

Transmission Overhaul

Types 220 and 220a

Operation No.
G 3

The transmissions for both Type 220 and Type 220a come with steering column gear shift and all four speeds positively synchronized. However, the two transmissions differ in several respects. The deviations will be seen from the description of the respective operations. Give the section "Checking and Reconditioning of Transmission" your particular attention, even if only a part has to be exchanged.

Gear Set for Type 220

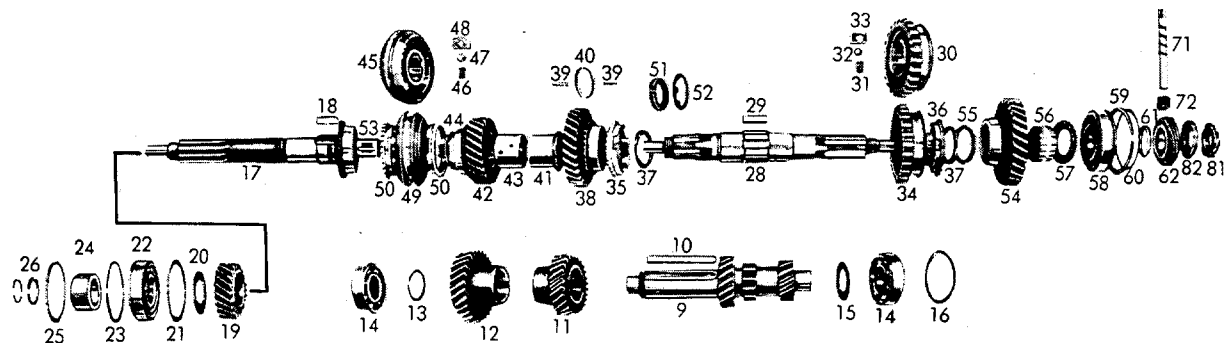


Fig. G 3/01

- | | | | |
|-----------------------------------|---|---|-----------------------------|
| 9 Countershaft | 23 Snap ring | 38 Second speed helical gear | 53 Kling roller bearing |
| 10 Key | 24 Spacer sleeve | 39 Bearing needle | 54 First speed helical gear |
| 11 Countershaft third speed gear | 25 Adjusting washer | 40 Spacer ring | 55 Contact washer |
| 12 Countershaft fourth speed gear | 26 Snap ring | 41 Bushing | 56 Roller assembly |
| 13 Lock ring | 27 Sealing ring | 42 Third speed helical gear | 57 Contact washer |
| 14 Grooved collar bearing | 28 Mainshaft | 43 Bushing | 58 Grooved collar bearing |
| 15 Guard washer | 29 Key | 44 Contact washer | 59 Snap ring |
| 16 Adjusting washer | 30 First and second speed synchronizer unit | 45 Third and fourth speed synchronizer unit | 60 Adjusting washer |
| 17 Driveshaft | 31 Pressure spring | 46 Pressure spring | 61 Spacer ring |
| 18 Key | 32 Steel ball | 47 Steel ball | 62 Speedometer drive gear |
| 19 Helical gear | 33 Follower | 48 Follower | 71 Driveshaft |
| 20 Oil thrower | 34 Gear sleeve | 49 Gear sleeve | 72 Small drive gear |
| 21 Spacer ring | 35 Synchronizer ring | 50 Synchronizer ring | 81 Slotted nut |
| 22 Grooved collar bearing | 36 Contact washer | 51 Slotted nut | 82 Lock plate |
| | | 52 Lock plate | |

Gear Set for Type 220a

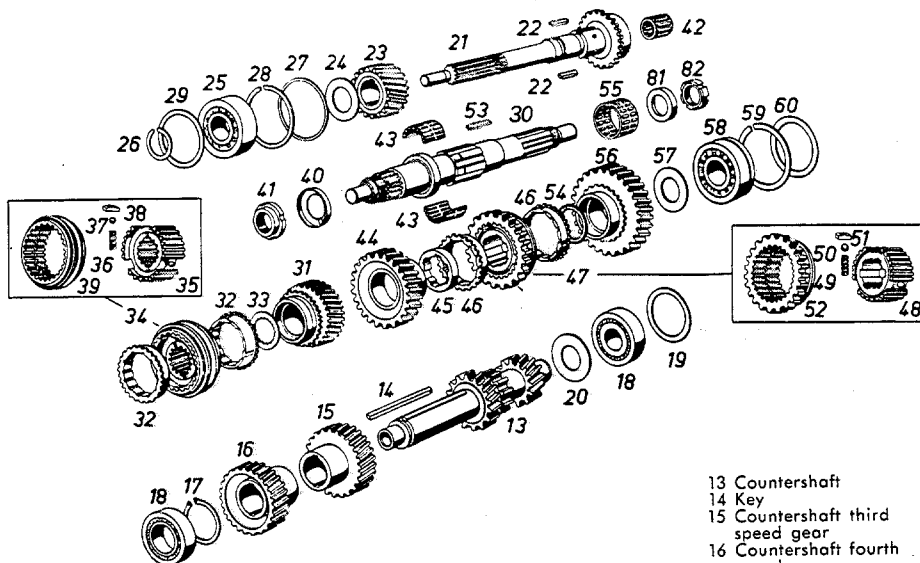


Fig. G 3/02

- | | |
|-----------------------------------|---|
| 13 Countershaft | 23 Helical gear |
| 14 Key | 24 Oil thrower |
| 15 Countershaft third speed gear | 25 Grooved collar bearing |
| 16 Countershaft fourth speed gear | 26 Snap ring |
| 17 Lock ring | 27 Spacer ring |
| 18 Grooved collar bearing | 28 Snap ring |
| 19 Adjusting washer | 29 Adjusting washer |
| 20 Guard washer | 30 Mainshaft |
| 21 Driveshaft | 31 Third speed helical gear |
| 22 Key | 32 Synchronizer ring |
| | 33 Contact washer |
| | 34 Third and fourth speed synchronizer unit |
| | 35 Synchronizer unit |
| | 36 Pressure spring |
| | 37 Steel ball |
| | 38 Follower |
| | 39 Gear sleeve |
| | 40 Lock plate |
| | 41 Slotted nut |
| | 42 Roller assembly |
| | 43 Split roller assembly |
| | 44 Second speed helical gear |
| | 45 Contact ring |
| | 46 Synchronizer ring |
| | 47 First and second speed synchronizer unit |
| | 48 Synchronizer unit |
| | 49 Pressure spring |
| | 50 Steel ball |
| | 51 Follower |
| | 52 Gear sleeve |
| | 53 Key |
| | 54 Contact washer |
| | 55 Roller assembly |
| | 56 First speed helical gear |
| | 57 Contact washer |
| | 58 Grooved collar bearing |
| | 59 Snap ring |
| | 60 Adjusting washer |

Special Tools:

Holding wrench for three-arm flange	187 589 08 07	Puller for ball bearing of main-shaft	136 589 02 33
Pin wrench for slotted nut (4 teeth) at mainshaft front end and Type 220 also rear end	120 589 04 07	Holding yoke for first and second speed gear	136 589 38 61
Pin wrench for slotted nut (6 teeth) at rear end of mainshaft (Type 220)	136 589 05 07	Mounting device for locking plate	191 589 02 31
Pin wrench for slotted nut at rear end of mainshaft (Type 220a), with 6 teeth	186 589 05 07	Mounting pin for needle bearing	187 589 02 39
with 4 teeth	186 589 07 07	Insertion sleeve for grease retainer	187 589 05 61
Bell-type puller for three-arm flange	136 589 03 33	Mounting pin for grease retainer	187 589 03 39
Pliers for mainshaft snap ring	136 589 00 37	Mounting pin for cover plate	187 589 01 39
Two levers for removing ball bearing from countershaft	136 589 00 35	Mounting pin for shifting rail	136 589 09 61
Mounting sleeve $31 \times 40 \times 93$ mm ($1.22 \times 1.57 \times 3.66$ ") for removing and installing the gear set (for Type 220 only)	136 589 07 61	Installing punch for ball bearing on mainshaft	136 589 07 39
Punch for ball bearing on countershaft	136 589 06 39	Mounting sleeve $31 \times 40 \times 75$ mm ($1.22 \times 1.57 \times 2.95$ ") for arresting the gear set (for Type 220 only)	136 589 08 51
Support angle for countershaft	136 589 11 61	Mounting sleeve $31 \times 40 \times 62$ mm ($1.22 \times 1.57 \times 2.44$ ") for arresting the gear set (for Type 220a only)	198 589 02 61
Puller for reverse shaft	136 589 27 33	Test device for checking true run of three-arm flange at transmission	136 589 04 21

I. Disassembly of Transmission

Procedure:

Removal of Gear Set:

1. Remove clutch throwout collar with bearing.

In Type 220 remove snap ring on front cover of transmission case and take off throwout collar with bearing including pressure spring and spring retainer.

In Type 220a press the two wire clips out of the throwout fork towards the rear, turn to the side and pull out as indicated in Fig. G 3/1. Take off throwout collar with bearing.

Note: The clutch throwout bearing of Type 220a requires no maintenance. **The bearing must in no case be washed out!**

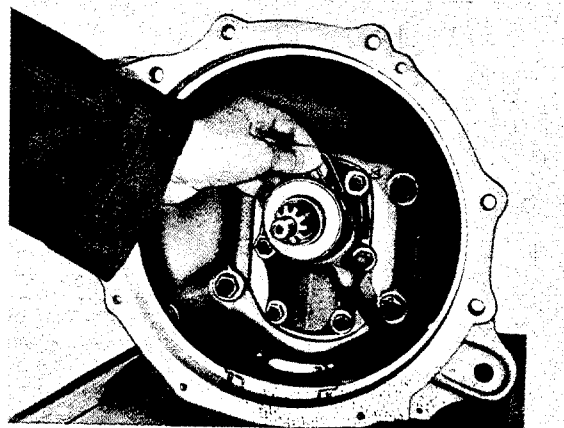


Fig. G 3/1

2. Set gear shift lever to neutral and unscrew transmission cover. To remove the cover, push a screw driver in the recess provided at the cover and pry the cover up (Fig. G 3/2).

Drain the transmission oil.

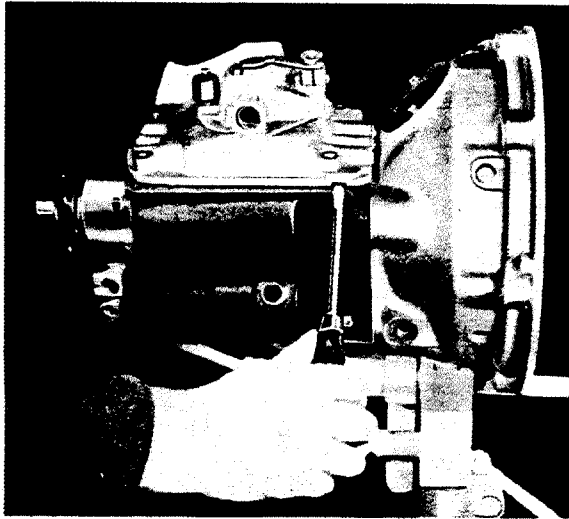


Fig. G 3/2

3. Unscrew clutch housing and front cover of transmission case. Watch out for adjusting washers in cover!
4. Loosen safety at three-arm flange. Engage reverse and fourth speed gear to block the transmission or hold three-arm flange in place by means of holding wrench 187 589 08 07, then unscrew slotted nut with pin wrench 136 589 05 07 or 120 589 04 07 in the case of Type 220 and 186 589 05 07 or 186 589 07 07 in the case of Type 220a. Pull three-arm flange by hand. If necessary, use puller 136 589 03 33.
5. Unscrew rear cover of transmission case with speedometer driveshaft and take off together with helical gear and spacer ring. Watch out for adjusting washers!

Note: In Type 220a the helical gear and spacer ring are made of one piece.

6. Take sealing ring off driveshaft, then remove snap ring in front of spacer sleeve with pliers 136 589 00 37 (Fig. G 3/6) and slip spacer sleeve off.

In Type 220a the snap ring is seated immediately in front of the ball bearing, and the grease retainer is pressed into the front cover of the transmission case.

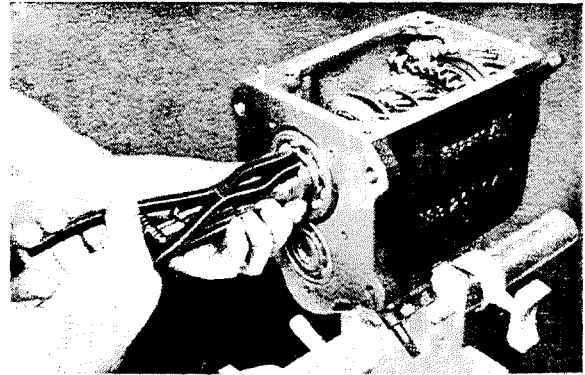


Fig. G 3/6

7. Drive mainshaft towards the front with a plastic hammer until it is possible to grip the bearing at the snap ring and press it forward by means of the two levers 136 589 00 35 (Fig. G 3/7). Pull the bearing with puller 135 589 02 33 (Fig. G 3/7a). Watch out for spacer ring located behind the snap ring!

Note: If it is not required to take the mainshaft apart, install holding yoke 136 589 38 61 between first and second speed gear before driving the mainshaft towards the front and

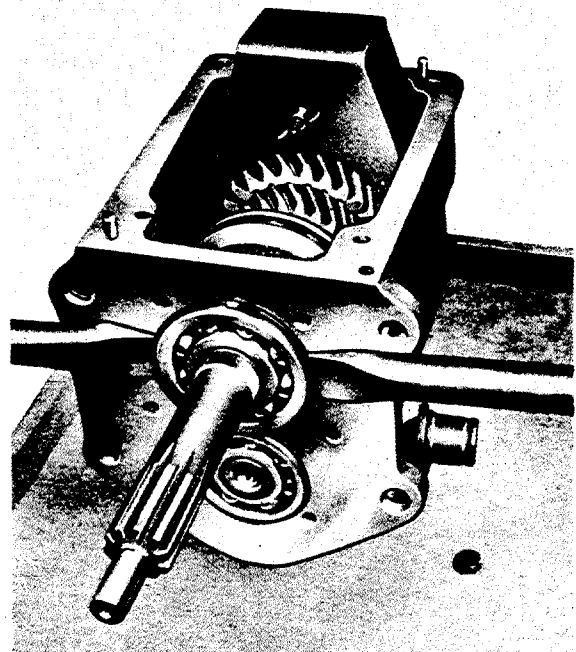


Fig. G 3/7

pulling the ball bearing (Fig. G 3/7). In this way the first speed gear is arrested and will not be displaced when the ball bearing is pulled.

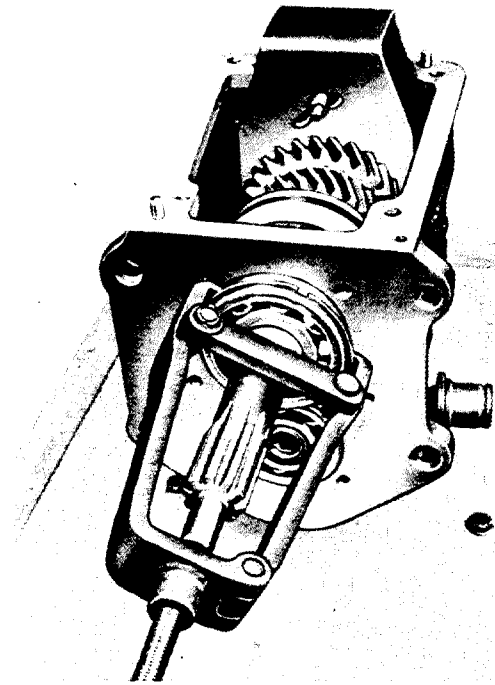


Fig. G 3/7a

8. Force driveshaft with mainshaft towards the rear until snap ring of rear ball bearing can be gripped and pulled by means of pulser 136 589 02 33 (Fig. G 3/8). Immediately after this has been done, tighten sleeve 136 589 07 61 or a suitable length of pipe $31 \times 40 \times 93 \text{ mm} = 1.22 \times 1.57 \times 3.66''$ (in Type 220a sleeve 198 589 02 61 or a length of pipe $31 \times 40 \times 62 \text{ mm} = 1.22 \times 1.57 \times 2.44''$) on mainshaft by means of the slotted nut. This is necessary in order to hold the first speed gear in place. Now the holding yoke 136 589 38 61 can be removed.

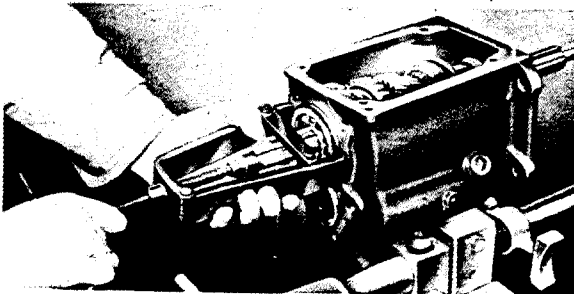


Fig. G 3/8

9. Lift driveshaft and mainshaft somewhat so that countershaft including front bearing can be driven from front to rear by means of punch 136 589 06 39. The countershaft will fall into the bottom part of the housing.

10. Pull driveshaft and mainshaft apart. Take driveshaft out towards the front and lift mainshaft out as indicated in Fig. G 3/10. Remove roller bearing and synchronizer ring.

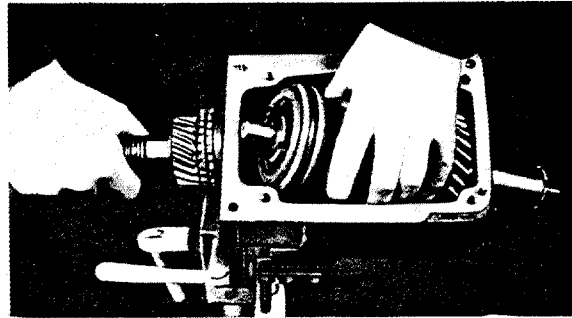


Fig. G 3/10

11. Place angle 136 589 11 61 so on countershaft that the second speed gear is propped against the wall of the transmission case (Fig. G 3/11).

Press rear ball bearing off countershaft by means of the two levers 136 589 00 35 (Fig. G 3/11a). Lift countershaft out of transmission case.

12. Turn out retaining screw with check nut for reverse shaft.

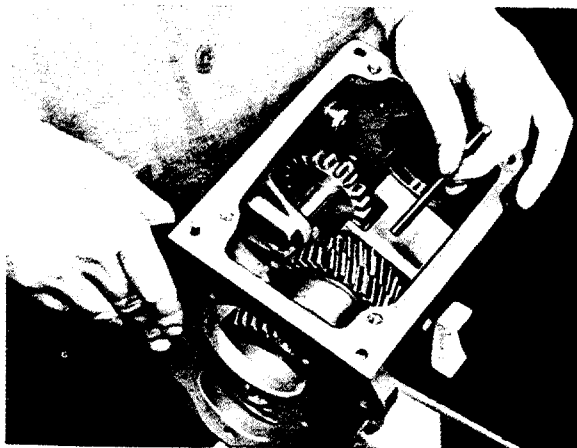


Fig. G 3/11

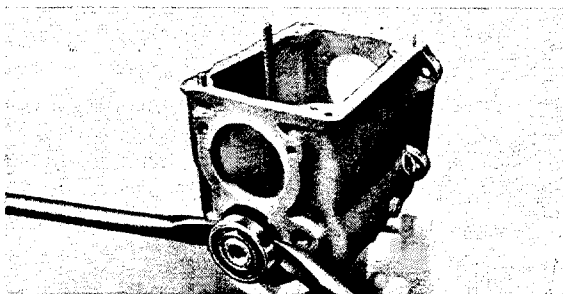


Fig. G 3/11a

Pull reverse shaft out towards the rear with puller 136 589 27 33 (Fig. G 3/12) and take reverse gear out.

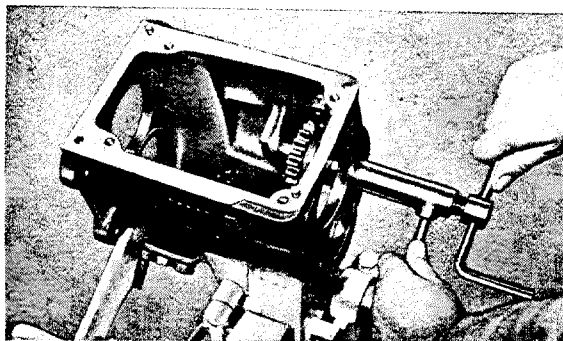


Fig. G 3/12

13. Take off intermediate arm with shift dog to reverse gear.

14. Pull front ball bearing off countershaft.
If necessary, press the two front gears off the countershaft. Before this is done, take lock ring off.

Note: The two helical gears are pressed on with a great overlap. They can only be removed by means of a hydraulic press or a large screw press (Fig. G 3/14)

Before the new gears are pressed on, check whether countershaft runs true. The permissible out of true is 0.02 mm (0.0008").

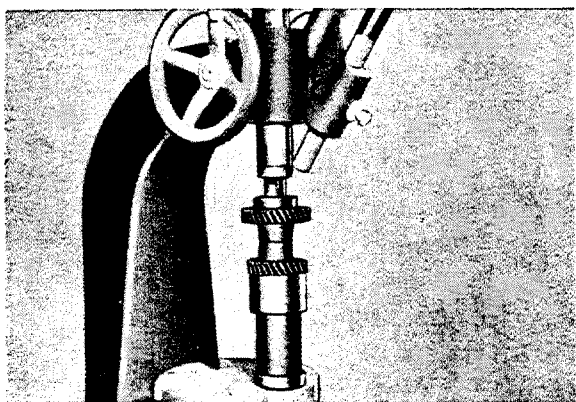


Fig. G 3/14

Mainshaft:

Note: The mainshaft of Type 220a has a collar as butting face for the third speed gear and not a steel bushing with collar as in Type 220. Due to this modification, disassembly of the mainshafts of Type 220 and Type 220a differs in several respects. The deviations will be seen from the following description.

15. Loosen slotted nut and remove sleeve 136 589 07 61.

Take off first speed gear with synchronizer ring, roller assembly and contact washers (Fig. G 3/15).

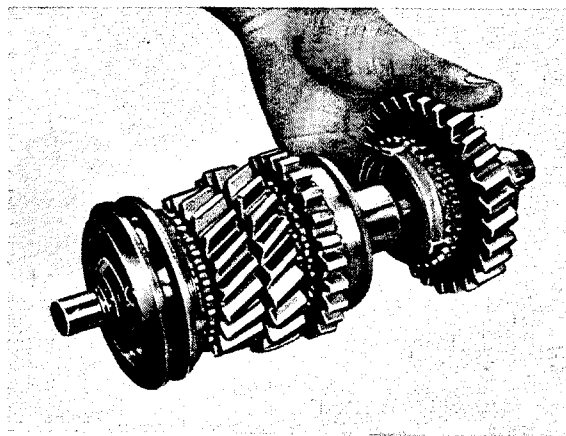


Fig. G 3/15

16. Take off first and second speed synchronizer unit (at the same time reverse gear) with synchronizer ring, contact washer and key (Fig. G 3/16).

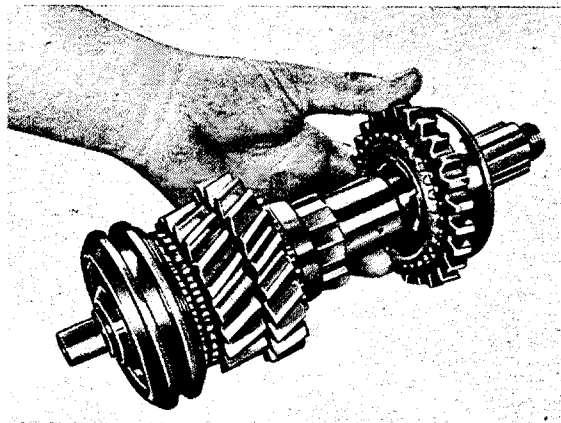


Fig. G 3/16

Type 220

17. Clamp mainshaft in a vise (use lead jaws). Loosen lock plate on mainshaft and unscrew slotted nut with pin wrench 120 589 04 07 (Fig. G 3/17).

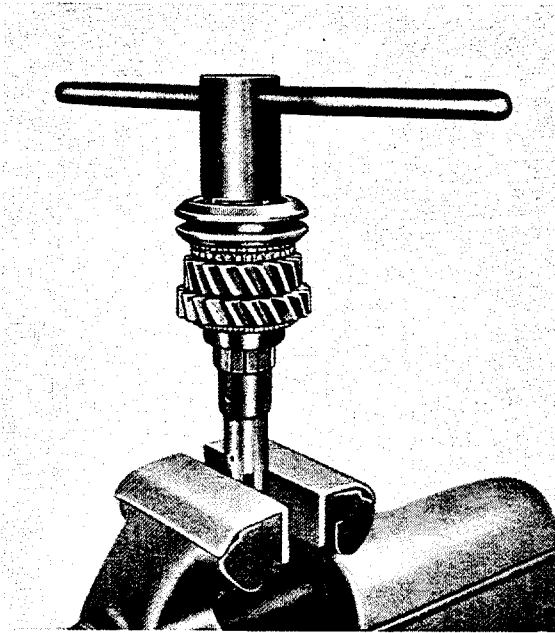


Fig. G 3/17

18. Take off third and fourth speed synchronizer unit.

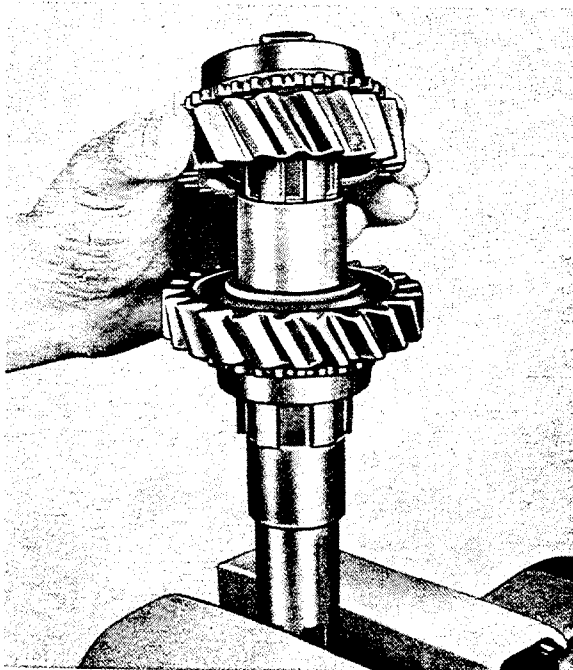


Fig. G 3/19

19. Take off third speed gear with synchronizer ring as well as brass washer (contact washer) and steel bushing with collar (Fig. G 3/19).
20. Take off second speed gear with two sets of 47 needles each and spacer ring as well as contact washer. Watch out for the needles!

Type 220a

- 17a. Turn contact ring of second speed gear so that splines of mainshaft and contact ring (1) coincide (Figs. G 3/17 and 17a).

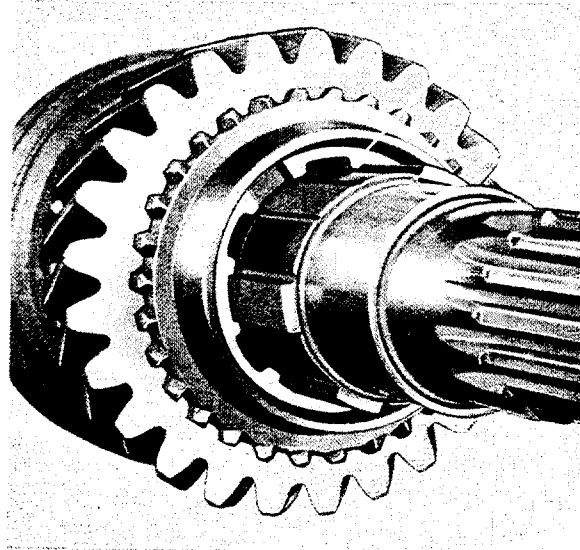


Fig. G 3/17a

Take off second speed gear together with contact ring and split roller assembly (Fig. G 3/17b).

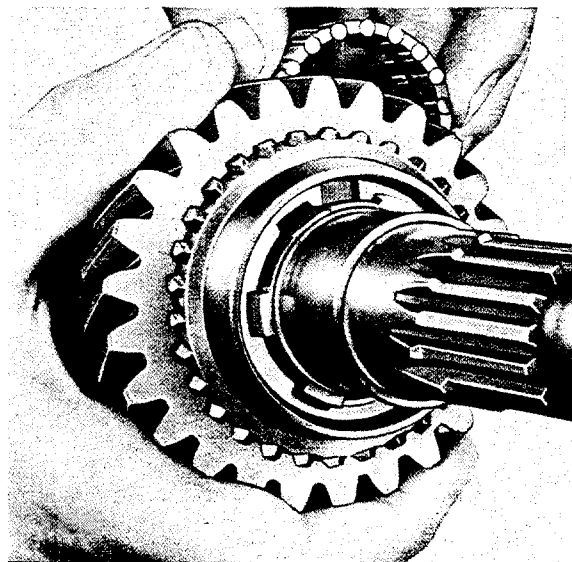


Fig. G 3/17b

18a. Clamp mainshaft in a vise. Loosen lock plate on mainshaft and unscrew slotted nut with pin wrench 120 589 04 07.

19a. Take off third and fourth speed synchronizer unit.

20a. Take off third speed gear with synchronizer ring and contact washer.

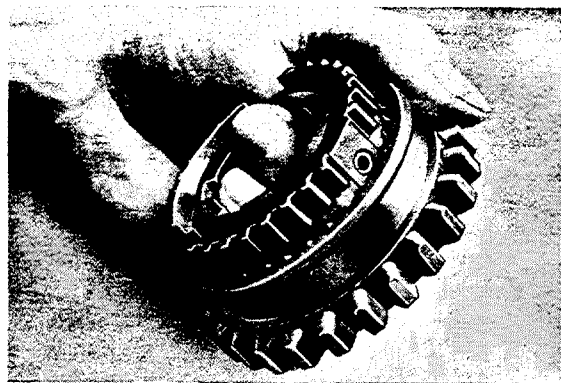


Fig. G 3/22

Synchronizer Units:

21. To disassemble the synchronizer units, insert synchronizer ring using it to push the synchronizer unit together with the followers a little out of the sleeve (Figs. G 3/21 and 21a).

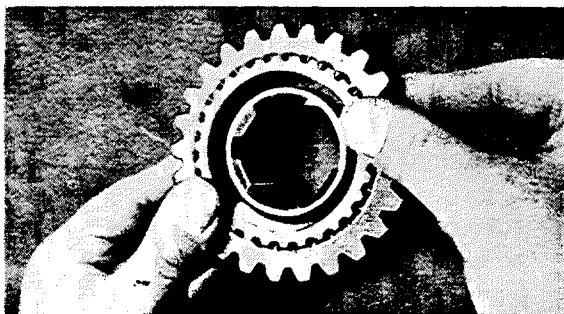


Fig. G 3/21



Fig. G 3/22a

Transmission Cover:

23. Drive out key retaining the shifting rails with a drift (Fig. G 3/23).

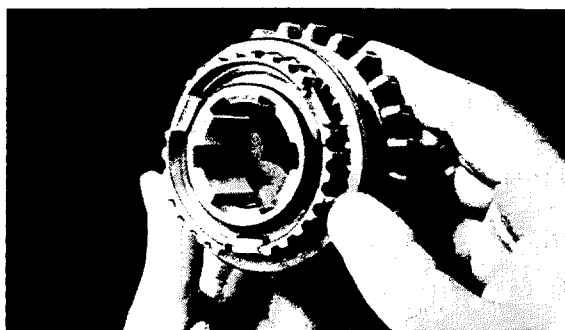


Fig. G 3/21a

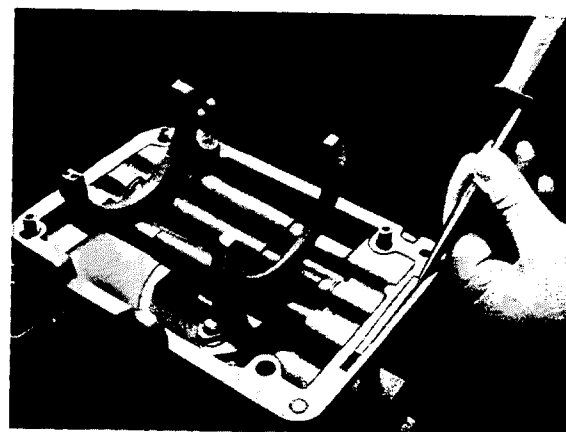


Fig. G 3/23

22. Push the three followers with the index finger forward one after the other and take the ball out (Fig. G 3/22). Take out synchronizer unit (Fig. G 3/22a).

24. Force shifting rails out of the cover with a drift. Be careful! Secure locking balls and pressure springs by following up with a suitable pin (Fig. G 3/24).

Be careful that spacer tubes and shims do not fall into the transmission cover.

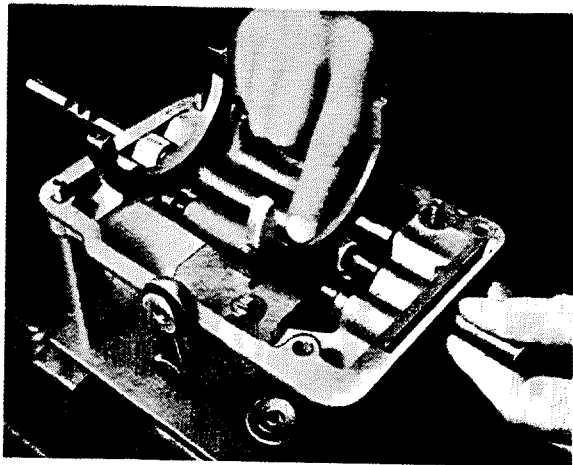


Fig. G 3/24

25. Remove shifting rails and slide spacer tube and shims on the respective shifting rail or note the dimensions.

26. Turn out screw plug for reverse speed stop and take out spring with latch and adjusting washer.

In Type 220, the stop for the reverse speed is located in the bearing body of the steering column gear shift.

27. Remove pointer from gear selector lever (in Type 220 only). Loosen nuts of selector and shift lever and pull both levers.

Note: Before taking off the levers mark the position of selector and shift lever on the respective shaft if there exist no marks.

28. Remove guide plate.

29. Lift out selector finger.

30. Take out lock ring in front of cover plate and drive shifter shaft with a suitable drift towards the cover plate forcing out the plate (Fig. G 3/30).

Take out washer and shift finger.

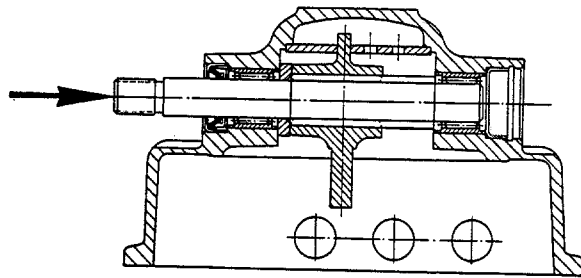


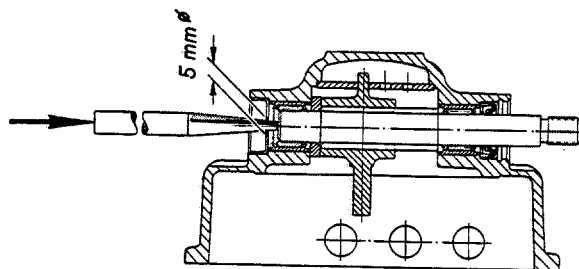
Fig. G 3/30

31. Push needle bearing out of bore in transmission cover. Press out grease retainer.

32. Loosen locking plate fastening screws and remove the plate.

For right-hand steering systems the following deviations regarding cf. 30 and 31 must be taken into consideration:

30. Take out lock ring in front of grease retainer. Use a drill having a diameter of approx. 5 mm (0.2") to drill a hole into the cover plate, then drive shifter shaft out by means of a suitable drift (Fig. G 3/30a). Take out washer and shift finger.



Dia. 5 mm (0.2")

Fig. G 3/30a

31. Push needle bearing out of bore in transmission cover. Press out cover plate.