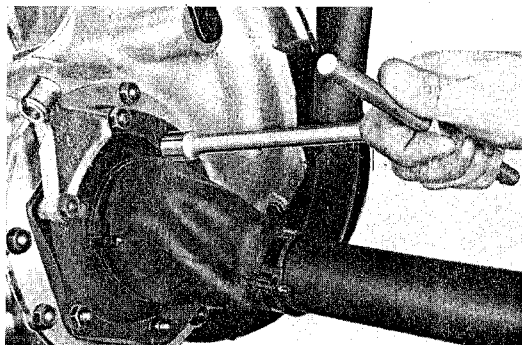


Fig. 112

3. Remove axle tube with bearing cover and gasket (16 RA).
4. Drive dowel pin out of bearing flange.

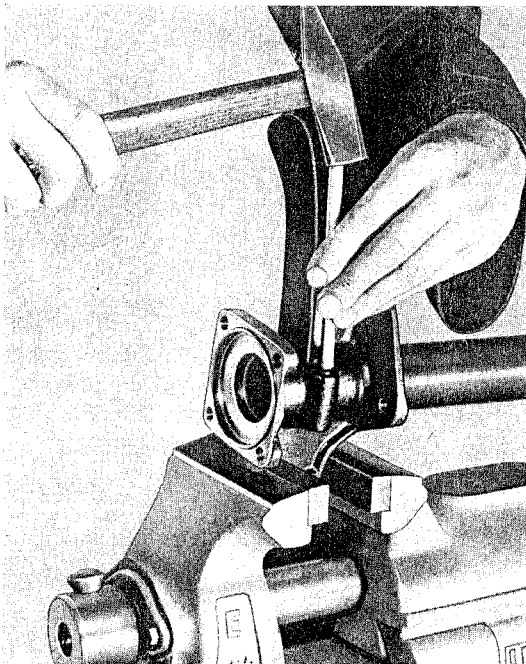


Fig. 113

Installation

The installation is accomplished in the reverse order of removal observing the following points:

1. Inspect spherical surface on rear axle tube and transmission side cover for wear. Remove roughness.
2. Inspect axle boot and replace if necessary.
3. Inspect bearing flange and replace if necessary. Before installation the mating surfaces should be thoroughly cleaned and the flange and axle tube covered with a light coat of grease. Install the flange using hydraulic press VW 400 with VW 407 and VW 433.

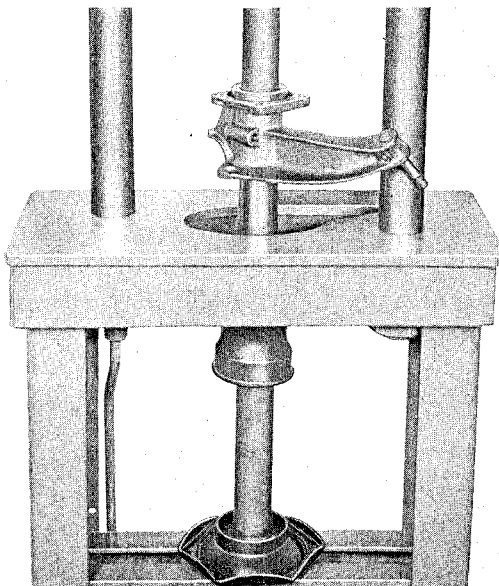


Fig. 114

4. Install new flange gaskets 0.1 to 0.3 mm (.004 to .012 in.) as required.
5. After installation the axle tube must move freely in all directions without any noticeable play. If necessary remove or add gaskets. Should corrections not be possible by inserting a 0.1 mm (.004 in.) gasket, the axle tube and side cover should be replaced or an oversize cover installed.

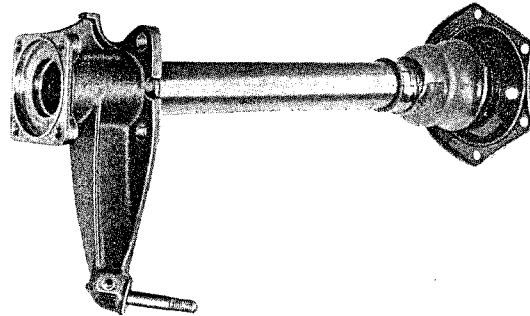


Fig. 115

18 RA

Removing and Installing Transmission Carrier and Rubber Mounts

Removal

1. Remove six bolts that hold the transmission rubber mounts to the transmission carrier.

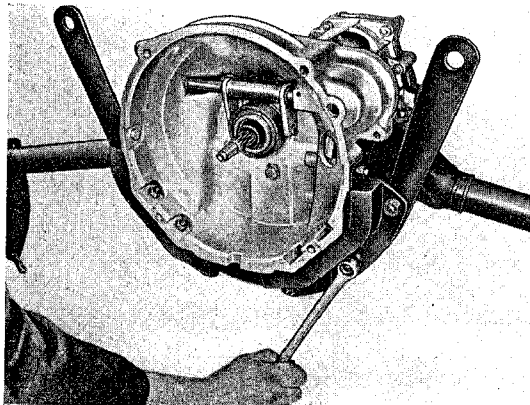


Fig. 116

2. Remove transmission carrier.
3. Remove rubber mounts from transmission housing (2 nuts and 1 bolt on each mount).

Removal of the rubber mounts is only necessary if these have been damaged or the rear axle is to be completely disassembled.

Installation

The installation is accomplished in the reverse order of removal observing the following points:

1. Inspect rubber mounts and replace if necessary.
2. Inspect transmission carrier for alignment. Straighten or replace as necessary.
3. Install transmission carrier. The flat side of the carrier must be toward the rubber flange.
4. Tighten mounting bolts uniformly.

Installing Main Shaft Seal (Rear axle installed)

19 RA

Special Tools:

VW 291b Press Sleeve for Installing Oil Seal

General

The main shaft seal can be renewed without removing or disassembling the transmission.

Installation

The installation is accomplished in the reverse order of removal observing the following points:

Removal

1. Remove engine (1 EN).
2. Remove clutch release bearing.

1. Apply sealing compound to outside of new oil seal so that no compound touches the sealing lip. Lubricate main shaft and sealing lip.

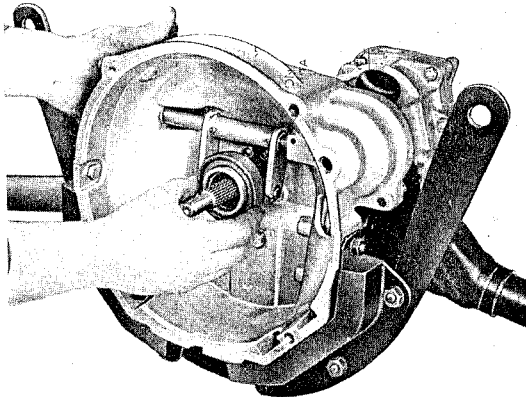


Fig. 117

3. Remove clutch release bearing guide.

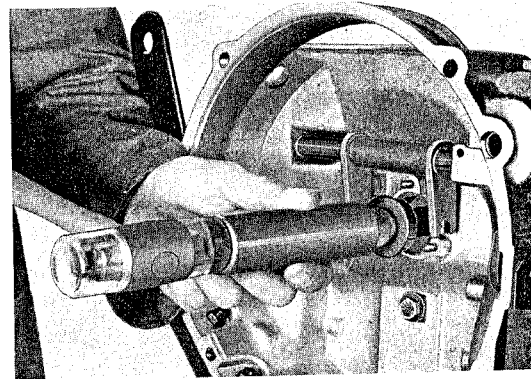


Fig. 119

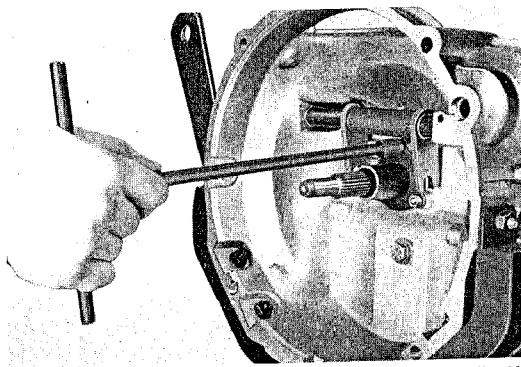


Fig. 118

4. Remove old seal (with screwdriver). Note: Do not damage seal seat in the transmission housing.

Warning

Care should be exercised to prevent the spring from being dislocated.

Note

The seal is exchanged in the same manner, on a disassembled transmission. The removal of the old seal may be simplified by driving it out from the inside.

20 RA

Removing and Installing Clutch Pivot Shaft

Special Tools:

- P 62 Drift to remove or install clutch pivot shaft bushing
P 64 Mandrel to install outer bushing of clutch pivot shaft

Removal

1. Remove return spring for clutch pivot shaft.

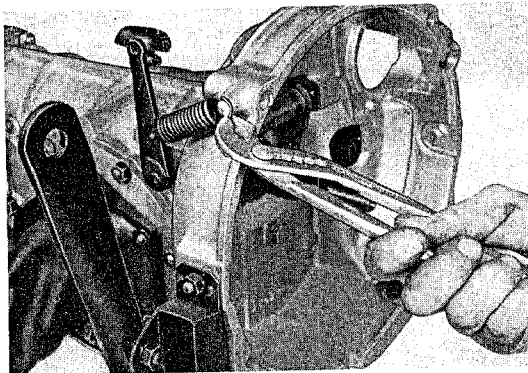


Fig. 120

2. Remove clutch release bearing.

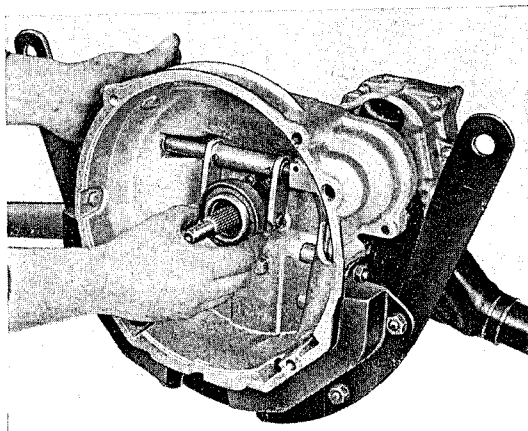


Fig. 121

3. Drive out roll pins.

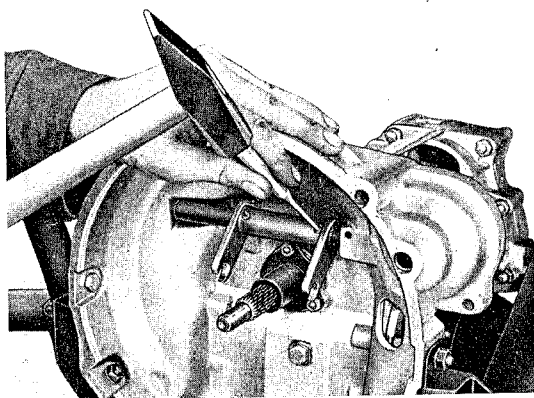


Fig. 122

4. Remove clutch pivot shaft.

Inspection

Inspect the bushings of the clutch pivot shaft. If necessary renew using tools P 62 and P 64.

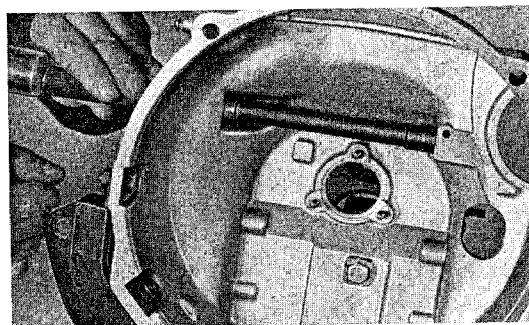


Fig. 123

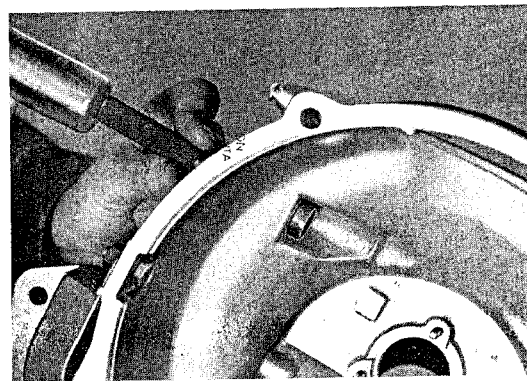
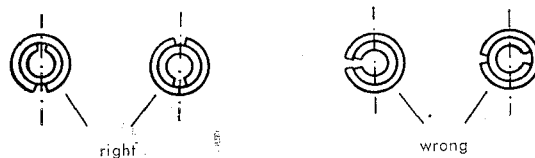


Fig. 124

Installation

The installation is accomplished in the reverse order of removal observing the following points:

1. The clutch release fork is fastened to the pivot shaft by two roll pins inserted into each other.
2. The openings of the roll pins should be offset 180° vertically (see sketch).



Removing and Installing Gear Shift Linkage

21 RA

Removal

1. Remove both front seats and rubber floor mats.
2. Remove floor tunnel cover mat.
3. Disconnect heater cables from heater flaps.
4. Mark position of gear shift lever bracket to avoid unnecessary adjustments when installing.
8. Remove gear shift lever bracket.
9. Slide rubber boot forward on shift rod.
10. Loosen clamping screw and push shift rod forward from flexible connector.

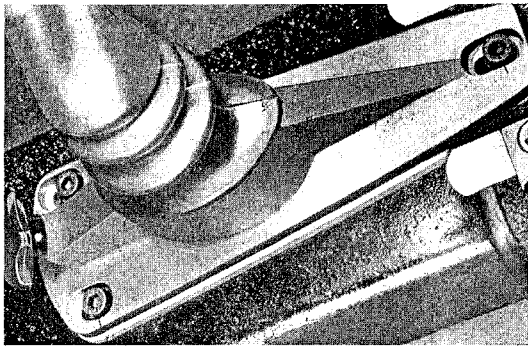


Fig. 125

5. Remove three allen screws.
6. Lift gear shift lever bracket and move to one side.
7. Remove lock ring from spindle for heater control screw and turn control knob till nut is free.

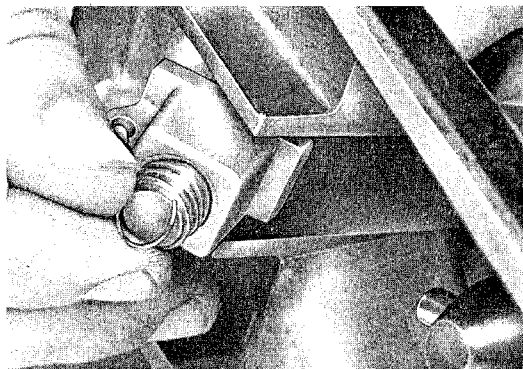


Fig. 126

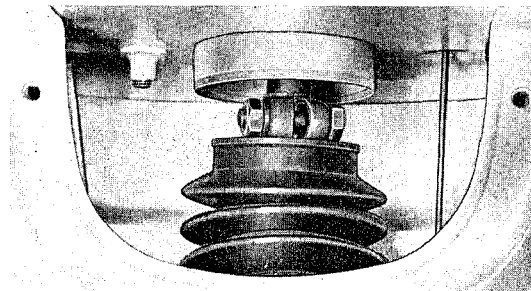


Fig. 127

11. Pull shift rod toward the front until the back end of the shift rod can be pushed back under the separating plate in the tunnel.

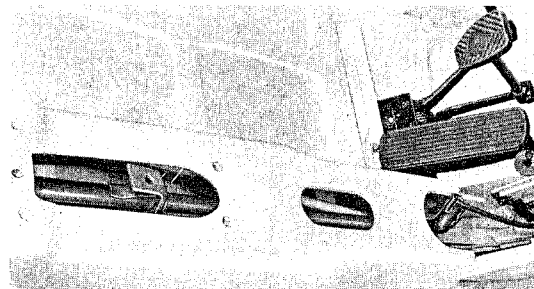


Fig. 128

12. Push shift rod back to shift bracket opening and remove pulling forward.

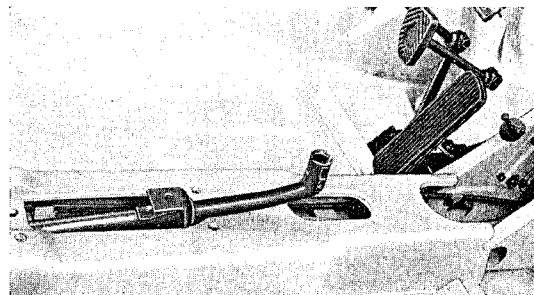


Fig. 129

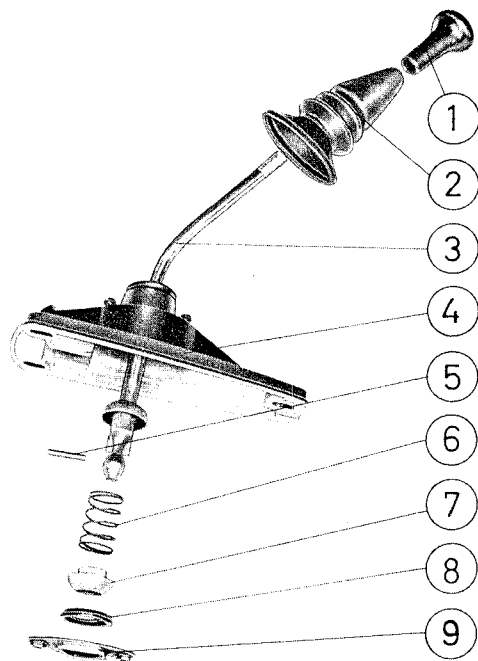


Fig. 130

- | | |
|----------------------|-------------------|
| ① Gear shift knob | ⑥ Spring |
| ② Rubber boot | ⑦ Ball |
| ③ Gear shift lever | ⑧ Socket |
| ④ Gear shift bracket | ⑨ Retaining plate |
| ⑤ Roll pin | |

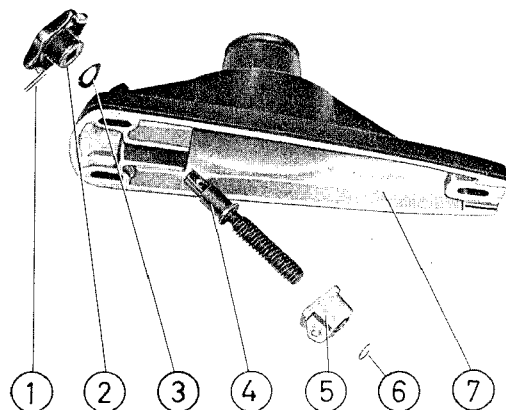


Fig. 132

- | |
|------------------------------|
| ① Roll pin |
| ② Heater control knob |
| ③ Spring washer |
| ④ Spindle for heater control |
| ⑤ Nut for heater control |
| ⑥ Lock ring |
| ⑦ Gear shift bracket |

Installation

The installation is accomplished in the reverse order of removal observing the following points:

1. Install nut for heater cable with the eye to the front (front of car).

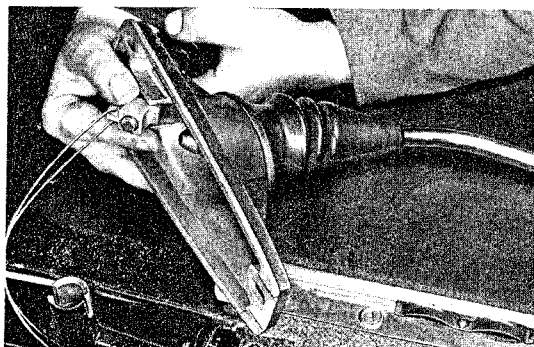


Fig. 131

2. Check whether the shift rod guide is centered over the rear threads of the bracket.

3. Install gear shift bracket and secure with three allen screws aligning the markings previously inscribed on the bracket.

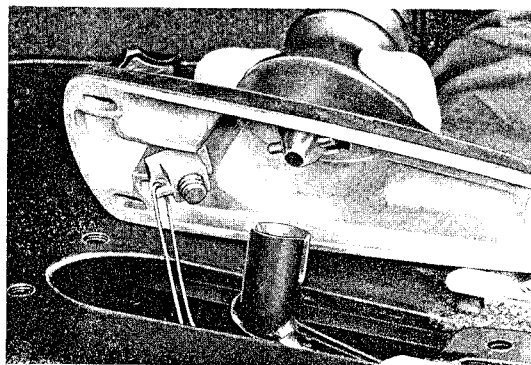


Fig. 133

Testing and Adjusting Gear Shift Mechanism

The gear shift mechanism is designed so that the travel of the selector is greater than the movement of the selector finger in the transmission. The difference is absorbed by the rubber coupling between selector rod and gear shift rod. To insure equal preload the shifting mechanism should be adjusted as follows:

1. Engage 1st or 2nd gear.
2. Loosen connection between coupling and selector rod so that preload is released.
3. Tighten clamp and test shifting mechanism in all gears.