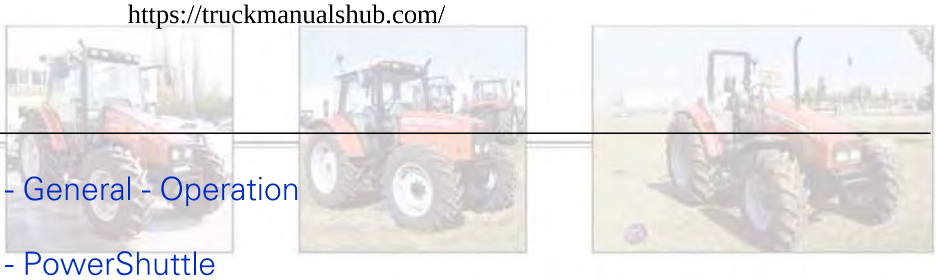
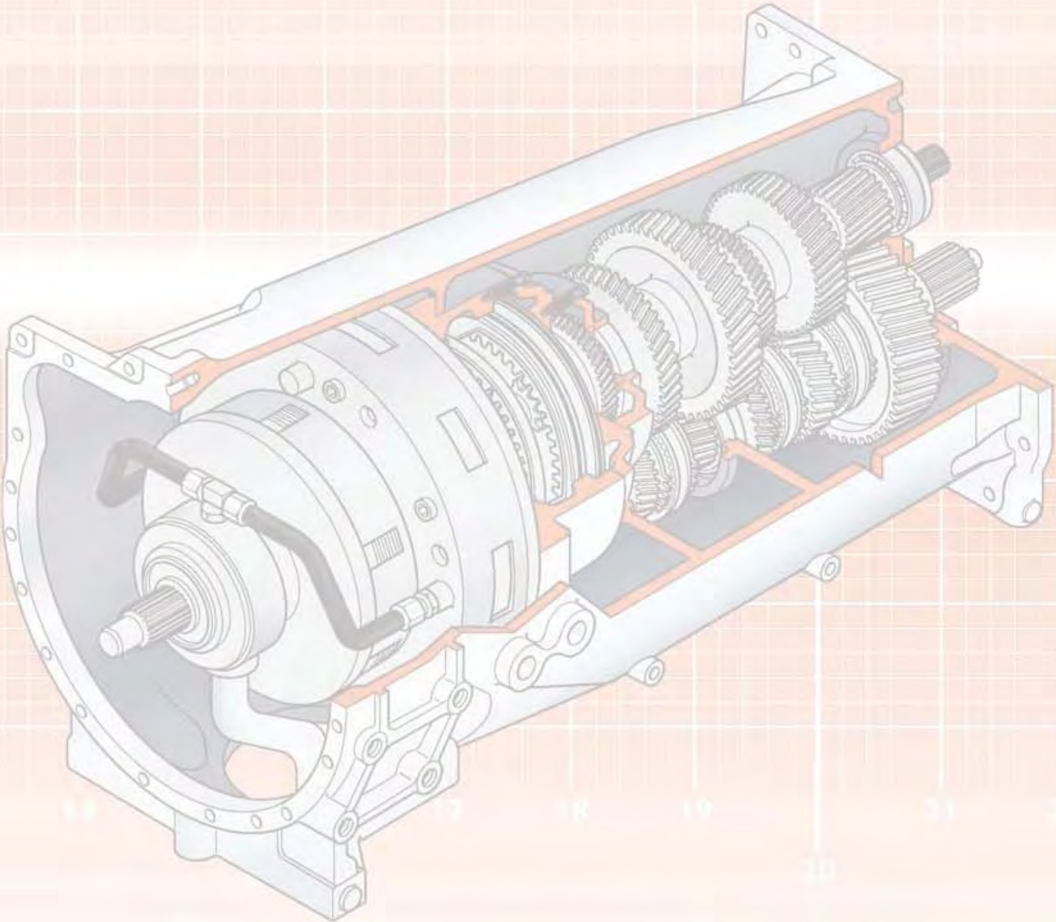


05 - Gearbox

CONTENTS



Gearbox



5A10 - GBA20 - Mechanical reverse shuttle - General - Operation

CONTENTS

A . General

The housing of the GBA20 gearbox with mechanical reverse shuttle consists of the following main components, in the order given:

- the engine clutch hydraulic mechanism,
- the Speedshift input unit,
- the mechanical reverse shuttle,
- the main gearbox,
- the creeper or super creeper gearbox (depending on option).

This section is mainly limited to a description of the gearbox.

Only a partial description is given of each major component, as more specific and detailed descriptions are given in their respective sections.

Engine clutch hydraulic mechanism

The engine clutch hydraulic mechanism comprises two slave cylinders, a guide and a thrust ball bearing. They are fitted to the front of the main gearbox input unit.

Speedshift input unit

The Speedshift input unit consists of a hydraulic mechanism and an epicyclic gear train. It is located at the front of the mechanical reverse shuttle. It allows two gearbox input ratios to be obtained via a solenoid valve.

Mechanical reverse shuttle

The purpose of the mechanical reverse shuttle is to transmit drive from the Speedshift to the layshaft fitted at the front of the main gearbox.

The mechanical reverse shuttle is located in the rear housing of the input unit, behind the Speedshift.

Main gearbox

The main gearbox consists of four basic gears and two speed ranges (Hare and Tortoise), giving a total of eight ratios for each direction of travel.

This transmission covers all usage requirements.

Creeper gearbox (optional)

The creeper gearbox is fitted to the gearbox output shaft.

It allows slow travel. It operates at a ratio of 4/1.

It is controlled mechanically and should only be engaged when the gearbox is in Tortoise range.

Super creeper gearbox (optional)

The super creeper gearbox is also fitted to the gearbox output shaft.

It consists of two epicyclic gear trains which allow a reduction ratio of 14/1, and therefore allows very slow travel.

Like the creeper gearbox, it is controlled mechanically.

GBA20 - Mechanical reverse shuttle - General - Operation

Parts list (Fig. 1 and Fig. 3)

(3) Screw
(4) Ring
(5) Secondary shaft
(6) Output sun gear
(7) Input sun gear
(8) Planet gear pins
(9) Planet carrier unit
(10) Seal (7 mm thick)
(11) Seal (10 mm thick)
(12) Double planet gears
(13) Unit
(14) Spacer
(15) Hub
(16) Needle roller bearings
(17) Friction washers
(18) Spring washer (Belleville)
(19) Rivets
(20) Thrust plate
(21) Brake disc
(22) "O" ring
(23) "O" ring
(24) Seal
(25) Hydraulic cover plate
(26) "O" ring
(27) Front cover plate
(28) Clutch piston
(29) "O" ring
(30) Intermediate plates
(31) Rings
(32) Needle roller bearing
(33) Ring carrier
(34) Threaded plug Ø 8
(35) Threaded plug Ø 10
(36) Primary shaft
(37) Circlip
(38) Tab washer
(39) Washer
(40) Ball bearing
(42) Discs
(43) Spring washers
(46) Seal
(47) Seal
(48) Brake piston
(50) Planet carrier assembly (30 kph version)
(51) Circlip
(52) Shim(s)
(53) Ball bearing
(54) Washer
(55) Reverse driving gear
(56) Needle roller bearing
(57) Double cone synchroniser
(58) Needle roller bearing
(59) Friction washer
(60) Ball bearing
(61) Ring
(62) Forward driving gear
(63) M8 screw
(64) M10 screw
(65) Needle roller bearing
(66) Seal
(67) Washers
(68) Pin
(69) Screw
(70) Spacer
(71) Needle roller bearings
(72) Reverse layshaft gear

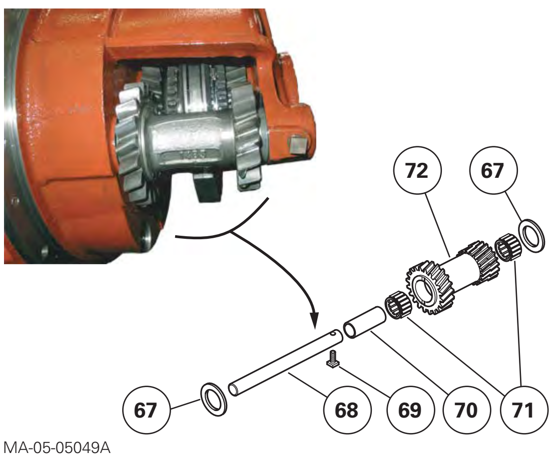


Fig. 1

Speedshift GBA20 mechanical reverse shuttle

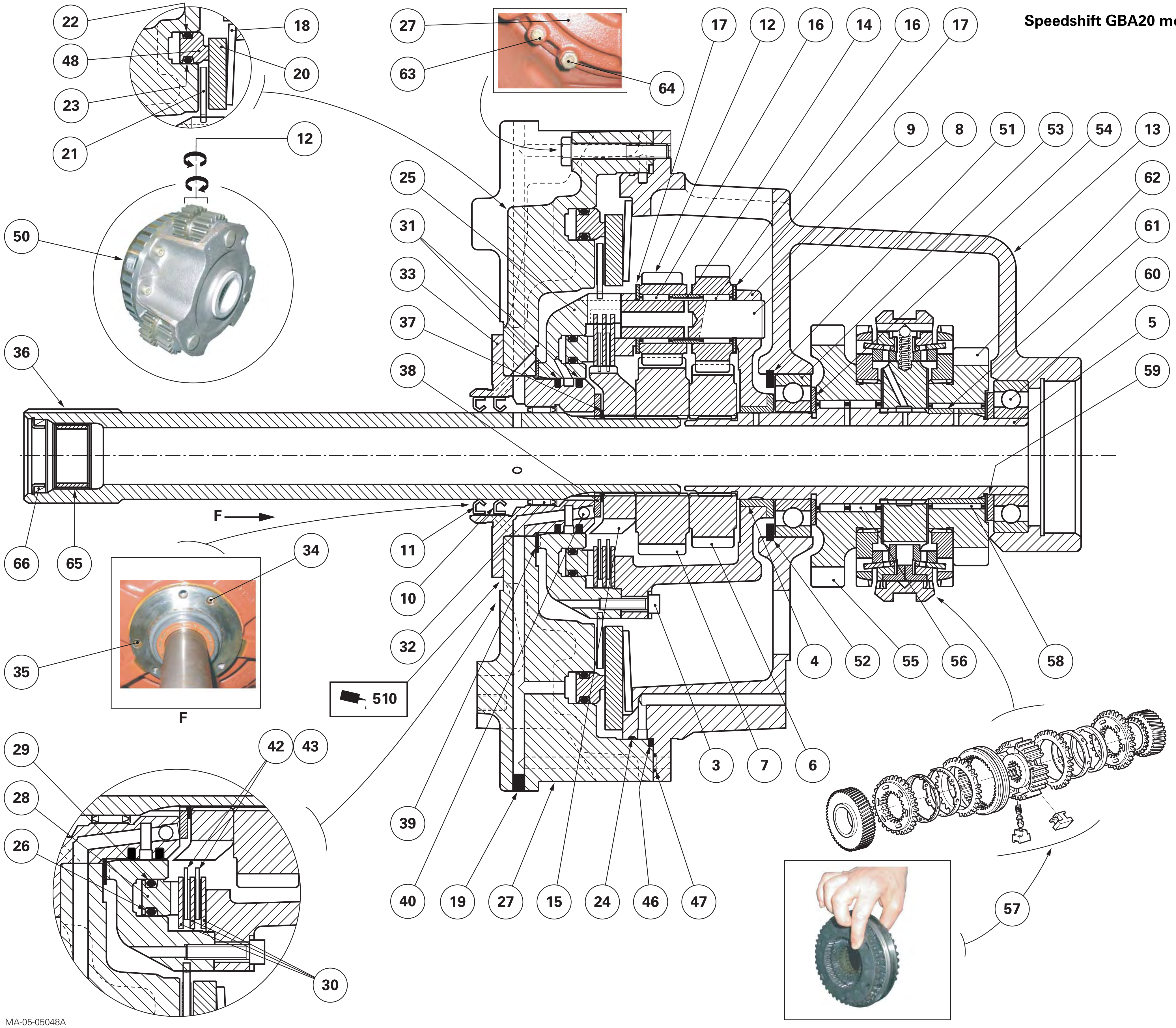


Fig. 2

Parts list Fig. 3

(1) Bearing cone
(2) Bearing cup
(3) Shim(s)
(6) Splined washers
(7) 1st driving gear
(8) Ring
(11) 1st - 2nd single cone synchroniser
(14) 2nd driving gear
(16) Bearing cup
(17) Bearing cone
(18) 4th driving gear
(23) 3rd - 4th single cone synchroniser
(24) Needle roller bearing
(26) Circlip
(27) Washer
(28) Needle roller bearings
(29) 3rd driving gear (Hare)
(31) Hare / Tortoise single cone synchroniser
(32) Washer
(35) Ring
(36) Tortoise gear
(37) Bearing cup
(38) Shim(s)
(39) Bearing cone
(40) Bearing cone
(41) Screw
(42) Shim(s)
(43) Shim
(44) Output shaft
(45) Circlip
(46) Stop plate
(48) Bearing cup
(49) Circlip
(50) Deflector
(51) Shim(s)
(52) Bearing cup
(53) Bearing cone
(54) Intermediate shaft
(55) 3rd driven gear
(56) 4th driven gear
(57) Spacer
(58) Shim(s)
(59) 2nd driven gear
(60) 1st driven gear
(61) Circlip
(62) Needle roller bearing
(63) Bearing cone
(64) Bearing cup
(65) Gearbox housing
(67) Input gear
(68) Nut
(69) Layshaft
(70) Snap ring
(71) Lubrication pipe
(72) Spring
(77) Washer with flat sections
(78) Tab washer
(79) Needle roller bearing
(80) Spacer
(81) Needle roller bearing
(82) Spacer

GBA20 gearbox mechanical reverse shuttle

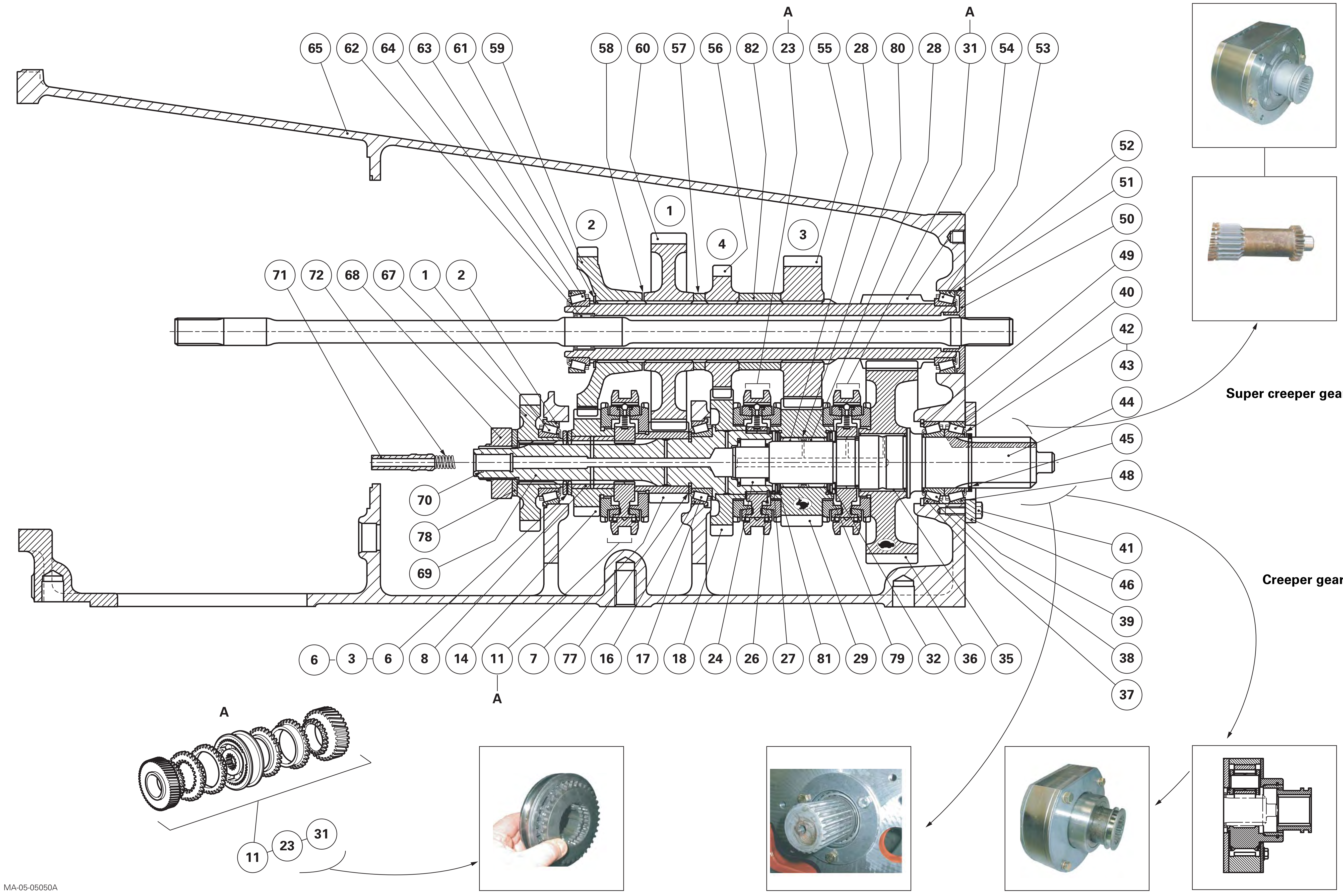


Fig. 3

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B . Construction and description

Construction

The GBA20 gearbox with mechanical reverse shuttle consists of three gear trains fitted to the:

- layshaft;
- intermediate shaft (or main shaft),
- output shaft.

It allows eight basic synchronised gear ratios:

- four gear ratios: 1st, 2nd, 3rd and 4th;
- two range ratios: Hare and Tortoise.

Its main characteristic is its assembly of three single cone synchronisers.

The main gearbox consists of four synchronised gears. A gear idle-mounted to the output shaft and controlled by a synchroniser allows the four initial gears to be doubled to obtain the eight basic gears.

The layshaft and the intermediate shaft are supported by tapered roller bearings.

The output shaft is fitted on two tapered roller bearings and one needle roller bearing.

The layshaft bearing cups are fitted up against the housing.

All gears have helical teeth and are constantly meshed.

To ensure optimum gearbox reliability, the bearings are fitted:

- with preload for the layshaft,
- with clearance for the intermediate shaft.

The output shaft may be set either with a slight clearance or a slight preload.

Lubrication

The lubricating oil of the lower shaftline is supplied from the tractor hydraulic system via a 1.5 bar valve. It passes through a channel in the layshaft and output shaft. Radial bores direct the oil to the gears, bearings, rings and synchronisers.

The splines of the Hare/Tortoise synchroniser hub are lubricated via a radial bore on the output shaft.

The oil flowing inside the intermediate shaft lubricates the tapered roller bearings and needle roller bearing (62). These bearings are fitted respectively at the ends of the shaft.

Description (Fig. 3)

Drive is transmitted from the main unit by the driven gear (67) which is permanently meshed with the driving gear (62) when in forward position (Fig. 7) or the layshaft gear (72) when in reverse position (Fig. 4).

The driven gear (67) is splined to the layshaft (69).

The two synchroniser hubs (11) (23) are splined to the layshaft (69).

The 2nd driving gear (14) is freely mounted on a ring (8).

The 1st (7) and 4th (18) driving gears are freely mounted directly on the shaft.

The 3rd driving gear (29) is fitted on needle roller bearings (28). It is also fitted with a needle roller thrust bearing on each of its faces to absorb any axial pressure.

The hub of the Hare / Tortoise synchroniser (31) is secured to the output shaft (44).

The driven gears (55), (56), (59) and (60) drive the intermediate shaft (54) by means of splines. The rear teeth of this shaft are constantly meshed with the Tortoise gear (36) idle-mounted on the output shaft.

GBA20 - Mechanical reverse shuttle - General - Operation

C . Operation

Single cone synchronisers

NOTE: *On GBA20 gearboxes with mechanical reverse shuttle, the 1st - 2nd and 3rd - 4th gear synchronisers and the Hare / Tortoise synchroniser are single cone type.*

Parts list (Fig. 4)

(1) Sliding coupler
(2) Cone (brake)
(3) Coupling flange
(4) Ball bearing
(5) Pressure elements
(6) Spring

Locked position (Fig. 4)

When the sliding coupler (1) moves towards the gear to be locked, it presses against the cone (2) which in turn presses against the male cone of the coupling flange (3) by means of the ball bearings (4) and pressure elements (5).

When the synchronisation is set, the sliding coupler (1) can mesh and silently lock with the teeth of the coupling flange (3).

Neutral position (Fig. 4)

The sliding coupler (1) is in the middle position. The balls (4) are pushed into the V groove of the sliding coupler by the pressure springs (6). The gears can turn freely on the shaft. In this neutral position, the sliding coupler is locked by three balls held in place by the pressure springs.

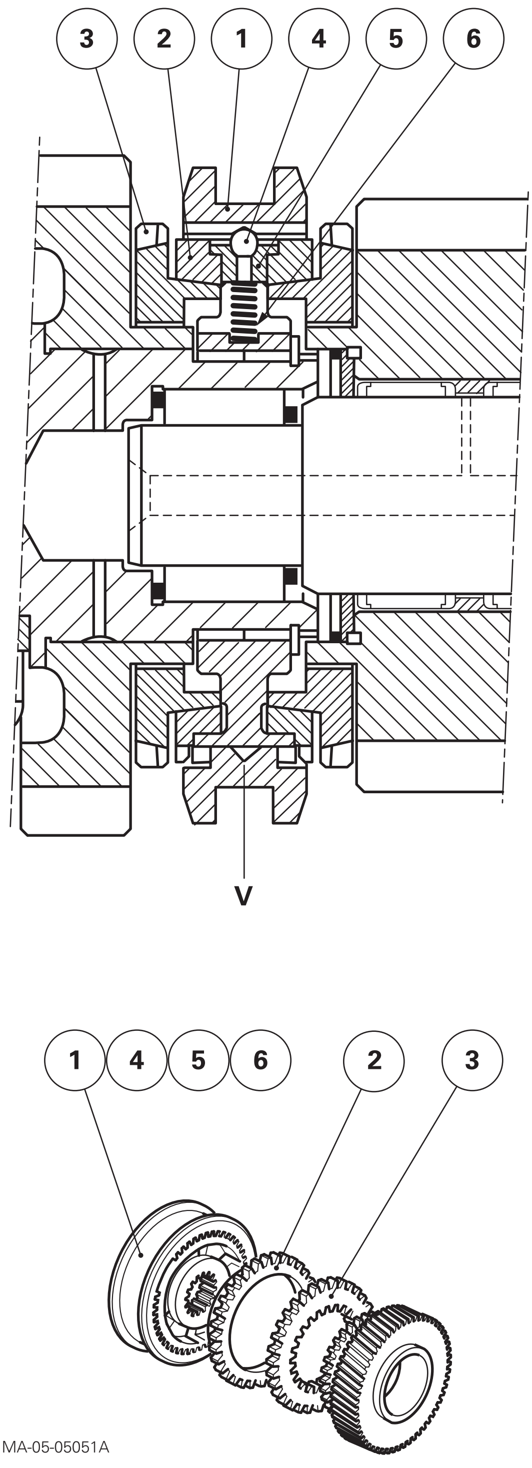

Fig. 4

Overhaul

If the single cone synchronisers (11), (23) and (31) have been disassembled, check the wear to the cone (2) as follows:

1. Stack the coupling flange (3) and the cone (2) on the relevant gear.
2. Correctly position the cone (2) on the male cone of the coupling flange, turning it one way then the other several times and applying manual pressure.
3. Using a set of shims, measure dimension X (Fig. 5) at three equidistant points.

   Calculate the average of the three values and proceed as described below, depending on the result obtained.

   On a new synchroniser, dimension X must be **1.5 mm maximum**.

   After operation, if X is **less than or equal to 0.80 mm**:

   - replace the cone (2)
   - check the measurement of X again, using the same process.

     If dimension X is still incorrect, also replace the coupling flange (3) or, if necessary, the entire synchroniser.

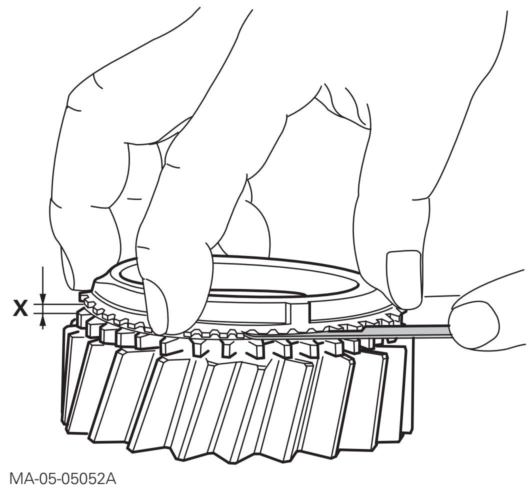

Fig. 5

Double cone synchroniser

***Note:** On GBA20 gearboxes, the mechanical reverse shuttle synchroniser is double cone type.*

Parts list (Fig. 6)

(1) Sliding coupler
(2) Cone (brake)
(3) Coupling flange
(4) Ball bearing
(5) Pressure elements
(6) Spring
(7) Ring
(8) Cone (brake)

Advantages and operation

The double cone synchroniser has the following advantages: improved reliability and increased resistance to transmission loads.

The operating principle of the double cone synchroniser is similar to that of the single cone synchroniser. The positions (locked and neutral) are obtained in the same way.

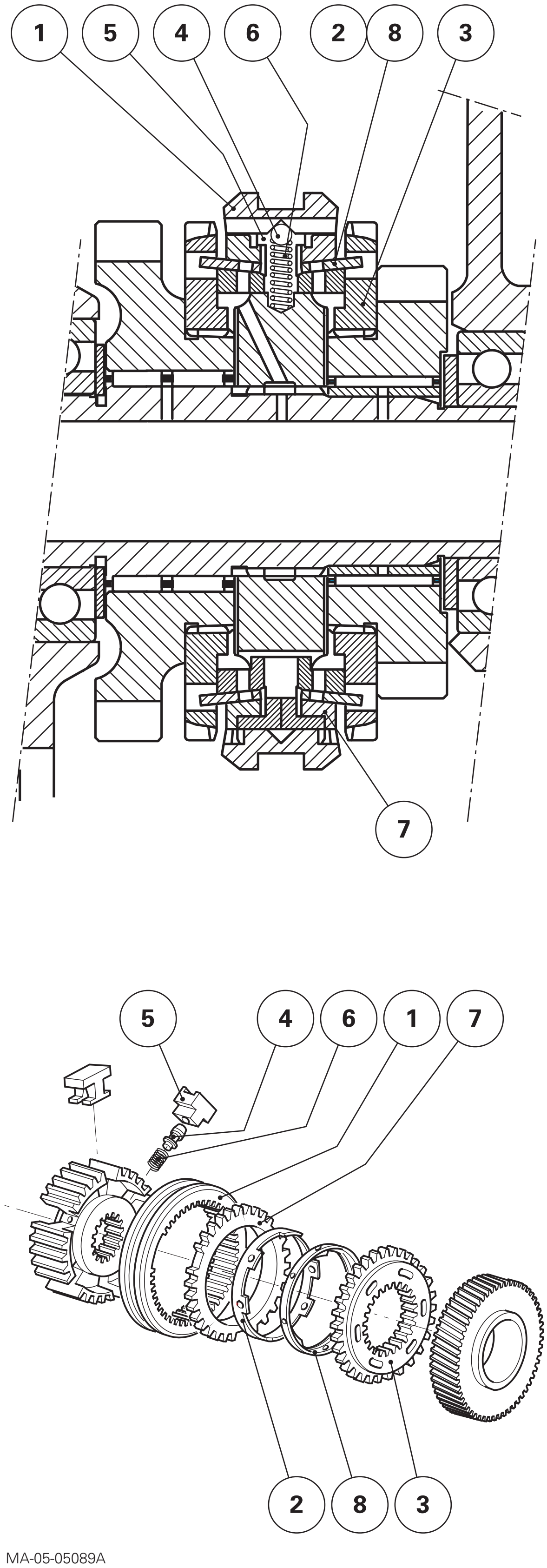

Fig. 6

Overhaul

If the double cone synchroniser of the mechanical reverse shuttle has been disassembled, check the cones (2) and (8) for wear as follows:

4. Stack the coupling flange (3), cones (2) and (8) and ring (7).

5. Correctly position the ring (7) on the cones (2) and (8), turning it one way then the other several times and applying manual pressure.

6. Using a set of shims, measure dimension X (Fig. 7) at three equidistant points.

Calculate the average of the three values and proceed as described below, depending on the result obtained.

On a new synchroniser, dimension X must be **1.6 mm minimum**.

After operation, if X is **less than or equal to 0.60 - 0.80 mm**:

- replace the cones (2) and (8)
- check the measurement of X again, using the same process.

  If dimension X is still incorrect, also replace the ring (7) or, if necessary, the entire synchroniser.

Slow speed range (Tortoise)

Gear engagement is obtained by moving one of the synchroniser sliding couplers (11) or (23) to join, in rotation, the layshaft (69) with one of the freely-mounted gears (1st, 2nd, 3rd, 4th). No matter what ratio is selected, the drive is transmitted to the intermediate shaft (54). The output shaft (44) is driven by the teeth machined on the intermediate shaft, which is constantly meshed to the idle-mounted gear (36).

The low range (Tortoise) is obtained by moving the synchroniser sliding coupler (31) backwards.

High speed range (Hare)

The high speed range is obtained by moving the synchroniser sliding coupler (31) forwards, meshing the driving gear (29) and the output shaft.

Consequently, in 3rd gear Hare, the intermediate shaft (54) is passive. The other gears are obtained by moving the synchroniser sliding couplers (11) or (23) as with the Tortoise range. Drive is transmitted to the output shaft (44) by driven gears (29) and (55).

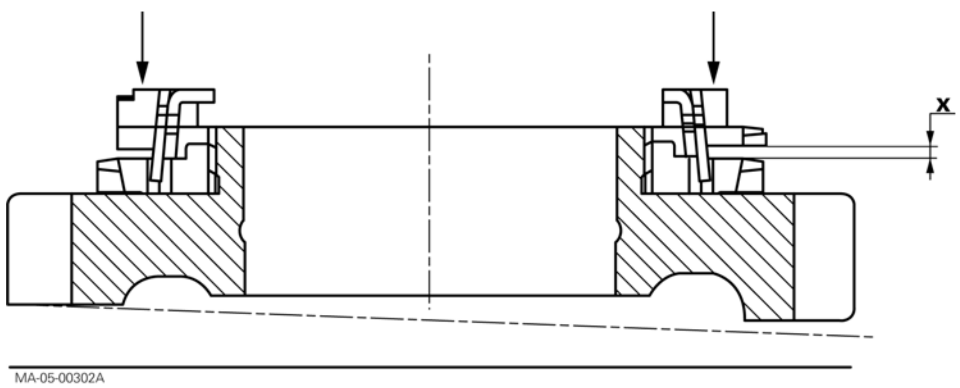

Fig. 7

D . Specifications of the GBA20 transmission assembly with mechanical reverse shuttle

See Fig. 8.

Legend

J Clearance
P Preload

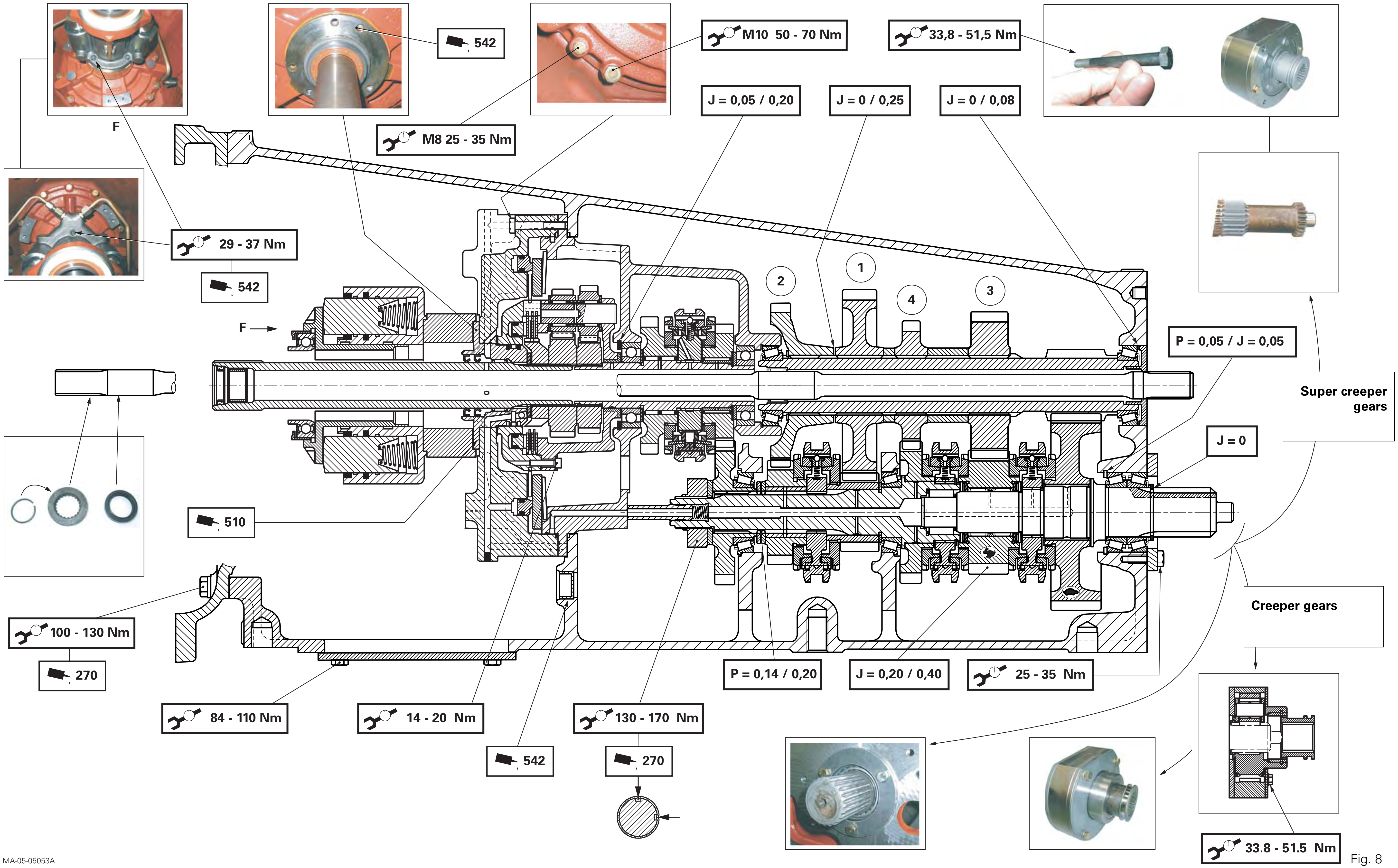
542
M10 50 - 70 Nm
33,8 - 51,5 Nm
J = 0,05 / 0,20
J = 0 / 0,25
J = 0 / 0,08
M8 25 - 35 Nm
F
29 - 37 Nm
542
2
1
4
3
F
P = 0,05 / J = 0,05
Super creeper gears
J = 0
510
100 - 130 Nm
270
84 - 110 Nm
14 - 20 Nm
542
130 - 170 Nm
270
P = 0,14 / 0,20
J = 0,20 / 0,40
25 - 35 Nm
Creeper gears
33.8 - 51.5 Nm
MA-05-05053A

Fig. 8

5A11 - GBA20 - Mechanical reverse shuttle - Input unit

CONTENTS

A . General

The GBA20 input unit with mechanical reverse shuttle (Fig. 1) consists of an interchangeable module.

It is located at the front of the main gearbox.

It is made of two separate parts: the mechanical reverse shuttle and the Speedshift (see chapter 5).

The input unit receives drive from the engine clutch and transmits it to the transmission via a driving gear (forward operation) or a layshaft gear (reverse operation).

These gears are located in the rear compartment of the input unit.

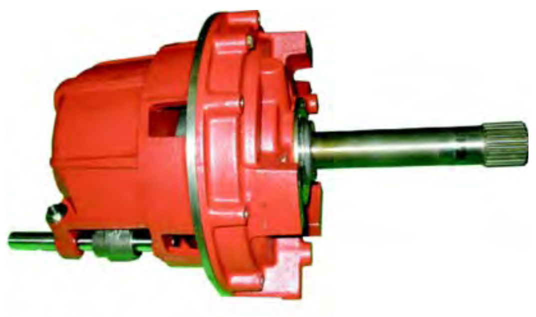

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Fig. 1

B . Removing and refitting the input unit

Preliminary steps

1. Disconnect the tractor between the engine and the gearbox (see chapter 2).
2. Mark the PTO shaft position and remove it from the gearbox.
3. Separate the hydraulic mechanism (1) from the input unit spacer (Fig. 2 and chapter 4)
4. Drain the transmission.
5. Remove the selector cover plate (see chapter 5).
6. Remove the selector (2) from the mechanical reverse shuttle (Fig. 2).
7. Attach tool ref. 3376883M1 to the front cover plate of the input unit (Fig. 3).

   IMPORTANT: *To attach the tool to the front cover plate of the input unit correctly, use locally obtained screws (1) (Fig. 3) that are long enough and of suitable strength.*

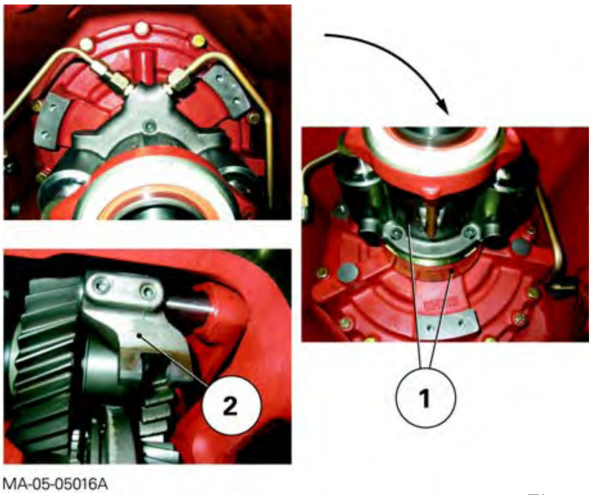

Fig. 2

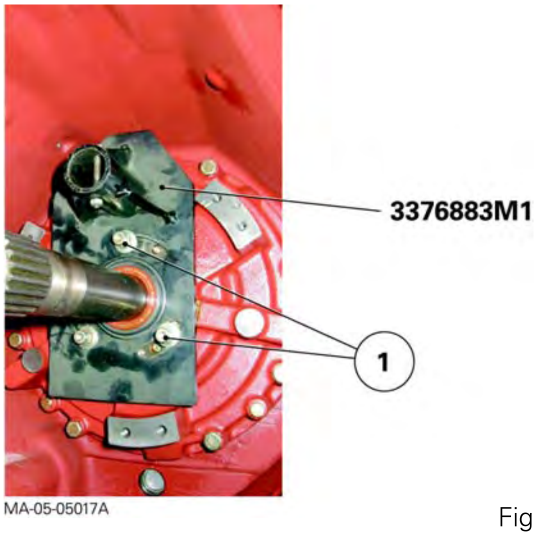

Fig. 3

Removal

8. Take out the M10 screws (1) (Fig. 4).

__Important:__ Do not take out the M8 screws (2) (Fig. 4) to avoid removing certain parts from the input unit.

9. Remove the gearbox input unit using tool ref. 3376883M1 (Fig. 4) and the handling bar (see § C).

Caution: Use the handling bar to prevent the input unit from tipping over during removal.

10. After removing the input unit, separate the tool from the front cover plate if necessary.

11. Discard the "O" rings (2) and (3) (Fig. 5).

12. Recover the cup (64) (Fig. 6) and the dowel (4) (Fig. 5).

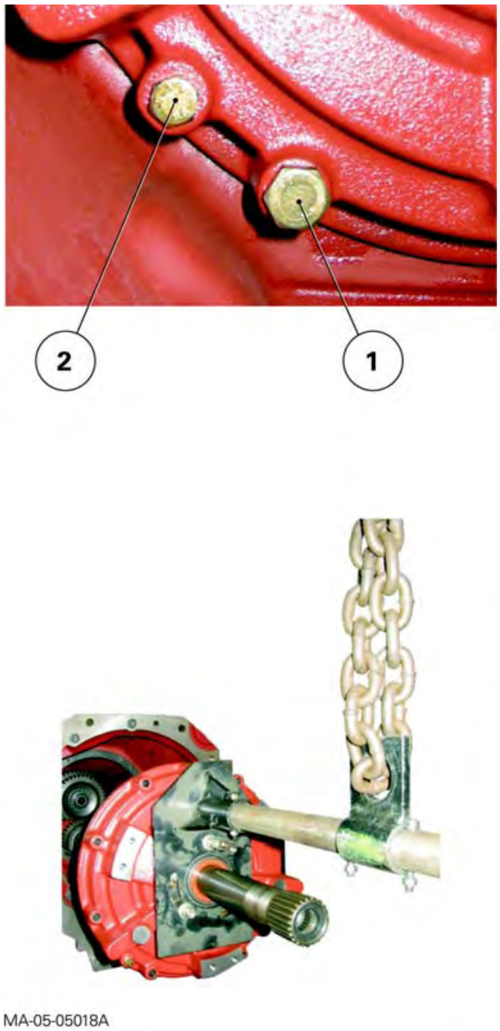

Fig. 4

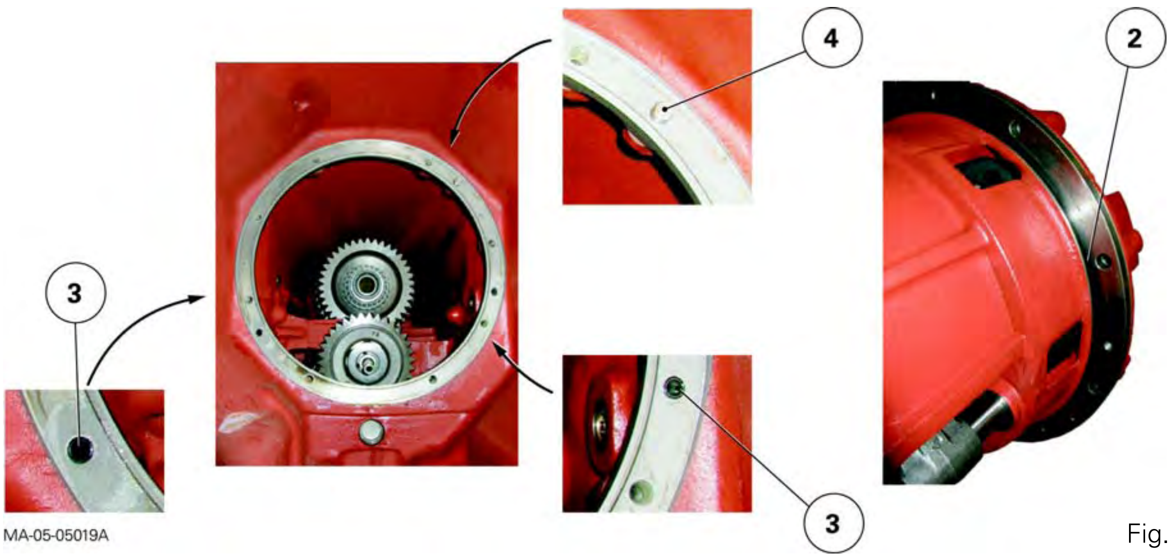

Fig. 5

Refitting the input unit

13. Clean the mating faces of the gearbox and input unit.

14. Check that the cup (64) is present (Fig. 6).

15. Fit the gearbox and input unit with new "O" rings (2) and (3).

Position the dowel (4) (Fig. 5).

16. Screw diametrically opposed guide studs "G" into the gearbox (Fig. 7).

NOTE: *The guide studs "G" assist insertion of the unit into the gearbox. Their use is advisable but not mandatory.*

17. With the help of an operator, insert the input unit into the gearbox and align the gearbox intermediate shaft with the input unit: slightly raise the intermediate shaft through the selector cover plate to ensure alignment (Fig. 8).

18. Turn the input shaft of the unit.

19. Engage the unit in the dowel (4).

Place the input unit on the gearbox bearing face.

20. Fit and tighten the M10 screws to a torque of 50 - 70 Nm.

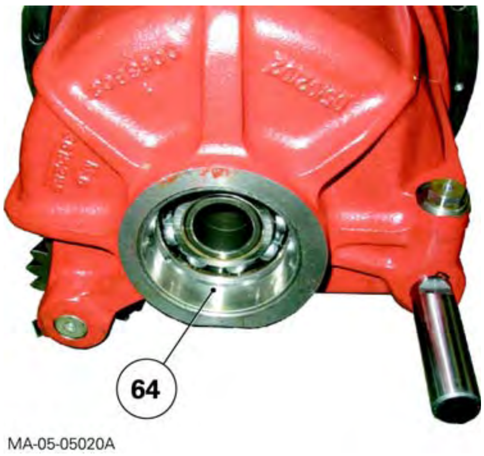

Fig. 6

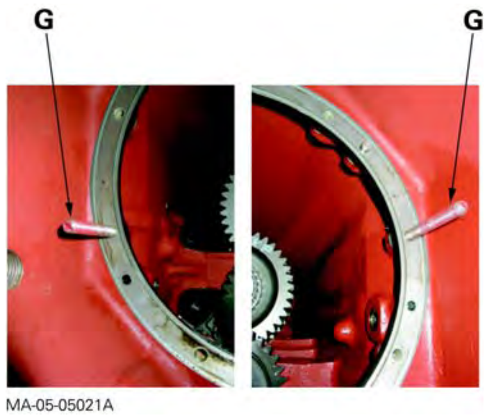

Fig. 7

Fig. 8

Final steps

21. After refitting the input unit, remove the tool ref. 3376883M1 and the handling bar from the front cover plate.

22. Assemble the spacer and hydraulic mechanism (1) of the engine clutch on the front cover plate of the input unit (Fig. 9 and chapter 4).

23. Fit and adjust the selector (2) on the mechanical reverse shuttle (Fig. 2 and chapter 5).

24. Refit the selector cover plate (see chapter 5).

25. Refit the PTO shaft (Fig. 10 and chapter 2).

26. Reconnect the tractor between the engine and the gearbox (see chapter 2).

27. Bleed the hydraulic mechanism of the engine clutch (see chapter 9).

28. Carry out a road test of the mechanical reverse shuttle and the Speedshift (low range and high range).

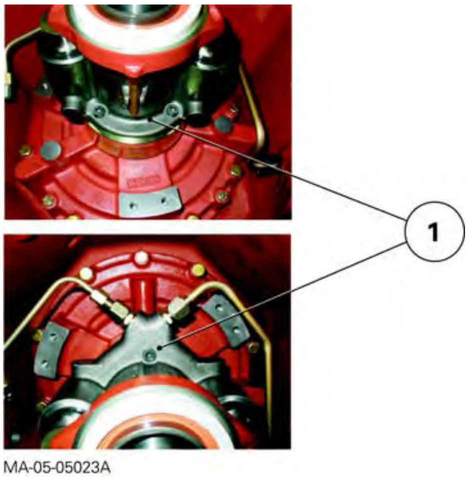

Fig. 9

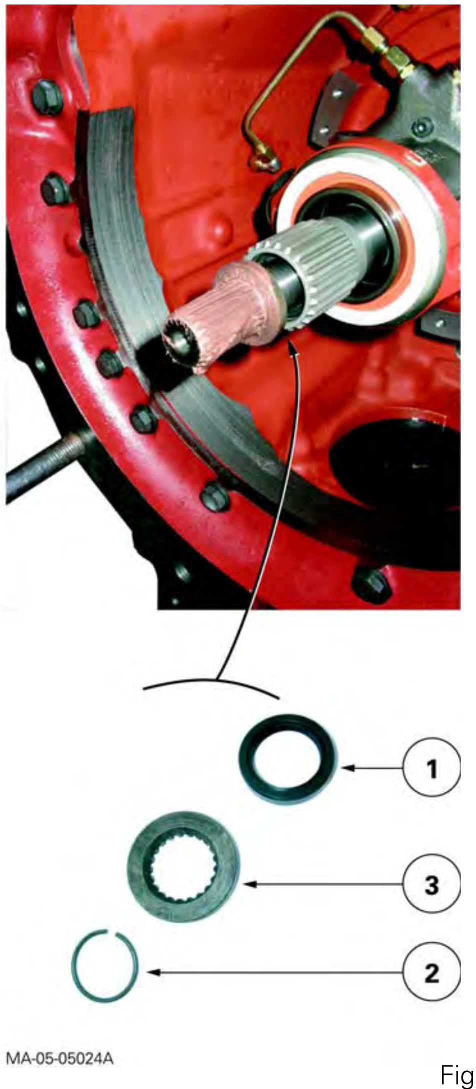

Fig. 10

C . Service tools

Tool available in the AGCO network

- **3376883M1:** Sling for input unit (Fig. 11)

Fig. 11

Makeshift tool

- **Handling bar** (Fig. 12)

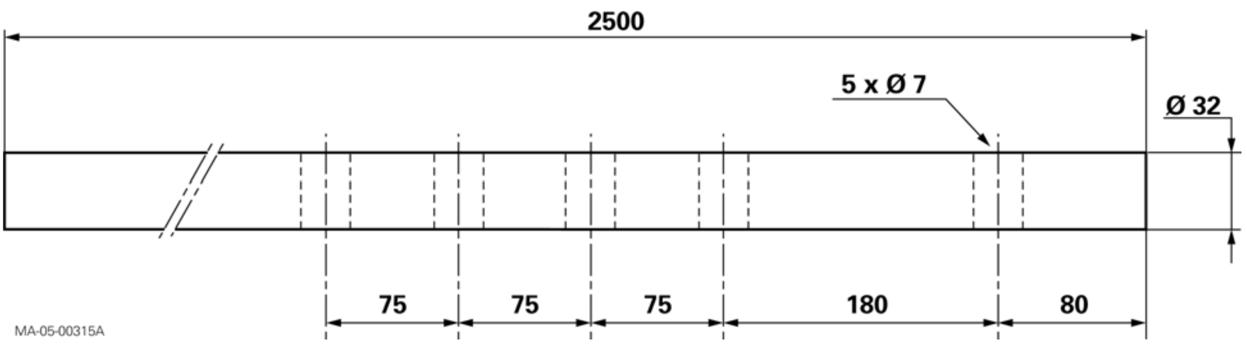

Fig. 12

5A12 - GBA20 - Mechanical reverse shuttle - Shuttle

CONTENTS

A . General

The mechanical reverse shuttle transmits drive from the Speedshift to the input gear (1) of the gearbox (Fig. 1).

The mechanical reverse shuttle is located in the rear housing of the input unit, behind the Speedshift.

It comprises (Fig. 2):
- two helical gears (forward operation (5) and reverse operation (23)) fitted on the needle roller bearings (6) and (20);
- a double cone synchroniser (18) whose hub (2) is splined to the secondary shaft;
- a secondary shaft (19) fitted on two ball bearings and supported by the two bearings of the reverse shuttle unit;
- a selector rail/synchroniser control fork assembly;
- a double layshaft gear (15) constantly meshed with the reverse gear (23) and the input gear (1) of the gearbox.

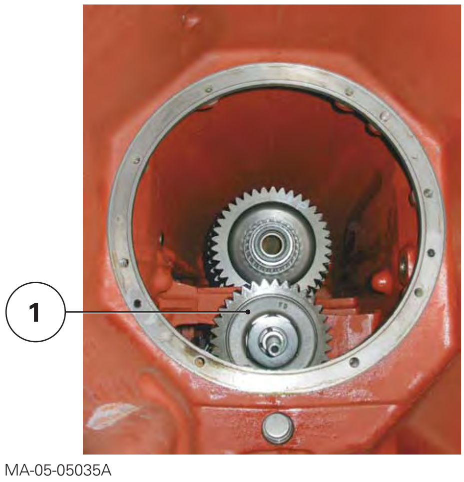

Fig. 1

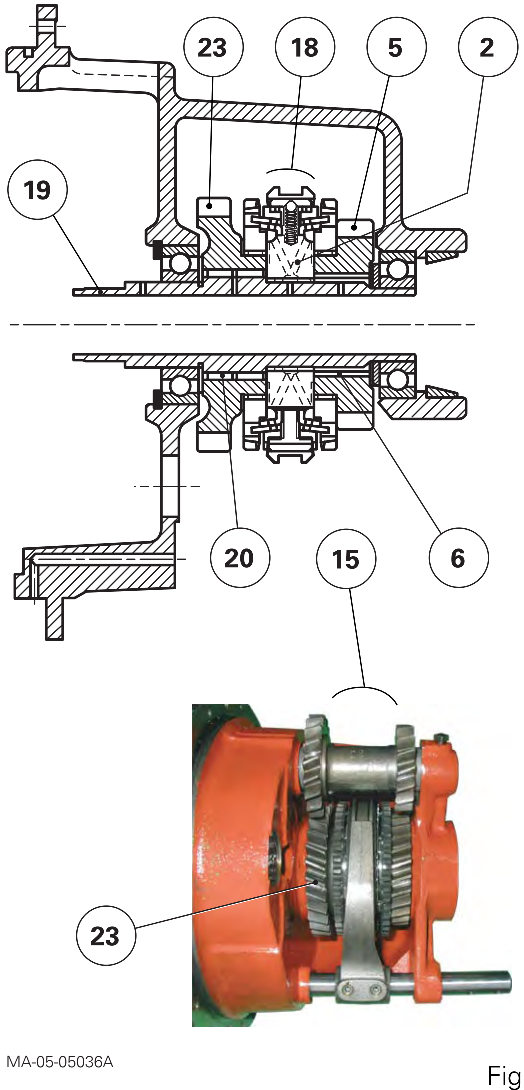

Fig. 2

GBA20 - Mechanical reverse shuttle - Shuttle

Parts list (Fig. 3)

(1) Shim(s)
(2) Synchroniser hub
(3) Sliding coupler
(4) Cone (brake)
(5) Forward driving gear
(6) Needle roller bearing
(7) Ring
(8) Friction washer
(9) Ball bearing
(10) Set screw
(11) Spacer
(12) Friction washers
(13) Reverse gear pin
(14) Needle roller bearings
(15) Double reverse gear
(17) Locking device
(18) Synchroniser assembly
(19) Secondary shaft
(20) Needle roller bearing
(21) Rings
(22) Coupling flanges
(23) Reverse driving gear
(24) Ball bearing
(25) Circlip
(26) Housing
(35) Friction washer
(39) Cones (brake)

View of the assembly

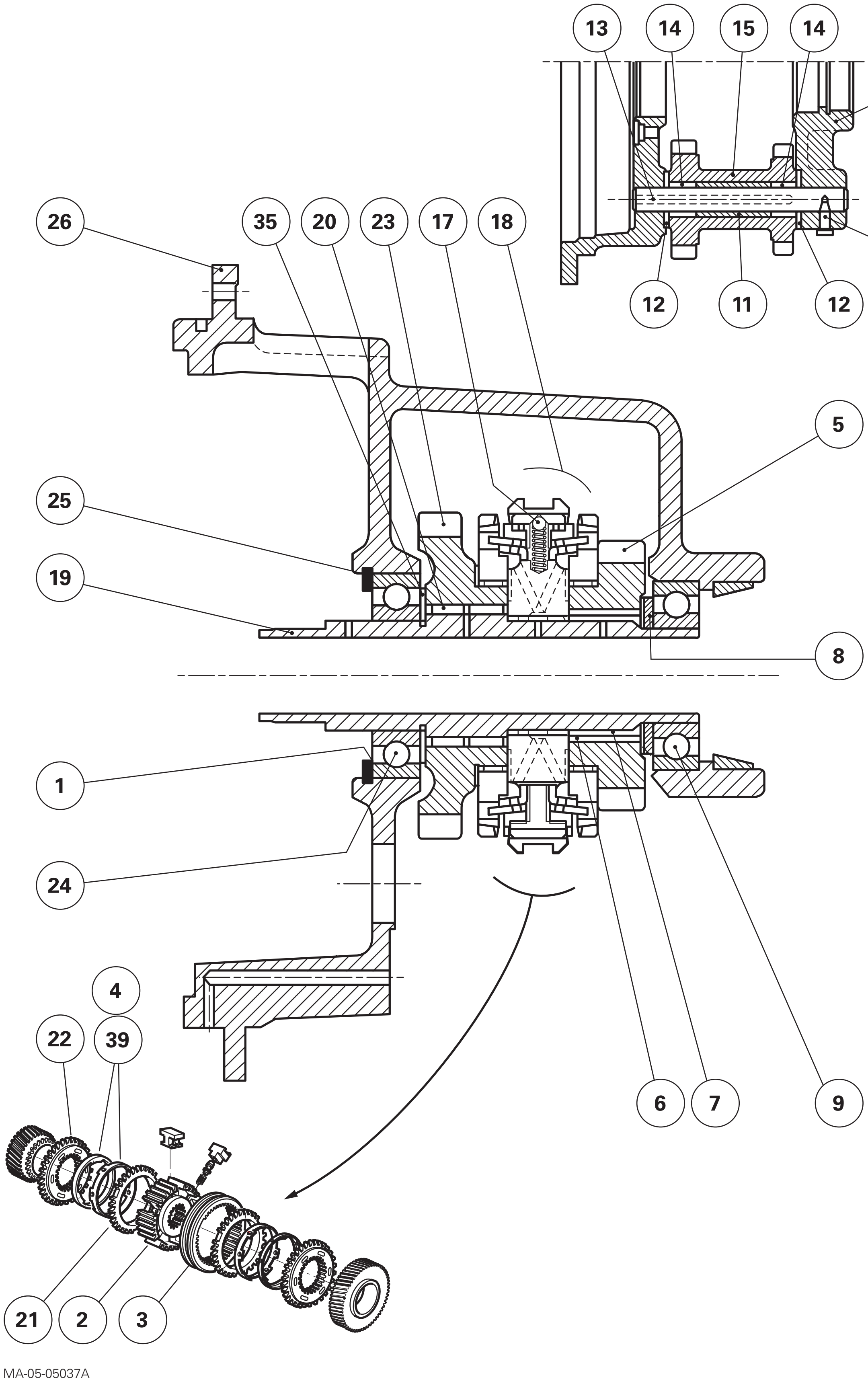

Fig. 3

GBA20 - Mechanical reverse shuttle - Shuttle

Parts list (Fig. 4)

(1) Shim(s)
(2) Synchroniser hub
(3) Sliding coupler
(4) Cone (brake)
(5) Forward driving gear
(6) Needle roller bearing
(7) Ring
(8) Friction washer
(9) Ball bearing
(10) Set screw
(11) Spacer
(12) Friction washers
(13) Reverse gear pin
(14) Needle roller bearings
(15) Double reverse gear
(17) Locking device
(19) Secondary shaft
(20) Needle roller bearing
(21) Rings
(22) Coupling flanges
(23) Reverse driving gear
(24) Ball bearing
(25) Circlip
(35) Friction washer
(39) Cones (brake)

Blown-up view

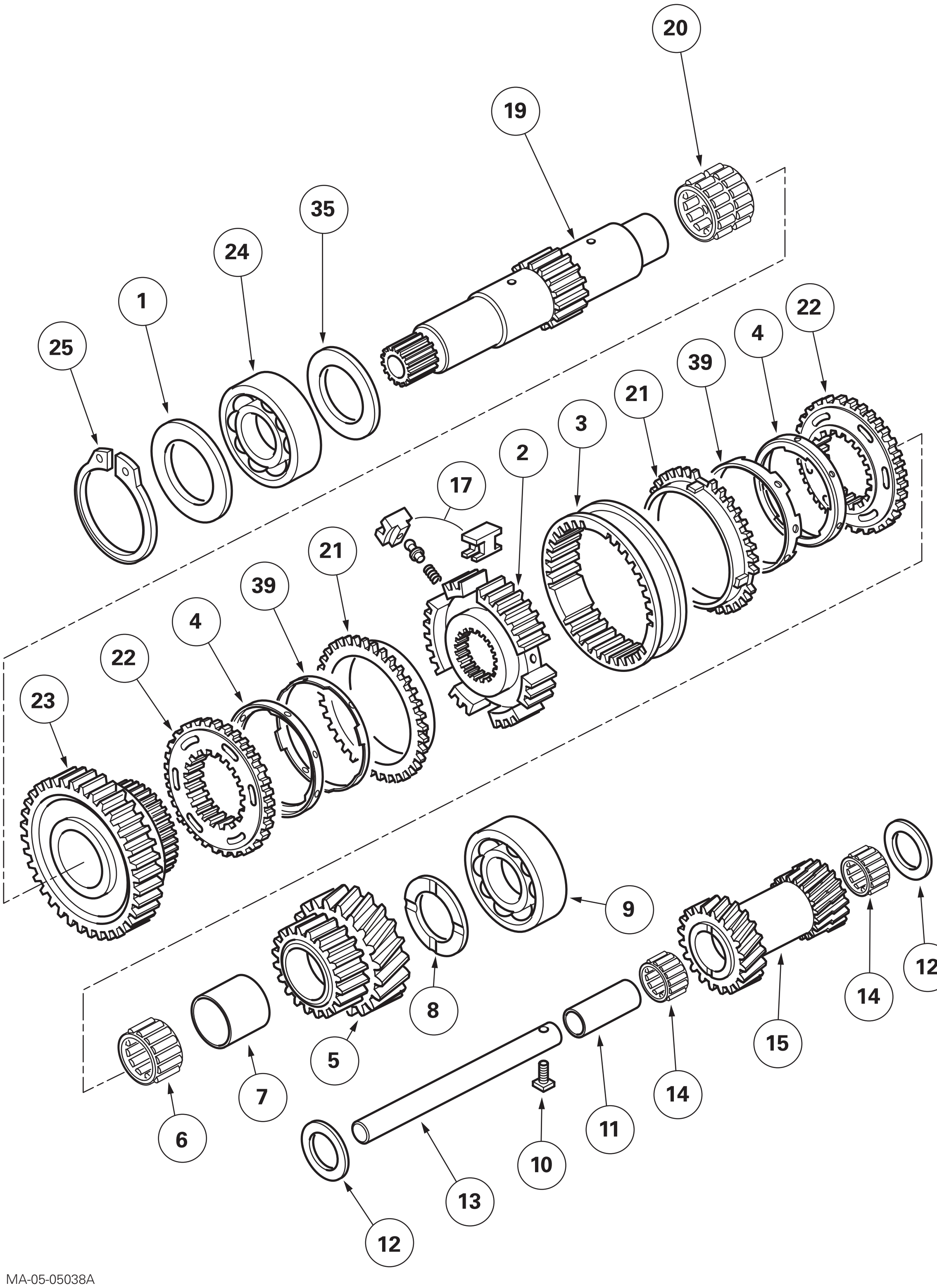

Fig. 4

B . Operation

Forward travel kinematics (Fig. 5)

The movement of the synchroniser sliding coupler (3) to the rear joins the gear (5) with the shaft (19).

The gear (1) is splined to the layshaft.

The constant meshing of gears (5) and (1) allows drive to be transmitted to the gearbox.

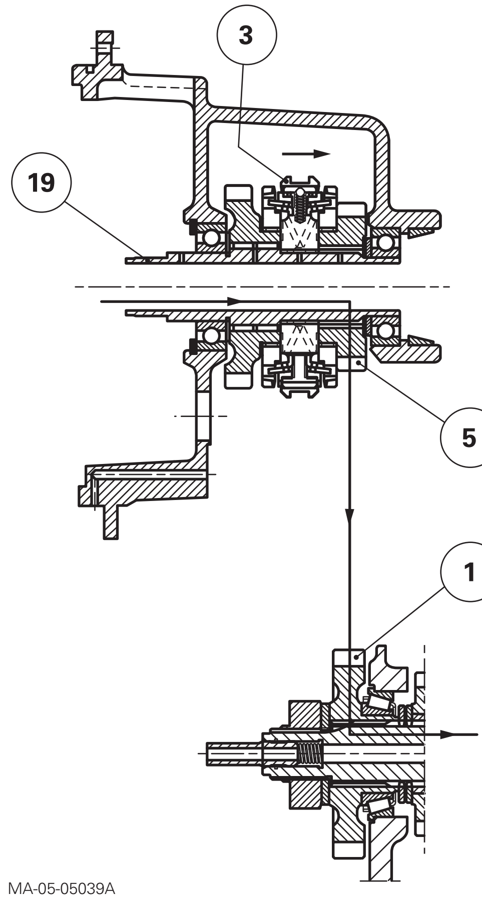

Fig. 5

Reverse travel kinematics (Fig. 6)

The movement of the synchroniser sliding coupler (3) to the front joins the gear (23) firmly with the shaft (19). Drive is transmitted via the gear (23), the teeth of the layshaft gear (15) and the gear (1). Consequently, the drive transmitted to the layshaft of the gearbox is reversed.

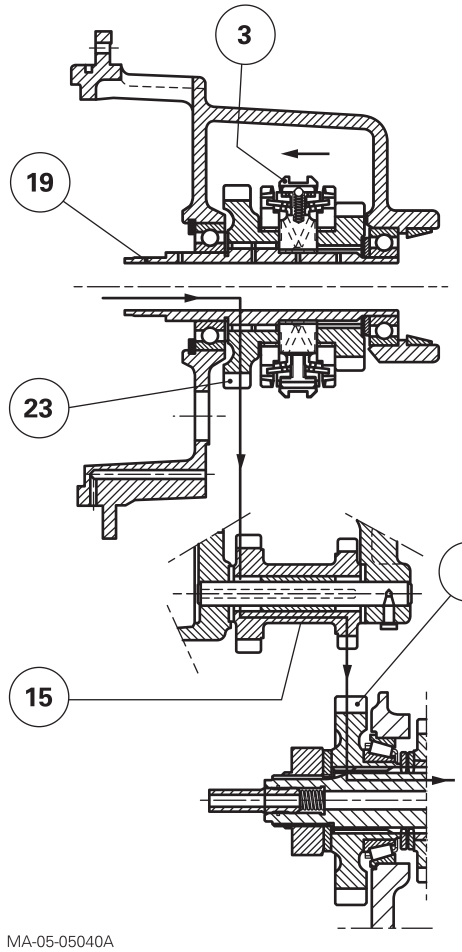

Fig. 6

C . Preliminary steps

IMPORTANT: *If the input unit is removed to replace the complete unit or just the housing (26), it is necessary to shim the intermediate shaft of the gearbox again after removing the input unit (see chapter 5).*

1. Disconnect the tractor between the engine and the gearbox (see chapter 2).
2. Drain the gearbox and the rear axle.
3. Remove the input unit (see chapter 5).
4. Remove the locking device, the selector rail and the shuttle fork (see chapter 5).
5. Remove the Speedshift (see chapter 5).

D . Disassembling and reassembling the reverse shuttle

Disassembling the layshaft gear (15) for reverse travel (Fig. 7)

6. Take out the set screw (10).
7. Take out the pin (13).
8. Remove the layshaft gear (15), the washers (12), the needle roller bearings (14) and the spacer (11).

Disassembling the reverse shuttle (Fig. 8)

9. Remove the circlip (25).
10. Remove the shim(s) (1).
11. Drive the secondary shaft out of the gear/synchroniser assembly.
12. Take out the gear/synchroniser assembly (18) from the housing. Remove the washer (8), marking its positioning.
13. Place the gear/synchroniser assembly on a workbench.
14. Separate (Fig. 9):
- the gear (5)
- the ring (7)
- the needle roller bearing (6)
- the cones (brake) (4) and (39)
- the coupling flanges (22)
- the gear (23)
- the needle roller bearing (20)

15. If required, extract the ball bearing (24) from the secondary shaft (19).
Remove the washer (35), marking its positioning.

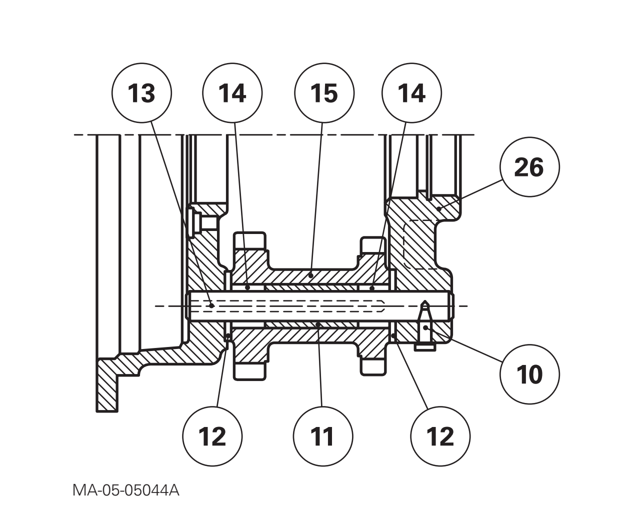

Fig. 7

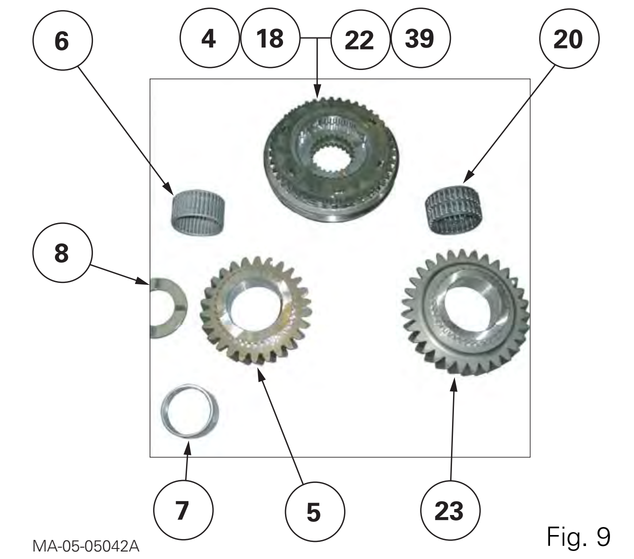

Fig. 9

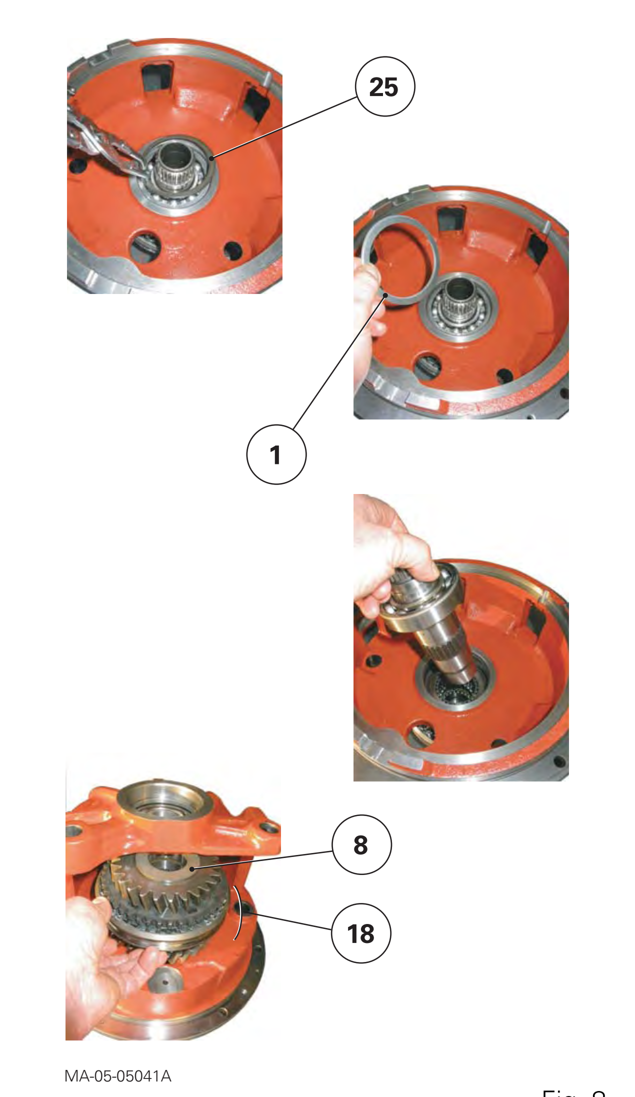

Fig. 8

Reassembling the reverse shuttle

16. Clean and check all components. Replace those that are defective.

17. Check that the ports and channels of the secondary shaft (19), the pin (13) and housing (26) are not blocked.

18. Lubricate the secondary shaft, the ring (7) and needle roller bearings (6) and (20).

19. If removed, place the washer (35) on the secondary shaft (19) as shown in Fig. 10.

Fit the ball bearing (24) against the washer (35) (Fig. 10), using a press and a makeshift sleeve (internal Ø = 47 mm; L = 60 mm).

IMPORTANT: *The sleeve is used to push against the internal cage of the ball bearing.*

20. Assemble (Fig. 11):
- the gear (5)
- the ring (7)
- the needle roller bearing (6)
- the cones (brake) (4) and (39)
- the coupling flanges (22)
- the gear (23)
- the needle roller bearing (20)

21. Refit the ball bearing (9) in the housing.

22. Refit the gear (5) (23)/synchroniser (18) assembly and the washer (8) in the housing (Fig. 12).

Turn the lubricating grooves of the washer (8) towards the gear (5) (Fig. 12).

23. Position the washer centrally (8).

24. Insert the secondary shaft (19) (Fig. 12) into the gear/synchroniser (18) assembly through the bore in the front of the gearbox.

25. Turn the shaft from right to left and vice versa to partially engage the splines of the secondary shaft in those of the synchroniser.

26. With the help of an operator, install the fitted unit on a table press.

27. Position a makeshift sleeve (internal Ø = 44 mm; L = 32 mm) under the internal ring of the ball bearing (9).

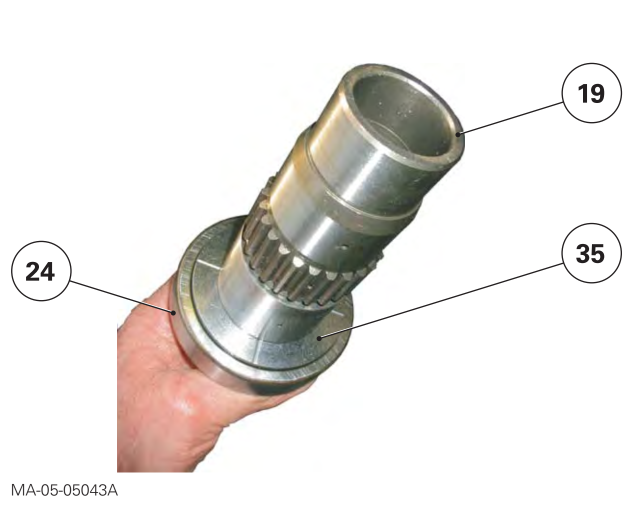

Fig. 10

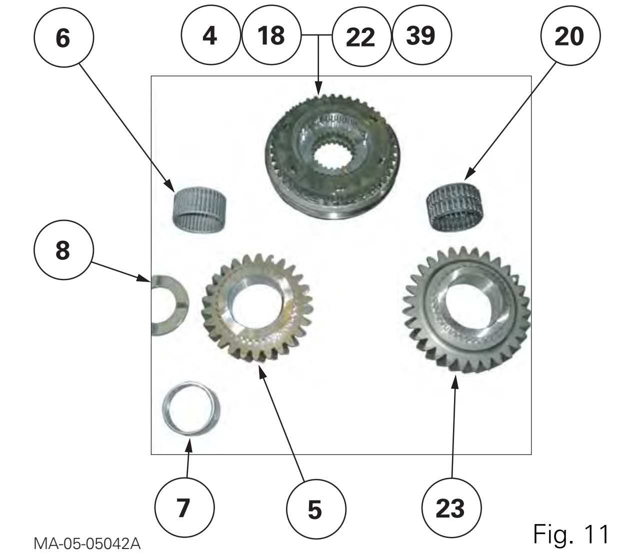

Fig. 11

28. Position the sleeve used during step 19 on the internal ring of the ball bearing (24).

29. Gradually fit the secondary shaft (19) securely using a press until resistance is felt.

Simultaneously check the gears rotate smoothly.

IMPORTANT: *It is recommended to use a press and sleeves to fit the secondary shaft under the correct conditions, and to avoid exposing the ball bearings to excessive force when fitting.*

30. Fit the shim(s) (1) removed during disassembly, and the circlip.

REMINDER: *If it is necessary to shim the secondary shaft (19), see § E.*

31. Check the axial clearance and rotation of the gears (5) and (23).

Manually check the rotation of the shaft (19).

Reassembling the layshaft gear (15) for reverse travel (Fig. 13)

32. Slide the needle roller bearings (14) separated by the spacer (11) into the layshaft gear (15).

33. Place the assembled layshaft gear in the housing (26). Slide a washer (12) onto each of its faces.

34. Fit the pin (13).

35. Lightly smear the thread of the set screw (10) with Loctite 242 or equivalent. Tighten to a torque of 28 - 43 Nm.

36. Manually check the axial clearance and backlash of the reverse layshaft gear.

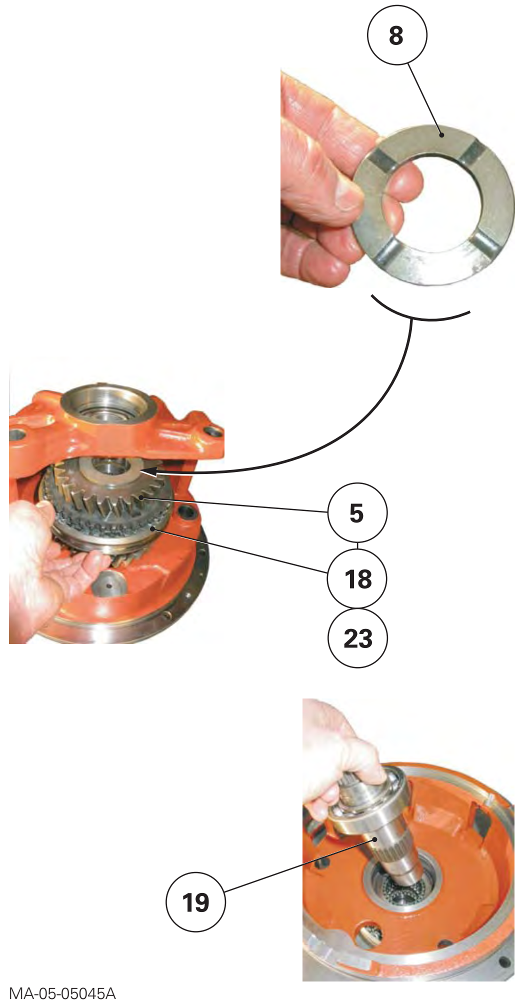

Fig. 12

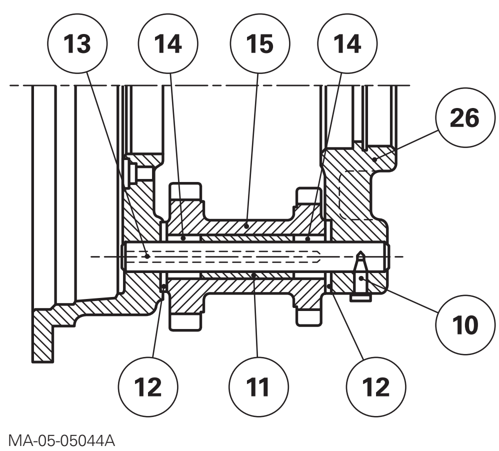

Fig. 13

E . Shimming the secondary shaft

37. Secure the unit in a vice fitted with protected jaws.

Preparing for shimming

38. Manually check for clearance on the secondary shaft (19) in the housing (26).

If there is no clearance, temporarily remove one or several shims (1).

Shimming

39. Position the dial gauge feeler pin on the end of the shaft (19) (Fig. 14).

40. Pull hard on the secondary shaft (19) to correctly position the ball bearing (24) against the circlip (25).

41. Set the dial gauge needle to zero.

42. Repeat step 40 while pushing to bring the ball bearing (9) up against the shoulder of the housing (26).

43. Depending on the clearance measured, select a new thickness of shim(s) (1) to obtain a clearance of **J1 = 0.05 to 0.20 mm** (Fig. 15).

NOTE: *If possible, shim the secondary shaft close to the minimum tolerance value.*

44. Remove the circlip (25).

45. Position the definitive shim(s) (1) selected during step 43 on the bearing (24).

46. Refit the circlip (25). Check it is correctly fitted at the base of the groove.

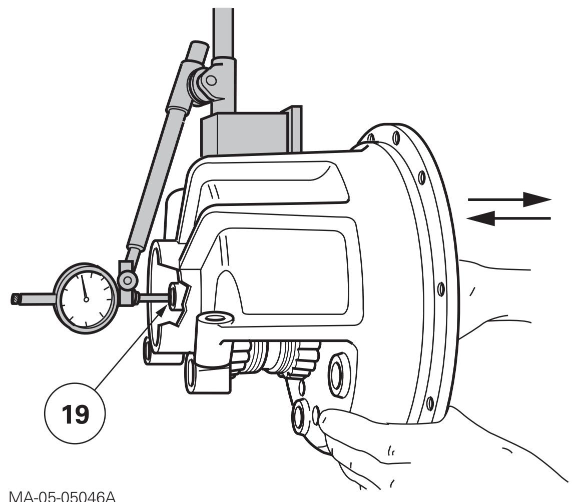

Fig. 14

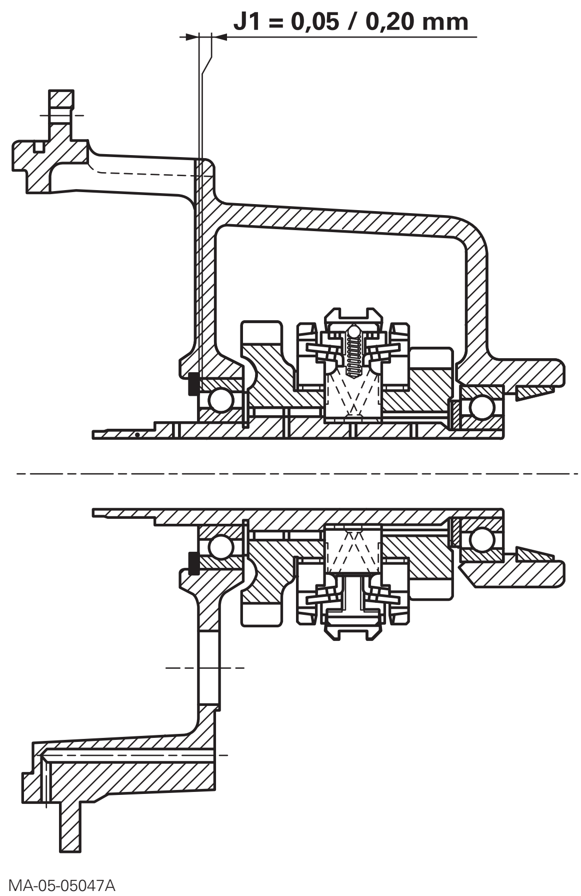

Fig. 15

F . Final steps

47. Refit:
- the Speedshift (see chapter 5);
- the shuttle fork, the selector rail and its locking device (see chapter 5).

48. Refit the input unit (see chapter 5).

49. Top up the oil level in the housings. Check it using the gauge at the rear of the centre housing.

50. Reconnect the tractor between the engine and the gearbox (see chapter 2).

51. Carry out a road test on all controls.

52. Check the tightness of the seals and hydraulic unions.

5A13 - GBA20 - Mechanical reverse shuttle - Speedshift

CONTENTS

A . General

The Speedshift unit is mounted between the hydraulic mechanism of the engine clutch and the mechanical reverse shuttle.

It is a hydraulically controlled gear shift system providing two input ratios to the gearbox. This function is provided by:

- a multidisc hydraulic clutch;
- an epicyclic gear train consisting of a planet carrier with three double planet gears, an input sun gear and an output sun gear;
- a planet carrier hydraulic braking system.

The design of the Speedshift allows ratio shifting while driving without declutching, even at full load.

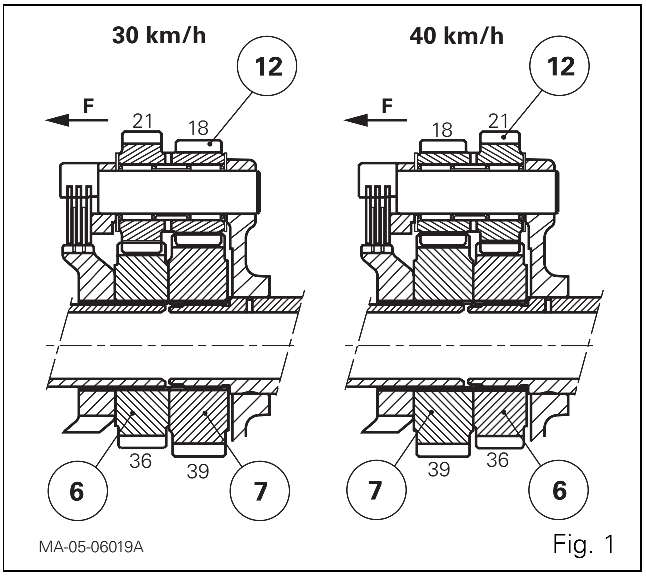

Fig. 1

Specific feature of the epicyclic gear train assembly

Legislation in force in certain countries limits forward speed to 30 kph. In this case, the sun gears (6) and (7) and planet gears (12) of the Speedshift epicyclic gear train should be positioned as in Fig. 1.

Parts list (Fig. 2)

(2) Screw
(3) Screw
(4) Ring
(5) Secondary shaft
(6) Input sun gear (30 kph)
Output sun gear (40 kph)
(7) Input sun gear (40 kph)
Output sun gear (30 kph)
(8) Planet gear pins
(9) Planet carrier unit
(10) Seal (7 mm thick)
(11) Seal (10 mm thick)
(12) Double planet gears
(13) Housing
(14) Spacer
(15) Hub
(16) Needle roller bearing
(17) Friction washers
(18) Spring washer (Belleville)
(19) Rivets
(20) Thrust plate
(21) Brake disc
(22) "O" ring
(23) "O" ring
(24) "O" ring
(25) Hydraulic cover plate
(26) "O" ring
(27) Front cover plate
(28) Clutch piston
(29) "O" ring
(30) Intermediate plates
(31) Rings
(32) Needle roller bearing
(33) Ring carrier
(34) Threaded plug Ø 8
(35) Threaded plug Ø 10
(36) Primary shaft
(37) Circlip
(38) Tab washer
(39) Washer
(40) Ball bearing
(42) Discs
(43) Spring washers
(46) Seal
(47) Seals
(48) Brake piston
(50) Planet carrier assembly
(65) Needle roller bearing
(66) Seal

View of the assembly

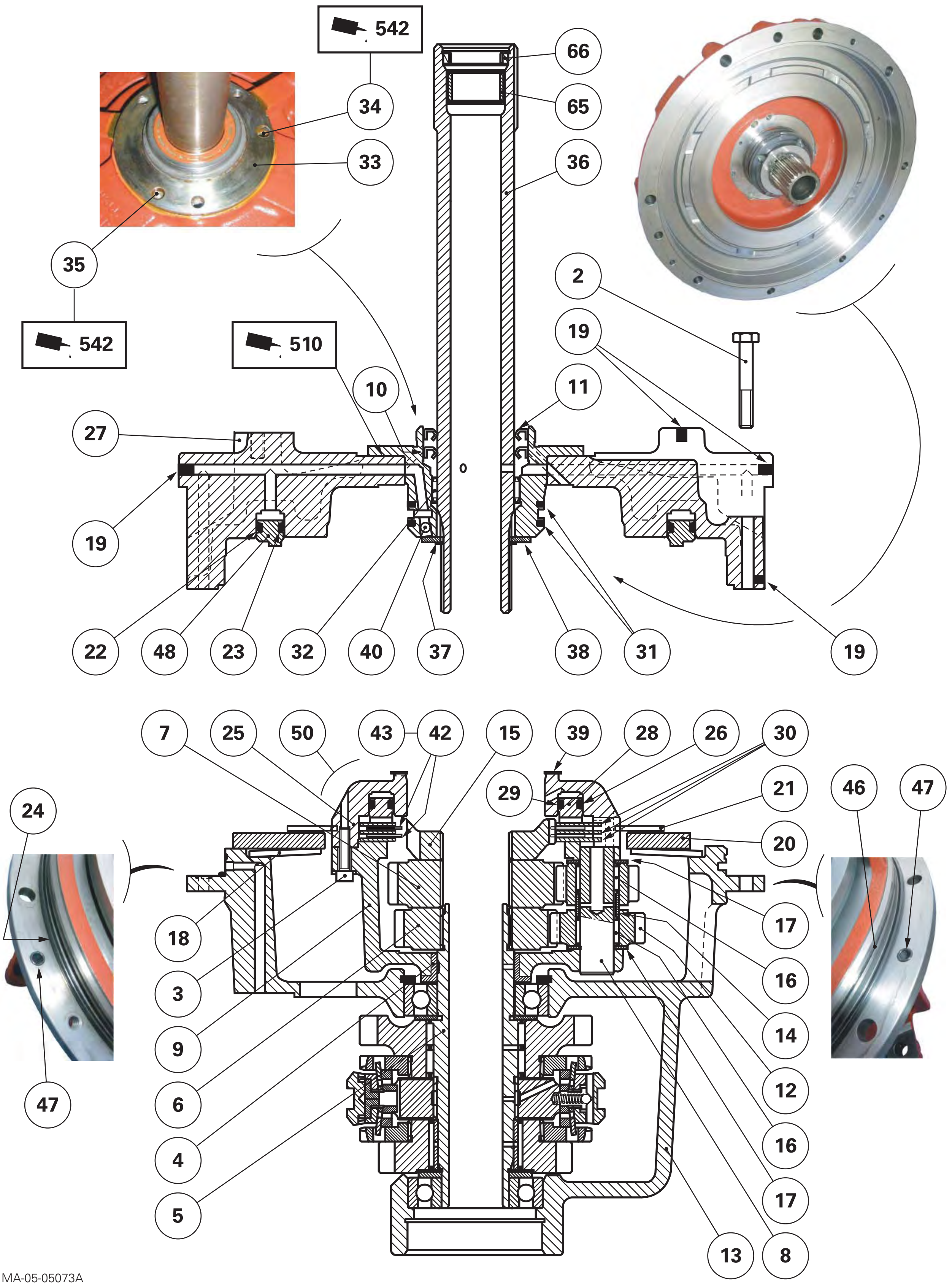

Fig. 2

Parts list (Fig. 3)

(2) Screw
(3) Screw
(4) Ring
(5) Secondary shaft
(6) Input sun gear (30 kph)
Output sun gear (40 kph)
(7) Input sun gear (40 kph)
Output sun gear (30 kph)
(8) Planet gear pins
(9) Planet carrier unit
(10) Seal (7 mm thick)
(11) Seal (10 mm thick)
(12) Double planet gears
(13) Housing
(14) Spacer
(15) Hub
(16) Needle roller bearing
(17) Friction washers
(18) Spring washer (Belleville)
(19) Rivets
(20) Thrust plate
(21) Brake disc
(22) "O" ring
(23) "O" ring
(24) "O" ring
(25) Hydraulic cover
(26) "O" ring
(27) Front cover plate
(28) Clutch piston
(29) "O" ring
(30) Intermediate plates
(31) Rings
(32) Needle roller bearing
(33) Ring carrier
(34) Threaded plug Ø 8
(35) Threaded plug Ø 10
(36) Primary shaft
(37) Circlip
(38) Tab washer
(39) Washer
(40) Ball bearing
(42) Discs
(43) Spring washers
(46) Seal
(47) Seals
(48) Brake piston
(50) Planet carrier assembly
(65) Needle roller bearing
(66) Seal

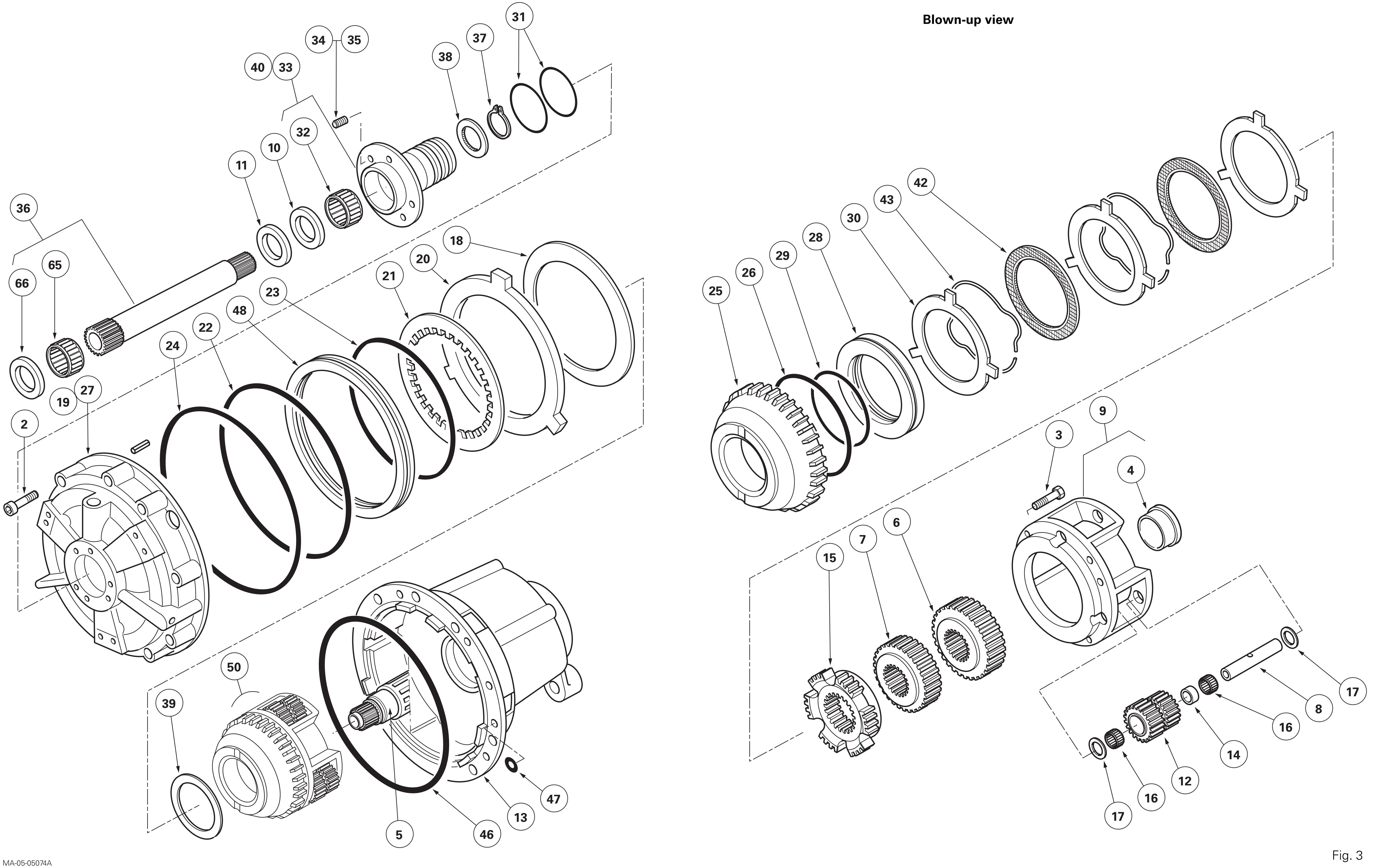
Blown-up view
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Fig. 3

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B . Operation

Mechanical action - boosting

In this position (Fig. 4), the hydraulic components are not supplied and the Speedshift operates in a mechanical manner. The oil in the chamber of pistons (28) and (48) returns to the housing via channel "C" and the solenoid valve located on the front right-hand side of the gearbox.

As the oil pressure has dropped, the planet carrier assembly (50) is locked in rotation by the Belleville washer (18) which compresses the thrust plate (20) and immobilises the disc (21) splined with the planet carrier assembly.

Drive from the primary shaft (36) is transferred to the input sun gear (7) splined to the shaft. The sun gear (7) drives the double planet gears (12) idle-mounted on the pins (8). The planet gears in turn drive the output sun gear (6) firmly attached to the secondary shaft (5), ratio 1.26.

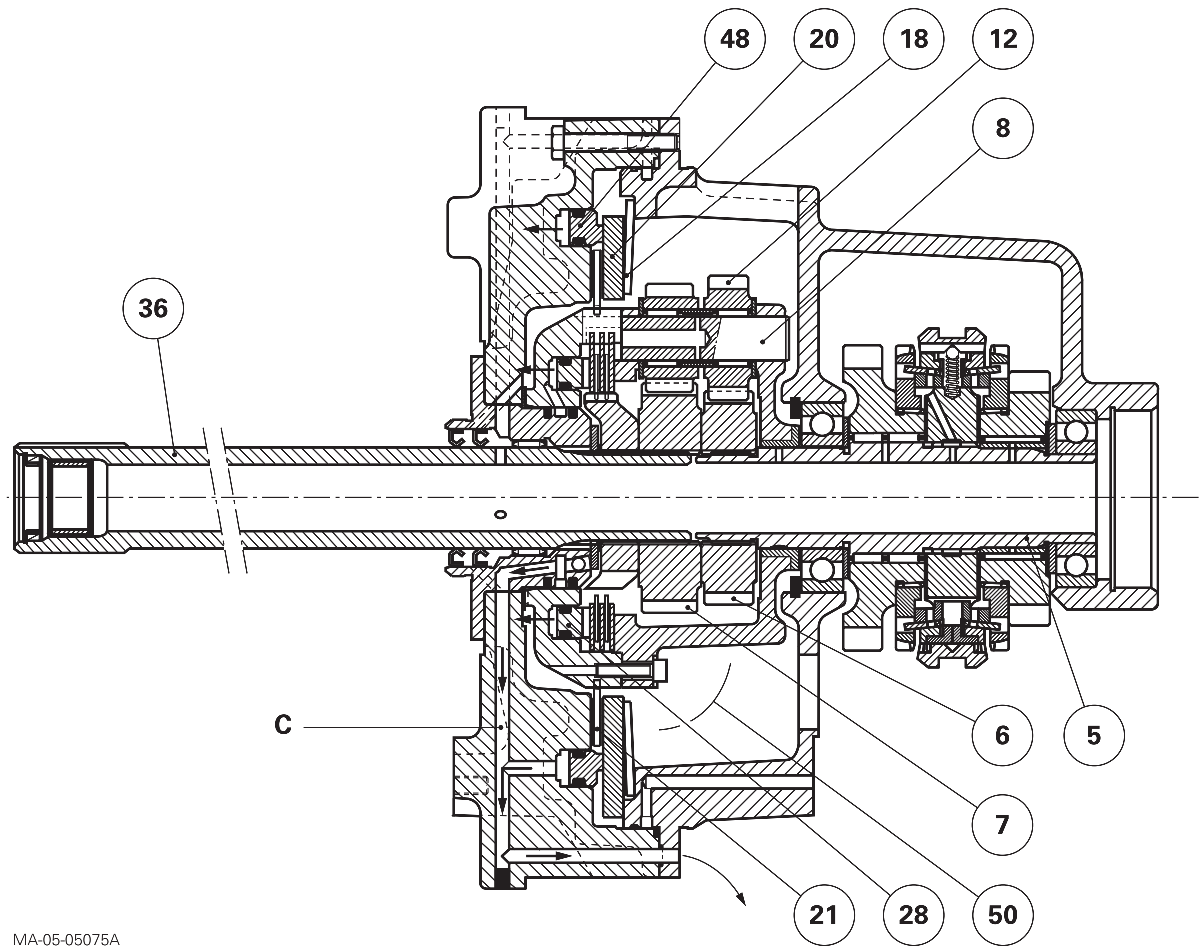

Fig. 4

Hydraulic action: direct drive reduction (Fig. 5)

The range shifting is carried out via a pulse button integrated into the transmission lever handle. This button activates the solenoid valve fitted at the front right-hand side of the gearbox. The solenoid valve simultaneously supplies the chamber of pistons (48) and (28). The brake piston (48) then presses against the thrust plate (20) which compresses the Belleville washer (18) thus releasing disc (21) and the planet carrier assembly (50). At the same time, the clutch piston (28) joins the intermediate plates (30) and the discs (42) driven by the hub (15). As the intermediate plates are firmly secured to the planet carrier with three lugs, drive is transferred from the input shaft (36) to the hub (15) and to the clutch assembly which drives the planet carrier (50). The primary shaft (36), the planet carrier assembly and the sun gears turn at the same speed as the secondary shaft (5), thus ensuring direct drive, ratio 1.

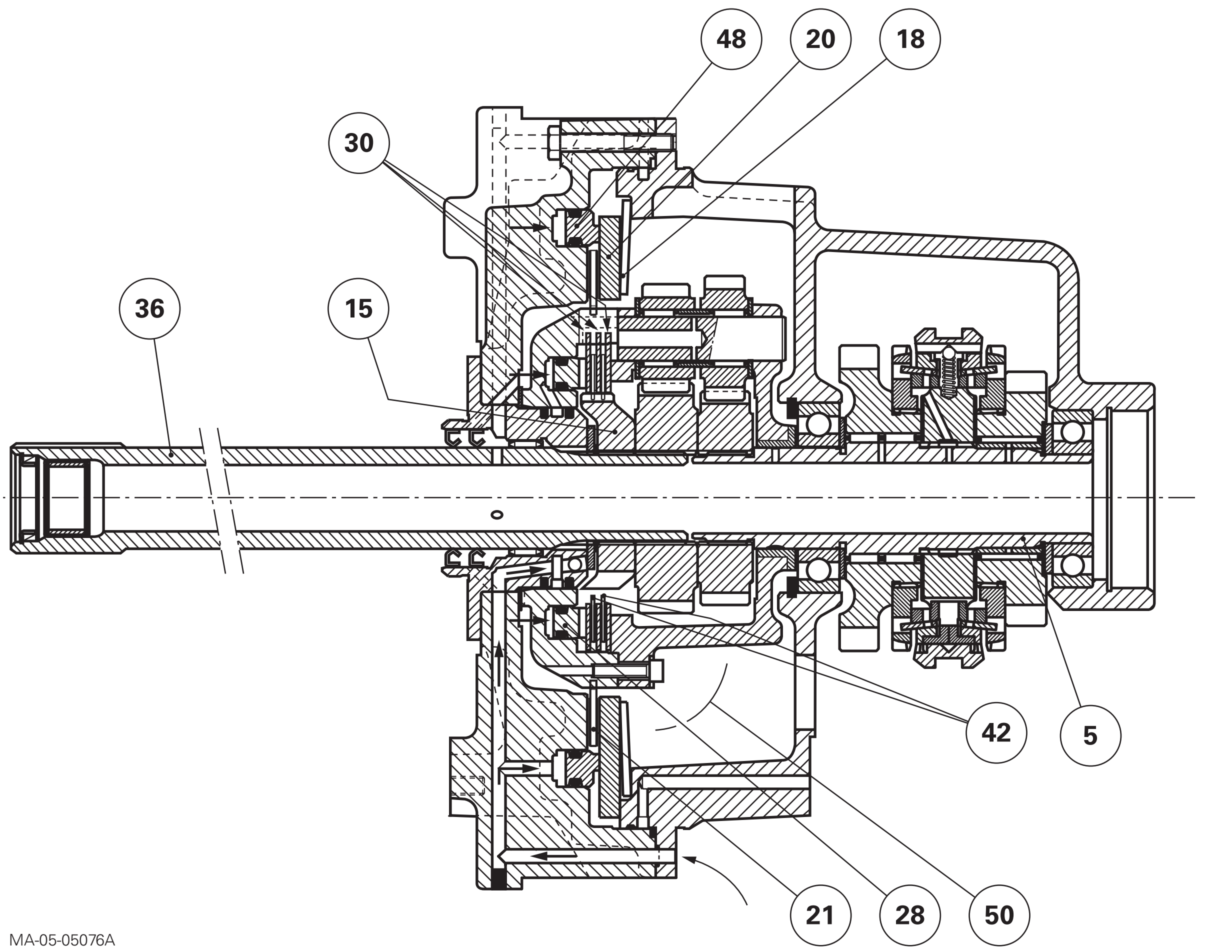

Fig. 5

C . Preliminary steps

1. Disconnect the tractor between the engine and the gearbox (see chapter 2).
2. Drain the gearbox and the rear axle if required.
3. Remove the engine clutch mechanism (see chapter 4).
4. Remove the input unit (see chapter 5).
5. Position the unit vertically.

D . Removing and disassembling the front cover plate

Removal (Fig. 7)

6. Remove the screws (2).
7. Manually remove the shaft assembly (36), the ring carrier (33) and the front cover plate (27).
8. Discard the seals (24), (46) and (47).
9. Remove and discard the rings (31).

Disassembly (Fig. 9)

10. Remove the circlip (37).
11. Remove the tab washer (38) and washer (39).
12. Separate the shaft (36) from the ring carrier (33).
13. Remove the piston (48) (Fig. 8) by lightly tapping the cover plate with a wooden block or using a jet of compressed air.
14. Separate and remove the ring carrier (33) from the cover plate (27) (Fig. 6).
15. Remove the seals (22) and (23) and discard them.

***Note:** Rivets (19) ensure that the oil channels are sealed.*

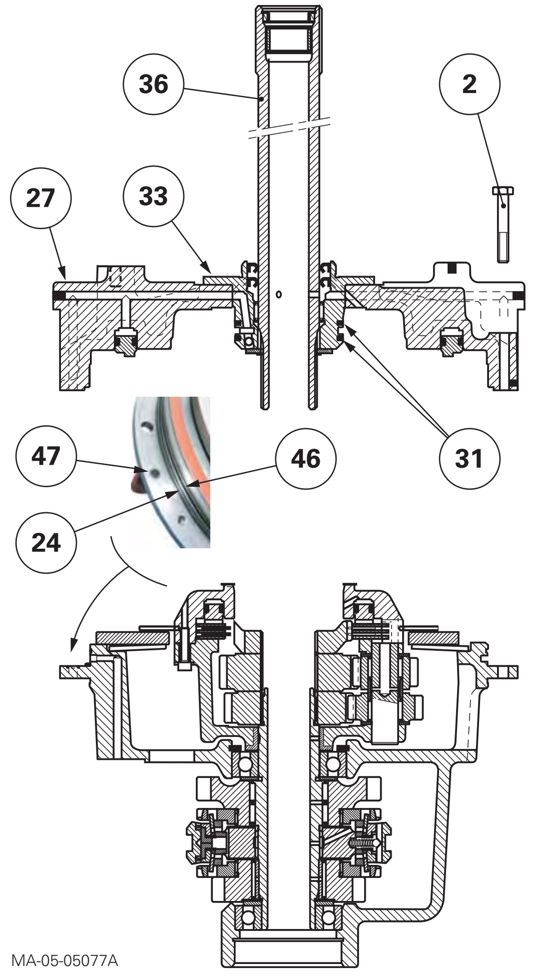

Fig. 7

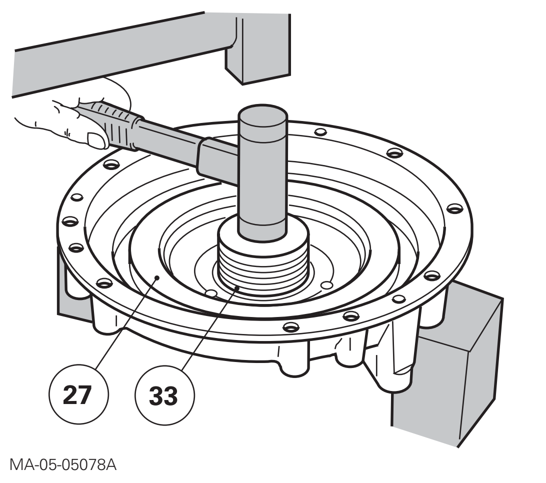

Fig. 6

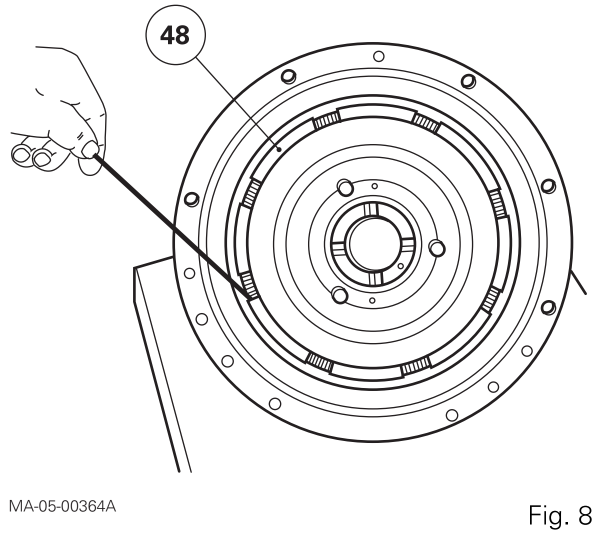

Fig. 8

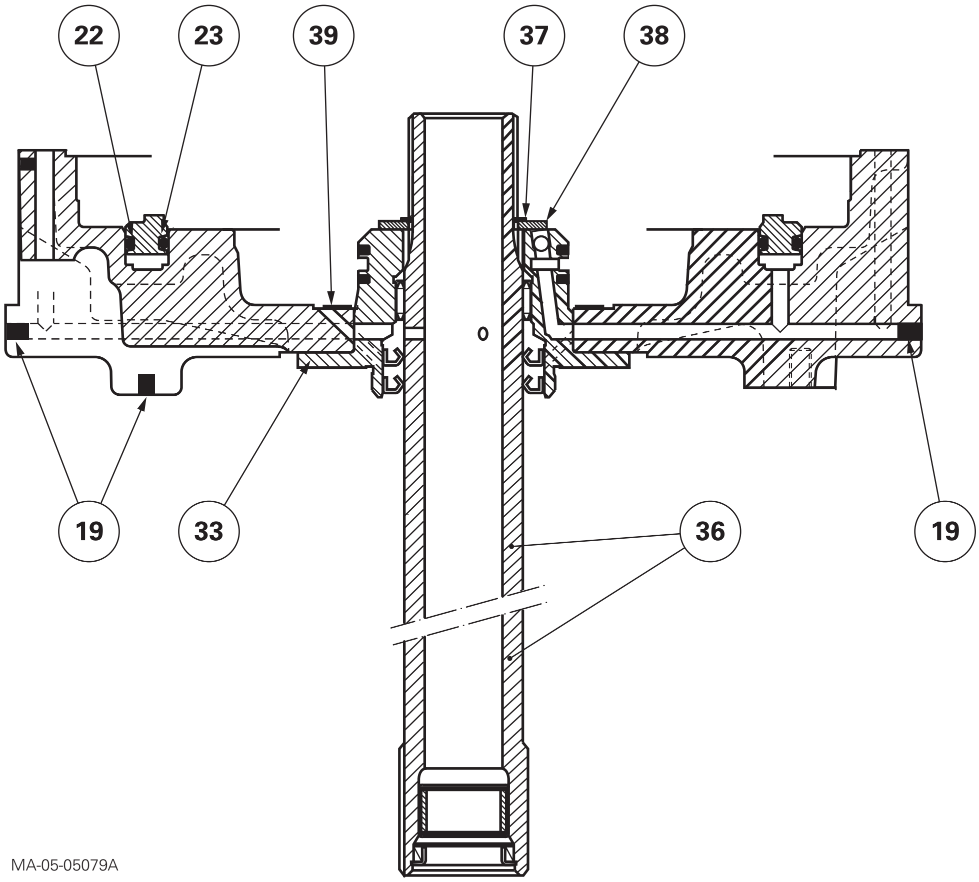

Fig. 9

E . Removing, splitting and disassembling the planet carrier assembly

Removal (Fig. 12)

16. Remove the brake disc (21), thrust plate (20), Belleville washer (18) and planet carrier assembly (50).

Separation

17. Put the planet carrier assembly on a workbench with the unit (9) turned upwards.
18. Remove the screws (3).
19. Separate the unit (9) from the hydraulic cover plate (25) while holding sun gears (6) and (7) (Fig. 10).

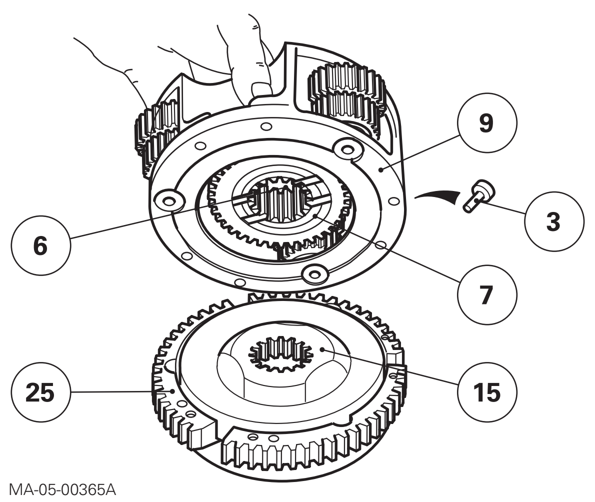

Fig. 10

Disassembly

***Note:** The text and figures in this section concern the disassembly of a planet carrier for a forward speed of **40 kph**.*

20. Remove the input sun gear (7), visually identifying the direction of the lubricating grooves.
21. Drive out the pins (8) using a drift and a hammer (Fig. 11).

***Note:** The pins are fitted tight in the thickest part of the planet carrier with the lubrication hole turned towards the hydraulic cover plate (25).*

22. Remove the planet gears (12).
23. Recover needle roller bearings (16), spacers (14) and washers (17).
24. Remove the output sun gear (6).

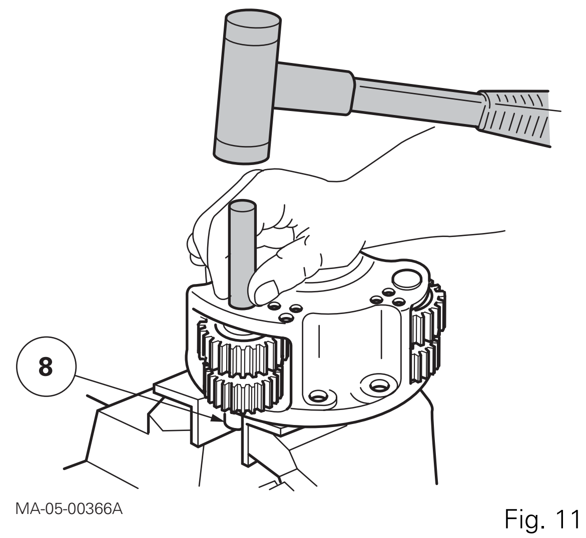

Fig. 11

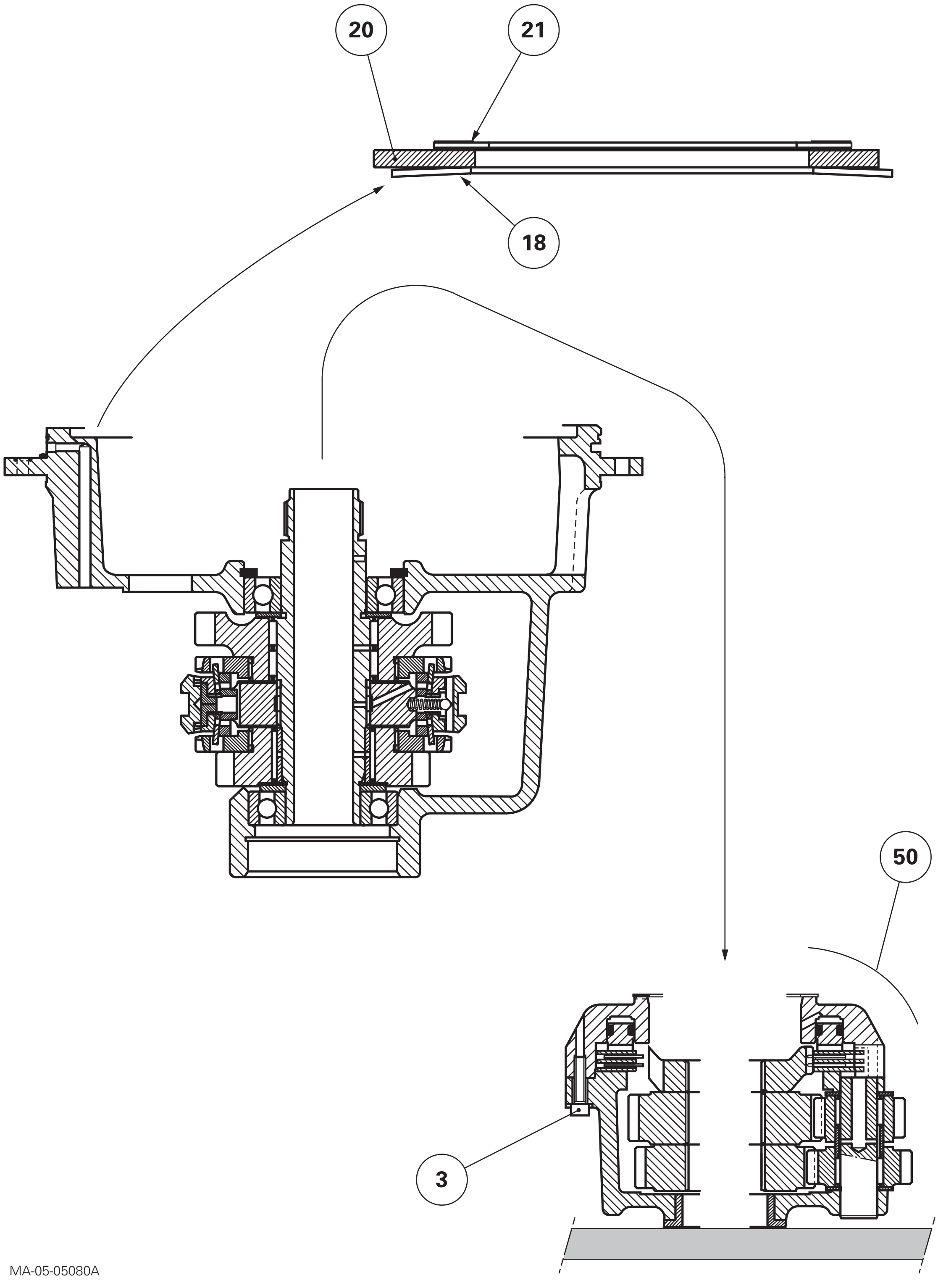

Fig. 12

F . Disassembling the hydraulic cover plate

25. Remove the splined hub (15).

26. Remove the intermediate plates (30), discs (42) and spring washers (43).

NOTE

The clutch consists of:

- *two friction discs;*
- *two spring washers;*
- *three intermediate plates.*

27. Remove the piston (28) by lightly tapping the cover plate (25) on a wooden block or using a jet of compressed air (Fig. 13).

28. Remove the seals (26) and (29) and discard them.

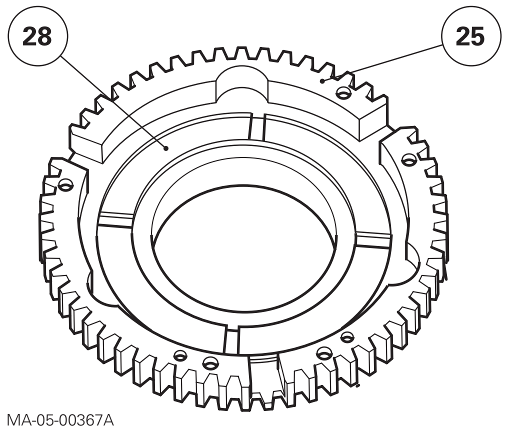

Fig. 13

G . Reassembling the planet carrier

29. Clean and check all components. Replace those that are defective.

30. Lubricate the needle roller bearings (16).

31. Make sure that the radial holes and axial channel for the lubrication of pins (8) are not blocked.

Reminder

Tractor speed can be between 30 and 40 kph.

Each speed is obtained by turning the planet gears and sun gears of the Speedshift epicyclic gear train (Fig. 1).

The sun gears have different numbers of teeth:

- *sun gear (6): 36 teeth*
- *sun gear (7): 39 teeth*

Note: *The text and figures in this section concern the reassembly of a planet carrier for a forward speed of **40 kph**.*

32. Put the output sun gear (6) in the unit (9), turning the sun gear lubricating grooves towards face "F" of the unit (Fig. 14).

33. Install the needle roller bearings (16), separated by a spacer (14) in a planet gear (12).

34. Put an "assembled" planet gear in the unit, the 18-tooth gear turned as in Fig. 1.

Note: *Each double planet gear is identified with one, two or three punchmarks on one of its faces which is not necessarily the 18-tooth gear. In this case, make the same marks on the aforementioned gear using an appropriate pen. A punchmark corresponds to the alignment of two teeth.*

35. Position the washers (**17**).

36. Centre the planet gear and washers with a guide pin Ø 16 mm, L = 80 mm (Fig. 15).

37. Insert the pin (8) into the free bore on face "F" of the unit (9) (Fig. 15) Fit it partially set back (Fig. 16), with the radial lubricating hole "a" turned outwards and the end of central channel "C" turned towards face "F" (Fig. 15).

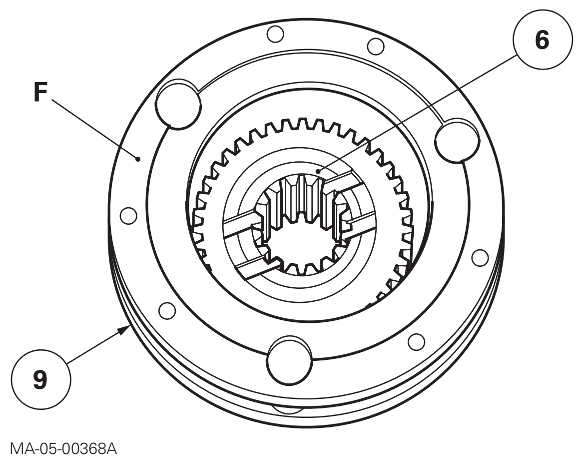

Fig. 14

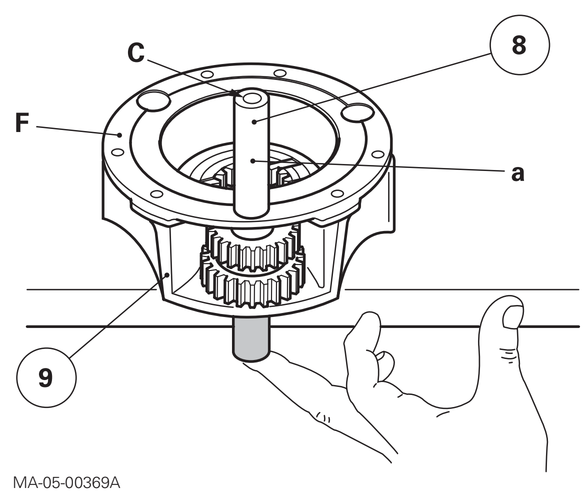

Fig. 15

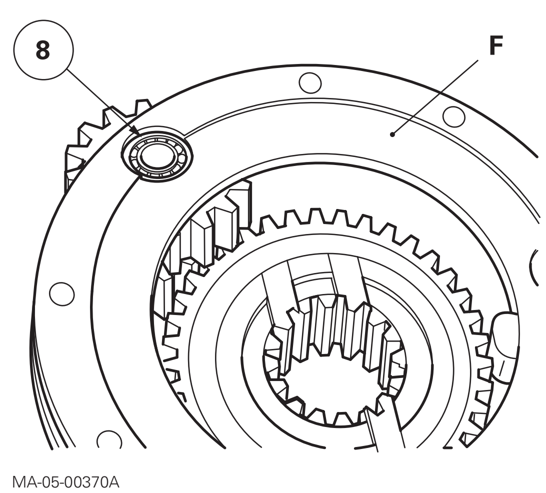

Fig. 16

38. Repeat steps 35 to 37 to assemble the two other planet gears.

During these operations, position the three planet gears according to marks "R" so that they run in a line corresponding with "O" (Fig. 17).

39. After final assembly of the pins (8), check again that the marks are correctly aligned.

IMPORTANT: *Incorrect alignment may make it impossible to assemble combined parts or cause damage to the epicyclic gear train.*

40. Fit the input sun gear (7) with the lubricating groove turned towards the output sun gear (6).

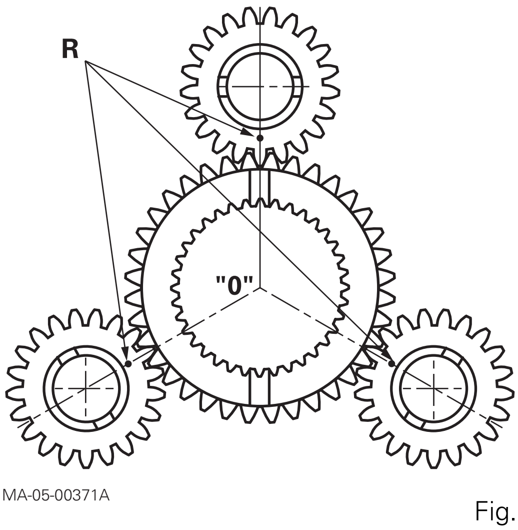

Fig. 17

H . Refitting the hydraulic cover plate

41. Clean and check all components. Replace those that are defective.

42. Make sure that the three holes of the 17-bar channel on the hydraulic cover plate (25) are not blocked (Fig. 18).

43. Fit the lubricated seals (26) and (29) and onto the piston (28).

44. Lubricate the mating faces of piston seals in the hydraulic cover plate.

45. Position the piston in the cover plate, turning the grooves towards the operator.

46. Fit the piston (28) using a plastic hammer, gradually and alternately striking around the circumference of the piston (Fig. 19).

Check that there are no fragments of "O" rings after fitting.

47. Install the splined hub (15) as shown in Fig. 10.

48. Install an intermediate plate (30), a disc (42) and a spring washer (43). Continue stacking parts, ending with an intermediate plate.

NOTE: *Arrange the cut section of spring washers in opposite directions.*

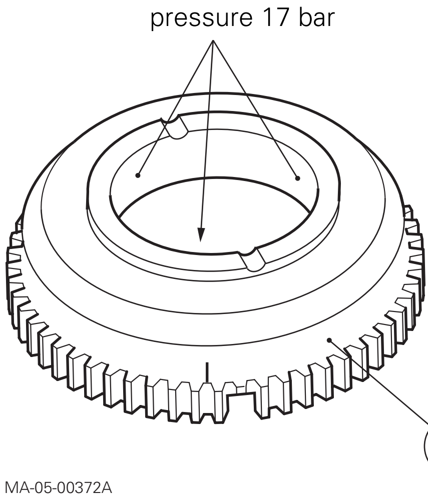

Fig. 18

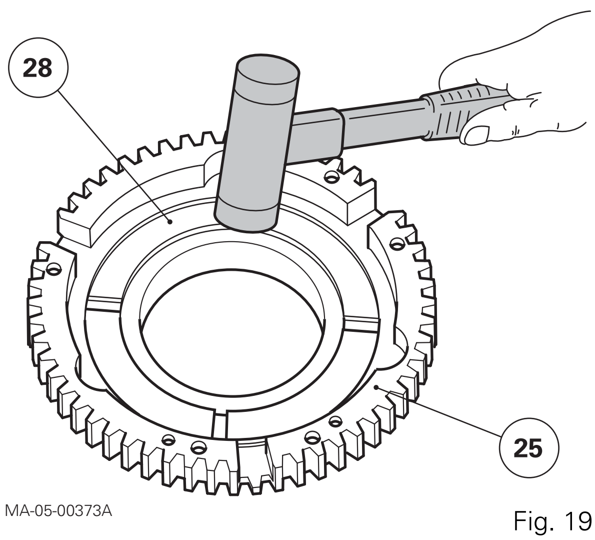

Fig. 19

I . Assembling the planet carrier

49. Screw two diametrically opposed guide studs in the hydraulic cover plate (25).

50. Assemble the planet carrier unit (9) on the hydraulic cover plate (25) while holding the sun gears (6) and (7) (Fig. 10).

***NOTE:** Position the unit and the cover plate so that the balancing marks (ground in marks) are on opposite sides as far as possible (Fig. 20).*

51. Refit the screws (3). They **must** be tightened to a torque of 14 - 20 Nm.

52. Strike pins (8) definitively against the hydraulic cover plate (25) with a pin punch.

53. Check that:

- the discs (42) are not compressed;
- the planet gears (12) and sun gears (6) and (7) turn freely.

54. Install the planet carrier assembly (50) on the shaft (5).

55. Position the Belleville washer (18) as in Fig. 5.

56. Position the thrust plate (20) in the housing (13).

57. Fit the brake disc (21) on the planet carrier assembly.

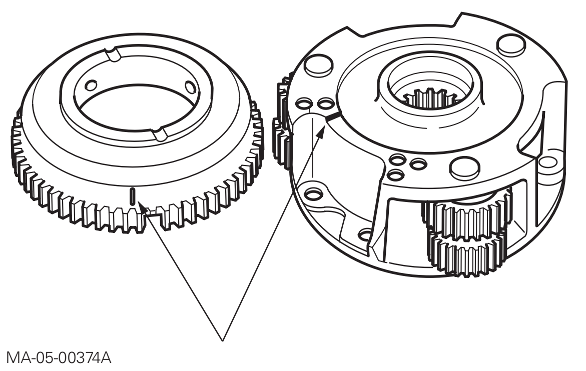

Fig. 20

J . Assembling and refitting the front cover plate

Reassembly

58. Clean the cover plate. Make sure that the 17-bar channel and the lubrication channel are not blocked. Check that the sealing rivets (19) are present.

59. Fit the seals (22) and (23) on the piston (48).

60. Lubricate the mating faces of the piston seals in the cover plate (27).

61. Position the piston in the cover plate, turning the grooves towards the operator.

62. Fit the piston (48) using a plastic hammer, gradually and alternately striking around the circumference of the piston (Fig. 21).

Check that there are no fragments of "O" rings after fitting.

63. If required, recondition the ring carrier (33) (Fig. 22) as follows:

- check that channels in the ring carrier are not blocked. The ball bearing (40) should be inserted correctly in its hole;
- with a press and suitable fixture, fit:
  - the needle roller bearing (32), 29.3 ± 0.1 mm from face F.

    Check that the needle rollers turn correctly;
  - the lubricated seal (10), 14.2 mm from face F.

    Ensure the seal does not cover the decompression holes;
  - the lubricated seal (11), 0.3 - 0.8 mm from face F.

    Ensure the seal does not cover the decompression holes.

64. Check that plugs (34) and (35) are present on the cover plate.

65. Smear Loctite 510 or equivalent on the mating face of the ring carrier on the cover plate, avoiding the hydraulic ports.

66. Position the ring carrier on the cover plate, making sure that the low pressure (17 bar) and lubrication holes correspond respectively with those on the cover plate;

Fit the ring carrier (33) (Fig. 22).

67. Hold the ring carrier temporarily in place using three locally obtained M8 screws (Fig. 22).

NOTE: *These screws are used to compress the ring carrier onto the cover plate while the seal is drying to ensure high-quality tightness of interfaces.*

68. Check that the lubrication holes on the shaft (36) are not blocked.

IMPORTANT: *If the shaft needle roller bearing (65) needs replacing, see § K.*

69. Slide the shaft in the ring carrier.

70. Refit the washer (38) and circlip (37).

71. Test-fit the new rings (31), making sure they turn freely in the grooves.

72. After this check, remove the rings and smear with miscible grease.

73. Fit the rings in their respective grooves, making sure:

- that they do not exceed the circumference of the ring carrier;
- their ends overlap correctly (Fig. 23).

IMPORTANT: *The slightest damage to rings may cause a leak followed by a pressure drop and incorrect operation of the Speedshift.*

74. Smear the washer (39) with grease and put it on the inner face of the cover plate (27).

Refitting

75. Fit the new seals (24), (46) and (47) on the housing (13).

76. Manually refit the shaft (36), ring carrier (33) and front cover plate (27) assembly using the same procedure as for removal.

77. Fit and tighten the screws (2) to a torque of 25 - 35 Nm.

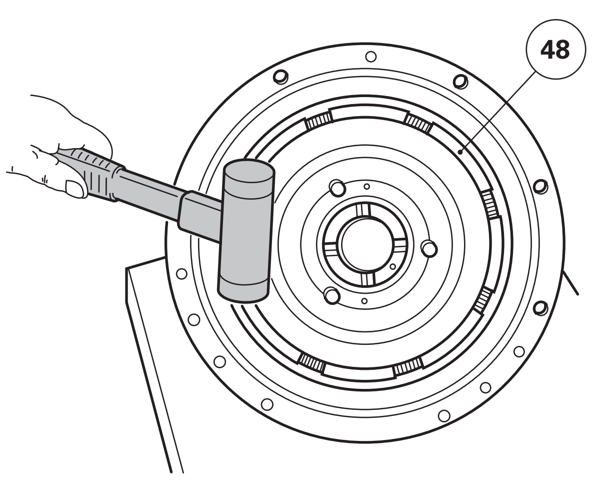

Fig. 21

Fig. 23

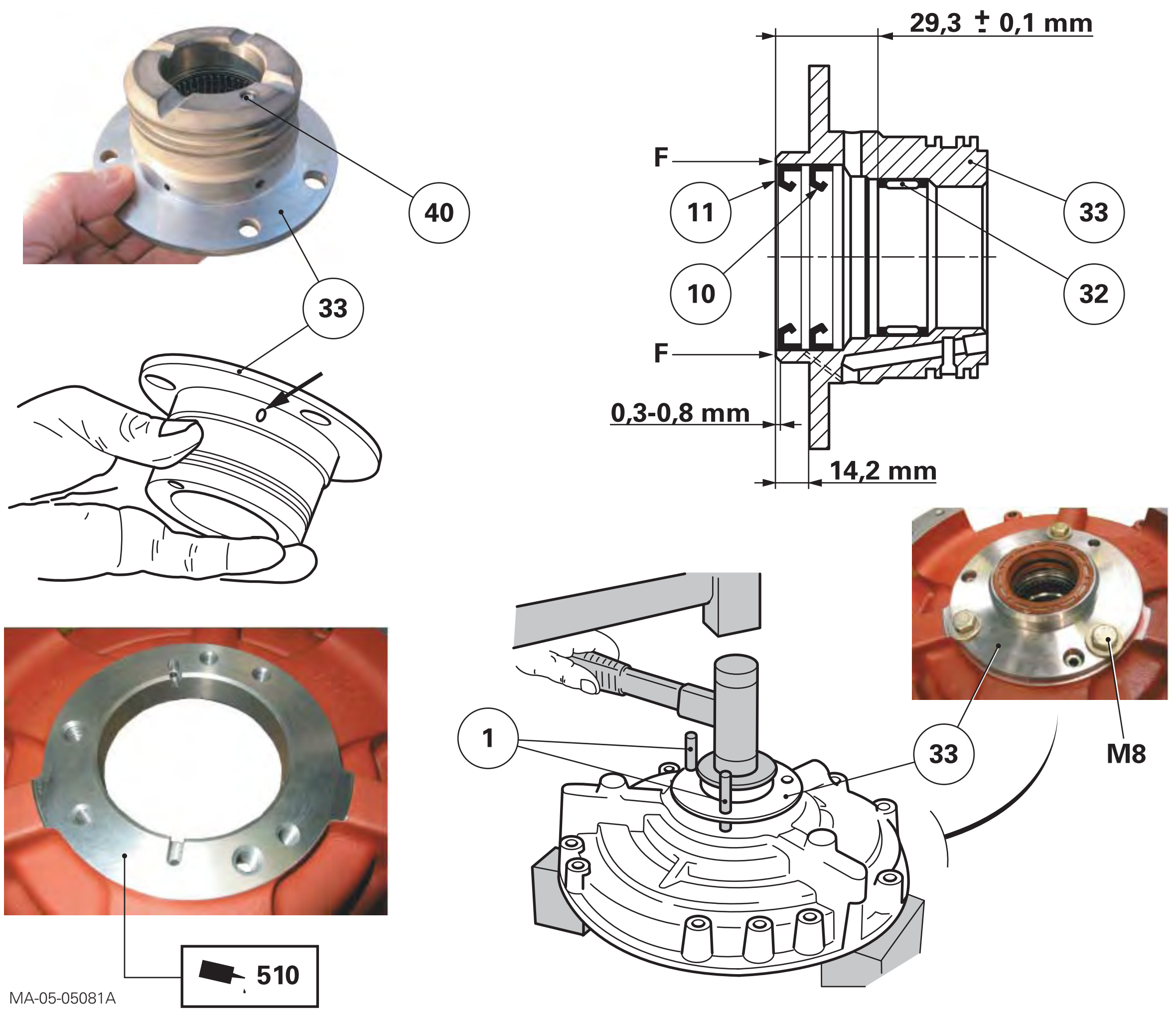

Fig. 22

K . Extracting and replacing the primary shaft needle roller bearing

Extraction

78. Extract the needle roller bearing (65) from the shaft (36) (Fig. 24) using a slide hammer puller. Discard it.

Replacement (Fig. 24)

79. Ensure there is no dirt inside the primary shaft (36).

80. Fit a new bearing (65) 15 - 16 mm from face F of the primary shaft using a press and suitable fixture.

81. After fitting, check that the bearing's needle rollers turn correctly.

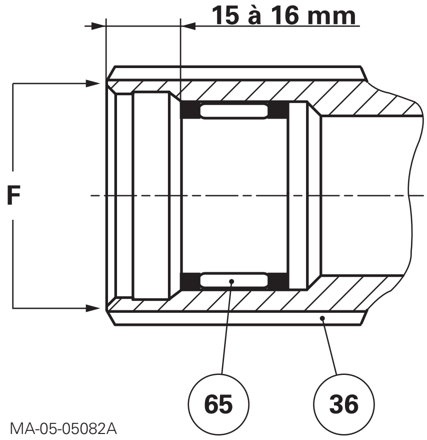

Fig. 24

L . Final steps

82. Take out the M8 screws temporarily fitted during step 67.

83. Refit the input unit (see chapter 5).

84. Refit the hydraulic mechanism of the engine clutch (see chapter 4).

85. Reconnect the tractor between the engine and the gearbox (see chapter 2).

5A14 - GBA20 - Mechanical reverse shuttle - Selector cover plate

CONTENTS

A . General

On 5400 series tractors with mechanical reverse shuttle, the selector cover plate is fitted to the right-hand side of the gearbox housing (Fig. 1).

It has two levers:
- a front lever to control the mechanical reverse shuttle;
- a rear lever to select the four basic gears and to indicate to the tractor electronic system when it is in neutral position for Hare / Tortoise range shifting.

Hare / Tortoise range shifting is carried out via a pulse button integrated into the transmission lever handle. The action is validated when the lever is in neutral.

A sensor "C" fitted to the selector cover plate buzzes to warn the user that a gear is engaged when the hand brake is on.

MA-05-05056A

Fig. 1

GBA20 - Mechanical reverse shuttle - Selector cover plate

Parts list (Fig. 2)

Hare / Tortoise fork locking and gear control

(1) Plug or oil return port
(2) Earthing lug
(3) Screw
(4) Centring screws
(5) Plug
(6) Stud and nut
(9) Selector cover plate
(13) Gear control finger and pin
(14) Speed grid
(15) Screw
(16) Support
(17) Locating ring
(18) Ball bearing
(19) Screw
(20) Spring
(21) Washer
(22) Circlip
(25) Seal
(26) Guide ring
(27) Seal
(28) Neutral position switch
(31) Plunger
(33) Washer
(34) Toggle switch
(35) Indexing rod

Mechanical reverse shuttle control

(25) Seal
(26) Guide ring
(36) Finger
(37) Pin
(38) Set screw
(39) Guide ring

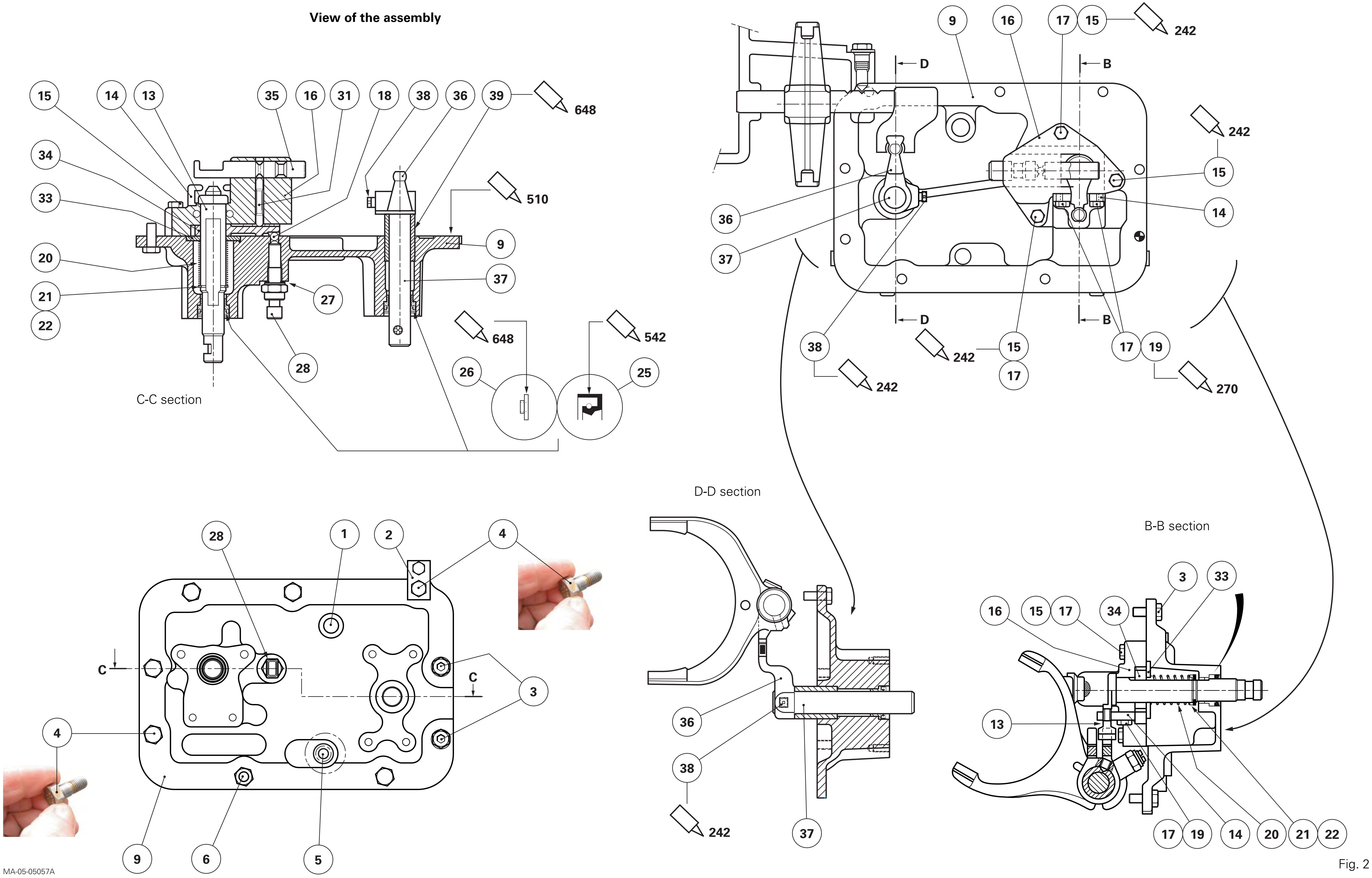
View of the assembly
C-C section
D-D section
B-B section
C
D
B
648
510
542
242
270
MA-05-05057A

Fig. 2

Parts list (Fig. 3)

Hare / Tortoise fork locking and gear control

(1) Plug or oil return port
(2) Earthing lug
(3) Screw
(4) Centring screws
(5) Plug
(6) Stud and nut
(9) Selector cover plate
(13) Gear control finger and pin
(14) Speed grid
(15) Screw
(16) Support
(17) Locating ring
(18) Ball bearing
(19) Screw
(20) Spring
(21) Washer
(22) Circlip
(25) Seal
(26) Guide ring
(27) Seal
(28) Neutral position switch
(31) Plunger
(33) Washer
(34) Toggle switch
(35) Indexing rod

Mechanical reverse shuttle control

(25) Seal
(26) Guide ring
(36) Finger
(37) Pin
(38) Set screw
(39) Guide ring

Blown-up view

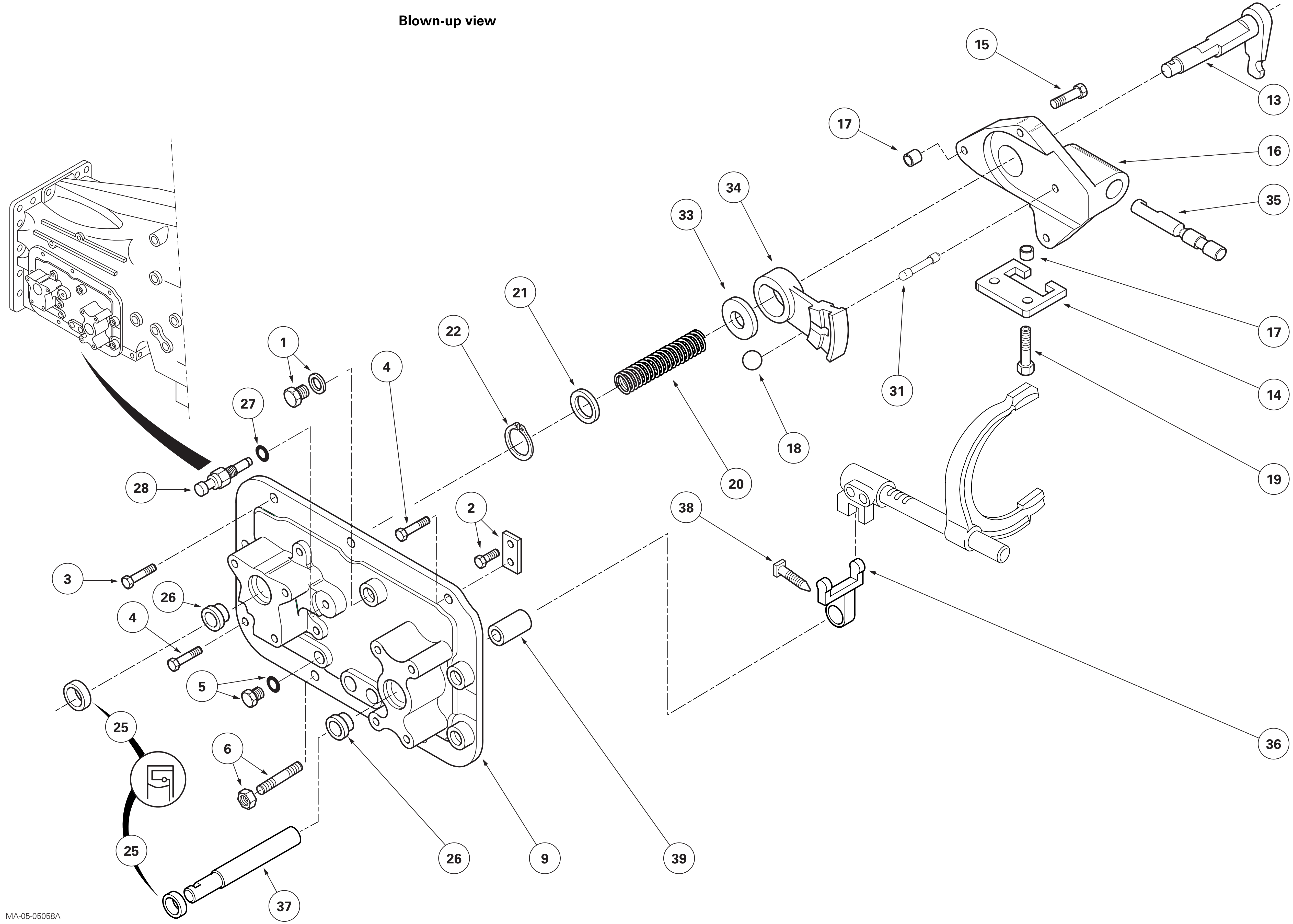

Fig. 3

Parts list (Fig. 4)

Hare / Tortoise fork locking and gear control

(2) Transmission lever.
(13) Control finger and pin
(31) Plunger
(34) Toggle switch
(35) Indexing rod

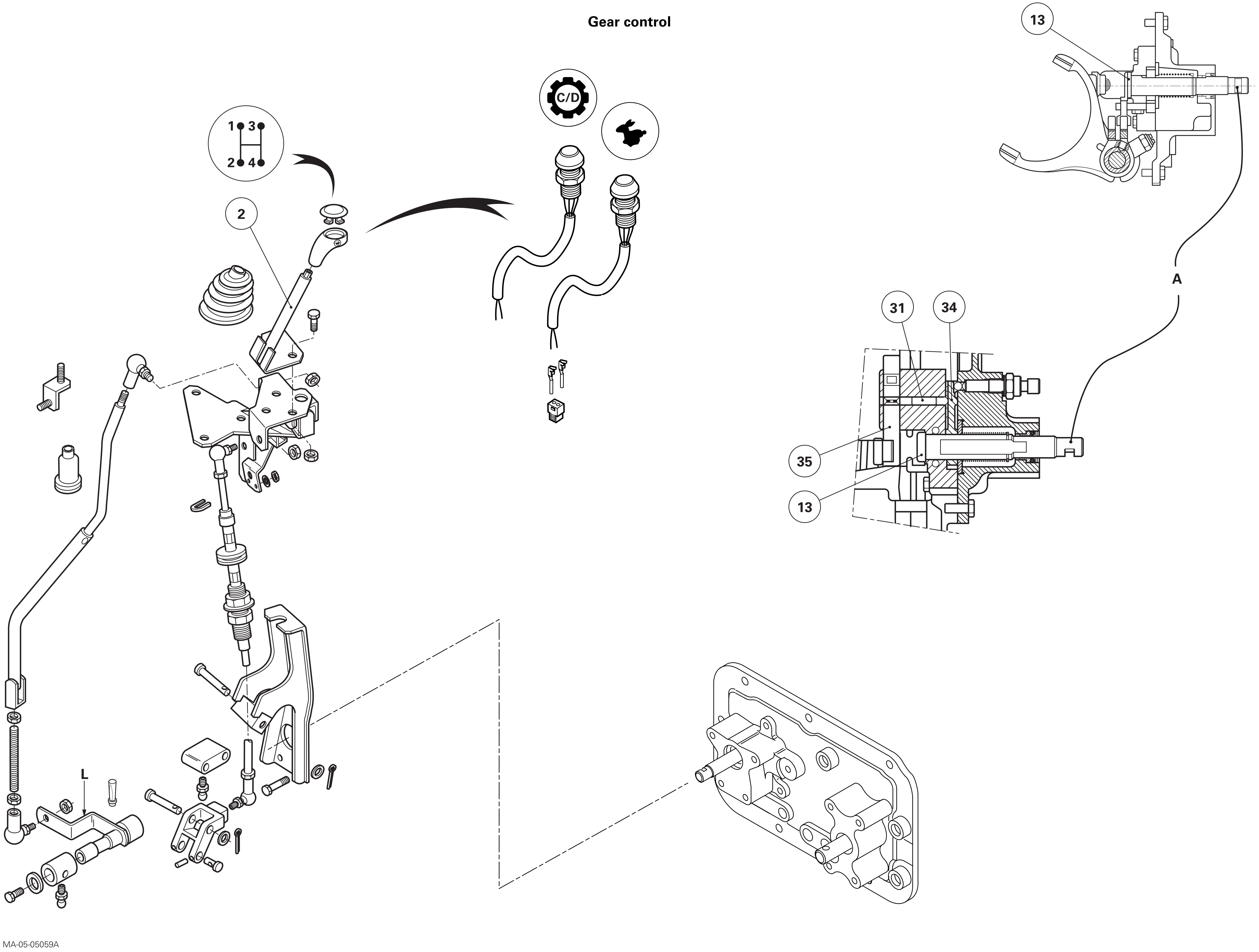

Fig. 4

Parts list (Fig. 5)

Mechanical reverse shuttle control

(1) Control lever
(2) Selector
(5) Rod
(6) Fork
(36) Finger
(37) Pin

Reverse shuttle control

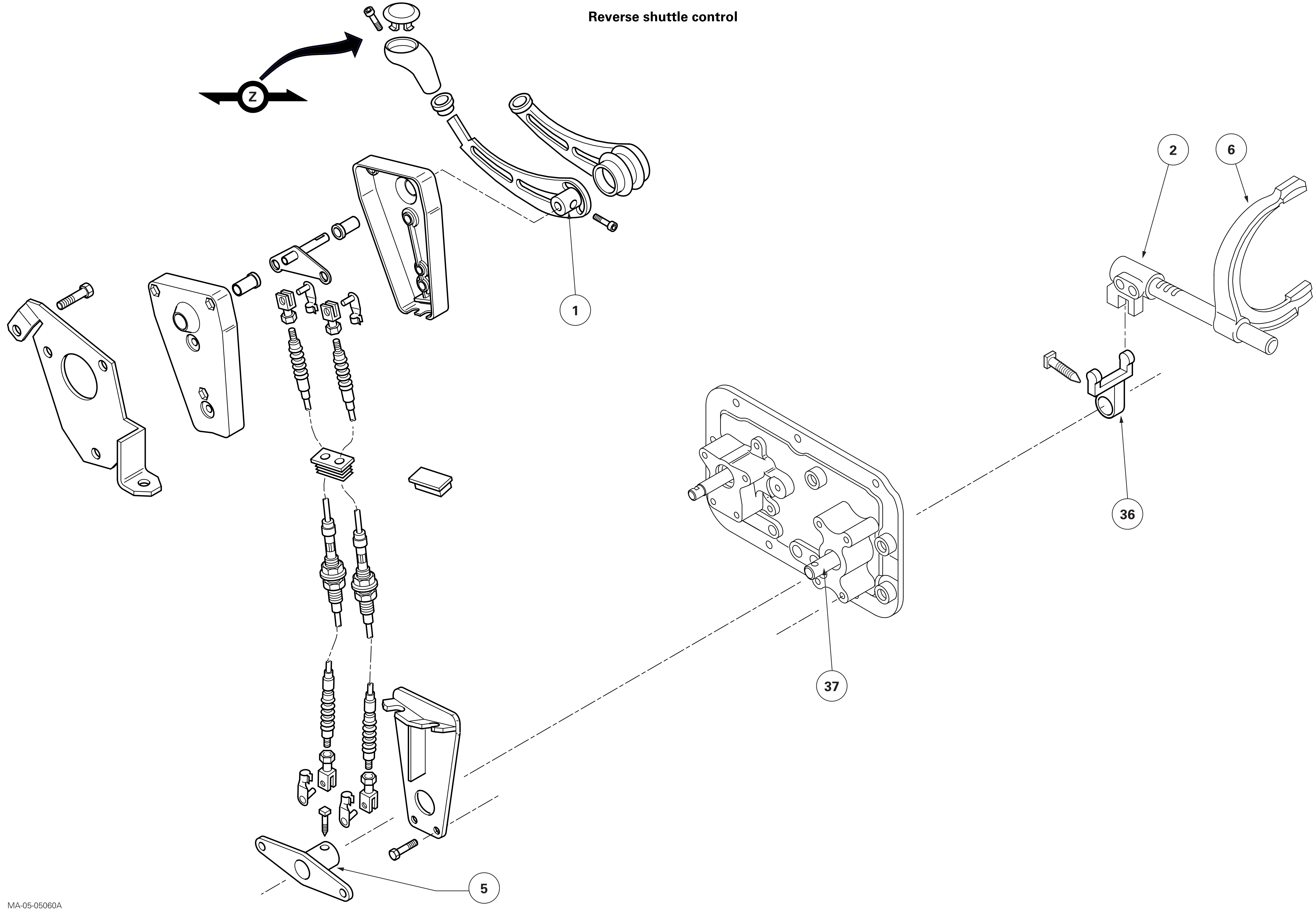

Fig. 5

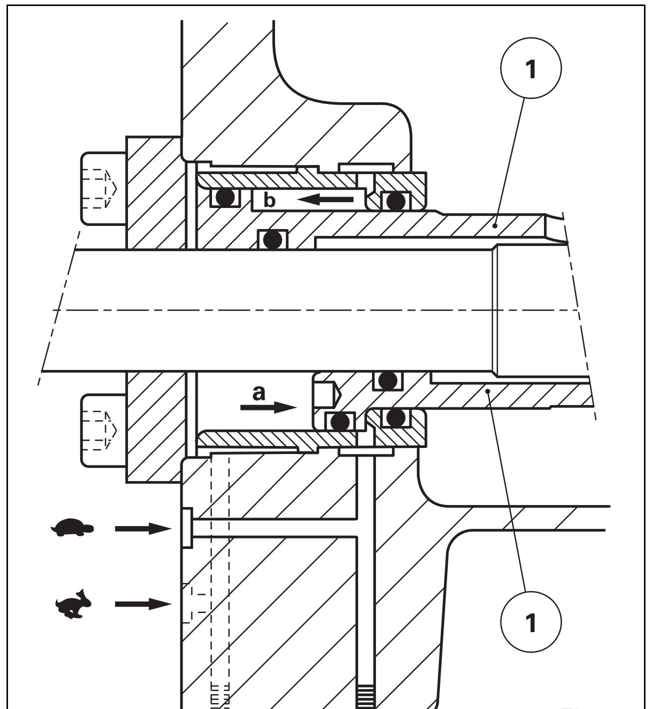

Fig. 6

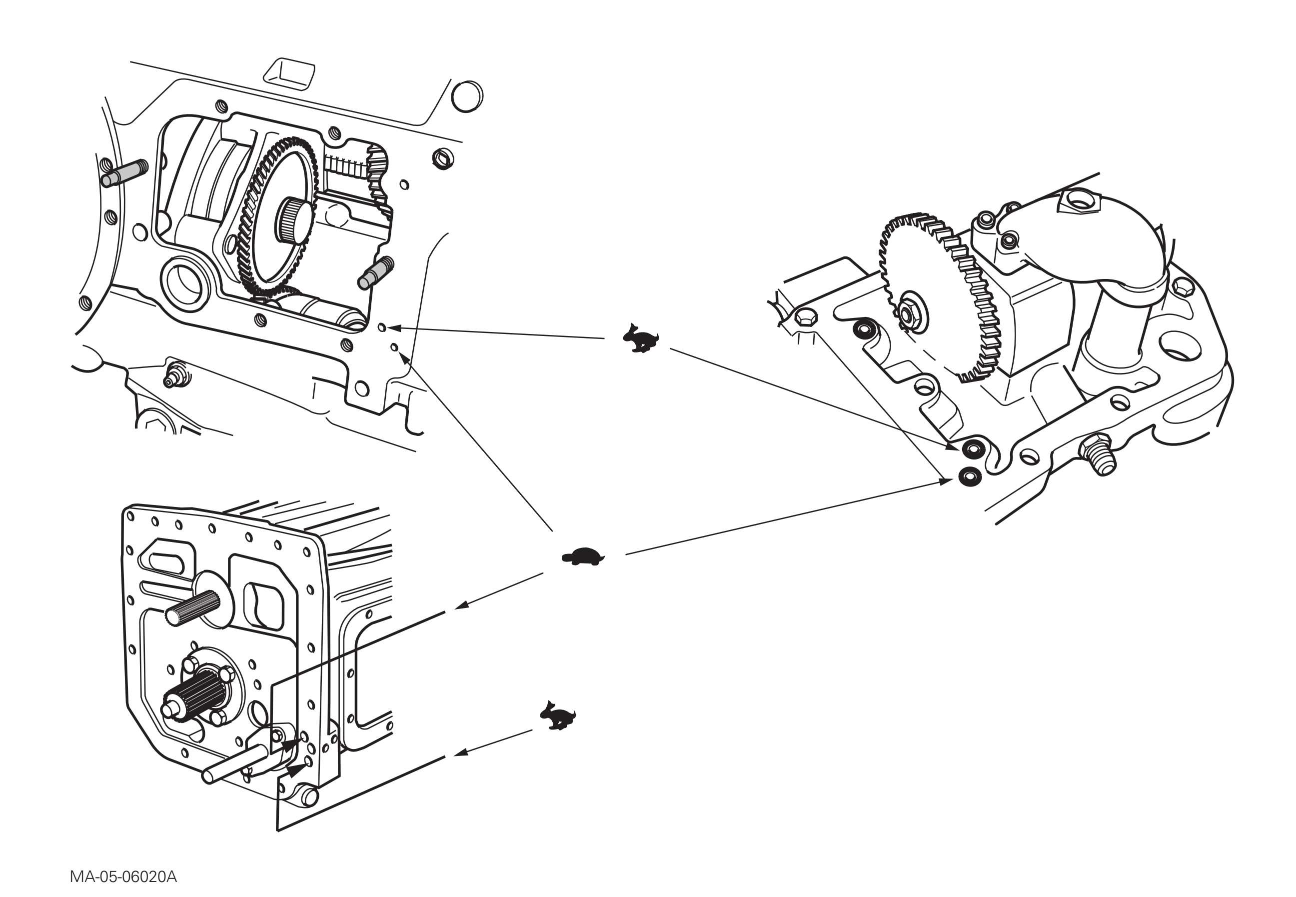

Fig. 7

B . Operation

Transmission lever (Fig. 4)

Selecting 1st - 2nd ratios

The transmission lever (2) operates lever L and engages the finger (13) in the 1st - 2nd fork.

The first ratio is obtained by moving lever L upwards and the second ratio downwards (Fig. 4). Simultaneously, the toggle switch (34) secured to pin A pivots and moves the plunger (31) thus locking the indexing rod (35) and the Hare/Tortoise fork.

Selecting 3rd - 4th ratios

In this configuration, the finger (13) secured to pin A is engaged in the 3rd - 4th gear fork.

The third ratio is obtained by moving lever L upwards and the fourth ratio downwards (Fig. 5).

The locking principle of the indexing rod (35) and Hare/Tortoise fork is identical to that used for the 1st - 2nd ratios.

Hare/Tortoise range

Hare/Tortoise range shifting is validated when the transmission lever is in the Neutral position.

If the button located on the transmission lever handle is activated and if switch (28) has confirmed the Neutral position of the lever, the electronic system of the tractor allows voltage to be supplied to or cut off from the Hare/Tortoise solenoid valve in order to obtain movement of the fork in the required range.

Hare position

The Hare/Tortoise solenoid valve, fitted on the lower part of the right-hand cover plate (see chapter 9) opens and supplies chamber "a" located behind piston (1) (Fig. 6). The piston moves forward, and pushes the fork (Hare / Tortoise).

The oil contained in chamber "b" is discharged into the Tortoise channel, and returns into the 17 bar system.

Tortoise position

When the pulse switch (Fig. 4) is activated again, the solenoid valve is closed, and the pressure drops in chamber "a" (Fig. 6). The piston (1) moves back due to the 17 bar pressure exerted on the annular face.

The oil contained in chamber "a" returns to the housing via the Hare channel and the solenoid valve.

Identification of Hare / Tortoise function ports

See Fig. 7.

Identification and function of Hare / Tortoise range locking elements

Toggle switch (34)

This is one of the main elements of the Hare / Tortoise range locking system. It is freely mounted on pin A (Fig. 4) and pivots with it by means of a flat section.

Function

- It moves the plunger (31) towards the indexing rod (35) and locks the latter during gear engagement.
- Via its opposite face it controls the neutral position of pin A (transmission lever) using the switch (28).

Indexing rod (35)

At one end there are two different locking grooves:

- the narrow groove: Hare position;
- the wide groove: Tortoise position.

The other end is designed to house the stop of the Hare / Tortoise fork.

Function

It avoids any unwanted reverse movement of the Hare / Tortoise fork in case of electronic or hydraulic malfunction.

Plunger (31)

Spherically shaped at each end, it moves between the toggle switch (34) and indexing rod (35).

Function

It acts as the system lock, whatever range is engaged.

Switch (28)

It is controlled by the toggle switch.

Function

It informs the tractor electronic system when the transmission lever is in neutral position.

Reverse shuttle lever (Fig. 5)

The reverse shuttle function is activated when the lever (1) is shifted either upwards (forward travel) or downwards (reverse travel).

When the lever (1) is shifted, the rod (5) and pin (37) rotate partly, the latter being secured to the finger (36). The finger (36) then moves the mechanical reverse shuttle fork (6) and selector (2).

C . Removing and refitting the cover plate

Preliminary steps

1. Immobilise the tractor. Chock the left rear wheel.
2. Apply the hand brake.
3. Chock between the frame and the front axle.
4. Drain the gearbox.
5. Raise the rear right-hand side of the tractor with a suitable jack.
6. Remove the wheel. Place an axle stand in position.
7. Remove the right-hand step and any surrounding parts that might hinder removal of the cover plate.

Removal

8. Removing the gear control (Fig. 8)
   - Disconnect the harness of sensor "C".
   - Remove the ball joint (4).
   - Remove the screw (3).
   - Remove the pins (11).
   - Disconnect the ball joint (5).
   - Mark the adjustment of the cable (6). Slightly loosen the top nut (12). Separate the cable from the support (2).
9. Removing the reverse shuttle control (Fig. 9)
   - Disconnect the clips (1). Mark the adjustment of the cables (2).
   - Loosen the lower nuts (3). Separate the cables from the support (4).
10. Disconnect the control cable (1) from the creeper or super creeper unit on tractors fitted with this option (Fig. 10).
11. Remove the screws (3) (4) and the nut (6), marking the location of the earthing lug (2) and centring screws (4) (Fig. 2).
12. If fitted, remove the support (2) of the creeper or super creeper unit control cable (Fig. 10).
13. Release and remove the selector cover plate.

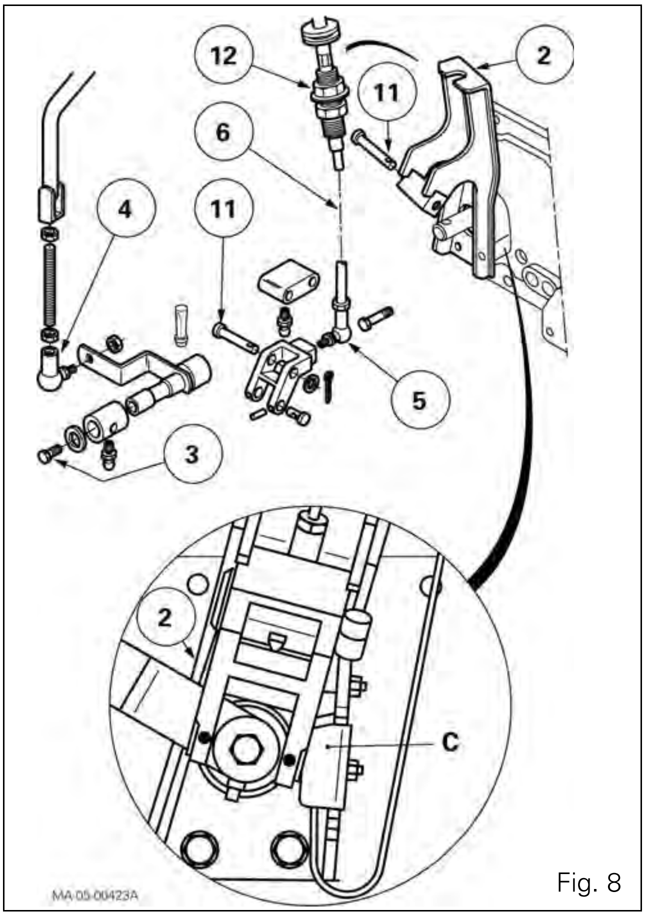

Fig. 8

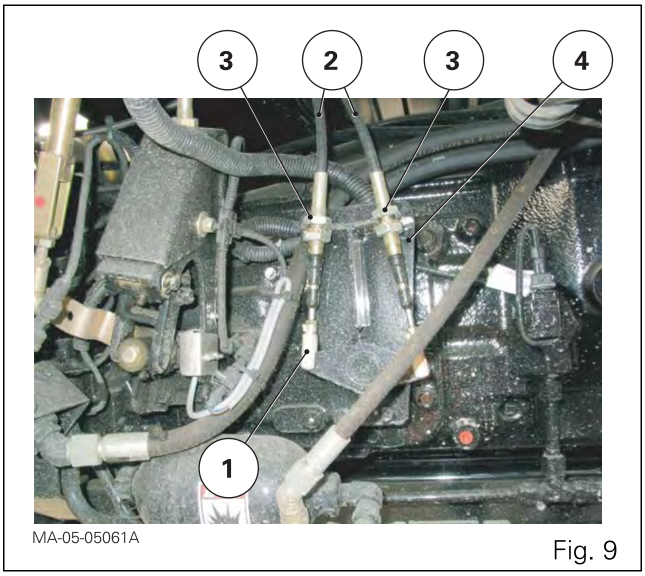

Fig. 9

GBA20 - Mechanical reverse shuttle - Selector cover plate

Refitting (Fig. 2)

14. Clean the mating face of the gearbox and the cover plate.

15. Fit:
- the 3rd - 4th fork in ratio 3 (Fig. 10)
- the Hare / Tortoise range fork in Hare position (Fig. 10).

IMPORTANT: *Before refitting the cover plate, check that the screw (1) is present (Fig. 10).*

16. Lightly smear the mating face of the gearbox housing with a sealing product such as Loctite 510 or equivalent.

17. Turn the finger (13) (Fig. 11) to the left.

Fit the indexing rod A in Hare position.

18. Move the selector (2) and finger (36) to neutral position (Fig. 10 and Fig. 11).

19. Fit the cover plate on the gearbox, ensuring that:
- the finger (13) is positioned correctly in the forks (Fig. 10 and Fig. 11);
- the finger (36) is engaged in the selector (2) (Fig. 10 and Fig. 11).

20. Refit the creeper or super creeper control cable support (if fitted).

21. Refit the earthing lug (2). Fit and tighten the screws (3) (4) and the nut (6) to a torque of 50 - 70 Nm.

IMPORTANT: *The centring screws (4) must be fitted as shown in Fig. 2.*

22. Depending on the option, reconnect and adjust the creeper or super creeper control (see chapter 5).

23. Reconnect the harness on the neutral position switch.

24. Reconnect:
- the gear control and sensor "C". Carry out step 8 in reverse order;
- the reverse shuttle control. Carry out step 9 in reverse order.

25. Using a grease gun, lubricate the joints of the gear control on the selector cover plate.

Legend (Fig. 10 and Fig. 11)

A Indexing rod for locking the Hare/Tortoise fork
L Synchronisation of the Hare/Tortoise mechanism in Hare range
(3) Engaged gear (e.g. 3rd gear)
(1) Screw
(9) Selector cover plate
(13) Finger
(18) Locking stop

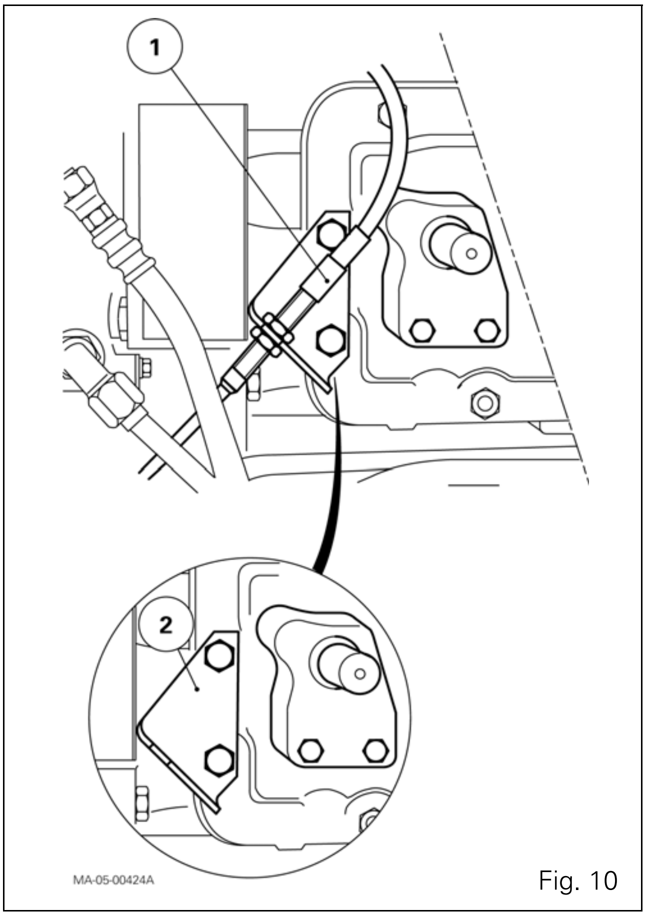

Fig. 10

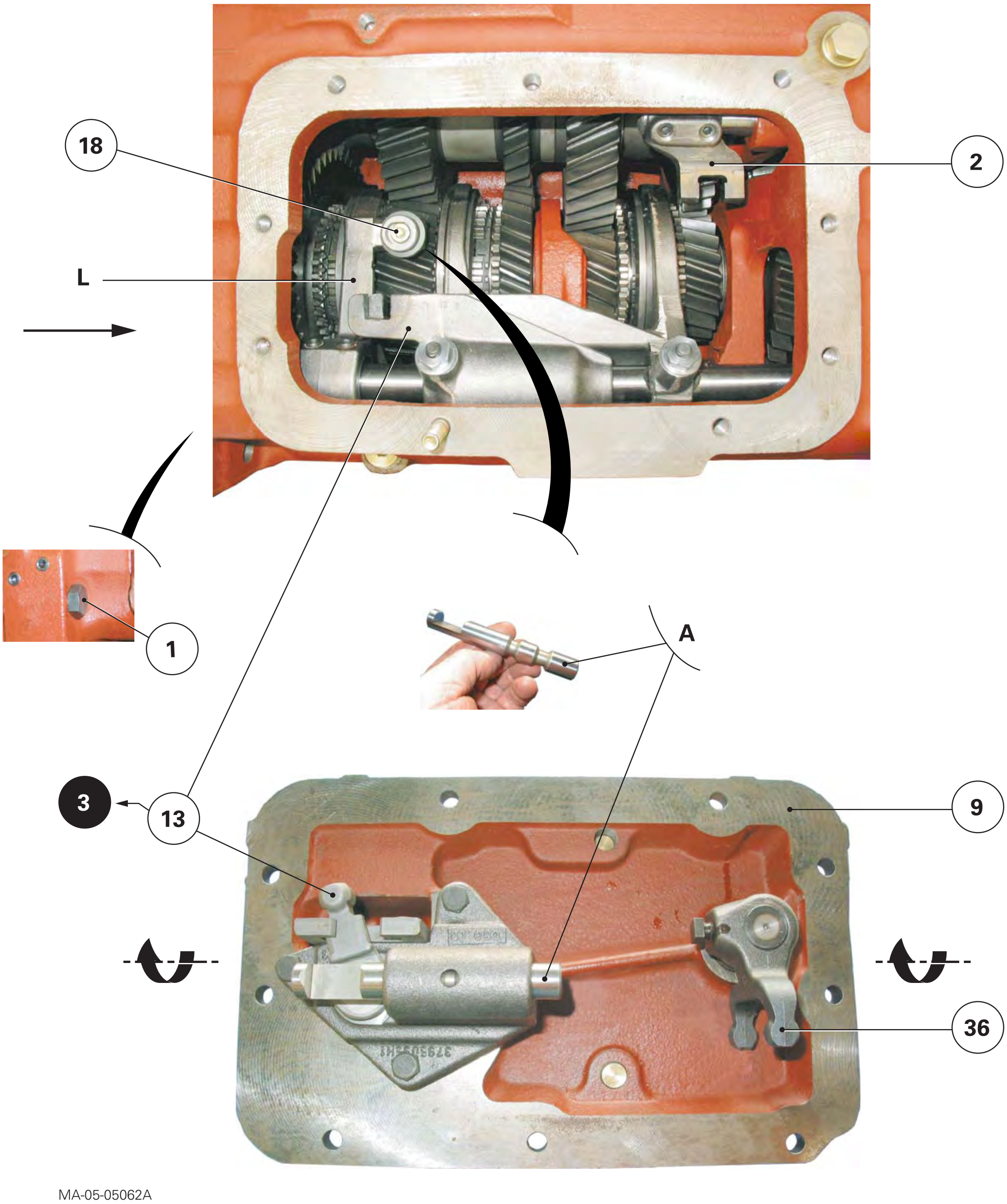

Fig. 11

Final steps

26. Check the shifting of all gears and the reverse shuttle. If required, adjust the controls (see § E).

Check the operation of the mechanical reverse shuttle.

27. As required, refit any components removed previously from around the cover plate.

28. Refit the wheel. Tighten the nuts to a torque of 400 - 450 Nm.

29. Top up the oil level in the housings. Check it using the gauge at the rear of the centre housing.

30. Remove the chocks between the frame and the front axle. Release the hand brake.

31. Check that the buzzer of the safety sensor vibrates correctly (ignition on, hand brake on and gear engaged).

32. Start the engine.

When on the road, check:

- shifting up and down of the gear ratios;
- operation of the Hare / Tortoise range with the pulse button located on the lever;
- operation of the reverse shuttle in the forward and reverse positions.

33. Check the tightness of the selector cover plate mating face and of the hydraulic unions.

D . Disassembling and reassembling the gear selector and reverse shuttle mechanisms

Preliminary step

34. Take off the cover plate (see § C). Secure it in a vice fitted with protective jaws.

Disassembly

Gear selector mechanism (Fig. 12 and Fig. 13)

35. Remove the screws (1). Remove the key (4) and selector (3). Remove the support (2) from the cover plate.

36. Remove the screws (15). Separate the cover plate (9) and support (16) comprising the gear control assembly. If necessary, extract the locating rings (17).

On the cover plate (9)

37. Take off the Neutral position switch (28). Recover the seal (27) and ball bearing (18).

38. Extract and discard the seal (25).

On the support (16)

39. Take off the circlip (22), washer (21) and remove the spring (20).

40. Release the washer (33) and toggle switch (34), marking its position and profile.

41. Recover the plunger (31). Extract the indexing rod (35).

42. If necessary:
- remove the screws (19);
- remove the speed grid (14);
- extract the locating rings (17).

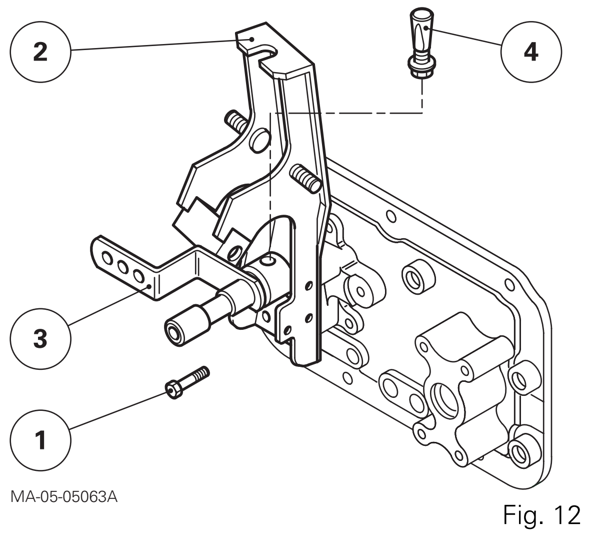

Fig. 12

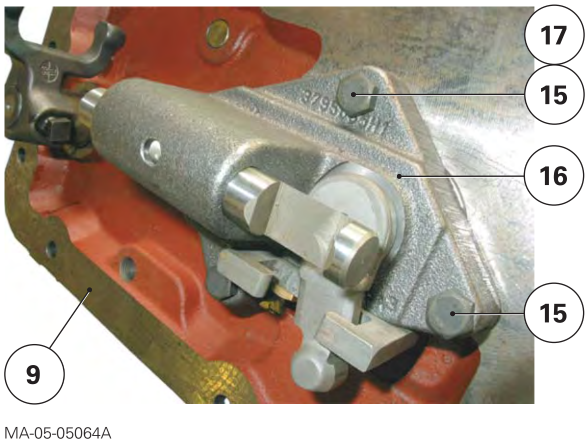

Fig. 13

GBA20 - Mechanical reverse shuttle - Selector cover plate

Reverse shuttle selector mechanism (Fig. 14 and Fig. 15)

43. Take out the set screw (4). Remove the rod (5).

44. Remove the screws (1). Separate the support (2) from the cover plate (9) (Fig. 14).

45. Take out the set screw (38). Remove the finger (36) and pin (37) from the cover plate.

On the cover plate (9)

46. Remove any plugs screwed to the cover plate.

47. Extract and discard the seal (25).

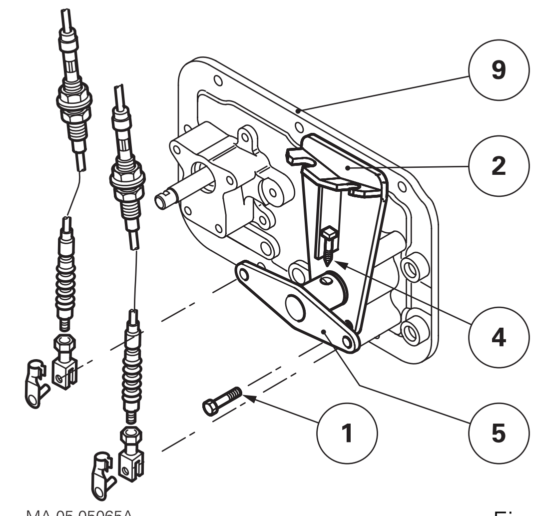

Fig. 14

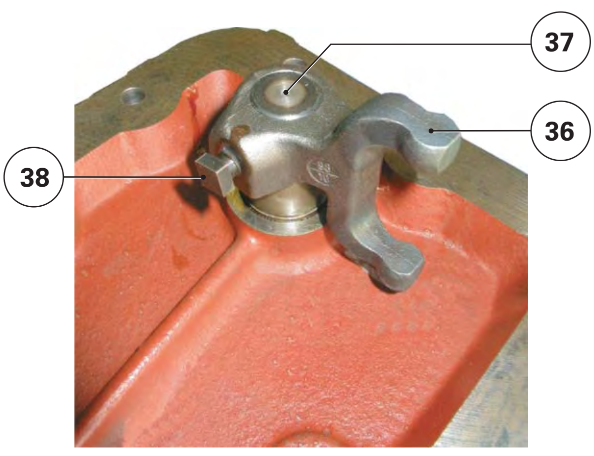

Fig. 15

Reassembly (Fig. 2)

Gear selector mechanism

48. If it was necessary to replace the guide ring (26), lightly smear its rim with Loctite 648 or equivalent. Fit it up against the shoulder of the cover plate.

On the support (16)

49. If necessary:
- fit the locating rings (17),
- refit the speed grid (14) on the support (16),
- tighten the screws (19), lightly smeared with Loctite 270 or equivalent, to a torque of 29 - 37 Nm.

50. Check that:
- the plunger (31) and indexing rod (35) move freely in the support (16),
- the flat section of the toggle switch (34) slides normally on the finger (13).

51. Slide the pin of the finger (13) into the support (16).

52. Turn the toggle switch (34) as required. Fit it onto the finger (13). Fit the washer (33).

53. Refit the spring (20) and washer (21). Fit the circlip (22).

54. Slide the plunger (31) into its cavity in the support (16).

55. Place the finger (13) in the Neutral position. Turn the indexing rod (35) as required and fit it.

On the cover plate (9)

56. Check that the locating rings (17) are present.

57. Refit the gear control and support (16) assembly on the cover plate (9).

58. Lightly smear the thread of the screws (15) with Loctite 242 or equivalent. Tighten to a torque of 29-37 Nm.

59. Protect the lip of the seal (25) by surrounding the cylindrical end of the finger (13) with a flexible protection. Lightly smear the external rim of the seal with Loctite 542 or equivalent and slide it onto the protection. Remove the safety shield. Fit the seal onto the cover plate using a suitable fixture.

60. Check that finger (13) is in the Neutral position.

61. Slide the ball bearing (18) into the depression on the toggle switch (34).

Checking the Neutral position switch (28)

62. Press manually on the button located at the end of the switch. Release the pressure and check that the button returns freely to its initial position. Repeat the operation several times. The check can be carried out using a multimeter.

63. Refit the switch complete with its seal and tighten to a torque of 15 - 25 Nm.

64. Refit the support (2), allowing a distance of **29 mm** between the support and the 22 mm diameter of pin A (Fig. 16).

Lightly smear the screws (1) with Loctite 270 and tighten them to a torque of 25 - 35 Nm.

IMPORTANT: *This dimension must be met for the sensor to operate correctly, see § A.*

65. Refit the selector (3). Fit and tighten the key (4) (Fig. 12).

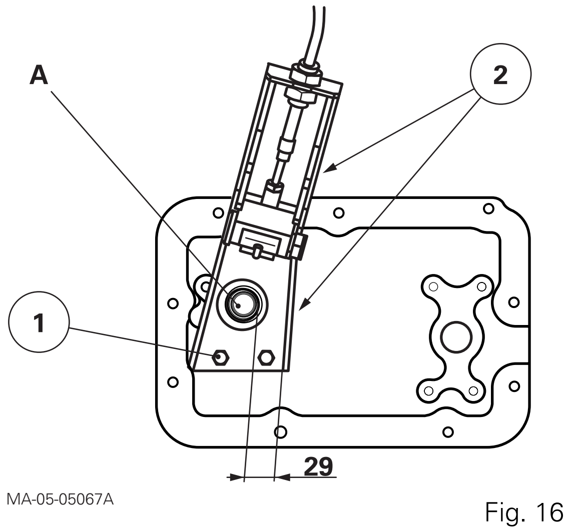

Fig. 16

Checking the locking system of the indexing rod (35)

66. In the grid (14), move the finger (13) from 1st to 4th ratio using the selector (3) (Fig. 12) and manually check for the correct locking of the indexing rod in each of its positions.

IMPORTANT: *This indexing rod is linked to the Hare/Tortoise fork by an adjustable stop. If the replacement of certain components of the locking system was necessary, it is mandatory to readjust this stop (see chapter 5).*

Reverse shuttle selector mechanism

67. Assemble the finger (36) and pin (37).

Lightly smear the thread of the set screw (38) with Loctite 242 or equivalent. Tighten this screw to a torque of 28 - 43 Nm.

68. If the guide rings (26) and (39) of the pin (37) needed replacing, lightly smear the rim of each ring with Loctite 648 or equivalent.

Fit these rings up against their respective shoulders on the cover plate.

69. Fit the support (2) on the cover plate (9).

Lightly smear the thread of the screws (1) with Loctite 270 or equivalent (Fig. 14). Tighten these screws to a torque of 25 - 35 Nm.

70. Slide the pin (37)/finger (36) assembly into the relevant bore on the cover plate.

71. Protect the lip of the seal (25) by surrounding the cylindrical end of the pin (37) with a flexible protection. Lightly smear the external rim of the seal with Loctite 542 or equivalent. Slide the seal onto the protection. Remove the safety shield. Insert the seal into the cover plate using a suitable fixture.

72. Refit the rod (5).

Lightly smear the thread of the set screw (4) with Loctite 242 or equivalent (Fig. 14). Tighten this screw to a torque of 30-35 Nm.

Final step

73. Remove the cover plate from the vice. Refit it on the gearbox (see § C).

E . Assembling and adjusting the gear linkage and reverse shuttle control cables

Gear linkage - cab side

Preparation (Fig. 17)

74. On the end of the rod (1) shaped with an angle of 166°, position the ball joint (2) as shown in Fig. 17. Tighten the nut (3).

75. Tighten the ball joint (4) up against the cable (6). Tighten the nut (5).

Assembly (Fig. 17)

76. Place the support (7) on a workbench.

77. On the support, fit and tighten:
- the transmission lever
- the previously prepared rod and cable.

78. Refit and secure the support onto the right-hand wheel housing of the cab. During this operation, ensure the rod and cable are inserted through the holes in the compartments.
Fit the shield rings.

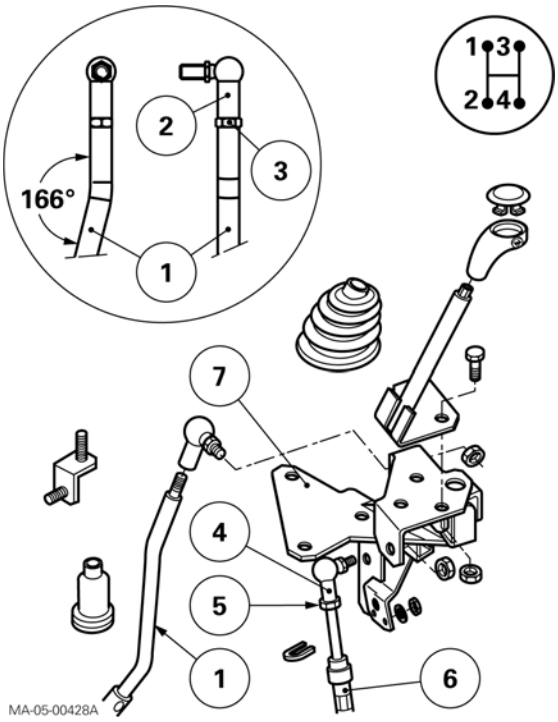

Fig. 17

Gear linkage - selector cover plate side

Preparation (Fig. 18)

79. Screw the threaded rod (9) (fitted with nuts (3) and the ball joint (4)) onto the rod (1).

80. Tighten the ball joint (5) up against the cable (6). Tighten the nut (7).

Assembly (Fig. 18)

81. Tighten and lock the other end of the ball joint (5) onto the cam (8).

82. On the previously fitted support (2) and lever "L", position the cam (8) and its extension block (10). Fit the pins (11), and lock them in place with new pins.

83. Fit the ball joint (4) on the lever L. Fit the washer and tighten the locknut.

Adjusting the rod (1) (Fig. 18)

84. Turn the threaded rod (9) and ball joint (4) to obtain a dimension X of **17 ± 1 mm** between the two nuts (3) when they are tightened.

Adjusting the cable (6) (Fig. 18)

85. Adjust the sheath end to balance (as far as possible) dimensions "C" and "D". Tighten the nuts (12) without altering the adjustment.

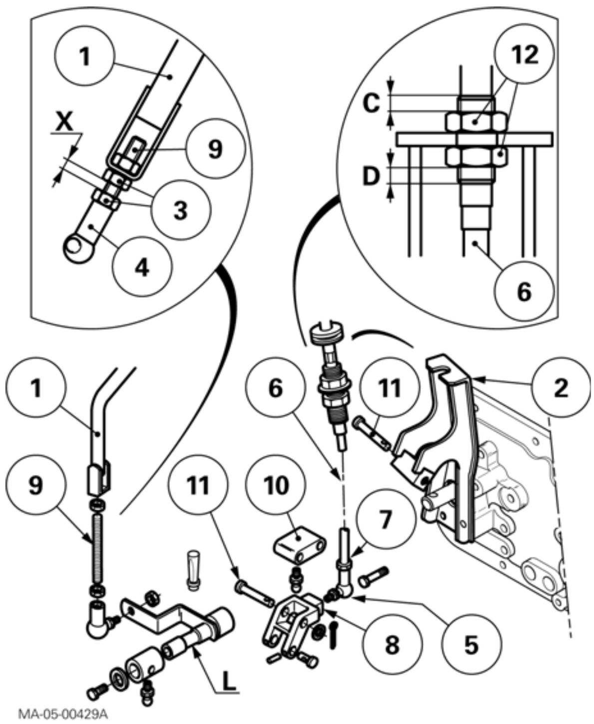

Fig. 18

Checking the proper engagement of each gear ratio and the position of the lever in the opening of the console.

***IMPORTANT:** This check should be performed with the gaiter of the transmission lever temporarily removed.*

86. Engage each gear ratio. During this operation, check that the lever is **never closer than 5 mm** from the edge of the console (Fig. 19 - Fig. 20).

Results

- **Lever movement is not hindered in any way by the console**

  Adjustment is correct. Position the gaiter.

- **Lever movement is hindered by the console**

  The lever is positioned incorrectly. Readjust the rod (1) (Fig. 18) on the selector cover plate side in accordance with the following instructions:

  - If the problem concerns the 1st or 3rd gear (Fig. 19), reduce dimension X (Fig. 18).
  - If the problem concerns the 2nd or 4th gear (Fig. 19), increase dimension X (Fig. 18).
  - If the problem concerns lateral movement of the lever between the 1-2 and 3-4 gear paths (Neutral position) (Fig. 20), adjust the cable sheath end (6) (dimensions C and D) (Fig. 18). Tighten the nuts (12).

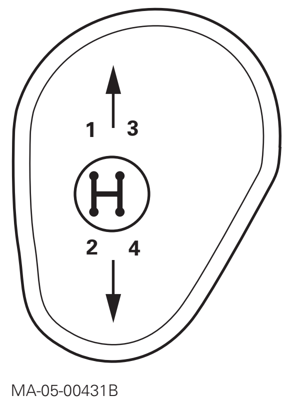

Fig. 19

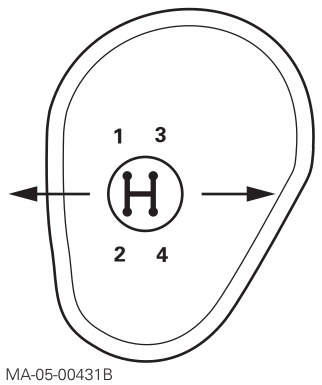

Fig. 20

Reverse shuttle control cables - cab side

***Note:** The assembled unit (4) and cables (2) (Fig. 21) are entered in the catalogue as a complete assembly under a single reference. However, this assembly comprises a number of parts, most of which are available as spare parts.*

Preparation (Fig. 21)

87. Screw the clevises (1) level with the threaded end of the cables (2).

88. Fit the clevises on the swinging lever (3). Fit the clips. Tighten the nuts.

89. Slide the cable sheath ends into the slots provided on the unit (4).

Position and tighten the cover plate (5).

Assembly (Fig. 21)

90. Assemble the support (6) on the unit (4).

91. Attach the unit (4) / support (6) assembly to the base of the instrument panel (8). Ensure the cables are inserted into the hole in the cab floor.

Position the feed-through conduits (7).

92. Position the floor mat.

93. Fit the instrument panel cover and related components.

94. Position the reverse shuttle lever. Tighten the screw after smearing it with Loctite 242 or equivalent.

Fit the gaiter.

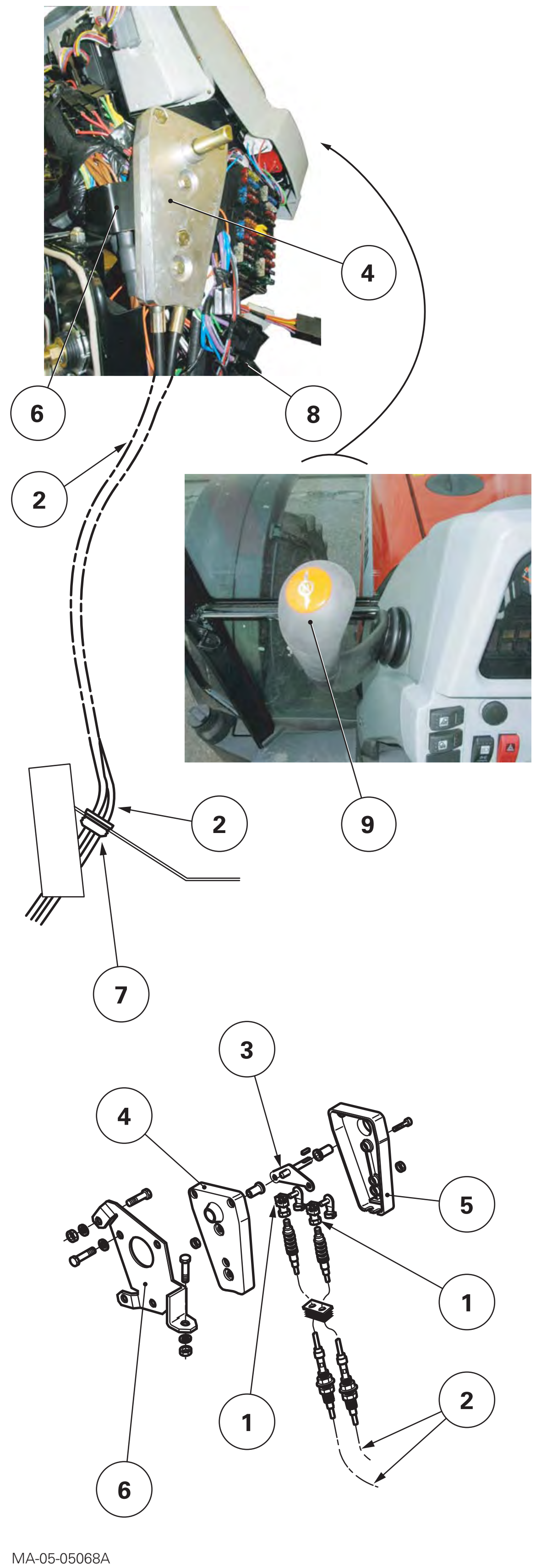

Fig. 21

Reverse shuttle control cables - selector cover plate side

Preparation (Fig. 22)

95. Screw the clevises (1) level with the threaded end of the cables (2).

Assembly (Fig. 22)

96. Slide the sheath ends (3) into the slots provided on the support (4).

*<u>**IMPORTANT:**</u> The cable fitted with an adhesive colour strip must be fitted in the left-hand slot in the support (4). The adhesive strip can be stuck anywhere on the cable and is represented by the letter R in Fig. 22.*

If the adhesive strip is missing, position the cables in the slots so that the shuttle lever position corresponds with the direction of movement of the tractor:

- *forward: lever pointing upwards*
- *reverse: lever pointing downwards*

***DANGER:* When carrying out maintenance on the rod (5), the tractor engine must be stopped.**

97. Place the rod (5) in neutral (Fig. 22).

98. Fit the clevises (1) to the rod.

99. Tighten the clevis nuts.

Cable adjustment (Fig. 23)

***DANGER:* When adjusting the cables, the tractor engine must be stopped.**

100. Gradually and alternately adjust the tension of the cables (2) using the sheath ends (3) to achieve **identical X and Y values**, if possible.

Tighten the nuts without altering the adjustment.

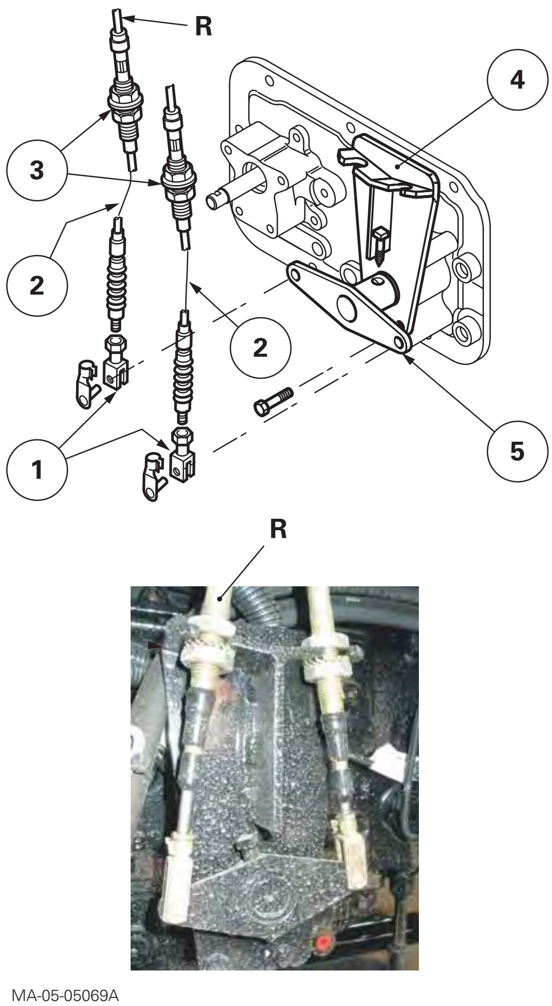

Fig. 22

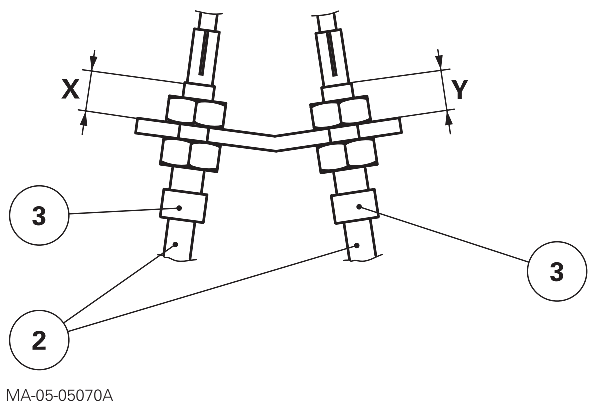

Fig. 23

Check

101. Alternately engage the forward and reverse positions.

102. For each ratio, check that the rod (5) locks correctly without excessive cable tension.

103. Carry out a road test of the gear controls and reverse shuttle.

5A15 - GBA20 - Mechanical reverse shuttle - Selector rails

CONTENTS

A . General

On the gearbox

The selector rail (7) holding the different forks is located on the right-hand side of the gearbox, on the selector cover plate side (Fig. 1). It passes through the gearbox housing and the Hare and Tortoise range control piston (13).

It is held in position by a set screw (8). A cup plug (9) closes off the bore at the front and a cover plate (15) closes the rear end.

The 1st - 2nd (5) and 3rd - 4th (6) forks are not adjustable.

The creeper gear fork (28) is adjustable by mechanical pressure.

Two adjustments are necessary to obtain the correct functioning of the fork (20) in both ranges (Hare / Tortoise):

- adjustment of the space between the fork pads and the synchroniser sliding coupler;
- adjustment of the stop (18), in relation to the position of the indexing rod fitted on the selector cover plate.

A creeper gearbox may be fitted as an option (see Fig. 1 and chapter 5).

A super-creeper gearbox may also be fitted as an option (see chapter 5). In this case, the end-of-travel pin (29) is not fitted.

On the input unit (Fig. 1)

The mechanical reverse shuttle synchroniser is controlled by:

- a selector;
- a selector rail;
- a fork.

The selector and the fork are adjustable.

Fig. 1

Parts list (Fig. 2)

(1) Plug
(2) Spring
(3) Detent plunger
(5) 1st - 2nd Fork
(6) 3rd - 4th Fork
(7) Selector rail
(8) Set screw
(9) Cup plug
(10) Cylinder
(11) "O" ring
(12) "O" ring
(13) Hare and Tortoise range piston
(14) "O" ring
(15) Cover plate
(16) Screw
(17) Screw
(18) Locking stop
(19) Adjustment screw
(20) Hare/Tortoise fork
(26) Nut
(27) Locking screw
(28) Creeper gear fork
(29) End-of-travel pin

View of the assembly

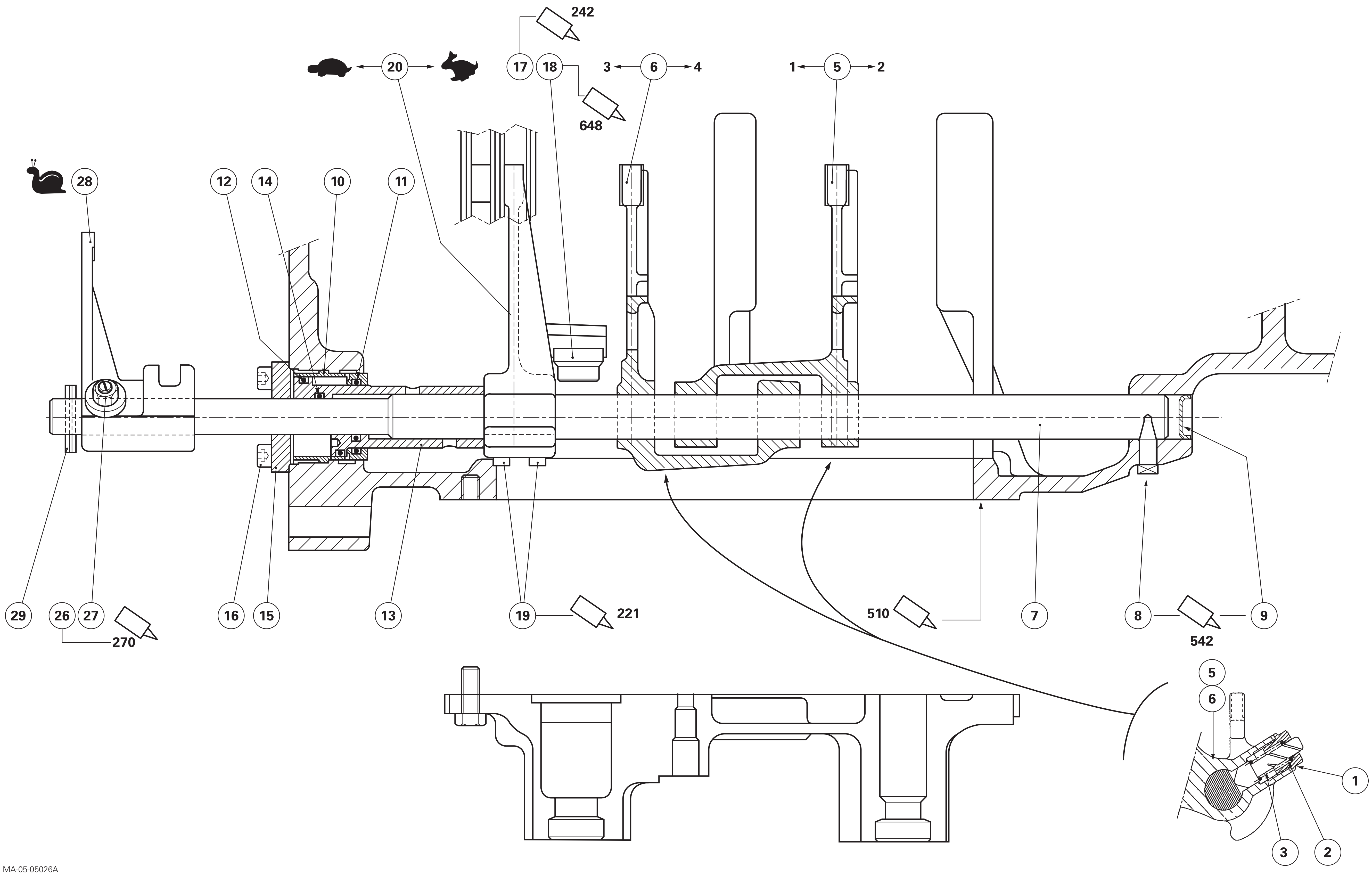

Fig. 2

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Parts list (Fig. 3)

(1) Plug
(2) Spring
(3) Detent plunger
(5) 1st - 2nd Fork
(6) 3rd - 4th Fork
(7) Selector rail
(8) Set screw
(9) Cup plug
(10) Cylinder
(11) "O" ring
(12) "O" ring
(13) Hare and Tortoise range piston
(14) "O" ring
(15) Cover plate
(16) Screw
(17) Screw
(18) Locking stop
(19) Adjustment screw
(20) Hare/Tortoise fork
(26) Nut
(27) Locking screw
(28) Creeper gear fork
(29) End-of-travel pin

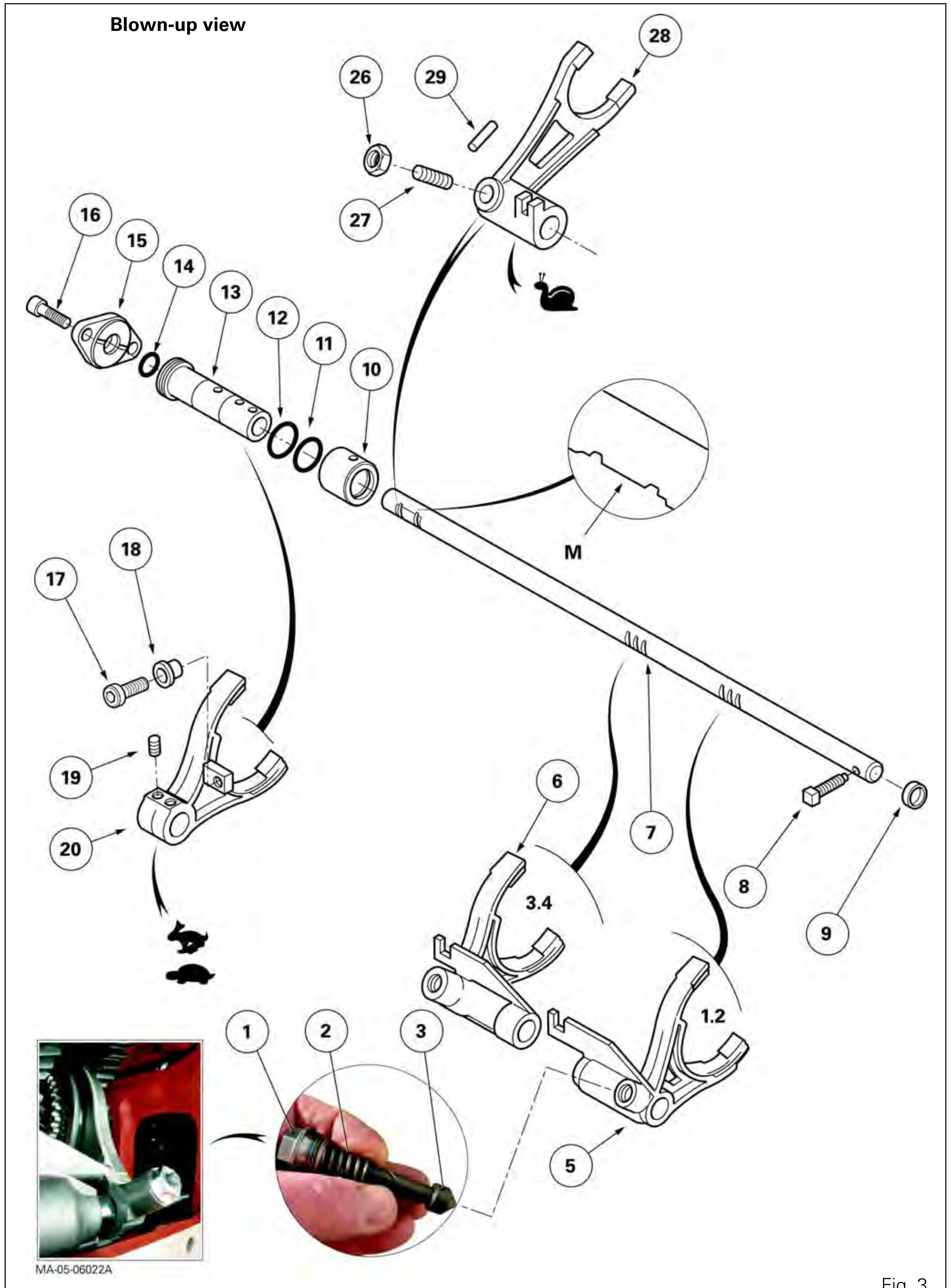

Fig. 3

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B . Maintenance guide

This guide describes a succession of operations to be followed depending on the mechanical component to be worked on.

Creeper gear fork

- Remove the selector cover plate (see chapter 5).
- Remove the right-hand hydraulic cover plate (see chapter 9).
- Remove the creeper gear fork

Hare / Tortoise fork

- Remove the selector cover plate (see chapter 5).
- Remove the right-hand hydraulic cover plate (see chapter 9).
- Remove the creeper gear fork (if fitted).
- Move the selector rail forward.
- Disassemble the hydraulic components (ram) of the Hare / Tortoise mechanism.
- Take out the range fork.

1st-2nd and 3rd-4th gear forks

- Remove the selector cover plate (see chapter 5).
- Remove the right-hand hydraulic cover plate (see chapter 9).
- Remove the creeper gear fork (if fitted).
- Move the selector rail forward.
- Disassemble the hydraulic components (ram) of the Hare / Tortoise mechanism.
- Take out the range fork.
- Move the selector rail backwards.
- Take out the 1st-2nd and 3rd-4th gear forks.

Main selector rail

- Remove the selector cover plate (see chapter 5).
- Remove the right-hand hydraulic cover plate (see chapter 9).
- Remove the creeper gear fork (if fitted).
- Move the selector rail forward.
- Disassemble the hydraulic components of the Hare / Tortoise mechanism.
- Take out the range fork.
- Take out the 1st-2nd and 3rd-4th gear forks.
- Move the selector rail backwards as far as it will go and disengage it through the selector cover plate opening.

Tractors with no creeper unit

The selector rail can also be removed through the front on tractors not fitted with a creeper unit. To do this it is necessary to:

- disconnect the tractor between the engine and the gearbox (see chapter 2);
- remove the gearbox spacer (only on tractors fitted with 6-cylinder engine) (see chapter 3).

Reverse shuttle selector

- Remove the selector cover plate (see chapter 5).
- Remove the reverse shuttle selector.

Shuttle fork

- Disconnect the tractor between the engine and the gearbox (see chapter 2).
- Remove (see chapter 5):
  - the selector cover plate;
  - the reverse shuttle selector;
  - the input unit;
  - the shuttle fork.

Shuttle selector rail

The shuttle selector rail is removed using the same procedure as for the fork.

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C . Creeper gear fork

Disassembly

1. Remove the rear right-hand wheel.
Chock the tractor.

2. Disconnect the creeper unit control cable on the rear axle.

3. Remove the selector cover plate (see chapter 5). Take out the plugs (1), the springs (2) and the detent plungers (3) to release the selector rail (Fig. 3).

4. Remove the hydraulic cover plate(s) (see chapter 9).

5. Remove the screw (1). Pull the rod (2) and the lever (3) outwards to release the finger of the fork (Fig. 4).

6. Unscrew the nut (26) and the locking screw (27) on the fork (28).

7. Take out the set screw (8).

8. Turn the selector rail (7) and drive out the pin (29) (Fig. 5 - Fig. 6) without dropping it into the housing.
Move the selector rail forward.

Removing the pin (1) from the coupling sleeve (2) on a 2 or 4WD tractor (steps 9 to 12)

NOTE: *Depending on the angular position of the coupling sleeve (2) located between the gearbox output shaft and the pinion, the pin (1) is accessible or inaccessible.*

2WD tractor

9. If the pin (1) is accessible, drive it out from the sleeve (2) (Fig. 7).

10. If the pin (1) is not accessible:
- raise the tractor rear axle using a trolley jack;
- turn the pinion to correctly position the coupling sleeve (2) (Fig. 7);
- drive out the pin (1) (Fig. 7).

4WD tractor

11. If the pin (1) is accessible, drive it out from the sleeve (2) (Fig. 7).

12. If the pin (1) is not accessible:
- disconnect the front differential lock control hoses;
- remove the guard (1). Uncouple the rear sleeve (5) from the transmission shaft (3) (Fig. 8);
- turn the pinion to correctly position the coupling sleeve (2) (Fig. 7);
- drive out the pin (1) (Fig. 7).

13. Provisionally fit the set screw (8) in order to hold the selector rail in place to remove the fork (28).

14. Slide the sleeve (2) and the coupler (1) closer together on the connecting shaft (3) (Fig. 9).

15. Note and mark the assembly order of the sleeve (2) (Fig. 9).
Disengage the sleeve/connecting shaft/coupler assembly towards the outer left-hand side.
Take it out of the fork (28) (Fig. 9) and remove it through the opening in the right-hand cover plate.

16. Remove the fork (28) on the selector rail (7) (Fig. 10).

17. Remove the lever (3) (Fig. 4).

18. To remove the creeper unit control rod (1), turn it so that it passes beneath the selector rail (7) (Fig. 11).
Discard the "O" ring (3).

GBA20 - Mechanical reverse shuttle - Selector rails

Reassembly

19. Clean and check all components. Replace those that are defective.

20. Refit the control rod and pull it as far to the right as possible. Fit a new lubricated "O" ring (Fig. 12).

21. Refit the lever (3) (Fig. 13). Tighten the screw.

22. Refit the fork on the selector rail.

***IMPORTANT:** Ensure that the finger (1) of the creeper gear control rod is pointing towards the front of the tractor (Fig. 13).*

23. Couple the sleeve/connecting shaft/coupler assembly inside the housing. Place it in the fork, turning the machined groove on the sleeve (2) towards the rear of the tractor (Fig. 14).

24. Slide the sleeve and coupler onto the connecting shaft.

25. Fit a new double pin (1) into the sleeve (2) (Fig. 7).

26. Take out the set screw (8).

27. Fit a new pin (29) and turn the selector rail (7) (Fig. 5 - Fig. 6).

28. Clean the set screw (8). Smear its thread with Loctite 542 and tighten to a torque of 38 - 43 Nm.

29. Ensure that the ball bearing fitted at the end of the locking screw (27) returns correctly to its initial position after pressure has been applied manually by the locking screw. Position the fork (28) and locking screw on flat section "M" of the selector rail (7) (between the two locking slots (Fig. 3).

Fully tighten the screw without forcing it in order to compress the ball bearing.

Loosen the screw by one-quarter turn. Clean the nut (26) and smear with Loctite 270 or equivalent. Tighten to a torque of 15 - 20 while holding the locking screw in place.

Check that the fork locks correctly.

30. Turn and push the rod (2) in order to engage the finger in the fork. Fit the screw (1) smeared with Loctite 542 or equivalent (Fig. 4).

31. Check that the rod operates correctly.

32. Check that the "O" rings for the internal hydraulic pipes are not damaged (see chapter 9).

33. Refit the right-hand cover plate (see chapter 9).

34. Attach the electrical harnesses with a retainer.

35. Refit the trailer brake valve (if fitted, open centre), checking that the "O" rings are not damaged. Tighten the screws to a torque of 25-35 Nm.

36. Reconnect the pipes and hoses via the hydraulic cover plate.

37. Refit the strainer, support and filter (open centre).

38. If necessary, on 4WD tractors:

- couple the rear sleeve (5) of the transmission shaft (3) (Fig. 8);
- refit the guard (1) (Fig. 8);
- reconnect the front differential lock control hoses.

39. Refit the plugs (1), the springs (2) and the detent plungers (3) (Fig. 3). Refit the selector cover plate (see chapter 5). Reconnect and adjust the creeper unit control cable (see chapter 5).

40. Refit the wheel.

41. Remove the axle stand and the jack.

42. Tighten the wheel nuts to a torque of 400 - 450 Nm.

43. Top up the oil level in the rear axle and gearbox.

44. Start the tractor.

45. Check the correct operation of the electrical and electronic circuits. Check the tightness of the cover plate mating face and the hydraulic unions.

46. Carry out a road test of the creeper unit control and 1st, 2nd, 3rd, 4th gears of the Hare/Tortoise ranges.

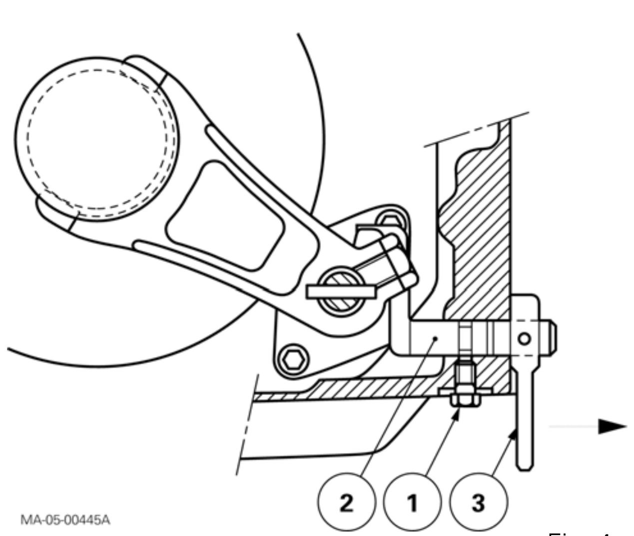

Fig. 4

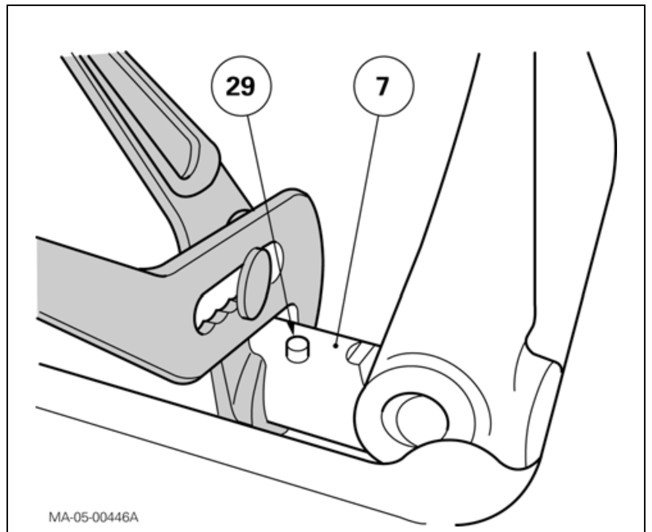

Fig. 5

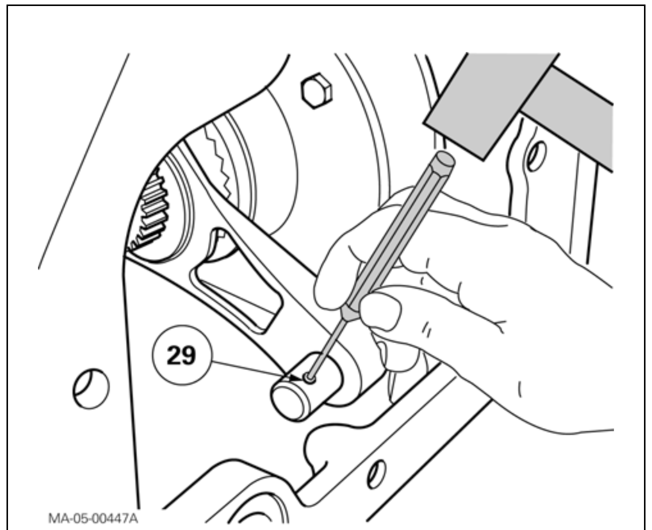

Fig. 6

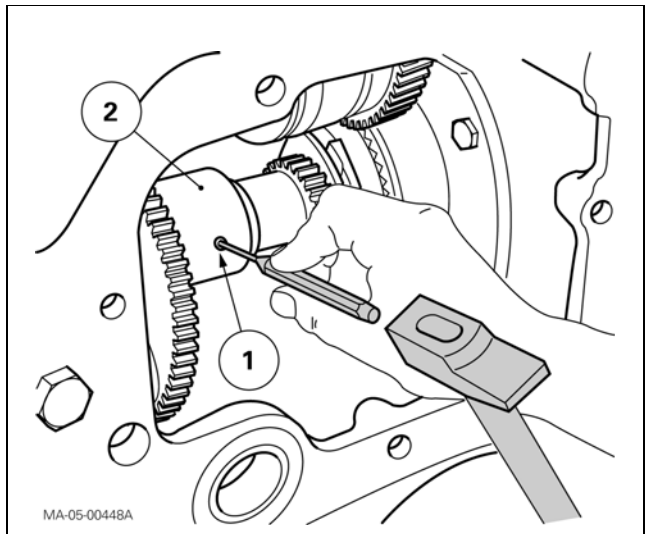

Fig. 7

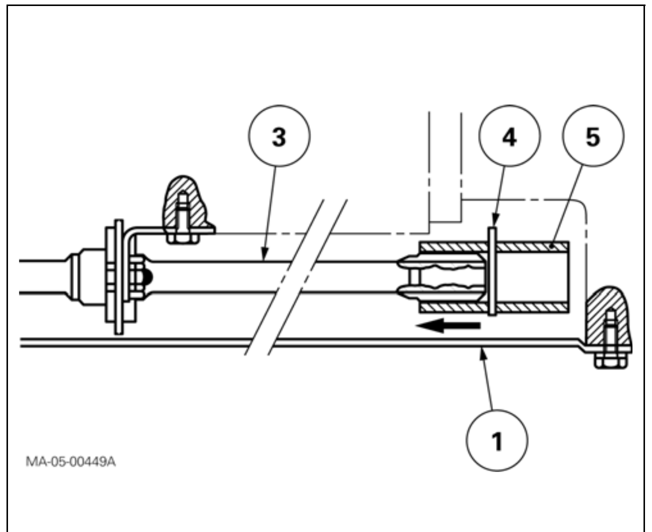

Fig. 8

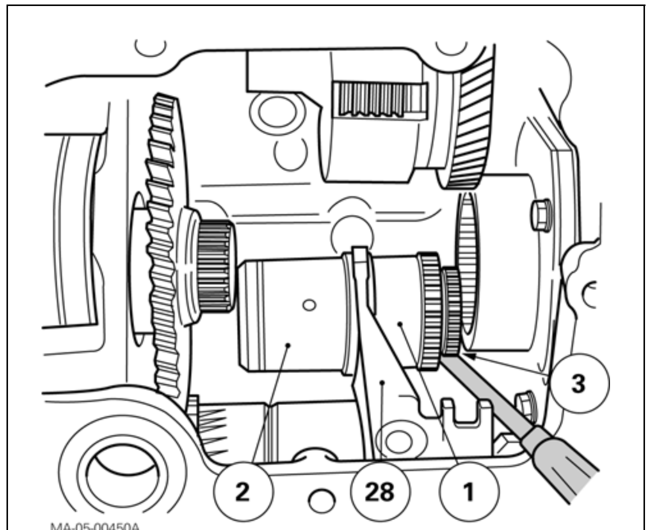

Fig. 9

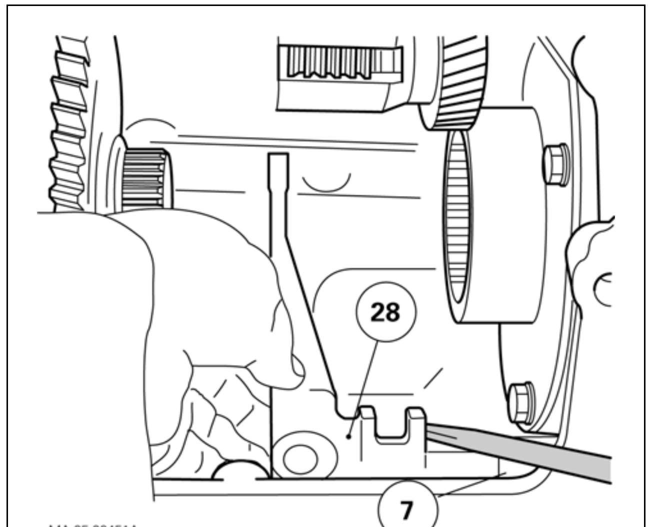

Fig. 10

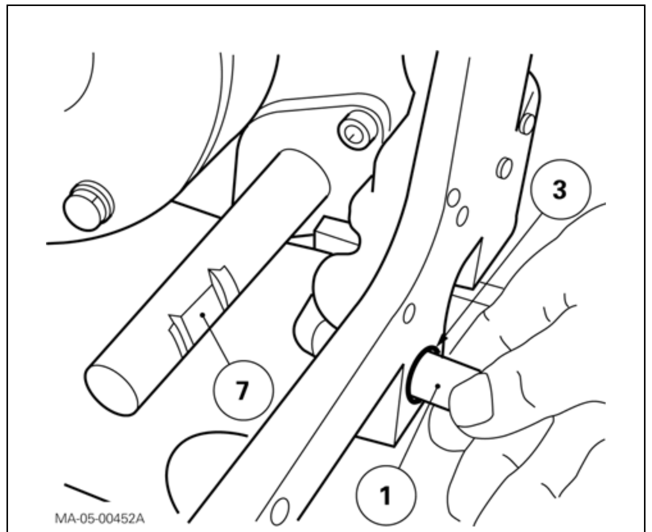

Fig. 11

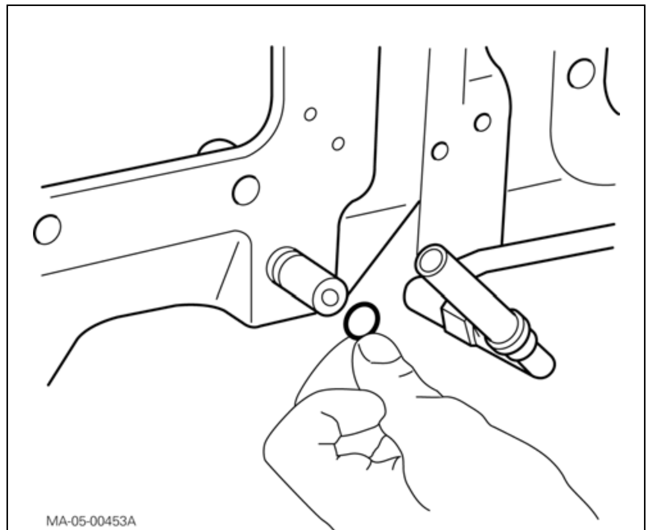

Fig. 12

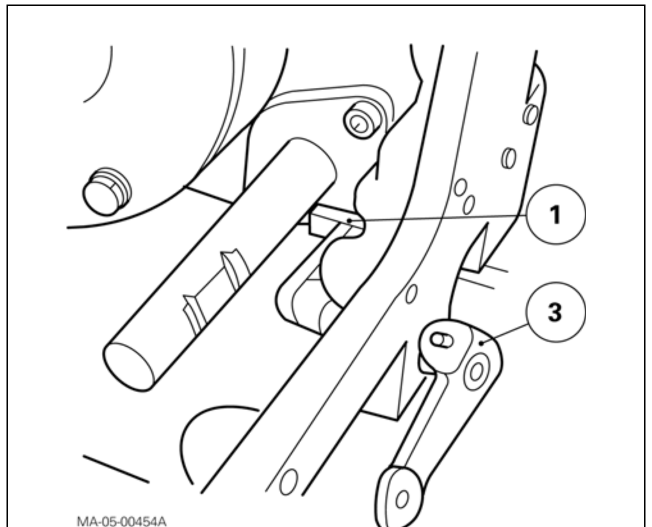

Fig. 13

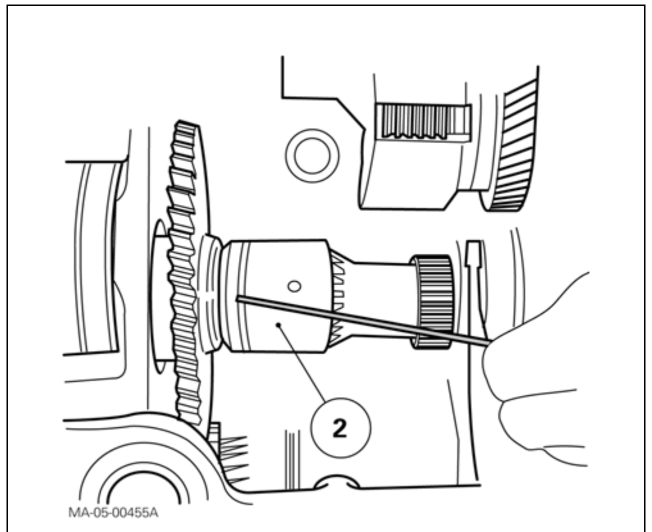

Fig. 14

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D . Hare / Tortoise fork and lock- 1st / 2nd - 3rd / 4th fork assembly and selector rail

Preliminary steps

47. Remove the right-hand rear wheel. Chock the tractor.

48. Remove the selector cover plate (see chapter 5).

Remove the right-hand hydraulic cover plate (see chapter 9).

Disassembly

49. Remove the plugs (1), the springs (2) and the detent plungers (3) (Fig. 2 and Fig. 3).

NOTE 1: The detent plungers are now longer (Fig. 2 and Fig. 3). This modification improves their guiding into the forks (5) and (6) and also into the plugs (1).

NOTE 2: To optimise operation, a decompression spring on the detent plunger drives out the oil enclosed in the spring chamber (2). This design allows the plunger to enter and exit the fork more smoothly, thus improving gear shifting.

50. Take out set screw (8) (Fig. 15).

51. Drive out the cup plug (9) forwards by striking the rear end of the selector rail (7) (Fig. 15).

52. Place the Tortoise and Hare fork (20) in the Hare position.

53. Remove the adjustment screws (19).

54. Remove the screws (16) and the cover plate (15).

55. Take out the Hare and Tortoise piston (13) and discard the seals.

56. Remove the cylinder (10) and discard the seal.

57. Turn the pump suction pipe (1) upwards (open centre Fig. 16).

58. Move the selector rail (7) to the rear in order to release the forks.

Slide the selector rail under the rear axle housing reinforcement (Fig. 16).

59. Take out the 1st-2nd and 3rd-4th gear forks.

60. Extract the Hare and Tortoise fork.

61. If necessary, remove the locking stop (18).

62. Take the selector rail out through the selector cover plate opening by passing it through the Hare / Tortoise cylinder bore (Fig. 17).

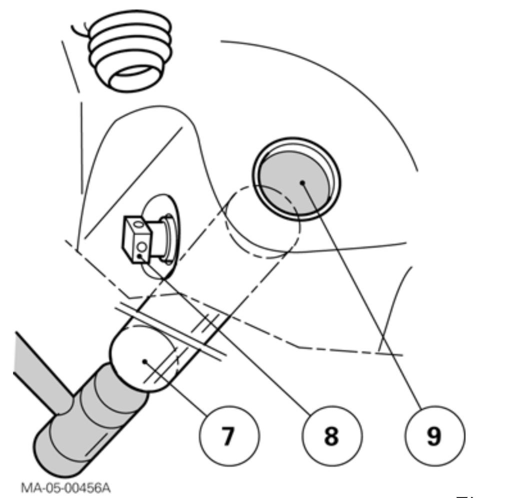


Fig. 15

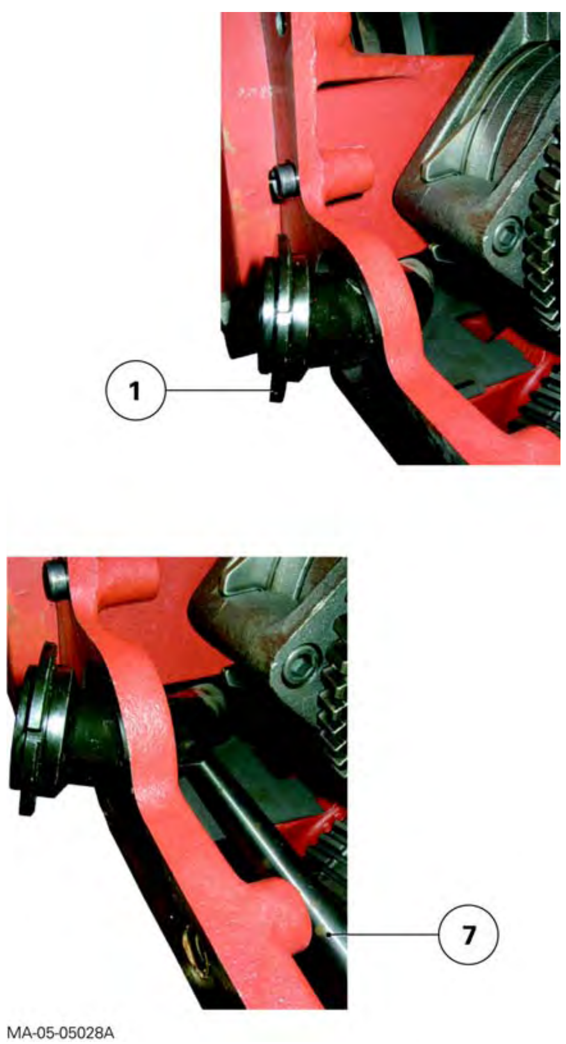


Fig. 16

Reassembly

63. Clean and check all components. Replace those that are defective.

64. Refit the selector rail through the selector cover plate opening and the Hare / Tortoise cylinder bore (Fig. 17).

Refit the forks.

65. Check that the hydraulic ports in the Hare / Tortoise cylinder (10) are not obstructed. Refit the cylinder fitted with a new "O" ring (11) (Fig. 18).

NOTE:

The cylinder (10) is held in position (Fig. 18):

- *at the front, by the shoulder machined on its outer diameter;*
- *at the rear, by the cover plate (15).*

66. Slide the selector rail forwards into the Hare / Tortoise fork and the 3rd-4th and 1st-2nd forks.

67. On the piston (13), fit the "O" rings (12) (14), and then insert the piston into the cylinder bore (10) and onto the selector rail (7) (Fig. 18).

Turn the adjustment screw holes towards the tapped holes on the fork. Temporarily lock the piston with a screw (19).

68. Fit the cover plate (15) with the screws (16). Tighten the screws to a torque of 25-35 Nm.

69. Clean the set screw (8). Smear its thread with Loctite 542 or equivalent. Tighten to a torque of 38 - 43 Nm.

70. Smear the cup plug (9) with Loctite 542 or equivalent. Fit it flush with the housing.

71. Fit the detent plungers, springs and locking plugs.

Tighten the plugs to a torque of 50 - 70 Nm.

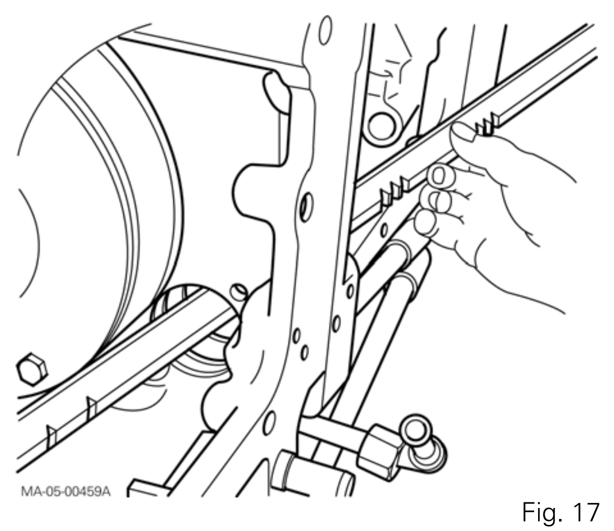


Fig. 17

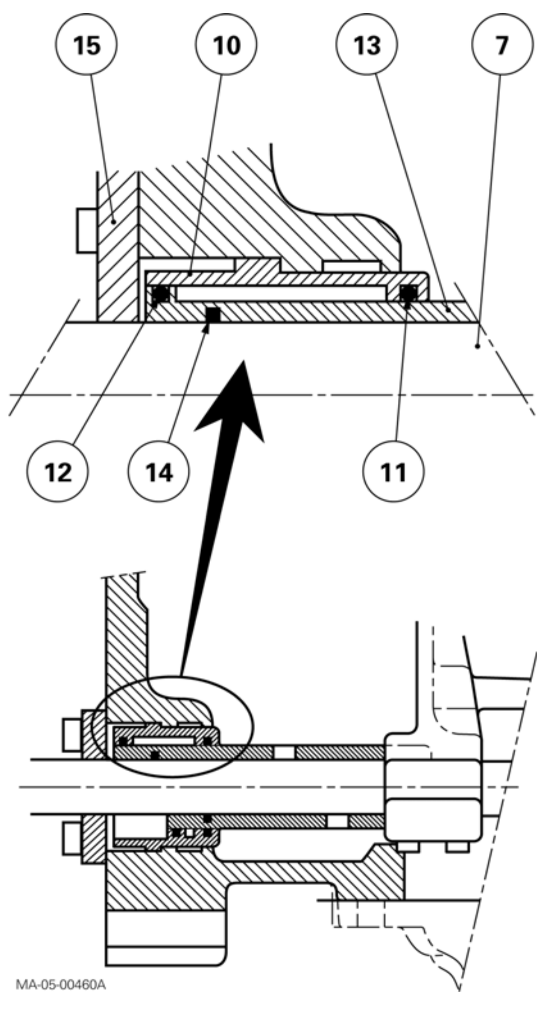


Fig. 18

Adjusting the clearance between the Hare / Tortoise fork pads and the synchroniser sliding coupler

Principle

The positioning of fork (20) is obtained by adjusting the difference in the dimension between the centre line of the tapped holes "Y" and the centre line of the indents "Z" on the piston (13).

A different fork movement is obtained either by adjusting the front screw or by adjusting the rear screw according to the adjustment required (Fig. 19).

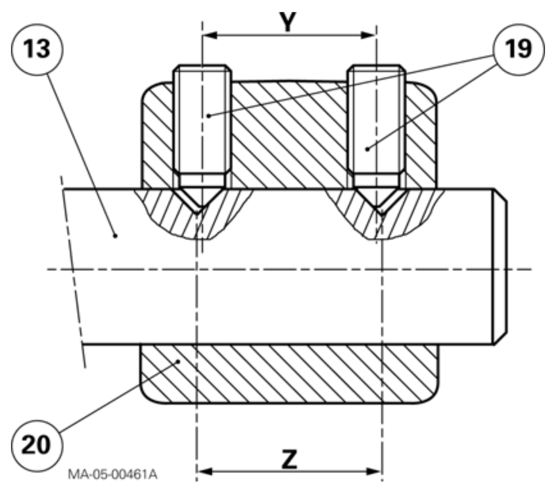


Fig. 19

Settings

72. Position the control piston (13) and the sliding coupler "C" in the high range (Hare) (Fig. 21).

73. Hold the sliding coupler manually against gear "L" of the high range (Fig. 21).

74. Adjust the position of the fork (20) using the two adjustment screws (19) previously cleaned in solvent and lightly smeared with Loctite 221 or equivalent, in order to obtain a clearance of **J1 = 0.3 mm** between the rear face of the pad and the sliding coupler (Fig. 20 - Fig. 21).

***NOTE:** For this adjustment, use the makeshift tool (see § F).*

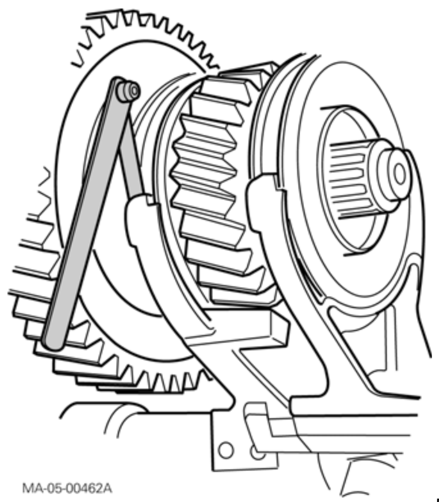


Fig. 20

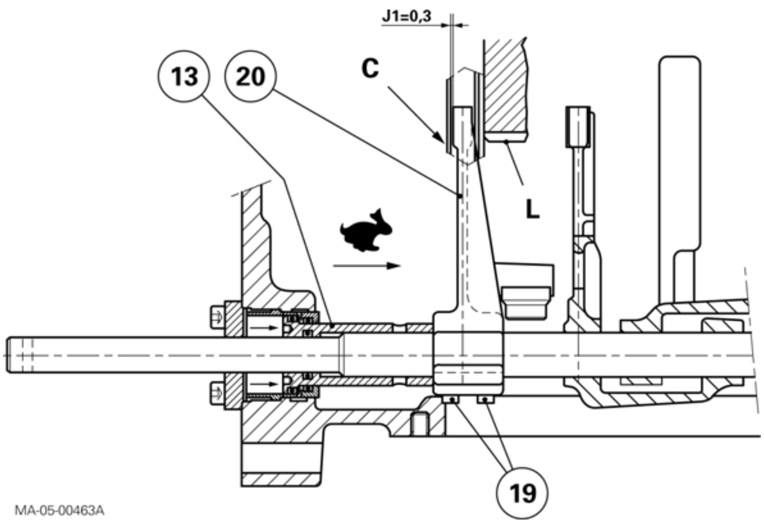


Fig. 21

75. Position the control piston (13) and the sliding coupler "C" in the low range (Tortoise) (Fig. 22).

76. Check that there is a clearance of **J2 = 0.3 minimum** (this value is determined by the clearance J1) between the pad and the sliding coupler when the latter rests against the gear "T" of the low range (Fig. 22)

Alternatively and progressively tighten the screws (19) to a torque of 25 - 35 Nm taking care not to modify the adjustment.

***IMPORTANT**: In the Tortoise position, if face "X" of the fork pad (20) is driven against the sliding coupler "C", increase the clearance J1 (Fig. 21).*

77. Check that the fork operates correctly.

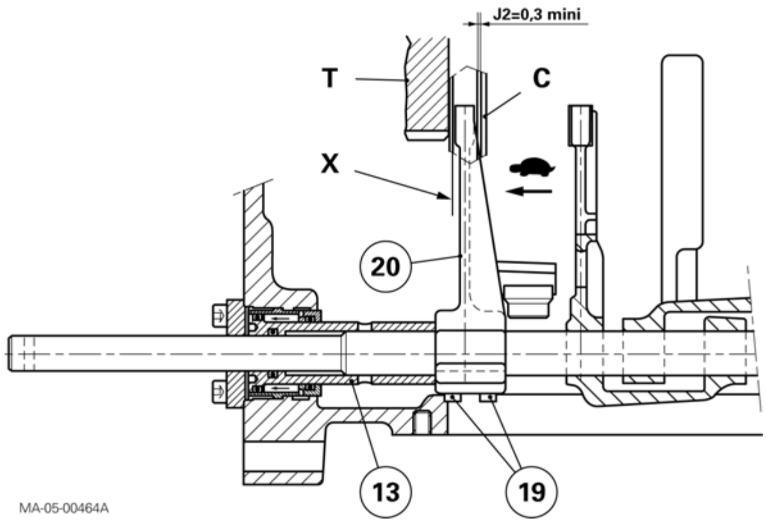


Fig. 22

Adjusting the Hare / Tortoise fork locking stop

Principle

Locking is adjusted by an adjustable stop (18) located on the Hare / Tortoise fork. This adjustment is obtained using a tool (see § F) whose role consists of conveying to the locking stop the positioning of the indexing rod, mounted on the selector cover plate.

The aim of this adjustment is to make the Hare/Tortoise mechanism safe during operation, by mechanically locking the fork in the Hare or Tortoise position.

***IMPORTANT**: Before adjusting the locking stop (18), it is essential to adjust the clearance between the Hare/Tortoise fork pads and the synchroniser sliding coupler.*

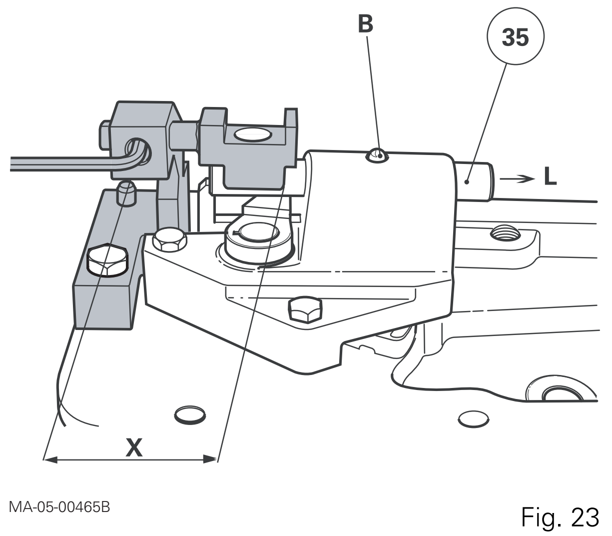


Fig. 23

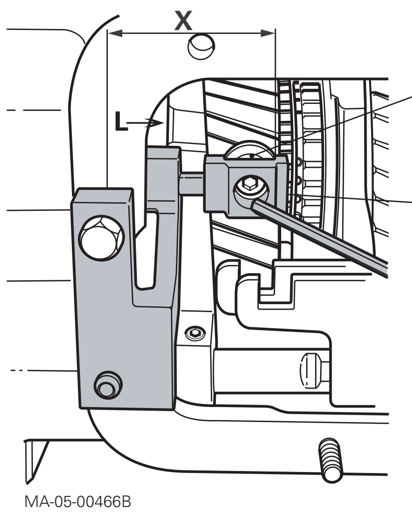


Fig. 24

On the cover plate (Fig. 25)

78. Place the indexing rod (35) in the high range position (Hare).

79. Engage the 3rd gear ratio.

80. Fit the tool on the selector cover plate (Fig. 23).

81. It is **essential** to equally distribute the clearance between the indexing rod and the plunger (31) (Fig. 25, detail A).

82. Using the tool, measure dimension X according to Fig. 23 and Fig. 25.

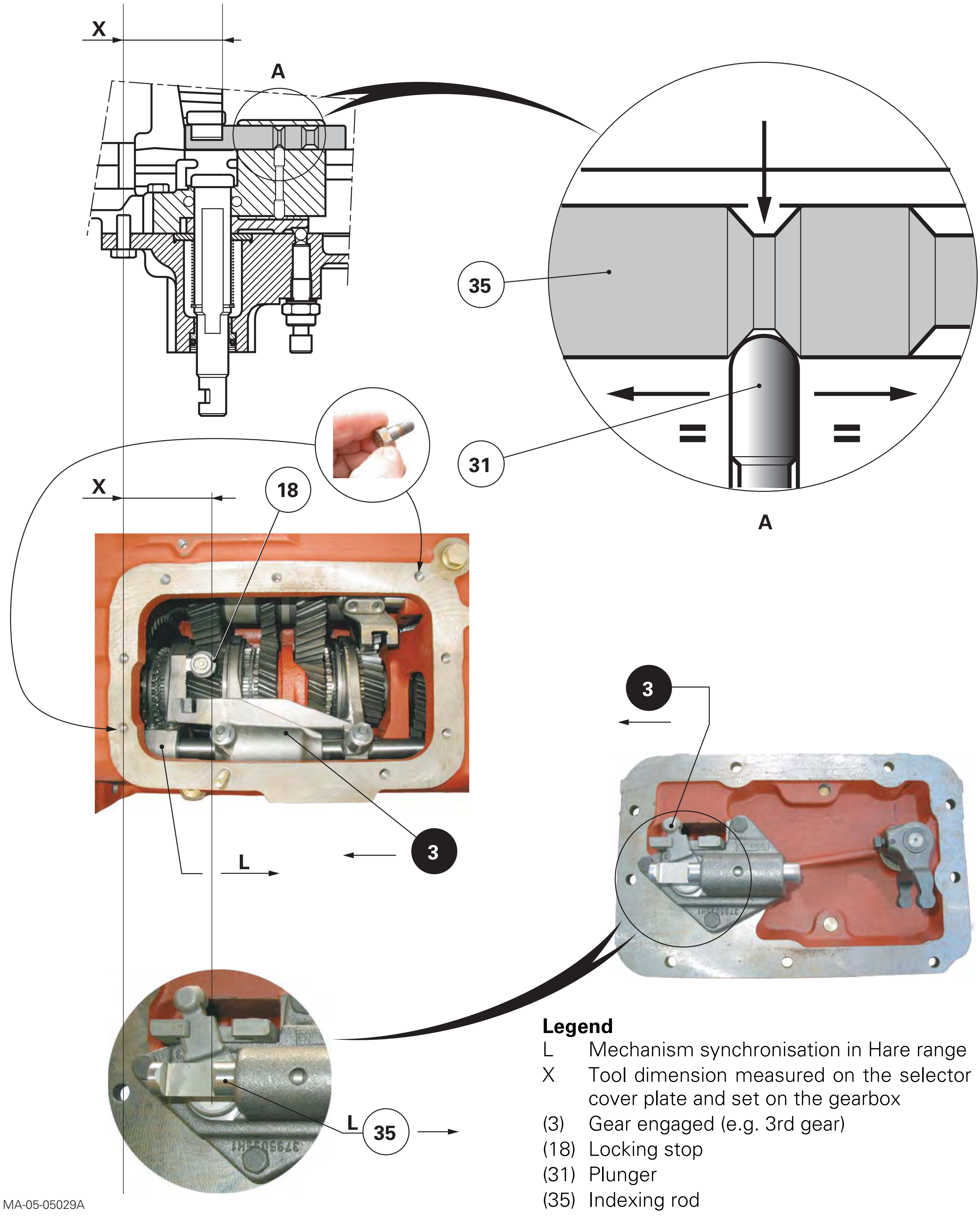
On the gearbox (Fig. 25)

83. Engage the 3rd ratio. Using the tool, set dimension X on the gearbox.

84. Apply manual pressure on the fork towards the Hare range.

85. Adjust the locking stop (18) (Fig. 24 - Fig. 25) by placing it in contact with the tool.

86. Lightly smear the thread of the screw (17) with Loctite 242 or equivalent. Tighten to a torque of 40-50 Nm.



Legend
L Mechanism synchronisation in Hare range
X Tool dimension measured on the selector cover plate and set on the gearbox
(3) Gear engaged (e.g. 3rd gear)
(18) Locking stop
(31) Plunger
(35) Indexing rod

Fig. 25

Check

87. Check the operation of the Hare and Tortoise ranges.

88. Check the smooth operation of all gears.

Final steps

89. Refit the right-hand hydraulic cover plate (see chapter 9).

90. Refit the selector cover plate (see chapter 5).

91. Reconnect and adjust the creeper unit control (if fitted) (see chapter 5).

92. Refit the rear wheel. Tighten the nuts to a torque of 400 - 450 Nm.

93. Top up the oil level in the housings. Check it using the gauge at the rear of the centre housing.

94. Carry out a road test.
- of gears from 1st to 4th and vice versa;
- of the Hare and Tortoise ranges;
- of the creeper unit (if fitted).

95. Check the tightness of the cover plate mating faces and the hydraulic unions.

E . Mechanical reverse shuttle selector - Fork and selector rail

Reverse shuttle selector (2)

Disassembly

96. Remove the selector cover plate (see chapter 5).

97. Remove the screws (1) (Fig. 26).
Remove the selector (2).

Preparing the selector

98. Clean the thread of the screws and the tapped holes in the selector. Check that the screws turn freely in the tapped holes.

99. Slide the selector onto the selector rail and adjust it.

100. Engage forward and reverse positions, and vice versa, using the selector rail to position the synchroniser components.

101. Next, position the selector rail (3) in neutral (Fig. 26).

102. Fit the tool 3378054M1 (see Fig. 27 and §F) to the gearbox. Secure it in place using two locally obtained screws.

Adjusting the selector (Fig. 27)

103. Lightly smear the thread of the screws (1) with Loctite 242 or equivalent.

104. Bring face "F" of the selector (2) flush with the tool, using the screws (1).

105. Alternately and gradually tighten the screws (1) to a torque 35 Nm without modifying the selector position.

Reassembly

106. Refit the selector cover plate (see chapter 5).

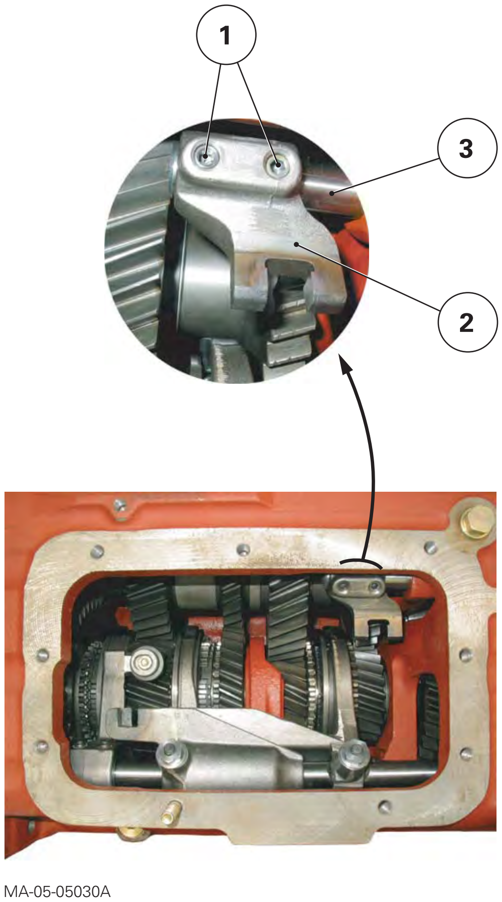


Fig. 26

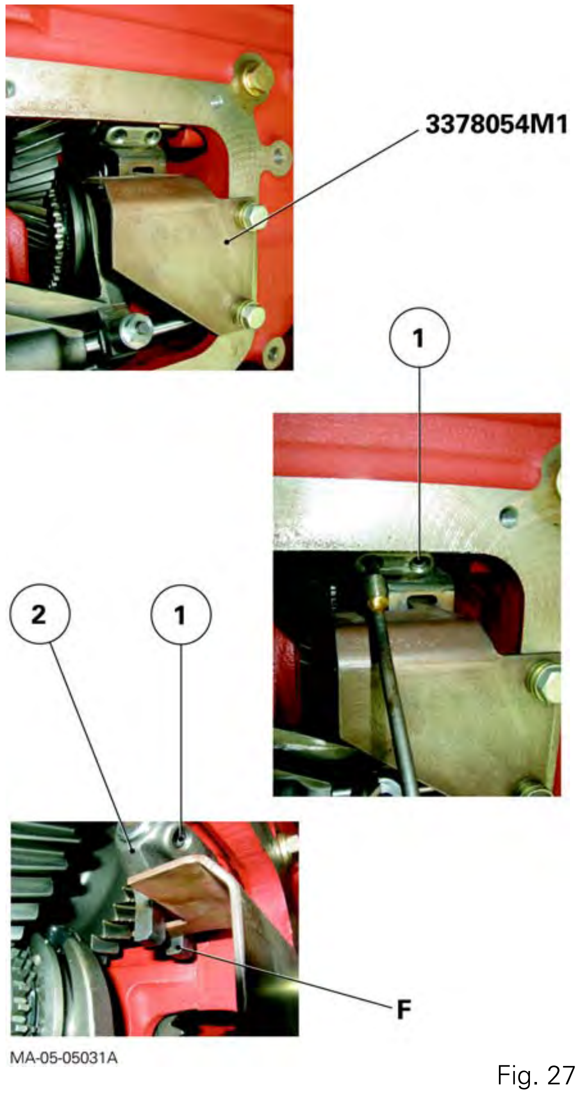


Fig. 27

Fork (6) and selector rail (4)

Preliminary steps

107. Disconnect the tractor between the engine and the gearbox (see chapter 2).

108. Remove the selector cover plate (see chapter 5).

109. Remove the input unit (see chapter 5).

Disassembly

110. Remove the plug (7), the spring (8) and the detent plunger (5).

***REMINDER**: The detent plunger (5) for the shuttle fork (6) has a different shape from those fitted on the 1st / 2nd and 3rd / 4th forks of the gearbox.*

111. Take out the screws (3) from the fork (6).

Remove the rail (4) and the fork.

Reassembly

112. Clean the thread of the screws and the tapped holes in the fork. Check that the screws turn freely in the tapped holes.

113. Slide the fork into the synchroniser sliding coupler.

114. Slide the selector rail (4) into the fork (6).

Adjust the fork.

Adjusting the fork (Fig. 28 and Fig. 29)

Adjusting principle

The positioning of the fork (6) is obtained by the difference between the centre line "Y" of the holes and the centre line "Z" of the indents on the selector rail (5). A different fork movement is obtained either by adjusting the front screw or by adjusting the rear screw (3) according to the adjustment required (Fig. 29).

115. Fit the detent plunger (5), the spring (8) and the plug (7).

Tighten the plug to a torque of 50 - 70 Nm.

IMPORTANT: *When disassembling all detent plungers (gearbox and input unit), the positioning of the reverse shuttle selector rail detent plunger must be respected (see step 110).*

116. Lightly smear the thread of the fork screws with Loctite 242 or equivalent. Fit the screws.

117. Position the locked fork towards the front.

Hold the synchroniser sliding coupler up against the gear.

Pre-adjust the fork using the above-mentioned principle.

118. Check that the front pads of the fork are not driven hard against the synchroniser sliding coupler.

119. Repeat the operation (locked fork towards the rear).

Check that the rear pads are not driven hard against the synchroniser sliding coupler.

The correct adjustment is obtained when clearance between the fork pads (front and rear) and the synchroniser sliding coupler is nearly equal, in both the forward and reverse positions.

120. Alternately and gradually tighten the screws (3) to a torque 35 Nm without modifying the fork adjustment.

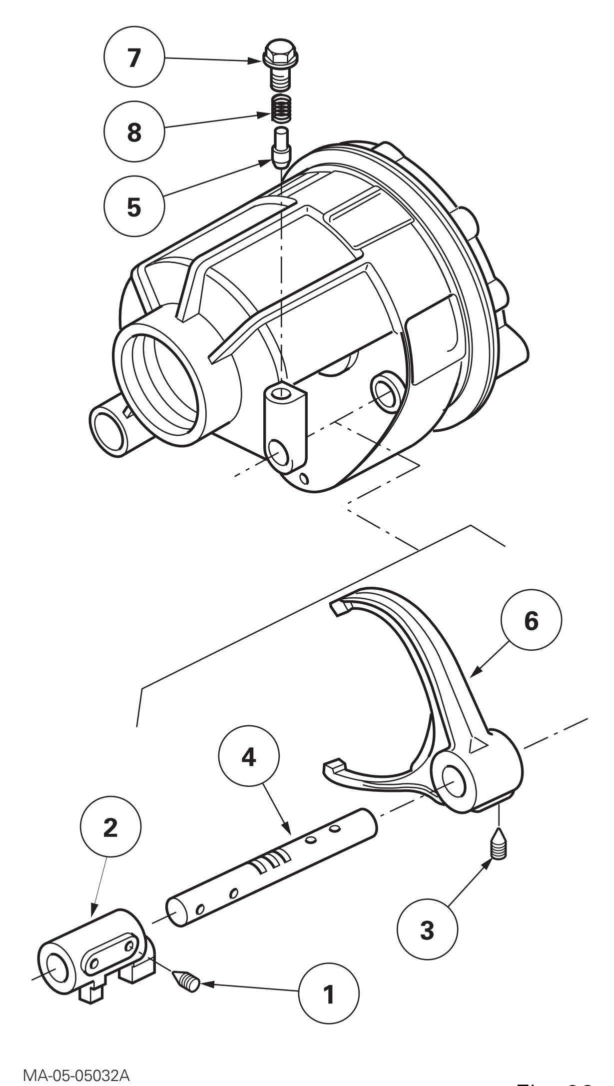


Fig. 28

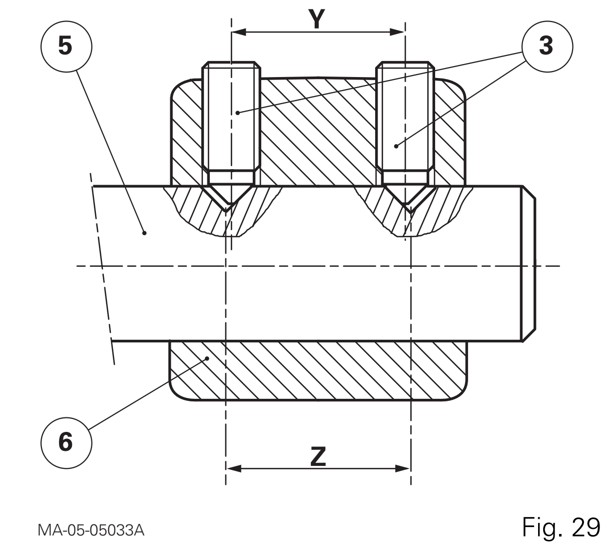


Fig. 29

Final steps

121. Refit the input unit (see chapter 5).
122. Adjust the selector (2) (see § E).
123. Refit the selector cover plate (see chapter 5).
124. Reconnect the tractor between the engine and the gearbox (see chapter 2).
125. Top up the oil level in the housings. Check it using the gauge at the rear of the centre housing.
126. Bleed the hydraulic mechanism of the engine clutch (see chapter 9).
127. Carry out a road test of the reverse shuttle (forward and reverse positions) and the control assembly.
128. Check the tightness of the mating faces and hydraulic unions.

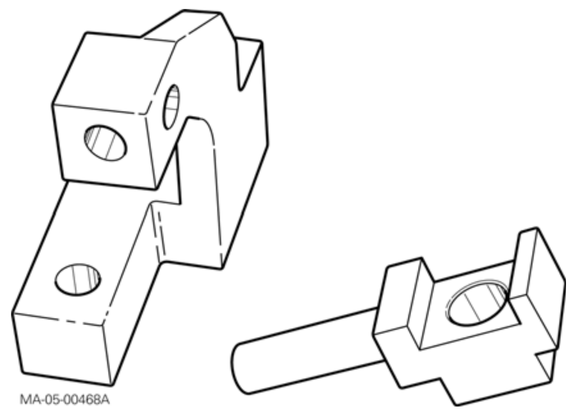


Fig. 30

F . Service tools

Tools available in the AGCO network

- **3378325M11:** - Hare and Tortoise fork locking stop adjustment tool (Fig. 30)
- **3378054M1:** Adjustment gauge (Fig. 31)

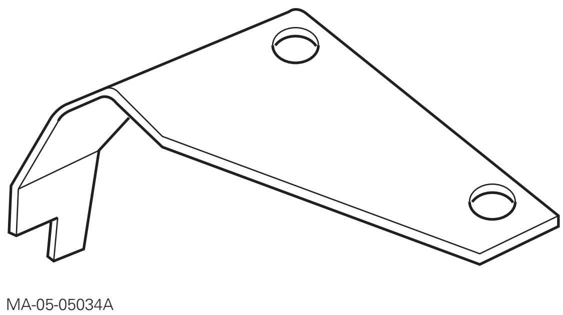


Fig. 31

Makeshift tool

- **Shim hinged on suitable fixture** (Fig. 32)

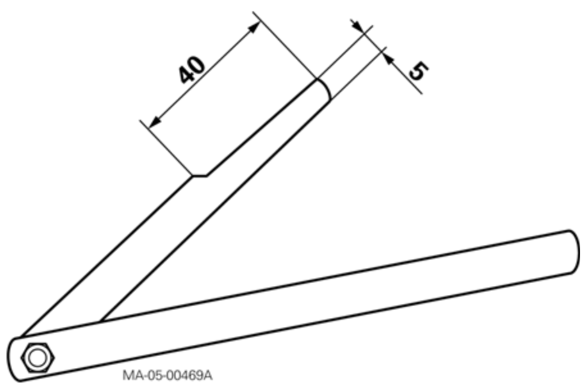


Fig. 32

5A16 - GBA20 - Mechanical reverse shuttle - Output shaft

CONTENTS

A . General

The bearings (28) (30) separated by a spacer (80) rotate the driving gear (29) on the output shaft. The bearings (79) (81) operate as axial stops.

A single cone synchroniser allows range shifting between gears (29) (Hare) and (36) (Tortoise).

Preloading, or the clearance between the cones (39) (40) and their respective cups (48) (37) is adjusted according to the thickness of the circlip (49).

Description

The output shaft transmits movement from the different ratios to the rear axle transfer shaft. It is fitted on the lower transmission line at the rear of the unit.

It is supported at the front by a needle roller bearing fitted in the layshaft bore and at the rear by two opposing tapered roller bearings.

The shaft (44) supports:
- the driving gear (29) fitted idle onto the combined bearings (28) (30);
- the idle-fitted gear (36) and ring (35) assembly;
- the Hare/Tortoise synchroniser (31), integral rotation by splines.

To ensure correct operation of the assembly depending on the load applied to the transmission, several adjustments are required:
- **Shimming J3:** via the circlip (49), this shimming cancels out the clearance between the cones (39) (40) and their respective cup.
- **Shimming J4**: the shim(s) (38) positioned between the shoulder of the shaft (44) and the cone (39) provide axial clearance for the gear (29).
- **Shimming J5:** the shim(s) (42) fitted between the cone (40) and the shim (43) cancel out the axial clearance of the cones (39) (40) on the shaft (44).

***Note:** The GBA20 gearbox output shaft without creeper gears may be replaced by two other shafts relating to the following options respectively: creeper unit or super creeper unit.*

Parts list (Fig. 1)

(21) Synchroniser cone (Hare)
(22) Synchroniser cone (Tortoise)
(24) Needle roller bearing
(27) Thrust washer
(28) Needle roller bearing
(29) 3rd driving gear (Hare)
(30) Needle roller bearing
(31) Hare / Tortoise single cone synchroniser
(32) Thrust washer
(35) Ring
(36) Tortoise gear
(37) Bearing cup
(38) Shim(s)
(39) Bearing cone
(40) Bearing cone
(41) Screw
(42) Shim(s)
(43) Shim
(44) Output shaft
(45) Circlip
(46) Stop plate
(47) 3rd synchroniser cone
(48) Bearing cup
(49) Circlip
(79) Needle roller bearing
(80) Spacer
(81) Needle roller bearing

View of the assembly

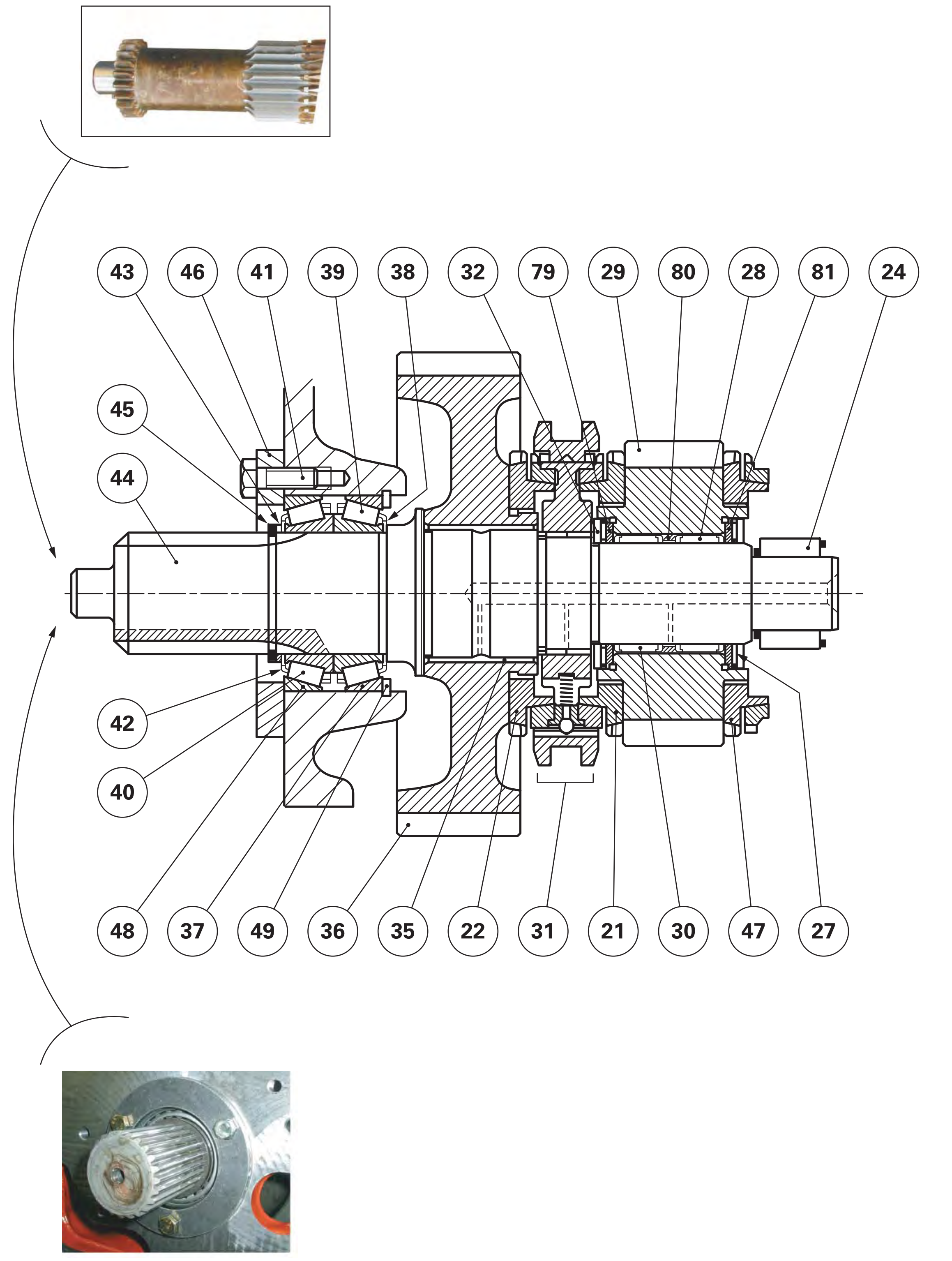


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Fig. 1

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Parts list (Fig. 2)

(21) Synchroniser cone (Hare)
(22) Synchroniser cone (Tortoise)
(24) Needle roller bearing
(27) Thrust washer
(28) Needle roller bearing
(29) 3rd driving gear (Hare)
(30) Needle roller bearing
(31) Hare / Tortoise single cone synchroniser
(32) Thrust washer
(35) Ring
(36) Tortoise gear
(37) Bearing cup
(38) Shim(s)
(39) Bearing cone
(40) Bearing cone
(41) Screw
(42) Shim(s)
(43) Shim
(44) Output shaft
(45) Circlip
(46) Stop plate
(47) 3rd synchroniser cone
(48) Bearing cup
(49) Circlip
(79) Needle roller bearing
(80) Spacer
(81) Needle roller bearing

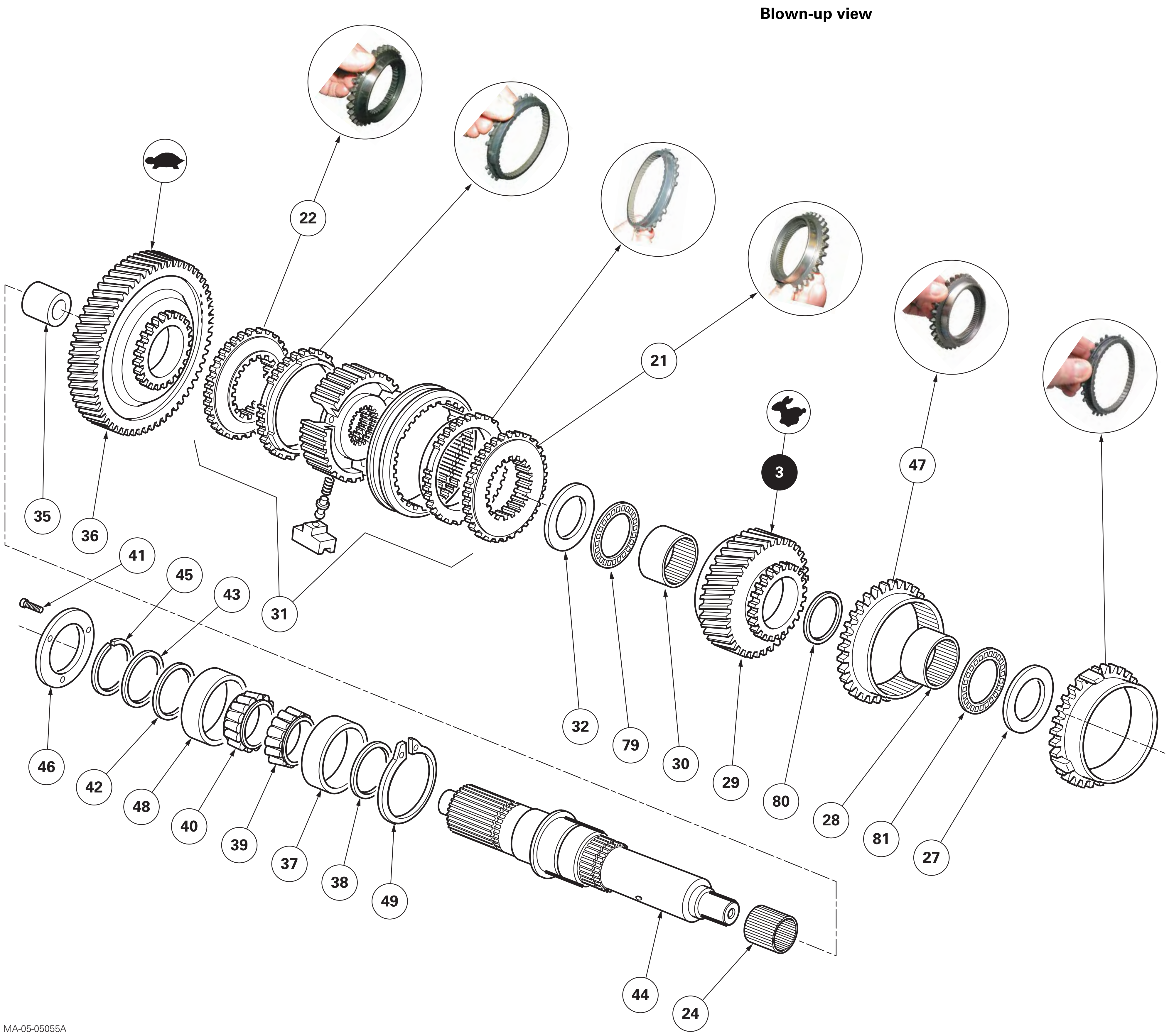

Fig. 2

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B . Preliminary steps

1. Disconnect the tractor between the gearbox and the rear axle (see chapter 2).
2. Remove the selector cover plate (see chapter 5).
3. If necessary, remove the screw (1) (Fig. 11).

C . Disassembling and reassembling the selector rail and the forks

***Note:** The tractor is disconnected. Consequently, selector rail removal is made easier by this separation which is to be made from the rear side of the gearbox housing. Apart from this point, the procedure remains unchanged.*

Disassembly

4. If the tractor is fitted with a creeper unit, remove the pin (1), the counter-nut (2), the adjustable lock (3), and the fork (4) with the sleeve (5) (Fig. 3).

   If the tractor is fitted with a super-creeper unit, the fork and its lock are removed as described above, except for the absence of the pin (1).
5. Remove the selector rail and the forks (see chapter 5).

Reassembly

6. Clean and check all components. Replace those that are defective.
7. Refit the selector rail and the forks (see chapter 5).
8. Depending on the equipment, refit the sleeve (5), fork (4), adjustable lock (3) and pin (1) (Fig. 3).

   To adjust the fork, see chapter 5.

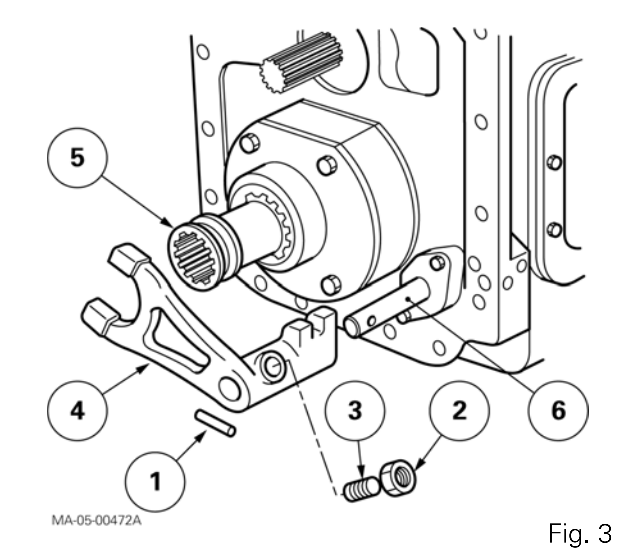

Fig. 3

D . Disassembling, reassembling and shimming the shaft

9. If the tractor is fitted with a creeper unit or super-creeper unit, remove the unit (see chapter 5).

Disassembly

IMPORTANT: *The bearing cones and cups are to be paired if reused.*

10. Remove the screws (41).
11. Remove the stop plate (46).
12. Remove the bearing cup (48).
13. Remove the circlip (45).
14. Remove the shim (43) and the shims (42).
15. Remove the bearing cones (40) (39).
16. Remove the shims (38) and the cup (37).
17. Remove the circlip (49).
18. Pull and remove the shaft (44) backwards while holding the gear assembly.
19. Through the selector cover plate opening, take out:
- the synchroniser (31) and its rings;
- the Hare / Tortoise synchroniser cones (21) and (22);
- the gear assembly (29) and needle roller bearings (28) (30);
- the cone (47) and the 3rd synchroniser ring;
- the two needle roller bearings (79) (81);
- the thrust washers (27) (32).

IMPORTANT: *The synchroniser cones and rings are to be paired if reused.*

20. If necessary, remove the Tortoise gear (36).

NOTE: *If work is necessary on this gear, first remove the input unit (see chapter 5) in order to lift the gearbox intermediate shaft to take out the gear concerned through the selector cover plate opening.*

21. Remove the needle roller bearing (24), while marking the assembly direction.

Reassembly

22. Check and clean all components. Replace those that are defective.
23. Position the needle roller bearing (24) in the bore of the layshaft "R", taking care to position the smaller diameter of the flexible ring towards the 3rd driving gear (Hare) (29) (Fig. 4).
24. Fit the shaft in the housing without the gears.
25. Fit a temporary circlip (49), minimum thickness.
26. Position the cup (37).

Preparation for J3 shimming (Fig. 5)

27. Slide cones (39) (40) and hold them against the shoulder of shaft (44) by applying pressure by hand. Fill space Y between the rear of cone (40) and the groove of circlip (45) with shims (42) and shim (43) which will be placed against circlip (45). Take a new circlip. The circlip must be held closed in the groove under a slight pressure (Fig. 6).
28. Fit the cup (48) and the stop plate (46). Tighten screws (41) to a torque of 25 - 35 Nm.

__IMPORTANT:__ For gearboxes fitted with a creeper unit, use the unit plate (1) (Fig. 9) to replace the stop plate (46) (Fig. 8). Tighten the screws to a torque of 33.8 - 51.5 Nm.

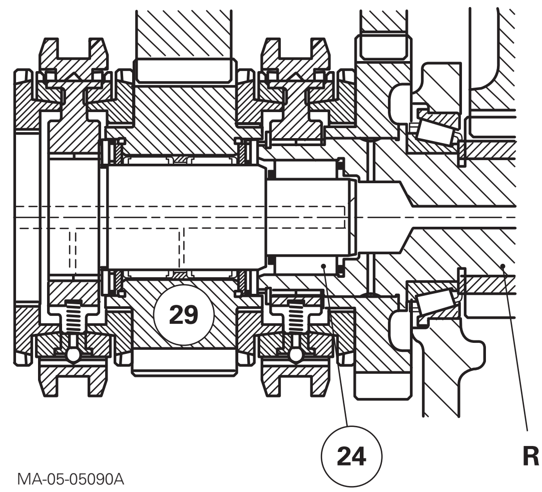

Fig. 4

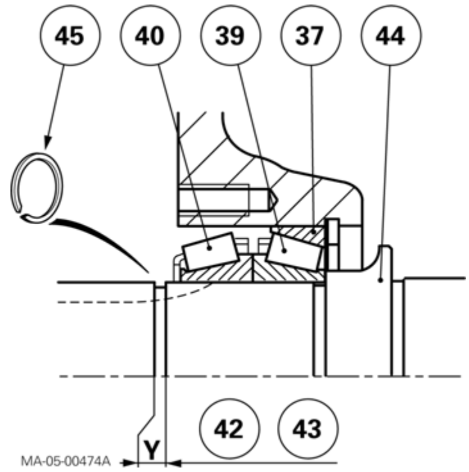

Fig. 5

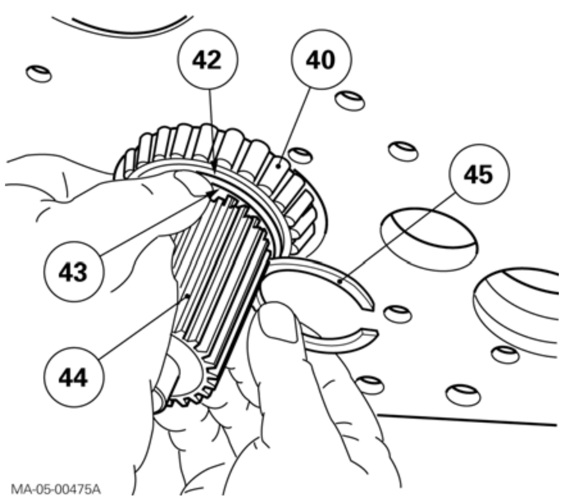

Fig. 6

J3 shimming (Fig. 7)

29. Put the dial gauge feeler pin against the end of the shaft (44) (Fig. 8 or Fig. 9).

30. Push the shaft, while turning it alternately from right to left to correctly "seat" the cones in the cups.

31. Set the dial gauge to zero.

32. Repeat step 30, this time pulling.

33. If the axial clearance is greater than 0.05 mm, set a definitive thickness of the circlip (49), to be fitted later during step 42, to obtain **J3 = -0.05 to +0.05 mm.**

34. Remove the circlip (45).

35. Remove the shim (43) and the shims (42).

36. Remove the screws (41) and the stop plate (46).

37. Remove:

- the cup (48);
- the bearing cones (40) (39), pairing them with their cups;
- the cup (37);
- the temporary circlip (49) fitted during step 25;
- the shaft (44).

Assembling the gears and the shaft

38. On the workbench, pre-assemble the 3rd driving gear (29) with the synchroniser cones (21) and the 3rd gear (47) fitted with their respective synchroniser ring.

Fit the bearings (79) (81) and washers (27) (32).

39. If removed, position the Tortoise gear (36) with its synchroniser ring (22) into the housing.

***IMPORTANT**: If the ring (35) of the Tortoise gear (36) is damaged, replace the gear assembly (the ring is rebored after fitting).*

Refit the input unit (see chapter 5).

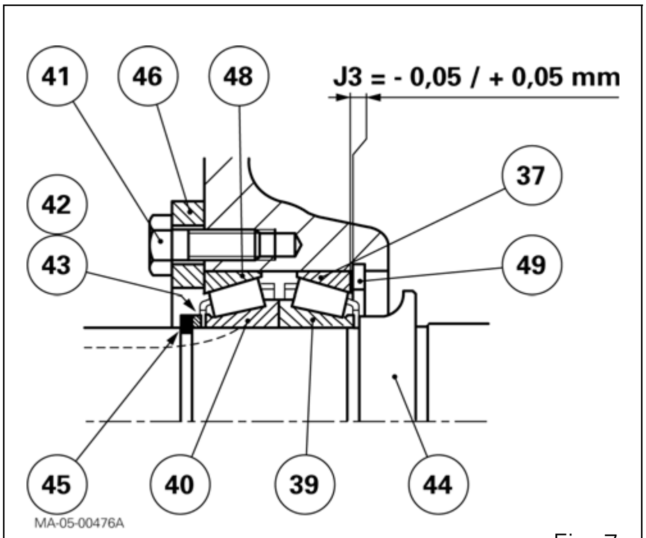

Fig. 7

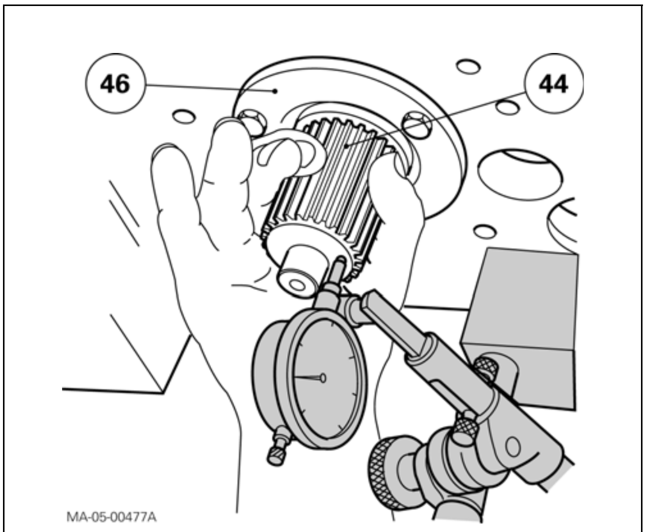

Fig. 8

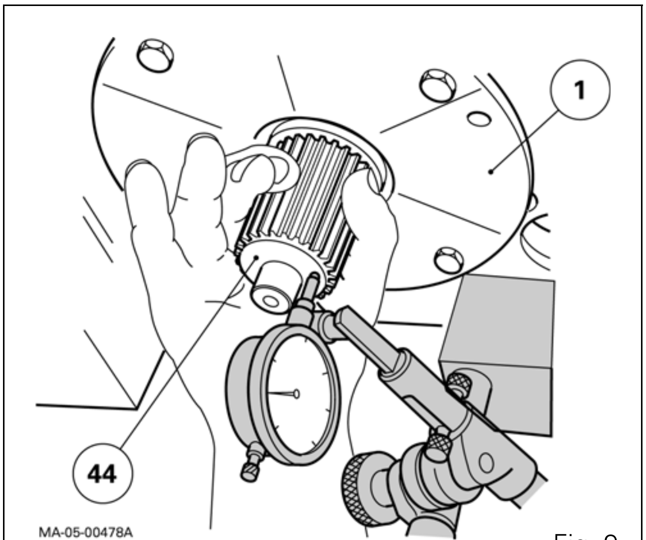

Fig. 9

40. In the housing, continue to fit:
- the 3rd driving gear (29) fitted with the needle roller bearings (28) (30) (recess "R" facing towards the 3rd-4th synchroniser (Fig. 10));
- the synchroniser (31).

REMINDER: *The needle roller bearings (28) (30) are force-fitted and are separated by a spacer (80).*

41. Fit the output shaft (44) while holding the gear assembly (Fig. 11).

J4 shimming (Fig. 12)

42. Fit the circlip (49) defined during step 33. Slide the cones and cups paired during step 37 onto the shaft.

43. Fit the stop plate (46). Tighten screws (41) to a torque of 25 - 35 Nm.

IMPORTANT: *For gearboxes fitted with a creeper unit, use the unit plate (1) (Fig. 9) to replace the stop plate (46) (Fig. 8). Tighten the screws to a torque of 33.8 - 51.5 Nm.*

44. Put the dial gauge feeler pin against the end of the shaft (44) (Fig. 8 or Fig. 9).

45. Push the shaft, while turning it alternately from right to left to correctly "seat" the cones in the cups.

46. Set the dial gauge to zero.

47. Repeat step 45, this time pulling.

Depending on the value read on the dial gauge, determine the thickness of shims Z (38) to obtain: **J4 = 0.20 to 0.40 mm** (Fig. 12)

48. Remove the screws (41) and the stop plate (46).

49. Remove the cup (48).

50. Remove cones (40) (39).

51. Slide the required thickness of shims Z (38), and cones (39) (40) onto the shaft.

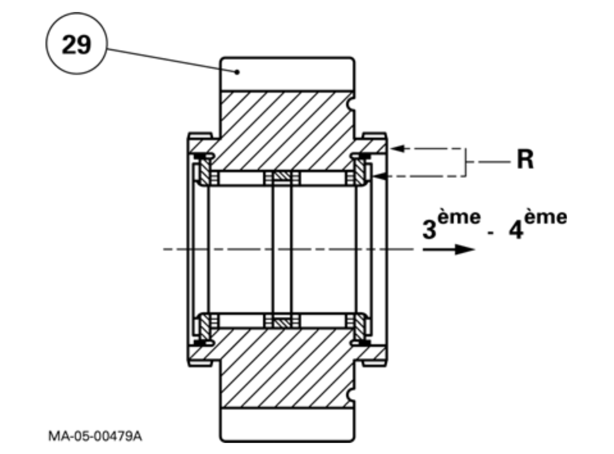

Fig. 10

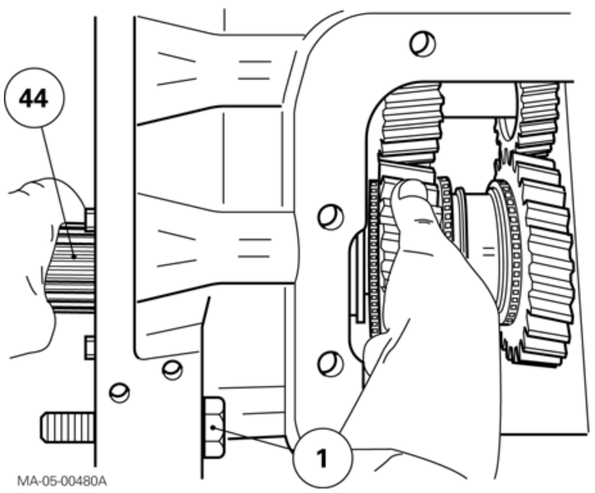

Fig. 11

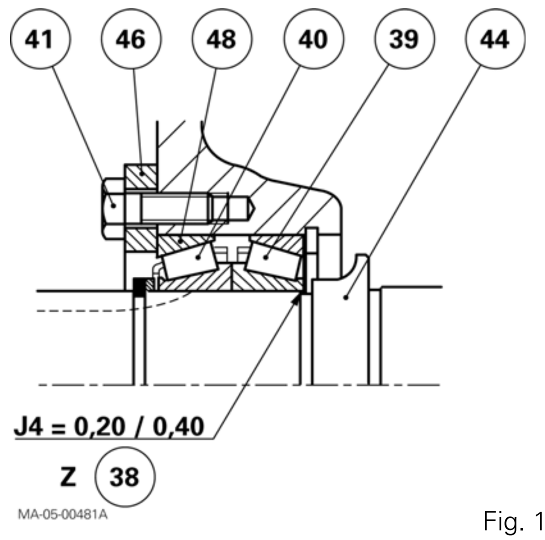

Fig. 12

J5 shimming (Fig. 13)

52. Carry out shimming to obtain the clearance **J5 = 0**.
53. Using the thickness of shims Y (42) (43), defined during step 27, determine the thickness of shims Z (38) to obtain the clearance **J5 = Y - Z**.
54. Fit the cup (48) and the stop plate (46). Tighten screws (41) to a torque of 25 - 35 Nm.
55. Slide the thickness of shims selected during step 53 onto the shaft.
56. Position the shim (43) on the circlip groove side.
Position the circlip (45): it must be held closed in the groove under slight pressure. Check that it is correctly positioned.
57. Refit the creeper or super creeper gearbox (depending on option).
58. Manually check the rotation of the shaft and its gears.
59. Refit the forks and the selector rail (see §C).

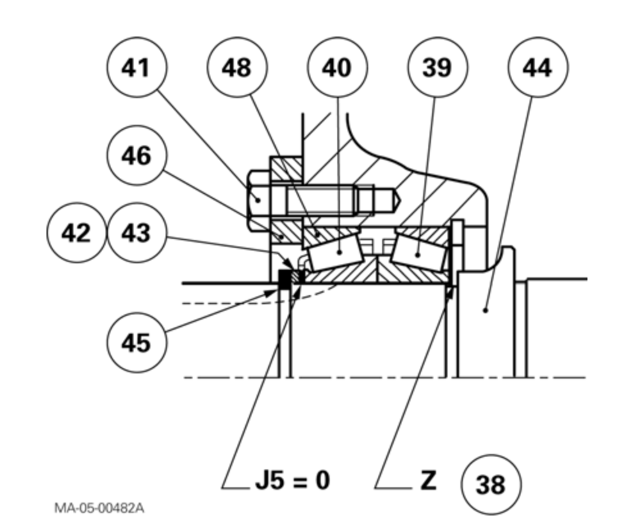

Fig. 13

E . Final steps

60. Refit the selector cover plate (see chapter 5), by first checking for the presence of the screw (1) (Fig. 11).
61. Reconnect the tractor between the gearbox and the rear axle (see chapter 2).
62. Check:
- the tightness of the systems;
- correct operation of electrical circuits.

63. Carry out a road test of the controls
64. Check the tightness of the mating faces (selector cover plate, gearbox on rear axle).

5A17 - GBA20 - Mechanical reverse shuttle - Layshaft

CONTENTS

A . General

The layshaft (69) is mounted on two tapered roller bearings (1) (17) with cups (2) (16), resting in the two lower bearings of the main gearbox. Each cup has a root face giving it optimum contact with the housing.

At the front it receives the input gear (67).

Between the two lower bearings, it supports the 1st (7) and the 2nd (14) idle mounted driving gears, as well as the 1st and 2nd gear synchroniser assembly (11), the hub of which is splined. At the rear, it holds the 4th driving gear (18) and the 3rd and 4th gear synchroniser assembly (23).

The 1st, 2nd (11) and 3rd, 4th (23) synchronisers are of the single cone type.

The rear bore contains a needle roller bearing that holds the front end of the output shaft. The turning parts are lubricated by a central channel and radial bores.

The tapered roller bearings are fitted with preload obtained by shim(s) (3) inserted between the splined washers (6) positioned against the input gear (67) and the ring (8). A washer (77) with flat sections acts as a stop for the 1st driving gear (7).

Parts list (Fig. 1)

(1) Bearing cone
(2) Bearing cup
(3) Shim(s)
(6) Splined washers
(7) 1st driving gear
(8) Ring
(11) 1st, 2nd single cone synchroniser
(14) 2nd driving gear
(16) Bearing cup
(17) Bearing cone
(18) 4th driving gear
(23) 3rd, 4th single cone synchroniser
(26) Circlip
(33) 4th synchroniser cone
(67) Input gear
(68) Nut
(69) Layshaft
(70) Snap ring
(71) Lubrication pipe
(72) Spring
(73) 1st synchroniser cone
(74) 2nd synchroniser cone
(77) Washer with flat sections
(78) Tab washer

View of the assembly

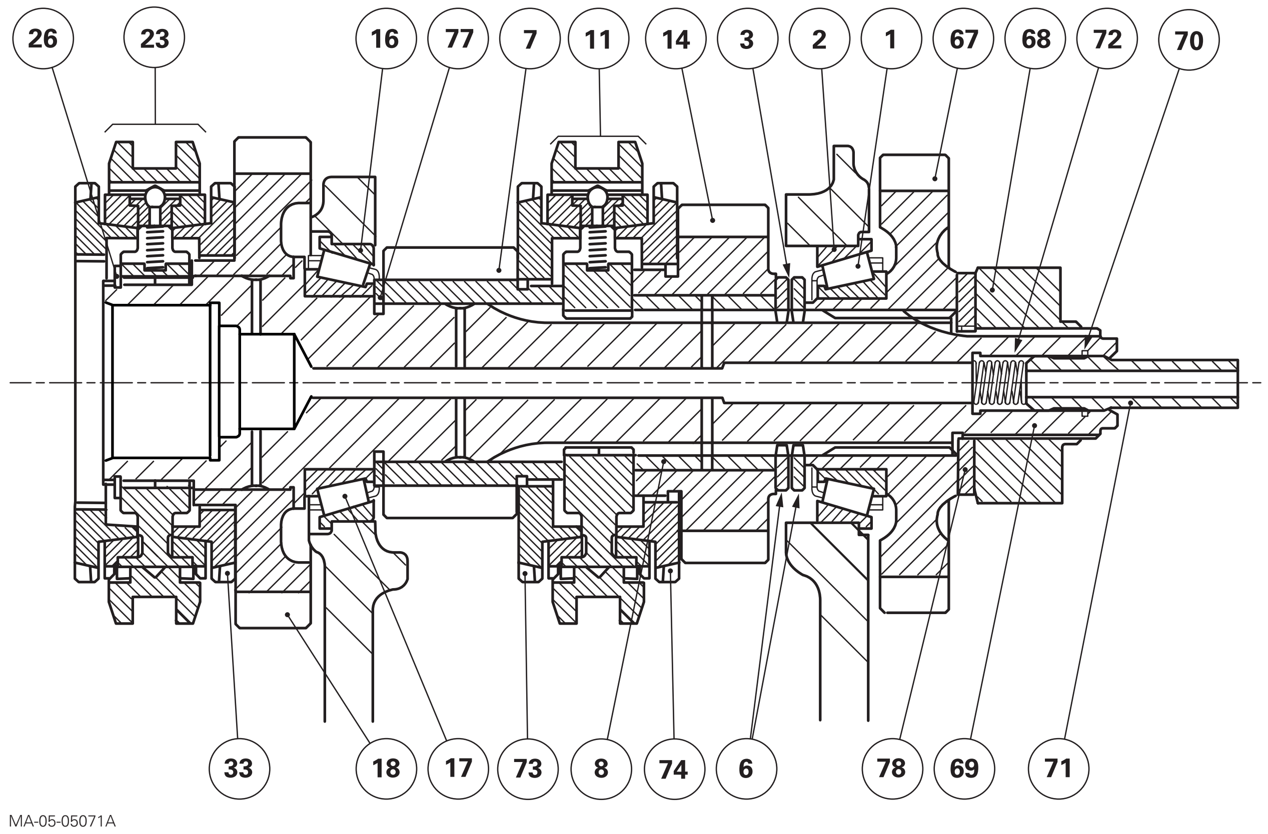

Fig. 1

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Parts list (Fig. 2)

(1) Bearing cone
(2) Bearing cup
(3) Shim(s)
(6) Splined washers
(7) 1st driving gear
(8) Ring
(11) 1st, 2nd single cone synchroniser
(14) 2nd driving gear
(16) Bearing cup
(17) Bearing cone
(18) 4th driving gear
(23) 3rd, 4th single cone synchroniser
(26) Circlip
(33) 4th synchroniser cone
(67) Input gear
(68) Nut
(69) Layshaft
(70) Snap ring
(71) Lubrication pipe
(72) Spring
(73) 1st synchroniser cone
(74) 2nd synchroniser cone
(77) Washer with flat sections
(78) Tab washer

Blown-up view

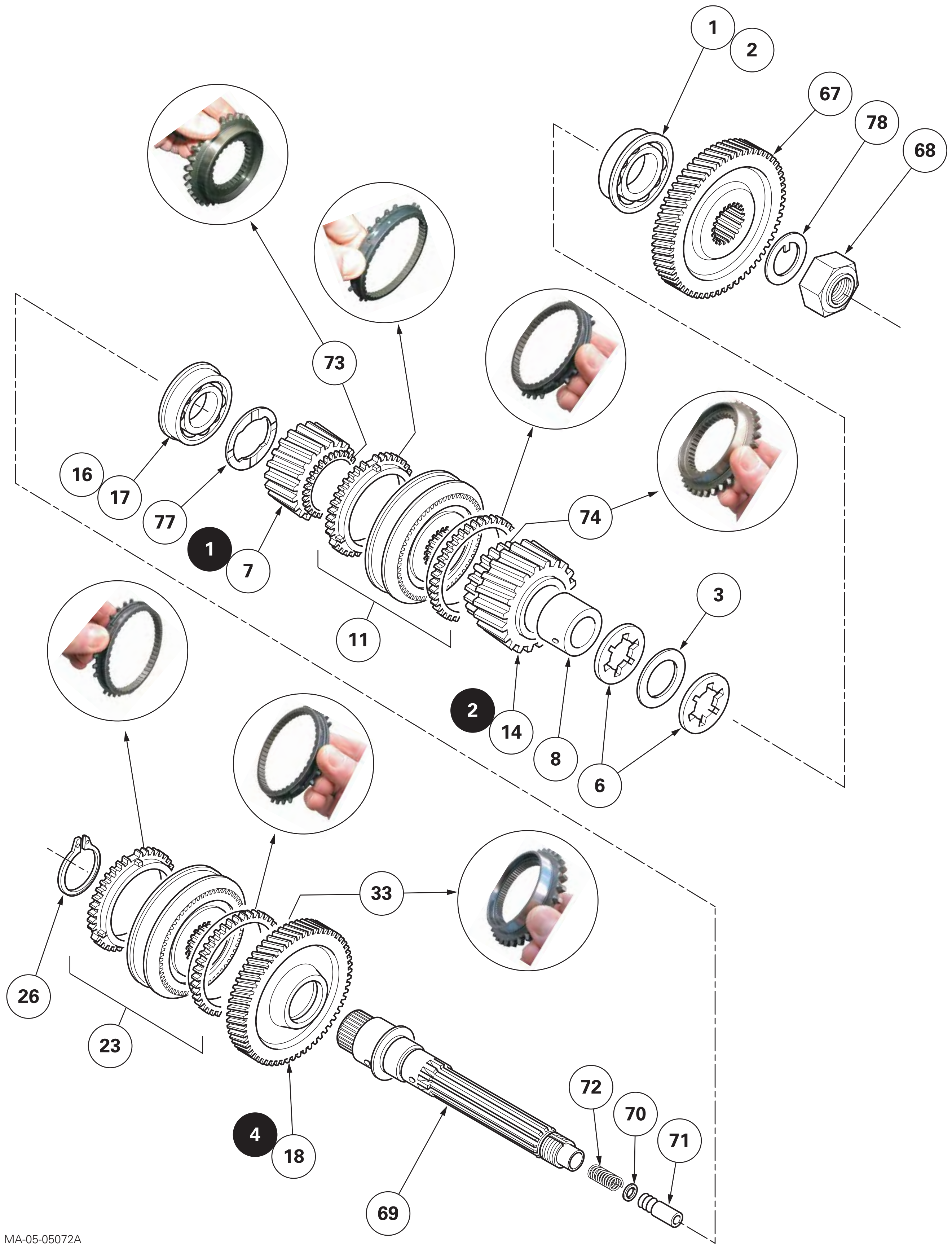

Fig. 2

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B . Preliminary steps

1. Split the tractor between the gearbox and the rear axle (see chapter 2).
2. Split the gearbox from the engine (see chapter 2).
3. Remove the selector cover plate (see chapter 5).
4. Remove the input unit assembly (see chapter 5).
5. Remove the intermediate shaft (see chapter 5).
6. Remove the selector rail and the forks (see chapter 5).
Remove the output shaft (see chapter 5).
7. Remove the layshaft.

C . Disassembling and reassembling the shaft

Disassembly

***NOTE:** If work is only carried out on the drive gear (67), hold the gear and 1st, 2nd synchroniser assembly in position using a screwdriver so as not to displace the washer with flat sections (77).*

8. Remove the circlip (26).

9. Remove the 3rd - 4th synchroniser (23) and the 4th gear ring. Mark the assembly order.
Remove the cone (33) and the 4th gear (18).

10. Position locking tool 3378082M1 (Fig. 3) and the makeshift supporting sleeve for the shaft (69) (Fig. 4) (see § E).

11. Remove the lubrication pipe (71) and the spring (72).

12. Unlock the nut (68) and loosen it using socket 3378010M1 (Fig. 5 and § E).

13. Remove the input gear (67) with the cone (1).

14. Remove the washers (6) and the shim(s) (3).

15. Remove the tool and sleeve (Fig. 3 - Fig. 4).

16. Take the shaft out through the rear of the housing, while supporting the 1st, 2nd gear assembly.

17. Remove the 1st, 2nd gear assembly and the synchroniser (11) with the ring (8). Remove the cups (16) and (2).
***NOTE:** Pair up the cups and the cones if they are to be reused.*

18. If the input gear (67), the shaft (69) or the tapered roller bearings (1) (2) and (16) (17) are to be replaced:
- remove the washer with flat sections (77);
- extract the bearings cones (1) and (17);
- remove snap ring (70).

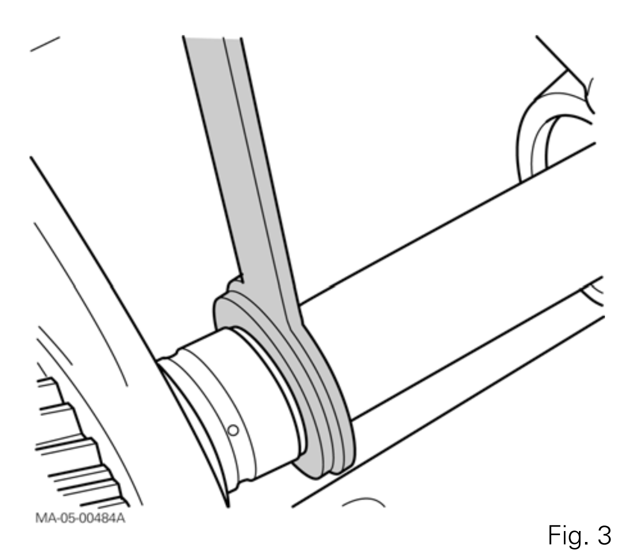

Fig. 3

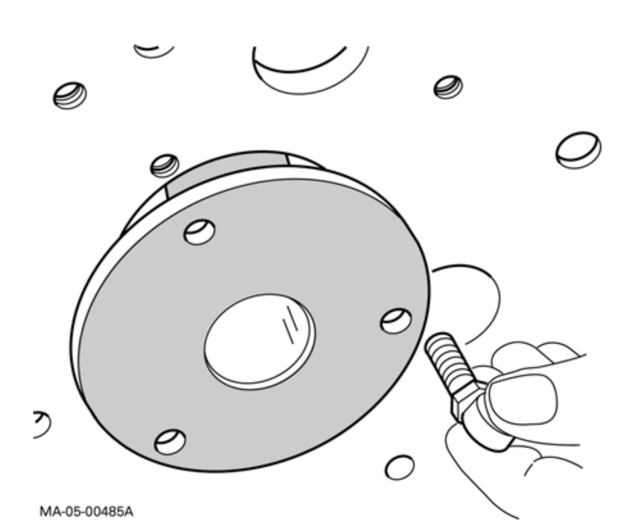

Fig. 4

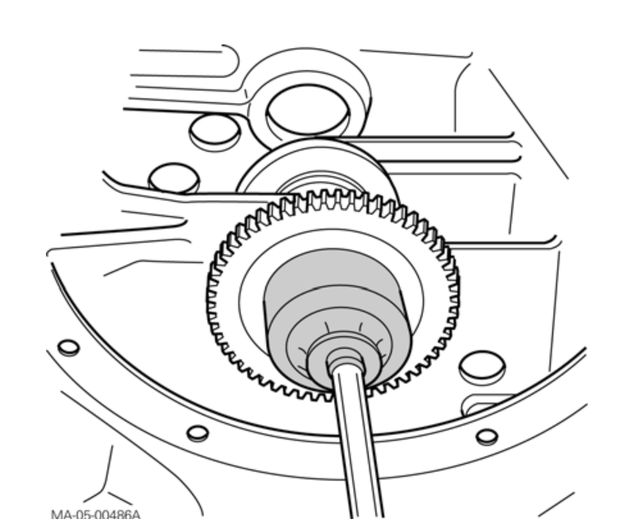

Fig. 5

Reassembly

19. Clean the housing and the mating faces.
20. With a jet of compressed air, check that no channels in the gearbox or in the shaft are blocked.
21. Clean and check all components. Replace those that are defective.
22. Lubricate the cones, cups, bearing bores and the ring.
23. If removed:
- fit the bearing cone (17) onto the shaft (69) using a press and a suitable fixture;
- refit the washer with flat sections (77), with the lubricating grooves facing towards the 1st gear (7);
- refit the snap ring (70).

24. Assemble the cups (2) and (16) inside the housing.
25. Refit the 1st, 2nd gear assembly, the synchroniser (11), the cones (73) (74) and the ring (8) into the housing.
26. Fit the shaft from the rear of the housing while supporting the gear/synchroniser assembly (Fig. 6), and ensuring that the ring (8) is correctly fitted in the gear (14).
27. Fit the locking tool 3378082M1 (see § E) and the makeshift supporting sleeve (Fig. 3 - Fig. 4).
28. If it has been removed, fit the cone (1) onto the gear (67), using a press and a suitable fixture.
29. Fit the washers (6) separated by a number of shims (3) sufficiently thick to obtain a temporary clearance of **0.10 to 0.15 mm** approx. in preparation for shimming with preload (see later).
30. Fit the gear (67) onto the shaft (69).
31. Fit the nut (68) using socket 3378010M1 and tighten to 130 - 170 Nm (Fig. 5).
32. Remove the tool and sleeve (Fig. 3 - Fig. 4).
33. Shim the shaft.
34. Place the dial gauge feeler pin at the end of the shaft (Fig. 7).
35. From the front of the housing, pull hard on the shaft, turning alternately from left to right to correctly seat the cones in their bearing cups.
36. Set the dial gauge to zero.
37. Repeat step 35, this time pushing.
38. Depending on the clearance measured, select the thickness of final shims required to obtain a preload of **P1 = 0.14 to 0.20 mm.** If possible, shim to the maximum tolerance.
39. Fit the locking tool and the supporting sleeve (Fig. 3 - Fig. 4).

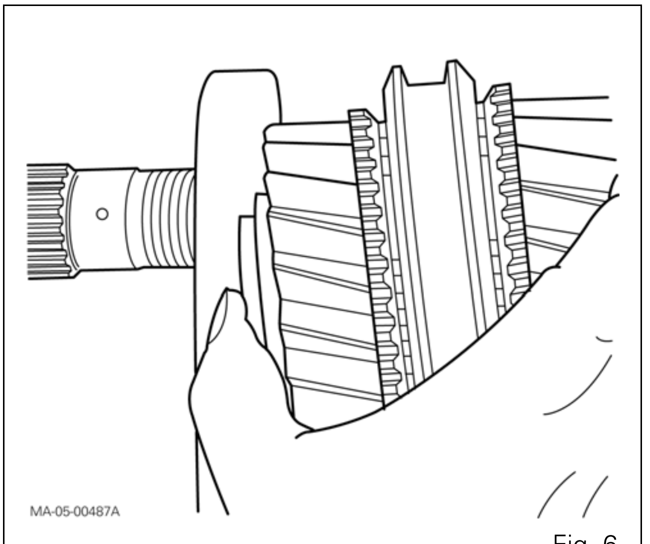

Fig. 6

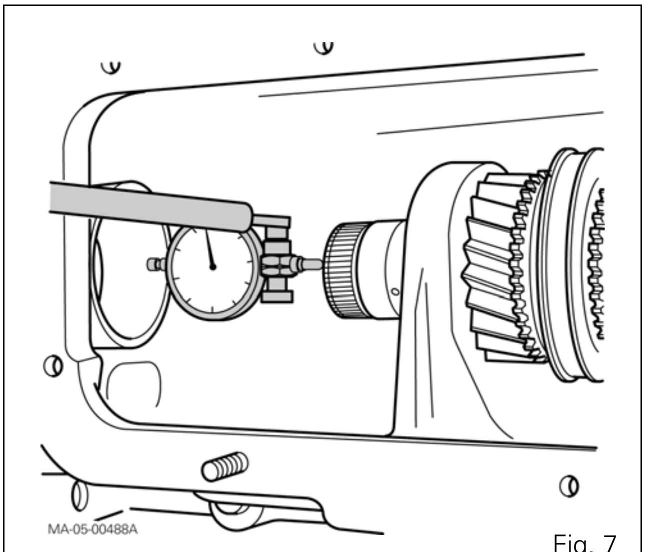

Fig. 7

40. Unlock the nut (68).
41. Remove the gear (67).
42. Position the shims (3) selected during step 38 between the two washers (6).
43. Refit the gear.
44. Degrease the thread of the shaft with a solvent.
45. Lightly smear the new nut (68) with Loctite 270 or equivalent then tighten to a torque of 130 - 170 Nm.
46. Using a suitable pin punch, lock the nut in place by bending the collar into the grooves of the shaft without breaking it.
47. Insert the spring (72) and the lubrication pipe (71) in the shaft.
48. Remove the tool and the supporting sleeve.
49. Fit:
- the gear (18);
- the 4th synchroniser cone (33);
- the 4th gear ring and the 3rd - 4th synchroniser (23). The lubricating grooves of the synchroniser should be turned towards the 4th gear (18).

50. Fit a new circlip (26), opening it as little as possible. After assembly, check that it is not bent.
51. Manually check:
- the axial clearance of the gears;
- the rotation of the shaft and its gears.

52. Check that the 1st, 2nd synchroniser operates properly.

D . Final steps

53. Refit and shim the output shaft (see chapter 5).
54. Refit the intermediate shaft (see chapter 5).
55. Refit the input unit assembly (see chapter 5).
56. Shim the intermediate shaft (see chapter 5).
57. Refit the selector rail and the forks (see chapter 5).
58. Refit the selector cover plate (see chapter 5).
59. Reconnect the gearbox to the engine (see chapter 2).
60. Reconnect the gearbox and the rear axle (see chapter 2).
61. Check operation of electric circuits.
62. Carry out a road test of the controls.
63. Check the tightness of the unions and mating faces (selector cover plate, gearbox on rear axle).

E . Service tools

Tools available in the AGCO network

- **3378010 M1:** - Socket for nut - Layshaft (Fig. 8)
- **3378082 M1:** - Locking tool - Layshaft (Fig. 9)

Makeshift tool

- **Supporting sleeve for the layshaft** (Fig. 10)

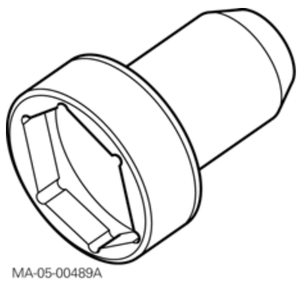

Fig. 8

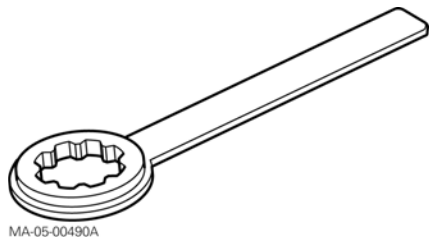

Fig. 9

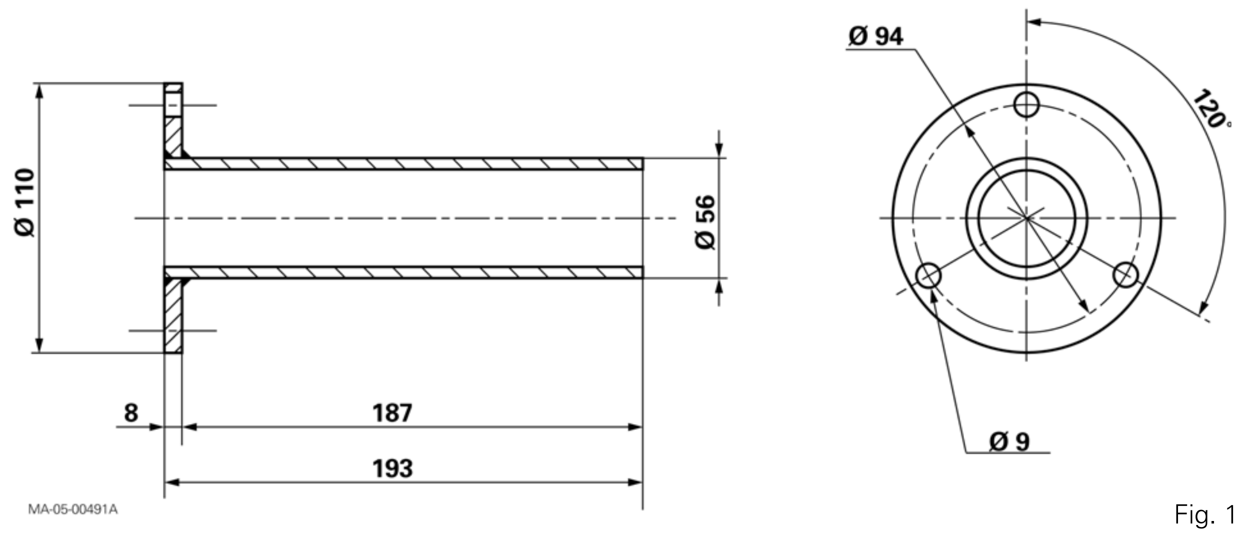

Fig. 10

5A18 - GBA20 - Mechanical reverse shuttle - Intermediate shaft

CONTENTS

A . General

The intermediate shaft and its gears (Fig. 1) form the upper shaftline of the GBA20 gearbox with mechanical reverse shuttle.

It supports the 1st to 4th driven gears.

The shaft rear teeth (54) are constantly meshed with the Tortoise gear.

The shaft is supported by:

- the tapered roller bearing (63) and (64) housed in the rear bearing of the input unit;
- the tapered roller bearing (52) and (53) located in the rear bearing of the gearbox.

The four gears are held in position by the spacers (57) and (82).

The operating clearance for these gears is obtained by inserting the shims (58) between the 1st (60) and 2nd (59) driven gears.

Parts list (Fig. 1)

(50) Oil deflector
(51) Shim(s)
(52) Bearing cup
(53) Bearing cone
(54) Shaft
(55) 3rd driven gear
(56) 4th driven gear
(57) Spacer
(58) Shim(s)
(59) 2nd driven gear
(60) 1st driven gear
(61) Circlip
(62) Needle roller bearing
(63) Bearing cone
(64) Bearing cup
(82) Spacer

View of the assembly

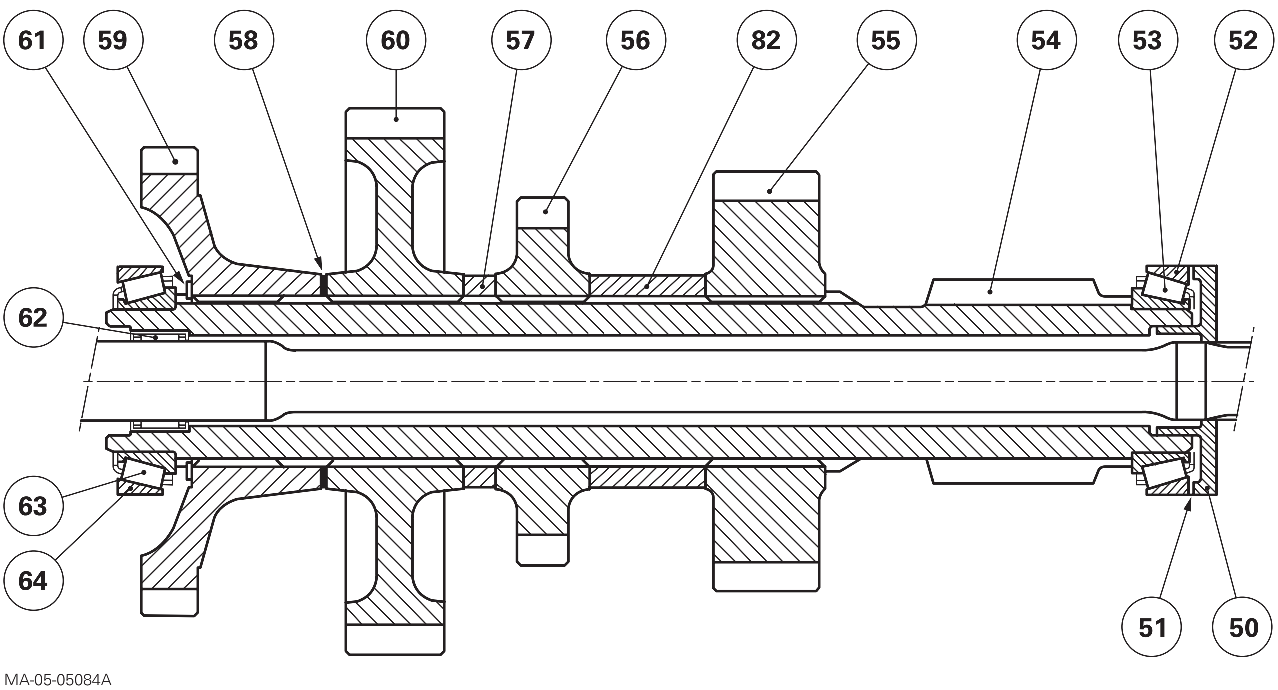

Fig. 1

Parts list (Fig. 2)

(50) Oil deflector
(51) Shim(s)
(52) Bearing cup
(53) Bearing cone
(54) Shaft
(55) 3rd driven gear
(56) 4th driven gear
(57) Spacer
(58) Shim(s)
(59) 2nd driven gear
(60) 1st driven gear
(61) Circlip
(62) Needle roller bearing
(63) Bearing cone
(64) Bearing cup
(82) Spacer

Blown-up view

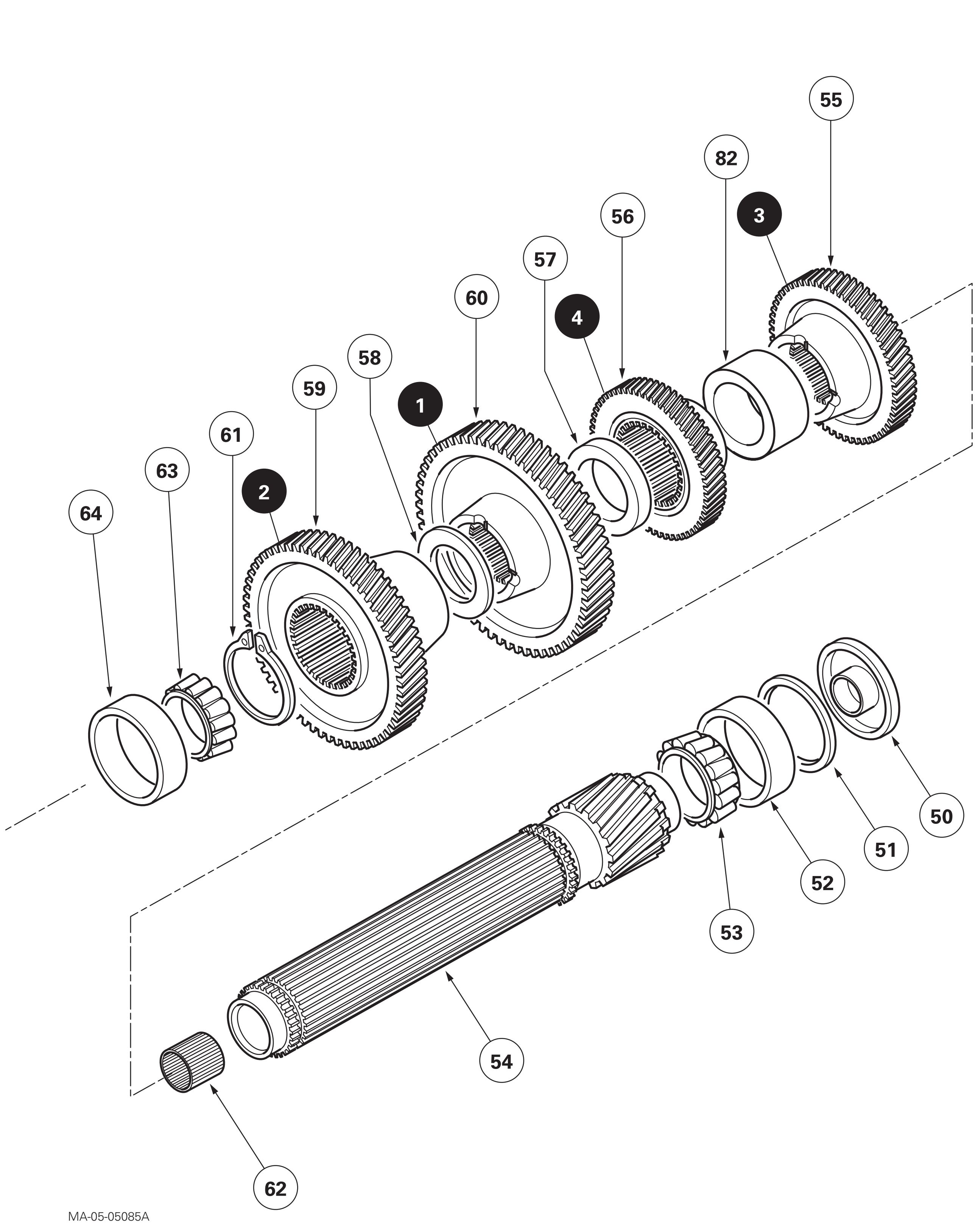

Fig. 2

B . Preliminary steps

Important: *To correctly shim the intermediate shaft tapered roller bearings, it is necessary to remove the gearbox.*

1. Split the tractor between the gearbox and the rear axle (see chapter 2).
2. Split the gearbox from the engine (see chapter 2).
3. Place the gearbox on a workbench or a suitable support.
4. Remove the selector cover plate (see chapter 5).
5. Remove the input unit (see chapter 5).

Important: *After removing the input unit, pair the bearing cup housed in the input unit rear bearing with the intermediate shaft front bearing cone.*

C . Removing and refitting the shaft and gear assembly

Removal

6. Remove the oil deflector (50) using a slide hammer puller and remove the shims (51) and the cup (52) (Fig. 3) to release the rear end of the shaft.
7. Take the shaft and gear assembly out through the front of the housing (Fig. 4), by tilting it so that the gears are released from the lower shafts.

   Important: *When removing the shaft, do not insert the handling bar in the bore as this will damage the needle roller bearing (62) (Fig. 4). If necessary, carry out the operation with the help of an assistant.*

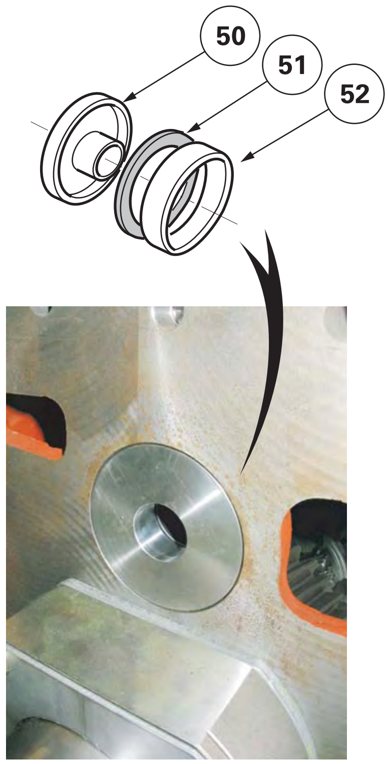

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Fig. 3

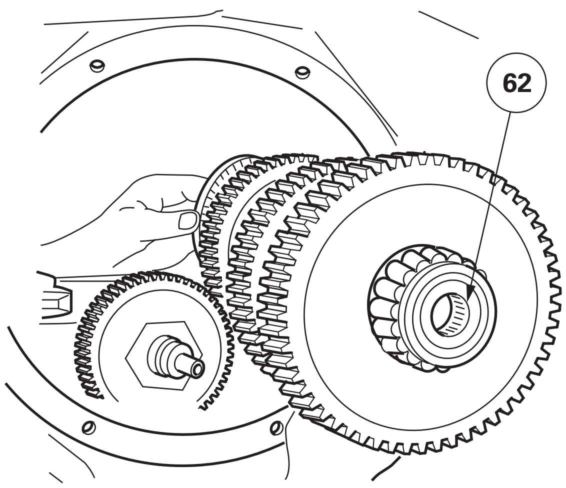

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Fig. 4

Refitting

8. Clean and check all components. Replace those that are defective.

9. In the housing, position the assembled shaft with its related gears.

10. If necessary, check and correct the shimming of the shaft (see § G). Otherwise, refit the cup (52), the original shims and the oil deflector (50).

D . Removing and refitting the gears

Disassembly (Fig. 1)

11. Extract the bearing cone (63).

12. Remove circlip (61) by opening it up as little as possible.

13. Remove 2nd gear (59), shims (58), 1st gear (60) and spacer (57).

14. Remove 4th gear (56), spacer (82) and 3rd gear (55).

Reassembly (Fig. 1)

15. Clean and check all components. Replace those that are defective.

16. Refit the 3rd gear (55), spacer (82) and 4th gear (56).

17. Fit the spacer (57). Fit the 1st gear (60) and the 2nd gear (59)**, temporarily without the shims (58)**.

18. Fit the circlip (61).

19. Shim the gears (see § F).

20. Refit the shaft, assembled with its related gears, in the housing (see § C).

E . Replacing the tapered roller bearings of the intermediate shaft

Disassembly

21. Remove the shaft (54) and gear assembly (see § C).

22. Extract the bearing cones (53) and (63). Discard them.

23. If necessary, replace the shaft.

Reassembly

24. If the shaft (54) has been replaced:

Using a suitable fixture and a press, fit a new needle roller bearing (62) thrust up against the shoulder of the shaft. Check needle rotation after assembly.

25. Reassemble the gears (see § D).

26. Fit bearing cones (63) and (53) using a press and a suitable fixture.

27. Position the shaft, assembled with its related gears, into the housing (see § C).

28. Shim the shaft (see § G).

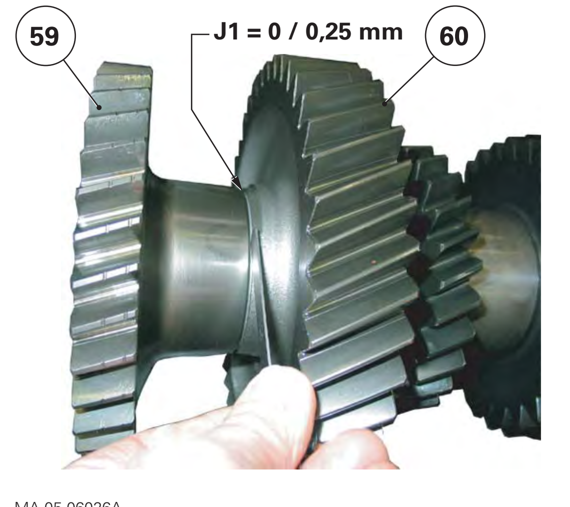

Fig. 5

F . Shimming the gears

Reminder: *The gears should be stacked temporarily without the shims (58).*

29. Using a set of shims, measure the space between the 1st gear (60) and the 2nd gear (59) (Fig. 5).

30. Depending on the measured distance, choose shim(s) of an appropriate thickness to obtain the clearance **J1 = 0 to 0.25 mm** (Fig. 5).

31. Remove the circlip (61), opening it up as little as possible, and remove the gear (59).

32. Slide the previously selected final shims onto the shaft. Refit the gear and position the circlip correctly.

33. Fit bearing cone (63) (see § E).

34. Refit the shaft, assembled with its related gears, in the housing (see § C).

G . Shimming the shaft

***IMPORTANT:** To carry out shimming on the intermediate shaft, the input unit must be refitted (see chapter 5).*

35. Carry out the shimming on the shaft to obtain a clearance of **J2 = 0 to 0.08 mm** (Fig. 7)

36. Fit the makeshift tool (Fig. 8 and § I) in the shaft.

37. Slightly compress the spring, while tightening the nut of the tool, to correctly seat the bearing cones in their cups.

38. Rotate the shaft a few turns. Check spring compression again.

39. Using a depth gauge (Fig. 6), measure dimension X between face A of the bearing cup (52) and face B of the housing (Fig. 7).

40. Measure the thickness Y of the oil deflector (50).

41. Calculate the difference between X and Y.

42. Determine the thickness of shims required to obtain the clearance J2.

***NOTE:** If possible, shim to the minimum tolerance.*

43. Remove the compression tool.

44. Fit the shims (51) selected during step 42.

45. Fit the oil deflector in the housing.

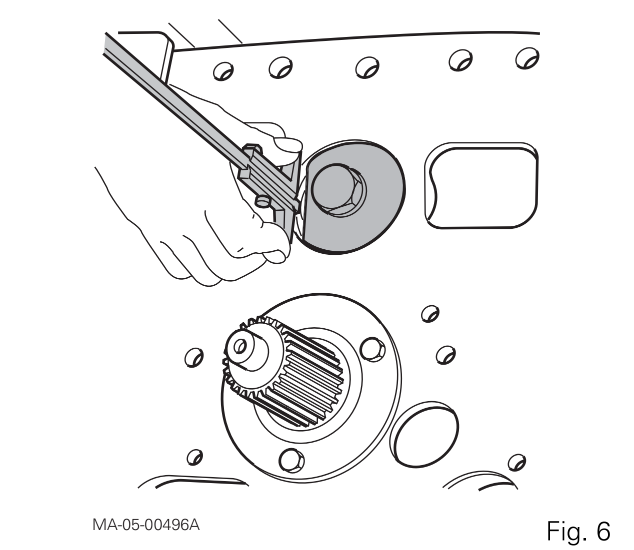

Fig. 6

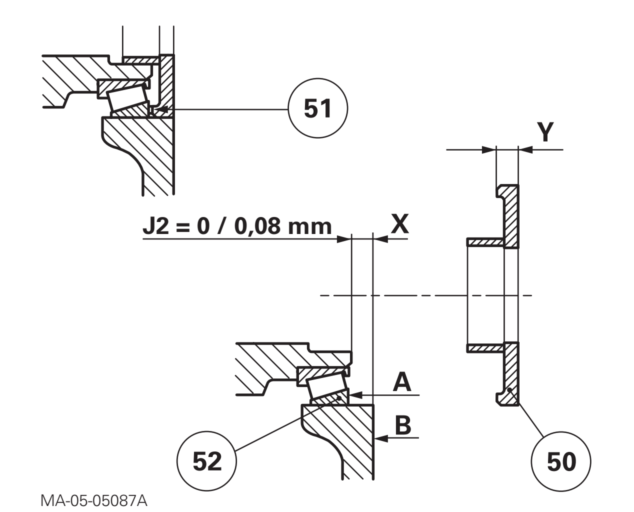

Fig. 7

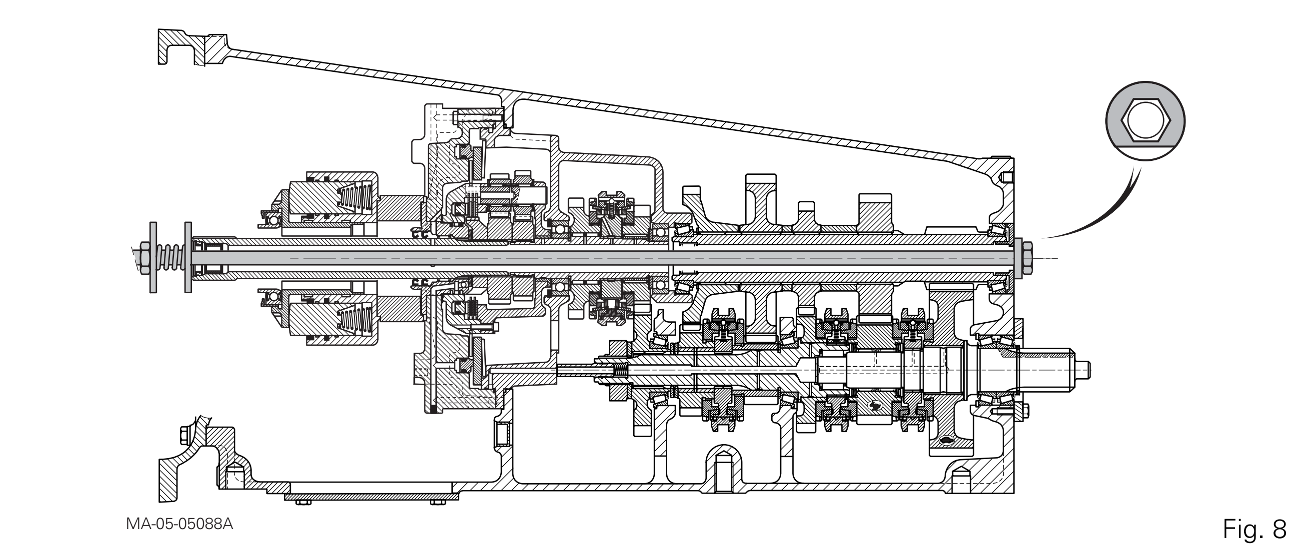

Fig. 8

H . Final steps

46. Refit the input unit (see chapter 5).

47. Refit the selector cover plate (see chapter 5).

48. Attach a sling to the gearbox. Lower it from the workbench or suitable support.

49. Reconnect the gearbox and the engine (see chapter 2).

50. Reconnect the tractor between the gearbox and the rear axle (see chapter 2).

51. Check:

- tightness of the hydraulic systems;
- correct operation of electrical circuits.

52. Carry out a road test of all controls.

53. Check the tightness of the unions and mating faces (selector cover plate, gearbox on rear axle).

I . Service tool

Makeshift tool

- **Shaft supporting tool (Fig. 9)**
  (1) MF 1610037M2 washer, locally adapted
  (2) MF 3619200M2 washer, to be machined
  (3) LL 2U washer:
    -int. Ø = 12.5
    -ext. Ø = 40
    -thickness = 2.5
  (4) HM10 nut
  (5) ext. Ø = 79.7 + 0 / - 0.2
  (6) M10 x 150 threaded rod: L = 1150
  (7) Spring:
    -int. Ø = 40
    -Thread Ø = 4
    -L = 95

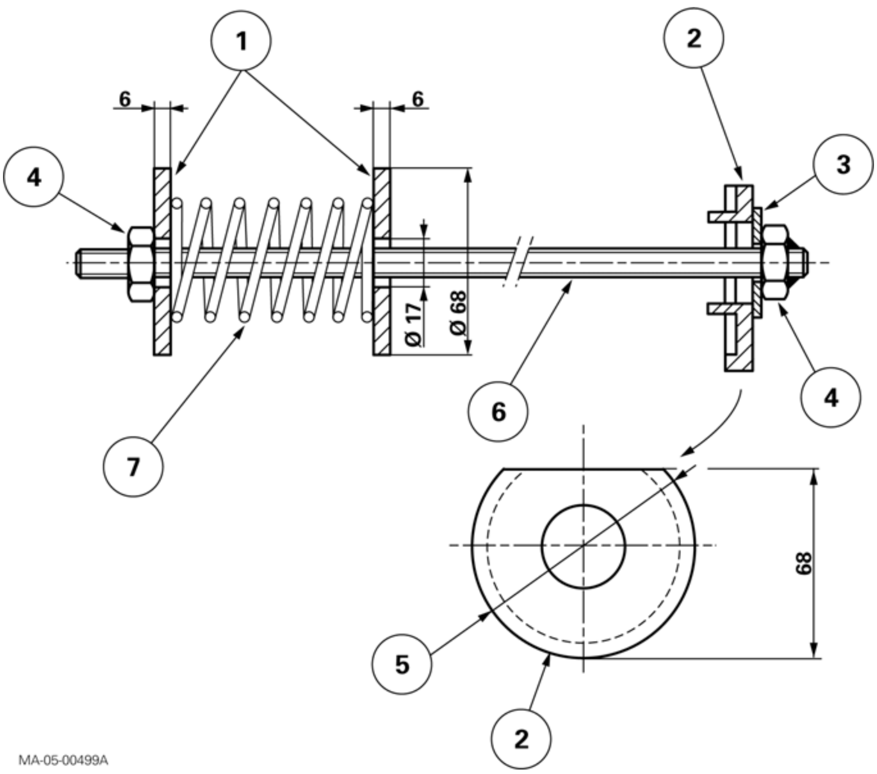

Fig. 9

5B10 - GBA20 - Power Shuttle - General - Operation

CONTENTS

A . General

The housing of the GBA20 gearbox with Power Shuttle consists of the following main components, in the order given:
- the Power Shuttle,
- the Speedshift input unit,
- the gearbox input gear train,
- the main gearbox,
- the creeper or super creeper gearbox (depending on option).

This section is mainly limited to a description of the gearbox.

Only a partial description is given of each major component, as more specific and detailed descriptions are given in their respective sections.

Power Shuttle

The Power Shuttle consists of two multidisc wet clutches (one for forward operation and one for reverse operation). These clutches are located at the front of the input unit, in front of the Speedshift unit.

The Power Shuttle is controlled by two proportional solenoid valves operated by a lever located to the left under the steering wheel and managed by the tractor electronic system.

Speedshift input unit

The Speedshift input unit consists of a hydraulic mechanism and an epicyclic gear train. It is located to the rear of the Power Shuttle. It allows two gearbox input ratios to be obtained via a hydraulic control unit and a solenoid valve.

Gearbox input gear train

The gearbox input gear train consists of two meshed gears:
- a driving gear located at the rear of the input unit;
- a driven gear attached to the gearbox layshaft.

The input gear train transmits drive from the engine to the gearbox.

Main gearbox

The main gearbox consists of four basic gears and two speed ranges (Hare and Tortoise), giving a total of eight ratios for each direction of travel.

This transmission covers all usage requirements.

Creeper gearbox (optional)

The creeper gearbox is fitted to the gearbox output shaft.

It allows slow travel. It operates at a ratio of 4/1.

It is controlled mechanically and should only be engaged when the gearbox is in Tortoise range.

Super creeper gearbox (optional)

The super creeper gearbox is also fitted to the gearbox output shaft.

It consists of two epicyclic gear trains which allow a reduction ratio of 14/1, and therefore allows very slow travel.

Like the creeper gearbox, it is controlled mechanically.

GBA20 - Power Shuttle - General - Operation

Parts list (Fig. 1)

(3) Screw
(4) Ring
(5) Secondary shaft
(6) Output sun gear
(7) Input sun gear
(8) Planet gear pins
(9) Planet carrier unit
(10) Friction washer
(12) Double planet gears
(13) Unit
(14) Spacers
(15) Hub
(16) Needle roller bearings
(17) Friction washers
(18) Spring washer (Belleville)
(19) Ring restrictor
(20) Thrust plate
(21) Brake disc
(22) "O" ring
(23) "O" ring
(24) Screw
(25) Hydraulic cover plate
(26) "O" ring
(27) Front cover plate
(28) Clutch piston
(29) "O" ring
(30) Intermediate plates
(31) Rings
(32) Needle roller bearings
(33) Ring carrier
(34) Screw
(36) Primary shaft
(37) Circlip
(38) Tab washer
(39) Washer
(40) Ball bearing
(41) Screw
(42) Discs
(43) Spring washers
(48) Brake piston
(50) Planet carrier assembly (30 kph version)
(51) Screw
(52) Cover plate
(53) Shim(s)
(54) Bearing cup
(56) Driving gear
(57) Bearing cup
(58) Bearing cone

GBA20 input train and Speedshift with Power Shuttle

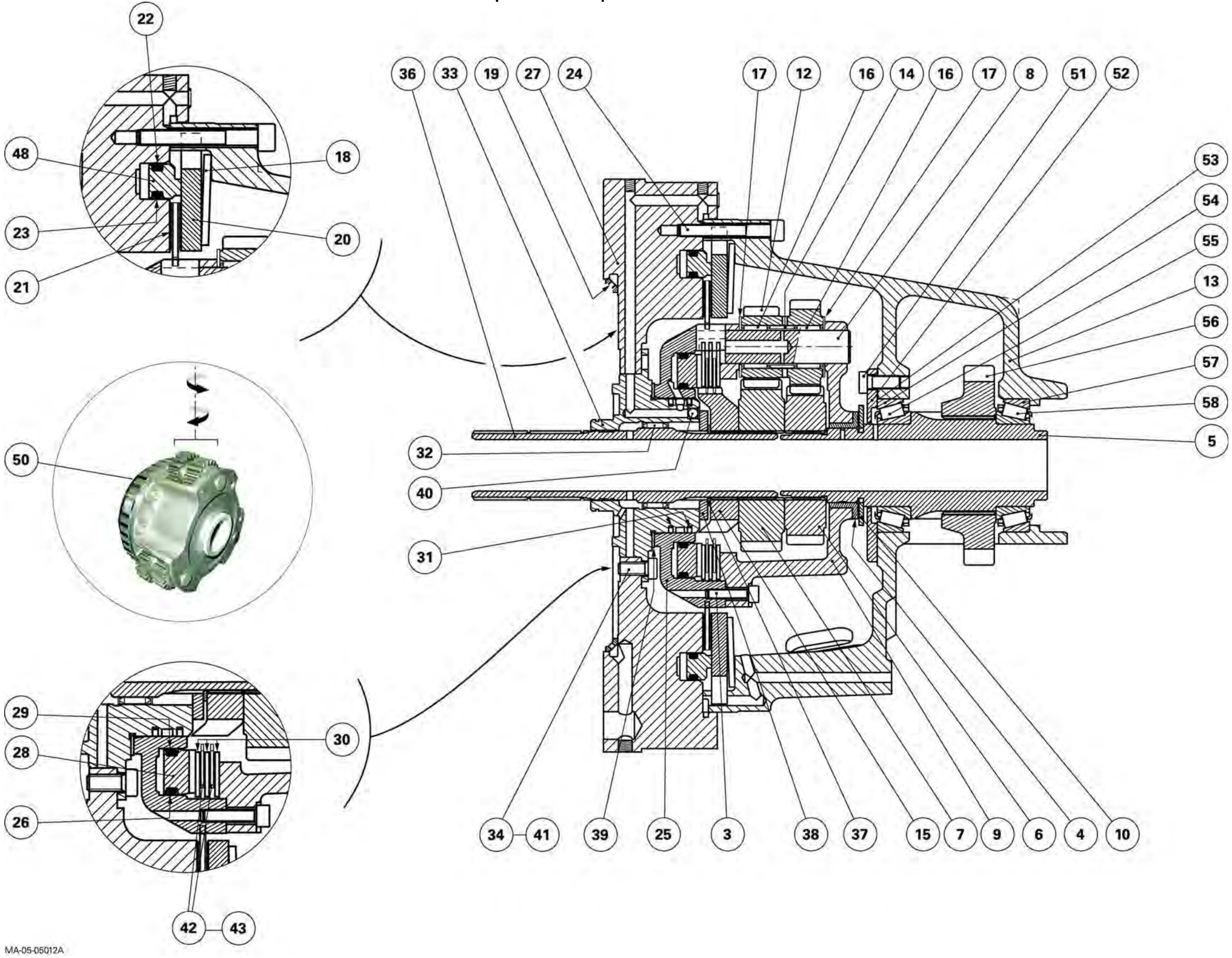

Fig. 1

Parts list Fig. 2

(1) Bearing cone
(2) Bearing cup
(3) Shim(s)
(6) Splined washers
(7) 1st driving gear
(8) Ring
(11) 1st - 2nd double cone synchroniser
(14) 2nd driving gear
(16) Bearing cup
(17) Bearing cone
(18) 4th driving gear
(23) 3rd - 4th double cone synchroniser
(24) Needle roller bearing
(26) Circlip
(27) Washer
(28) Needle roller bearings
(29) 3rd driving gear (Hare)
(31) Hare / Tortoise double cone synchroniser
(32) Washer
(35) Ring
(36) Tortoise gear
(37) Bearing cup
(38) Shim(s)
(39) Bearing cone
(40) Bearing cone
(41) Screw
(42) Shim(s)
(43) Shim
(44) Output shaft
(45) Circlip
(46) Stop plate
(48) Bearing cup
(49) Circlip
(50) Deflector
(51) Shim(s)
(52) Bearing cup
(53) Bearing cone
(54) Intermediate shaft
(55) 3rd driven gear
(56) 4th driven gear
(57) Spacer
(58) Shim(s)
(59) 2nd driven gear
(60) 1st driven gear
(61) Circlip
(62) Needle roller bearing
(63) Bearing cone
(64) Bearing cup
(65) Gearbox housing
(67) Input gear
(68) Nut
(69) Layshaft
(70) Snap ring
(71) Lubrication pipe
(72) Spring
(77) Washer with flat sections
(78) Tab washer
(79) Needle roller bearing
(80) Spacer
(81) Needle roller bearing
(82) Spacer

GBA20 gearbox with Power Shuttle

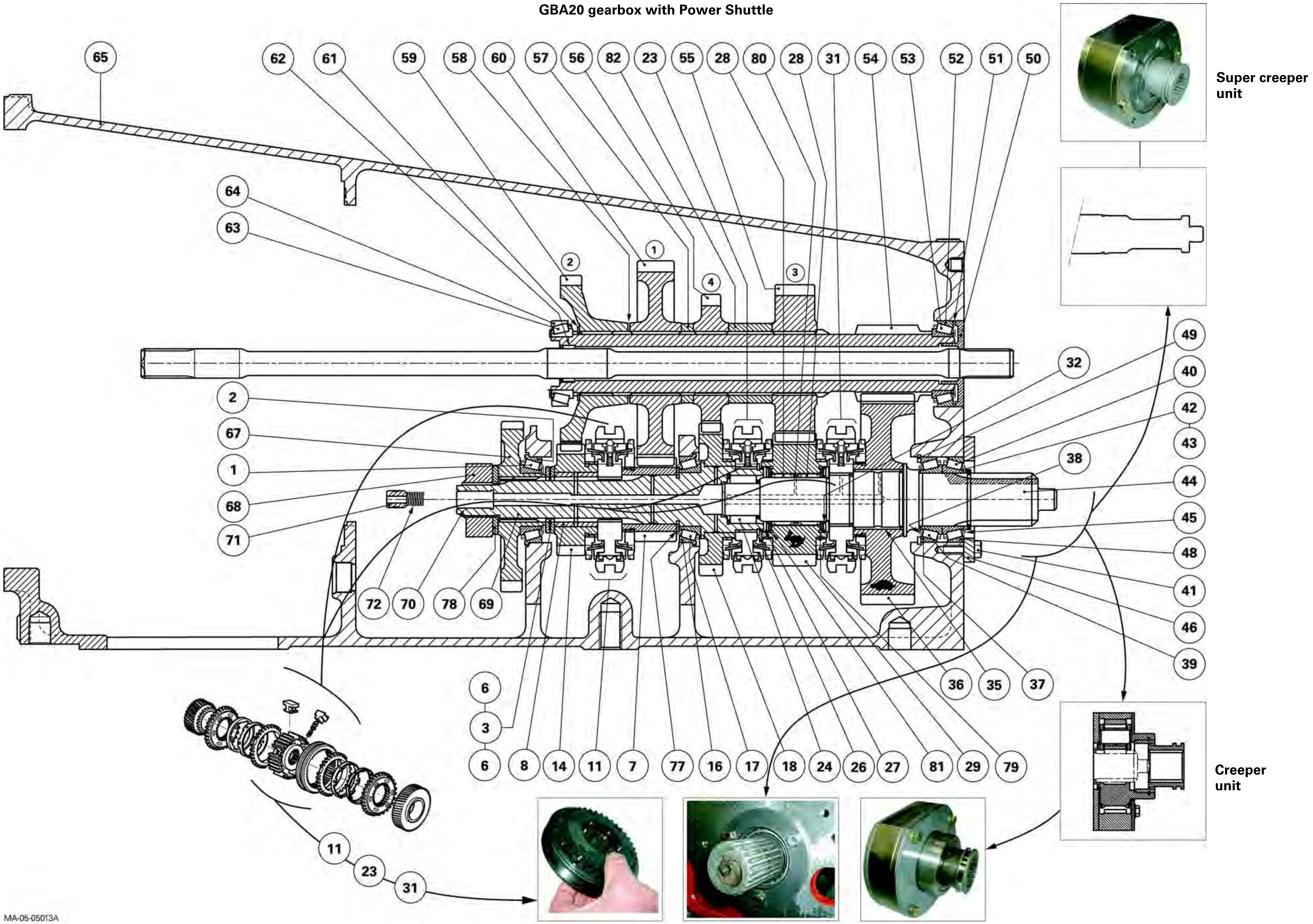

Fig. 2

B . Construction and description

Construction

The GBA20 gearbox with Power Shuttle consists of three gear trains fitted to the:

- layshaft;
- intermediate shaft (or main shaft),
- output shaft.

It allows eight basic synchronised gear ratios:

- four gear ratios: 1st, 2nd, 3rd and 4th;
- two range ratios: Hare and Tortoise.

Its main characteristic is its assembly of three double cone synchronisers.

The main gearbox consists of four synchronised gears. A gear idle-mounted to the output shaft and controlled by a synchroniser allows the four initial gears to be doubled to obtain the eight basic gears.

The layshaft and the intermediate shaft are supported by tapered roller bearings.

The output shaft is fitted on two tapered roller bearings and one needle roller bearing.

The layshaft bearing cups are fitted up against the housing.

All gears have helical teeth and are constantly meshed.

To ensure optimum gearbox reliability, the bearings are fitted:

- with preload for the layshaft,
- with clearance for the intermediate shaft.

The output shaft may be set either with a slight clearance or a slight preload.

Lubrication

The lubricating oil of the lower shaftline is supplied from the tractor hydraulic system via a 1.5 bar valve. It passes through a channel in the layshaft and output shaft. Radial bores direct the oil to the gears, bearings, rings and synchronisers.

The splines of the Hare/Tortoise synchroniser hub are lubricated via a radial bore on the output shaft.

The oil flowing inside the intermediate shaft lubricates the tapered roller bearings and needle roller bearing (62). These bearings are fitted respectively at the ends of the shaft.

Description (Fig. 2)

Drive is transferred from the main gearbox by the driven gear (67) which is permanently meshed with the driving gear for the input gear train (Power Shuttle).

The driven gear (67) is splined to the layshaft (69).

The two synchroniser hubs (11) (23) are splined to the layshaft (69).

The 2nd driving gear (14) is freely mounted on a ring (8).

The 1st (7) and 4th (18) driving gears are freely mounted directly on the shaft.

The 3rd driving gear (29) is fitted on needle roller bearings (28). It is also fitted with a needle roller thrust bearing on each of its faces to absorb any axial pressure.

The hub of the Hare / Tortoise synchroniser (31) is secured to the output shaft (44).

The driven gears (55), (56), (59) and (60) drive the intermediate shaft (54) by means of splines. The rear teeth of this shaft are constantly meshed with the Tortoise gear (36) idle-mounted on the output shaft.

C . Operation

__NOTE:__ On GBA20 gearboxes with Power Shuttle, the 1st - 2nd and 3rd - 4th gear synchronisers and the Hare / Tortoise synchroniser are double cone type.

The double cone synchroniser has the following advantages: improved reliability and increased resistance to transmission loads.

Synchronisers (double cone)

Parts list (Fig. 3)

(1) Sliding coupler
(2) Cone (brake)
(3) Coupling flange
(4) Ball bearing
(5) Pressure elements
(6) Spring
(7) Ring
(8) Cone (brake)

Locked position (Fig. 3)

When the sliding coupler (1) moves towards the gear to be locked, it is pressed against the ring (7) by the ball bearings (4) and pressure elements (5).

The ring (7) transmits the pressure received to the cones (2) and (8) to set a synchronisation speed.

When the synchronisation is set, the sliding coupler (1) can mesh and silently lock with the teeth of the coupling flange (3).

Neutral position (Fig. 3)

The sliding coupler (1) is in the middle position. The ball bearings (4) are pushed into the V groove of the sliding coupler by the pressure springs (6). The gears can turn freely on the shaft. In this neutral position, the sliding coupler is locked by three balls held in place by the pressure springs.

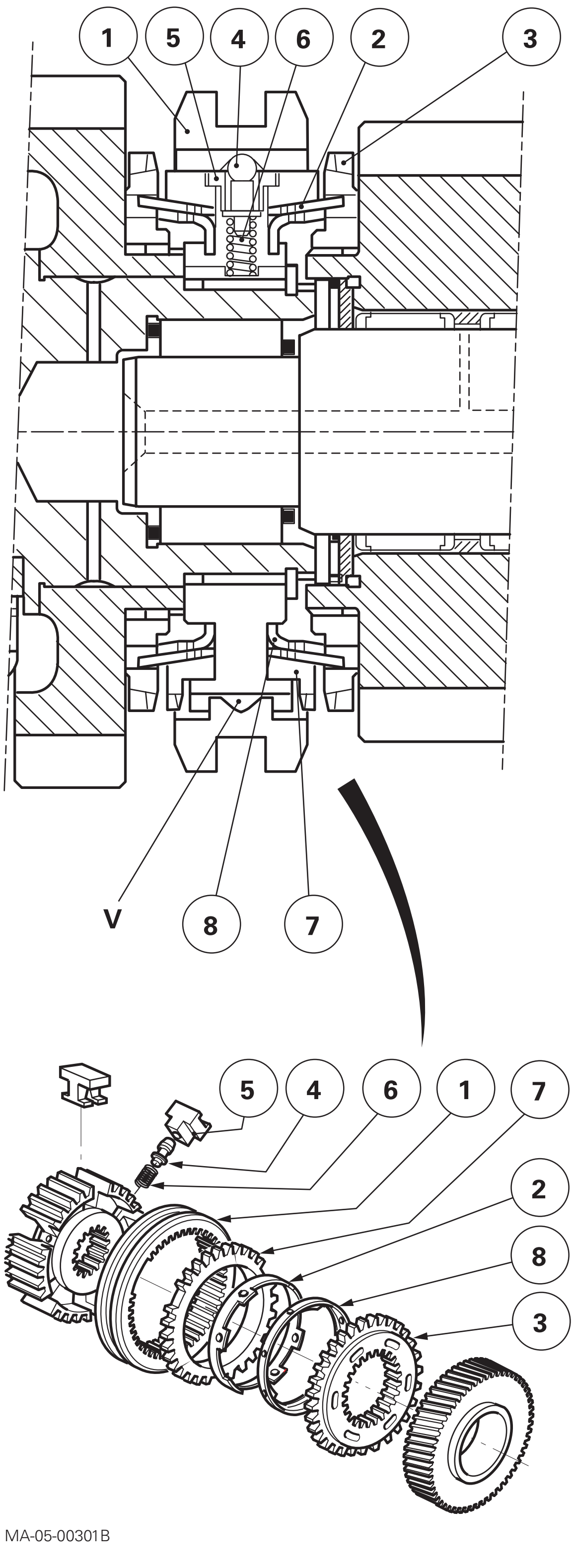

Fig. 3

Overhaul

If the synchronisers (11), (23) and (31) are disassembled, check the wear to the cones (2) and (8) in the following manner:

1. Stack the coupling flange (3), cones (2) and (8) and ring (7).
2. Correctly position the ring (7) on the cones (2) and (8), turning it one way then the other several times and applying manual pressure.
3. Using a set of shims, measure dimension X (Fig. 4) at three equidistant points.

   Calculate the average of the three values and proceed as described below, depending on the result obtained.

   On a new synchroniser, dimension X must be **1.6 mm minimum**.

   After operation, if X is **less than or equal to 0.60 - 0.80 mm**:

   - replace the cones (2) and (8),
   - check the measurement of X again, using the same process.

     If dimension X is still incorrect, also replace the ring (7) or, if necessary, the entire synchroniser.

Slow speed range (Tortoise)

Gear engagement is obtained by moving one of the synchroniser sliding couplers (11) or (23) to join, in rotation, the layshaft (69) with one of the freely-mounted gears (1st, 2nd, 3rd, 4th). No matter what ratio is selected, the drive is transmitted to the intermediate shaft (54). The output shaft (44) is driven by the teeth machined on the intermediate shaft, which is constantly meshed to the idle-mounted gear (36).

The low range (Tortoise) is obtained by moving the synchroniser sliding coupler (31) backwards.

High speed range (Hare)

The high speed range is obtained by moving the synchroniser sliding coupler (31) forwards, meshing the driving gear (29) and the output shaft.

Consequently, in 3rd gear Hare, the intermediate shaft (54) is passive. The other gears are obtained by moving the synchroniser sliding couplers (11) or (23) as with the Tortoise range. Drive is transmitted to the output shaft (44) by driven gears (29) and (55).

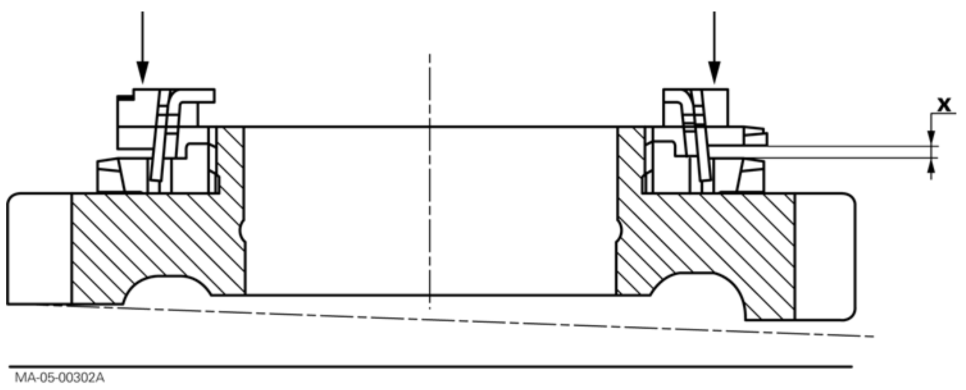

Fig. 4

D . Specifications of the GBA20 transmission assembly with Power Shuttle

See Fig. 5.

Legend

J Clearance
P Preload

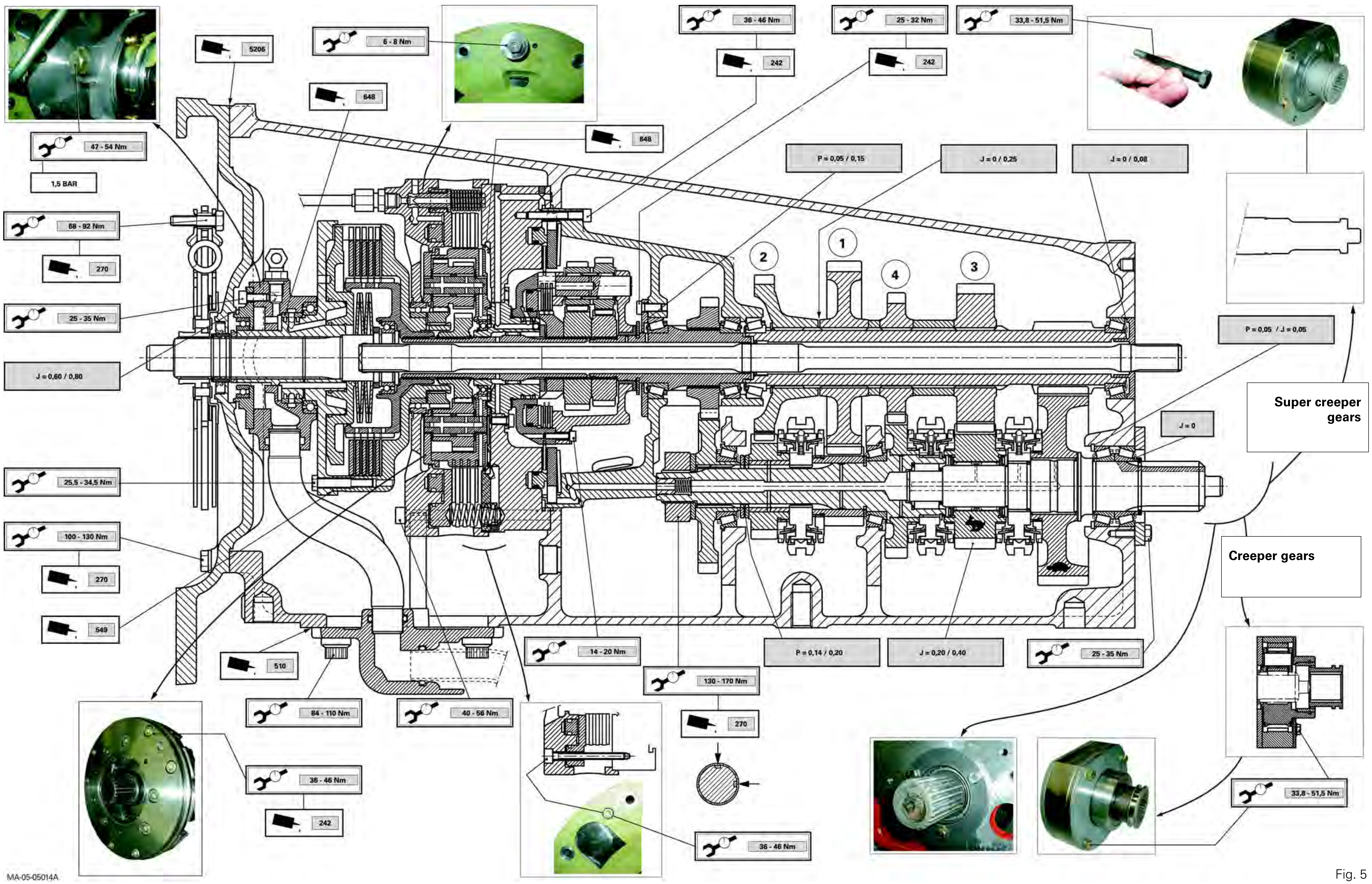
47 - 54 Nm
1,5 BAR
5206
6 - 8 Nm
648
648
36 - 46 Nm
242
25 - 32 Nm
242
33,8 - 51,5 Nm
P = 0,05 / 0,15
J = 0 / 0,25
J = 0 / 0,08
68 - 92 Nm
270
25 - 35 Nm
J = 0,60 / 0,80
1
2
3
4
P = 0,05 / J = 0,05
Super creeper gears
J = 0
25,5 - 34,5 Nm
100 - 130 Nm
270
549
Creeper gears
510
84 - 110 Nm
40 - 56 Nm
14 - 20 Nm
130 - 170 Nm
270
P = 0,14 / 0,20
J = 0,20 / 0,40
25 - 35 Nm
36 - 46 Nm
242
36 - 46 Nm
33,8 - 51,5 Nm
MA-05-05014A

Fig. 5

5B11 - GBA20 - Power Shuttle - Input unit

CONTENTS

A . General

The input unit with Power Shuttle is in the form of an interchangeable module on which a Power Shuttle is assembled.
It is fitted at the gearbox input.

It is made up of two separate parts:
- the Power Shuttle (see chapter 5);
- the Speedshift.

The input unit receives movement from the Power Shuttle and transmits it to the transmission by means of a driving gear located in the rear housing of the unit.

The Speedshift

This is an independent function allowing two gearbox input ratios to be obtained.
It is located in front of the driving gear of the gearbox input gear train.
It consists of a hydraulic mechanism and an epicyclic gear train.
For operation, see chapter 5.

B . Preliminary steps

***SPECIAL POINT:** If the input unit is removed to replace the complete unit or just the cover plate (1) and the unit (2) (Fig. 1), when refitting, it is necessary to reshim the gearbox intermediate shaft (see chapter 5).*

1. Disconnect the tractor between the engine and the gearbox (see chapter 2).
2. Drain the gearbox and the rear axle.
3. Remove the spacer (4) (see chapter 3).

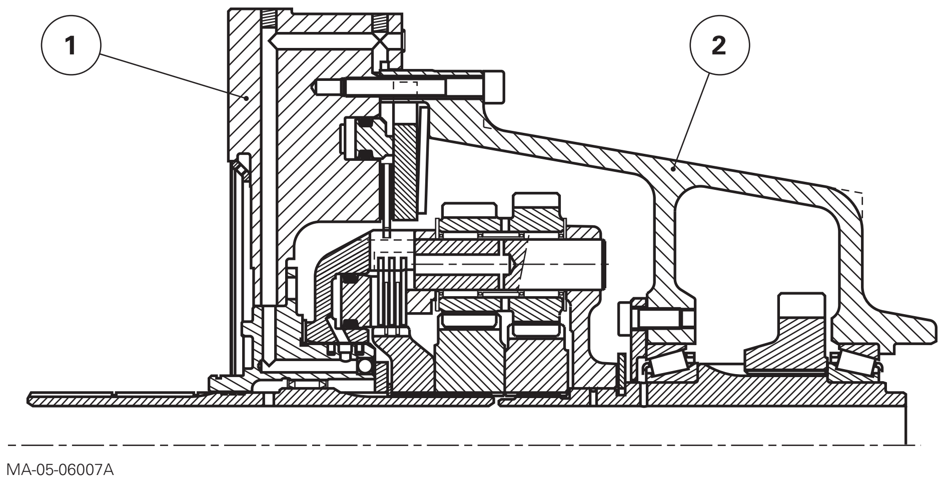

Fig. 1

C . Removal

4. Remove the forward clutch from the Power Shuttle (see chapter 5).
5. Take out the PTO shaft (1) from the gearbox (Fig. 4) and mark its position.
6. Remove union (91) (Fig. 2).
7. Extract the transfer pipe (88) (Fig. 2, pressure connector line, lubrication).
8. Disconnect and remove the potentiometer sensor (1) located above and on the right-hand side of the selector cover plate (Fig. 3).
9. Sling the input unit using tool 3378225M11, a makeshift handling bar (see § G) and a suitable lifting device as in Fig. 4.

   Note: *The sling hides two diametrically opposed screws (1) on the input unit (Fig. 5). Before fitting the tool to the unit, remove these screws.*

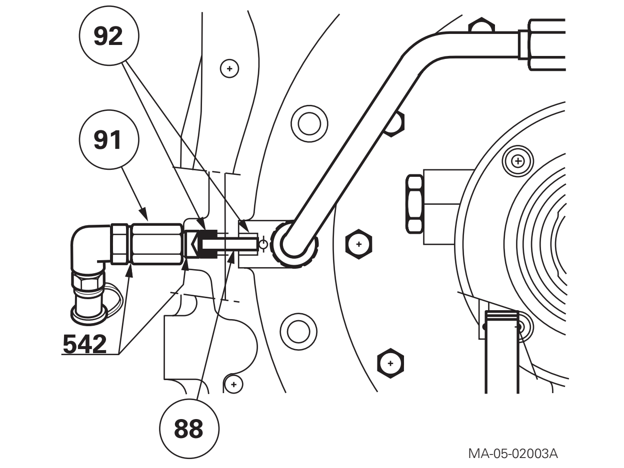

Fig. 2

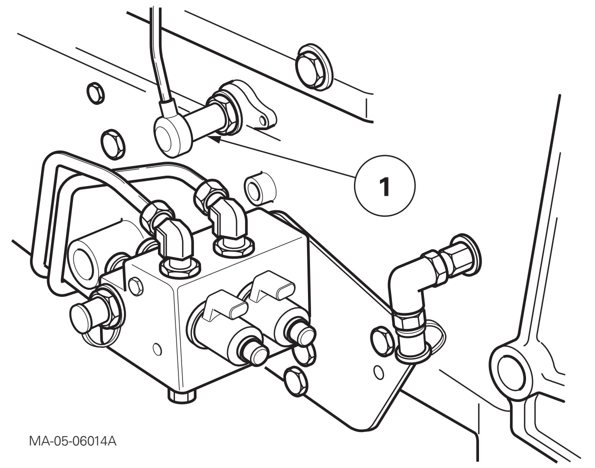

Fig. 3

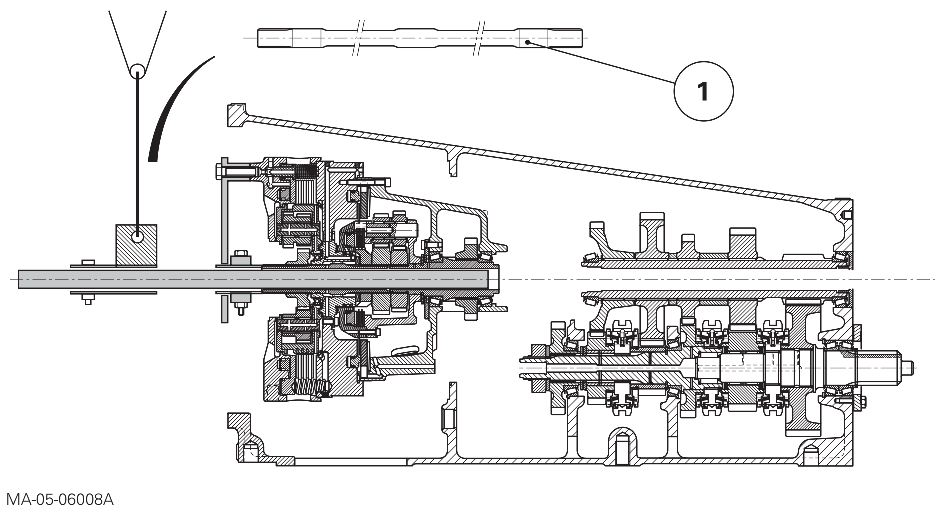

Fig. 4

GBA20 - Power Shuttle - Input unit

10. Remove the remaining screws (1) securing the unit to the gearbox (Fig. 5) without touching screws (2) (8 mm Allen key) (Fig. 5).

11. With the help of an assistant, **carefully** pull the unit forward.

12. Release the unit from the gearbox and remove it.

CAUTION: Use a handling bar to prevent the input unit from tipping over during removal.

13. Discard the "O" rings (3) (Fig. 6).

14. Remove the tool and the handling bar.

15. Position the unit vertically.

16. Separate the Power Shuttle reverse clutch from the input unit (see chapter 5).

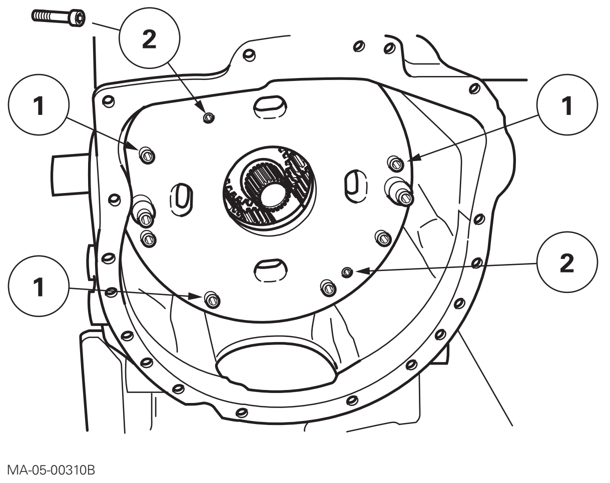

Fig. 5

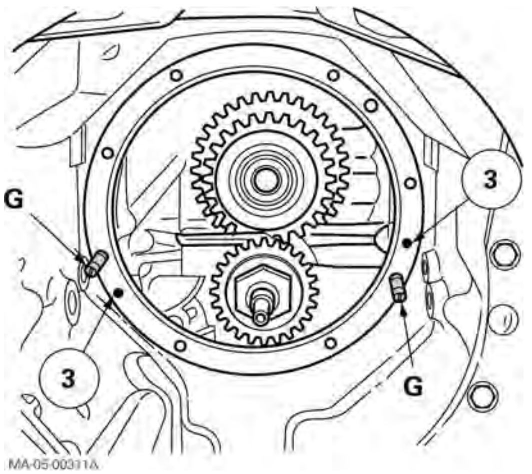

Fig. 6

D . Refitting

17. Refit the previously removed reverse clutch (see chapter 5).

18. On the input unit, check that the cup (64) (Fig. 7) is fitted.

19. On the gearbox housing (Fig. 6) place:

- the new "O" rings (3),
- two guide studs "G" approximately 200 mm in length (optional).

***NOTE:** On the Power Shuttle version, there is no dowel between the gearbox housing and the input unit.*

20. Using the tools used for removal and with the help of an assistant, fit the unit in the gearbox housing, taking the same safety steps as those used during removal.

21. Slide the unit on the guide studs (if fitted) until it is in contact with the housing.

If it is difficult to fit the input unit home, proceed as follows:

- Remove the clutch control unit and the selector cover plate.
- Check that the bearing cone for the gearbox intermediate shaft engages correctly in the cup (64) (see chapter 5). If not, raise the shaft slightly.

22. Replace the "O" rings (92) on the transfer pipe (88) (Fig. 2).

23. On the input unit, tighten screws (1) (Fig. 5) to a torque of 40 - 56 Nm.

24. Lightly smear the thread of the union (91) (Fig. 2) with Loctite 542 or equivalent. Refit the union to the gearbox housing.

25. Refit and adjust the potentiometer sensor (see § E).

26. Fit the PTO shaft in the gearbox, with the longest end "E" (Fig. 8) directed towards the Power Shuttle forward clutch.

27. Refit the forward clutch (see chapter 5).

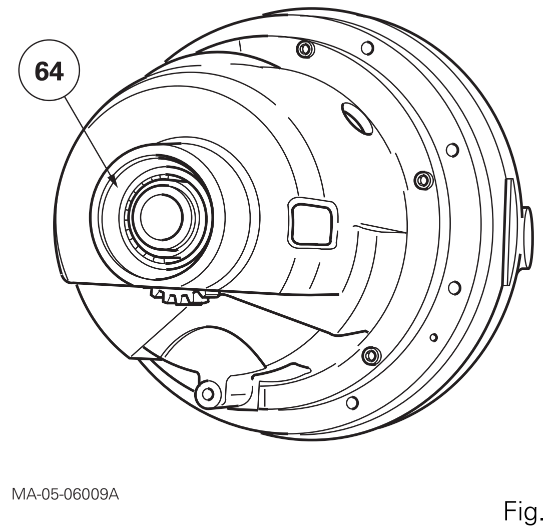

Fig. 7

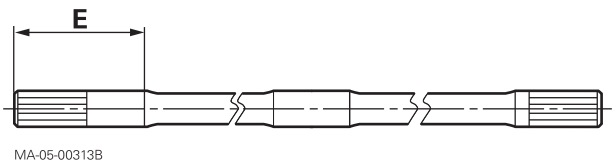

Fig. 8

E . Adjusting the potentiometer sensor

28. Smear the sensor thread with Loctite 5922 or equivalent.

Fit and adjust the sensor.

29. Screw the sensor (1) home (Fig. 9), without forcing it. Make sure that its end is in contact with the driving gear (2) (see chapter 5).

Unscrew the sensor 1/2 to 3/4 of a turn.

Tighten the nut to a torque of 5 - 7 Nm.

For operation, see chapter 11 - Electronics.

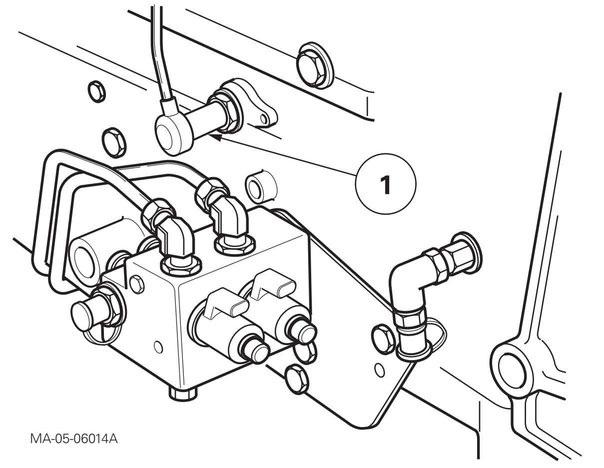

Fig. 9

F . Final steps

30. Refit the spacer (4) (see chapter 3).

31. If removed, fit the selector cover plate (see chapter 5).

32. If removed, install the Power Shuttle clutch control unit. Refit the lubrication pipes. Reconnect the connectors (see chapter 9).

33. Top up the oil level in the housings. Check it using the gauge at the rear of the centre housing.

34. Reconnect the tractor between the engine and the gearbox (see chapter 2).

35. Carry out a road test of the Power Shuttle and high and low Speedshift ranges.

36. Check the tightness of the mating faces of the selector cover plate (if necessary), the spacer (4) and the hydraulic unions.

G . Service tools

Tool available in the AGCO network

- **3378225M11:** - Sling for unit with Power Shuttle (Fig. 10)

Makeshift tool

- **Handling bar** (Fig. 11)

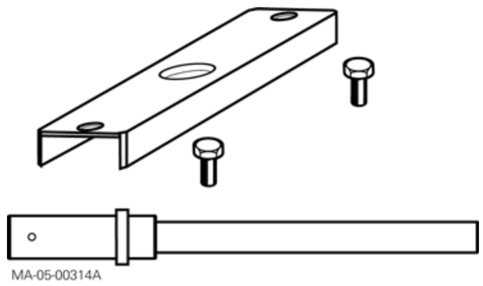

Fig. 10

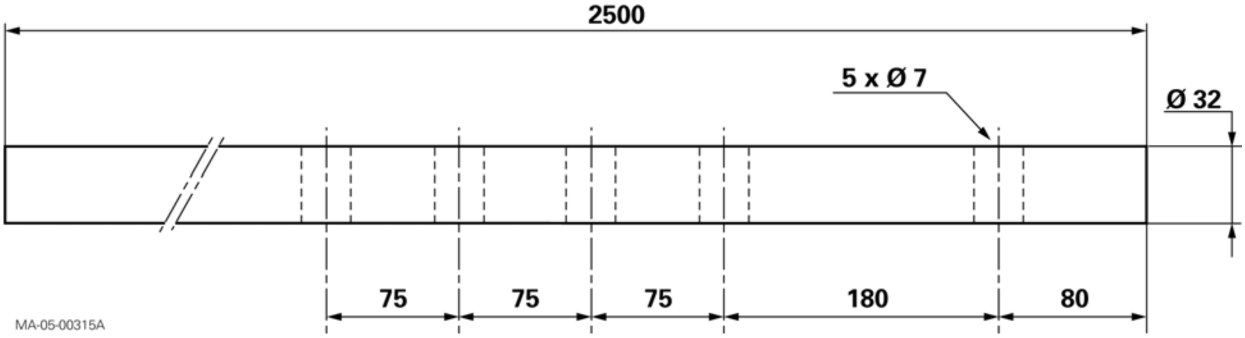

Fig. 11

5B12 - GBA20 - Power Shuttle - Shuttle

CONTENTS

A . General

The Power Shuttle consists of two electrohydraulically controlled clutches. It is designed to enable direction of travel reversal under load. It can be fitted to all 5400 tractors.

The Power Shuttle transmits the drive from the engine to the layshaft mounted on the front of the main gearbox by means of gears located respectively at the rear of the unit and at the gearbox input.

A lever located to the left under the steering wheel, controls the Power Shuttle.
Depending on the position selected by the operator (forward, neutral, reverse), the lever manages the proportional solenoid valves of the forward and reverse clutches by means of the tractor electronic system.

The solenoid valves are located at the front and to the right of the gearbox on a clutch unit containing the Speedshift hydraulic control system.
A filter element (60 microns) located under the selector cover plate, upstream from the clutch unit, provides additional filtering of oil supplying the solenoid valves (clutches, Speedshift).

A potentiometer sensor screwed to the gearbox housing sends information on shaft rotational speed to the electronic system.

Shifting of any forward ratio to the corresponding reverse ratio, or vice versa, is easy without declutching or stopping the tractor. This "assisted" reversal enables gradual changing of the operating direction, even at high travel speeds without abrupt changes in speed. The clutches slow down tractor movement until the required speed is reached so that the direction of travel can be reversed.

The conventional hydraulically operated clutch pedal is replaced by an electrohydraulically operated manoeuvring pedal. This pedal modulates the pressure in the forward or reverse clutches through the tractor electronic system and thus facilitates precise movements such as implement hitching.

Construction

The forward and reverse clutches of the Power Shuttle are of different design.

Forward clutch

The forward clutch consists of:
- a conventional multidisc wet clutch consisting of a bell (33), the rear face of which is splined to assemble the input sun gear (53);
- an input shaft (19) crossing the spacer (4) which separates the engine flywheel from the transmission oil. The shaft is constantly meshed with the damper secured to the engine flywheel. It is splined so as to rotate with the clutch unit (18) which comprises the intermediate plates (30) and the discs (29) in which the piston (28) travels,
- a drive hub (27) comprising the discs (29), which is attached to the primary shaft (55). The forward clutch is centred in the cover plate (38) of the reverse clutch by the ball bearing (32).

Reverse clutch

The reverse clutch consists of:
- an epicyclic gear train consisting of three double planet gears (52) and three single planet gears (59),
- a hydraulic braking device for the planet carrier (49),
- a cover plate (38) supporting the forward clutch and with an inner face machined for fitting hydraulic components.

The double and single planet gears (52) (59) of the epicyclic gear train mesh respectively on the input and output sun gears (53) (58). The pins (50) are idle-mounted and held in the planet carrier by plates (63). A central drilled channel and radial ports supply lubrication to the needle roller bearings (60).

The planet carrier braking device consists of an annular piston (39) and a plate (43) that is loaded by springs (62) and discs (47) splined to the planet carrier.

The intermediate plates (46) are immobilised by the pins (71).

Fixed unit

The fixed unit (1) has two functions:

- it receives the low pressure supplying the forward clutch via the pipe (74),
- it acts as a housing for the clutch lubrication and cooling pump.

The pipes (31) connecting the unit (1) and the cover plate (38) lubricate the reverse clutch braking device.

The shims (3) fitted between the closing spacer (4) and the fixed unit (1) provide axial clearance for the forward clutch.

Drive transmission

Drive from the Power Shuttle is transmitted to a mechanical component located in the rear compartment of the input box.

This component comprises a secondary shaft (1) attached to the gear (2) by splines (Fig. 1).

The shaft is fitted on two tapered roller bearings "R", and is supported by two bearings of the input unit.

The shims (3) (Fig. 1) fitted between the cover plate and the unit are used to preload the bearings.

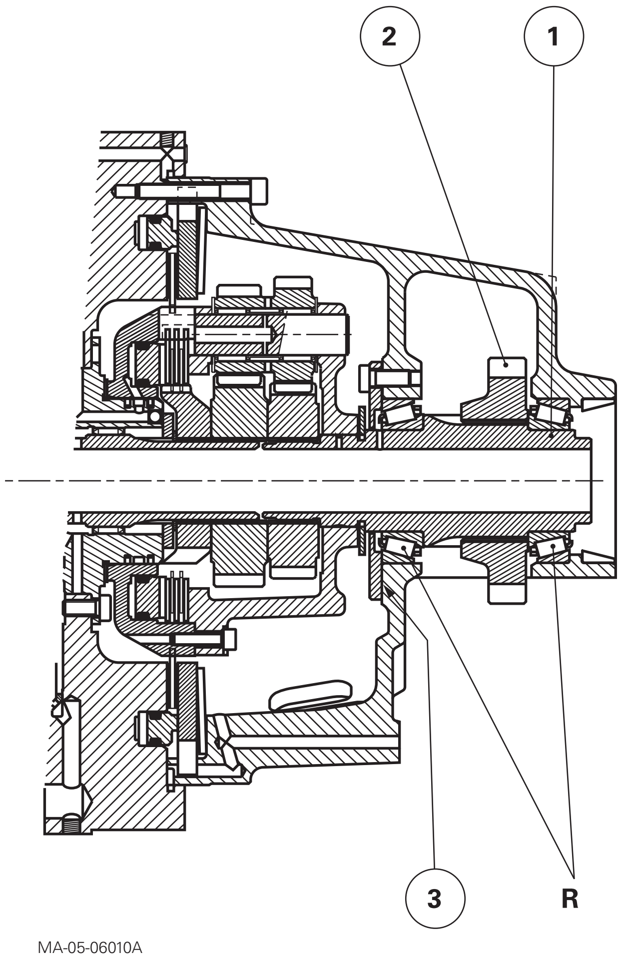

Fig. 1

Operating principle

Forward clutch

When the lever under the steering wheel is in the Forward position, the relevant solenoid valve is activated and supplies a pressure that moves the piston (28). This, in turn, compresses the intermediate plates (30) and the discs (29) against the bell (33).

The movement from the engine to the gearbox complies with the following drive train:

- input shaft (19) splined to unit (18),
- unit (18);
- intermediate plates (30);
- discs (29) compressed by the piston (28);
- hub (27),
- primary shaft (55),
- main gearbox layshaft via the input gear.

Simultaneously, the pressure applied behind the piston (39) of the braking device drops and the planet carrier assembly (discs (47), intermediate plates (46) and epicyclic gear train) rotate freely.

Lubrication

During forward operation, the oil flow from the centre housing via the pump (14) is directed towards the intermediate plates (30) and the discs (29) via the ports of the forward clutch unit (18) opened by movement of the piston (28).

At the same time, lubrication of the braking device of the planet carrier (discs (47) and intermediate plates (46)) of the reverse clutch is interrupted.

Reverse clutch

When the previously mentioned lever is moved from the Forward to Reverse position, the solenoid valve concerned is activated and supplies the piston (39) of the braking device of the planet carrier. The piston then presses on plate (43) which compresses discs (47) and the intermediate plates (46) against the front cover plate of the input unit and stops the rotation of the planet carrier assembly. The drive from the engine is directly transmitted to the bell (33) splined to the input sun gear (53), without passing through the discs and intermediate plates of the forward clutch.

Simultaneously, the oil pressure in the chamber of the piston (28) drops and frees the discs (29) and intermediate plates (30).

The input sun gear (53) then drives the double planet gears (52) freely mounted on the pins (50) which, in turn, drive the single planet gears (59) thus reversing the rotation of the output sun gear (58) splined to the primary shaft (55). The primary shaft then transmits the drive from the engine to the main gearbox layshaft via the input gear.

Note: *A valve screwed to the top section of the cover plate (38) creates a small permanent bleed starting from 13 bar to provide an automatic bleed of the piston supply system (39).*

Lubrication

As the piston (39) moves, it operates spools (44) that act as valves and compress springs (45) via the plate (43). The spools have a drilled centre channel and radial ports, allowing oil to flow to the channels in the cover plate (38) and the channels in the front cover plate of the input unit, thus lubricating the discs (47) and the intermediate plates (46). Lubrication of the mechanical components of the epicyclic gear train is via the lubricating system of the input unit.

At the same time, the lubricating oil flow to the discs (29) and intermediate plates (30) of the forward clutch is interrupted, thus preventing any possible drive to the discs due to a "drag" effect.

Neutral position

In neutral position, the supply to the solenoid valves is cut, placing the forward and reverse clutches at rest and eliminating transmission of the engine drive to the gearbox.

The lubrication flow is also interrupted. The pressure inside the system opens the valve (1) (Fig. 18) and directs the oil to the housing.

Note: *After changing a solenoid valve or its coil, the Power Shuttle hydraulic unit, the unit or one of its components or the electronic controller, it is necessary to calibrate the clutches (see chapter 11).*

GBA20 - Power Shuttle - Shuttle

Parts list (Fig. 2, Fig. 3, Fig. 4)

(1) Pump unit
(2) Pump cover plate
(3) Shim(s)
(4) Spacer
(5) Locking ring
(6) Splined ring
(7) "O" ring
(8) Anti-extrusion rings
(9) Snap rings
(10) Seal
(11) Circlip
(12) Ball bearing
(13) Screw
(14) Lubricating pump
(15) Seal rings
(16) Ring
(17) Centring pin
(18) Forward clutch unit
(19) Input shaft
(20) Pin
(21) Circlip
(22) Ball bearing
(23) Snap ring
(24) Seal
(25) Belleville washers
(26) Index holes
(27) Drive hub
(28) Forward clutch piston
(29) Forward clutch discs
(30) Forward clutch intermediate plates
(31) Lubrication pipe
(32) Ball bearing
(33) Forward clutch bell
(34) Planet carrier cover plate
(35) Rivets
(36) Seal
(37) Cover plate
(38) Reverse clutch cover plate
(39) Reverse clutch piston
(40) Rivets
(41) Seal
(42) Seal
(43) Plate
(44) Spools
(45) Springs
(46) Reverse clutch intermediate plates
(47) Reverse clutch discs
(48) Ring restrictor
(49) Planet carrier
(50) Planet gear pins
(51) Spacers
(52) Double planet gears
(53) Input sun gear
(54) Snap ring
(55) Primary shaft
(56) Snap ring
(57) Ball bearing
(58) Output sun gear
(59) Single planet gears
(60) Needle roller bearings
(61) Snap rings
(62) Springs
(63) Stop plates
(64) Screw
(65) Snap ring
(66) Screw
(67) "O" ring
(68) Ball bearing
(69) Seal
(70) Screw
(71) Pins
(72) Union
(73) 1.5 bar valve
(74) Pipe
(75) "O" rings
(76) Pipe
(77) Screw
(78) Pipe
(79) Screw
(80) Flange
(81) Seal
(82) Strainer
(83) Cover plate
(84) Plug
(85) Seal
(86) Pipe
(87) Pipe
(88) Transfer pipe
(89) Seal (Loctite)
(90) Diagnostics connector (lubrication)
(91) Union
(92) "O" rings
(93) Union
(94) Pipe
(95) "O" rings
(96) Dust seal
(97) Screw
(98) Snap ring
(99) Screw
(100) Ring
(101) Elbow union

View of the assembly

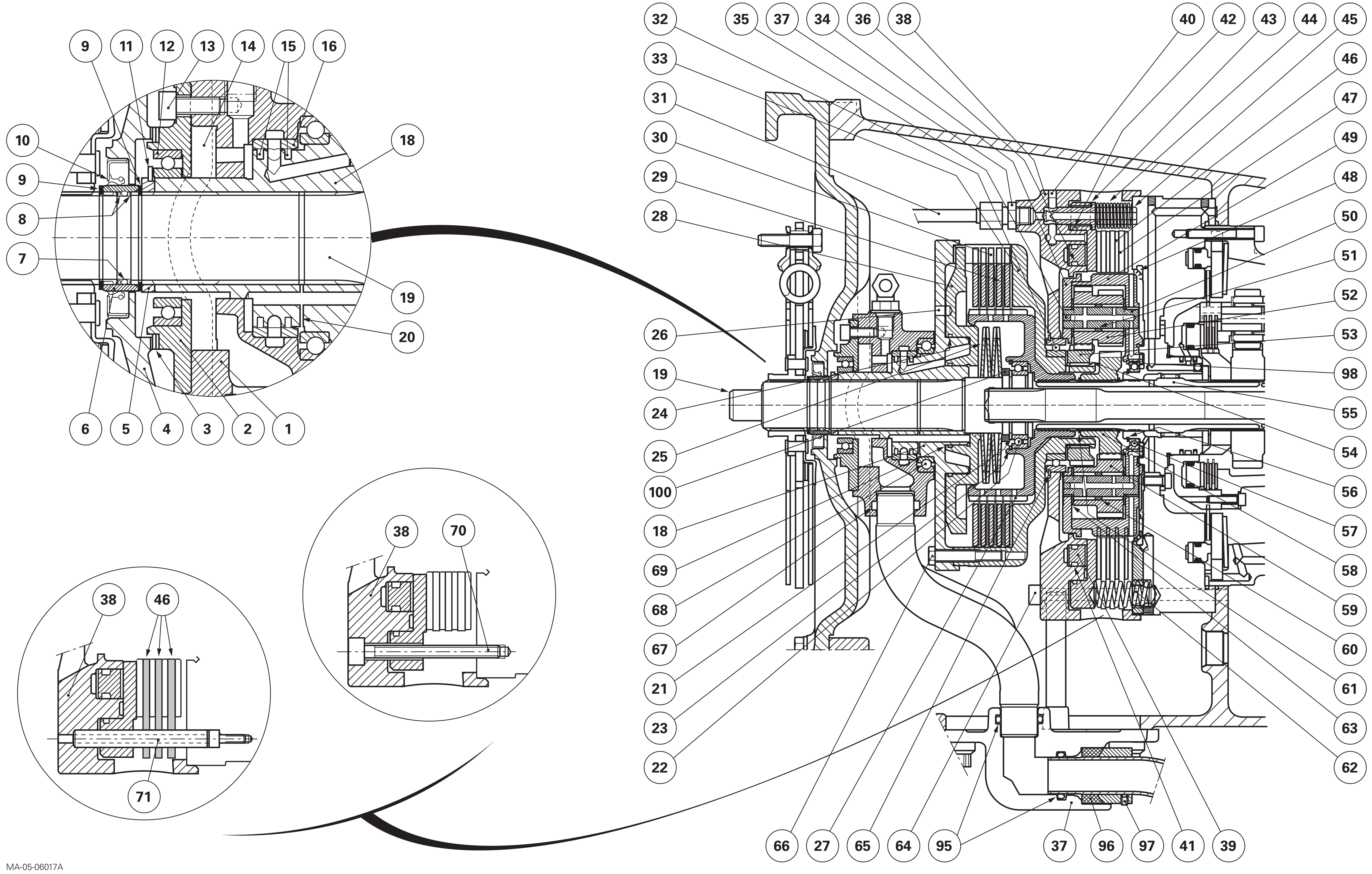

Fig. 2

Parts list (Fig. 2, Fig. 3, Fig. 4)

(1) Pump unit
(2) Pump cover plate
(3) Shim(s)
(4) Spacer
(5) Locking ring
(6) Splined ring
(7) "O" ring
(8) Anti-extrusion rings
(9) Snap rings
(10) Seal
(11) Circlip
(12) Ball bearing
(13) Screw
(14) Lubricating pump
(15) Seal rings
(16) Ring
(17) Centring pin
(18) Forward clutch unit
(19) Input shaft
(20) Pin
(21) Circlip
(22) Ball bearing
(23) Snap ring
(24) Seal
(25) Belleville washers
(26) Index holes
(27) Drive hub
(28) Forward clutch piston
(29) Forward clutch discs
(30) Forward clutch intermediate plates
(31) Lubrication pipe
(32) Ball bearing
(33) Forward clutch bell
(34) Planet carrier cover plate
(35) Rivets
(36) Seal
(37) Cover plate
(38) Reverse clutch cover plate
(39) Reverse clutch piston
(40) Rivets
(41) Seal
(42) Seal
(43) Plate
(44) Spools
(45) Springs
(46) Reverse clutch intermediate plates
(47) Reverse clutch discs
(48) Ring restrictor
(49) Planet carrier
(50) Planet gear pins
(51) Spacers
(52) Double planet gears
(53) Input sun gear
(54) Snap ring
(55) Primary shaft
(56) Snap ring
(57) Ball bearing
(58) Output sun gear
(59) Single planet gears
(60) Needle roller bearings
(61) Snap rings
(62) Springs
(63) Stop plates
(64) Screw
(65) Snap ring
(66) Screw
(67) "O" ring
(68) Ball bearing
(69) Seal
(70) Screw
(71) Pins
(72) Union
(73) 1.5 bar valve
(74) Pipe
(75) "O" rings
(76) Pipe
(77) Screw
(78) Pipe
(79) Screw
(80) Flange
(81) Seal
(82) Strainer
(83) Cover plate
(84) Plug
(85) Seal
(86) Pipe
(87) Pipe
(88) Transfer pipe
(89) Seal (Loctite)
(90) Diagnostics connector (lubrication)
(91) Union
(92) "O" rings
(93) Union
(94) Pipe
(95) "O" rings
(96) Dust seal
(97) Screw
(98) Snap ring
(99) Screw
(100) Ring
(101) Elbow union

View of the assembly

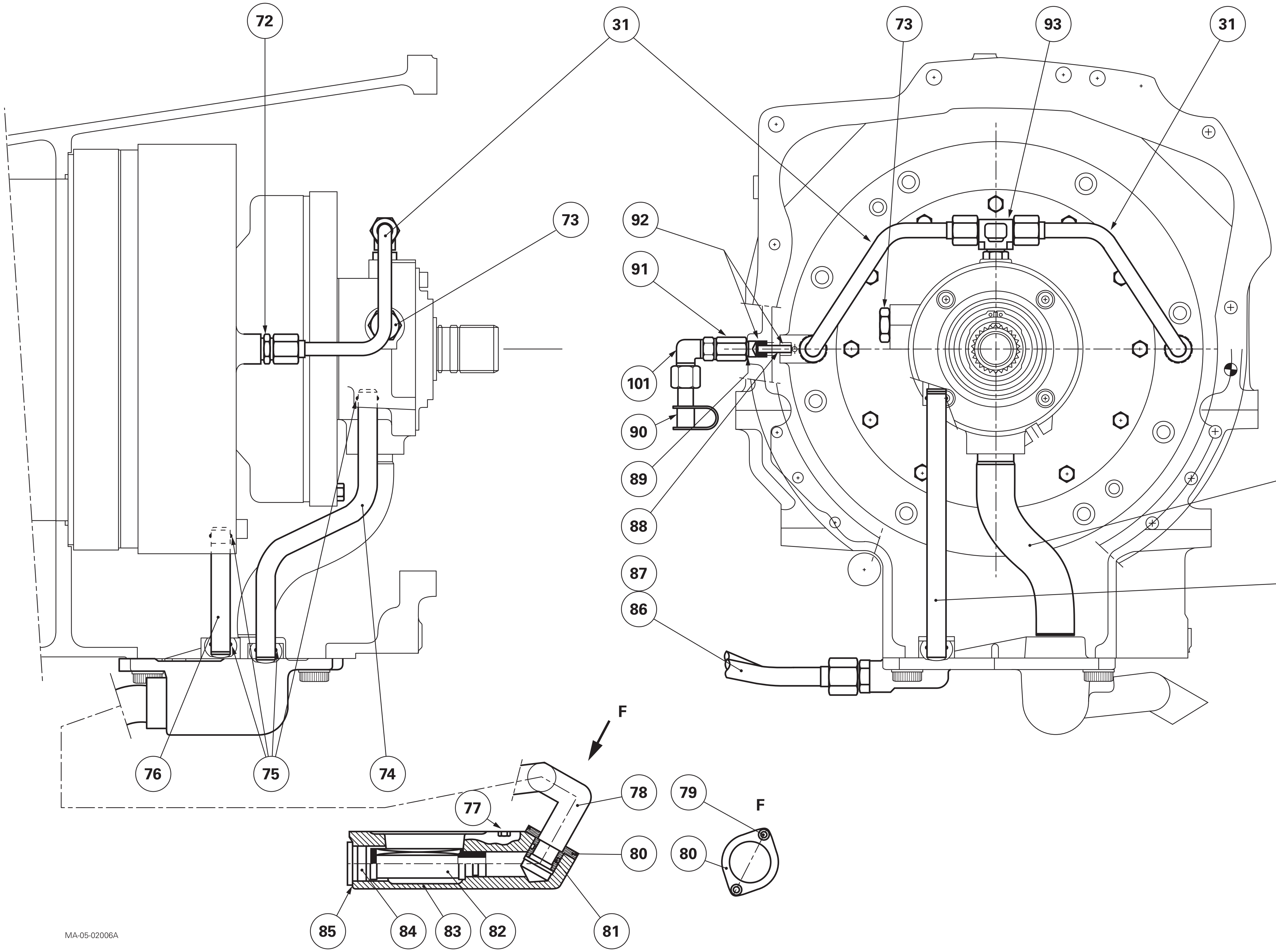

Fig. 3

Parts list (Fig. 2, Fig. 3, Fig. 4)

(1) Pump unit
(2) Pump cover plate
(3) Shim(s)
(4) Spacer
(5) Locking ring
(6) Splined ring
(7) "O" ring
(8) Anti-extrusion rings
(9) Snap rings
(10) Seal
(11) Circlip
(12) Ball bearing
(13) Screw
(14) Lubricating pump
(15) Seal rings
(16) Ring
(17) Centring pin
(18) Forward clutch unit
(19) Input shaft
(20) Pin
(21) Circlip
(22) Ball bearing
(23) Snap ring
(24) Seal
(25) Belleville washers
(26) Index holes
(27) Drive hub
(28) Forward clutch piston
(29) Forward clutch discs
(30) Forward clutch intermediate plates
(31) Lubrication pipe
(32) Ball bearing
(33) Forward clutch bell
(34) Planet carrier cover plate
(35) Rivets
(36) Seal
(37) Cover plate
(38) Reverse clutch cover plate
(39) Reverse clutch piston
(40) Rivets
(41) Seal
(42) Seal
(43) Plate
(44) Spools
(45) Springs
(46) Reverse clutch intermediate plates
(47) Reverse clutch discs
(48) Ring restrictor
(49) Planet carrier
(50) Planet gear pins
(51) Spacers
(52) Double planet gears
(53) Input sun gear
(54) Snap ring
(55) Primary shaft
(56) Snap ring
(57) Ball bearing
(58) Output sun gear
(59) Single planet gears
(60) Needle roller bearings
(61) Snap rings
(62) Springs
(63) Stop plates
(64) Screw
(65) Snap ring
(66) Screw
(67) "O" ring
(68) Ball bearing
(69) Seal
(70) Screw
(71) Pins
(72) Union
(73) 1.5 bar valve
(74) Pipe
(75) "O" rings
(76) Pipe
(77) Screw
(78) Pipe
(79) Screw
(80) Flange
(81) Seal
(82) Strainer
(83) Cover plate
(84) Plug
(85) Seal
(86) Pipe
(87) Pipe
(88) Transfer pipe
(89) Seal (Loctite)
(90) Diagnostics connector (lubrication)
(91) Union
(92) "O" rings
(93) Union
(94) Pipe
(95) "O" rings
(96) Dust seal
(97) Screw
(98) Snap ring
(99) Screw
(100) Ring
(101) Elbow union

Blown-up view

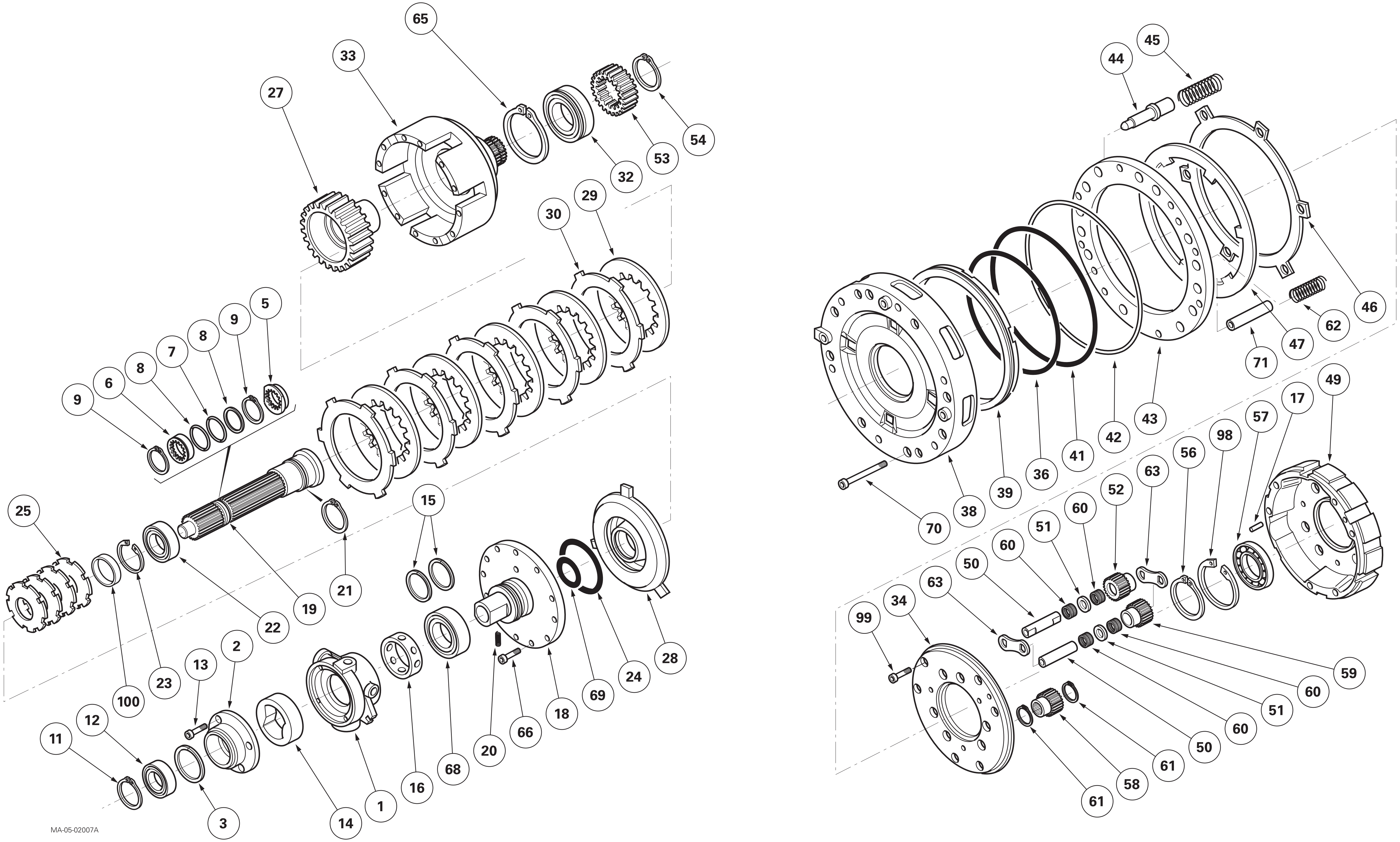

Fig. 4

B . Removing and refitting the forward clutch

Preliminary steps

1. Disconnect the tractor between the engine and the gearbox (see chapter 2).
2. Drain the gearbox and the centre housing.
3. Remove the spacer (4) from the gearbox (see chapter 3).
4. Remove the pipes (86) and (87).
Detach and remove the cover plates (37) and (83), the flange (80) and the pipe (78) (Fig. 3).
5. Remove the pipes (31) (74) (76) (94) (Fig. 3).

Removal

6. Remove the forward clutch (2) (Fig. 5) and release it from the housing using a makeshift tool (see § G).

Refitting

7. Clean the components. Replace those that are defective.
NOTE: *If forward clutch shimming is necessary, refer to § D.*
8. Check that the PTO shaft (1) is installed (Fig. 5).
9. Refit the clutch using the tool used for removal.

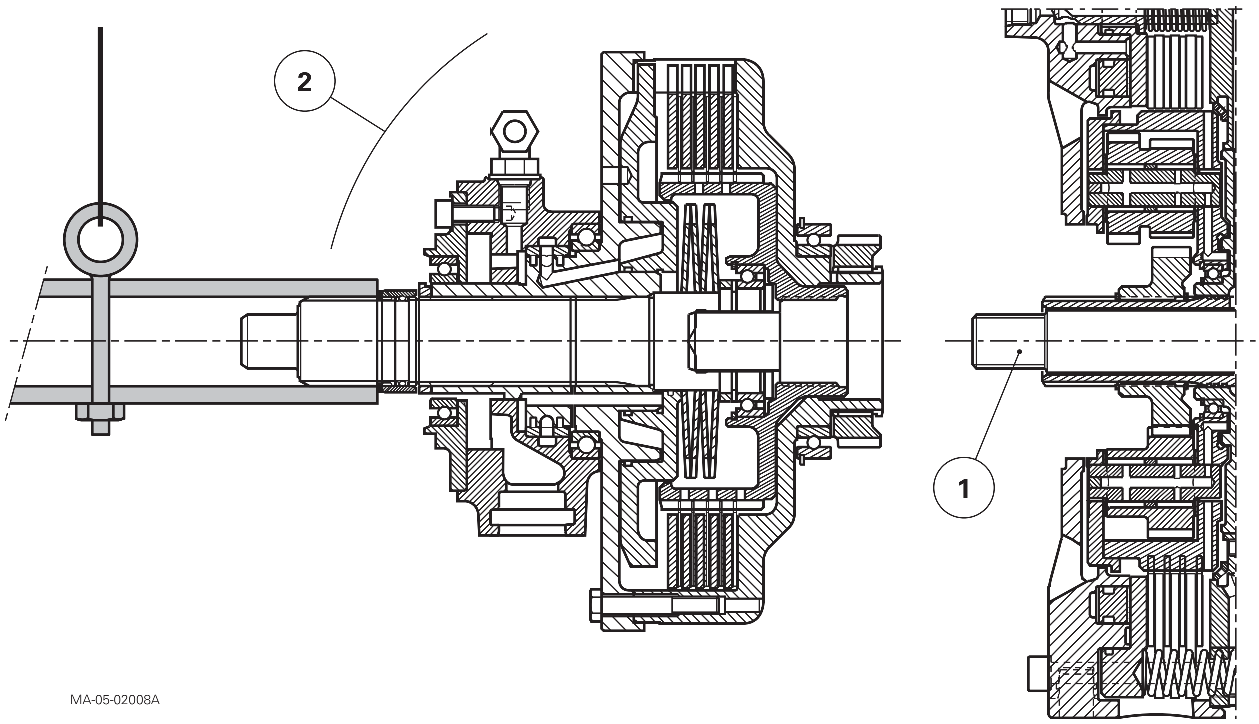

Fig. 5

Final steps

10. Replace the seals (67) and (75).
11. Refit the pipes (31) (74) (76) (94).
12. Replace the "O" rings (95).
13. Clean the mating faces on the gearbox housing and the cover plate (37). Smear the mating face of the housing with Loctite 510 or equivalent.
14. Replace the dust seal (96) and the "O" ring (81).
15. Refit the pipe (78), the flange (80) and the cover plates (37) and (83) smeared first with Loctite 510 or equivalent. Tighten the screws to a torque of 84 - 110 Nm.
16. Tighten screw (97) moderately and screws (79) to a torque of 44 - 53 Nm.
17. Reconnect the pipes (86) (87).
18. Refit the gearbox spacer (4) (see chapter 3).
19. Top up the oil level in the housings. Check it using the gauge at the rear of the centre housing.
20. Reconnect the tractor between the engine and the gearbox (see chapter 2).
21. Carry out a road test of the Power Shuttle and high and low Speedshift ranges.
22. Check the tightness of the mating faces on the spacer (4), the cover plates (37) and (83) and the hydraulic unions.

C . Disassembling and reassembling the forward clutch

Disassembly

23. Separate the bell (33) from the unit (18). Remove the discs (29) and the intermediate plates (30).
24. Remove the front snap ring (9). Remove the splined ring (6), the anti-extrusion rings (8) and seal (7).
25. Remove the circlip (11). Remove the cover plate (2) from the pump (14) complete with bearing (12).
26. Take the lubrication pump out of the fixed unit (1) and separate it from the clutch unit (18).
27. Remove the rings (15). If necessary, extract ring (16) and remove the 1.5 bar valve (73).
28. Place the partially disassembled clutch on a suitable makeshift fixture (Fig. 6 and § G).
29. Compress the Belleville washers (25) and remove the rear snap ring (9) (Fig. 6).
30. Remove locking ring (5). Gradually de-compress the Belleville washers.
31. Separate the clutch housing (18) fitted with the piston (28) from the shaft (19).
32. Remove the Belleville washers and the ring (100).
33. Remove the snap ring (23). Take out the shaft (19) complete with bearing (22) from the hub (27).
34. Remove the circlip (21). Extract the bearing (22) from the shaft (19).
35. Remove the piston.

Remove the seals (24) (69). Discard them.

If necessary, extract the bearing (68) from the unit (1) of the pump (14).

36. If necessary, remove snap ring (54) and remove the input sun gear (53). Remove the snap ring (65). Extract the bearing (32).

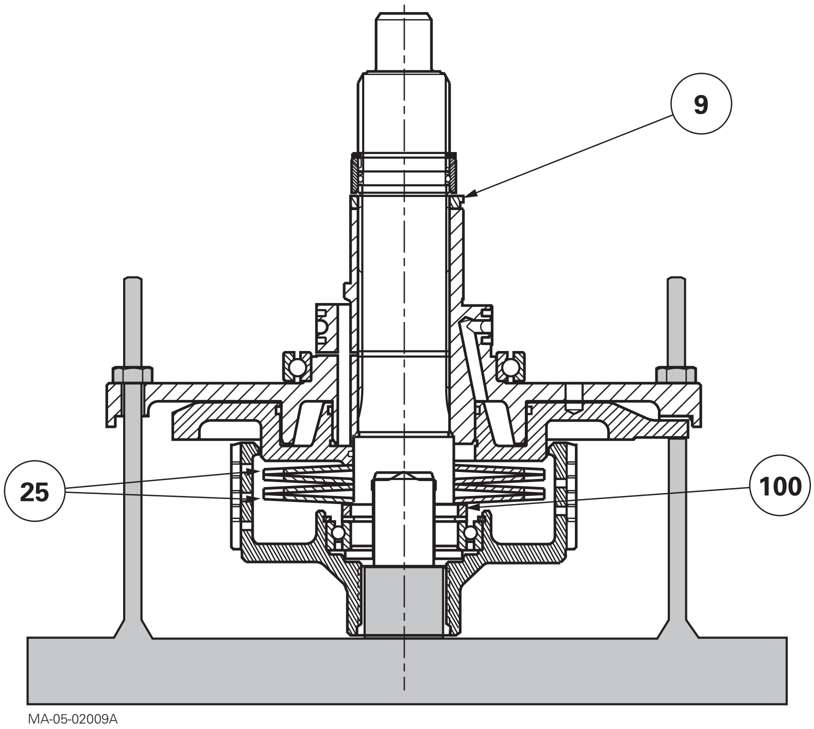

Fig. 6

Reassembly

37. Make sure that the pin (20) is fitted.

38. If removed, fit the bearing (32) on the bell (33), using a press and a suitable fixture. Fit the snap ring (65).

39. If removed, fit the bearing (68).

40. Lubricate the new seals (24) (69) and fit them on the piston.

41. Fit the piston (28), using a pin of suitable diameter to align the index holes bored in the unit (18) and piston (Fig. 7).

Note: *The angular position of the piston depends on the position of the lubricating ports for the unit (18).*

Complete the installation of the piston by gradually and alternately striking its rim with a plastic hammer.

Check that there are no seal fragments after fitting.

42. Using a suitable fixture, force fit the bearing (22) on the shaft (19), with the sealed side directed towards the reverse clutch. Fit the circlip (21).

43. Fit the assembly (shaft, bearing, circlip) in the hub (27). Fit the snap ring (23).

44. Refit the ring (100) and the Belleville washers as shown in Fig. 8.

45. Assemble the unit (18) fitted with the piston (28) on the shaft (19).

46. Compress the Belleville washers using the same fixture as in step 28. Position the ring (5), aligning two of the flat sections with those of the unit (18). Replace the rear snap ring (9) and correctly position it in the bottom of the groove.

47. Remove the fixture.

48. Check that the rings (15) turn freely in their grooves. Position the rings, lightly smeared with miscible grease, making sure that they do not protrude beyond the rim of the unit (18).

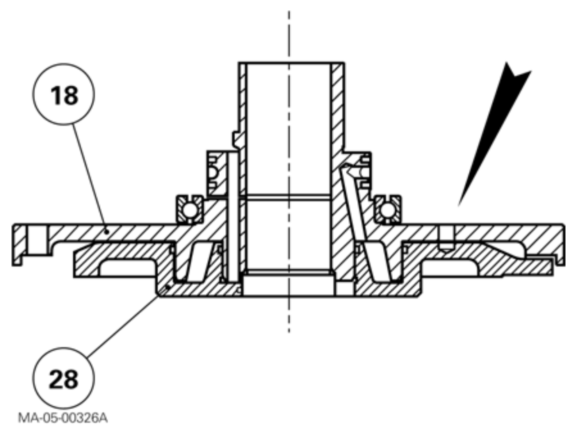

Fig. 7

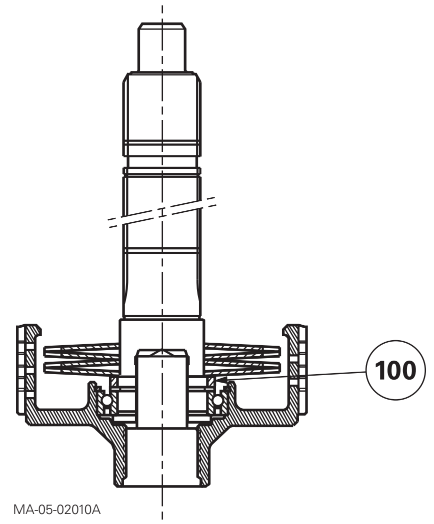

Fig. 8

49. If required, fit the 1.5 bar valve (73). Tighten to a torque of 47 - 54 Nm.

Insert ring (16) using a suitable fixture, with the chamfer "C" turned as shown in Fig. 9.

50. Lubricate the ring. Assemble fixed unit (1) on the unit (18).

51. Lubricate pump (14) with transmission oil and position it aligning the flat sections of the rotor with those on the unit (18).

52. Manually check the angular movement of the rotor on the flat sections of unit (18).

53. Fit the bearing (12) on the cover plate (2) of the pump. Fit the cover plate. Fit the circlip (11) and screws (13) and tighten to a torque of 25 - 35 Nm.

54. Lubricate and fit a new assembly ("O" ring (7) and anti-extrusion rings (8)). Slide on the splined ring (6). Fit a new front snap ring (9).

55. Soak the discs (29) in a transmission oil bath for approximately 1 hour. Check that they are correctly impregnated.

56. Position the intermediate plates (30), by aligning their lugs and the discs (29) on the hub (27) (see note and Fig. 10).

NOTE 1: *The number of discs and intermediate plates depends on the tractor type.*

Power output (HP)	No. of discs	No. of intermediate plates
65 to 105	4	5
110	5	6

NOTE 2: *The bell (33) differs according to the number of discs.*

57. Position the bell (33) onto the unit (18) with Loctite 549 or equivalent, with the lugs of the intermediate plates inserted in the slots of the bell.

Fit and tighten the screws (66) to a torque of 25.5 - 34.5 Nm.

58. Manually check the rotation of the hub (27).

59. If necessary, refit the input sun gear (53) and position the snap ring (54).

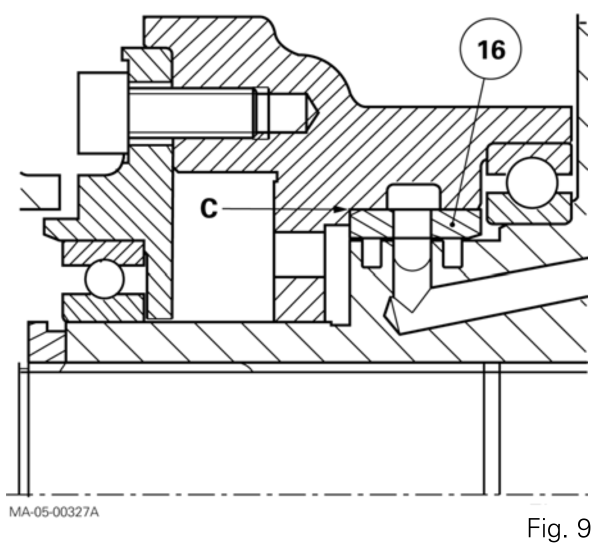

Fig. 9

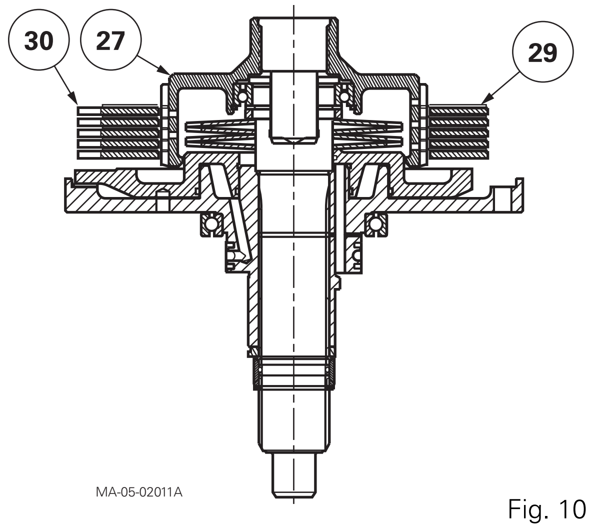

Fig. 10

D . Shimming the forward clutch

This operation involves obtaining an axial clearance J1 of 0.60 to 0.80 mm between the pump cover plate (2) and the spacer (4) (Fig. 11).

To carry out this operation, remove the PTO shaft.

60. Refit the clutch to the cover plate (38) of the reverse clutch, using the tool used in Fig. 5, § B.

61. Fit an approx. 2 mm thick shim (3) onto the cover plate (2) (Fig. 11).

62. Lubricate the lip of the seal (10). Protect the lip of the seal by fitting a guard (see chapter 3) on the splines of the shaft (19). Fit two guide studs on diametrically opposed sides of the gearbox housing and temporarily refit the spacer (4) without Loctite. Gradually tighten several screws.

63. Place a dial gauge at the end of the shaft (19) and check the clearance by moving the shaft sideways (Fig. 11).

IMPORTANT: *Check that the snap ring (65) for the bearing (32) is correctly in contact with the cover plate (38) (Fig. 11).*

64. Remove the spacer (4).

Depending on the reading previously obtained with the dial gauge, define a new thickness of shim(s) (3) in order to obtain a **J1 clearance between 0.60 and 0.80 mm** (Fig. 11).

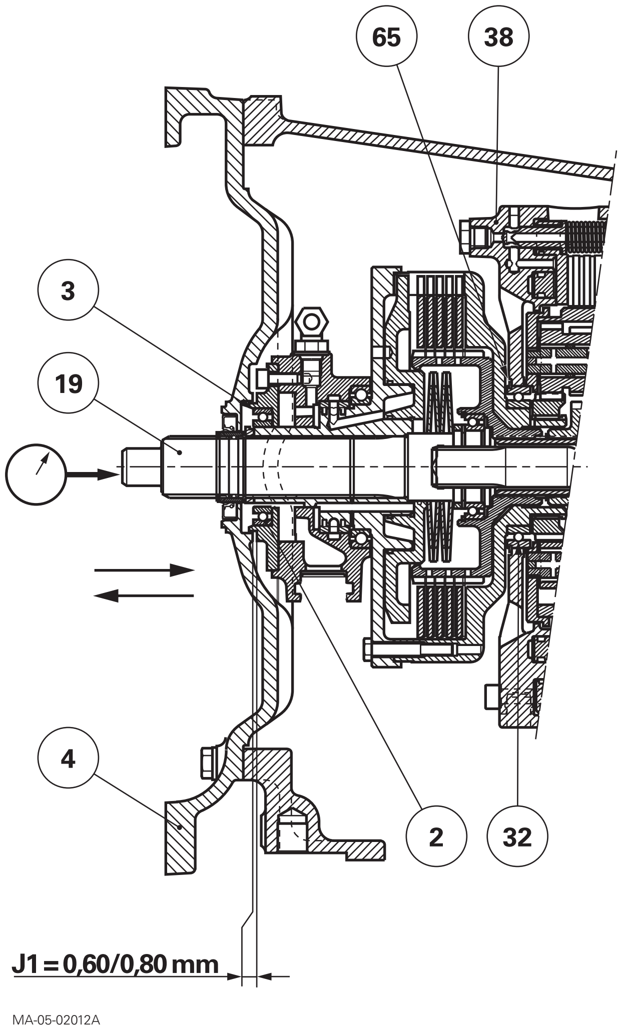

Fig. 11

E . Disassembling and reassembling the reverse clutch

Preliminary steps

65. Remove the forward clutch (see § B).

66. Remove the input unit (see chapter 5).

Disassembly (Fig. 12)

67. Remove the screws (70) and the cover plate (38).

68. Recover the spools (44) and the springs (45) (Fig. 12).

69. Remove the large springs (62) and the pins (71).

70. On the cover plate (38), remove:

- the plate (43),
- the seal (42) and discard it,
- the piston (39),
- the seals (36) (41) and discard them,
- the unions (72), the valve (1) (Fig. 18) and the seal (75) from the 17 bar supply port (Fig. 3).

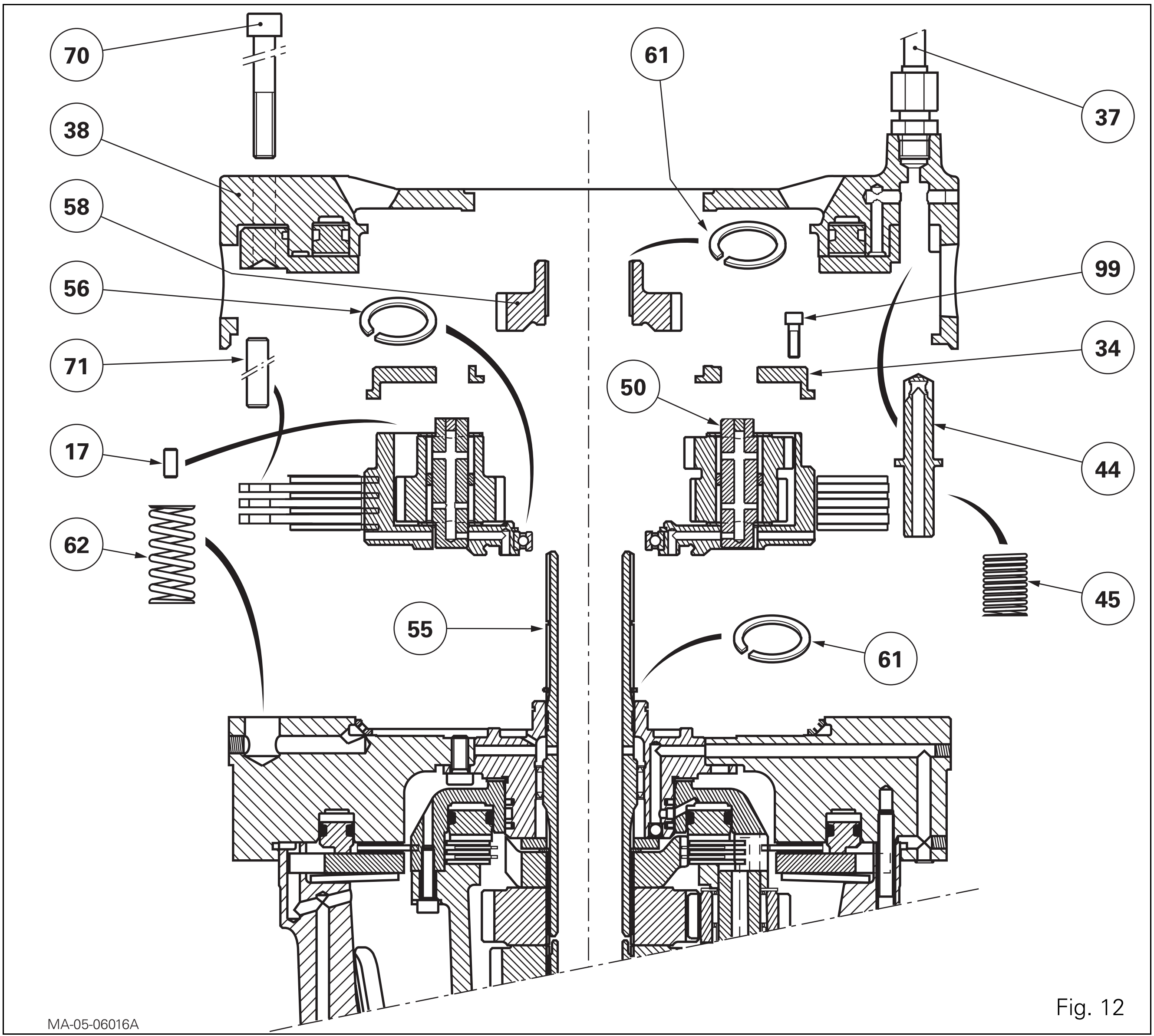

Fig. 12

71. Immobilise the planet carrier (49) using the immobilising tool, ref. 3378240M1 (see Fig. 13 and § G).

72. Remove the screws (99) from the cover plate (34) (Fig. 12 and Fig. 13) and remove the cover plate.

73. Remove the discs (47) and the intermediate plates (46).

74. Separate the output sun gear (58), held by the snap rings (61), from the primary shaft (55) (Fig. 12).

75. Remove the snap ring (56) (Fig. 12).

76. Remove the planet carrier (49) with the double and single planet gears (52) (59).

77. On the planet carrier (49), remove:

- the plates (63),
- the pins (50) and double planet gears (52) assembly Mark their position,
- the pins (50) and single planet gears (59) assembly Mark their position,
- the snap ring (98) and the bearing (57).

NOTE: *The rotation of the planet gears around the pins (50) is on two rows of needle rollers (60), joined and separated by a spacer (51).*

IMPORTANT: *When the planet gears and pins have been removed, check that no needle roller or spacer remains in the planet carrier.*

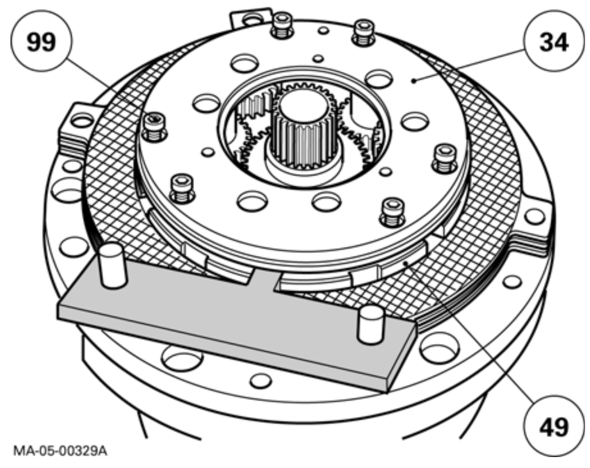

Fig. 13

Reassembly

78. Clean and check all components. Replace those that are defective.

79. Check that the ports in the planet gear pins and the channels in the planet carrier are not blocked.

80. Where necessary, fit the planet gears with two rows of needle rollers smeared with miscible grease and separated by a spacer.

81. On the planet carrier, refit:

- bearing (57) and position the snap ring (98),
- double and single planet gears (52) (59) positioned as shown in Fig. 14,
- the pins (50), with the lubricating ports fitted facing those in the planet carrier (49).

  Note: *Each end of the pins (50) has:*

  - *a port, one of which is closed off by a rivet (35) and the other is used to lubricate the planet gears;*
  - *a flat section and a shoulder preventing any pin rotation or any side movement.*

82. Refit the partially assembled planet carrier. Position the snap ring (56) and the rear snap ring (61).

83. Position marks "R" (punch marks) on the double planet gears (52) (Fig. 15) so that they pass through a centre line meeting at "O" (Fig. 15).

Important: *The mark on the front face of the planet gear corresponds to the alignment of two splines. It is* ***mandatory*** *to correctly position the punch marks before assembling the output sun gear (58).*

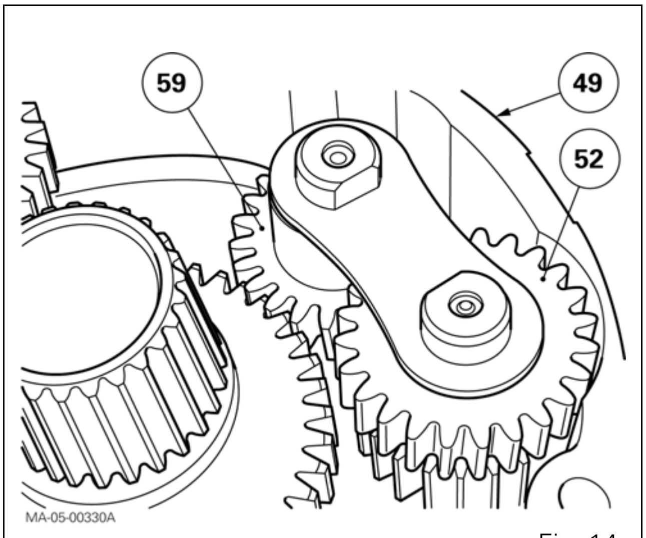

Fig. 14

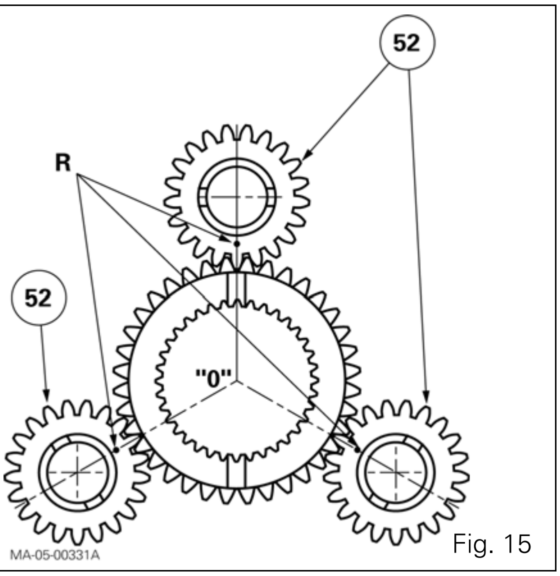

Fig. 15

84. Slide the output sun gear (58), correctly turned as shown in Fig. 2, on to the primary shaft (55), making sure that the punch marks for each planet gear remain in the required position.

85. Fit the front snap ring (61).

86. Soak the discs (47) in a transmission oil bath for approximately 1 hour. Check that they are correctly impregnated.

87. Fit the discs (47) and the intermediate plates (46) depending on the type of tractor (Fig. 16).

Power output (HP)	No. of discs	No. of intermediate plates
65 to 105	3	2
110	4	3

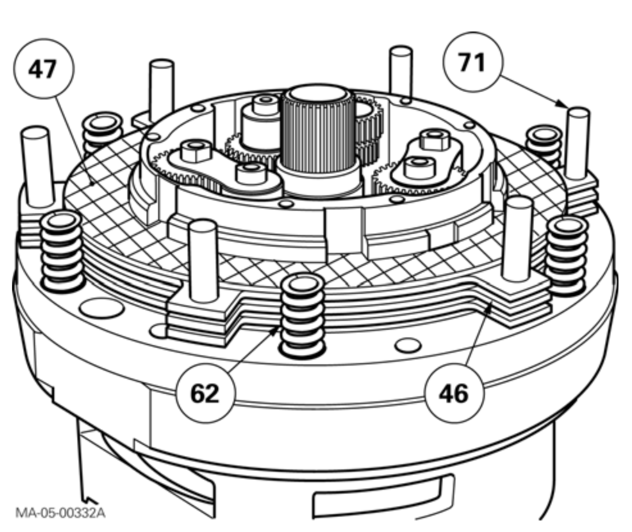

Fig. 16

88. Check that the centring pin (17) is present (Fig. 12).

89. Refit the cover plate (34). Check that it is correctly positioned on the planet gear pins (50) and in the centring pin (Fig. 12).

90. Immobilise the planet carrier, using the same method as used during disassembly.

91. Fit and tighten the screws (99) Fig. 12) to 36 - 46 Nm with its thread lightly smeared with Loctite 242 or equivalent.

92. On the cover plate (38), check for the presence of the rivets (40) at the end of the channels.

Refit:

- piston (39) with new lubricated seals (36) (41), gradually and alternately striking around the piston rim with a plastic hammer. Check that there are no seal fragments after fitting.
- plate (43) with a new lubricated seal (42), aligning the holes of the plate with those in the cover plate (38). Fit the plate using the same method as used for the piston (39).

  Note: *The thickness of the plate (43) differs according to the number of discs and intermediate plates.*

93. Refit the pins (71) and the springs (62) (Fig. 17) in their respective locations on the input unit.

94. Smear the spools (44) and the springs (45) with miscible grease. Fit and fix the spools in each compartment of the cover plate (38), with the tips facing towards the unions (72) (Fig. 2). Slide and fix a spring (45) on each spool.

95. On the external face of the cover plate (38), fit three sufficiently long and equally spaced studs in the holes provided for the screws (64).

96. Refit and position the cover plate, with the port of the valve (1) facing upwards (Fig. 18).

97. Before fitting the screws (70), it is **mandatory** to check that the spools (44) slide freely in each compartment of the front cover plate on the input unit. To do this, compress the springs (45), using a screwdriver passed through the tapped holes of the unions (72). If the springs cannot be compressed, investigate the cause.

98. Pre-tighten the screws (70).

99. During pre-tightening, check that the spools (44) still slide freely. Also check that each end of the (large) springs (62) is correctly housed in its respective seat.

100. Tighten screws (70) to a final torque of 36 - 46 Nm (Fig. 12).

After completing the tightening, check again that each spool can move freely and returns to its initial position.

IMPORTANT: *A spool valve that is blocked open can restrict or interrupt lubrication of the forward clutch during operation.*

101. It is **mandatory** to fit and tighten the valve (1) fitted with its seal to 6 - 8 Nm max. (Fig. 18). Screw in the unions (72).

102. Refit the input unit (see chapter 5) and the forward clutch (see § B).

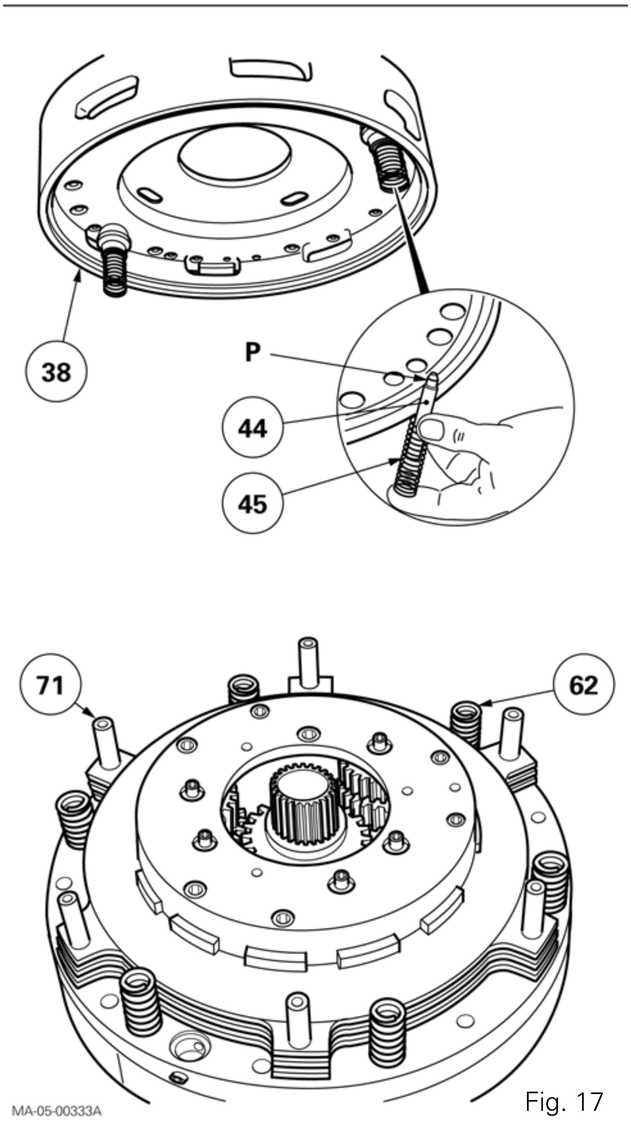

Fig. 17

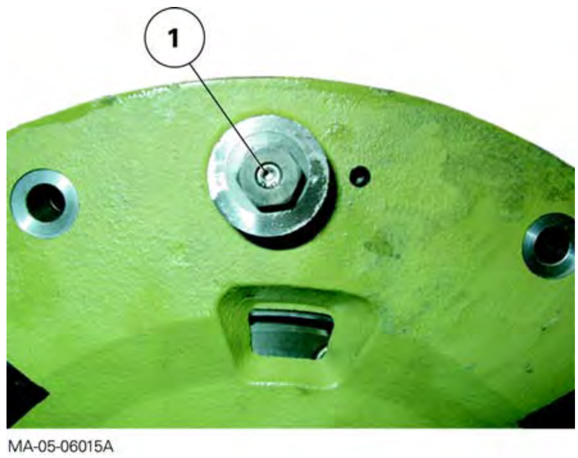

Fig. 18

F . Disassembling and reassembling the driving gear and shimming the shaft

Preliminary steps

103. Remove the forward clutch (see § B).

104. Remove the input unit (see chapter 5).

105. Remove the reverse clutch (see § E).

106. Remove the Speedshift unit (see chapter 5).

Disassembly (Fig. 19)

107. Remove the screws (5) and the stop plate (8).

108. Recover the shims (3) and the cup (4).

109. Take out the secondary shaft (1), fitted with the bearing cone (6) and the unit (7).

110. Note and mark the assembly order of the driving gear (2). Remove this gear.

111. Recover the bearing cone (9). Extract the cup (10).

Reassembly

112. Check that the ports for the secondary shaft (1) and the housing channels (7) are not blocked.

113. Clean and check all components. Replace those that are defective.

114. Lubricate the bearing cups and cones before assembling.

115. Fit the cup (10) in the housing. Fit the bearing cone (9) in this cup.

116. Position the gear (2), correctly turned in the housing (Fig. 19).

117. Fit the bearing cone (6) against the shoulder of the shaft (1). Slide the shaft in through the gear (2) and the bearing (9).

118. Position the cup (4).

Determine the thickness of shims (3) to obtain a temporary clearance of approx. 0.10 to 0.15 mm for final shimming with preload. Position the shims and the stop plate (8). Tighten the screws to a torque of 25-32 Nm.

119. Position the unit (7) in a vice.

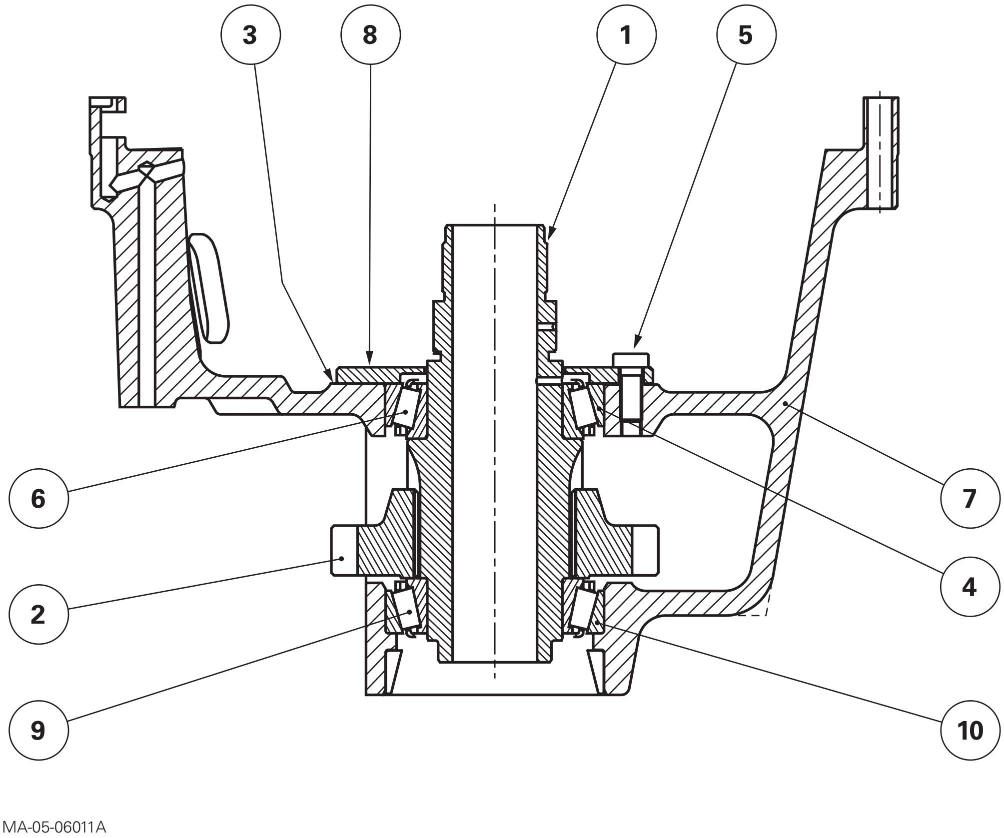

Fig. 19

Shimming the shaft (1) (Fig. 20)

120. Place the dial gauge feeler pin on the end of the shaft (Fig. 20).

121. Pull on the shaft, turning it alternately from right to left to correctly "seat" the cones in the bearing cups.

122. Set the dial gauge needle to zero.

123. Repeat step 121, this time pushing.

124. Depending on the clearance measured, select a new thickness of shims (3) to obtain a preload P1 so that: **P1 = 0.05 to 0.15 mm** (Fig. 20).

NOTE: *If possible, shim to the maximum tolerance.*

125. Remove the screws (5). Remove stop plate (8).

126. Position the final shims (3) selected during step 124 on the unit (7). Refit the plate (8). Fit and definitively tighten the screws (5) to a torque of 25 - 35 Nm, with their threads lightly greased with Loctite 242 or equivalent.

127. Manually check the rotation of the shaft (1).

Final steps

128. Refit the Speedshift unit (see chapter 5).

129. Refit the reverse clutch (see § E).

130. Refit the input unit (see chapter 5).

131. Refit the forward clutch (see § B).

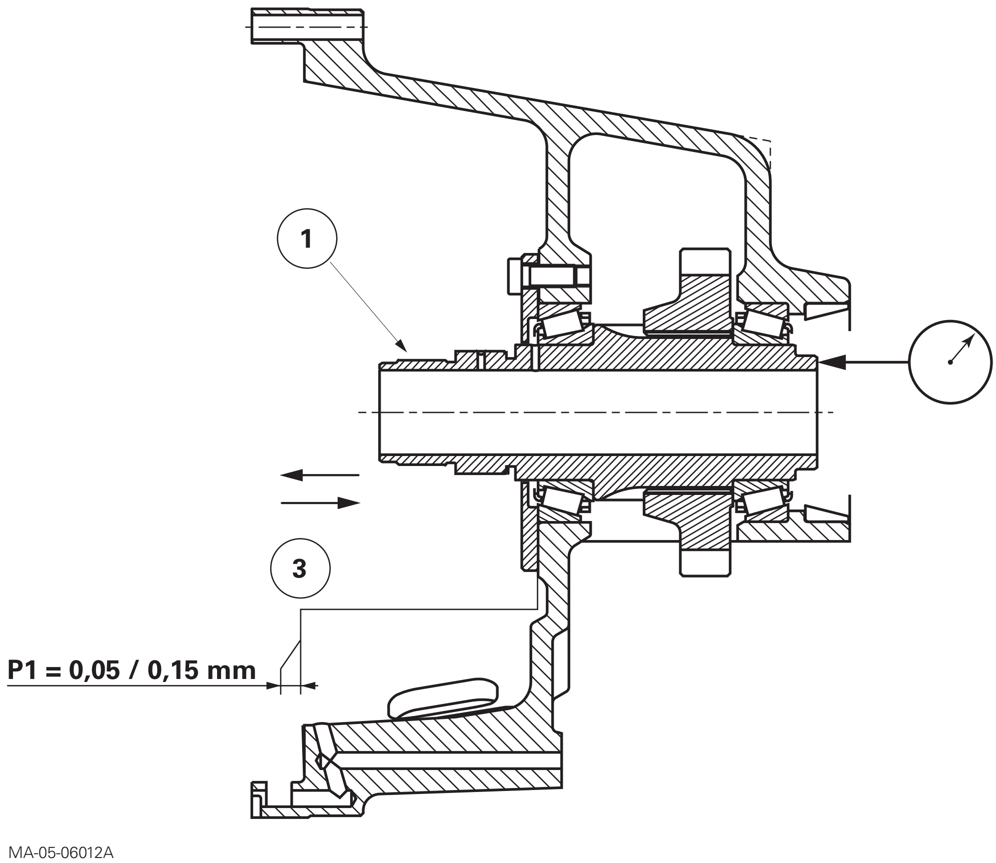

Fig. 20

G . Service tools

Tool available in the AGCO network

- **3378240 M1:** - Planet carrier immobilising tool (Fig. 21)

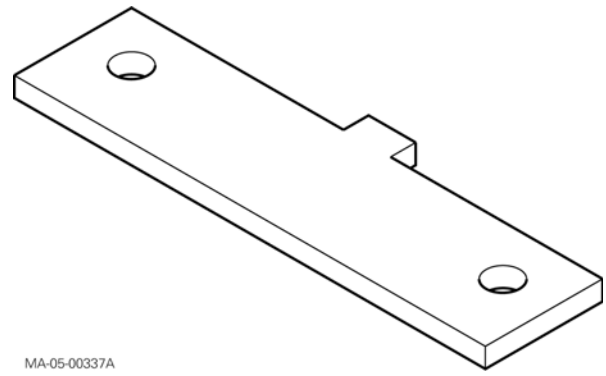

Fig. 21

Makeshift tools

- **Belleville washer compression tool** (Fig. 22)
  (1) Iron "U": 60
  (2) Threaded rod: Ø 8
  (3) Round iron to be machined to the following dimensions: Ø = 36, L = 60

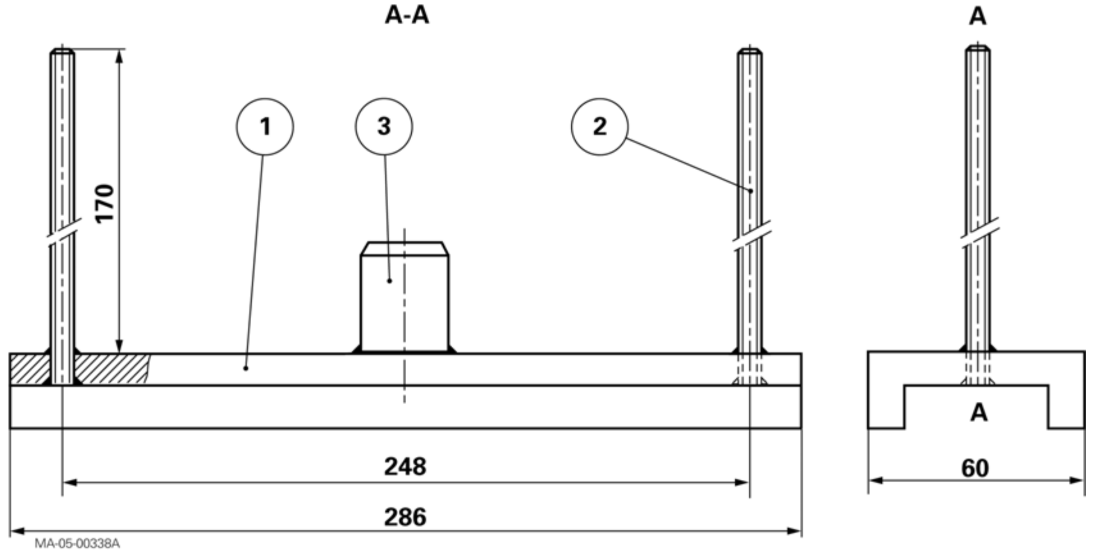

Fig. 22

- **Sleeve for removing/refitting the clutch assembly** (Fig. 23)
  (1) Tube: Tu52B ext. Ø 42.4 thickness 5
  (2) Tube: Tu52B ext. Ø 48.3 thickness 2.9

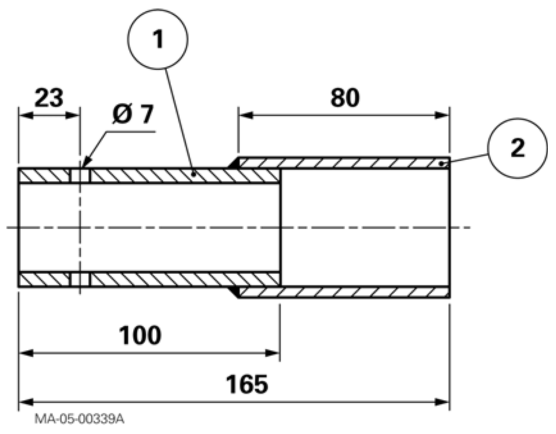

Fig. 23

5B13 - GBA20 - Power Shuttle - Speedshift

CONTENTS

A . General

The Speedshift unit is located between the Power Shuttle reverse clutch and the mechanical unit comprising the driving gear (see chapter 5).

This is a hydraulically controlled gear shift mechanism providing two input ratios to the gearbox. This function is provided by:

- a multidisc hydraulic clutch;
- an epicyclic gear train consisting of a planet carrier with three double planet gears, an input sun gear and an output sun gear;
- a planet carrier hydraulic braking system.

The design of the Speedshift allows ratio shifting while driving without declutching, even at full load.

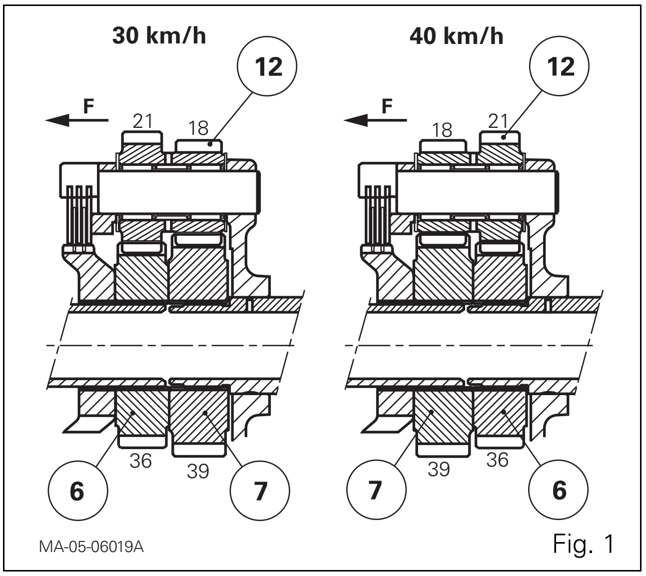

Fig. 1

Specific feature of the epicyclic gear train assembly

Legislation in force in certain countries limits forward speed to 30 kph. In this case, the sun gears (6) and (7) and planet gears (12) of the Speedshift epicyclic gear train should be positioned as in Fig. 1.

Parts list (Fig. 2 and Fig. 3)

(1) Seals
(2) Rivets
(3) Screw
(4) Ring
(5) Secondary shaft
(6) Input sun gear (30 kph)
Output sun gear (40 kph)
(7) Input sun gear (40 kph)
Output sun gear (30 kph)
(8) Planet gear pins
(9) Planet carrier unit
(10) Friction washer
(11) Rivet
(12) Double planet gears
(13) Housing
(14) Spacers
(15) Hub
(16) Needle roller bearing
(17) Friction washers
(18) Spring washer (Belleville)
(19) Ring restrictor
(20) Thrust plate
(21) Brake disc
(22) "O" ring
(23) "O" ring
(24) Screw
(25) Hydraulic cover plate
(26) "O" ring
(27) Front cover plate
(28) Clutch piston
(29) "O" ring
(30) Intermediate plates
(31) Rings
(32) Needle roller bearing
(33) Ring carrier
(34) Screw
(36) Primary shaft
(37) Circlip
(38) Tab washer
(39) Washer
(40) Ball bearing
(41) Screw
(42) Discs
(43) Spring washers
(48) Brake piston
(50) Planet carrier assembly

View of the assembly

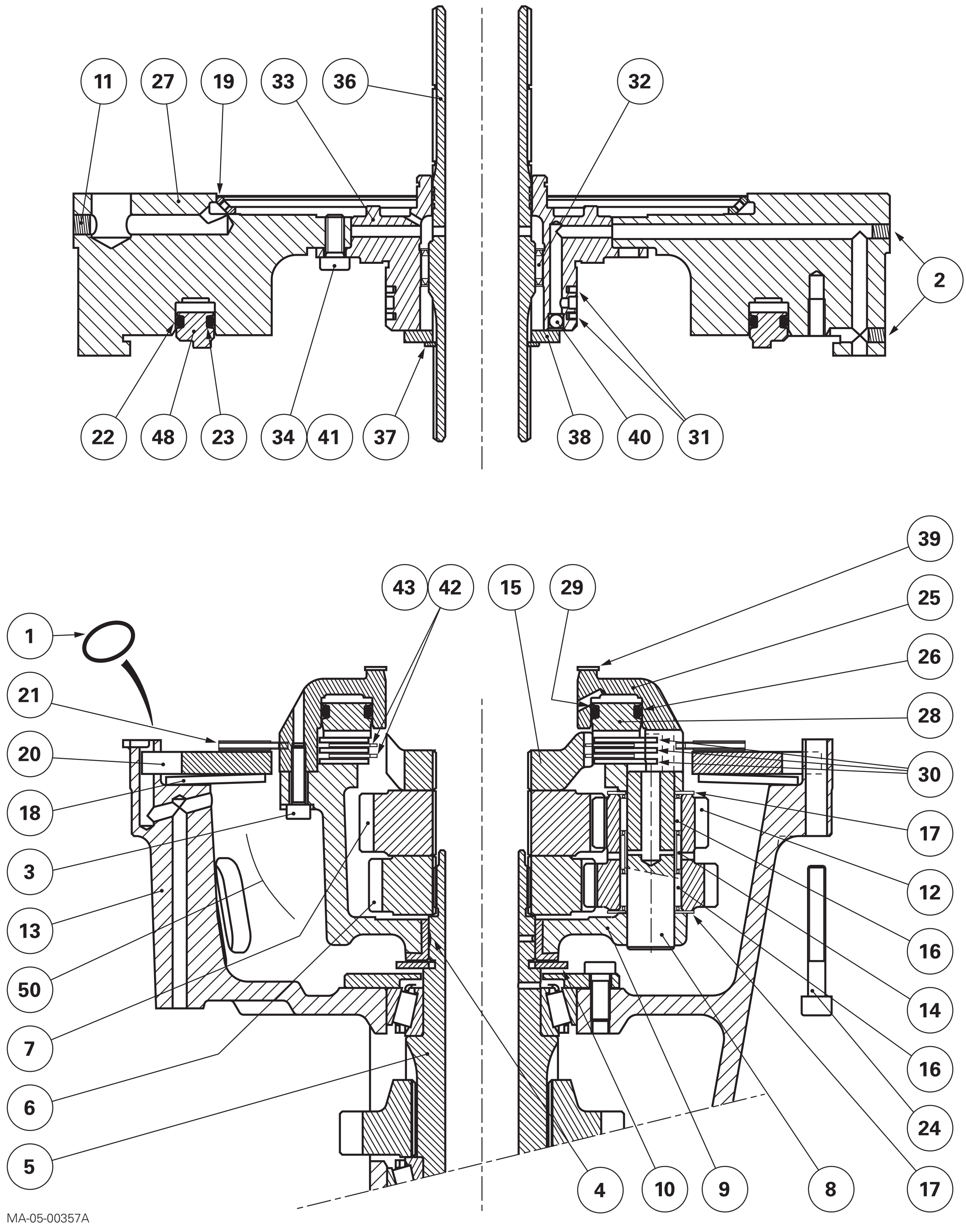

Fig. 2

Parts list (Fig. 2 and Fig. 3)

(1) Seals
(2) Rivets
(3) Screw
(4) Ring
(5) Secondary shaft
(6) Input sun gear (30 kph)
Output sun gear (40 kph)
(7) Input sun gear (40 kph)
Output sun gear (30 kph)
(8) Planet gear pins
(9) Planet carrier unit
(10) Friction washer
(11) Rivet
(12) Double planet gears
(13) Housing
(14) Spacers
(15) Hub
(16) Needle roller bearing
(17) Friction washers
(18) Spring washer (Belleville)
(19) Ring restrictor
(20) Thrust plate
(21) Brake disc
(22) "O" ring
(23) "O" ring
(24) Screw
(25) Hydraulic cover plate
(26) "O" ring
(27) Front cover plate
(28) Clutch piston
(29) "O" ring
(30) Intermediate plates
(31) Rings
(32) Needle roller bearing
(33) Ring carrier
(34) Screw
(36) Primary shaft
(37) Circlip
(38) Tab washer
(39) Washer
(40) Ball bearing
(41) Screw
(42) Discs
(43) Spring washers
(48) Brake piston
(50) Planet carrier assembly

Blown-up view

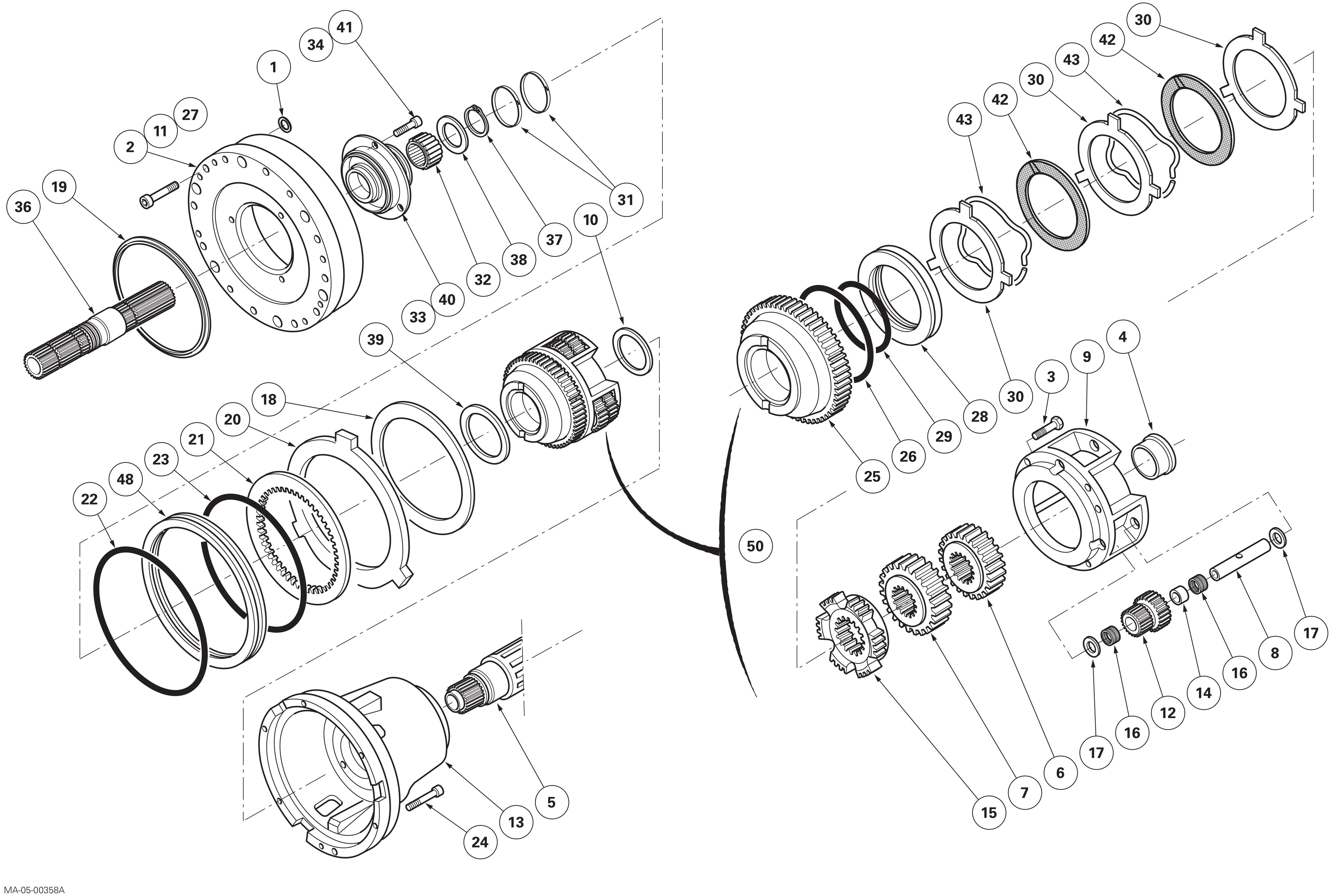

Fig. 3

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B . Operation

Mechanical action - boosting

In this position (Fig. 4), the hydraulic components are not supplied and the Speedshift operates in a mechanical manner. The oil in the chamber of pistons (28) and (48) returns to the housing via channel "C" and the solenoid valve mounted on the Power Shuttle clutch unit. This clutch unit is located on the front right-hand side of the gearbox (see chapter 9).

As the oil pressure has dropped, the planet carrier assembly (50) is locked in rotation by the Belleville washer (18) which compresses the thrust plate (20) and immobilises the disc (21) splined with the planet carrier assembly.

Drive from the primary shaft (36) is transferred to the input sun gear (7) splined to the shaft. The sun gear (7) drives the double planet gears (12) idle-mounted on the pins (8). The planet gears in turn drive the output sun gear (6) firmly attached to the secondary shaft (5), ratio 1.26.

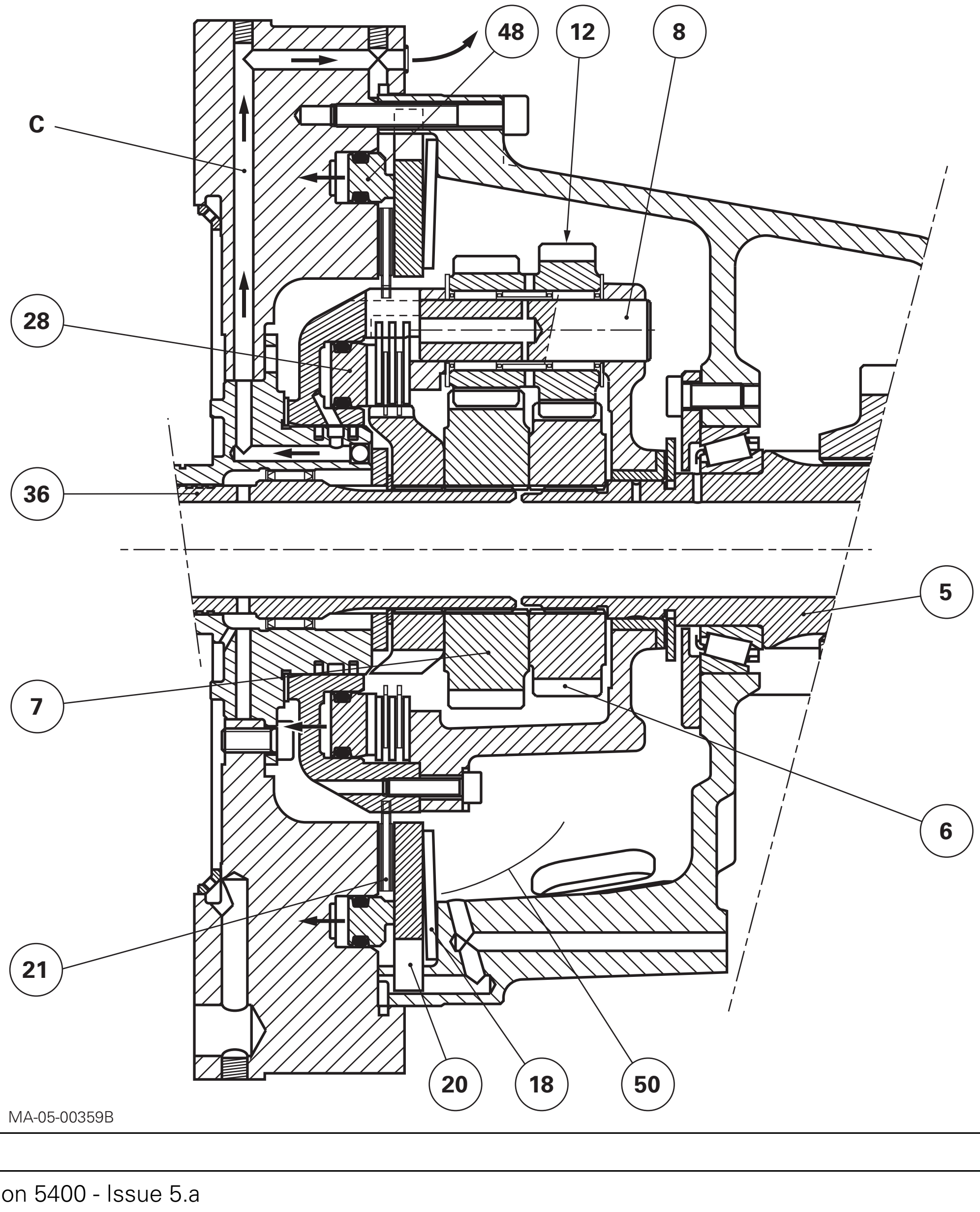

Fig. 4

Hydraulic action: direct drive reduction (Fig. 5)

The range shifting is carried out via a pulse button integrated into the transmission lever handle. This button activates the solenoid valve mounted on the Power Shuttle clutch unit located on the front right-hand side of the gearbox. The solenoid valve simultaneously supplies the chamber of pistons (48) and (28). The brake piston (48) then presses against the thrust plate (20) which compresses the Belleville washer (18) thus releasing disc (21) and the planet carrier assembly (50).

At the same time, the clutch piston (28) joins the intermediate plates (30) and the discs (42) driven by the hub (15). As the intermediate plates are firmly secured to the planet carrier with three lugs, drive is transferred from the input shaft (36) to the hub (15) and to the clutch assembly which drives the planet carrier (50). The primary shaft (36), the planet carrier assembly and the sun gears turn at the same speed as the secondary shaft (5), thus ensuring direct drive, ratio 1.

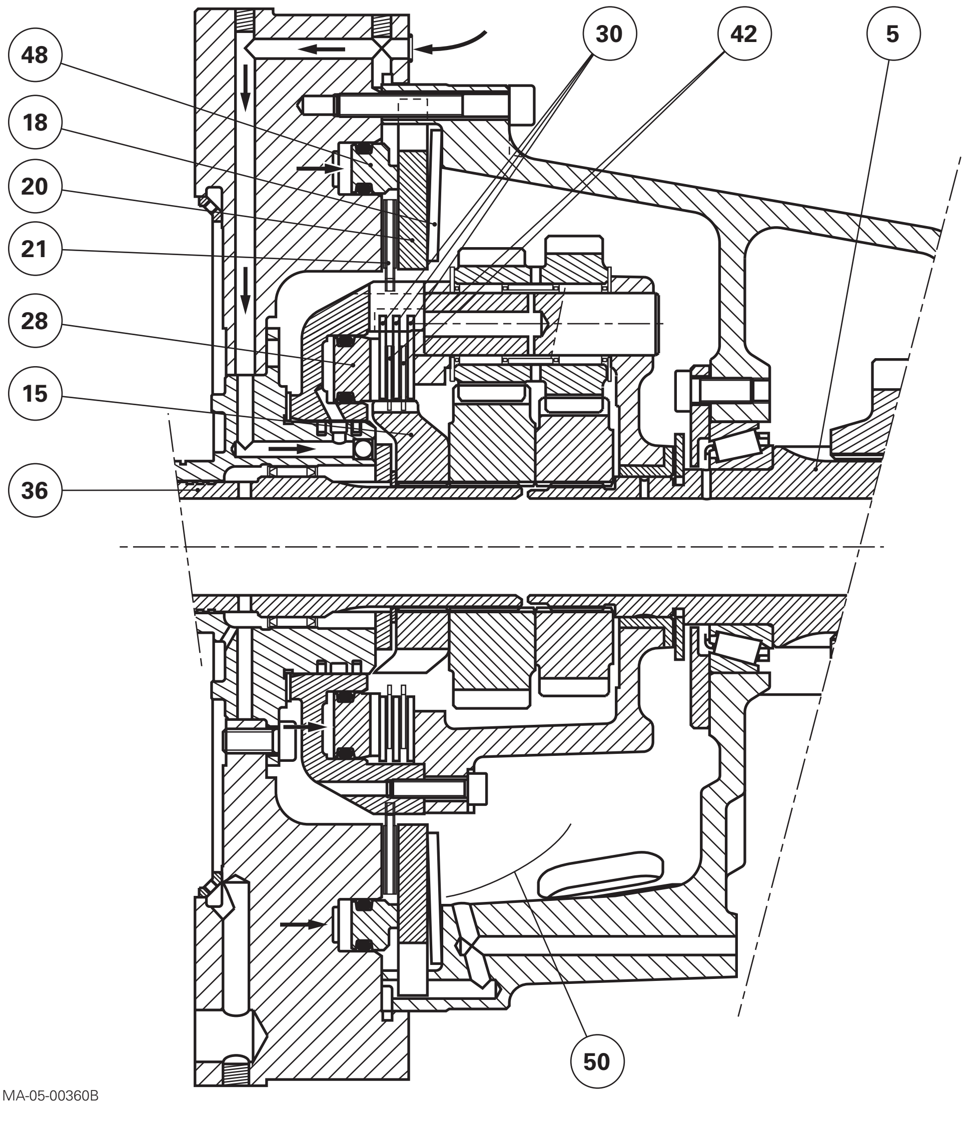

Fig. 5

C . Preliminary steps

1. Disconnect the tractor between the engine and the gearbox (see chapter 2).
2. Drain the gearbox and the rear axle. Remove the spacer (see chapter 3).
3. Remove the Power Shuttle forward clutch (see chapter 5).
4. Remove the input unit (see chapter 5).
5. Separate the Power Shuttle reverse clutch from the input unit (see chapter 5).
6. Position the unit vertically.

D . Removing and disassembling the front cover plate

Removal (Fig. 6)

7. Remove the screws (24).
8. Using two tabs or two makeshift rings, remove the shaft (36), the ring carrier (33) and the front cover plate (27) assembly.
9. Recover and discard the seals (1).
10. Remove and discard the seal rings (31).

Disassembly (Fig. 8)

11. Remove the circlip (37). Remove the tab washer (38) and washer (39).
12. Separate the shaft (36) from the ring carrier (33).
13. If necessary, remove screws (34) (41). Separate and remove the ring carrier (33) from the cover plate.
14. Remove the piston (48) (Fig. 7) by lightly tapping the cover plate with a wooden block or using a jet of compressed air.
15. Remove the seals (22) and (23) and discard them.

NOTE 1: *The ring restrictor (19) is held in the cover plate by Loctite 648 or an equivalent product.*

NOTE 2: *The rivets (2) and (11) ensure oil channel tightness.*

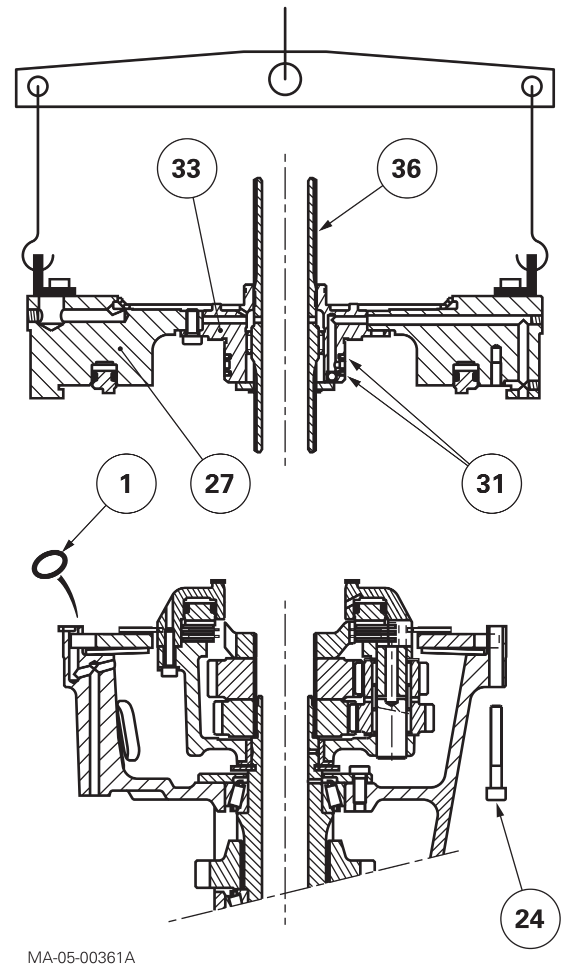

Fig. 6

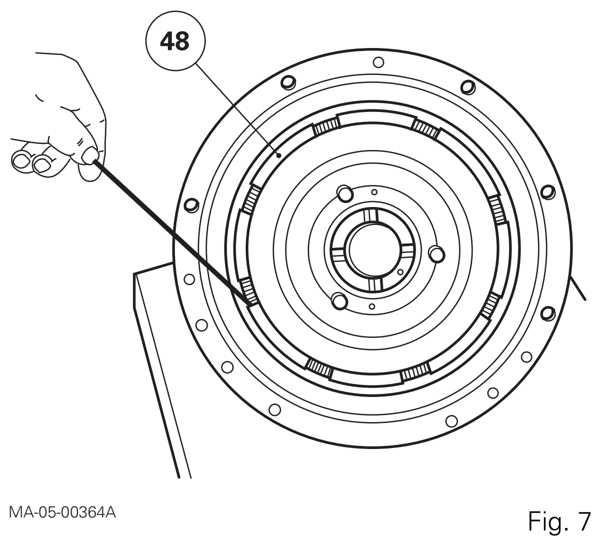

Fig. 7

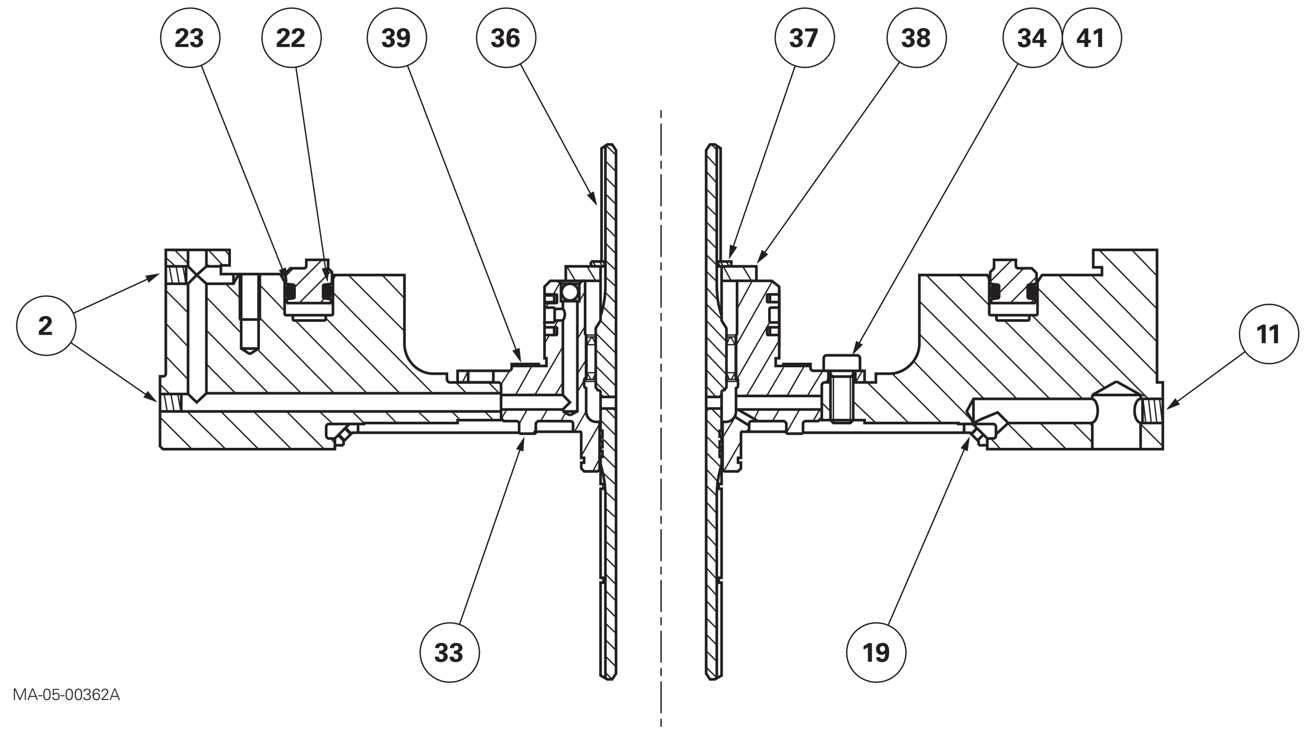

Fig. 8

E . Removing, splitting and disassembling the planet carrier assembly

Removal (Fig. 11)

16. Remove the brake disc (21), thrust plate (20), Belleville washer (18) and planet carrier assembly (50).

Separation

17. Put the planet carrier assembly on a workbench with the unit (9) turned upwards.

18. Remove the screws (3).

19. Separate the unit (9) from the hydraulic cover plate (25) while holding sun gears (6) and (7) (Fig. 9).

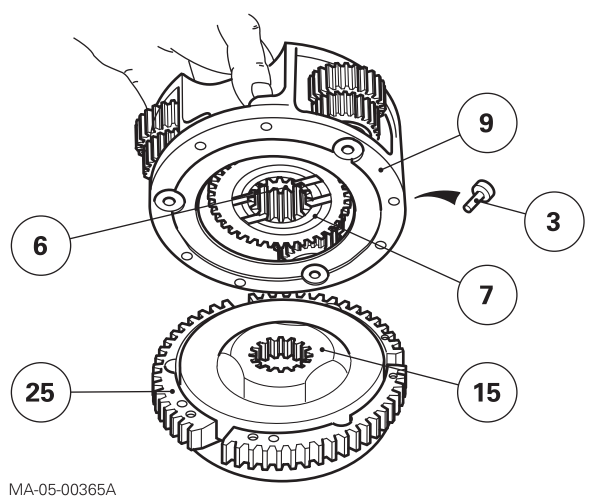

Fig. 9

Disassembly

Note: *The text and figures in this section concern the disassembly of a planet carrier for a forward speed of **40 kph**.*

20. Remove the input sun gear (7), visually identifying the direction of the lubricating grooves.

21. Drive out the pins (8) using a drift and a hammer (Fig. 10).

Note: *The pins are fitted tight in the thickest part of the planet carrier with the lubrication hole turned towards the hydraulic cover plate (25).*

22. Remove the planet gears (12).

23. Recover needle roller bearings (16), spacers (14) and washers (17).

24. Remove the output sun gear (6).

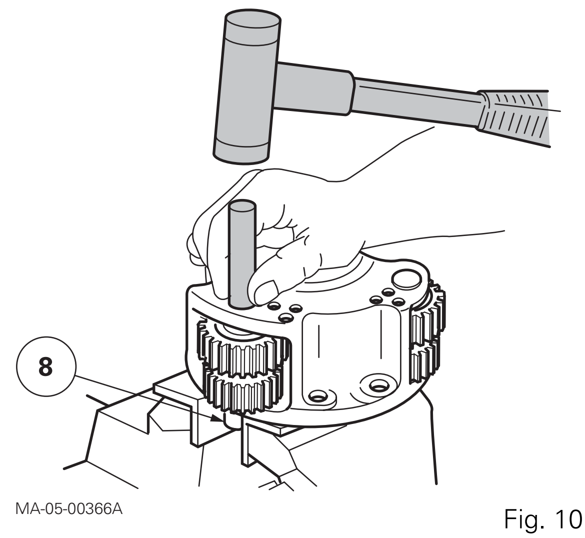

Fig. 10

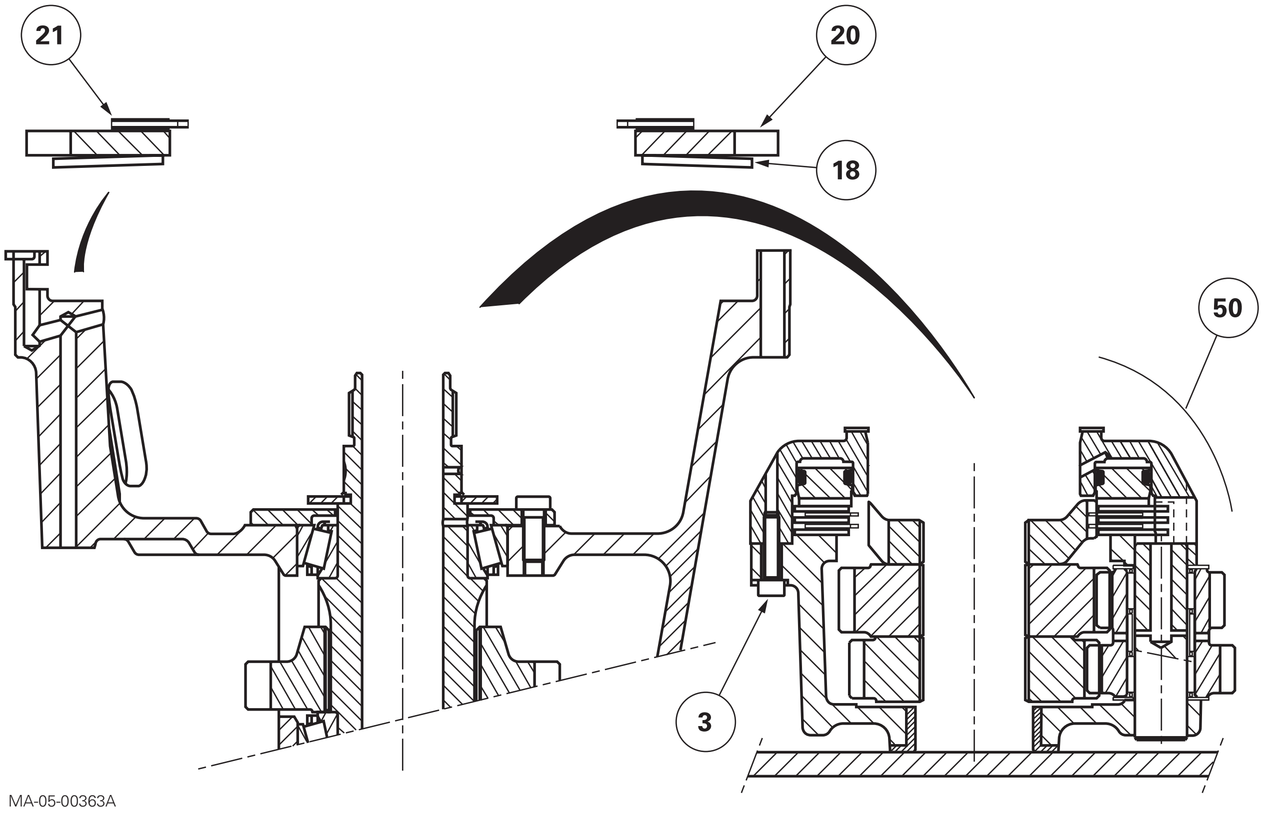

Fig. 11

F . Disassembling the hydraulic cover plate

25. Remove the splined hub (15).

26. Remove the intermediate plates (30), discs (42) and spring washers (43).

NOTE

The clutch consists of:

- *two friction discs;*
- *two spring washers;*
- *three intermediate plates.*

27. Remove the piston (28) by lightly tapping the cover plate (25) on a wooden block or using a jet of compressed air (Fig. 12).

28. Remove the seals (26) and (29) and discard them.

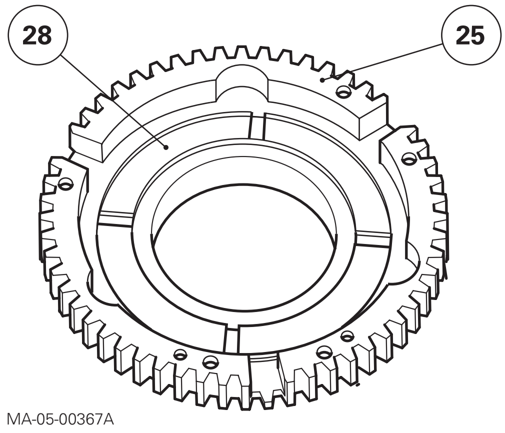

Fig. 12

G . Reassembling the planet carrier

29. Clean and check all components. Replace those that are defective.

30. Lubricate the needle roller bearings (16).

31. Make sure that the radial holes and axial channel for the lubrication of pins (8) are not blocked.

Reminder

Tractor speed can be between 30 and 40 kph.

Each speed is obtained by turning the planet gears and sun gears of the Speedshift epicyclic gear train (Fig. 1).

The sun gears have different numbers of teeth:

- *sun gear (6): 36 teeth*
- *sun gear (7): 39 teeth*

Note: *The text and figures in this section concern the reassembly of a planet carrier for a forward speed of **40 kph**.*

32. Put the output sun gear (6) in the unit (9), turning the sun gear lubricating grooves towards face "F" of the unit (Fig. 13).

33. Install the needle roller bearings (16), separated by a spacer (14) in a planet gear (12).

34. Put an "assembled" planet gear in the unit, the 18-tooth gear turned as in Fig. 1.

Note: *Each double planet gear is identified with one, two or three punchmarks on one of its faces which is not necessarily the 18-tooth gear. In this case, make the same marks on the aforementioned gear using an appropriate pen. A punchmark corresponds to the alignment of two teeth.*

35. Position the washers (**17**).

36. Centre the planet gear and washers with a guide pin Ø 16 mm, L = 80 mm (Fig. 14).

37. Insert the pin (8) into the free bore on face "F" of the unit (9) (Fig. 14) Fit it partially set back (Fig. 15), with the radial lubricating hole "a" turned outwards and the end of central channel "C" turned towards face "F" (Fig. 14).

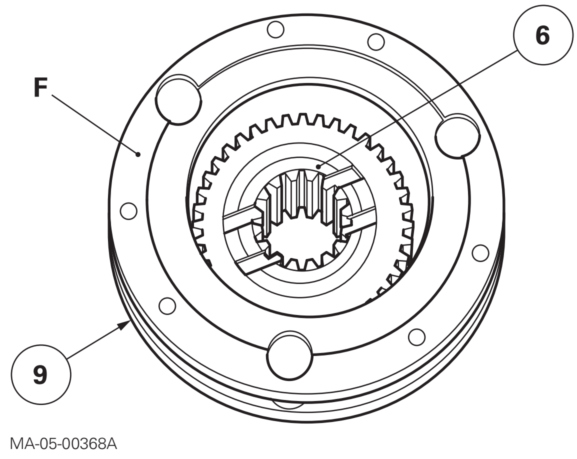

Fig. 13

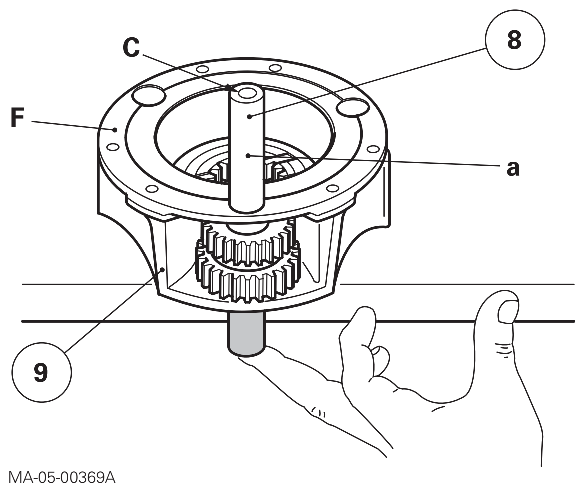

Fig. 14

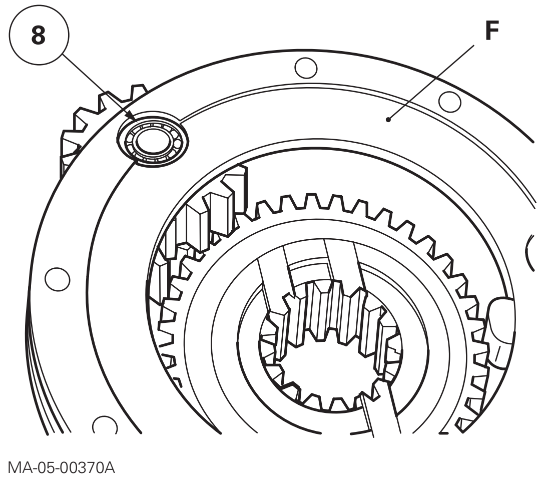

Fig. 15

38. Repeat steps 35 to 37 to assemble the two other planet gears.

During these operations, position the three planet gears according to marks "R" so that they run in a line corresponding with "O" (Fig. 16).

39. After final assembly of the pins (8), check again that the marks are correctly aligned.

IMPORTANT: *Incorrect alignment may make it impossible to assemble combined parts or cause damage to the epicyclic gear train.*

40. Fit the input sun gear (7) with the lubricating groove turned towards the output sun gear (6).

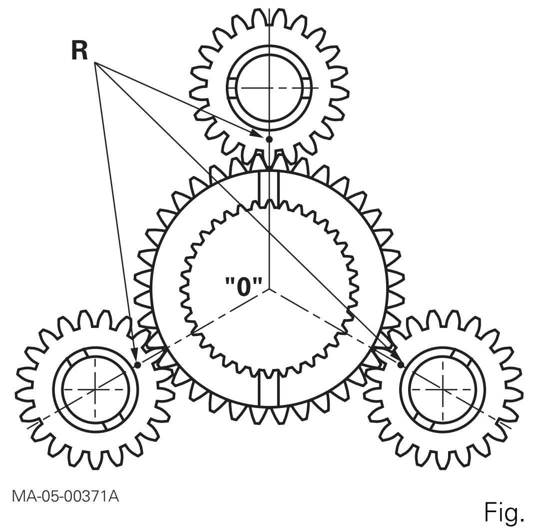

Fig. 16

H . Refitting the hydraulic cover plate

41. Clean and check all components. Replace those that are defective.

42. Make sure that the three holes of the 17-bar channel on the hydraulic cover plate (25) are not blocked (Fig. 17).

43. Fit the lubricated seals (26) and (29) and onto the piston (28).

44. Lubricate the mating faces of piston seals in the hydraulic cover plate.

45. Position the piston in the cover plate, turning the grooves towards the operator.

46. Fit the piston (28) using a plastic hammer, gradually and alternately striking around the circumference of the piston (Fig. 18).

Check that there are no fragments of "O" rings after fitting.

47. Install the splined hub (15) as shown in Fig. 9.

48. Install an intermediate plate (30), a disc (42) and a spring washer (43). Continue stacking parts, ending with an intermediate plate.

NOTE: *Arrange the cut section of spring washers in opposite directions.*

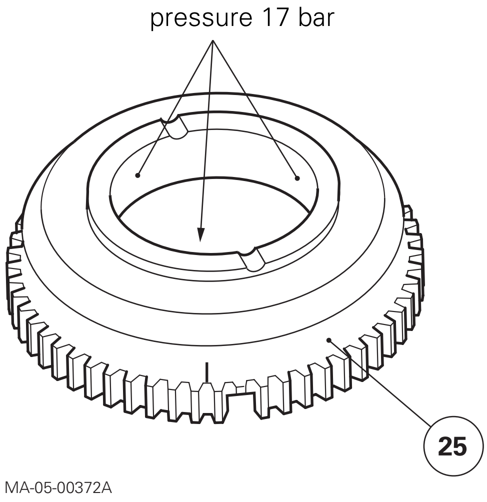

Fig. 17

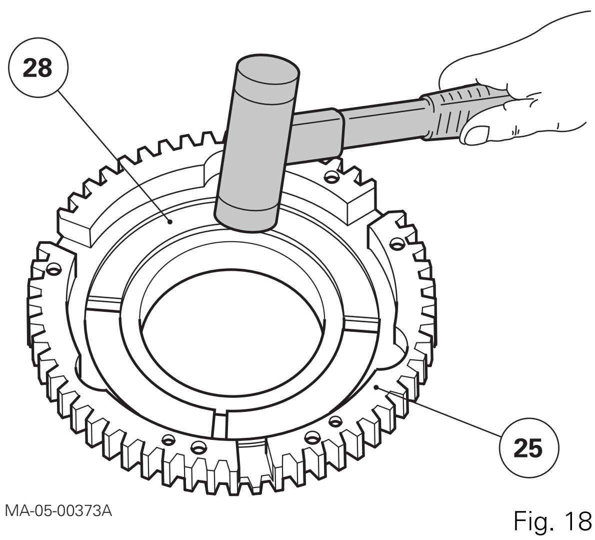

Fig. 18

I . Assembling the planet carrier

49. Screw two diametrically opposed guide studs in the hydraulic cover plate (25).

50. Assemble the planet carrier unit (9) on the hydraulic cover plate (25) while holding the sun gears (6) and (7) (Fig. 9).

NOTE: *Position the unit and the cover plate so that the balancing marks (ground in marks) are on opposite sides as far as possible (Fig. 19).*

51. Refit the screws (3). They **must** be tightened to a torque of 14 - 20 Nm.

52. Strike pins (8) definitively against the hydraulic cover plate (25) with a pin punch.

53. Check that:

- the discs (42) are not compressed;
- the planet gears (12) and sun gears (6) and (7) turn freely.

54. Install the planet carrier assembly (50) on the shaft (5).

55. Position the Belleville washer (18) as in Fig. 2.

56. Position the thrust plate (20) in the housing (13).

57. Fit the brake disc (21) on the planet carrier assembly.

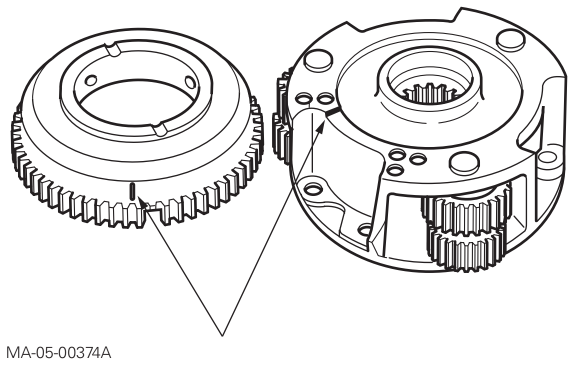

Fig. 19

J . Assembling and refitting the front cover plate

Reassembly

58. Clean the cover plate. Make sure that the 17-bar channel and the lubrication channel are not blocked. Check that the sealing rivets (2) and (11) are present.

59. Fit the seals (22) and (23) on the piston (48).

60. Lubricate the mating faces of the piston seals in the cover plate (27).

61. Position the piston in the cover plate, turning the grooves towards the operator.

62. Fit the piston (48) using a plastic hammer, gradually and alternately striking around the circumference of the piston (Fig. 20).

Check that there are no fragments of "O" rings after fitting.

63. If work is necessary on the ring carrier (33):

- check that the channels are not blocked and that the ball bearing (40) is correctly crimped in its port (Fig. 21). If necessary, fit the needle roller bearing (32) 18.13 to 18.33 mm from face "F" (Fig. 21);
- position the ring carrier on the cover plate, making sure that the low pressure (17 bar) and lubrication holes correspond respectively with those on the cover plate;
- fit and tighten screws (34) and (41), lightly smeared with Loctite 242 or similar, to a torque of 25 - 35 Nm.

64. Check that the lubrication holes on the shaft (36) are not blocked.

65. Slide the shaft in the ring carrier.

66. Refit the washer (38) and circlip (37).

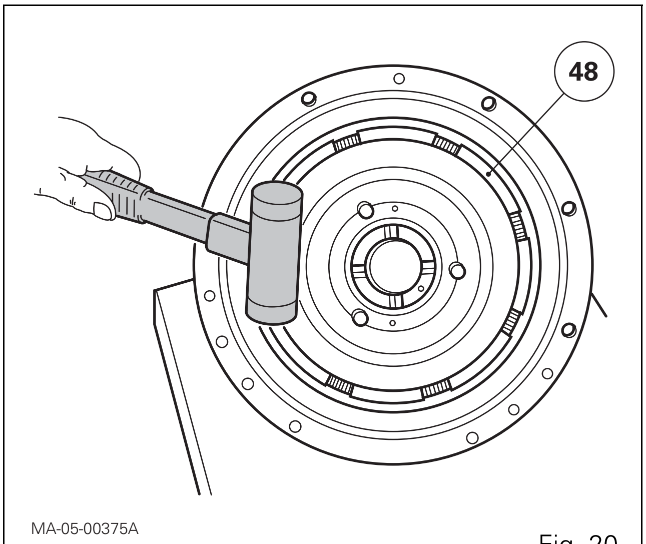

Fig. 20

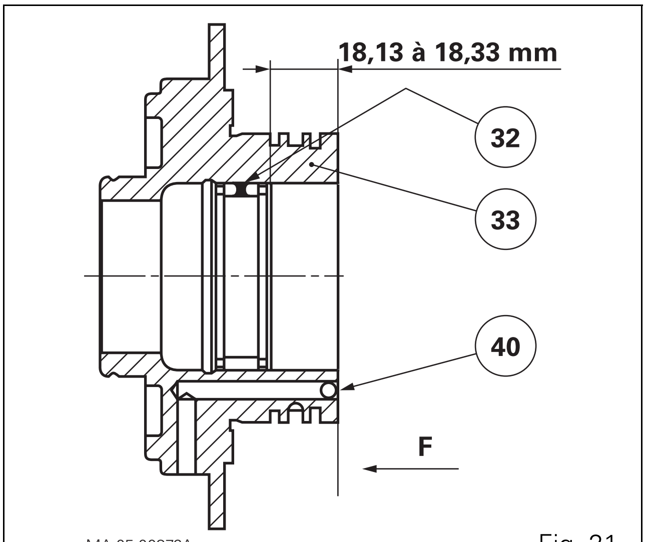

Fig. 21

67. Test-fit the new rings (31), making sure they turn freely in the grooves.

68. After this check, remove the rings and smear with miscible grease.

69. Fit the rings in their respective grooves, making sure:

- that they do not exceed the circumference of the ring carrier;
- their ends overlap correctly (Fig. 22).

IMPORTANT: *The slightest damage to rings may cause a leak followed by a pressure drop and incorrect operation of the Speedshift.*

70. Smear the washer (39) with grease and fit it on the ring carrier (33).

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Fig. 22

Refitting

71. Fit the new seals (1) on the housing (13).

72. Refit the shaft (36), ring carrier (33) and front cover plate (27) assembly using the same procedure as for removal.

73. Install and tighten the screws (24) to a torque of 36 - 46 Nm, with the thread lightly smeared with Loctite 242 or similar.

74. Remove the makeshift lifting tool.

K . Final steps

75. Refit the Power Shuttle reverse clutch (see chapter 5).

76. Refit the input unit (see chapter 5) and the Power Shuttle forward clutch (see chapter 5).

77. Refit the spacer (see chapter 3).

78. Reconnect the tractor between the engine and the gearbox (see chapter 2).

5B14 - GBA20 - Power Shuttle - Selector cover plate

CONTENTS

A . General

5400 series tractors are equipped with a selector cover plate fitted with a single control lever. This lever is located on the rear of the cover plate and is used to select the four basic gears and the Hare/Tortoise (Hi-Lo) function.

Hare / Tortoise range shifting is carried out via a pulse button integrated into the transmission lever handle. The action is only validated when the lever is in the Neutral position.

A sensor "C" fitted to the selector cover plate buzzes to warn the user that a gear is engaged when the hand brake is on.

GBA20 - Power Shuttle - Selector cover plate

Parts list (Fig. 1 - Fig. 2)

(1) Oil return port
(2) Earthing lug
(3) Screw
(4) Screw
(5) Temperature sensor
(6) Stud and nut
(9) Selector cover plate
(10) Return ports
(13) Gear control finger
(14) Speed grid
(15) Screw
(16) Support
(17) Locating ring
(18) Ball bearing
(19) Screw
(20) Spring
(21) Washer
(22) Circlip
(25) Seal
(26) Guide ring
(27) Seal
(28) Neutral position switch
(29) Hexagonal spacers
(31) Plunger
(33) Washer
(34) Toggle switch
(35) Indexing rod

View of the assembly

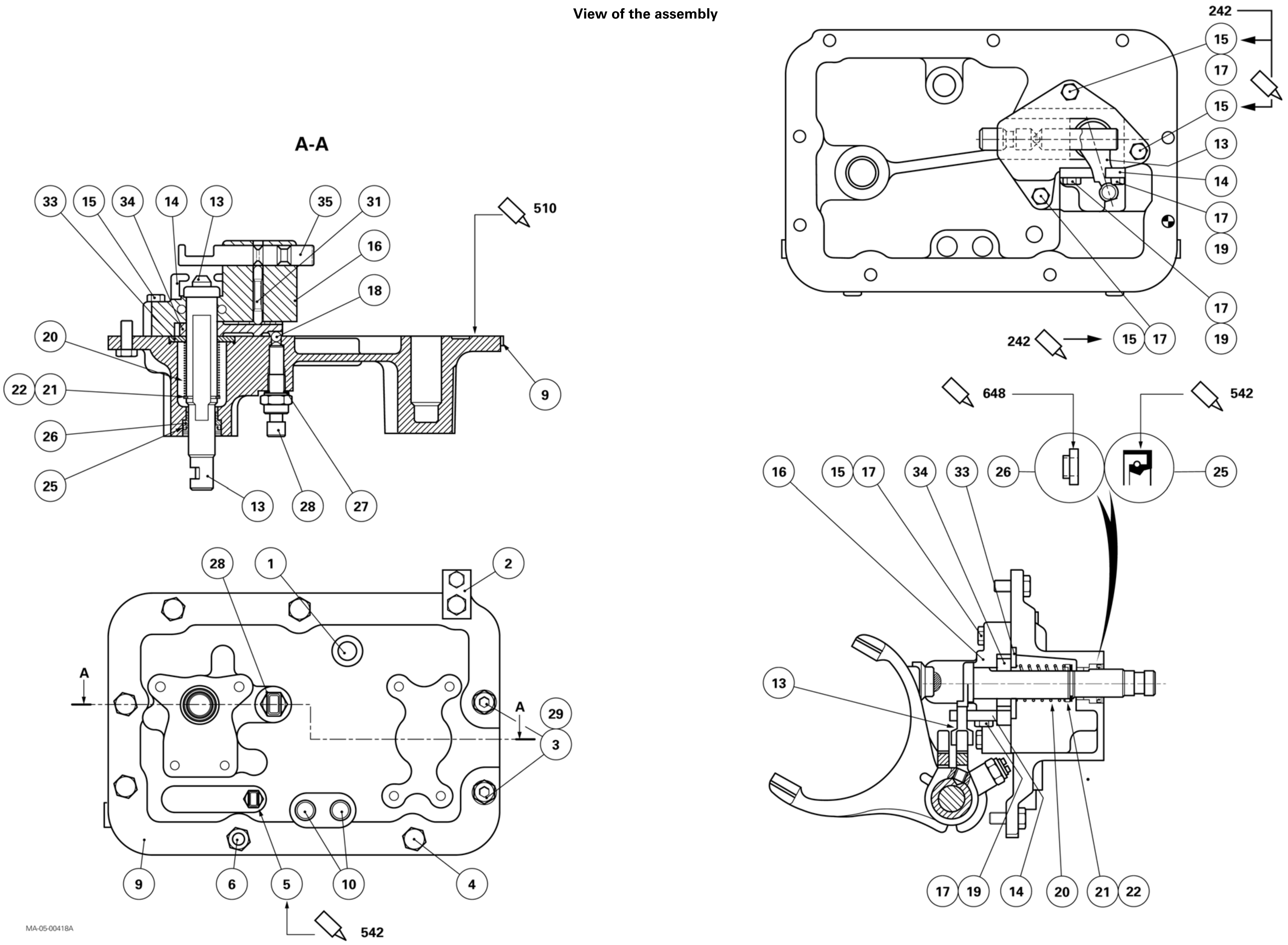

Fig. 1

Parts list (Fig. 1 - Fig. 2)

(1) Oil return port
(2) Earthing lug
(3) Screw
(4) Screw
(5) Temperature sensor
(6) Stud and nut
(9) Selector cover plate
(10) Return ports
(13) Gear control finger
(14) Speed grid
(15) Screw
(16) Support
(17) Locating ring
(18) Ball bearing
(19) Screw
(20) Spring
(21) Washer
(22) Circlip
(25) Seal
(26) Guide ring
(27) Seal
(28) Neutral position switch
(29) Hexagonal spacers
(31) Plunger
(33) Washer
(34) Toggle switch
(35) Indexing rod

Blown-up view

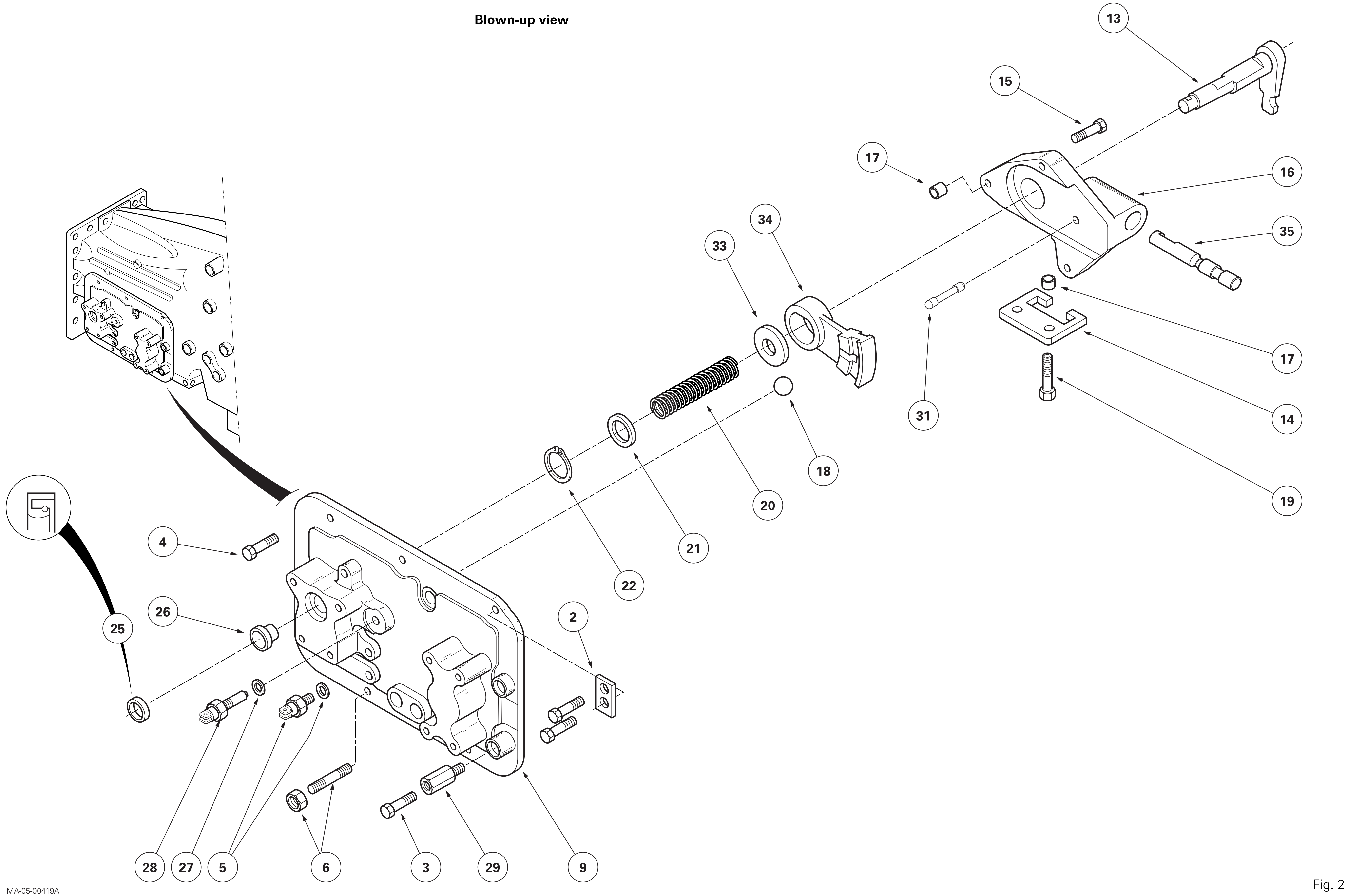

Fig. 2

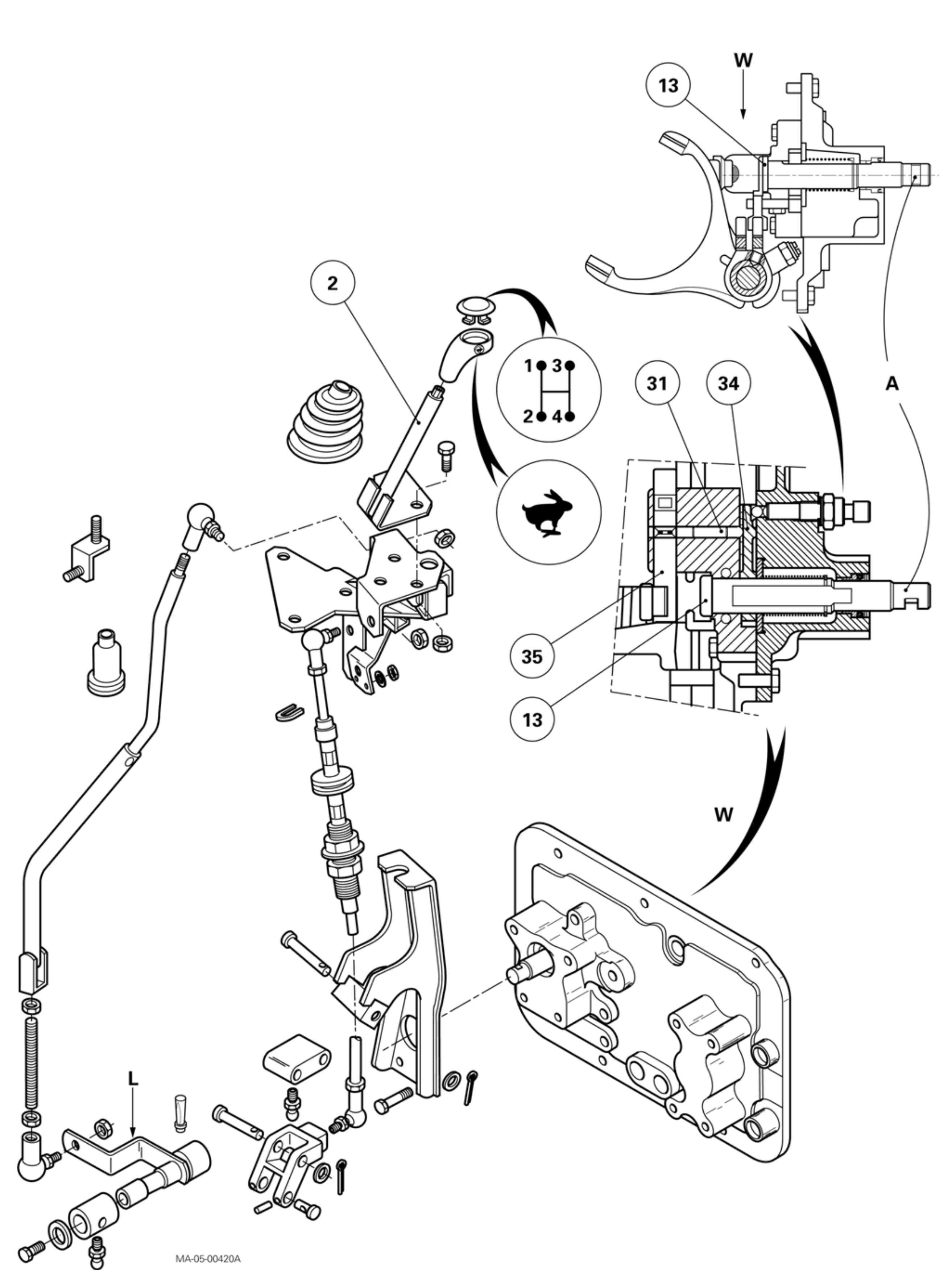

Fig. 3

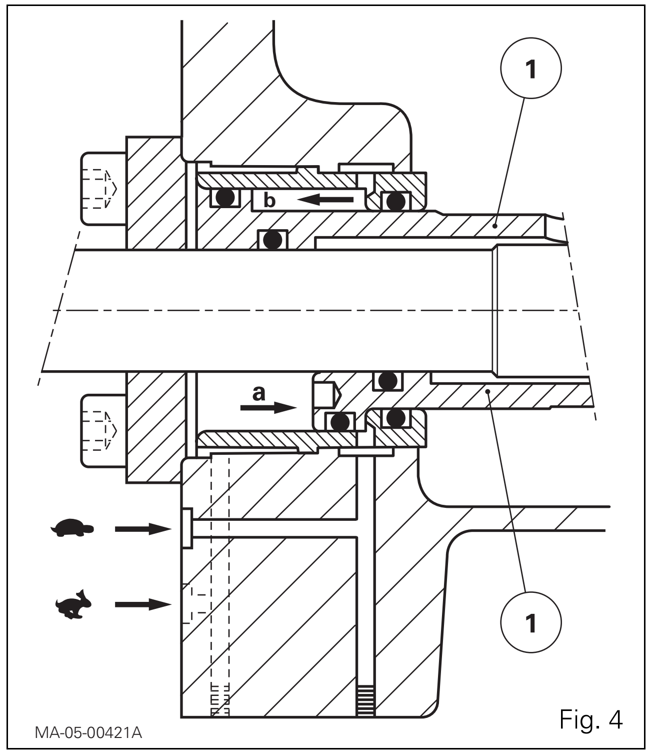

Fig. 4

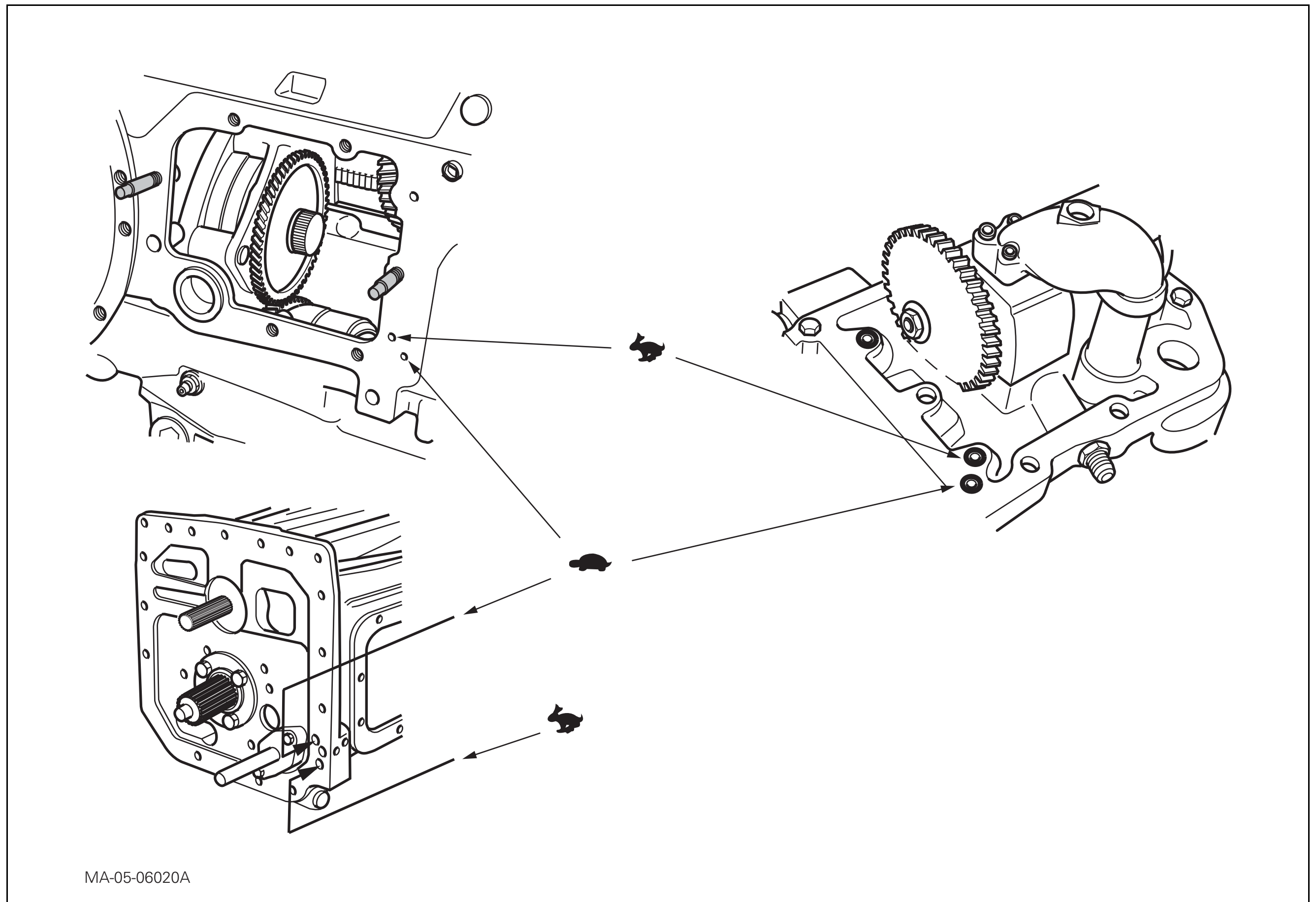

Fig. 5

B . Operation

Transmission lever (Fig. 3)

Selecting 1st - 2nd ratios

The transmission lever (2) operates lever L and engages the finger (13) in the 1st - 2nd fork.

The first ratio is obtained by moving lever L upwards and the second ratio downwards (Fig. 3). Simultaneously, the toggle switch (34) secured to pin A pivots and moves the plunger (31) thus locking the indexing rod (35) and the Hare/Tortoise fork.

Selecting 3rd - 4th ratios

In this configuration, the finger (13) secured to pin A is engaged in the 3rd - 4th gear fork.

The third ratio is obtained by moving lever L upwards and the fourth ratio downwards (Fig. 3).

The locking principle of the indexing rod (35) and Hare/Tortoise fork is identical to that used for the 1st - 2nd ratios.

Hare/Tortoise range

Hare/Tortoise range shifting is validated when the transmission lever is in the Neutral position.

If the button located on the transmission lever handle is activated and if switch (28) has confirmed the Neutral position of the lever, the electronic system of the tractor allows voltage to be supplied to or cut off from the Hare/Tortoise solenoid valve in order to obtain movement of the fork in the required range.

Hare position

The Hare/Tortoise solenoid valve, fitted on the lower part of the right-hand cover plate (see chapter 9) opens and supplies chamber "a" located behind piston (1) (Fig. 4). The piston moves forward, and pushes the fork (Hare / Tortoise).

The oil contained in chamber "b" is discharged into the Tortoise channel, and returns into the 17 bar system.

Tortoise position

When the pulse switch (Fig. 3) is activated again, the solenoid valve is closed, and the pressure drops in chamber "a" (Fig. 4). The piston (1) moves back due to the 17 bar pressure exerted on the annular face.

The oil contained in chamber "a" returns to the housing via the Hare channel and the solenoid valve.

Identification of Hare / Tortoise function ports

See Fig. 5.

Identification and function of Hare / Tortoise range locking elements

Toggle switch (34)

This is one of the main elements of the Hare / Tortoise range locking system. It is freely mounted on pin A (Fig. 3) and pivots with it by means of a flat section.

Function

- It moves the plunger (31) towards the indexing rod (35) and locks the latter during gear engagement
- Via its opposite face it controls the neutral position of pin A (transmission lever) using the switch (28).

Indexing rod (35)

At one end there are two different locking grooves:

- the narrow groove: Hare position;
- the wide groove: Tortoise position.

The other end is designed to house the stop of the Hare / Tortoise fork.

Function

It avoids any unwanted reverse movement of the Hare / Tortoise fork in case of electronic or hydraulic malfunction.

Plunger (31)

Spherically shaped at each end, it moves between the toggle switch (34) and indexing rod (35).

Function

It acts as the system lock, whatever range is engaged.

Switch (28)

It is controlled by the toggle switch.

Function

It informs the tractor electronic system when the transmission lever is in neutral position.

C . Removing and refitting the cover plate

Preliminary steps

1. Immobilise the tractor. Chock the left rear wheel.
2. Apply the hand brake.
3. Chock between the frame and the front axle.
4. Drain the gearbox.
5. Raise the rear right-hand side of the tractor with a suitable jack.
6. Remove the wheel. Place an axle stand in position.
7. Remove the right-hand step and any surrounding parts that might hinder removal of the cover plate.

Removal (Fig. 6)

8. Disconnect the harness of sensor "C" (Fig. 6). Remove the ball joint (4). Remove the screw (3).
9. Remove the pins (11). Disconnect the ball joint (5).
10. Mark the adjustment of the cable (6). Slightly loosen the top nut (12) and separate the cable from the support (2).
11. Disconnect the control cable (1) from the creeper unit on tractors fitted with this option (Fig. 7).
12. Remove the screws (3) and (4) and the nut (6), marking the location of the earthing lug (2) (Fig. 1).
13. If fitted, remove the support (2) of the creeper unit control cable (Fig. 7).
14. Release and remove the selector cover plate.

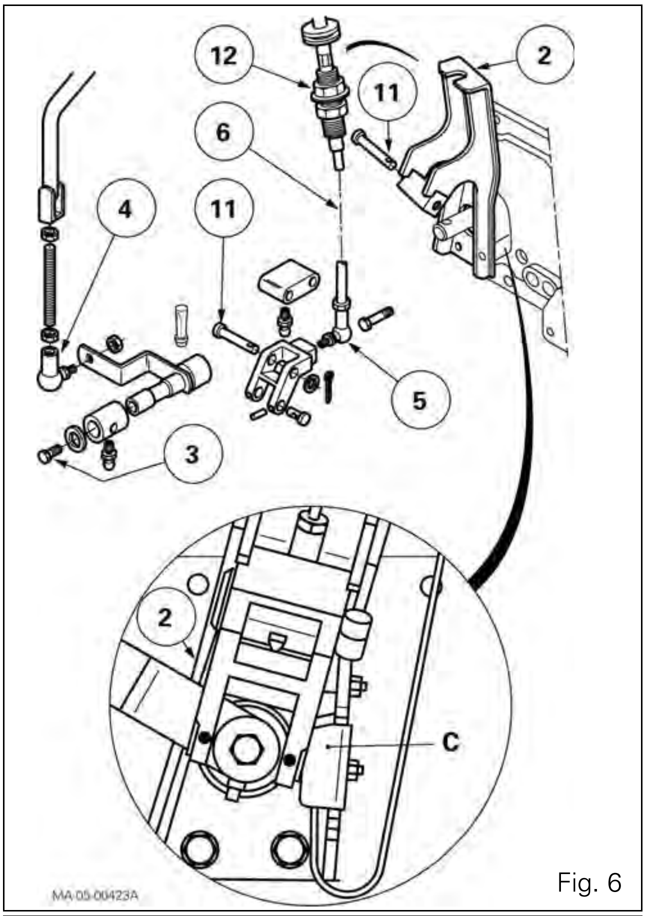

Fig. 6

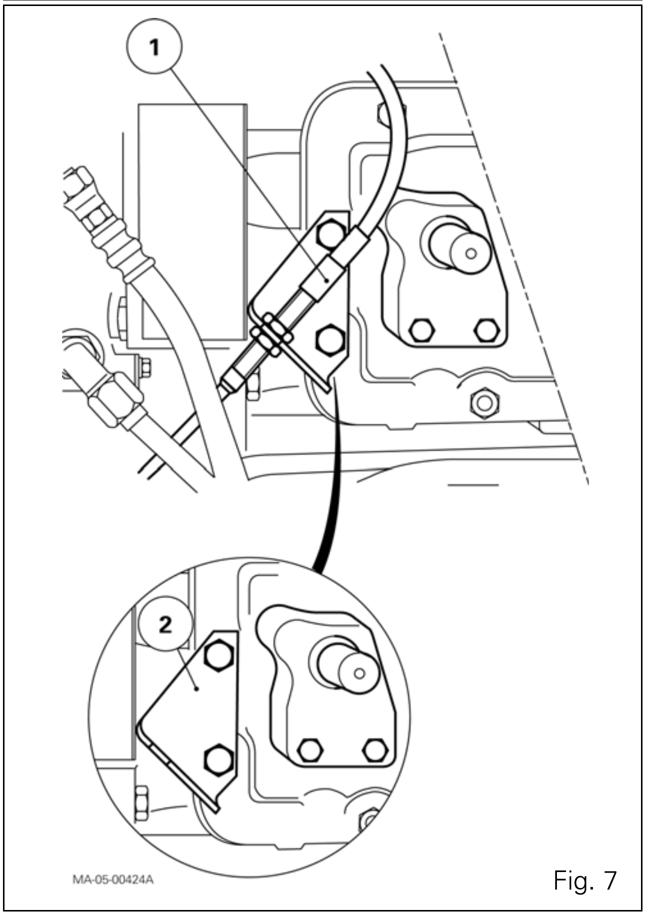

Fig. 7

GBA20 - Power Shuttle - Selector cover plate

Refitting (Fig. 1)

15. Clean the mating face of the gearbox and the cover plate.

16. Place the 3rd - 4th fork in ratio 3 (Fig. 8)

__IMPORTANT:__ Before refitting the cover plate, check that the screw (1) is present (Fig. 8).

17. Lightly smear the mating face of the gearbox housing with a sealing product such as Loctite 510 or equivalent.

18. Turn the finger (13) (Fig. 8) to the left.

19. Position the cover plate on the gearbox, checking that the finger is correctly fitted in the forks.

20. Refit the creeper control cable support (if fitted).

21. Refit the earthing lug (2). Fit and tighten the screws (3) (4) and the nut (6) to a torque of 50 - 70 Nm.

22. Depending on the option, reconnect and adjust the creeper control (see chapter 5).

23. Reconnect the harnesses to the temperature sensor (5) and the Neutral position switch.

24. Reconnect the transmission lever and reconnect the sensor. Perform steps 8 to 10 in reverse order.

25. Using a grease gun, lubricate the joints of the gear control on the selector cover plate.

Legend Fig. 8

A Indexing rod for locking the Hare/Tortoise fork
L Synchronisation of the Hare/Tortoise mechanism in Hare range
(3) Gear engaged (e.g. 3rd gear)
(1) Screw
(9) Selector cover plate
(13) Finger
(18) Locking stop

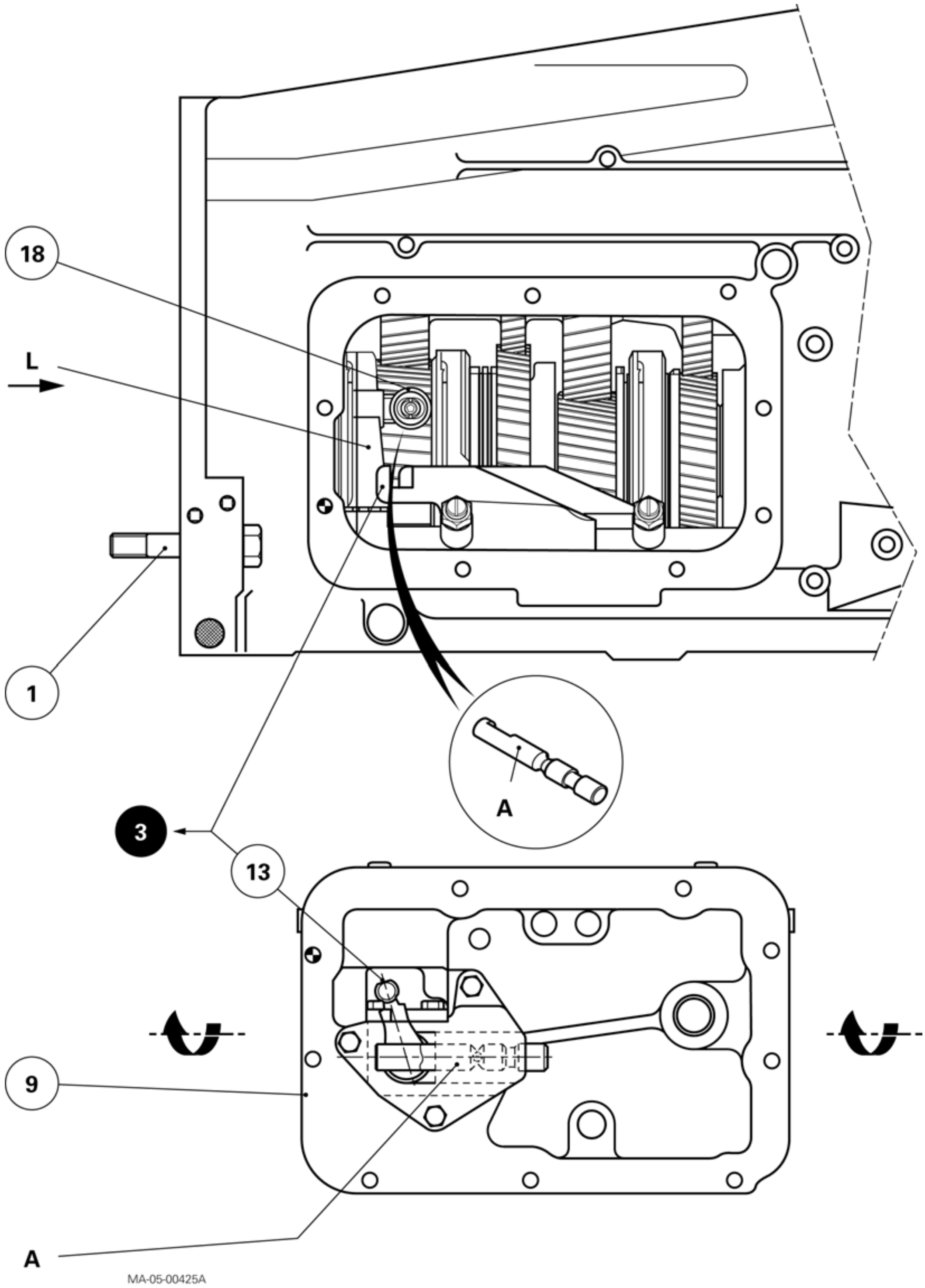

Fig. 8

Final steps

26. Check the shifting of all gears. If required, adjust the control (see § E).

27. As required, refit any components removed previously from around the cover plate.

28. Refit the wheel. Tighten the nuts to a torque of 400 - 450 Nm.

29. Top up the oil level in the housings. Check it using the gauge at the rear of the centre housing.

30. Remove the chocks between the frame and the front axle. Release the hand brake.

31. Check that the buzzer of the safety sensor vibrates correctly (ignition on, hand brake on and gear engaged).

32. Start the engine.

On the road, check the shifting up and down of the gear ratios, as well as the operation of the Hare / Tortoise range using the pulse button located on the lever.

33. Check the tightness of the selector cover plate mating face and of the hydraulic unions.

D . Disassembling and reassembling the selector mechanisms

Preliminary steps

34. Take off the cover plate (see § C). Secure it in a vice fitted with protective jaws.

Disassembly (Fig. 1)

35. Remove the screws (1). Remove the key (4) and selector (3). Separate the support (2) from the cover plate (Fig. 9).

36. Remove the screws (15). Separate the cover plate (9) and support (16) comprising the gear control assembly. If necessary, extract the locating rings (17).

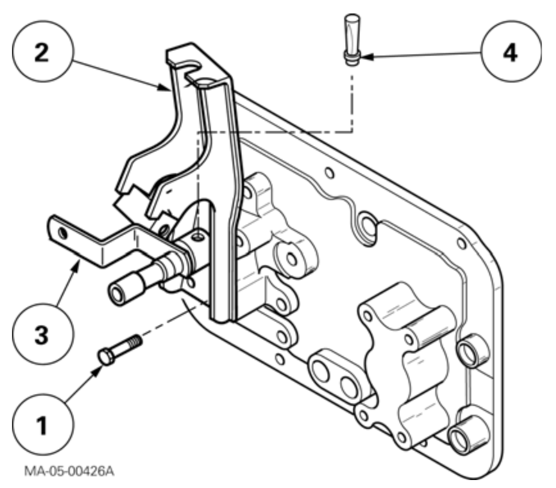

Fig. 9

On the cover plate (9)

37. Take off the Neutral position switch (28). Recover the seal (27) and ball bearing (18).

38. If necessary, remove the temperature sensor (5) and the unions screwed onto the return ports (1) (10).

39. Extract and discard the seal (25).

On the support (16)

40. Take off the circlip (22), washer (21) and remove the spring (20).

41. Release the washer (33) and toggle switch (34), marking its position and profile.

42. Recover the plunger (31). Extract the indexing rod (35).

43. If necessary:
- remove the screws (19);
- remove the speed grid (14);
- extract the locating rings (17).

Reassembly (Fig. 1)

44. If it was necessary to replace the guide ring (26), lightly smear its rim with Loctite 648 or equivalent. Fit it up against the shoulder of the cover plate.

On the support (16)

45. If necessary:
- fit the locating rings (17),
- refit the speed grid (14) on the support (16),
- tighten the screws (19), lightly smeared with Loctite 270 or equivalent, to a torque of 29 - 37 Nm.

46. Check that:
- the plunger (31) and indexing rod (35) move freely in the support (16),
- the flat section of the toggle switch (34) slides normally on the finger (13).

47. Slide the pin of the finger (13) into the support (16).

48. Turn the toggle switch (34) as required. Fit it onto the finger (13). Fit the washer (33).

49. Refit the spring (20) and washer (21). Fit the circlip (22).

50. Slide the plunger (31) into its cavity in the support (16).

51. Place the finger (13) in the Neutral position. Turn the indexing rod (35) as required and fit it.

On the cover plate (9)

52. Check that the locating rings (17) are present.

53. Refit the gear control and support (16) assembly on the cover plate (9).

54. Lightly smear the thread of the screws (15) with Loctite 242 or equivalent. Tighten to a torque of 29-37 Nm.

55. Protect the lip of the seal (25) by surrounding the cylindrical end of the finger (13) with a flexible protection. Lightly smear the external rim of the seal with Loctite 542 or equivalent and slide it onto the protection. Remove the safety shield. Fit the seal onto the cover plate using a suitable fixture.

56. Check that finger (13) is in the Neutral position.

57. Slide the ball bearing (18) into the depression on the toggle switch (34).

Checking the Neutral position switch (28)

58. Press manually on the button located at the end of the switch. Release the pressure and check that the button returns freely to its initial position. Repeat the operation several times. The check can be carried out using a multimeter.

59. Refit the switch complete with its seal and tighten to a torque of 15 - 25 Nm.

60. Refit the support (2), allowing a distance of **29 mm** between the support and the 22 mm diameter of pin A (Fig. 10).

Lightly smear the screws (1) with Loctite 270 and tighten them to a torque of 25 - 35 Nm.

IMPORTANT: *This dimension must be met for the sensor to operate correctly, see § A.*

61. Refit the selector (3). Fit and tighten the key (4) (Fig. 9).

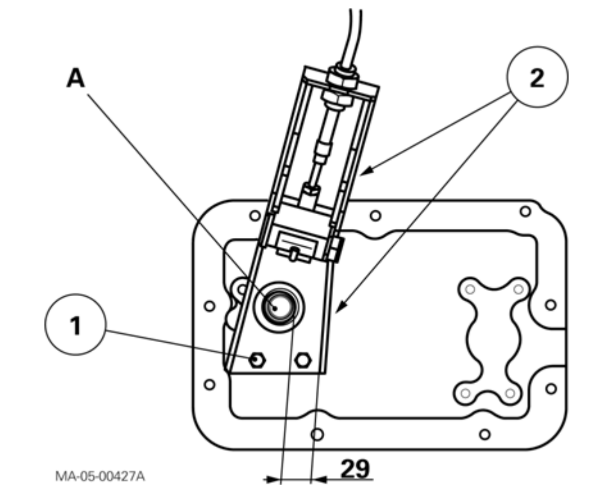

Fig. 10

Checking the locking system of the indexing rod (35)

62. In the grid (14), move the finger (13) from 1st to 4th ratio using the selector (3) (Fig. 9) and manually check for the correct locking of the indexing rod in each of its positions.

IMPORTANT: *This indexing rod is linked to the Hare/Tortoise fork by an adjustable stop. If the replacement of certain components of the locking system was necessary, it is mandatory to readjust this stop (see chapter 5).*

Final step

63. Remove the cover plate from the vice. Refit it on the gearbox (see § C).

E . Fitting and adjusting the gear linkage

Cab side

Preparation (Fig. 11)

64. On the end of the rod (1) shaped with an angle of 166°, position the ball joint (2) as shown in Fig. 11. Tighten the nut (3).

65. Tighten the ball joint (4) up against the cable (6). Tighten the nut (5).

Assembly (Fig. 11)

66. Place the support (7) on a workbench.

67. On the support, fit and tighten:
- the transmission lever
- the previously prepared rod and cable.

68. Refit and secure the support onto the right-hand wheel housing of the cab. During this operation, ensure the rod and cable are inserted through the holes in the compartments.
Fit the shield rings.

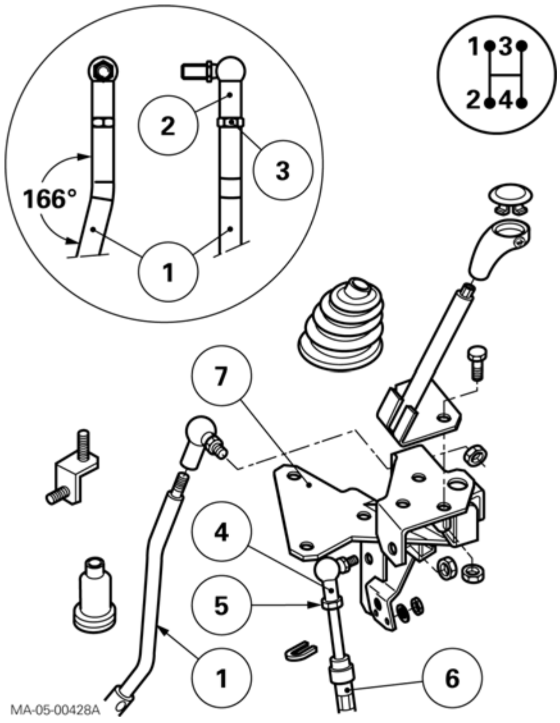

Fig. 11

Selector cover plate side

Preparation (Fig. 12)

69. Screw the threaded rod (9) (fitted with nuts (3) and the ball joint (4)) onto the rod (1).

70. Tighten the ball joint (5) up against the cable (6). Tighten the nut (7).

Assembly (Fig. 12)

71. Tighten and lock the other end of the ball joint (5) onto the cam (8).

72. On the previously fitted support (2) and lever "L", position the cam (8) and its extension block (10). Fit the pins (11), and lock them in place with new pins.

73. Fit the ball joint (4) on the lever L. Fit the washer and tighten the locknut.

Adjusting the rod (1) (Fig. 12)

74. Turn the threaded rod (9) and ball joint (4) to obtain a dimension X of **17 ± 1 mm** between the two nuts (3) when they are tightened.

Adjusting the cable (6) (Fig. 12)

75. Adjust the sheath end to balance (as far as possible) dimensions "C" and "D". Tighten the nuts (12) without altering the adjustment.

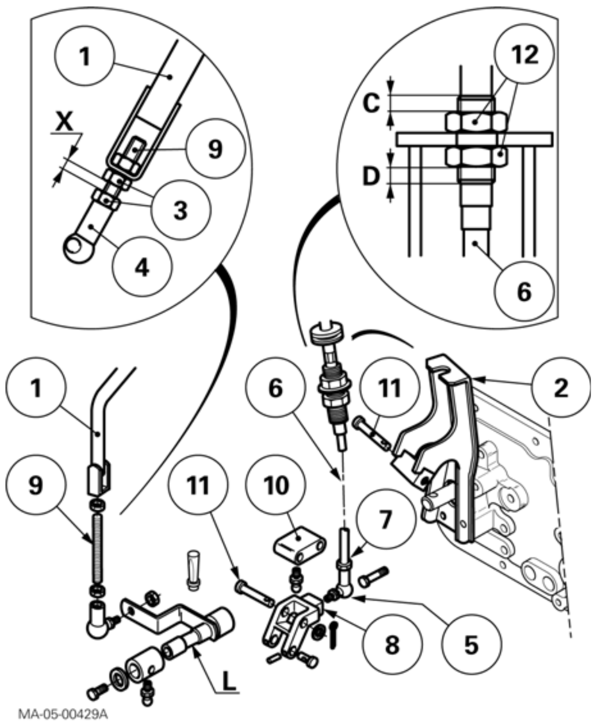

Fig. 12

Checking the proper engagement of each gear ratio and the position of the lever in the opening of the console.

IMPORTANT: *This check should be performed with the gaiter of the transmission lever temporarily removed.*

76. Engage each gear ratio. During this operation, check that the lever is **never closer than 5 mm** from the edge of the console (Fig. 13 - Fig. 14).

Results

- **Lever movement is not hindered in any way by the console**

  Adjustment is correct. Position the gaiter.

- **Lever movement is hindered by the console**

  The lever is positioned incorrectly. Readjust the rod (1) (Fig. 12) on the selector cover plate side in accordance with the following instructions:

  - If the problem concerns the 1st or 3rd gear (Fig. 13), reduce dimension X (Fig. 12).
  - If the problem concerns the 2nd or 4th gear (Fig. 13), increase dimension X (Fig. 12).
  - If the problem concerns lateral movement of the lever between the 1-2 and 3-4 gear paths (Neutral position) (Fig. 14), adjust the cable sheath end (6) (dimensions C and D) (Fig. 12). Tighten the nuts (12).

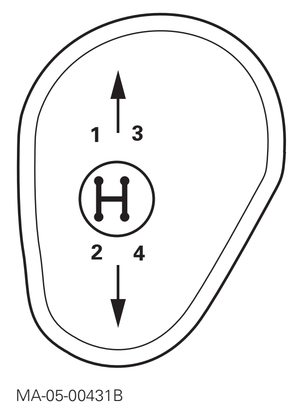

Fig. 13

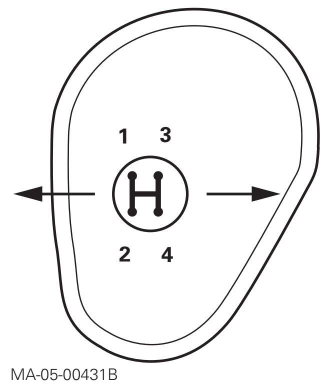

Fig. 14

5B15 - GBA20 - Power Shuttle - Selector rails

CONTENTS

A . General

The selector rail (7) holding the different forks is located on the right-hand side of the gearbox, on the selector cover plate side. It passes through the gearbox housing and the Hare and Tortoise range control piston (13).

It is held in position by a set screw (8). A cup plug (9) closes off the bore at the front and a cover plate (15) closes the rear end.

The 1st - 2nd (5) and 3rd - 4th (6) forks are not adjustable.

The creeper gear fork (28) is adjustable by mechanical pressure.

Two adjustments are necessary to obtain the correct functioning of the fork (20) in both ranges (Hare / Tortoise):

- adjustment of the space between the fork pads and the synchroniser sliding coupler;
- adjustment of the stop (18), in relation to the position of the indexing rod fitted on the selector cover plate.

A creeper gearbox may be fitted as an option (see chapter 5).

A super-creeper gearbox may also be fitted as an option (see chapter 5). In this case, the end-of-travel pin (29) is not fitted.

GBA20 - Power Shuttle - Output shaft

Parts list (Fig. 2)

(1) Plug
(2) Spring
(3) Detent plunger
(5) 1st - 2nd Fork
(6) 3rd - 4th Fork
(7) Selector rail
(8) Set screw
(9) Cup plug
(10) Cylinder
(11) "O" ring
(12) "O" ring
(13) Hare and Tortoise range piston
(14) "O" ring
(15) Cover plate
(16) Screw
(17) Screw
(18) Locking stop
(19) Adjustment screw
(20) Hare/Tortoise fork
(26) Nut
(27) Locking screw
(28) Creeper gear fork
(29) End-of-travel pin

View of the assembly

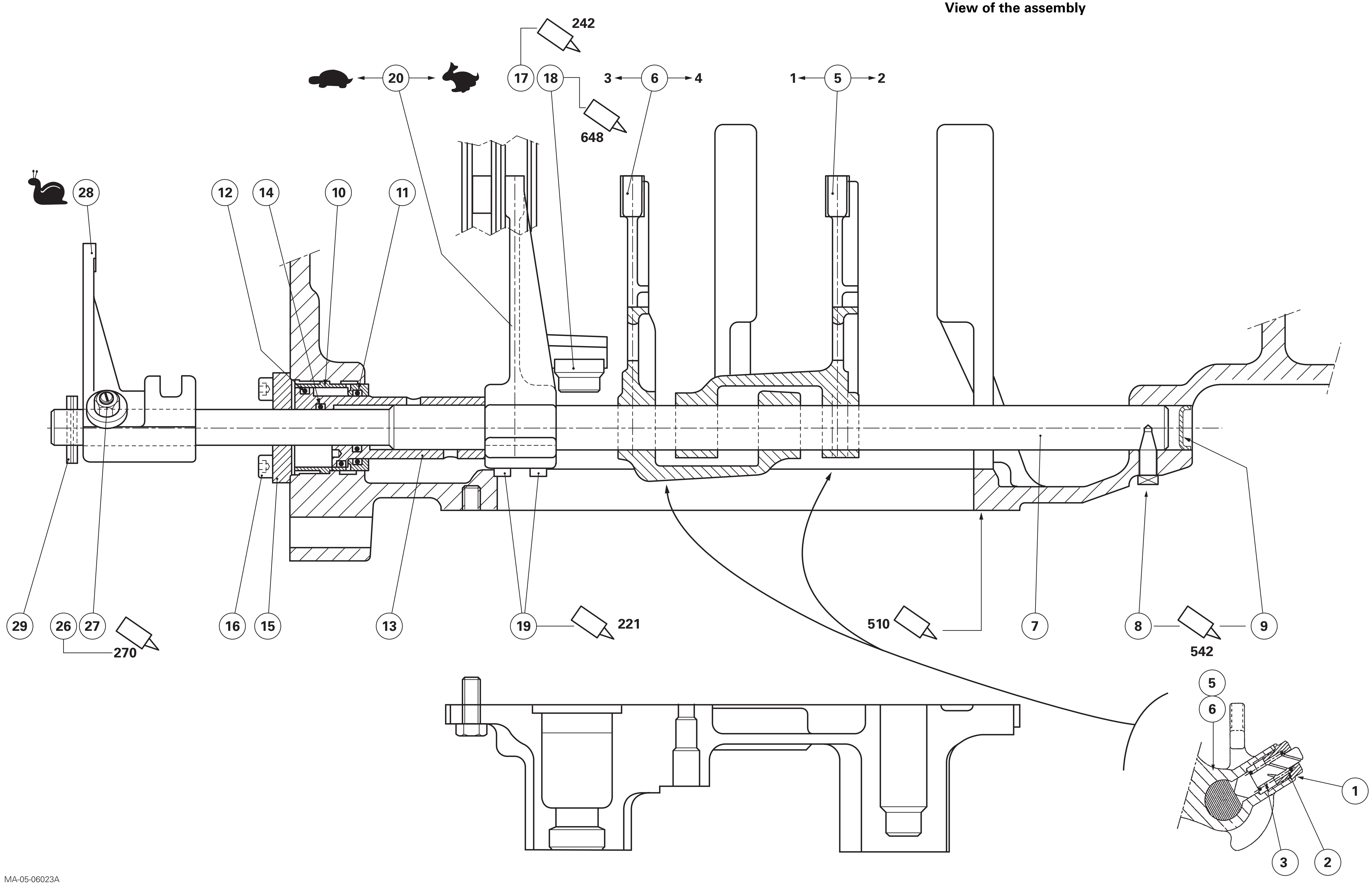

Fig. 1

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Parts list (Fig. 2)

(1) Plug
(2) Spring
(3) Detent plunger
(5) 1st - 2nd Fork
(6) 3rd - 4th Fork
(7) Selector rail
(8) Set screw
(9) Cup plug
(10) Cylinder
(11) "O" ring
(12) "O" ring
(13) Hare and Tortoise range piston
(14) "O" ring
(15) Cover plate
(16) Screw
(17) Screw
(18) Locking stop
(19) Adjustment screw
(20) Hare/Tortoise fork
(26) Nut
(27) Locking screw
(28) Creeper gear fork
(29) End-of-travel pin

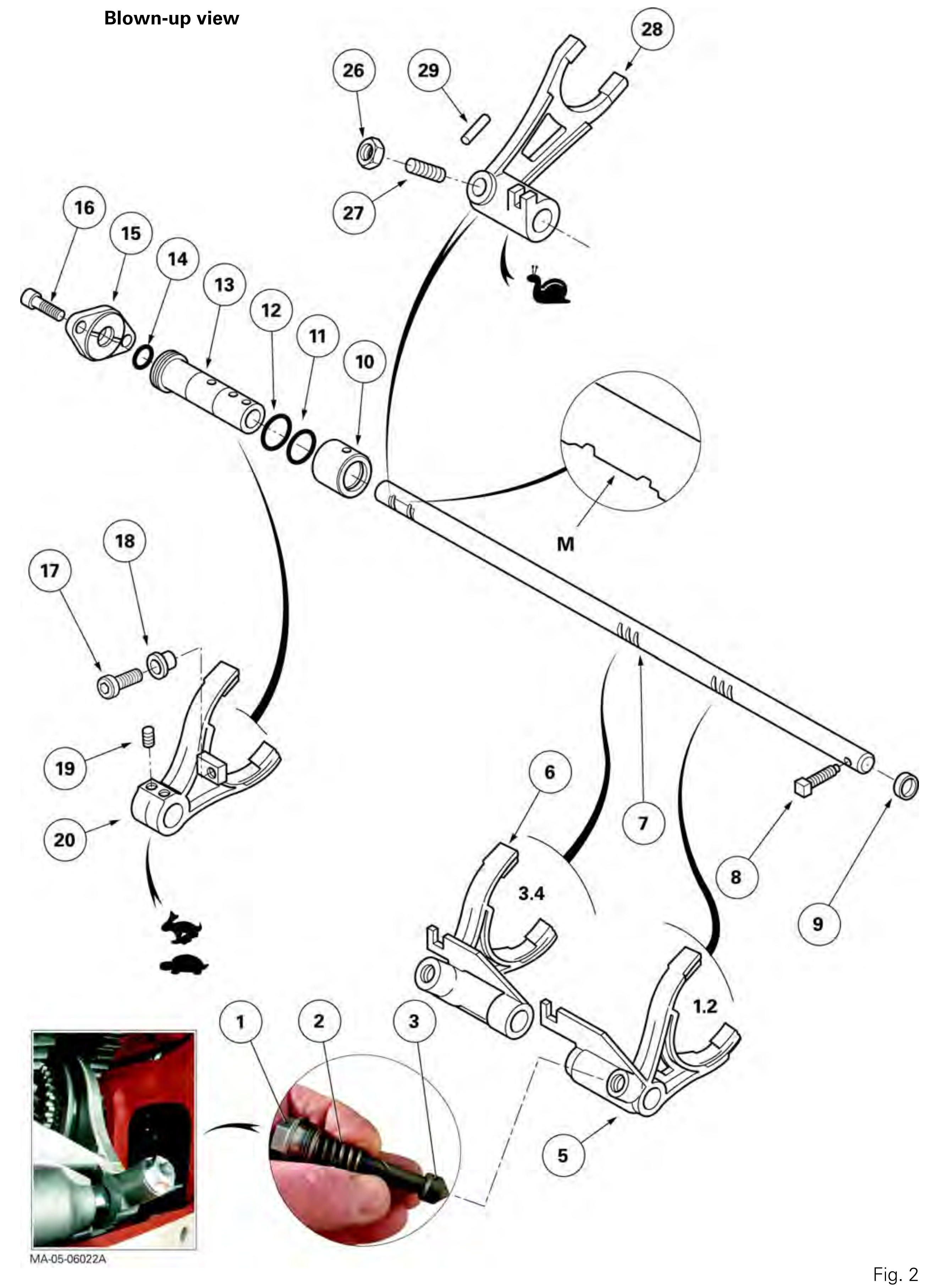

Fig. 2

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B . Maintenance guide

This guide describes a succession of operations to be followed depending on the mechanical component to be worked on.

Creeper gear fork

- Remove the selector cover plate (see chapter 5).
- Remove the right-hand hydraulic cover plate (see chapter 9).
- Remove the creeper gear fork

Hare / Tortoise fork

- Remove the selector cover plate (see chapter 5).
- Remove the right-hand hydraulic cover plate (see chapter 9).
- Remove the creeper gear fork (if fitted).
- Move the selector rail forward.
- Disassemble the hydraulic components (ram) of the Hare / Tortoise mechanism.
- Take out the range fork.

1st-2nd and 3rd-4th gear forks

- Remove the selector cover plate (see chapter 5).
- Remove the right-hand hydraulic cover plate (see chapter 9).
- Remove the creeper gear fork (if fitted).
- Move the selector rail forward.
- Disassemble the hydraulic components (ram) of the Hare / Tortoise mechanism.
- Take out the range fork.
- Move the selector rail backwards.
- Take out the 1st-2nd and 3rd-4th gear forks.

Selector rail

- Remove the selector cover plate (see chapter 5).
- Remove the right-hand hydraulic cover plate (see chapter 9).
- Remove the creeper gear fork (if fitted).
- Move the selector rail forward.
- Disassemble the hydraulic components of the Hare / Tortoise mechanism.
- Take out the range fork.
- Take out the 1st-2nd and 3rd-4th gear forks.
- Move the selector rail backwards as far as it will go and disengage it through the selector cover plate opening.

Tractors with no creeper unit

The selector rail can also be removed through the front on tractors not fitted with a creeper unit. To do this it is necessary to:

- disconnect the tractor between the engine and the gearbox (see chapter 2);
- remove the gearbox spacer (only on tractors fitted with 6-cylinder engine) (see chapter 3).

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C . Creeper gear fork

Disassembly

1. Remove the rear right-hand wheel.
Chock the tractor.

2. Disconnect the creeper unit control cable on the rear axle.

3. Remove the selector cover plate (see chapter 5). Take out the plugs (1), the springs (2) and the detent plungers (3) to release the selector rail (Fig. 2).

4. Remove the hydraulic cover plate(s) (see chapter 9).

5. Remove the screw (1). Pull the rod (2) and the lever (3) outwards to release the finger of the fork (Fig. 3).

6. Unscrew the nut (26) and the locking screw (27) on the fork (28).

7. Take out the set screw (8).

8. Turn the selector rail (7) and drive out the pin (29) (Fig. 4 - Fig. 5) without dropping it into the housing.
Move the selector rail forward.

Removing the pin (1) from the coupling sleeve (2) on a 2 or 4WD tractor (steps 9 to 12)

Note: *Depending on the angular position of the coupling sleeve (2) located between the gearbox output shaft and the pinion, the pin (1) is accessible or inaccessible.*

2WD tractor

9. If the pin (1) is accessible, drive it out from the sleeve (2) (Fig. 6).

10. If the pin (1) is not accessible:
- raise the tractor rear axle using a trolley jack;
- turn the pinion to correctly position the coupling sleeve (2) (Fig. 6);
- drive out the pin (1) (Fig. 6).

4WD tractor

11. If the pin (1) is accessible, drive it out from the sleeve (2) (Fig. 6).

12. If the pin (1) is not accessible:
- disconnect the front differential lock control hoses;
- remove the guard (1). Uncouple the rear sleeve (5) from the transmission shaft (3) (Fig. 7);
- turn the pinion to correctly position the coupling sleeve (2) (Fig. 6);
- drive out the pin (1) (Fig. 6).

13. Provisionally fit the set screw (8) in order to hold the selector rail in place to remove the fork (28).

14. Slide the sleeve (2) and the coupler (1) closer together on the connecting shaft (3) (Fig. 8).

15. Note and mark the assembly order of the sleeve (2) (Fig. 8).
Disengage the sleeve/connecting shaft/coupler assembly towards the outer left-hand side.
Take it out of the fork (28) (Fig. 8) and remove it through the opening in the right-hand cover plate.

16. Remove the fork (28) on the selector rail (7) (Fig. 9).

17. Remove the lever (3) (Fig. 3).

18. To remove the creeper unit control rod (1), turn it so that it passes beneath the selector rail (7) (Fig. 10).
Discard the "O" ring (3).

Reassembly

19. Clean and check all components. Replace those that are defective.

20. Refit the control rod and pull it as far to the right as possible. Fit a new lubricated "O" ring (Fig. 11).

21. Refit the lever (3) (Fig. 12). Tighten the screw.

22. Refit the fork on the selector rail.

***IMPORTANT:** Ensure that the finger (1) of the creeper gear control rod is pointing towards the front of the tractor (Fig. 12).*

23. Couple the sleeve/connecting shaft/coupler assembly inside the housing. Place it in the fork, turning the machined groove on the sleeve (2) towards the rear of the tractor (Fig. 13).

24. Slide the sleeve and coupler onto the connecting shaft.

25. Fit a new double pin (1) into the sleeve (2) (Fig. 6).

26. Take out the set screw (8).

27. Fit a new pin (29) and turn the selector rail (7) (Fig. 4 - Fig. 5).

28. Clean the set screw (8). Smear its thread with Loctite 542 and tighten to a torque of 38 - 43 Nm.

29. Ensure that the ball bearing fitted at the end of the locking screw (27) returns correctly to its initial position after pressure has been applied manually by the locking screw. Position the fork (28) and locking screw on flat section "M" of the selector rail (7) (between the two locking slots (Fig. 2)

Fully tighten the screw without forcing it in order to compress the ball bearing.

Loosen the screw by one-quarter turn. Clean the nut (26) and smear with Loctite 270 or equivalent. Tighten to a torque of 15 - 20 while holding the locking screw in place.

Check that the fork locks correctly.

30. Turn and push the rod (2) in order to engage the finger in the fork. Fit the screw (1) smeared with Loctite 542 or equivalent (Fig. 3).

31. Check that the rod operates correctly.

32. Check that the "O" rings for the internal hydraulic pipes are not damaged (see chapter 9).

33. Refit the right-hand cover plate (see chapter 9).

34. Attach the electrical harnesses with a retainer.

35. Refit the trailer brake valve (if fitted, open centre), checking that the "O" rings are not damaged. Tighten the screws to a torque of 25-35 Nm.

36. Reconnect the pipes and hoses via the hydraulic cover plate.

37. Refit the strainer, support and filter (open centre).

38. If necessary, on 4WD tractors:

- couple the rear sleeve (5) of the transmission shaft (3) (Fig. 7);
- refit the guard (1) (Fig. 7);
- reconnect the front differential lock control hoses.

39. Refit the plugs (1), the springs (2) and the detent plungers (3) (Fig. 2). Refit the selector cover plate (see chapter 5). Reconnect and adjust the creeper unit control cable (see chapter 5).

40. Refit the wheel.

41. Remove the axle stand and the jack.

42. Tighten the wheel nuts to a torque of 400 - 450 Nm.

43. Top up the oil level in the rear axle and gearbox.

44. Start the tractor.

45. Check the correct operation of the electrical and electronic circuits. Check the tightness of the cover plate mating face and the hydraulic unions.

46. Carry out a road test of the creeper unit control and 1st, 2nd, 3rd, 4th gears of the Hare/Tortoise ranges.

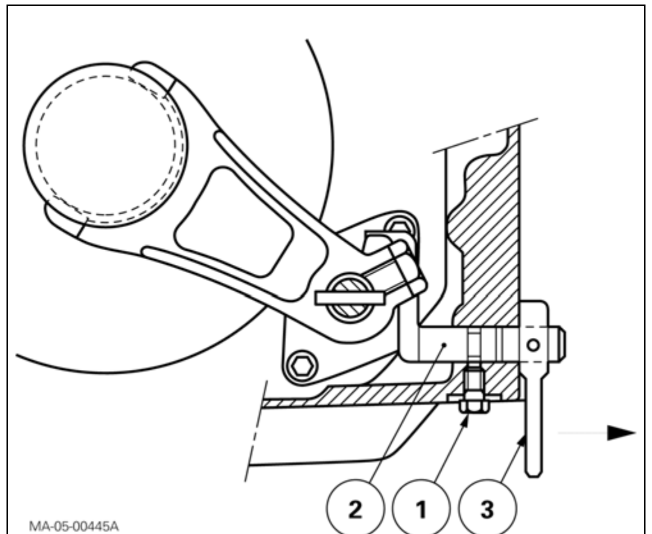

Fig. 3

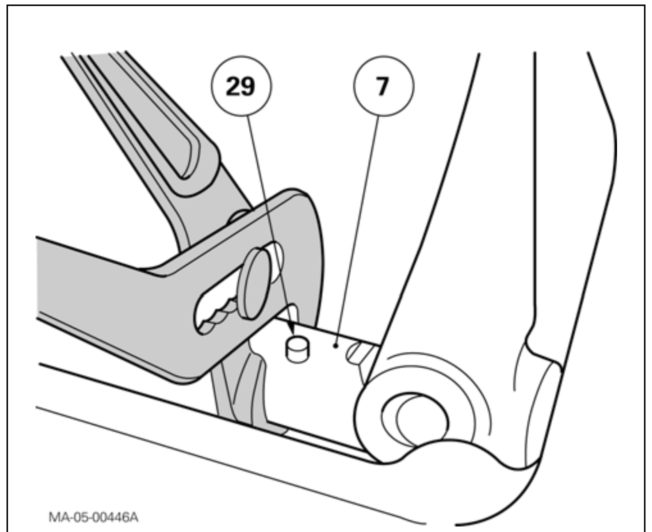

Fig. 4

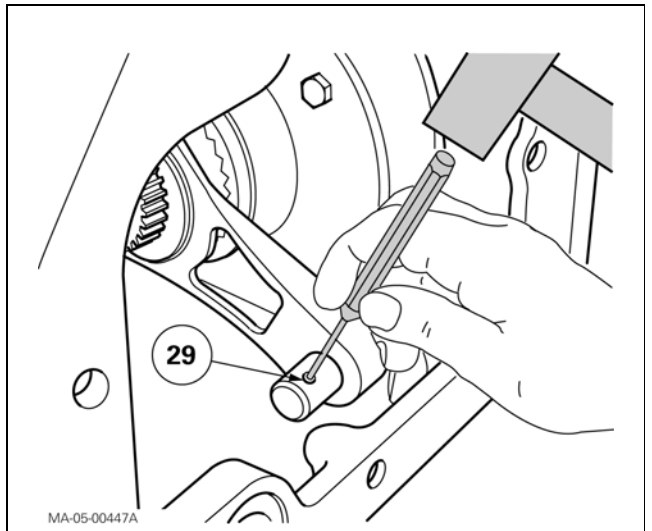

Fig. 5

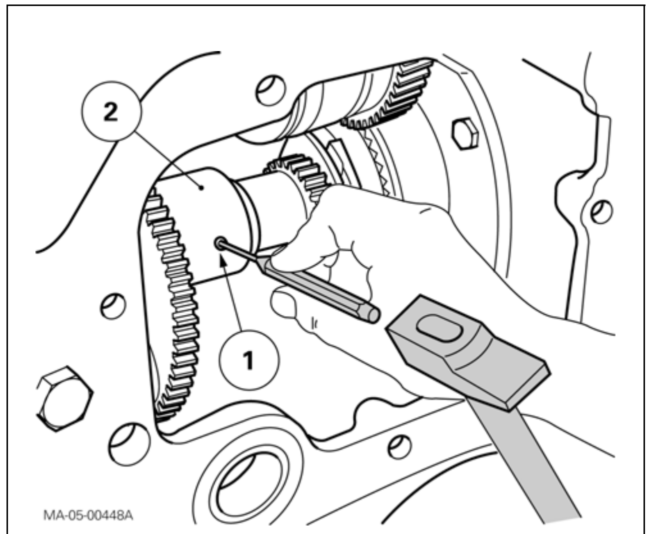

Fig. 6

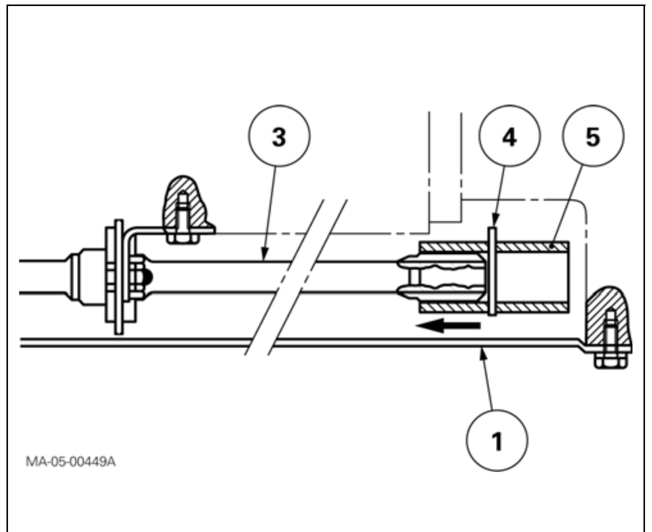

Fig. 7

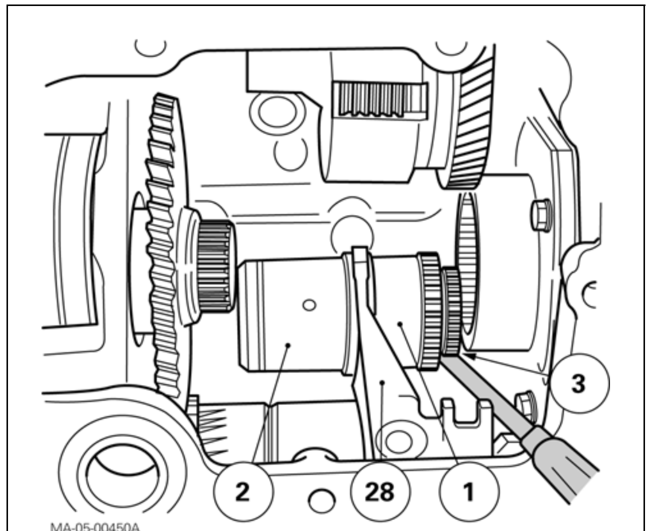

Fig. 8

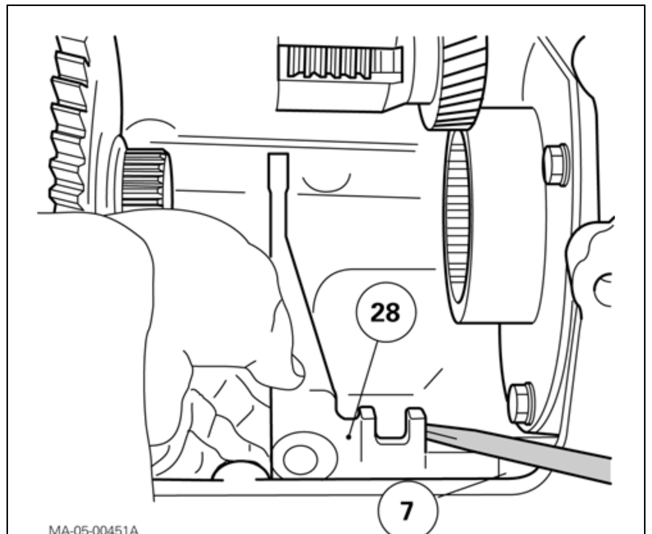

Fig. 9

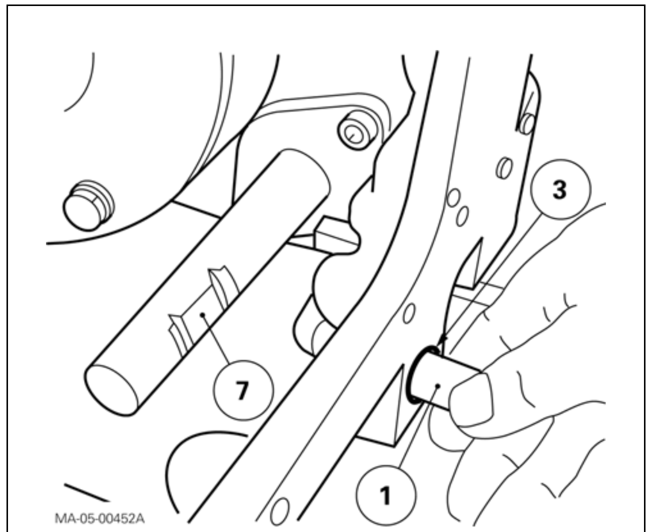

Fig. 10

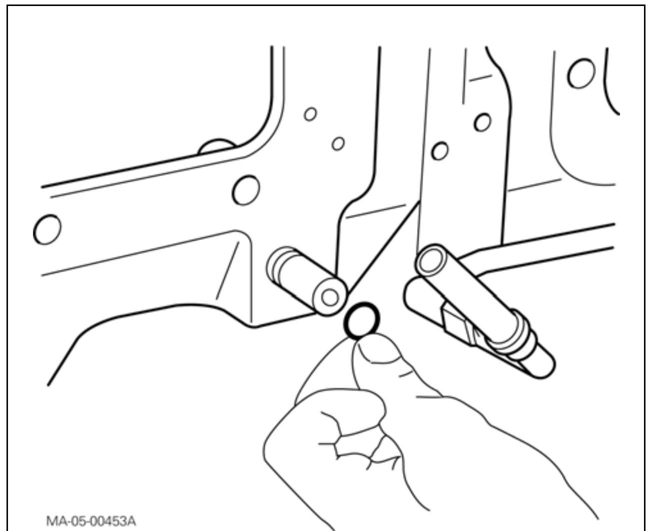

Fig. 11

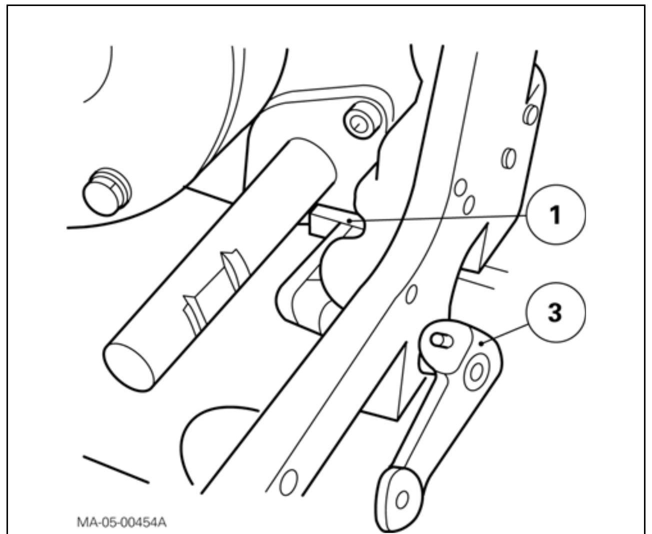

Fig. 12

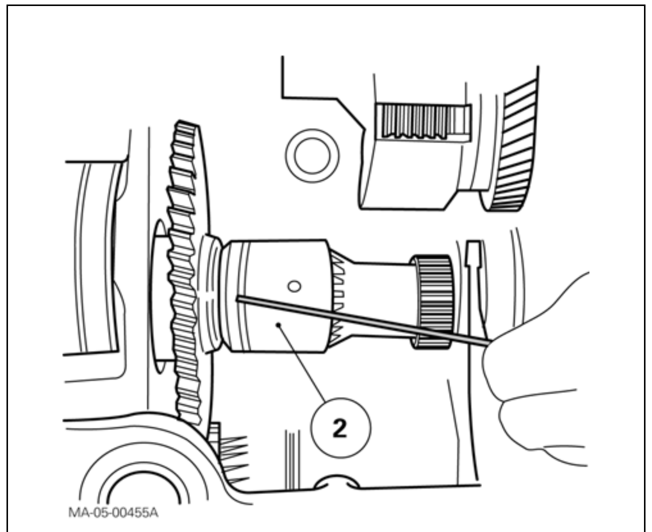

Fig. 13

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D . Hare / Tortoise fork and lock- 1st / 2nd - 3rd / 4th fork assembly and selector rail

Preliminary steps

47. Remove the right-hand rear wheel. Chock the tractor.

48. Remove the selector cover plate (see chapter 5).

Remove the right-hand hydraulic cover plate (see chapter 9).

Disassembly

49. Remove the plugs (1), the springs (2) and the detent plungers (3) (Fig. 1 and Fig. 2).

Note 1: *The detent plungers are now longer (Fig. 1 and Fig. 2). This modification improves their guiding into the forks (5) and (6) and also into the plugs (1).*

Note 2: *To optimise operation, a decompression spring on the detent plunger drives out the oil enclosed in the spring chamber (2). This design allows the plunger to enter and exit the fork more smoothly, thus improving gear shifting.*

50. Take out set screw (8) (Fig. 14).

51. Drive out the cup plug (9) forwards by striking the rear end of the selector rail (7) (Fig. 14).

52. Place the Tortoise and Hare fork (20) in the Hare position.

53. Remove the adjustment screws (19).

54. Remove the screws (16) and the cover plate (15).

55. Take out the Hare and Tortoise piston (13) and discard the seals.

56. Remove the cylinder (10) and discard the seal.

57. Turn the pump suction pipe (1) upwards (open centre).

58. Move the selector rail (7) to the rear in order to release the forks.

Slide the selector rail under the rear axle housing reinforcement (Fig. 16).

59. Take out the 1st-2nd and 3rd-4th gear forks.

60. Extract the Hare and Tortoise fork.

61. If necessary, remove the locking stop (18).

62. Take the selector rail out through the selector cover plate opening by passing it through the Hare / Tortoise cylinder bore (Fig. 17).

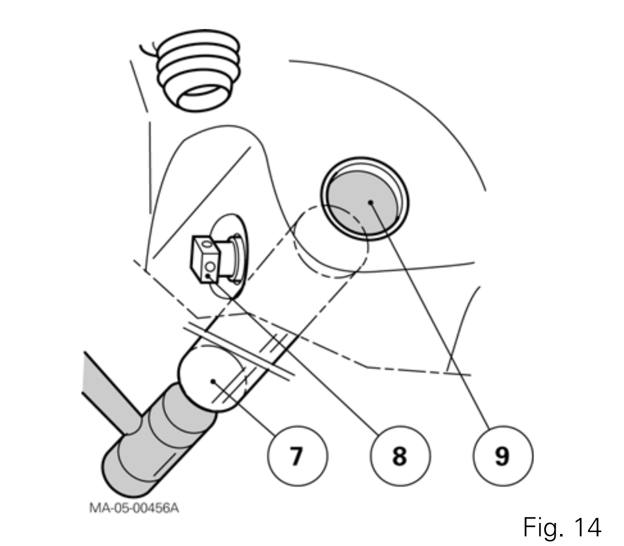


Fig. 14

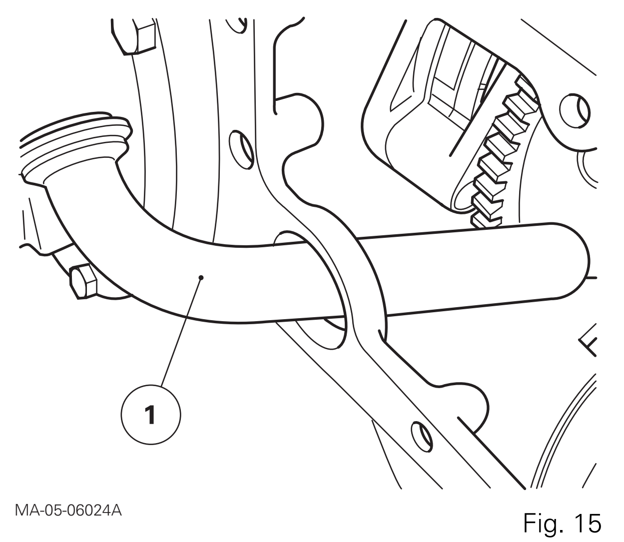


Fig. 15

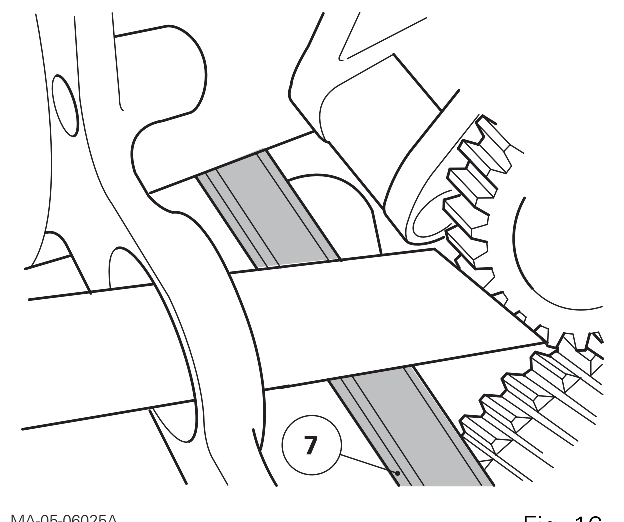


Fig. 16

Reassembly

63. Clean and check all components. Replace those that are defective.

64. Refit the selector rail through the selector cover plate opening and the Hare / Tortoise cylinder bore (Fig. 17).

Refit the forks.

65. Check that the hydraulic ports in the Hare / Tortoise cylinder (10) are not obstructed. Refit the cylinder fitted with a new "O" ring (11) (Fig. 18).

NOTE:

The cylinder (10) is held in position (Fig. 18):

- *at the front, by the shoulder machined on its outer diameter;*
- *at the rear, by the cover plate (15).*

66. Slide the selector rail forwards into the Hare / Tortoise fork and the 3rd-4th and 1st-2nd forks.

67. On the piston (13), fit the "O" rings (12) (14), and then insert the piston into the cylinder bore (10) and onto the selector rail (7) (Fig. 18).

Turn the adjustment screw holes towards the tapped holes on the fork. Temporarily lock the piston with a screw (19).

68. Fit the cover plate (15) with the screws (16). Tighten the screws to a torque of 25-35 Nm.

69. Clean the set screw (8). Smear its thread with Loctite 542 or equivalent. Tighten to a torque of 38 - 43 Nm.

70. Smear the cup plug (9) with Loctite 542 or equivalent. Fit it flush with the housing.

71. Fit the detent plungers, springs and locking plugs.

Tighten the plugs to a torque of 50 - 70 Nm.

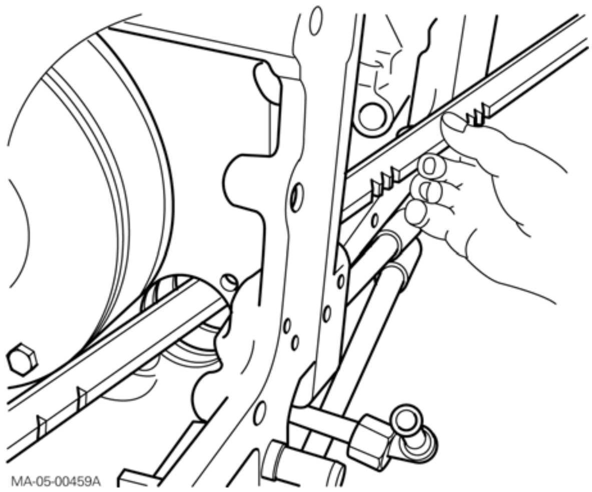


Fig. 17

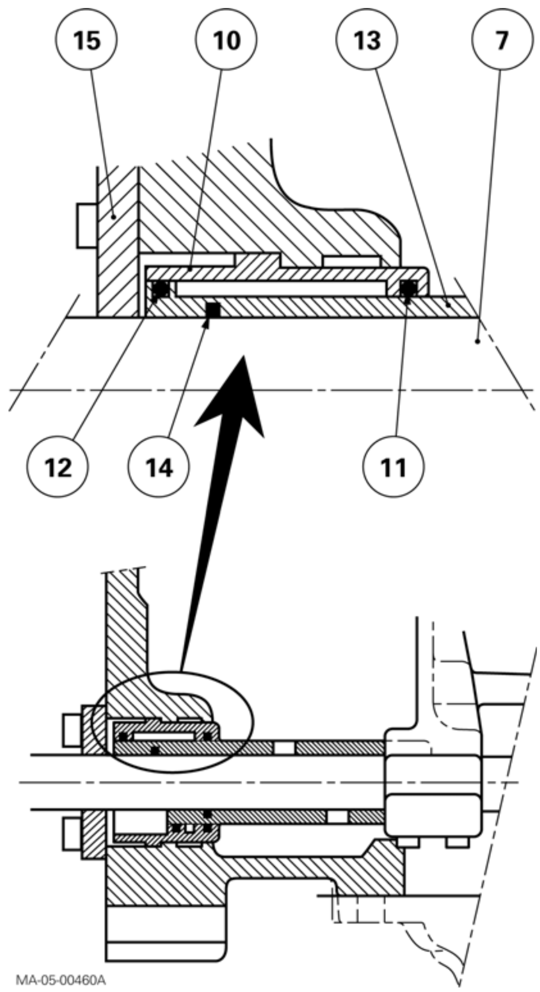


Fig. 18

Adjusting the clearance between the Hare / Tortoise fork pads and the synchroniser sliding coupler

Principle

The positioning of fork (20) is obtained by adjusting the difference in the dimension between the centre line of the tapped holes "Y" and the centre line of the indents "Z" on the piston (13).

A different fork movement is obtained either by adjusting the front screw or by adjusting the rear screw according to the adjustment required (Fig. 19).

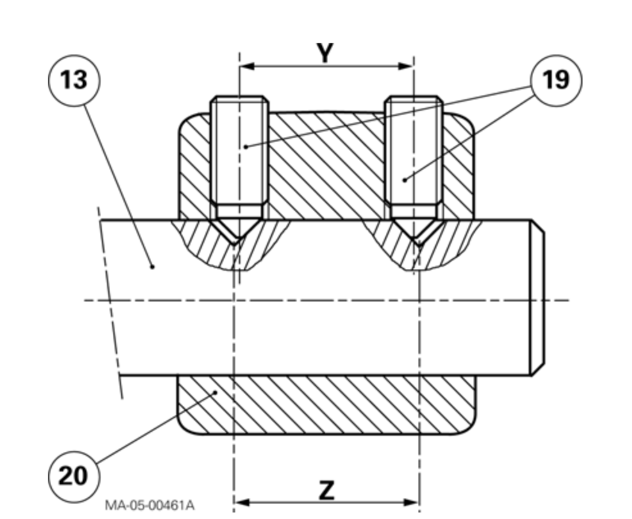


Fig. 19

Settings

72. Position the control piston (13) and the sliding coupler "C" in the high range (Hare) (Fig. 21).

73. Hold the sliding coupler manually against gear "L" of the high range (Fig. 21).

74. Adjust the position of the fork (20) using the two adjustment screws (19) previously cleaned in solvent and lightly smeared with Loctite 221 or equivalent, in order to obtain a clearance of **J1 = 0.3 mm** between the rear face of the pad and the sliding coupler (Fig. 20 - Fig. 21).

***NOTE:** For this adjustment, use the makeshift tool (see § E).*

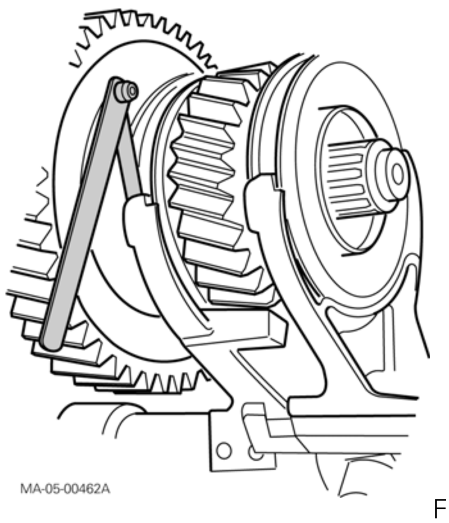


Fig. 20

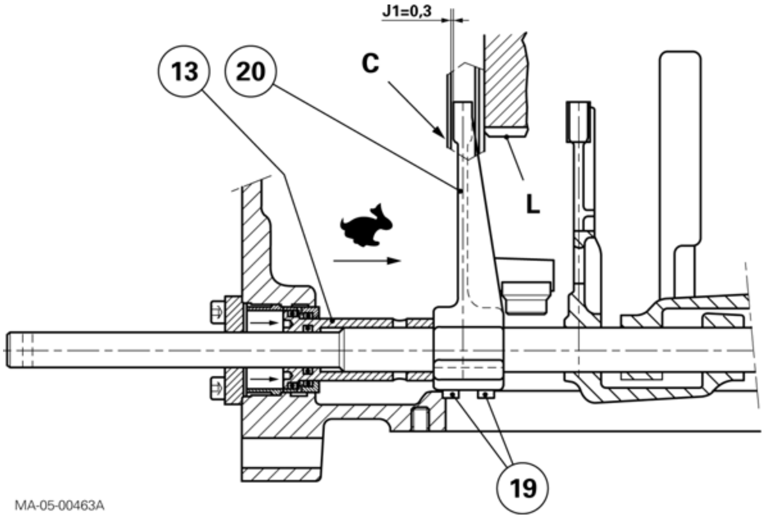


Fig. 21

75. Position the control piston (13) and the sliding coupler "C" in the low range (Tortoise) (Fig. 22).

76. Check that there is a clearance of **J2 = 0.3 minimum** (this value is determined by the clearance J1) between the pad and the sliding coupler when the latter rests against the gear "T" of the low range (Fig. 22)

Alternatively and progressively tighten the screws (19) to a torque of 25 - 35 Nm taking care not to modify the adjustment.

IMPORTANT*: In the Tortoise position, if face "X" of the fork pad (20) is driven against the sliding coupler "C", increase the clearance J1 (Fig. 21).*

77. Check that the fork operates correctly.

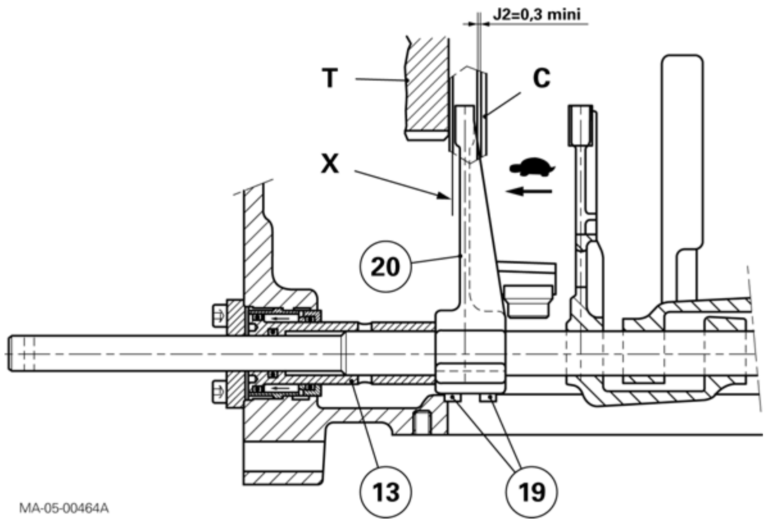


Fig. 22

Adjusting the Hare / Tortoise fork locking stop

Principle

Locking is adjusted by an adjustable stop (18) located on the Hare / Tortoise fork. This adjustment is obtained using a tool (see § E) whose role consists of conveying to the locking stop the positioning of the indexing rod, mounted on the selector cover plate.

The aim of this adjustment is to make the Hare/Tortoise mechanism safe during operation, by mechanically locking the fork in the Hare or Tortoise position.

***IMPORTANT**: Before adjusting the locking stop (18), it is essential to adjust the clearance between the Hare/Tortoise fork pads and the synchroniser sliding coupler.*

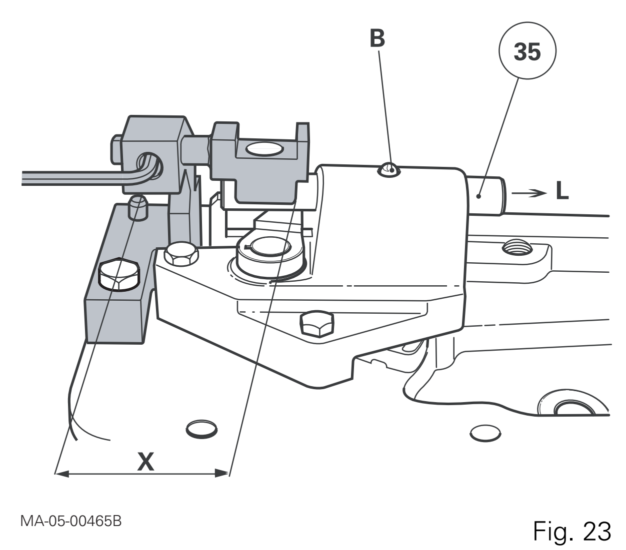


Fig. 23

On the cover plate (Fig. 25)

78. Place the indexing rod (35) in the high range position (Hare).

79. Engage the 3rd gear ratio.

80. Fit the tool on the selector cover plate (Fig. 23).

81. It is **essential** to equally distribute the clearance between the indexing rod and the plunger (31) (Fig. 25, detail A).

82. Using the tool, measure dimension X according to Fig. 23 and Fig. 25.

On the gearbox (Fig. 25)

83. Engage the 3rd ratio. Using the tool, set dimension X on the gearbox.

84. Lightly smear the mating face of the locking stop (18) on the fork with Loctite 648 or equivalent.

Apply manual pressure on the fork towards the Hare range.

85. Adjust the locking stop (18) (Fig. 24 - Fig. 25) by placing it in contact with the tool.

86. Lightly smear the thread of the screw (17) with Loctite 242 or equivalent. Tighten to a torque of 40-50 Nm.

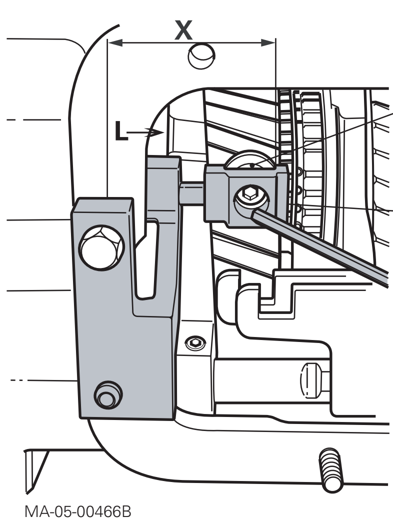
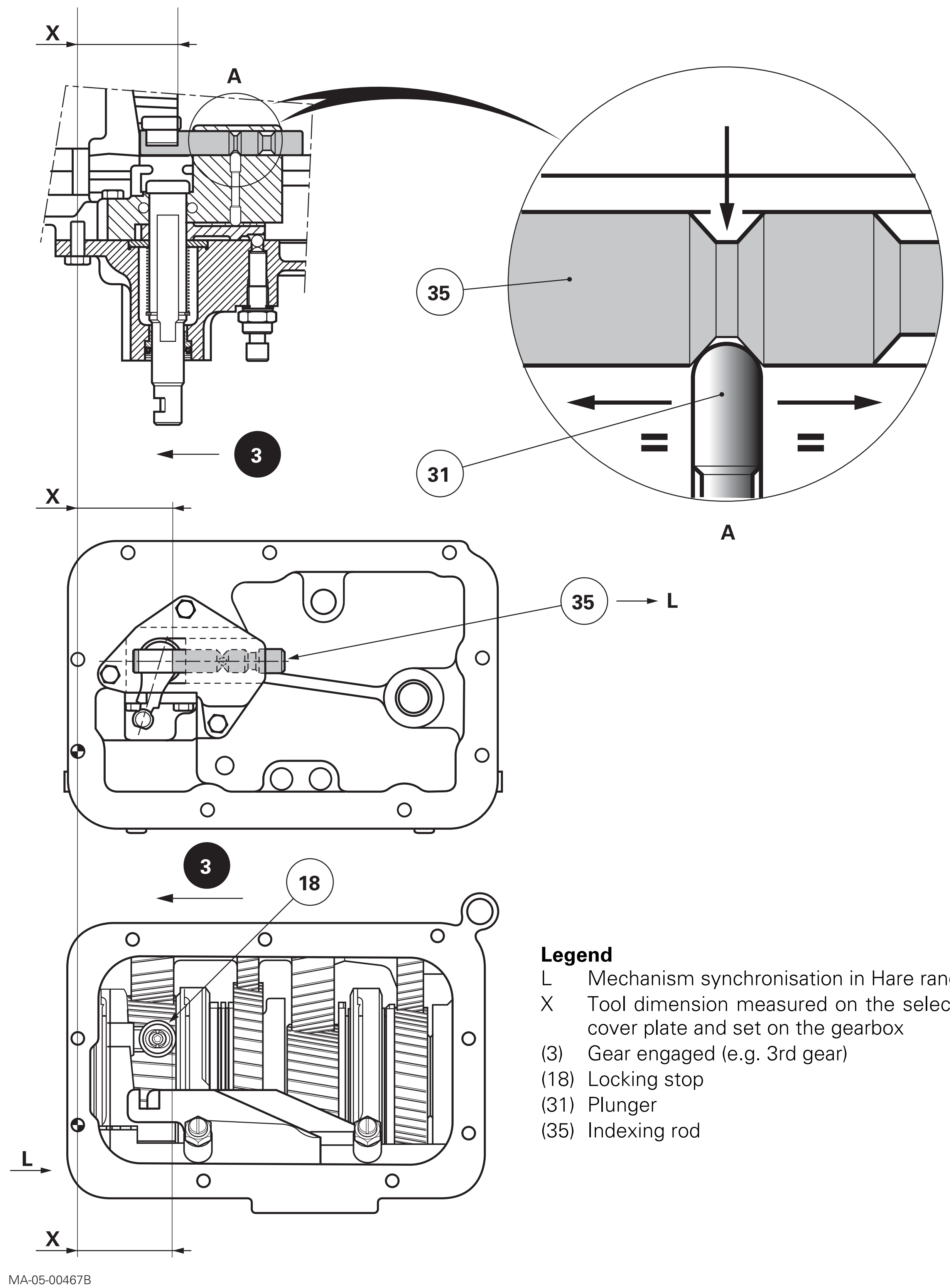


Fig. 24



Legend

L Mechanism synchronisation in Hare range
X Tool dimension measured on the selector cover plate and set on the gearbox
(3) Gear engaged (e.g. 3rd gear)
(18) Locking stop
(31) Plunger
(35) Indexing rod

Fig. 25

Check

87. Check the operation of the Hare and Tortoise ranges.

88. Check the smooth operation of all gears.

Final steps

89. Refit the right-hand hydraulic cover plate (see chapter 9).

90. Refit the selector cover plate (see chapter 5).

91. Reconnect and adjust the creeper unit control (if fitted) (see chapter 5).

92. Refit the rear wheel. Tighten the nuts to a torque of 400 - 450 Nm.

93. Top up the oil level in the housings. Check it using the gauge at the rear of the centre housing.

94. Carry out a road test.
- of gears from 1st to 4th and vice versa;
- of the Hare and Tortoise ranges;
- of the creeper unit (if fitted).

95. Check the tightness of the cover plate mating faces and the hydraulic unions.

E . Service tools

Tools available in the AGCO network

- **3378325M11:** - Hare and Tortoise fork locking stop adjustment tool (Fig. 26)

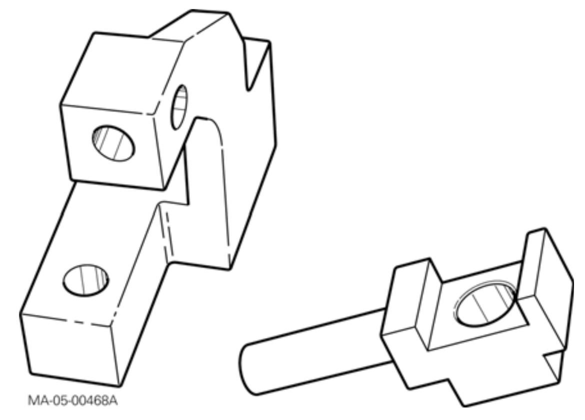


Fig. 26

Makeshift tool

- **Shim hinged on suitable fixture** (Fig. 27)

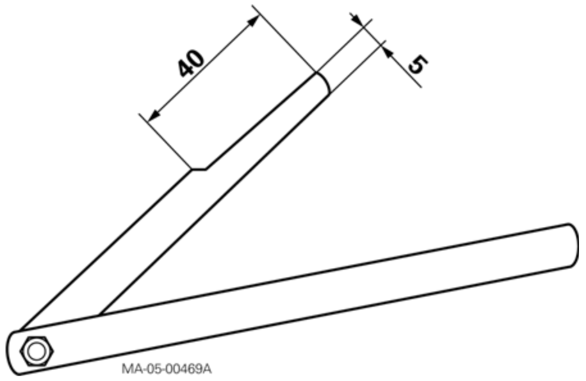


Fig. 27

5B16 - GBA20 - Power Shuttle - Output shaft

CONTENTS

A . General

The bearings (28) (30) separated by a spacer (80) rotate the driving gear (29) on the shaft. The bearings (79) (81) operate as axial stops.

A double cone synchroniser enables range shifting between gears (29) (Hare) and (36) (Tortoise).

Preloading, or the clearance between the cones (39) (40) and their respective cups (48) (37) is adjusted according to the thickness of the circlip (49).

Description

The output shaft transmits movement from the different ratios to the rear axle transfer shaft. It is fitted on the lower transmission line at the rear of the unit.

It is supported at the front by a needle roller bearing fitted in the layshaft bore and at the rear by two opposing tapered roller bearings.

The shaft (44) supports:
- the driving gear (29) fitted idle onto the combined bearings (28) (30);
- the idle-fitted gear (36) and ring (35) assembly;
- the Hare/Tortoise synchroniser (31), integral rotation by splines.

To ensure correct operation of the assembly depending on the load applied to the transmission, several adjustments are required:
- **Shimming J3:** via the circlip (49), this shimming cancels out the clearance between the cones (39) (40) and their respective cup.
- **Shimming J4**: the shim(s) (38) positioned between the shoulder of the shaft (44) and the cone (39) provide axial clearance for the gear (29).
- **Shimming J5:** the shim(s) (42) fitted between the cone (40) and the shim (43) cancel out the axial clearance of the cones (39) (40) on the shaft (44).

***Note:** The GBA20 gearbox output shaft without creeper gears may be replaced by two other shafts relating to the following options respectively: creeper unit or super creeper unit.*

Parts list (Fig. 1)

(21) Synchroniser cone (Hare)
(22) Synchroniser cone (Tortoise)
(24) Needle roller bearing
(27) Thrust washer
(28) Needle roller bearing
(29) 3rd driving gear (Hare)
(30) Needle roller bearing
(31) Hare / Tortoise double cone synchroniser
(32) Thrust washer
(35) Ring
(36) Tortoise gear
(37) Bearing cup
(38) Shim(s)
(39) Bearing cone
(40) Bearing cone
(41) Screw
(42) Shim(s)
(43) Shim
(44) Output shaft
(45) Circlip
(46) Stop plate
(48) Bearing cup
(49) Circlip
(79) Needle roller bearing
(80) Spacer
(81) Needle roller bearing

View of the assembly

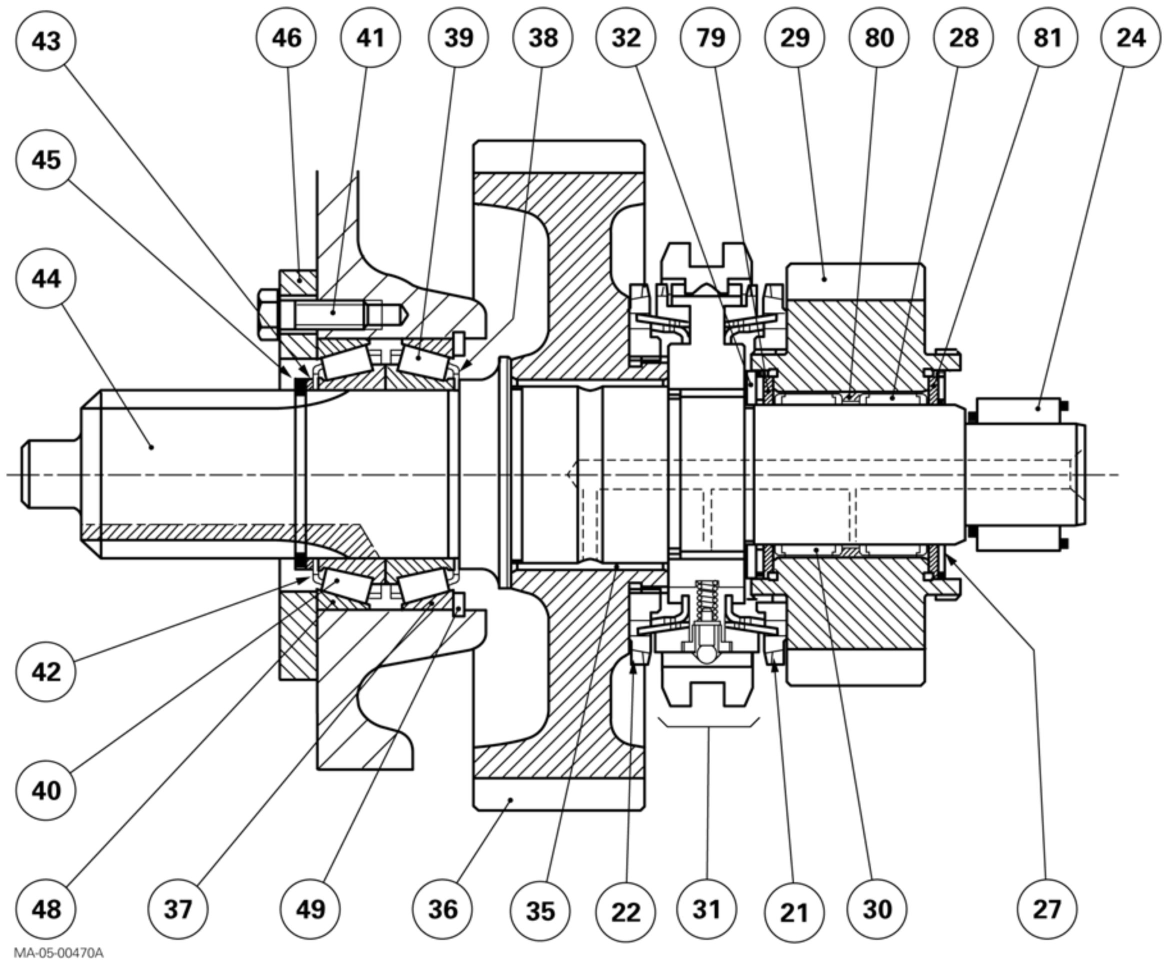


Fig. 1

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Parts list (Fig. 2)

(21) Synchroniser cone (Hare)
(22) Synchroniser cone (Tortoise)
(24) Needle roller bearing
(27) Thrust washer
(28) Needle roller bearing
(29) 3rd driving gear (Hare)
(30) Needle roller bearing
(31) Hare / Tortoise double cone synchroniser
(32) Thrust washer
(35) Ring
(36) Tortoise gear
(37) Bearing cup
(38) Shim(s)
(39) Bearing cone
(40) Bearing cone
(41) Screw
(42) Shim(s)
(43) Shim
(44) Output shaft
(45) Circlip
(46) Stop plate
(48) Bearing cup
(49) Circlip
(79) Needle roller bearing
(80) Spacer
(81) Needle roller bearing

Blown-up view

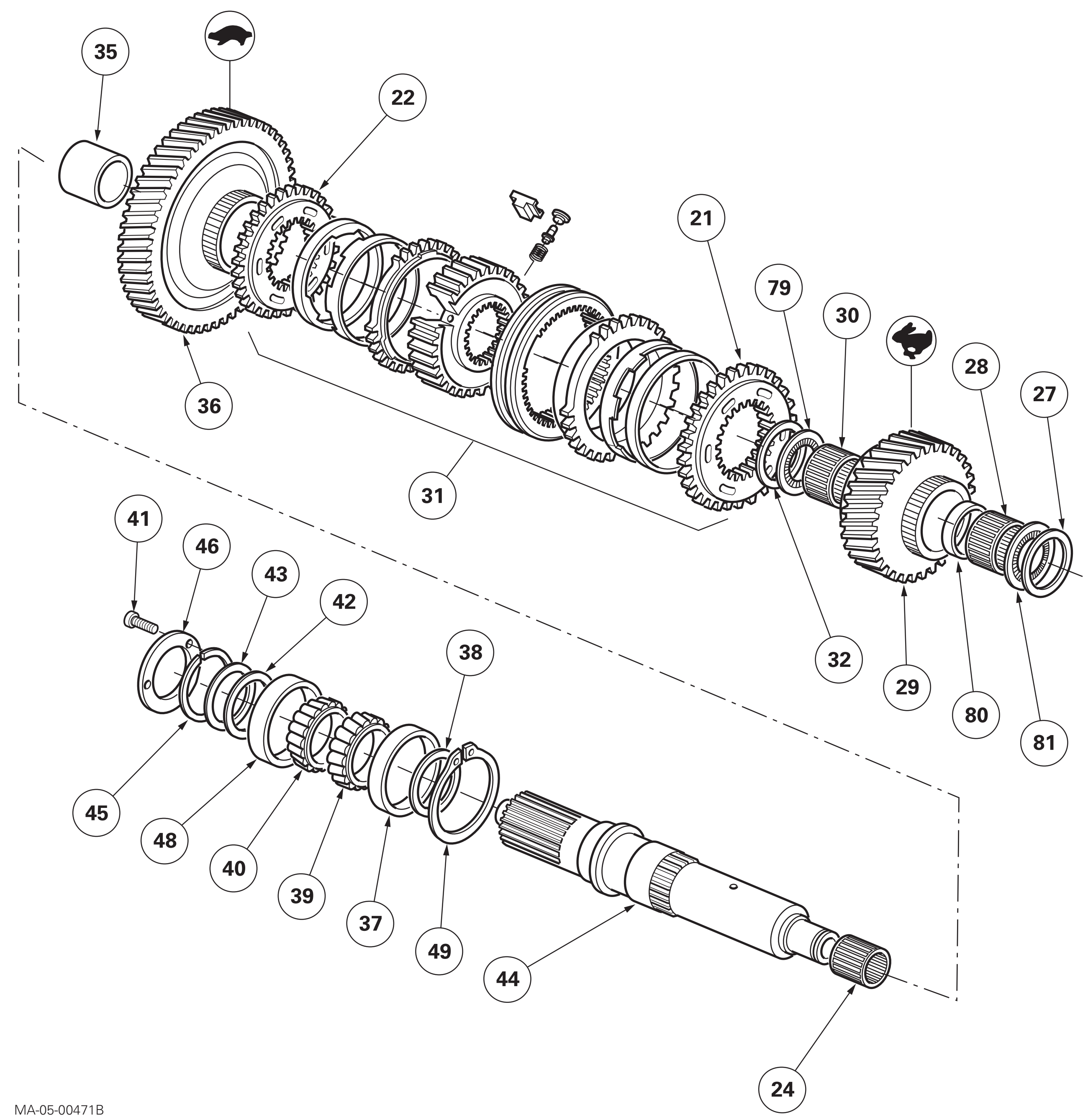

Fig. 2

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B . Preliminary steps

1. Disconnect the tractor between the gearbox and the rear axle (see chapter 2).

2. Remove the selector cover plate (see chapter 5).

3. If necessary, remove the screw (1) (Fig. 11).

C . Disassembling and reassembling the selector rail and the forks

NOTE: *The tractor is disconnected. Consequently, selector rail removal is made easier by this separation which is to be made from the rear side of the gearbox housing. Apart from this point, the procedure remains unchanged.*

Disassembly

4. If the tractor is fitted with a creeper unit, remove the pin (1), the counter-nut (2), the adjustable lock (3), and the fork (4) with the sleeve (5) (Fig. 3).

If the tractor is fitted with a super-creeper unit, the fork and its lock are removed as described above, except for the absence of the pin (1).

5. Remove the selector rail and the forks (see chapter 5).

Reassembly

6. Clean and check all components. Replace those that are defective.

7. Refit the selector rail and the forks (see chapter 5).

8. Depending on the equipment, refit the sleeve (5), fork (4), adjustable lock (3) and pin (1) (Fig. 3).

To adjust the fork, see chapter 5.

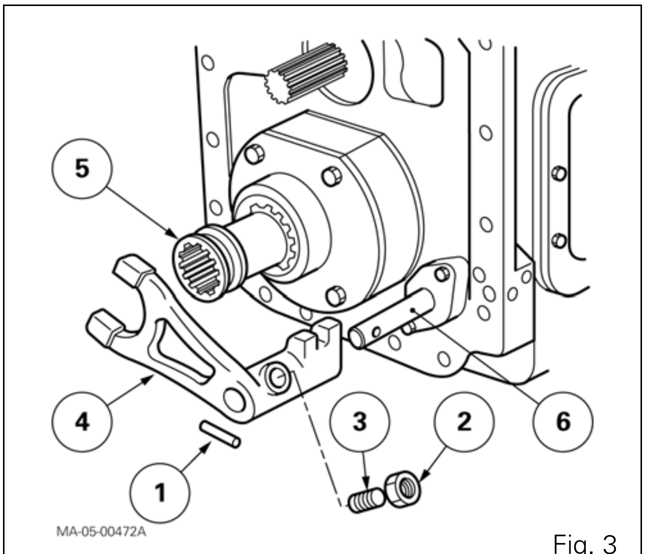

Fig. 3

D . Disassembling, reassembling and shimming the shaft

9. If the tractor is fitted with a creeper unit or super-creeper unit, remove the unit (see chapter 5).

Disassembly

IMPORTANT: *The bearing cones and cups are to be paired if reused.*

10. Remove the screws (41).
11. Remove the stop plate (46).
12. Remove the bearing cup (48).
13. Remove the circlip (45).
14. Remove the shim (43) and the shims (42).
15. Remove the bearing cones (40) (39).
16. Remove the shims (38) and the cup (37).
17. Remove the circlip (49).
18. Pull and remove the shaft (44) backwards while holding the gear assembly.
19. Through the selector cover plate opening, take out:
- the synchroniser (31);
- the Hare / Tortoise synchroniser rings;
- the gear assembly (29) and needle roller bearings (28) (30);
- the 3rd synchroniser ring;
- the two needle roller bearings (79) (81);
- the thrust washers (27) (32).

20. If necessary, remove the Tortoise gear (36).
NOTE: *If work is necessary on this gear, first remove the input unit (see chapter 5) in order to lift the gearbox intermediate shaft to take out the gear concerned through the selector cover plate opening.*

21. Remove the needle roller bearing (24), while marking the assembly direction.

Reassembly

22. Check and clean all components. Replace those that are defective.
23. Position the needle roller bearing (24) in the bore of the layshaft "R", taking care to position the smaller diameter of the flexible ring towards the 3rd driving gear (Hare) (29) (Fig. 4).
24. Fit the shaft in the housing without the gears.
25. Fit a temporary circlip (49), minimum thickness.
26. Position the cup (37).

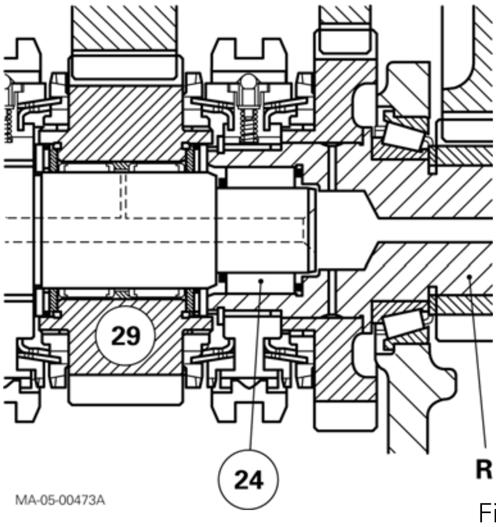

Fig. 4

Preparation for J3 shimming (Fig. 5)

27. Slide cones (39) (40) and hold them against the shoulder of shaft (44) by applying pressure by hand. Fill space Y between the rear of cone (40) and the groove of circlip (45) with shims (42) and shim (43) which will be placed against circlip (45). Take a new circlip. The circlip must be held closed in the groove under a slight pressure (Fig. 6).
28. Fit the cup (48) and the stop plate (46). Tighten screws (41) to a torque of 25 - 35 Nm.

***Important:** For gearboxes fitted with a creeper unit, use the unit plate (1) (Fig. 9) to replace the stop plate (46) (Fig. 8). Tighten the screws to a torque of 33.8 - 51.5 Nm.*

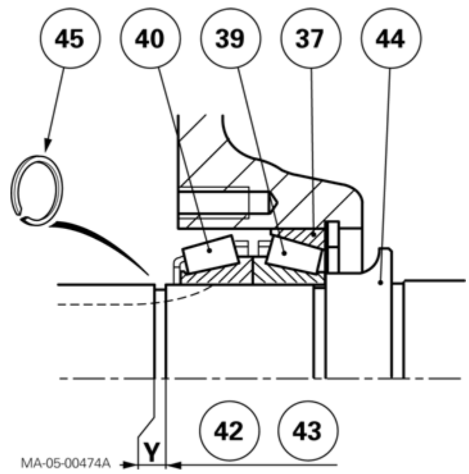

Fig. 5

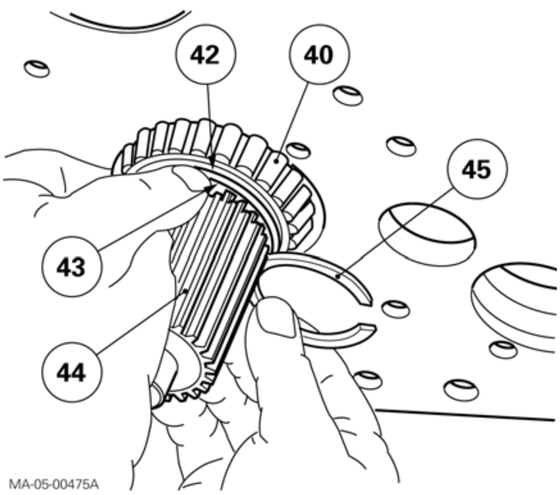

Fig. 6

J3 shimming (Fig. 7)

29. Put the dial gauge feeler pin against the end of the shaft (44) (Fig. 8 or Fig. 9).

30. Push the shaft, while turning it alternately from right to left to correctly "seat" the cones in the cups.

31. Set the dial gauge to zero.

32. Repeat step 30, this time pulling.

33. If the axial clearance is greater than 0.05 mm, set a definitive thickness of the circlip (49), to be fitted later during step 42, to obtain **J3 = -0.05 to +0.05 mm.**

34. Remove the circlip (45).

35. Remove the shim (43) and the shims (42).

36. Remove the screws (41) and the stop plate (46).

37. Remove:

- the cup (48);
- the bearing cones (40) (39), pairing them with their cups;
- the cup (37);
- the temporary circlip (49) fitted during step 25;
- the shaft (44).

Assembling the gears and the shaft

38. On a workbench, pre-assemble the 3rd driving gear (29) with the 3rd gear and synchroniser (21) rings, the bearings (79) (81), the washers (27) (32) and the synchroniser (31).

39. If removed, position the Tortoise gear (36) with its synchroniser ring (22) into the housing.

***IMPORTANT**: If the ring (35) of the Tortoise gear (36) is damaged, replace the gear assembly (the ring is rebored after fitting).*

Refit the input unit (see chapter 5).

40. In the housing, continue to fit:

- the 3rd driving gear (29) fitted with the needle roller bearings (28) (30) (recess "R" facing towards the 3rd-4th synchroniser (Fig. 10));
- the synchroniser (31).

***REMINDER:** The needle roller bearings (28) (30) are force-fitted and are separated by a spacer (80).*

41. Fit the output shaft (44) while holding the gear assembly (Fig. 11).

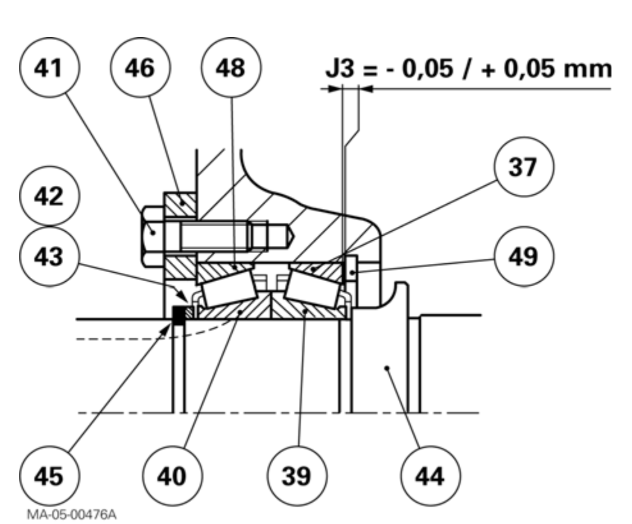

Fig. 7

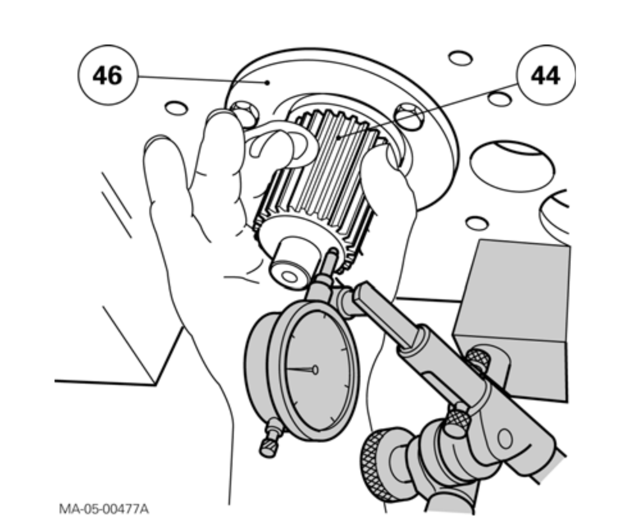

Fig. 8

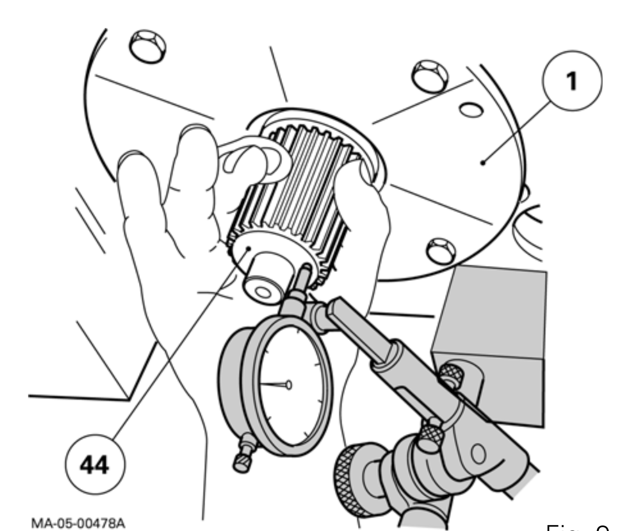

Fig. 9

J4 shimming (Fig. 12)

42. Fit the circlip (49) defined during step 33. Slide the cones and cups paired during step 37 onto the shaft.

43. Fit the stop plate (46). Tighten screws (41) to a torque of 25 - 35 Nm.

__Important:__ For gearboxes fitted with a creeper unit, use the unit plate (1) (Fig. 9) to replace the stop plate (46) (Fig. 8). Tighten the screws to a torque of 33.8 - 51.5 Nm.

44. Put the dial gauge feeler pin against the end of the shaft (44) (Fig. 8 or Fig. 9).

45. Push the shaft, while turning it alternately from right to left to correctly "seat" the cones in the cups.

46. Set the dial gauge to zero.

47. Repeat operation 45 this time by pulling.

Depending on the value read on the dial gauge, determine the thickness of shims Z (38) to obtain: **J4 = 0.20 to 0.40 mm** (Fig. 12)

48. Remove the screws (41) and the stop plate (46).

49. Remove the cup (48).

50. Remove cones (40) (39).

51. Slide the required thickness of shims Z (38), and cones (39) (40) onto the shaft.

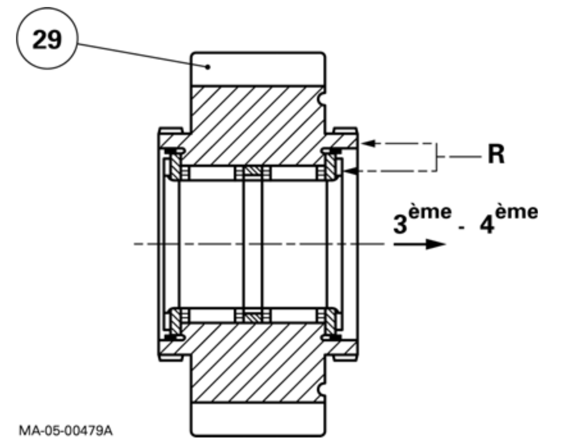

Fig. 10

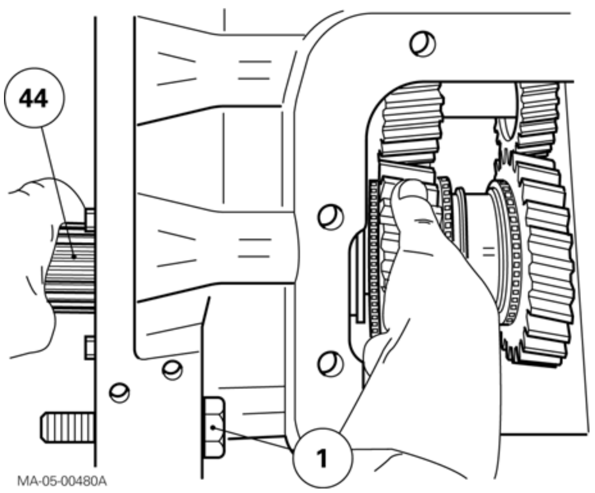

Fig. 11

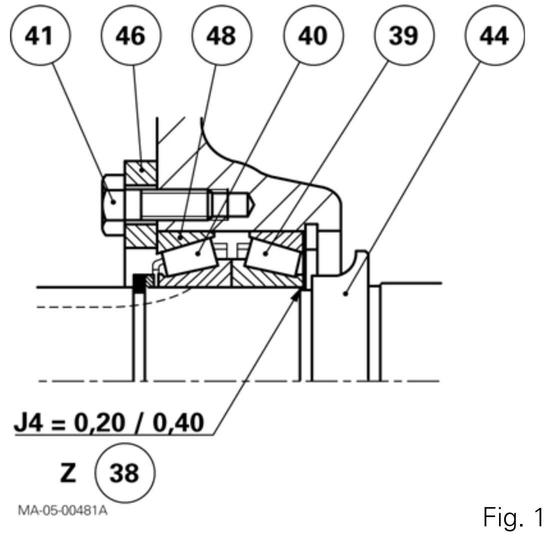

Fig. 12

GBA20 - Power Shuttle - Output shaft

J5 shimming (Fig. 13)

52. Carry out shimming to obtain the clearance **J5 = 0**.

53. Using the thickness of shims Y (42) (43), defined during step 27, determine the thickness of shims Z (38) to obtain the clearance **J5 = Y - Z**.

54. Fit the cup (48) and the stop plate (46). Tighten screws (41) to a torque of 25 - 35 Nm.

55. Slide the thickness of shims selected during step 53 onto the shaft.

56. Position the shim (43) on the circlip groove side.

Position the circlip (45): it must be held closed in the groove under slight pressure. Check that it is correctly positioned.

57. Refit the creeper or super creeper gearbox (depending on option).

58. Manually check the rotation of the shaft and its gears.

59. Refit the forks and the selector rail (see §C).

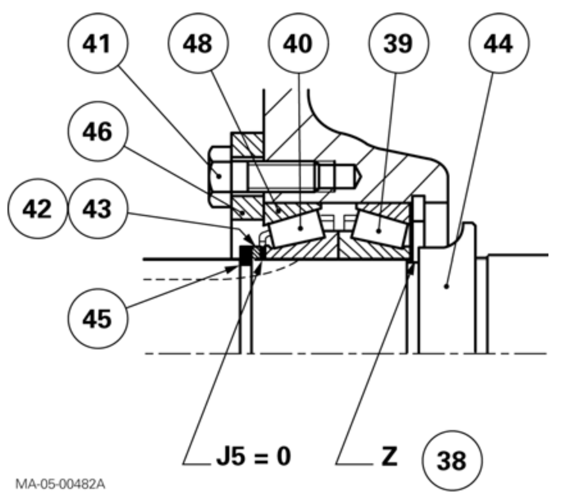

Fig. 13

E . Final steps

60. Refit the selector cover plate (see chapter 5), by first checking for the presence of the screw (1) (Fig. 11).

61. Reconnect the tractor between the gearbox and the rear axle (see chapter 2).

62. Check:
- the tightness of the systems;
- correct operation of electrical circuits.

63. Carry out a road test of the controls

64. Check the tightness of the mating faces (selector cover plate, gearbox on rear axle).

5B17 - GBA20 - Power Shuttle - Layshaft

CONTENTS

A . General

The layshaft (69) is mounted on two tapered roller bearings (1) (17) with cups (2) (16), resting in the two lower bearings of the main gearbox. Each cup has a root face giving it optimum contact with the housing.

At the front it receives the input gear (67).

Between the two lower bearings, it supports the 1st (7) and the 2nd (14) idle mounted driving gears, as well as the 1st and 2nd gear synchroniser assembly (11), the hub of which is splined. At the rear, it holds the 4th driving gear (18) and the 3rd and 4th gear synchroniser assembly (23).

The 1st, 2nd (11) and 3rd, 4th (23) synchronisers are of the double cone type.

The rear bore contains a needle roller bearing that holds the front end of the output shaft. The turning parts are lubricated by a central channel and radial bores.

The tapered roller bearings are fitted with preload obtained by shim(s) (3) inserted between the splined washers (6) positioned against the input gear (67) and the ring (8). A washer (77) with flat sections acts as a stop for the 1st driving gear (7).

Parts list (Fig. 1)

(1) Bearing cone
(2) Bearing cup
(3) Shim(s)
(6) Splined washers
(7) 1st driving gear
(8) Ring
(11) 1st, 2nd double cone synchroniser
(14) 2nd driving gear
(16) Bearing cup
(17) Bearing cone
(18) 4th driving gear
(23) 3rd, 4th double cone synchroniser
(26) Circlip
(33) 4th synchroniser cone
(47) 3rd synchroniser cone
(67) Input gear
(68) Nut
(69) Layshaft
(70) Snap ring
(71) Lubrication pipe
(72) Spring
(73) 1st synchroniser cone
(74) 2nd synchroniser cone
(77) Washer with flat sections
(78) Tab washer

View of the assembly

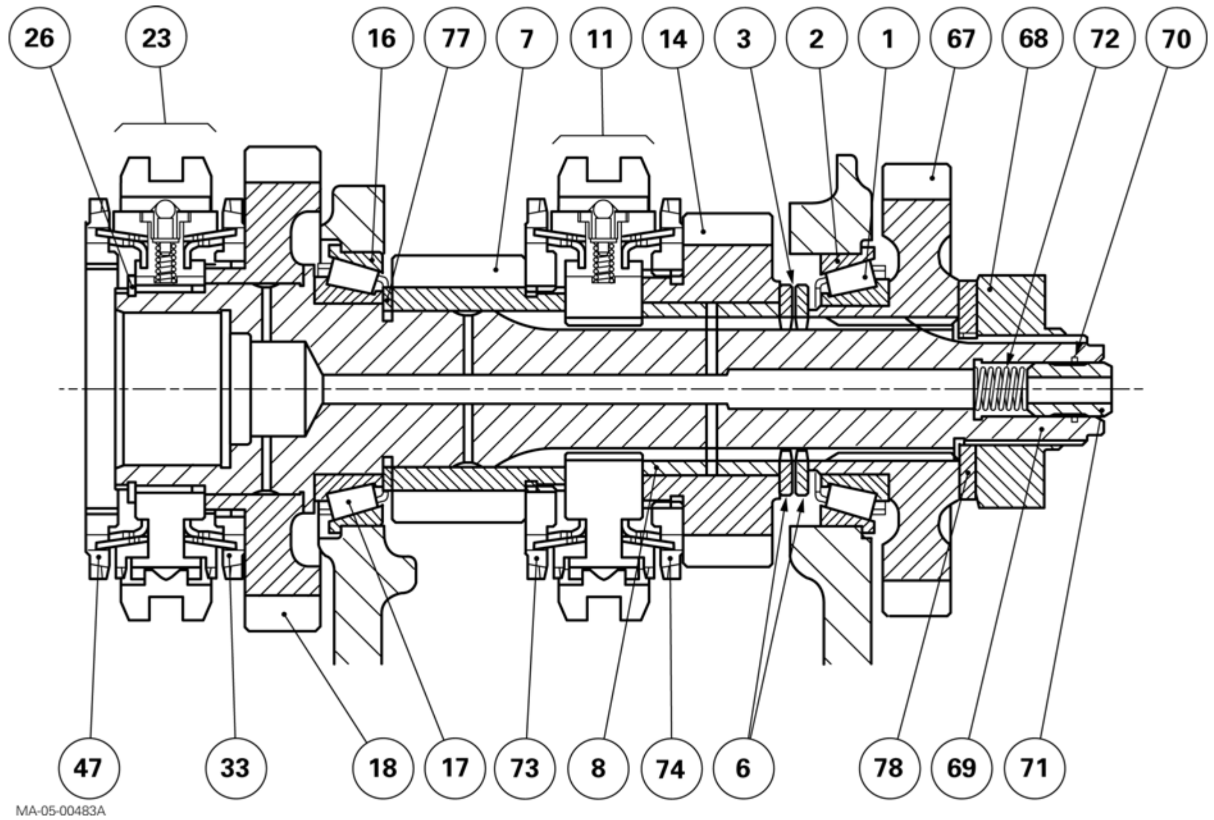

Fig. 1

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Parts list (Fig. 2)

(1) Bearing cone
(2) Bearing cup
(3) Shim(s)
(6) Splined washers
(7) 1st driving gear
(8) Ring
(11) 1st, 2nd double cone synchroniser
(14) 2nd driving gear
(16) Bearing cup
(17) Bearing cone
(18) 4th driving gear
(23) 3rd, 4th double cone synchroniser
(26) Circlip
(33) 4th synchroniser cone
(47) 3rd synchroniser cone
(67) Input gear
(68) Nut
(69) Layshaft
(70) Snap ring
(71) Lubrication pipe
(72) Spring
(73) 1st synchroniser cone
(74) 2nd synchroniser cone
(77) Washer with flat sections
(78) Tab washer

Blown-up view

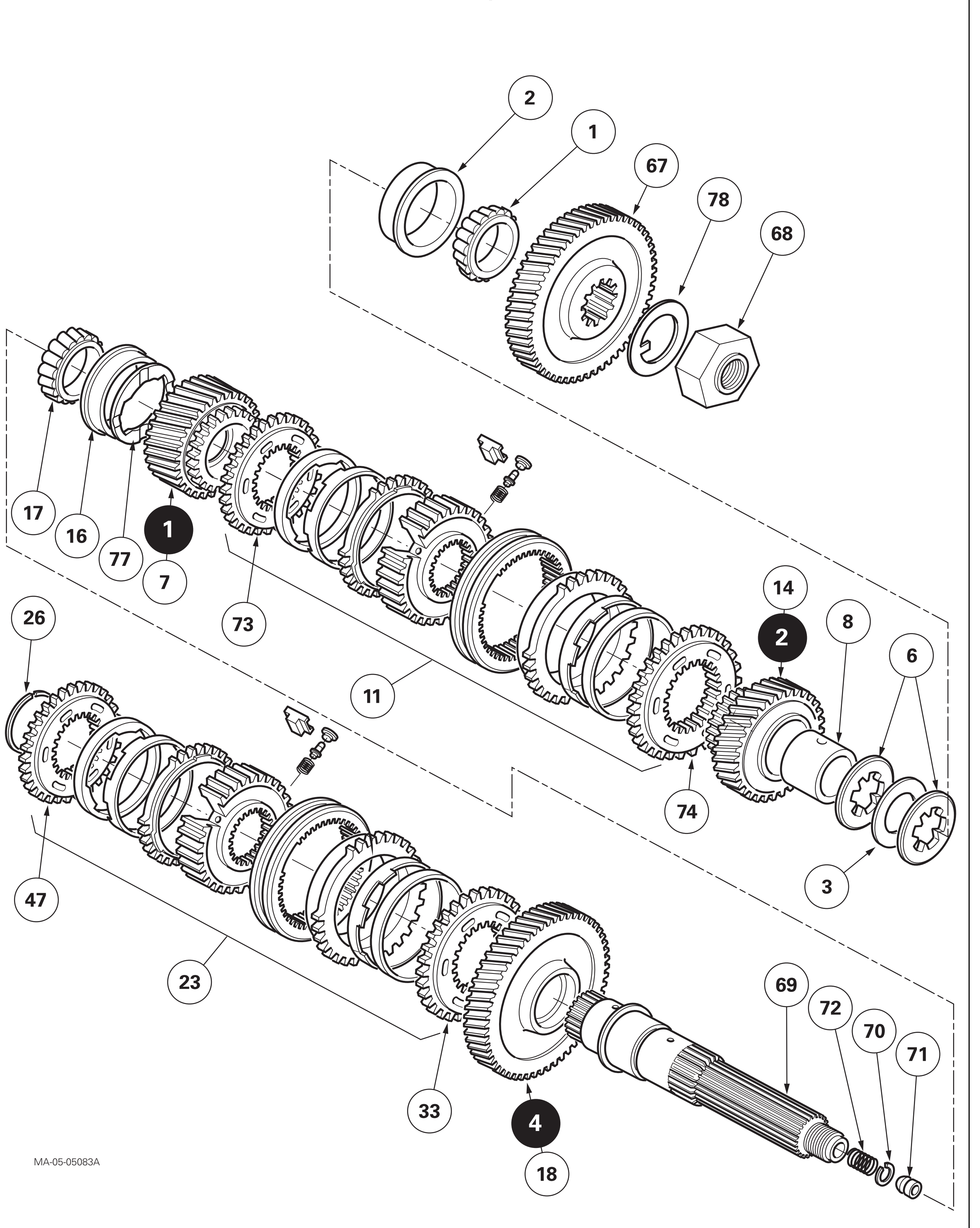

Fig. 2

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B . Preliminary steps

1. Split the tractor between the gearbox and the rear axle (see chapter 2).
2. Split the gearbox from the engine (see chapter 2).
3. Remove the selector cover plate (see chapter 5).
4. Remove the input unit assembly (see chapter 5).
5. Remove the intermediate shaft (see chapter 5).
6. Remove the selector rail and the forks (see chapter 5).
   Remove the output shaft (see chapter 5).
7. Remove the layshaft.

C . Disassembling and reassembling the shaft

Disassembly

***NOTE:** If work is only carried out on the drive gear (67), hold the gear and 1st, 2nd synchroniser assembly in position using a screwdriver so as not to displace the washer with flat sections (77).*

8. Remove the circlip (26).

9. Remove the 3rd, 4th synchroniser (23) and the cones (33) and (47). Mark the assembly order.
Remove the 4th gear (18).

10. Position locking tool 3378082M1 (Fig. 3) and the makeshift supporting sleeve for the shaft (69) (Fig. 4) (see § E).

11. Remove the lubrication pipe (71) and the spring (72).

12. Unlock the nut (68) and loosen it using socket 3378010M1 (Fig. 5 and § E).

13. Remove the input gear (67) with the cone (1).

14. Remove the washers (6) and the shim(s) (3).

15. Remove the tool and sleeve (Fig. 3 - Fig. 4).

16. Take the shaft out through the rear of the housing, while supporting the 1st, 2nd gear assembly.

17. Remove the 1st, 2nd gear assembly and the synchroniser (11) with the ring (8). Remove the cups (16) and (2).

***NOTE:** Pair up the cups and the cones if they are to be reused.*

18. If the input gear (67), the shaft (69) or the tapered roller bearings (1) (2) and (16) (17) are to be replaced:
- remove the washer with flat sections (77);
- extract the bearings cones (1) and (17);
- remove snap ring (70).

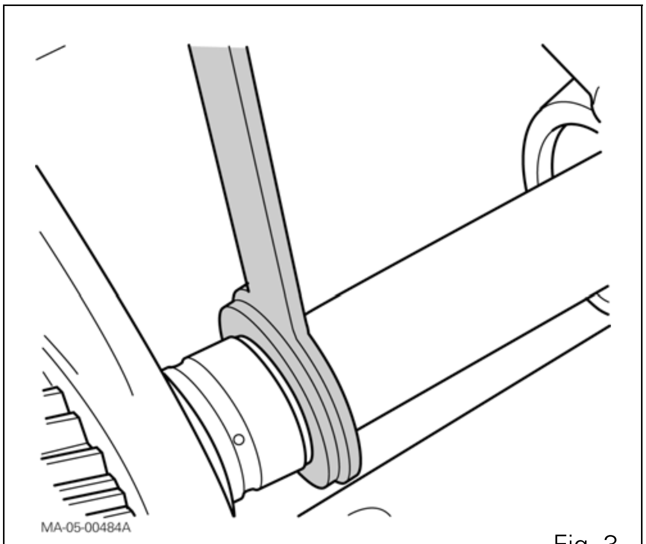


Fig. 3

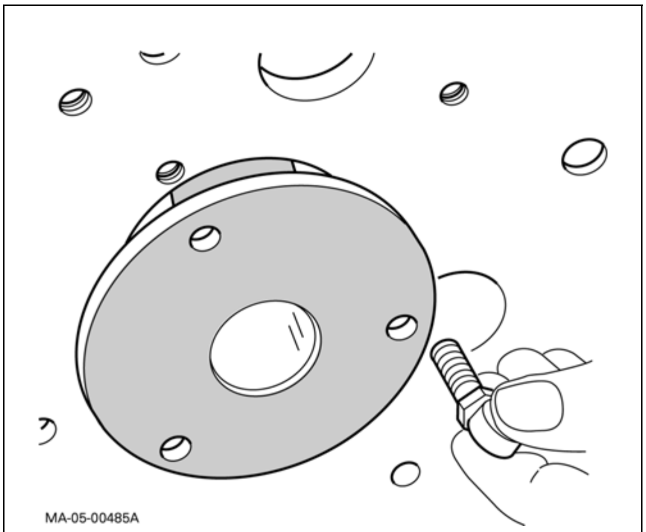


Fig. 4

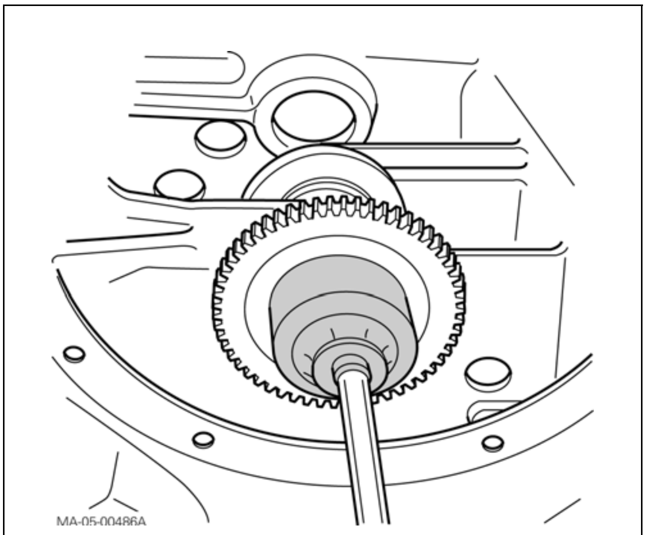


Fig. 5

Reassembly

19. Clean the housing and the mating faces.
20. With a jet of compressed air, check that no channels in the gearbox or in the shaft are blocked.
21. Clean and check all components. Replace those that are defective.
22. Lubricate the cones, cups, bearing bores and the ring.
23. If removed:
- fit the bearing cone (17) onto the shaft (69) using a press and a suitable fixture;
- refit the washer with flat sections (77), with the lubricating grooves facing towards the 1st gear (7);
- refit the snap ring (70).

24. Assemble the cups (2) and (16) inside the housing.
25. Refit the 1st, 2nd gear assembly, the synchroniser (11), the cones (73) (74) and the ring (8) into the housing.
26. Fit the shaft from the rear of the housing while supporting the gear/synchroniser assembly (Fig. 6), and ensuring that the ring (8) is correctly fitted in the gear (14).
27. Fit the locking tool 3378082M1 (see § E) and the makeshift supporting sleeve (Fig. 3 - Fig. 4).
28. If it has been removed, fit the cone (1) onto the gear (67), using a press and a suitable fixture.
29. Fit the washers (6) separated by a number of shims (3) sufficiently thick to obtain a temporary clearance of **0.10 to 0.15 mm** approx. in preparation for shimming with preload (see later).
30. Fit the gear (67) onto the shaft (69).
31. Fit the nut (68) using socket 3378010M1 and tighten to 130 - 170 Nm (Fig. 5).
32. Remove the tool and sleeve (Fig. 3 - Fig. 4).
33. Shim the shaft.
34. Place the dial gauge feeler pin at the end of the shaft (Fig. 7).
35. From the front of the housing, pull hard on the shaft, turning alternately from left to right to correctly seat the cones in their bearing cups.
36. Set the dial gauge to zero.
37. Repeat step 35, this time pushing.
38. Depending on the clearance measured, select the thickness of final shims required to obtain a preload of **P1 = 0.14 to 0.20 mm.** If possible, shim to the maximum tolerance.
39. Fit the locking tool and the supporting sleeve (Fig. 3 - Fig. 4).

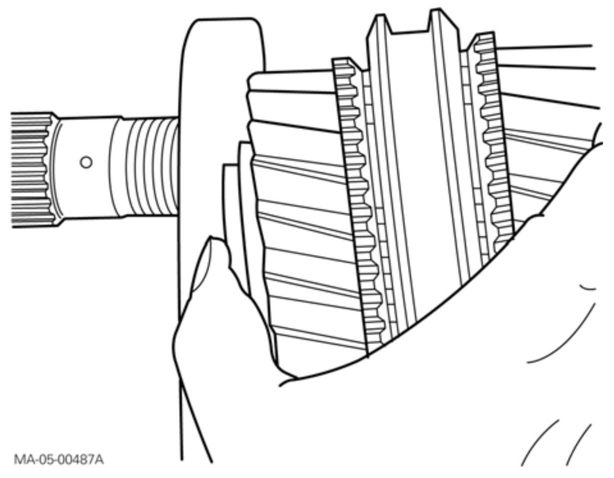


Fig. 6

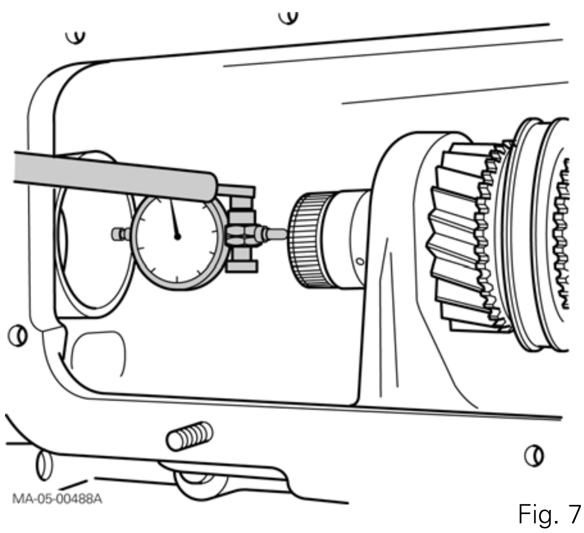


Fig. 7

40. Unlock the nut (68).
41. Remove the gear (67).
42. Position the shims (3) selected during step 38 between the two washers (6).
43. Refit the gear.
44. Degrease the thread of the shaft with a solvent.
45. Lightly smear the new nut (68) with Loctite 270 or equivalent then tighten to a torque of 130 - 170 Nm.
46. Using a suitable pin punch, lock the nut in place by bending the collar into the grooves of the shaft without breaking it.
47. Insert the spring (72) and the lubrication pipe (71) in the shaft.
48. Remove the tool and the supporting sleeve.
49. Fit the gear (18), the 3rd, 4th synchroniser cones (33) and (47) and the 3rd, 4th synchroniser (23). The lubricating grooves should be turned towards the 4th gear (18).
50. Fit a new circlip (26), opening it as little as possible. After assembly, check that it is not bent.
51. Manually check:
- the axial clearance of the gears;
- the rotation of the shaft and its gears.

52. Check that the 1st, 2nd synchroniser operates properly.

D . Final steps

53. Refit and shim the output shaft (see chapter 5).
54. Refit the intermediate shaft (see chapter 5).
55. Refit the input unit assembly (see chapter 5).
56. Shim the intermediate shaft (see chapter 5).
57. Refit the selector rail and the forks (see chapter 5).
58. Refit the selector cover plate (see chapter 5).
59. Reconnect the gearbox to the engine (see chapter 2).
60. Reconnect the gearbox and the rear axle (see chapter 2).
61. Check operation of electric circuits.
62. Carry out a road test of the controls
63. Check the tightness of the unions and mating faces (selector cover plate, gearbox on rear axle).

E . Service tools

Tools available in the AGCO network

- **3378010 M1:** - Socket for nut - Layshaft (Fig. 8)
- **3378082 M1:** - Locking tool - Layshaft (Fig. 9)

Makeshift tool

- **Supporting sleeve for the layshaft** (Fig. 10)

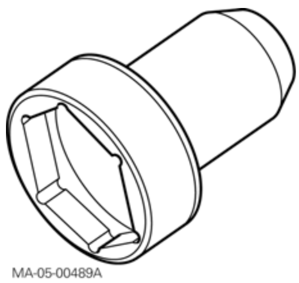


Fig. 8

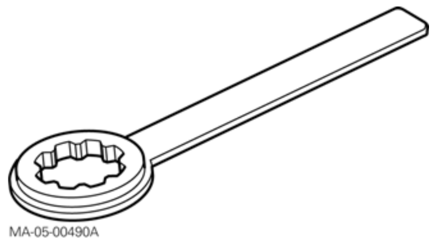


Fig. 9

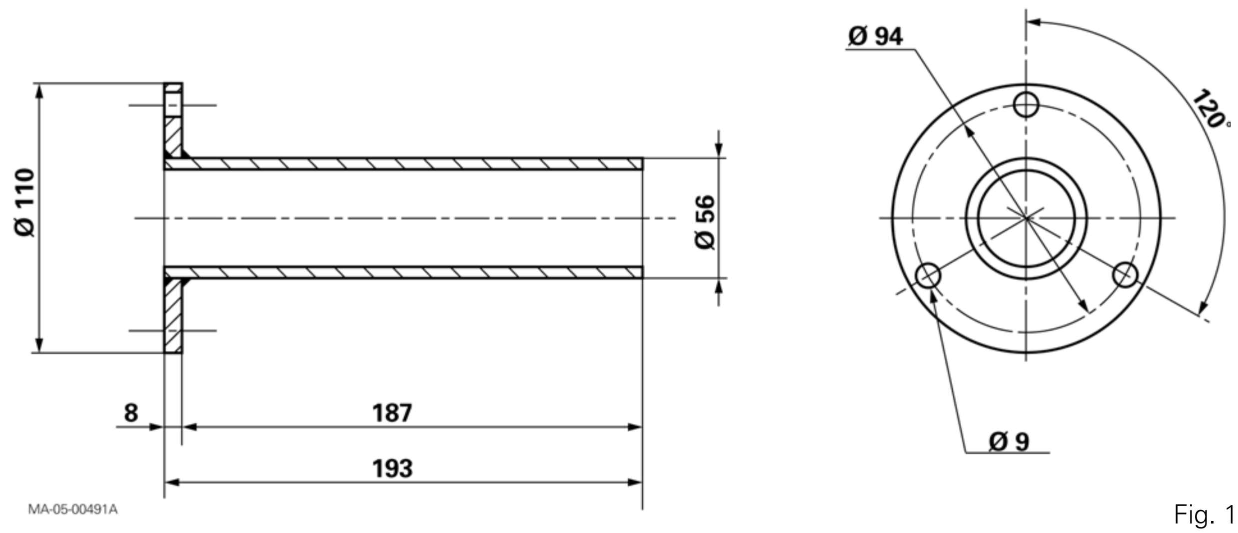


Fig. 10

5B18 - GBA20 - Power Shuttle - Intermediate shaft

CONTENTS

A . General

The intermediate shaft and its gears (Fig. 1) form the upper shaftline of the GBA20 gearbox with Power Shuttle.

It supports the 1st to 4th driven gears.

The shaft rear teeth (54) are constantly meshed with the Tortoise gear.

The shaft is supported by:

- the tapered roller bearing (63) and (64) housed in the rear bearing of the input unit;
- the tapered roller bearing (52) and (53) located in the rear bearing of the gearbox.

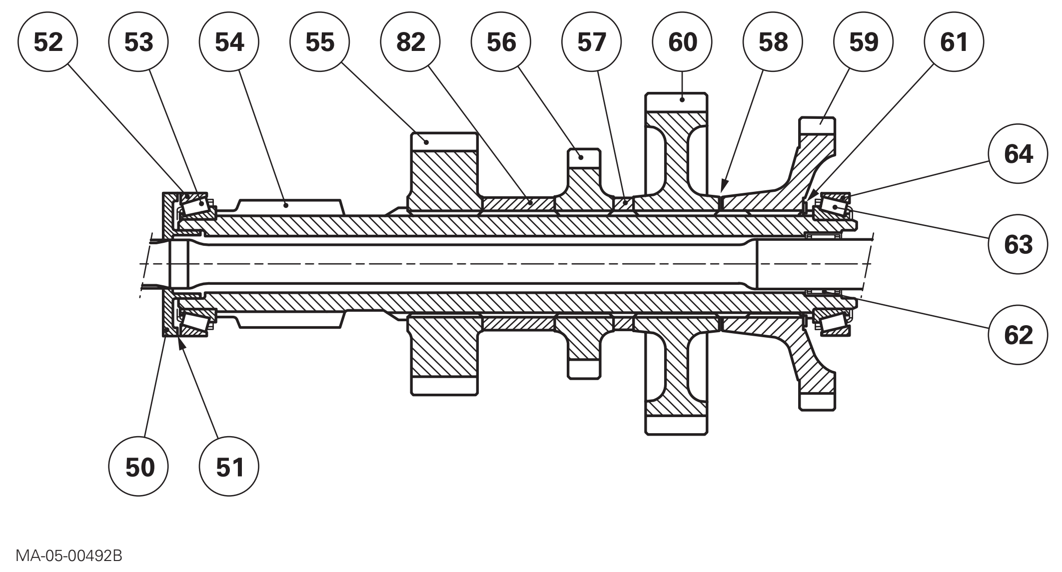
The four gears are held in position by the spacers (57) and (82).

The operating clearance for these gears is obtained by inserting the shims (58) between the 1st (60) and 2nd (59) driven gears.

Parts list (Fig. 1)

(50) Oil deflector
(51) Shim(s)
(52) Bearing cup
(53) Bearing cone
(54) Shaft
(55) 3rd driven gear
(56) 4th driven gear
(57) Spacer
(58) Shim(s)
(59) 2nd driven gear
(60) 1st driven gear
(61) Circlip
(62) Needle roller bearing
(63) Bearing cone
(64) Bearing cup
(82) Spacer

View of the assembly



Blown-up view

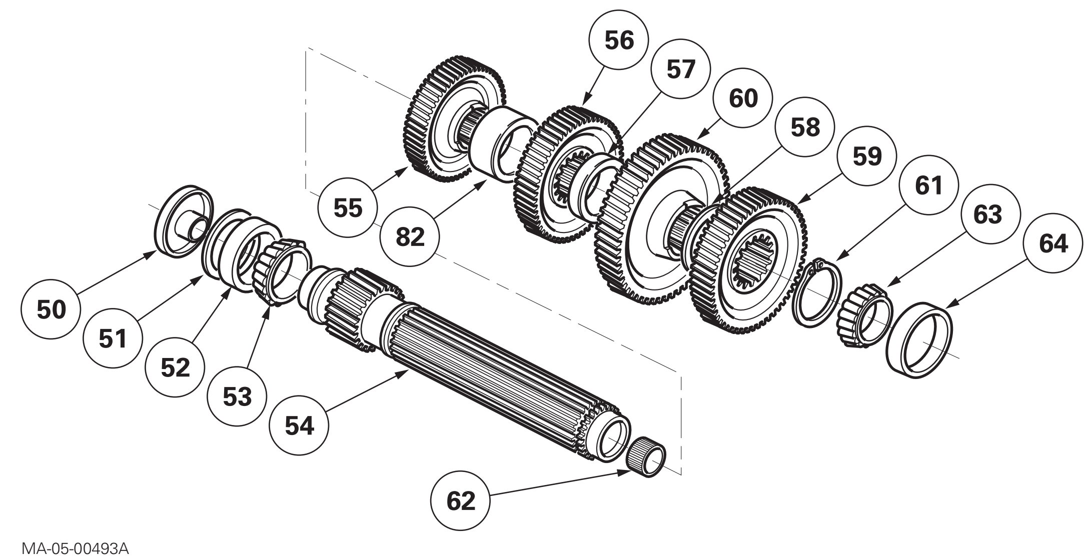


Fig. 1

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B . Preliminary steps

IMPORTANT: *To correctly shim the intermediate shaft tapered roller bearings, it is necessary to remove the gearbox.*

1. Split the tractor between the gearbox and the rear axle (see chapter 2).
2. Split the gearbox from the engine (see chapter 2).
3. Place the gearbox on a workbench or a suitable support.
Remove the Power Shuttle forward clutch (see chapter 5).
4. Remove the selector cover plate (see chapter 5).
5. Remove the input unit (see chapter 5).

IMPORTANT: *After removing the input unit, pair the bearing cup housed in the input unit rear bearing with the intermediate shaft front bearing cone.*

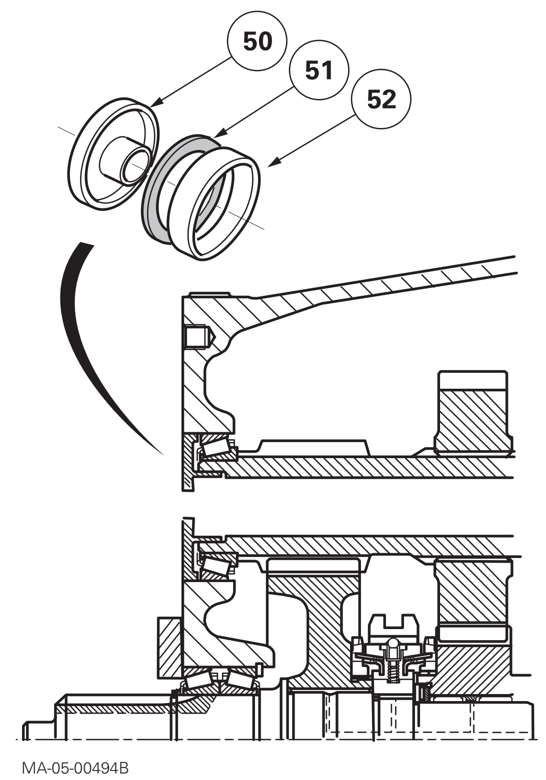

Fig. 2

C . Removing and refitting the shaft and gear assembly

Removal

6. Remove the oil deflector (50) using a slide hammer puller and remove the shims (51) and the cup (52) (Fig. 2) to release the rear end of the shaft.
7. Take the shaft and gear assembly out through the front of the housing (Fig. 3), by tilting it so that the gears are released from the lower shafts.
IMPORTANT*: When removing the shaft, do not insert the handling bar in the bore as this will damage the needle roller bearing (62) (Fig. 3). If necessary, carry out the operation with the help of an assistant.*

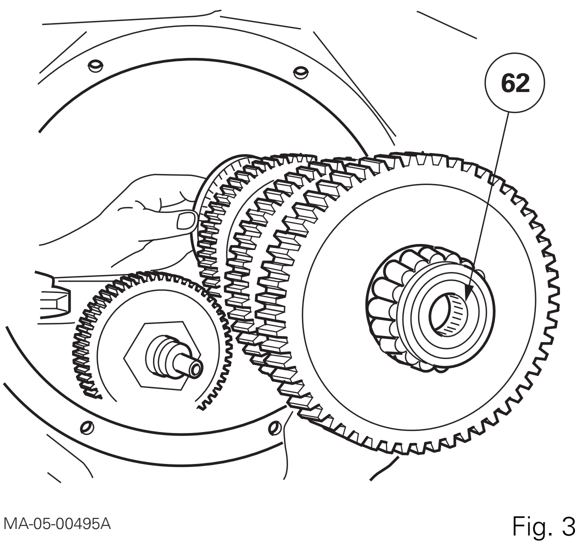

Fig. 3

Refitting

8. Clean and check all components. Replace those that are defective.

9. In the housing, position the assembled shaft with its related gears.

10. If necessary, check and correct the shimming of the shaft (see § G). Otherwise, refit the cup (52), the original shims and the oil deflector (50).

D . Removing and refitting the gears

Disassembly (Fig. 1)

11. Extract the bearing cone (63).

12. Remove circlip (61) by opening it up as little as possible.

13. Remove 2nd gear (59), shims (58), 1st gear (60) and spacer (57).

14. Remove 4th gear (56), spacer (82) and 3rd gear (55).

Reassembly (Fig. 1)

15. Clean and check all components. Replace those that are defective.

16. Refit the 3rd gear (55), spacer (82) and 4th gear (56).

17. Fit the spacer (57). Fit the 1st gear (60) and the 2nd gear (59)**, temporarily without the shims (58)**.

18. Fit the circlip (61).

19. Shim the gears (see § F).

20. Refit the shaft, assembled with its related gears, in the housing (see § C).

E . Replacing the tapered roller bearings of the intermediate shaft

Disassembly

21. Remove the shaft (54) and gear assembly (see § C).
22. Extract the bearing cones (53) and (63). Discard them.
23. If necessary, replace the shaft.

Reassembly

24. If the shaft (54) has been replaced:
Using a suitable fixture and a press, fit a new needle roller bearing (62) thrust up against the shoulder of the shaft. Check needle rotation after assembly.
25. Reassemble the gears (see § D).
26. Fit bearing cones (63) and (53) using a press and a suitable fixture.
27. Position the shaft, assembled with its related gears, into the housing (see § C).
28. Shim the shaft (see § G).

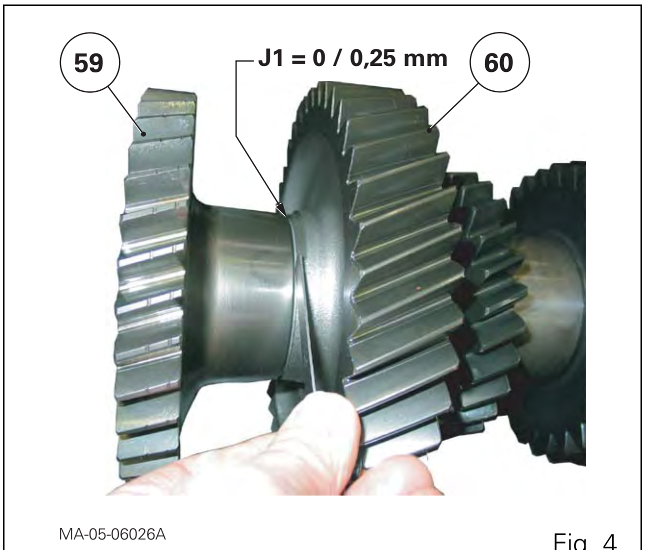

Fig. 4

F . Shimming the gears

Reminder: *The gears should be stacked temporarily without the shims (58).*

29. Using a set of shims, measure the space between the 1st gear (60) and the 2nd gear (59) (Fig. 4).
30. Depending on the measured distance, choose shim(s) of an appropriate thickness to obtain the clearance **J1 = 0 to 0.25 mm** (Fig. 4).
31. Remove the circlip (61), opening it up as little as possible, and remove the gear (59).
32. Slide the previously selected final shims onto the shaft. Refit the gear and position the circlip correctly.
33. Fit bearing cone (63) (see § E).
34. Refit the shaft, assembled with the related gears, in the housing (see § C).

G . Shimming the shaft

***IMPORTANT:** To carry out shimming on the intermediate shaft, the input unit must be refitted (see chapter 5).*

35. Carry out the shimming on the shaft to obtain a clearance of **J2 = 0 to 0.08 mm** (Fig. 6)

36. Fit the makeshift tool (Fig. 7 and § I) in the shaft.

37. Slightly compress the spring, while tightening the nut of the tool, to correctly seat the bearing cones in their cups.

38. Rotate the shaft a few turns. Check spring compression again.

39. Using a depth gauge (Fig. 5), measure dimension X between face A of the bearing cup (52) and face B of the housing (Fig. 6).

40. Measure the thickness Y of the oil deflector (50).

41. Calculate the difference between X and Y.

42. Determine the thickness of shims required to obtain the clearance J2.

***NOTE:** If possible, shim to the minimum tolerance.*

43. Remove the compression tool.

44. Fit the shims (51) selected during step 42.

45. Fit the oil deflector in the housing.

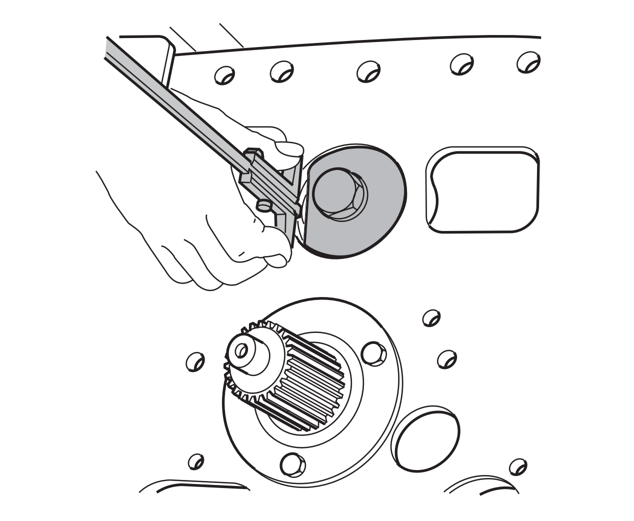

Fig. 5

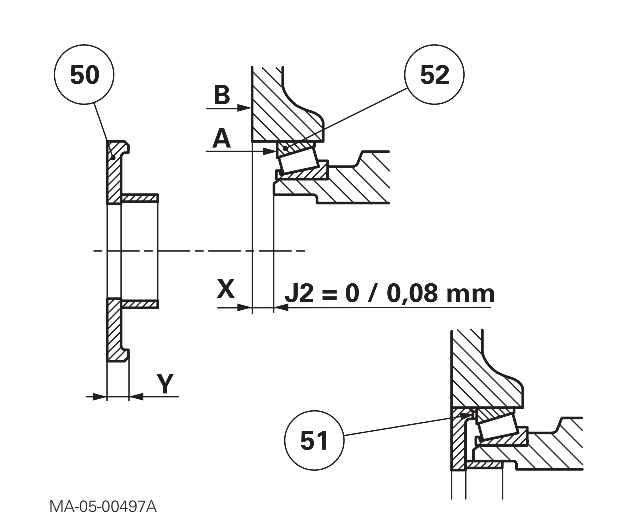

Fig. 6

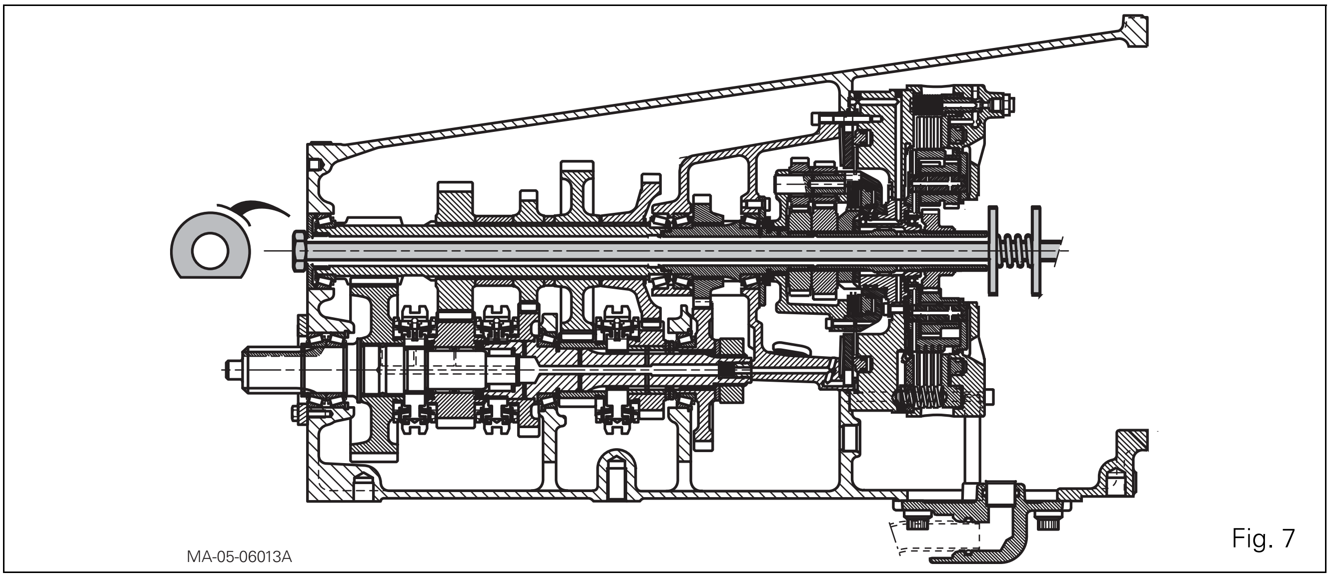

Fig. 7

H . Final steps

46. Refit the input unit (see chapter 5).

47. Refit the selector cover plate (see chapter 5).

48. Refit the Power Shuttle forward clutch (see chapter 5).

Attach a sling to the gearbox. Lower it from the workbench or suitable support.

49. Reconnect the gearbox and the engine (see chapter 2).

50. Reconnect the tractor between the gearbox and the rear axle (see chapter 2).

51. Check:

- tightness of the hydraulic systems;
- correct operation of electrical circuits.

52. Carry out a road test of all controls.

53. Check the tightness of the unions and mating faces (selector cover plate, gearbox on rear axle).

I . Service tool

Makeshift tool

- **Shaft supporting tool (Fig. 8)**
  (1) MF 1610037M2 washer, locally adapted
  (2) MF 3619200M2 washer, to be machined
  (3) LL 2U washer:
    -int. Ø = 12.5
    -ext. Ø = 40
    -thickness = 2.5
  (4) HM10 nut
  (5) ext. Ø = 79.7 + 0 / - 0.2
  (6) M10 x 150 threaded rod: L = 1150
  (7) Spring:
    -int. Ø = 40
    -Thread Ø = 4
    -L = 95

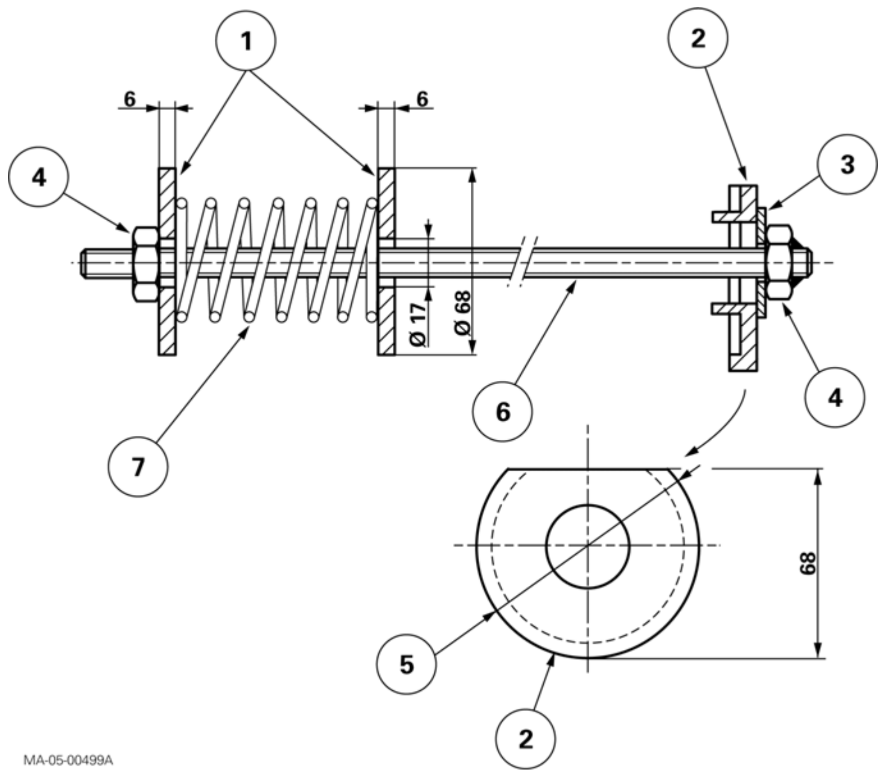

Fig. 8

5C10 - GBA25 - General - Operation

CONTENTS

A . General

The housing of the Dyna-4 GBA25 gearbox consists of the following main components, in the order given (Fig. 1):

(1) the Powershift module, providing four ratios for shifting under load (A, B, C and D)

(2) the Power Shuttle

(3) the main gearbox comprising four robotically-controlled mechanical ratios

(4) the creeper or super creeper gearbox (if fitted)

Only the gearbox is described in this section. Each major component shall be partially discussed in this section as these components are individually and more thoroughly described in their own respective sections.

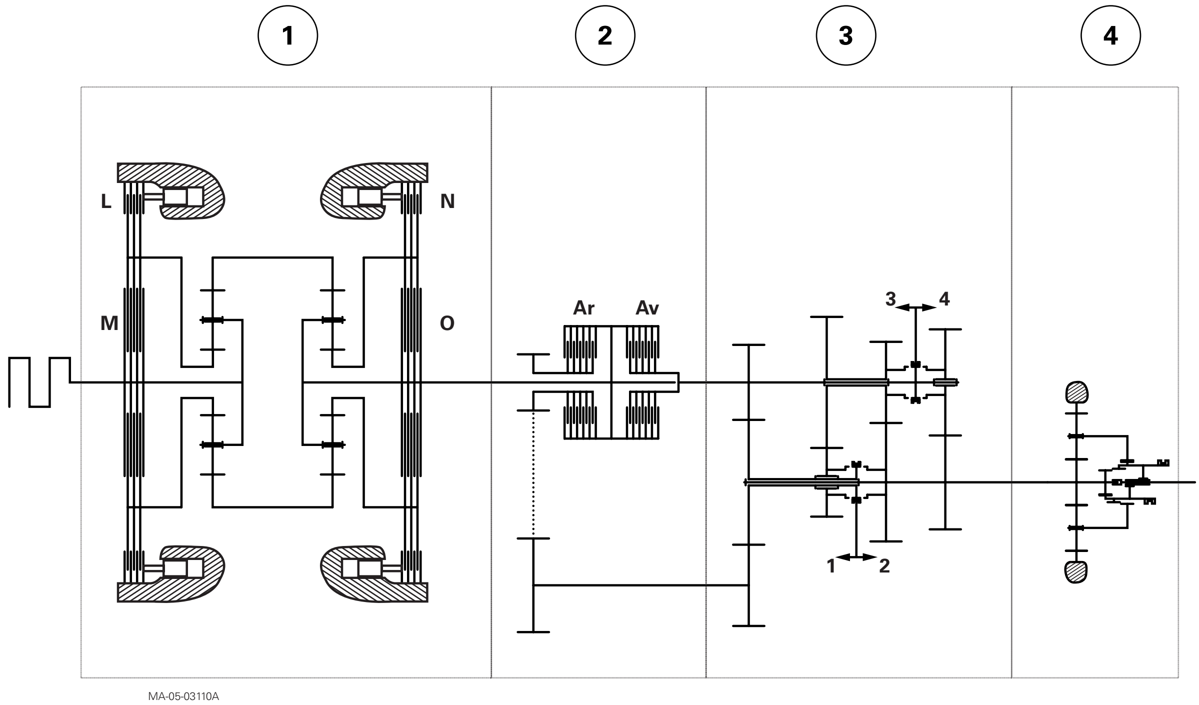

Fig. 1

Powershift module

This module provides four ratios for shifting under load (A, B, C and D).

The Powershift module comprises two epicyclic gear trains, two brakes and two multidisc clutches.

The brakes are controlled hydraulically by two proportional solenoid valves with an ON/OFF control, and the clutches are engaged by Belleville washers and disengaged by plates connected to the brakes located in the same module.

PowerShuttle

The PowerShuttle is fitted in the centre of the unit. It links the ratios for shifting under load and the gearbox.

The PowerShuttle comprises two multidisc wet clutches controlled by two proportional solenoid valves with PWM control.

A mainshaft ensures reverse position.

Robotic gearbox

The gearbox has four ranges. The ratios are selected by two hydraulically-controlled synchronisers.

Gearbox input drive is supplied by the Powershift module.

The four gearbox ranges are automated, so all ratios can be engaged or disengaged automatically by the tractor electronic management system.

Creeper and super-creeper unit

A unit fitted on the secondary shaft, to the rear of the gearbox, provides very slow travel speeds. This unit comprises one or two final drives providing a reduction of 4/1 (creeper speeds) or 14/1 (super creeper speeds). These ratios are engaged mechanically.

Lubrication

Lubrication is provided by the tractor hydraulic circuit. Oil arrives at two points located on the left-hand side of the gearbox housing. Oil flows to the bearings and clutches to be lubricated via internal channels in the gearbox shafts.

Parts list (Fig. 2)

- (A) Powershift module
- (B) PowerShuttle module
- (C) Reverse driving gear
- (D) Mechanical unit module providing four robotically controlled ranges
- (E) Single cone synchroniser
- (F) Double cone synchroniser
- (G) PTO shaft
- (H) Gearbox output shaft
- (Av) Forward clutch
- (Ar) Reverse clutch
- (L) Brake
- (M) Clutch
- (N) Brake
- (O) Clutch

Description of the Dyna-4 GBA25 gearbox

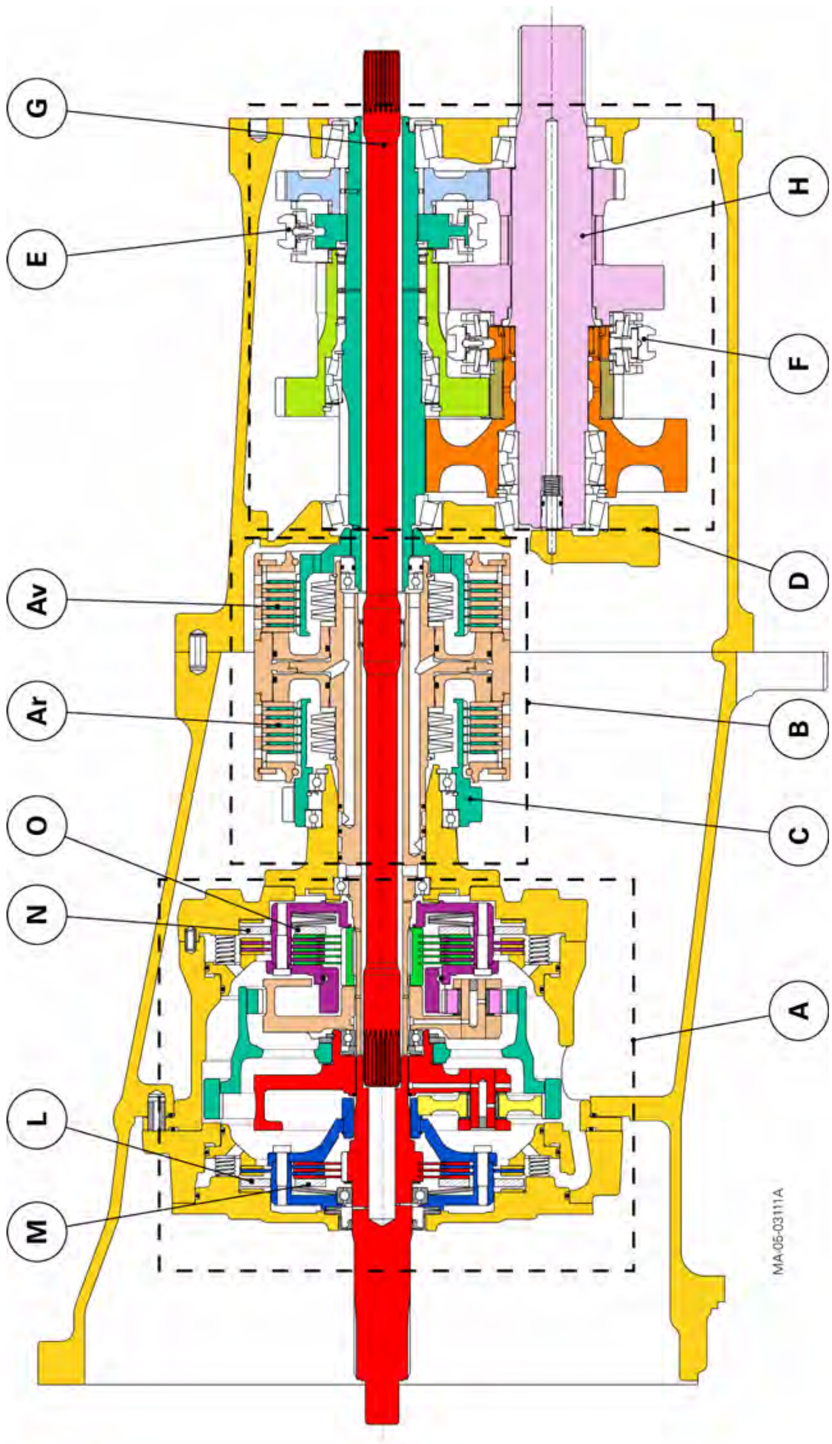

Fig. 2

Parts list (Fig. 3)

(1) Gearbox housing
(2) Compartment
(3) Shims
(4) Primary shaft
(5) Bearing cup
(6) Bearing cone
(7) Double pinion
(8) Circlip
(9) Spacer
(10) Shims
(11) Bearing cone
(12) Bearing cup
(13) Bearing cup
(14) Bearing cone
(15) 3rd and 4th single cone synchroniser
(16) Spacer
(17) Circlip
(18) Circlip
(19) Spacer
(20) Needle bearing
(21) Needle bearing
(22) Spacer
(23) Circlip
(24) Circlip
(25) Ring
(26) 4th driving gear
(27) Bearing cup
(28) Bearing cone
(29) Plug
(30) "O" ring
(31) Power take-off shaft
(32) Secondary shaft
(33) Bearing cone
(34) Bearing cup
(35) 4th driven gear
(36) Spacer
(37) 4th driven gear
(38) Bearing cup
(39) Bearing cone
(40) Lubrication pipe
(41) Spring
(42) "O" ring
(43) Shims
(44) Spacer
(45) Circlip
(46) Washer
(47) Shims
(48) Bearing cup
(49) Bearing cone
(50) Bearing cone
(51) Bearing cup
(52) 2nd gear pinion
(53) 1st gear intermediate pinion
(54) 1st and 2nd double cone synchroniser
(55) Needle bearing

Parts list (Fig. 4)

(56) Powershift module housing
(57) Spring
(58) Brake "L" disc/thrust plate assembly
(59) Clutch "M" disc/thrust plate assembly
(60) Clutch "M" bell housing
(61) Ball bearing
(62) Front epicyclic gear train primary shaft
(63) Lip seal
(64) Friction washers
(65) Belleville washer
(66) Cover
(67) Clutch "M" cover
(68) Planet carrier
(69) Brake "L" piston
(70) Ring gear
(71) Ring-gear carrier
(72) Sun gear
(73) Planetary gear
(74) Ring
(75) Ball bearing
(76) Circlip
(77) Spacer
(78) Pin
(79) Needle bearing
(80) Planet carrier
(81) Ring gear
(82) Pin
(83) Needle bearing
(84) Sun gear
(85) Snap ring
(86) Clutch "O" cover
(104) Brake "N" piston
(105) Spring
(106) Brake "N" disc/thrust plate assembly
(107) Clutch "O" disc/thrust plate assembly
(108) Belleville washers
(109) Secondary shaft
(110) Ball bearing
(111) Clutch "O" bell housing
(112) PowerShuttle assembly
(113) Driven transfer gear
(114) Reverse mainshaft
(115) Driving transfer gear
(116) Bearing cup
(117) Bearing cup
(118) Bearing cone
(119) Bearing cone
(120) Cover
(121) Hub
(122) Ball bearing

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View of the Dyna-4 GBA25 gearbox assembly

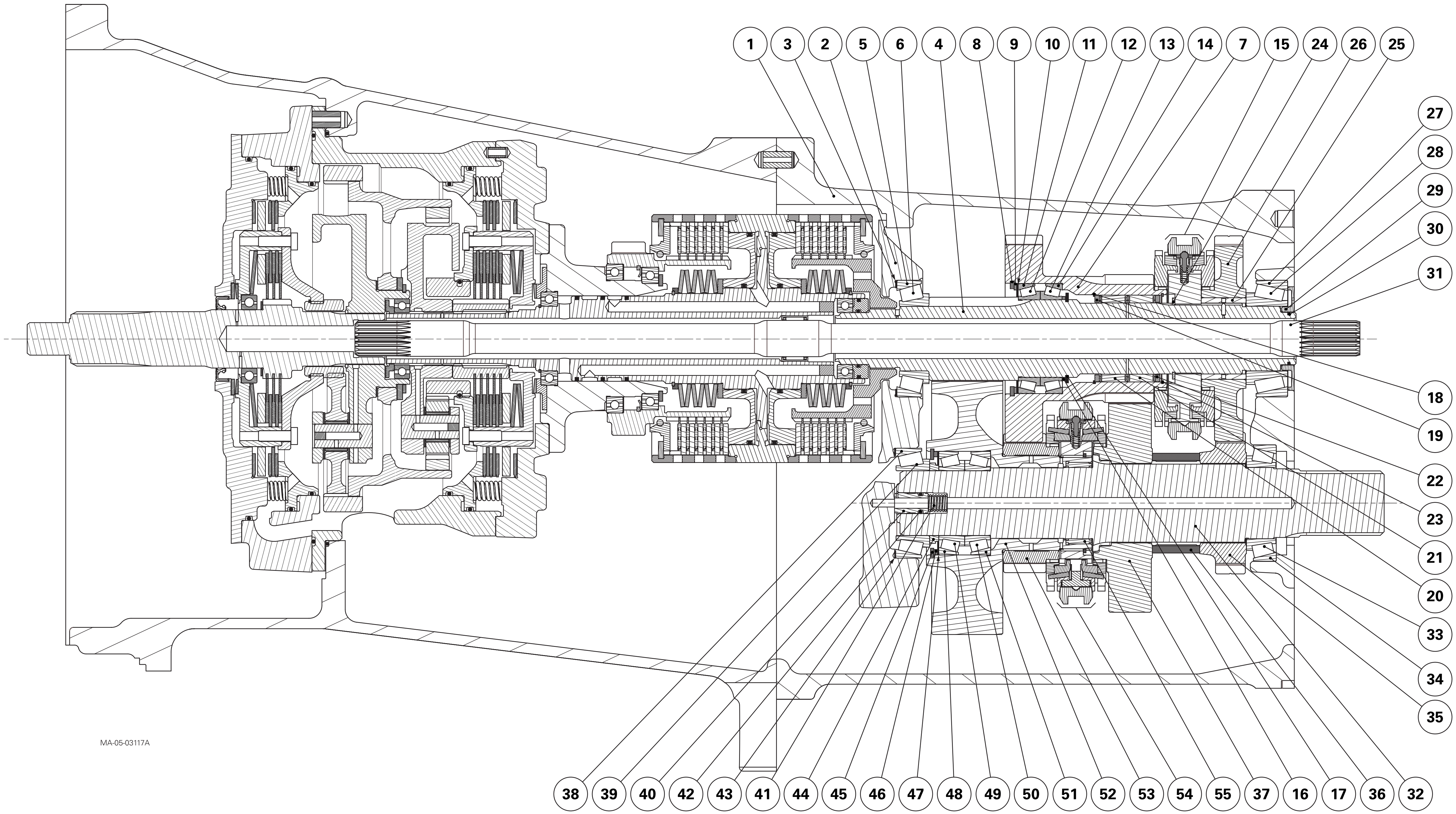

Fig. 3

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View of the Dyna-4 GBA25 gearbox assembly

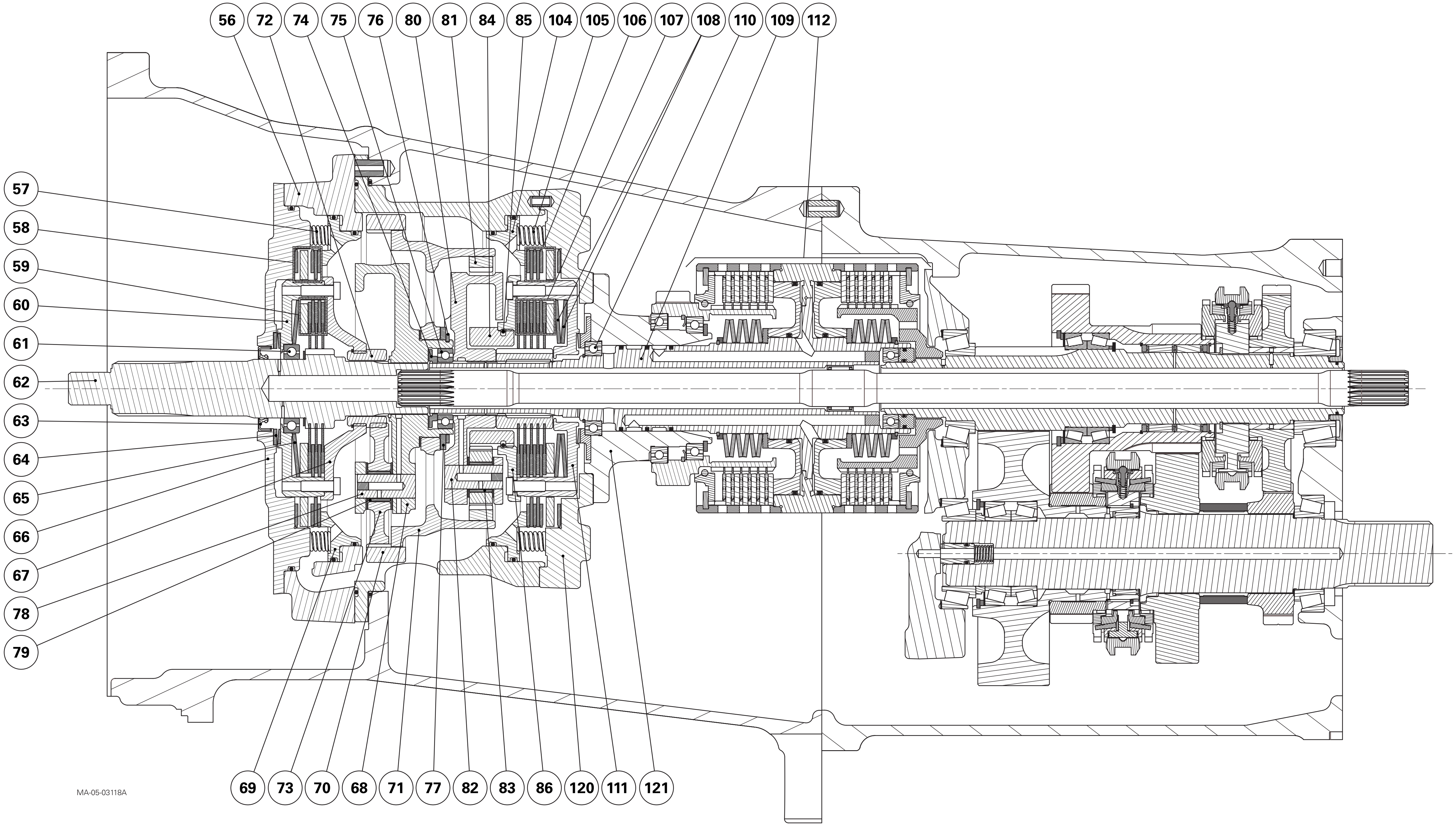

Fig. 4

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B . Construction and description

The Dyna-4GBA25 gearbox provides four basic synchronised ratios and four ratios for shifting under load. The 16 ratios can be engaged in forward and reverse position without using the clutch pedal.

The unit housing consists of two sections:

- front housing: fitted just behind the engine, it supports the shifting under load section of the transmission (Powershift module) and the PowerShuttle.
- rear housing: fitted just behind the front housing, it supports the main gearbox and the robotically-controlled section of the gearbox.

Construction of the main gearbox (Fig. 3)

The gearbox is completely crossed by the PTO shaft (31) which links the engine flywheel to the PTO clutch in the rear axle. This shaft turns at the centre of a series of shafts forming the upper shaftline.

In the rear housing (1), a vertical compartment (2) supports the front bearings (5)(6) and (38)(39) of the primary (4) and secondary (32) units. It also contains the lubricating channels.

The housings are bolted together and act as an oil tank for the tractor hydraulic circuit.

The main gearbox comprises four synchronised ratios with two synchronisers (15) and (54). Four gear trains are distributed on the two shafts (4) and (32).

Each ratio is obtained by engaging only one synchroniser at a time.

The first ratio uses three gear trains, while the three other ratios each use one gear train (see § C).

The primary shaft (4) is supported by two taper roller bearings (5)(6) and (27)(28). Adjustment is ensured by shims (3) fitted under the bearing cup (5).

The secondary shaft (32) is also supported by two taper roller bearings (38)(39) and (34)(33). Adjustment is ensured by shims (43) fitted under the bearing cup (38).

Primary shaft (4)

On the primary shaft (4), the 1st and 3rd ratio pinions are integral and form a double pinion (7) that turns idle on the shaft. This assembly is supported by two taper roller bearings (11)(12) and (13)(14) fitted in an X shape, and two needle bearings (20) and (21).

The position of the bearings (11)(12) and (13)(14) is adjusted by shims (10).

The 2nd ratio pinion is machined in the primary shaft (4), and the 4th ratio pinion (26) turns idle and is supported by a lubricated ring (25).

Secondary shaft (32)

On the secondary shaft, the 2nd ratio pinion (52) turns idle. It is supported by two taper roller bearings (48)(49) and (50)(51) fitted in an X shape, and a needle bearing (55).

The bearings (48)(49) and (50)(51) are adjusted by shims (47).

The 2nd ratio pinion (52) acts as a rotating pin for the 1st ratio pinion (53), which turns without a bearing. The friction surface is lubricated by internal channels. The double cone synchroniser (54) is fitted on the 2nd ratio pinion and is meshed with the pinion (53) or (37).

The 3rd (37) and 4th (35) ratio pinions are meshed by the splines on the secondary shaft (32).

Construction of the Powershift module (Fig. 4)

The Powershift module on the Dyna-4 GBA25 transmission is located behind the engine flywheel.

Each module is fitted in a cast-iron housing screwed into the gearbox housing. It includes two epicyclic gear trains with three planetary gears.

Front epicyclic gear train

The front epicyclic gear train functions with the clutch (M) and the brake (L).

The primary shaft (62) is linked to the planet carrier (68). It links the PTO shaft and engine flywheel.

The clutch discs (59) are splined to the primary shaft (62). The thrust plates of the clutch (59) are integral with the clutch cover (60) and sun gear (72).

The brake discs (58) are connected to the clutch bell housing (60) and the sun gear (72) via the cover (67).

The front epicyclic gear train ring gear (70) drives the rear epicyclic gear train ring gear (81) via the ring-gear carrier (71).

Rear epicyclic gear train

The rear epicyclic gear train functions with the clutch (O) and the brake (N).

The clutch discs (107) are splined to the output shaft (109) and the planet-carrier (80). The thrust plates of the clutch (107) are integral with the clutch bell housing (111) and sun gear (84). The sun gear is held to the clutch bell housing (86) by the snap ring (85).

The brake discs (105) are connected to the clutch bell housing (111) and sun gear (84).

Drive enters via the ring gear (81), driven by the front epicyclic gear train ring gear (70).

Drive exits via the planet-carrier (80) towards the PowerShuttle.

Reverse position (Fig. 6)

The reverse position is ensured by a mainshaft comprised of a shaft (114) and two pinions (113) and (115). It transmits drive from the PowerShuttle (112) to the 2nd ratio pinion (52) on the secondary shaft (32) of the main unit.

The pinions (113) and (115) are linked to the shaft by splines.

The pinion (115) is fitted on bearings (116)(118) and (117)(119) with preload shimming at the bearing cup (116).

Clutch/brake operation (Fig. 5)

The clutches/brakes that select the Powershift module ratios are each controlled by a piston (P). When a brake is engaged, the related clutch is disengaged, and vice versa.

The control pistons (P) act both on the brake discs (F) and on an intermediate plate (I). When the piston (P) is pressurised, the plate (I) pushes back the Belleville washer(s) (B) of the clutch (E). When the pressure is released, the Belleville washer (B) pushes back the piston (P) via the intermediate plate (I) and tightens the clutch discs (E).

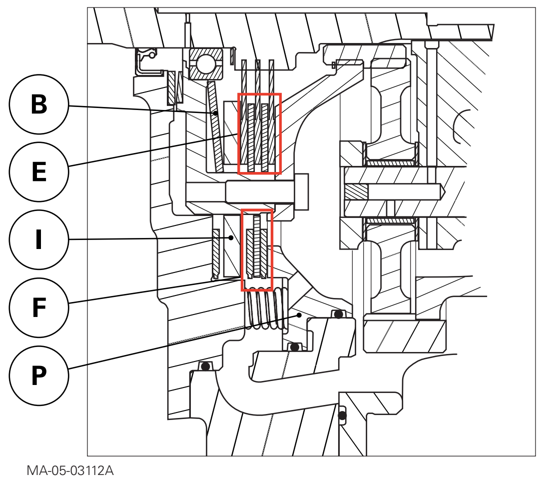


Fig. 5

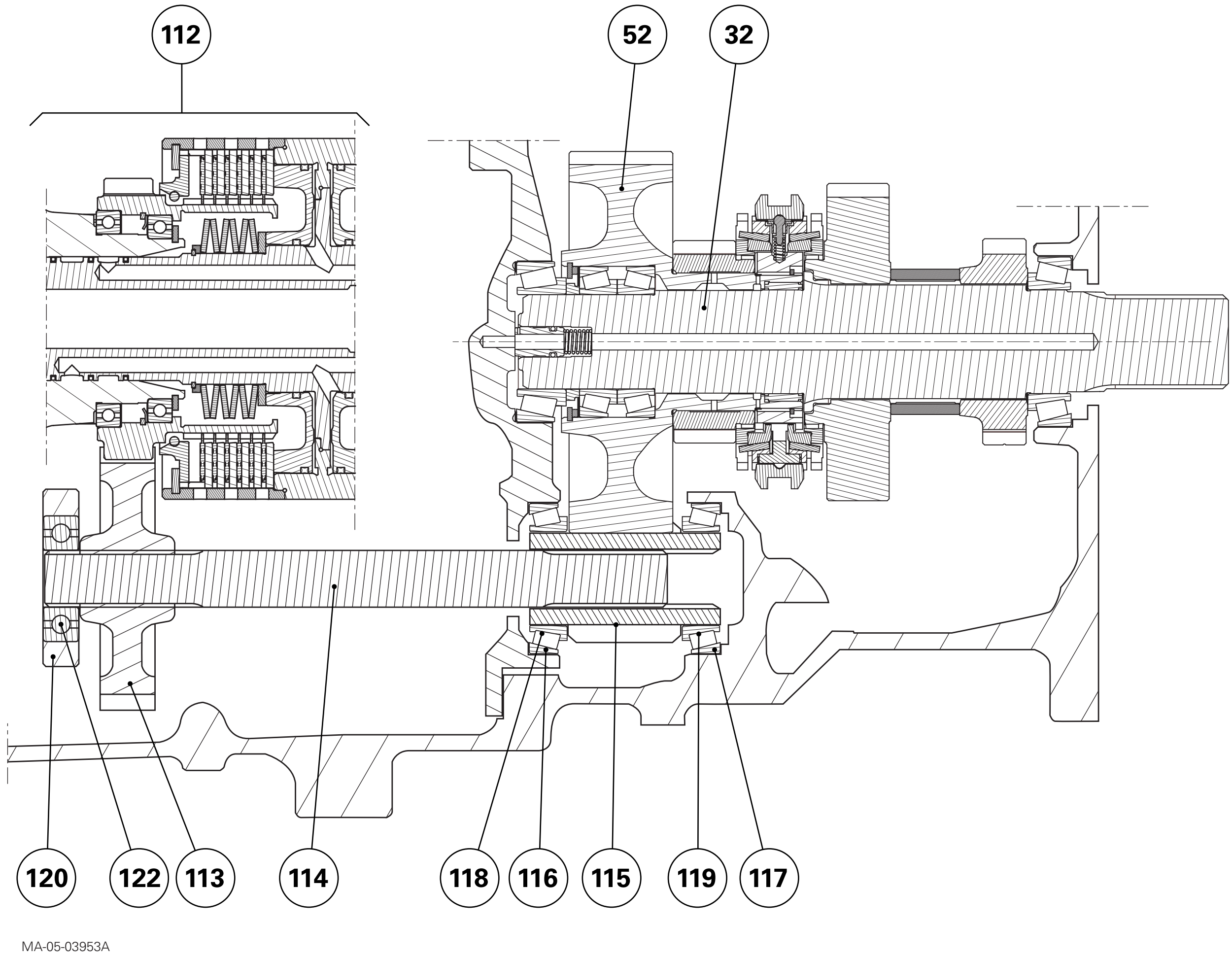


Fig. 6

C . Kinematics of the GBA25 gearbox

Parts list (Fig. 7)

(Av) Forward clutch
(Ar) Reverse clutch
(L) Planetary gear brake, Powershift module front epicyclic gear train
(M) Planetary gear clutch, Powershift module front epicyclic gear train
(N) Planetary gear brake, Powershift module rear epicyclic gear train
(O) Planetary gear clutch, Powershift module rear epicyclic gear train

Powershift module kinematics (Fig. 7)

Ratio A (1/1.5)

The front epicyclic gear train piston (69) is not pressurised; the clutch (M) is tightened by the Belleville washers. The sun gear and the planet-carrier are attached, thereby creating a mechanical lock; the front epicyclic gear train is thus "locked" and its ratio is 1/1.

The rear epicyclic gear train piston (104) is pressurised. The brake (N) is tightened and holds the sun gear in relation to the housing. The rear epicyclic gear train turns and reduces the input speed.

Ratio B (1/1.22)

The front epicyclic gear train piston (69) is pressurised; the clutch (M) is loosened. The brake (L) is tightened and holds the sun gear (72) in relation to the housing. The front epicyclic gear train turns and multiplies the input speed.

The rear epicyclic gear train is in the same position as at ratio A.

Ratio C (1/1)

The two epicyclic gear train pistons (69)(104) are not pressurised. The two clutches (M) and (O) are tightened by their respective Belleville washers. The sun gear is attached to the planet-carrier in each epicyclic gear train, thereby creating a mechanical lock. The two epicyclic gear trains are "locked", the module input speed is the same at its output and the ratio is 1/1.

Ratio D (1/0.813)

The front epicyclic gear train piston (69) is pressurised; the clutch (M) is loosened. The brake (L) is tightened and holds the sun gear (72) in relation to the housing. The front epicyclic gear train turns and multiplies the input speed.

The second epicyclic gear train is "locked" as at ratio C; its ratio is 1/1.

Kinematics of the PowerShuttle (Fig. 7)

When the transmission is in neutral, the PowerShuttle clutches are not pressurised.

In forward position, the "Av" clutch is engaged, and directly transmits drive from the Powershift to the primary shaft of the gearbox.

In reverse position, the "Ar" clutch is engaged, and transmits drive to a mainshaft then to a 2nd ratio pinion on the secondary shaft of the main gearbox.

Kinematic diagrams of the Dyna-4GBA25 gearbox

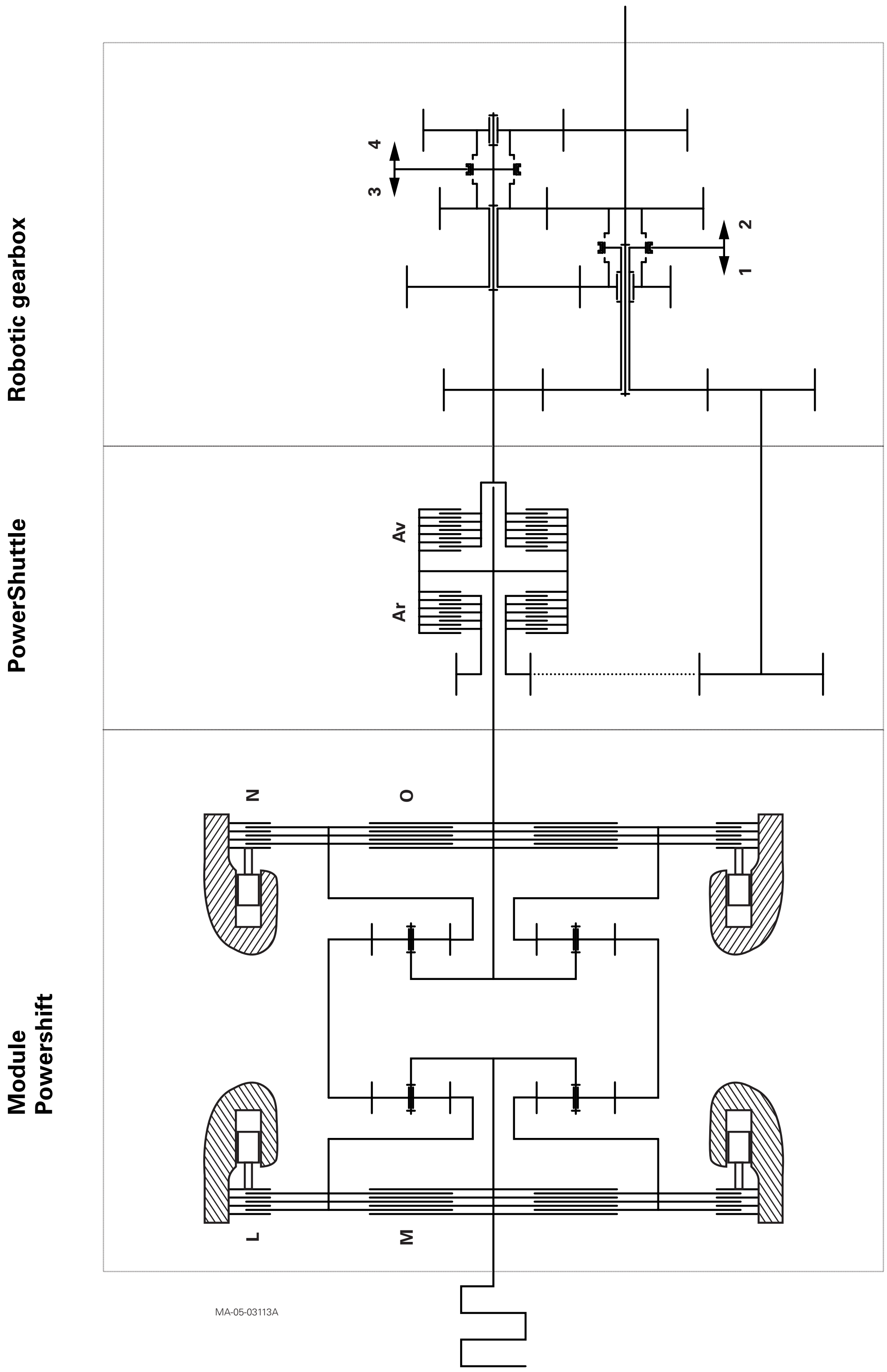


Fig. 7

Kinematics of the main gearbox (Fig. 7 and Fig. 8)

Range 1

The reduction is carried out on three gear trains.

The first gear train drives the second train via the 1st gear synchronisers, then the third train.

Range 2

The reduction is carried out on the first gear train. The 2nd gear synchronisers secure the 2nd ratio pinion to the secondary shaft.

Range 3

The reduction is carried out on the third gear train. The primary shaft is secured to the 3rd ratio pinion by the 3rd gear synchronisers.

Range 4

The reduction is carried out on the fourth gear train. The primary shaft is secured to the 4th ratio pinion by the 4th gear synchronisers.

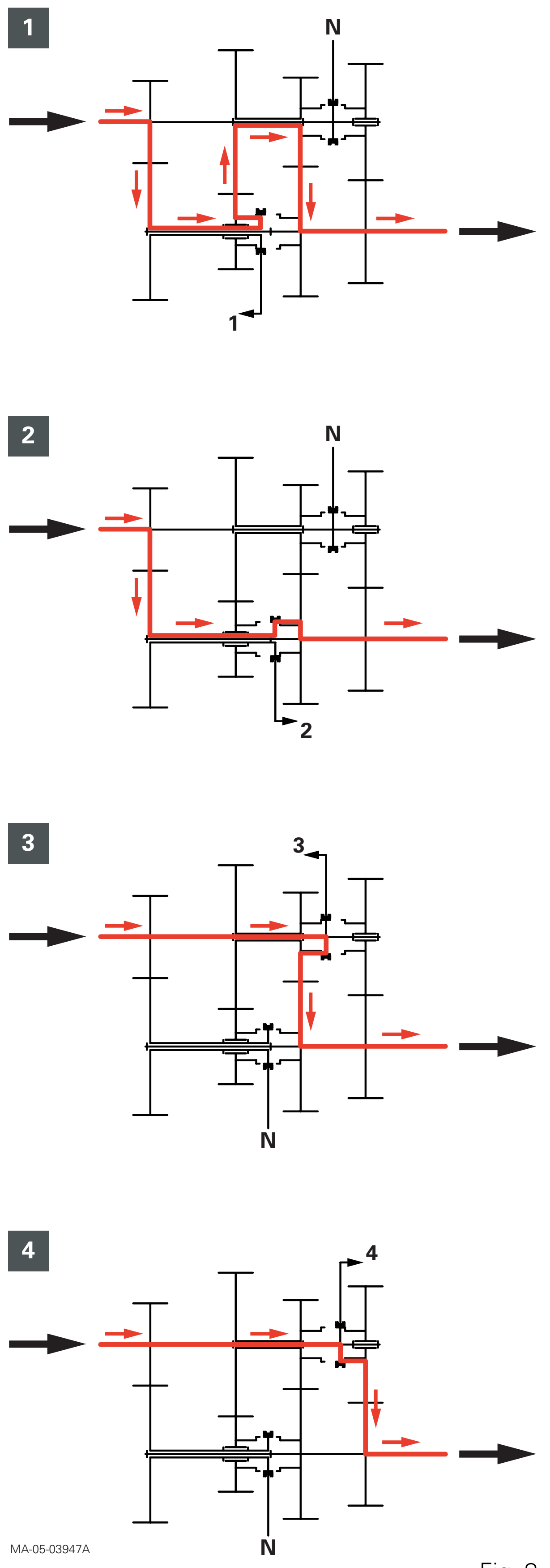


Fig. 8

D . Synchronisers

Single cone synchronisers (Ranges 3 and 4)

Parts list (Fig. 9)

(1) Sliding coupler
(2) Cone (brake)
(3) Coupling flange
(4) Ball bearing
(5) Pressure connectors
(6) Spring

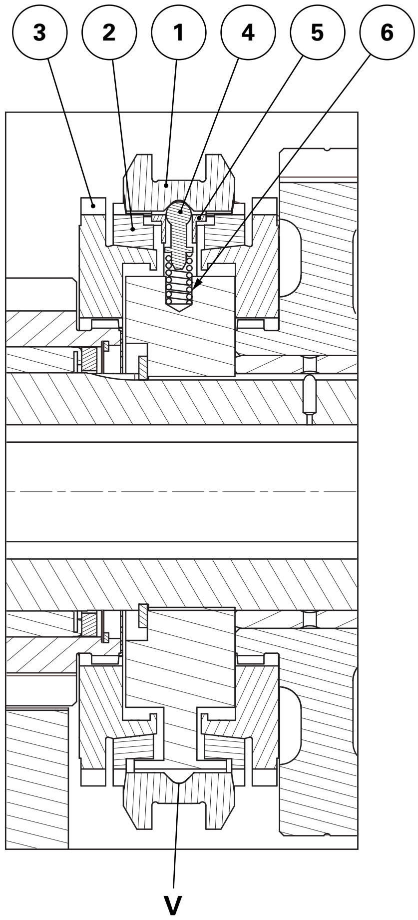
Locked position (Fig. 9)

When the sliding coupler (1) moves towards the gear to be locked, it presses against the cone (2) which in turn presses against the male cone of the coupling flange (3) via ball bearings (4) and pressure elements (5).

When the synchronisation is set, the sliding coupler (1) can mesh and silently lock with the teeth of the coupling flange (3).

Neutral position (Fig. 9)

Sliding coupler (1) is in the middle position. The balls (4) are pushed into the V groove of the sliding coupler by pressure springs (6). In this neutral position, the sliding coupler is locked by three balls held in place by the pressure springs.



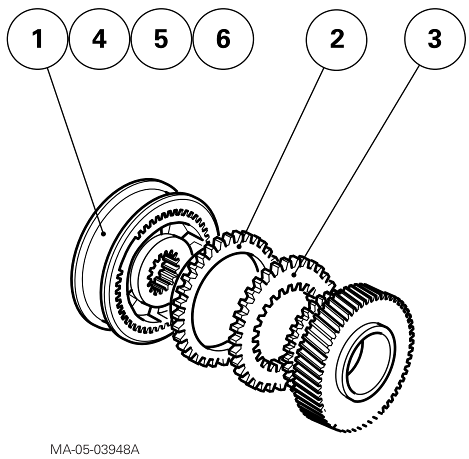


Fig. 9

Check

If the single cone synchronisers (11), (23) and (31) have been disassembled, check the wear to the cone (2) as follows:

1. Stack the coupling flange (3) and cone (2) on the relevant pinion.
2. Correctly position the cone (2) on the male cone of the coupling flange, revolving several times and applying manual pressure.
3. Using a set of thickness shims, measure dimension X (Fig. 10) at three equidistant points.

   Calculate the average of the three values and proceed as described below, depending on the result obtained.

   On a new synchroniser, dimension X must be **1.5 mm maximum**.

   After operation, if X is **less than or equal to 0.80 mm**:

   - replace the cone (2);
   - check the measurement of X again, using the same process.

     If dimension X remains incorrect, also replace the coupling flange (3) or, if necessary, the complete synchroniser.

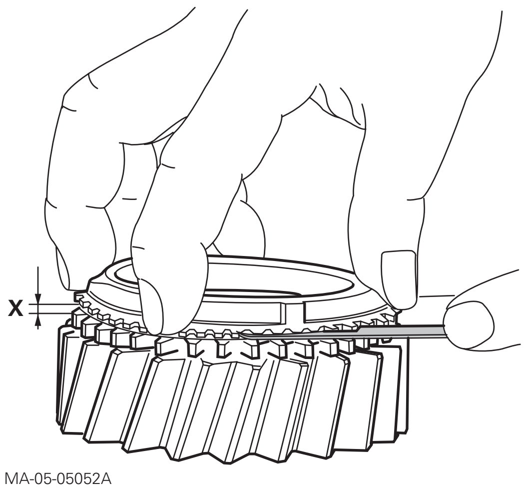


Fig. 10

Double cone synchronisers (Ranges 1 and 2)

Parts list (Fig. 11)

(1) Sliding coupler
(2) Cone (brake)
(3) Coupling flange
(4) Ball bearing
(5) Pressure connectors
(6) Spring
(7) Ring
(8) Cone (brake)

Advantages and operation

The double cone synchroniser has the following advantages: improved reliability and increased resistance to transmission loads.

The operating principle of the double cone synchroniser is similar to that of the single cone synchroniser. The positions (locked and neutral) are obtained in the same way.

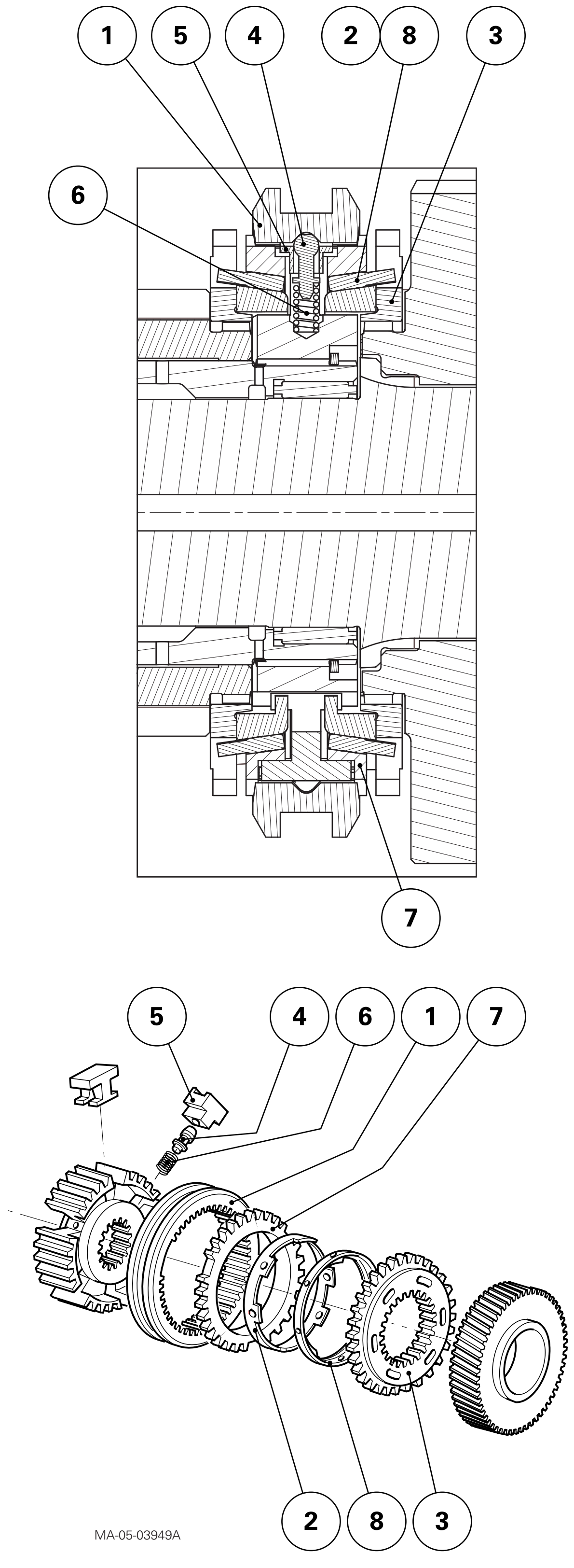


Fig. 11

Check

When disassembling the double cone synchroniser of the mechanical reverse shuttle, check the cones (2) and (8) for wear as follows:

4. Stack the coupling flange (3), cones (2) and (8) and ring (7).

5. Correctly position the ring (7) on the cones (2) and (8), revolving them alternately each several turns and applying pressure manually.

6. Using a set of thickness shims, measure dimension X (Fig. 12) at three equidistant points.

Calculate the average of the three values and proceed as described below, depending on the result obtained.

On a new synchroniser, dimension X must be **1.6 mm minimum**.

After operation, if X is **less than or equal to 0.60–0.80 mm**:

- replace the cones (2) and (8);
- check the measurement of X again, using the same process.

  If dimension X remains incorrect, also replace the ring (7) or, if necessary, the complete synchroniser.

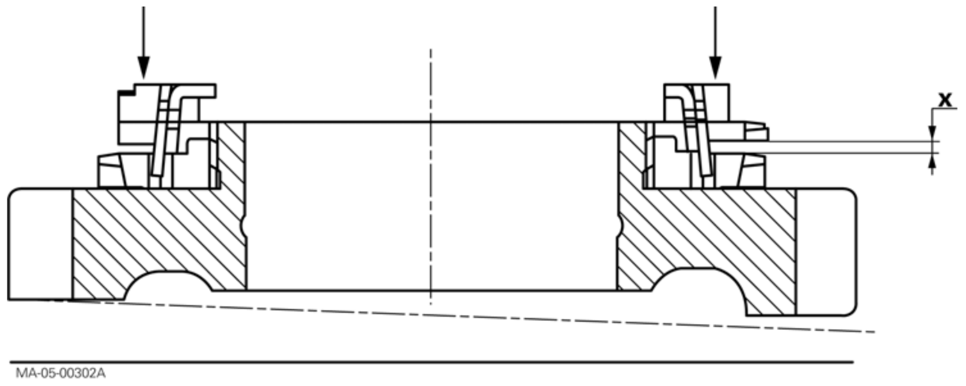


Fig. 12

E . Main gearbox robotic control

Description (Fig. 13)

The synchronisers are controlled conventionally by forks (1) and (2) and selector rails (3) and (4).

The selector rails are controlled hydraulically. The selector rails are fitted on double-acting pistons (5) and (6).

On the selector rail (4) that controls the 1st and 2nd gear synchroniser, the piston (6) is damped by a spring (7) to smoothen shifting between ranges 1 and 2.

The selector rails are adjusted by tightening or loosening the adjustable stops (8) and (9). Once adjusted, the stops are held in rotation by screws (10) and (11).

A safety pin (12) prevents the selector rails from being engaged simultaneously. When a selector rail is engaged, the pin locks the other one at the groove (13).

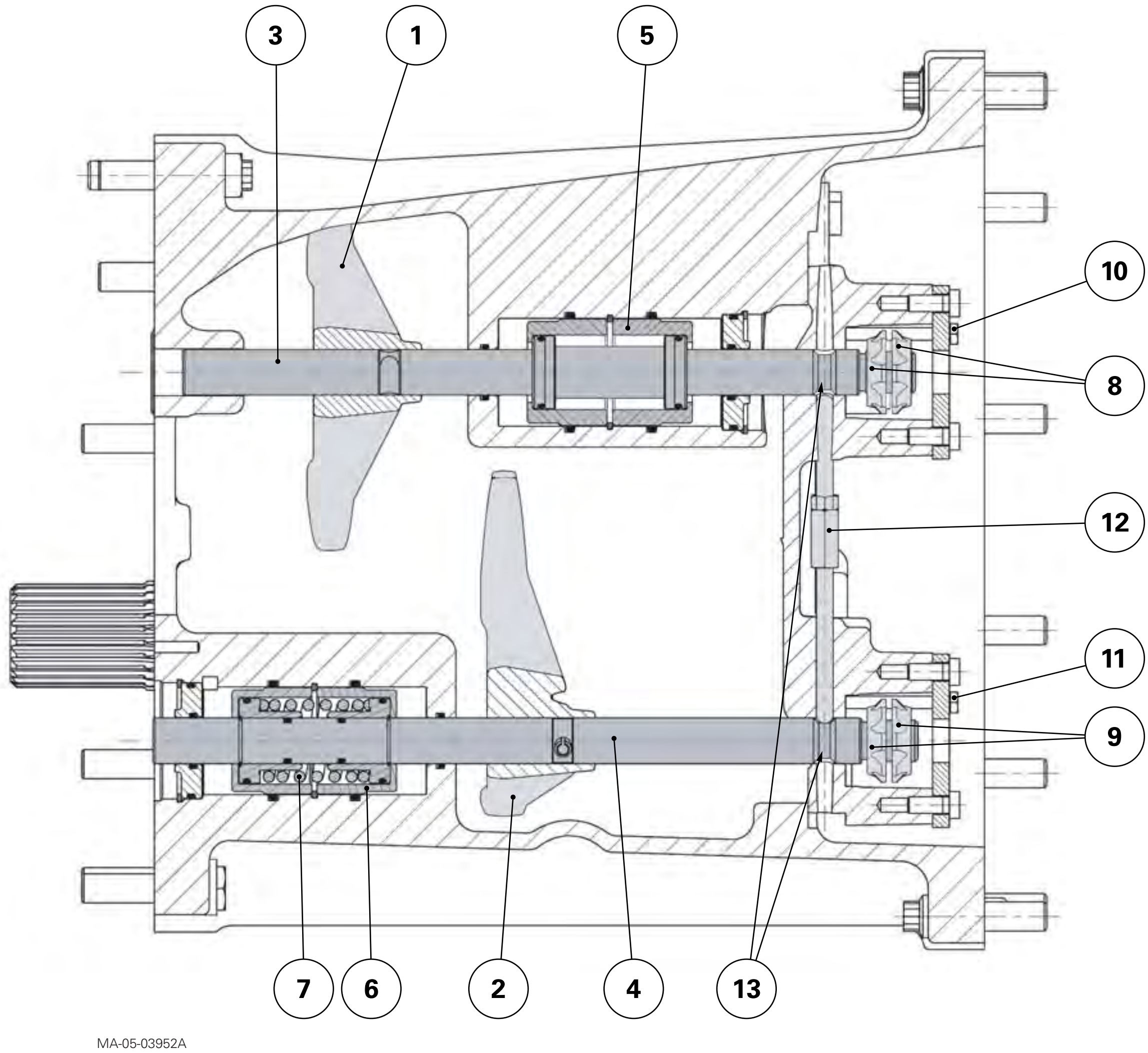


Fig. 13

F . GBA25 - disassembly steps

Step 1: Removing the PTO shaft

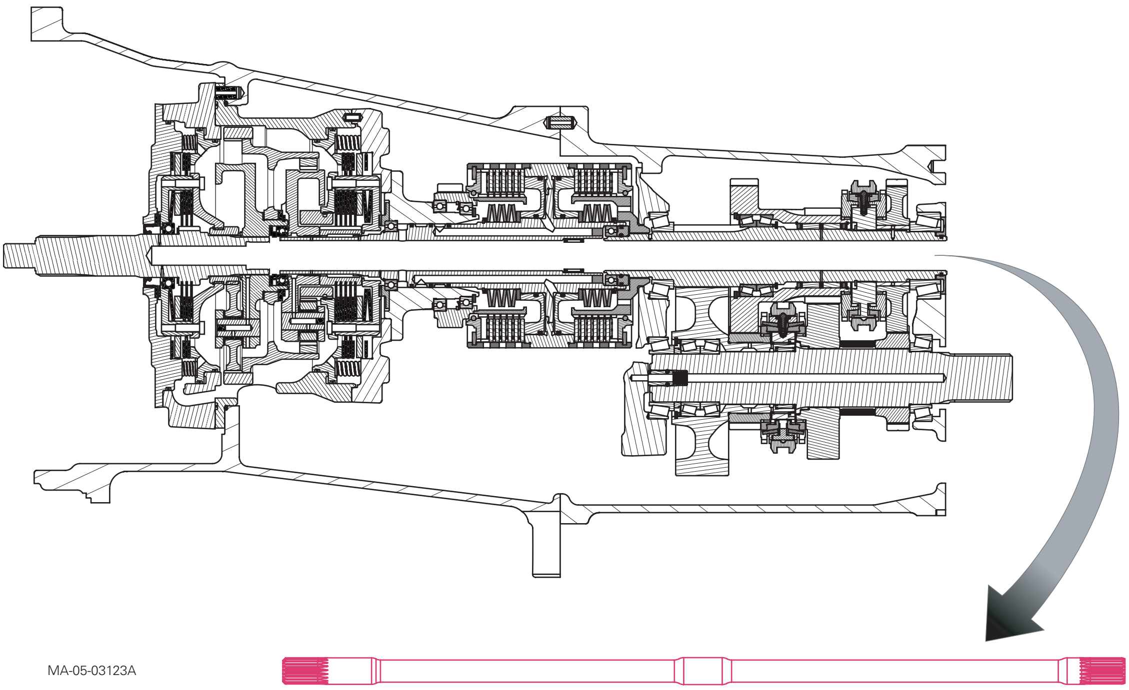


Fig. 14

Step 2: Splitting the mechanical unit

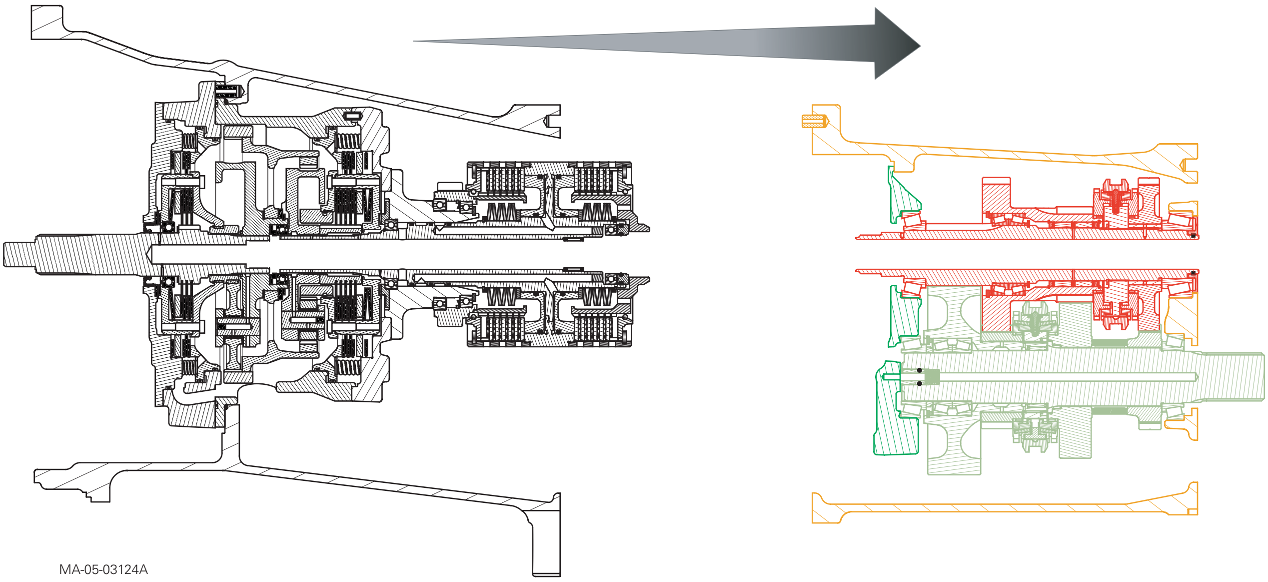


Fig. 15

Step 3: Removing the reverse spacer and reverse mainshaft

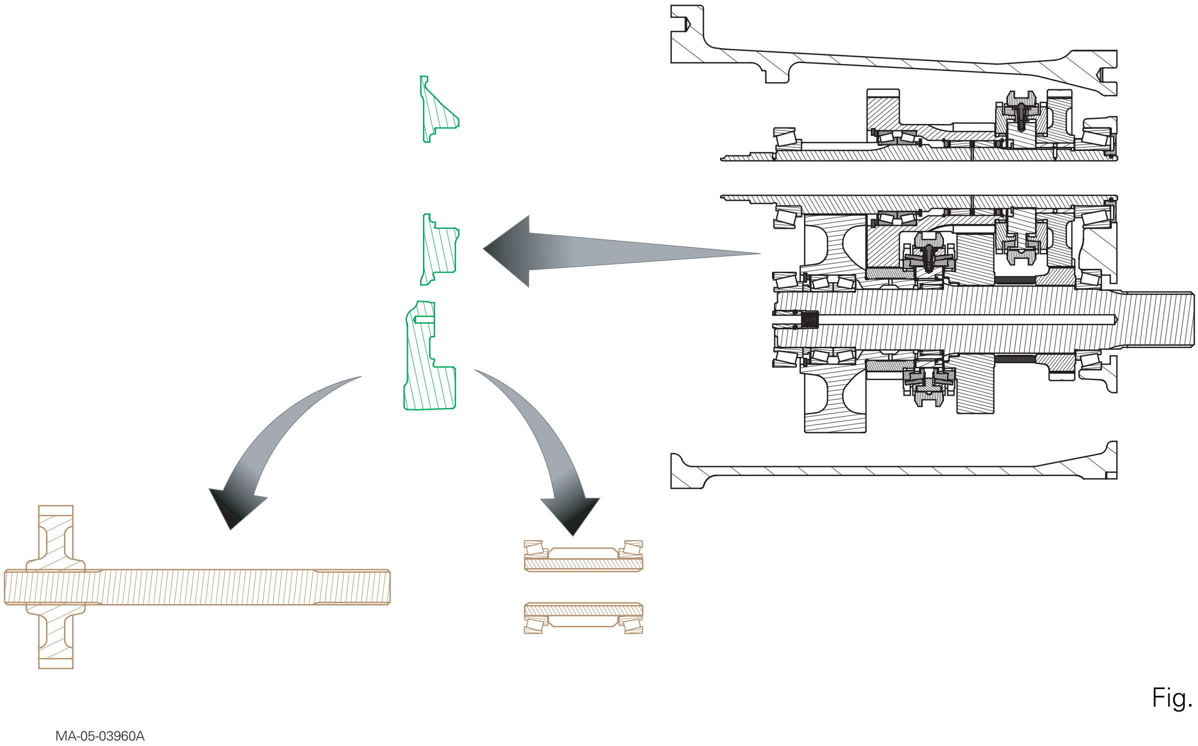


Fig. 16

Step 4: Removing the primary and secondary shafts

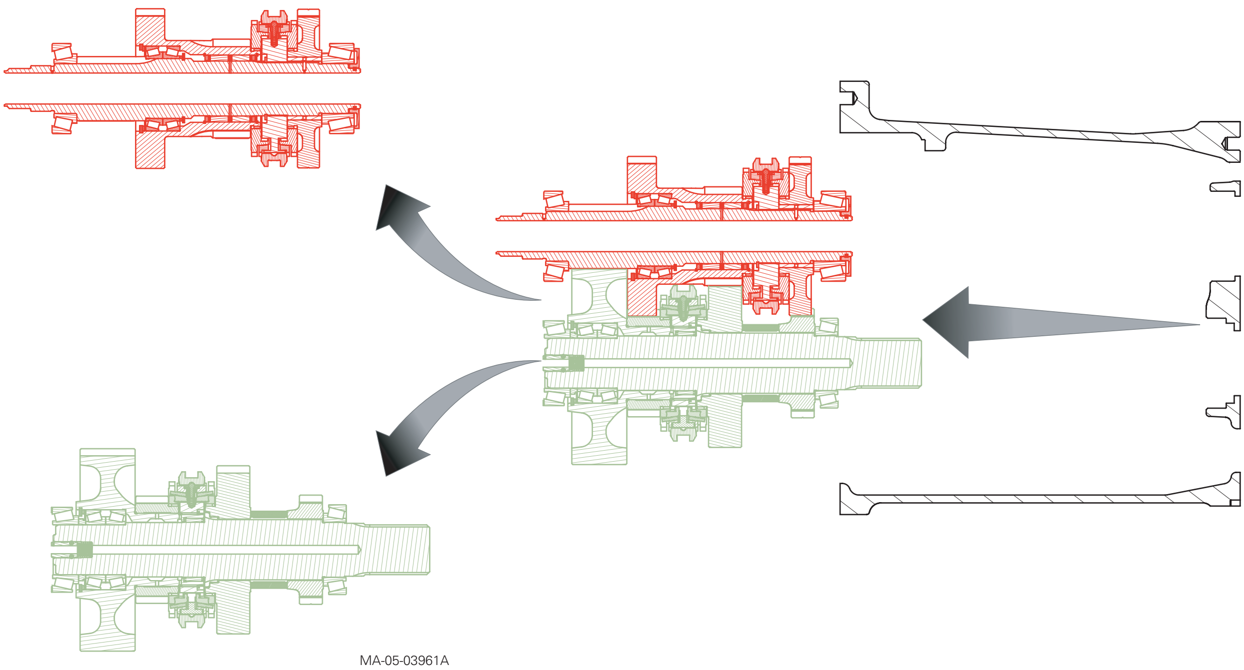


Fig. 17

Step 5: Removing the Powershift module and PowerShuttle

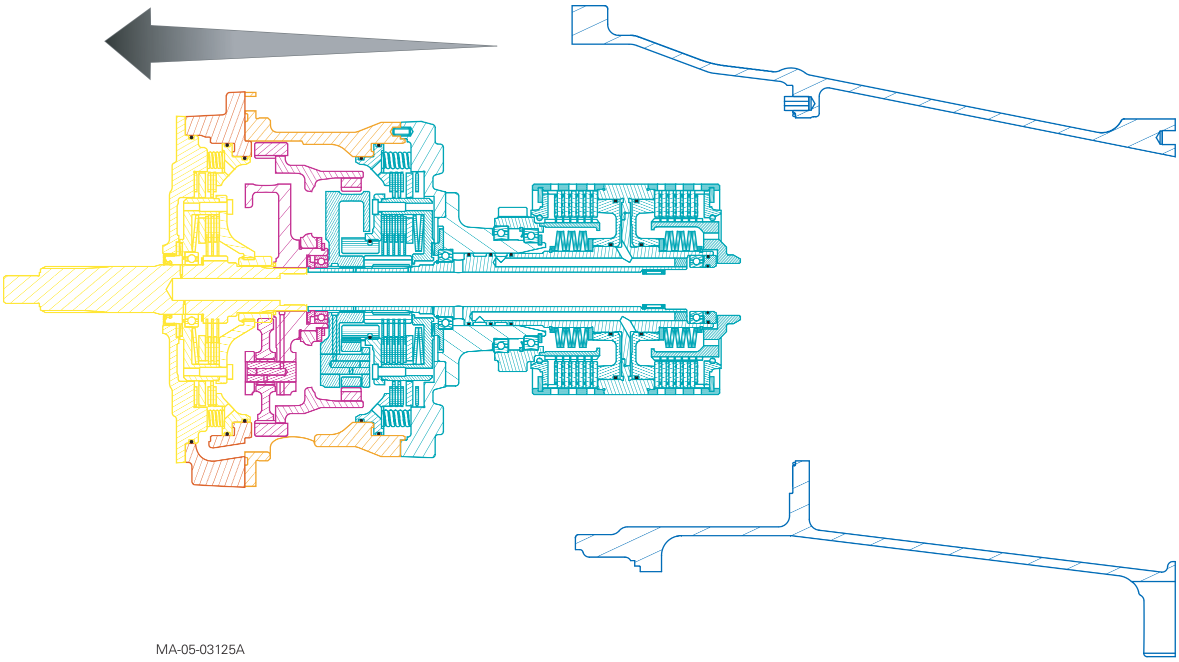


Fig. 18

Step 6: Removing the PowerShuttle and the Powershift module rear planet-carrier

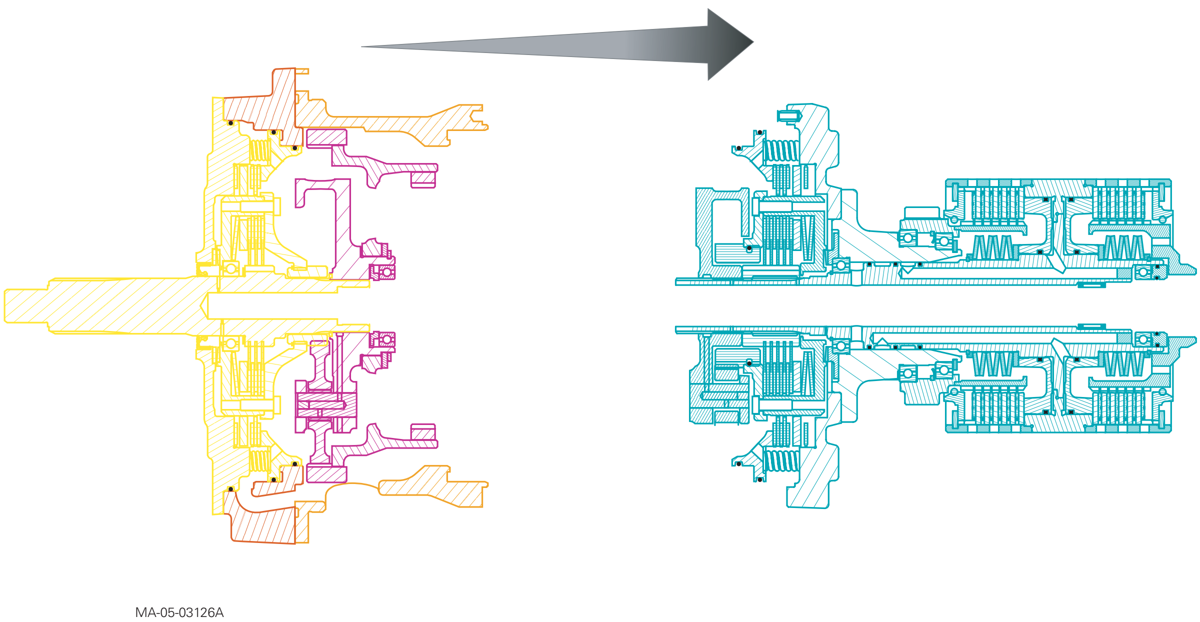


Fig. 19

Step 7: Splitting the PowerShuttle and the Powershift module rear planet-carrier

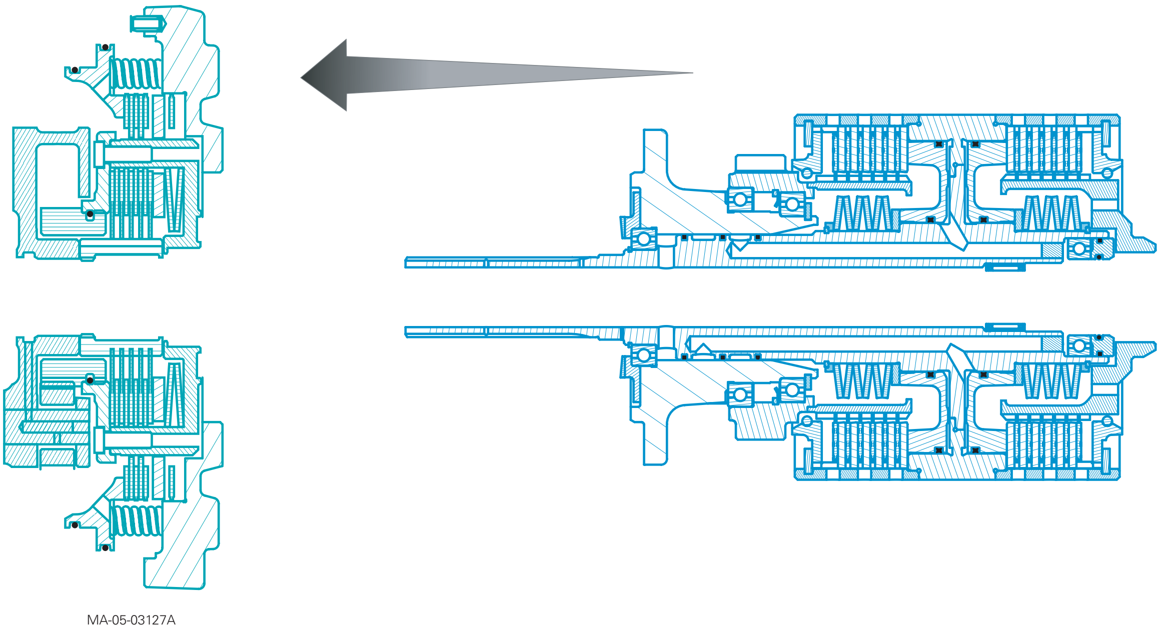


Fig. 20

Step 8: Removing the Powershift module housing and ring gears

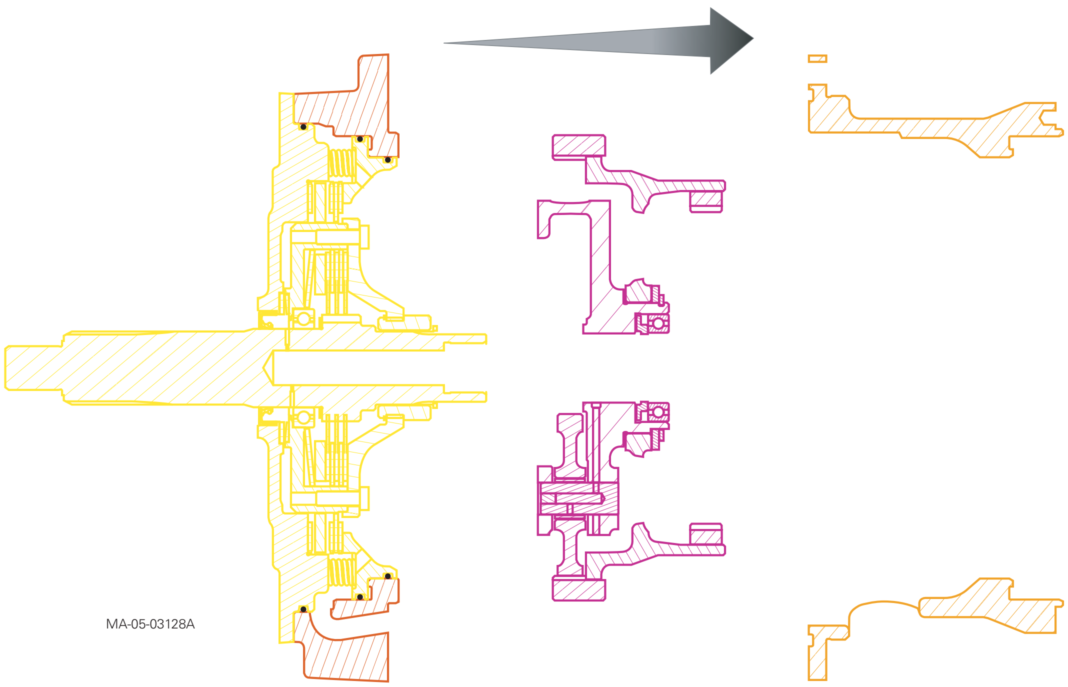


Fig. 21

Step 9: Removing the Powershift module front cover

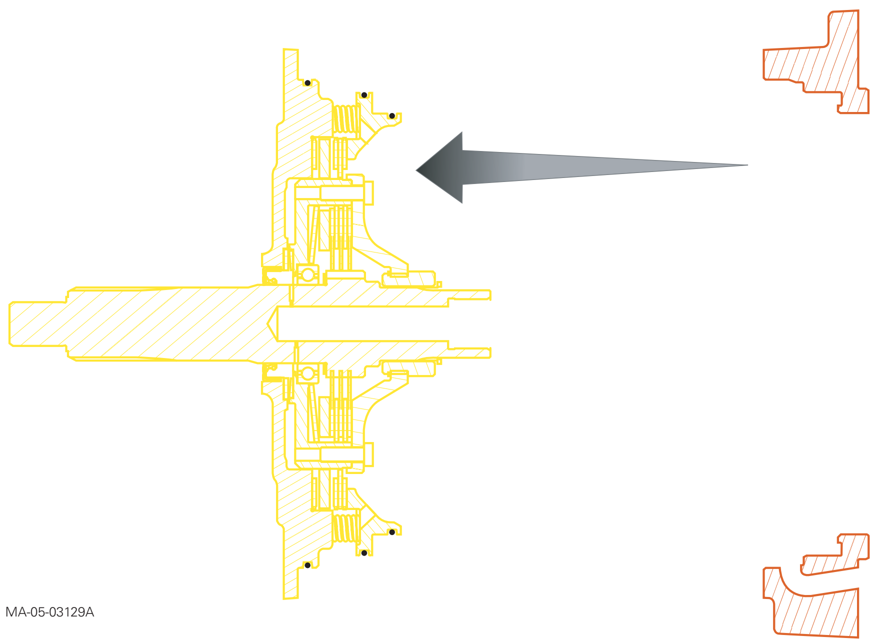


Fig. 22

G . Transmission GBA25 specifications

Parts list (Fig. 23 and Fig. 24)

(P) Preload
(J) Clearance
(C) Dimension

Specifications for Dyna-4 GBA25 gearbox

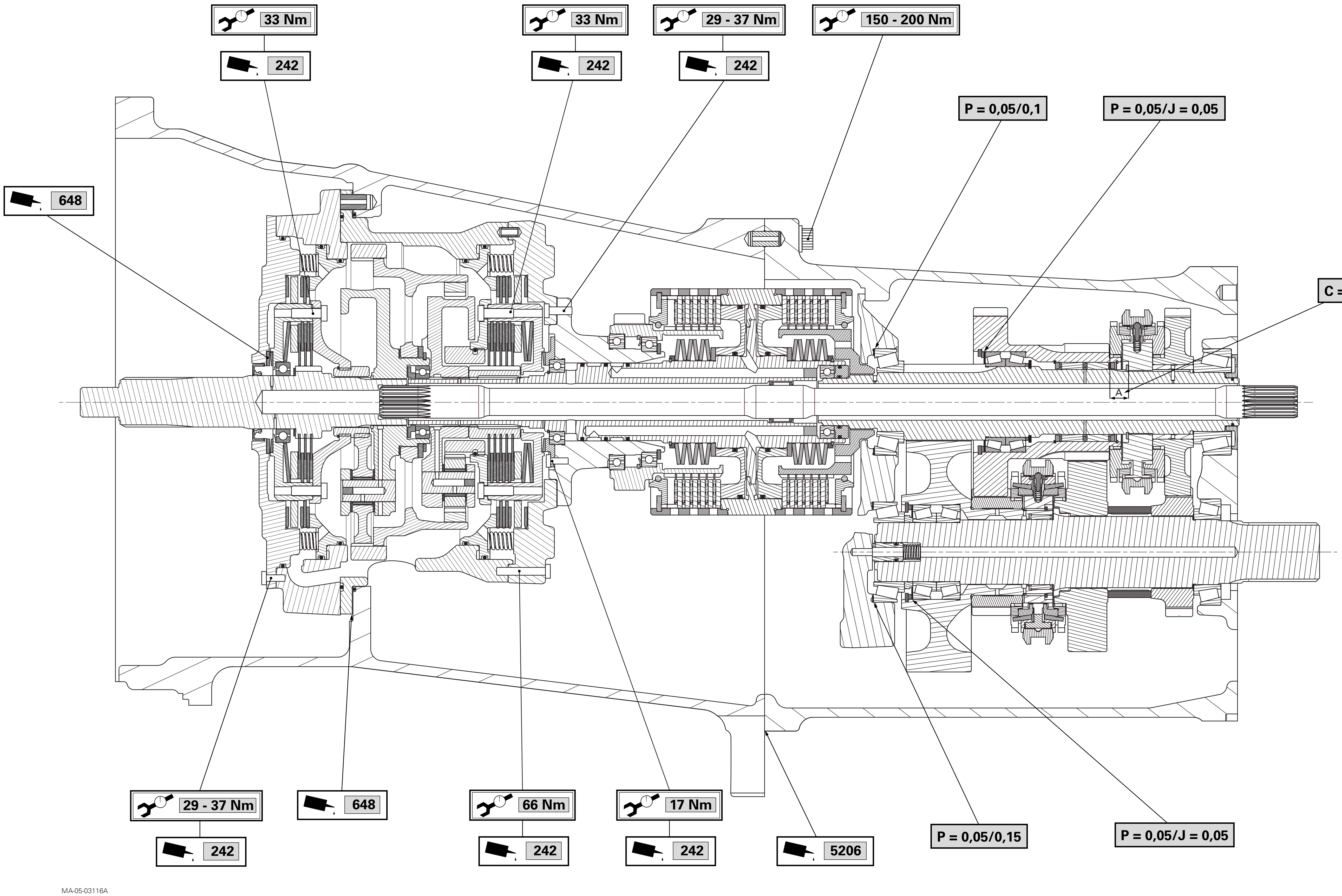


Fig. 23

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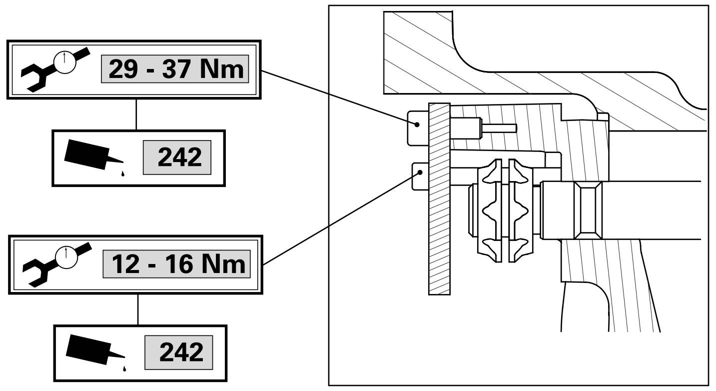
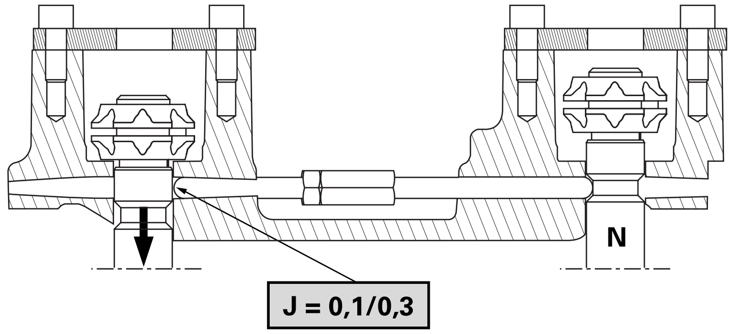
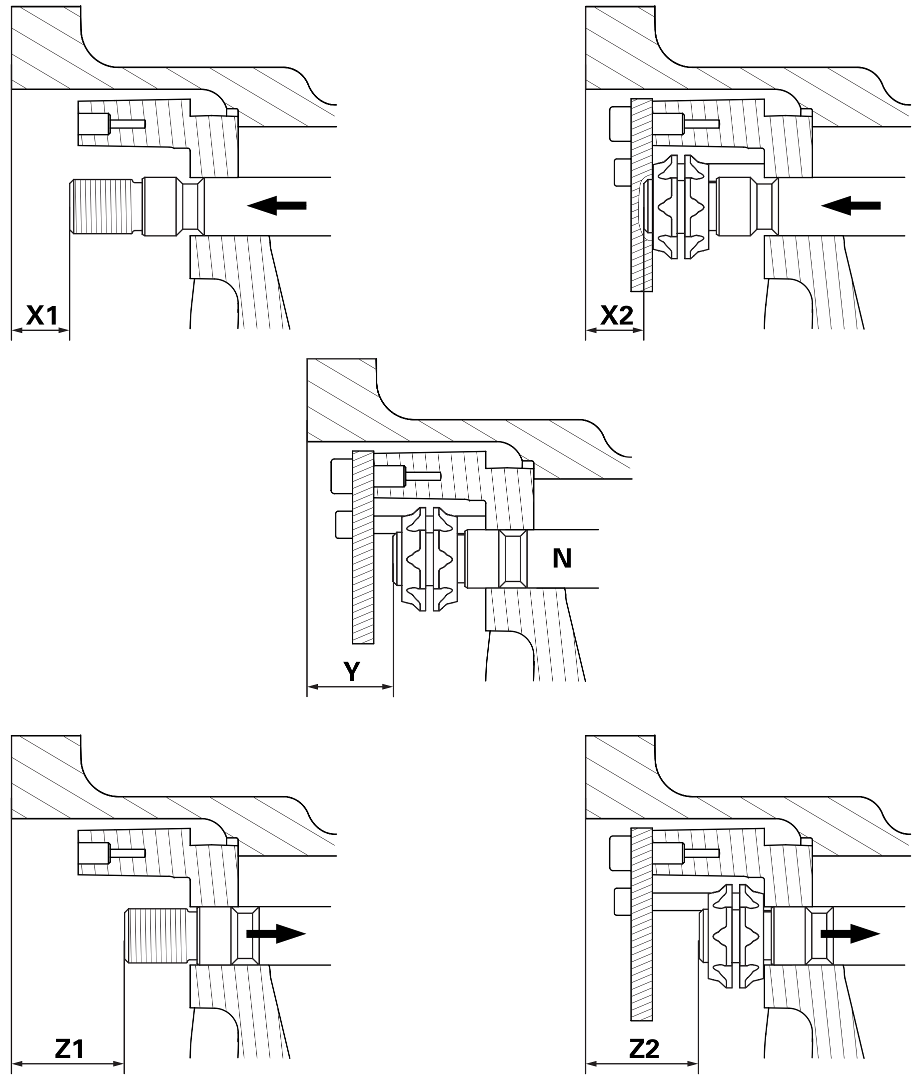
Specifications for Dyna-4 GBA25 gearbox





	1-2	3-4
X1	20,785 +/- 1	21,830 +/- 0,8
X2	21,255 +/- 1,095	22,300 +/- 0,895
Y	32,215 +/- 1,245	33,213 +/- 1,093
Z1	43,625 +/- 0,9	44,425 +/- 0,8
Z2	43,155 +/- 0,995	43,955 +/- 0,895
Z2-X2	21,9 +/- 1,4	21,655 +/- 1,275



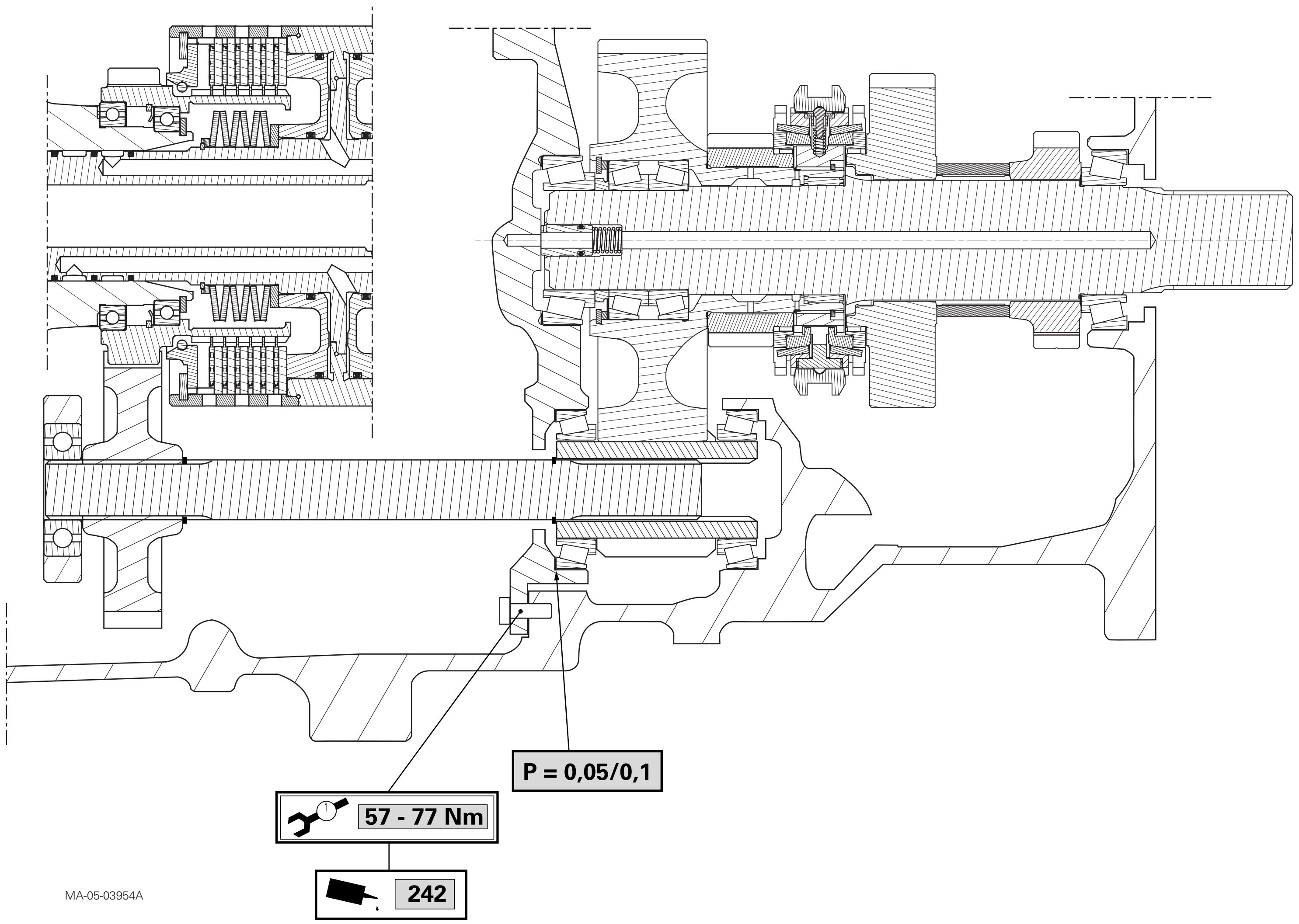


Fig. 24

5C11 - GBA25 - PowerShuttle

CONTENTS

A . General

The PowerShuttle, also called "ISC", is a system consisting of two electrohydraulically controlled multi-disc clutches. It enables the direction to be reversed under load. It is fitted to all tractors with a Dyna-4GBA25 gearbox.

The reverse shuttle is fitted in the centre of the gearbox. It links the gearbox Powershift module to the gearbox mechanical section.
The PowerShuttle is used as the main clutch of the transmission.

The PowerShuttle design is simple. It comprises two multidisc clutches, one for forward travel and one for reverse travel. The reverse shuttle transmits the drive from the gearbox Powershift module to the gearbox mechanical section.

Forward drive is transmitted directly to the mechanical gearbox primary shaft. For reverse travel, a gear train and a mainshaft transmit drive to the second ratio pinion on the secondary shaft of the mechanical gearbox.

A common lever under the steering wheel to the left reverses the direction of travel and shifts the Power-shift ratios A, B, C and D.
It is also fitted with a position for manual declutching of the transmission.

Depending on the position selected by the operator, the lever controls two proportional solenoid valves via an Autotronic 5 calculator fitted in the cab floor.
The clutch pedal or manoeuvring pedal also controls the clutch via sensors and the calculator. It is useful when carrying out precise manoeuvres or attaching implements.

The two solenoid valves are fitted on a hydraulic unit located at the front right of the gearbox. This unit also includes the control solenoid valves of the Powershift ratios. It is fed by the tractor hydraulic circuit with at a pressure of 20 bar.

A speed sensor fitted to the right-hand side of the gearbox informs the calculator of the rotational output speed of the PowerShuttle. The measurement is taken at the second ratio pinion of the secondary shaft.

Parts list (Fig. 1 and Fig. 2)

(1) PowerShuttle primary shaft
(2) Snap ring
(3) Bearing
(4) Rings
(5) Bearing
(6) Reverse driving gear
(7) Bearing
(8) Circlip
(9) Snap ring
(10) Collar
(11) Discs
(12) Thrust plates
(13) Washer
(14) Reverse shuttle unit
(15) Thrust plates
(16) Discs
(17) Belleville washers
(18) Circlip
(19) Snap ring
(20) Forward output hub
(21) Gearbox housing
(22) Mechanical gearbox primary shaft
(23) Power take-off shaft
(24) Lubricating oil deflector
(25) Snap ring
(26) Powershift module cover
(27) Snap ring
(28) Reverse clutch cover
(29) Circlip
(30) Forward clutch piston
(31) Belleville washers
(32) Reverse clutch piston
(33) Seal
(34) Seal
(35) Seal
(36) Seal
(37) Washer
(38) Reverse driving gear
(39) Bearing
(40) Forward clutch cover
(41) "O" ring
(42) Sealing ring
(43) Ring
(44) Snap ring
(45) Ring
(46) Gearbox internal compartment
(47) Mechanical gearbox secondary shaft
(48) Second range driven gear
(49) Reverse transfer gear
(50) Bearing
(51) Mainshaft
(52) Shims
(53) Bearing cup
(54) Bearing cone
(55) Bearing cup
(56) Bearing cone
(57) Bearing
(58) Circlip
(59) Flange
(60) Needle bearing
(61) Circlip

View of the Dyna-4 GBA25 PowerShuttle assembly

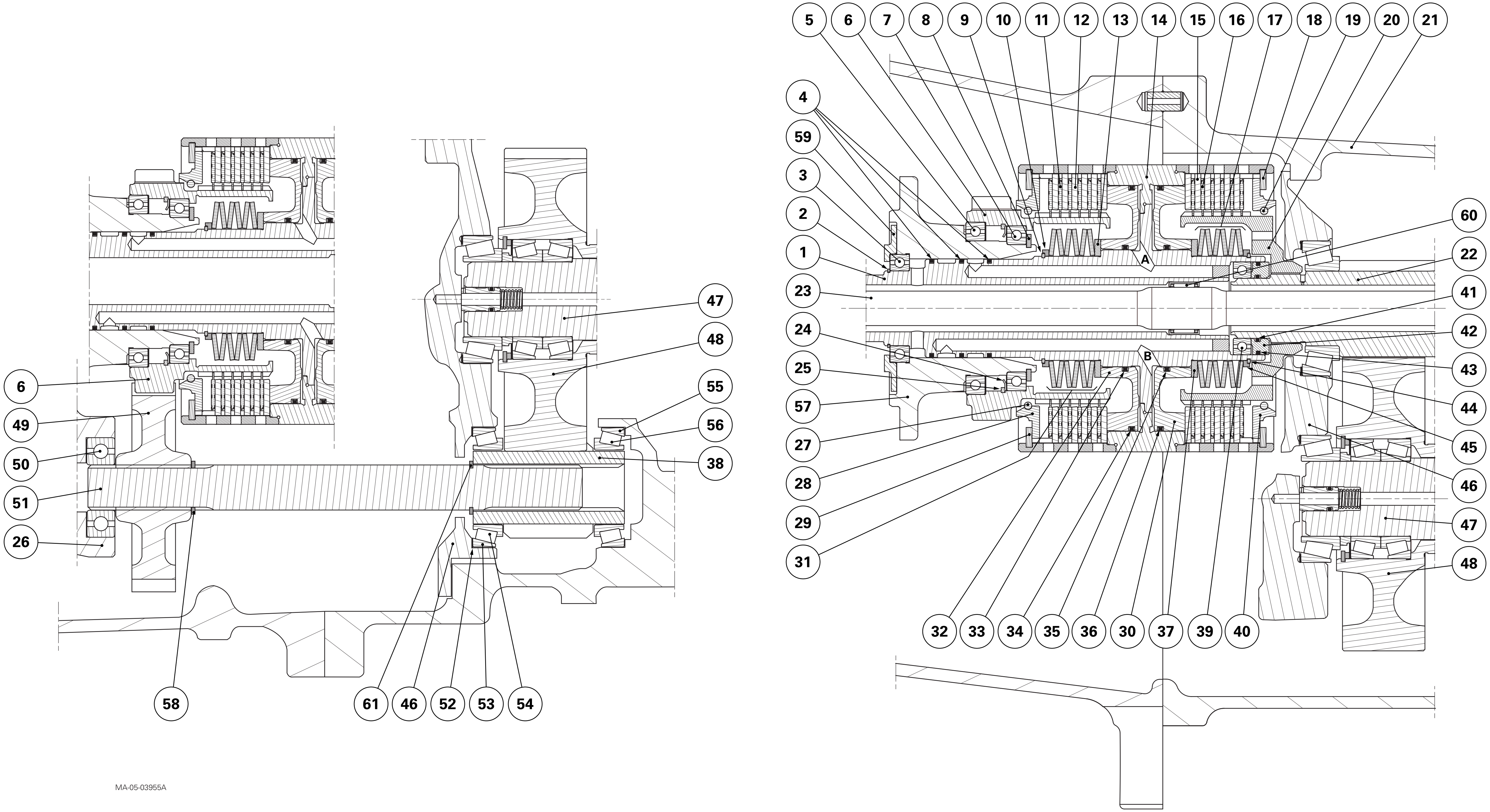


Fig. 1

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Blown-up view of the Dyna-4 GBA25 PowerShuttle

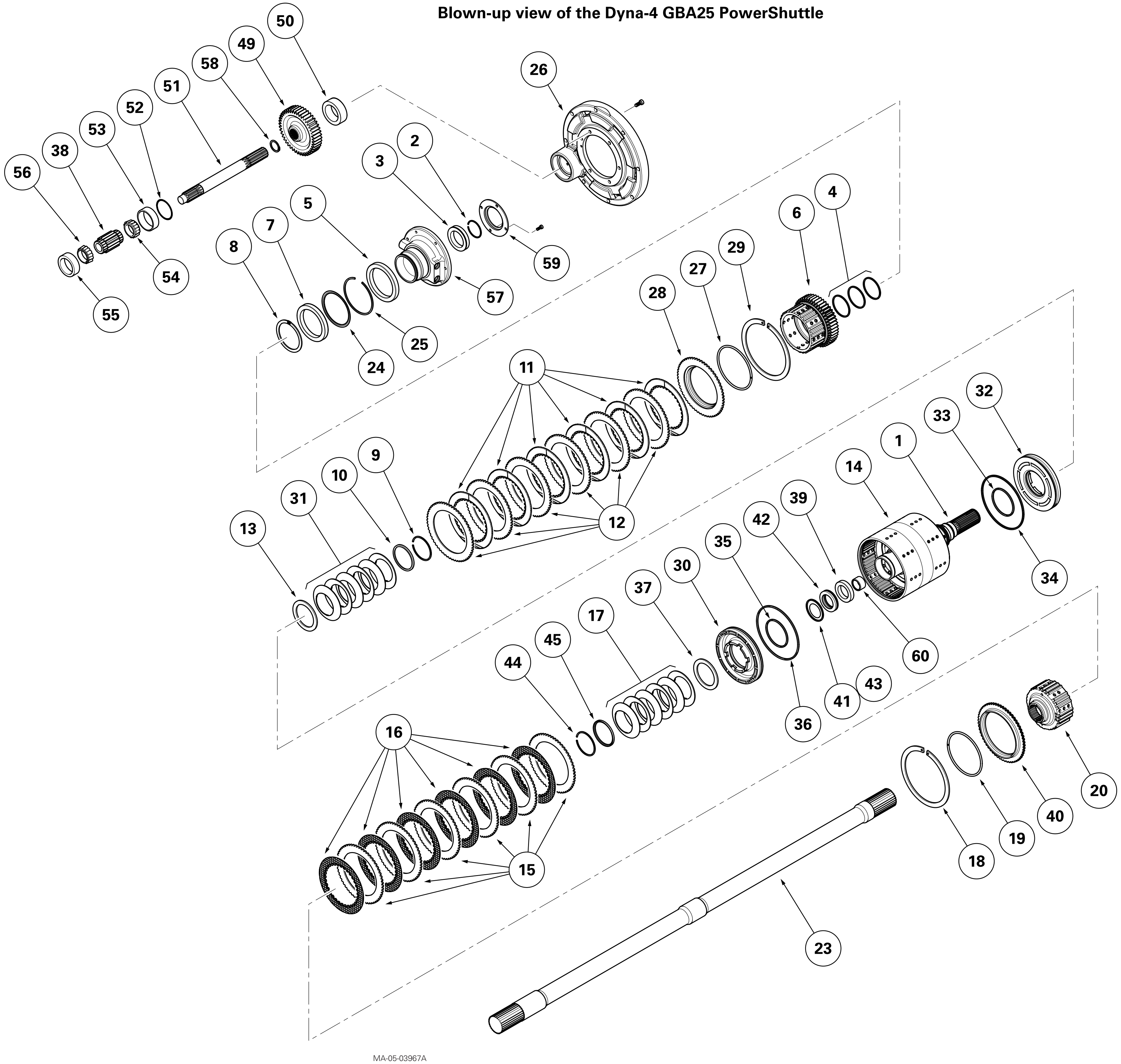

Fig. 2

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Construction (Fig. 1 and Fig. 2)

The PowerShuttle unit comprises two identical clutches fitted opposite one another.

The PowerShuttle consists mainly of a gearbox (14) fitted to the output shaft (1) of the Powershift module. The shaft (1) is supported on the Powershift module side by a ball bearing (3) held on the bearing (57) by the flange (59). On the mechanical gearbox side, the shaft (1) is supported by a ball bearing (39) fitted on the primary shaft of the mechanical gearbox (22).

The forward position output hub (20) is splined to the shaft (22). The reverse pinion (6) turns on two ball bearings (5) and (7).

Each clutch mechanism comprises a piston (30) and (32), a series of discs (16) (11) and thrust plates (15) (12). The tightness of the pistons is ensured by seals with square sections (35) (36) and (33) (34). Each piston is repositioned by a series of Belleville washers (17) and (31).

A thrust washer (13) or (37) is positioned between the piston (32) or (30) and the Belleville washers (31) or (17). The Belleville washers (31) and (17) are held on the shaft (1) by the rings (10) and (45) and snap rings (9) and (44) respectively.

The reverse transfer shaft (51) is supported at the front by a ball bearing (50) fitted tightly in the cover (26) of the Powershift module. On the mechanical gearbox side, the pinion (38) splined to the shaft (51) turns on two taper roller bearings. This part of the mechanism is described in the "Mechanical gearbox" section.

The pinion (49) is splined to the shaft (51). A circlip (58) holds the pinion (49) in position on the shaft (51).

Operation

Forward

To engage the forward position, the piston is supplied by the 20 bar hydraulic circuit of the tractor. Oil flows through the channel (B Fig. 1) in the shaft (1) and moves the piston (30). The discs (16) and thrust plates (15) are compressed between the piston and cover (40).

Input drive is transmitted via the unit (14) to the thrust plates (15) and discs (16). The splined hub (20) directly drives the gearbox primary shaft (22).

Reverse

The clutch mechanism is identical to the forward position. The reverse pinion (6) drives the mechanical gearbox second gear pinion (48) via the transfer shaft (51); the pinion turns idle on the secondary shaft (47). The direction of travel is reversed by a series of reverse driving pinions (6), (49) and (38).

Note: *The forward and reverse position ratios are identical.*

Control

Pressure is supplied to the pistons (30) and (32) by internal channels (A) and (B) located in the shaft (1). Two solenoid valves located on the gearbox right-hand cover control the clutches. The internal channels are located in the bearing (57) and in the shaft (1). Three rings (4) provide the seal between the bearing (57) and shaft (1). The channels are blocked at the end of the shaft (1) by plugs.

Lubrication

A flow of oil from the tractor hydraulic circuit is sent to the bearing (57) on the left-hand side of the gearbox. The oil flow is channelled to the centre of the upper shaftline. Radial bores distribute the oil to the various elements. The channels are blocked at the end of the shaft (1) by plugs. The seal ring (42), "O" ring (41) and ring (43) prevent the oil from leaking out where the shafts (1) and (22) join.

PowerShuttle control

Reversing the direction of travel is controlled electro-hydraulically by an Autotronic 5 calculator used to control the transmission. The calculator controls two proportional solenoid valves that control the Power-Shuttle clutches. To control the gradual reverse shifting or engagement of a clutch, the calculator receives information concerning engine rotational speed, ground speed and PowerShuttle output rotational speed (see chapter 11 Electronics).

B . Preliminary steps

1. Drain the transmission oil
2. Split the tractor between the engine and the gearbox (see chapter 2).
3. Remove:
   - either the complete gearbox (if an operation is to be carried out on the whole transmission assembly)
   - or only the Powershift module from the unit by leaving the mechanical unit coupled to the rear axle (if servicing is to be carried out on the Powershift module or reverse shuttle only)

   NOTE: *It is possible to carry out an operation on the forward clutch by splitting the tractor between the Powershift module and the mechanical gearbox.*
4. Remove (Fig. 3):
   - all hydraulic pipes fitted to the unit housing
   - the unit control hydraulic unit with its connecting pipes
   - the union and lubricating pipe of the Powershift module
   - the PTO shaft.

Fig. 3

C . Remove and reinstall the Power-Shuttle

Removal

5. If the entire gearbox has been removed (step 3), separate the Powershift module from the mechanical gearbox.
6. Locally make four legs on which to set the unit vertically, as shown in Fig. 4. Use a M14 screw or threaded rod, and weld on a nut to ensure a minimum distance of 120 mm between the unit and the work surface.

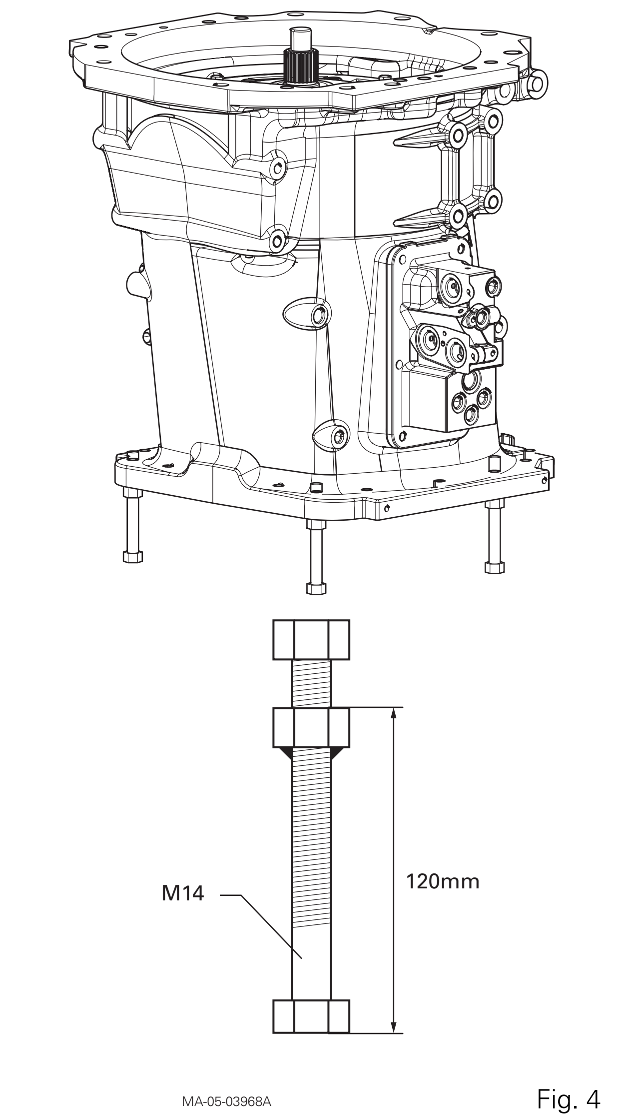

Fig. 4

7. Unscrew the two diametrically opposed screws (A Fig. 5) and replace them with two shackles to sling the gearbox.
8. Unscrew the 8 screws (B Fig. 5).

   IMPORTANT: *do not remove screws (C Fig. 5). They hold the front epicyclic gear train housing (D Fig. 5) in place.*
9. Sling the gearbox Powershift module using the shackles fitted in step7.
10. Make a mark (R Fig. 6) on the housings in order to refit the modules correctly at reassembly.
11. Fit the Powershift module on a fixture positioned on the forward clutch (Fig. 6).
12. Take out the screws holding the cover (26) on the housing (D).
13. Using the sling, raise and separate the front section of the Powershift module (Fig. 5).

    NOTE: *During this step, the brake, clutch and rear planet-carrier remain on the PowerShuttle.*

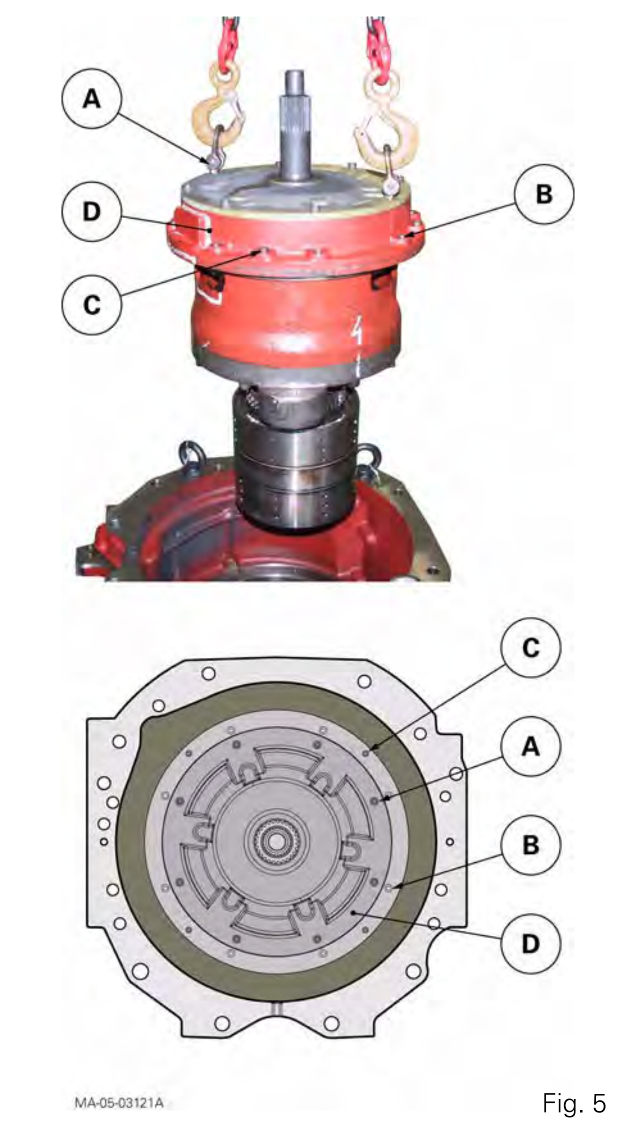

Fig. 5

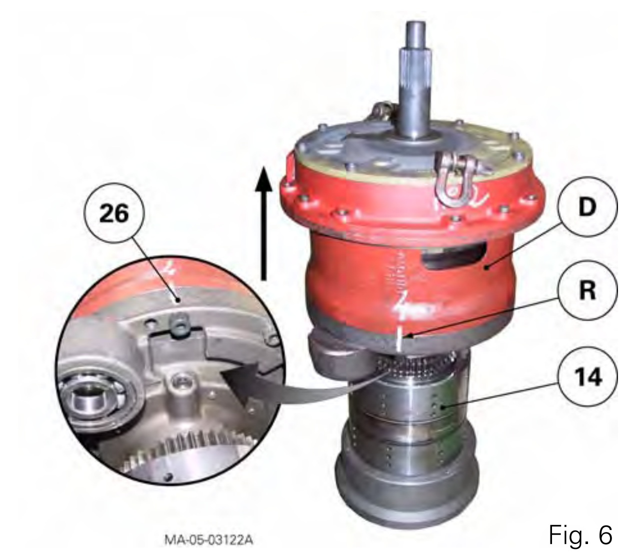

Fig. 6

14. Remove the planet-carrier (Fig. 7).

15. Take out the brake and clutch assembly (G) and the friction washer (H).

16. Remove the screws from the cover (26) on the bearing (57).

Refitting

17. Fit the PowerShuttle on a fixture positioned on the forward clutch (Fig. 6).

18. Fit the cover (26) on the bearing (57). Ensure there is a snap ring (2) on the shaft (1).

19. Fit the cover screws (26) smeared with Loctite 242 or equivalent. Tighten to a torque of 29–37 Nm.

20. Fit the friction washer (H) smeared with oil on the clutch unit (G).

21. Refit the brake and clutch assembly (G) on the cover (26 Fig. 7).

***NOTE:** If the brake discs and clutch discs have been replaced, they must be soaked for approximately one hour in a transmission oil bath. See the Power-shift module chapter for the procedure.*

22. Refit the planet-carrier (F Fig. 7).

23. Align the lubricating port (arrow) with a tooth on each planet gear (Fig. 8).

24. Sling the Powershift module as in step 9.

25. Check for the presence of return springs (S Fig. 8) in the cover (26).

26. Carry out step 13 in reverse order, aligning the two parts using the mark (R Fig. 7).

***NOTE:** Take care when inserting the planetary gears into the Powershift module piston.*

27. Fit the cover screws (26) to the Powershift module, after smearing them with Loctite 242 or equivalent. Tighten the screws to a torque of 66 Nm.

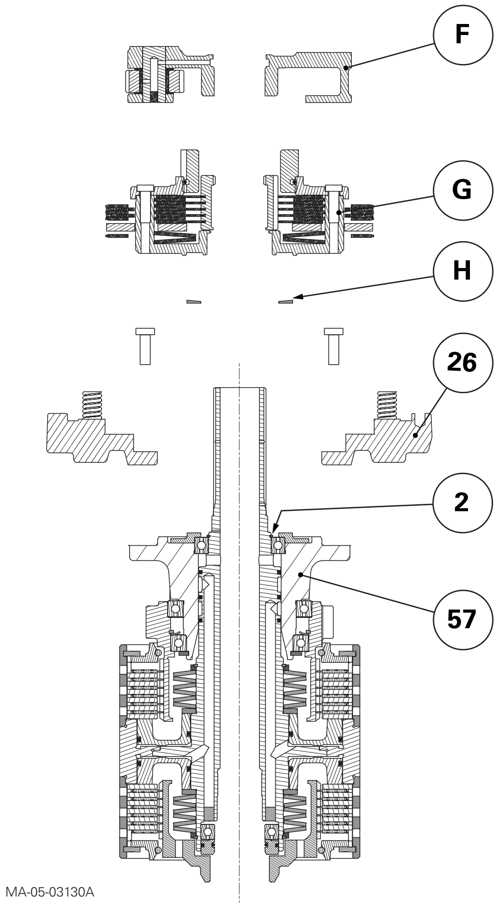

Fig. 7

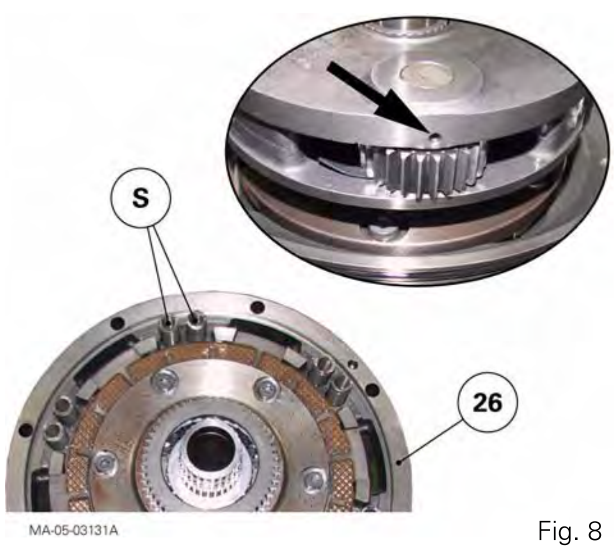

Fig. 8

28. Clean the mating faces (Fig. 9) then apply Loctite 510 or equivalent sealing product.

29. Refit the "O" ring (J Fig. 9). Smear it with grease and fit it on the Powershift module.

30. Sling the reverse shuttle and Powershift module assembly. Fit the assembly in the unit housing.

31. Lower the sling by aligning the centring pin (L) with the port (Fig. 9).

32. Refit the screws (B) of the housing (D) (Fig. 5).

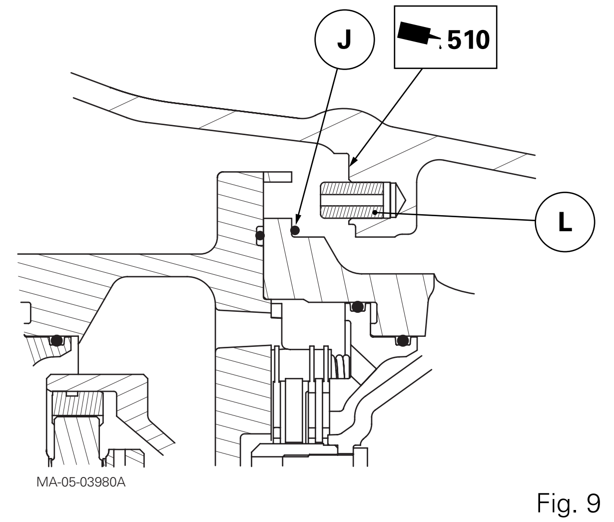

Fig. 9

D . Removing and refitting the PowerShuttle

Removing

Reverse clutch

33. Remove the PowerShuttle assembly (see § C).
34. Remove the plate (59). Remove the snap ring (2).
35. Remove the circlip (29) (step 1 Fig. 10).
36. Remove the bearing (57), reverse pinion (6), bearings (5) (7) and bearing (3) assembly (step 2 Fig. 10).
37. If it is necessary to replace the bearings (5) (7), take off the circlip (8), oil deflector (24) and snap ring (25).

NOTE: Mark the order of assembly of the oil deflector (24).

38. Remove the clutch discs (11) and thrust plates (12).
39. Remove and discard the rings (4 Fig. 10).

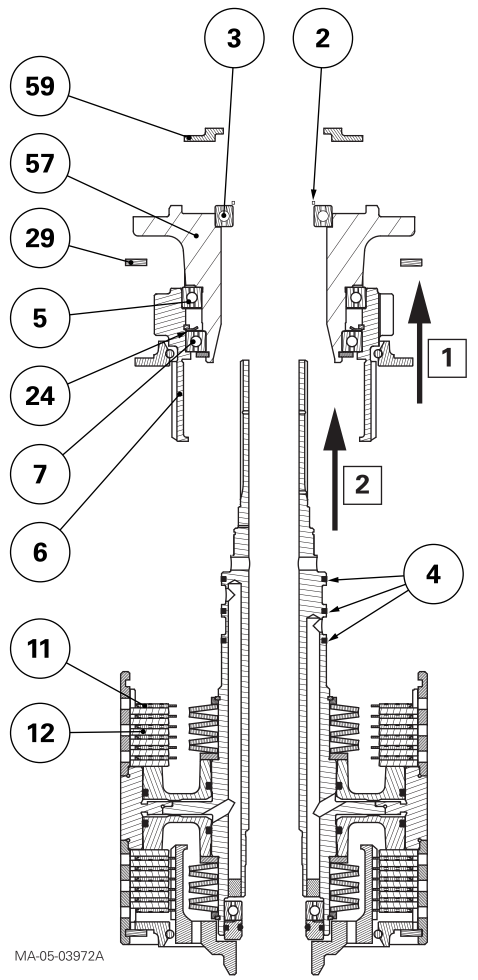

Fig. 10

40. Fit the reverse shuttle unit on a press with the Belleville washers (31 Fig. 11) facing upwards. Using the tool (ATP3002 see § F), compress the Belleville washers (31).

41. Remove the snap ring (9) and washer (10) (Fig. 12). Release the press and take off the Belleville washers (31) and thrust washer (13).

42. Drive off the piston (32) using compressed air. Discard the seals with square sections (33) (34).

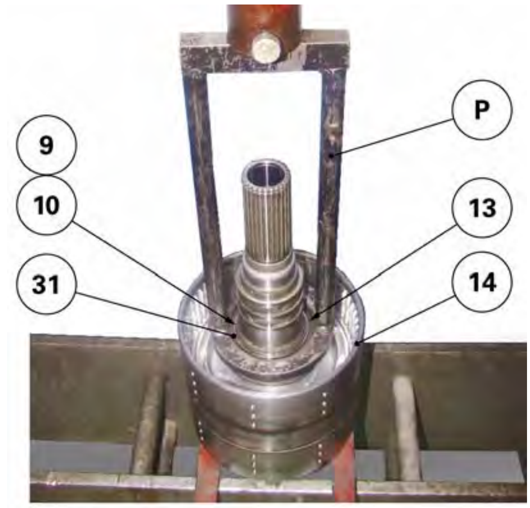

Fig. 11

Forward clutch

43. Turn over the clutch unit (14).

44. Remove the circlip (18).

45. Take off the cover plate (40) with the hub (20) and snap ring (19).

46. Remove the discs (16) and thrust plates (15).

47. Repeat steps 40 and 41 with the Belleville washers (17), snap ring (44) and washers (45) and (37).

48. Drive out the piston (30) using a jet of compressed air. Discard the seals with square sections (35) (36).

49. Take off the sealing ring (42) and the bearing (39). Discard the "O" ring (41) and ring (43) (Fig. 13).

50. If necessary, take off the needle bearing (60 Fig. 13).

Fig. 12

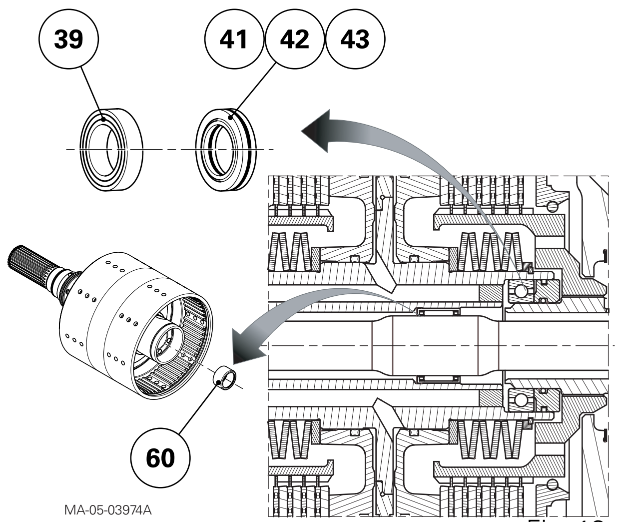

Fig. 13

Replacing

NOTE: *"O" rings and seals with a square section must previously be greased to ensure they are positioned correctly.*

NOTE: *New discs must always be soaked for approximately one hour in transmission oil.*

51. Check the condition of the parts of the mechanism. Replace those that are defective. Ensure the clutch lubricating and control ports in the shaft (1) are clean.

Assembling pistons (30) and (32)

52. Fit new greased seals with square sections (33)(34) and (35)(36) in the grooves of the pistons (30) and (32).

NOTE: *Ensure the seals are correctly positioned in the grooves.*

53. Grease the piston sleeves in the unit (14 Fig. 14).

54. Fit the pistons (30) and (32) in the unit (14) by striking the rim of each piston alternately with a plastic hammer.

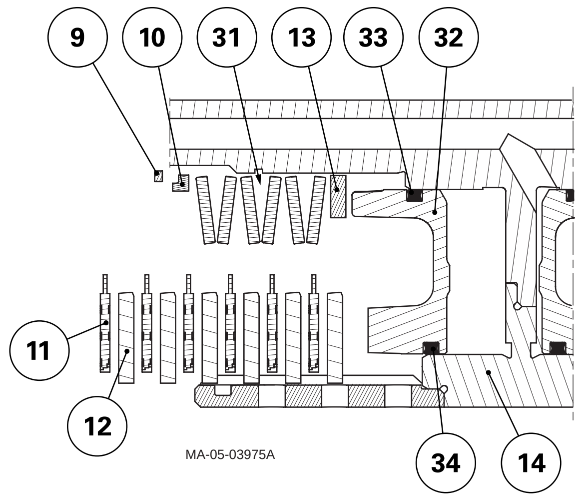

Fig. 14

Reverse clutch

55. Position the washer (13) then the Belleville washers (31) on the unit (14). Using a press and implement (ATP3002 see § F), compress the Belleville washers (31) as in step 40.

56. Fit the thrust washer (10). Fit a new snap ring (9).

NOTE: *Ensure the washer (10) is positioned correctly. Its shoulder should be facing the snap ring.*

57. Grease three new rings (4) and fit them on the grooves of the shaft (1).

58. If the bearings (5) and (7) have been removed (step 37), refit them in correct order on the hub (6):

- the bearing (7)
- the oil deflector (24)
- a new snap ring (25)
- the bearing (5).

59. Ensure the clutch lubricating and control ports in the bearing (57) are clean.

60. Assemble the sprocket hub (6) with the bearing (57).

61. Fit the circlip (8).

62. Position the bearing (57), sprocket hub (6) and bearings (5) (7) assembly on a fixture with a central hole to insert the shaft (1), with the hub turned upwards (Fig. 15).

63. Slide the discs (11) and thrust plates (12) onto the reverse pinion (6).

NOTE: *Ensure the discs and thrust plates are stacked in the correct order (Fig. 15).*

64. Align the splines of the thrust plates (12) (Fig. 15).

65. Lower the reverse shuttle unit (14) so its splines slide onto those of the thrust plates (Fig. 15).

66. Fit the circlip (29) in the groove on the unit (14).

Fig. 15

Forward clutch

67. If the needle bearing (60) supporting the PTO shaft has been removed (step 49), replace it with a new one.

68. Grease the "O" ring (41) and ring (43). Fit them on the sealing ring (42).

69. On the shaft (1):

- insert the bearing (39)
- insert the ring (42).

IMPORTANT: *Ensure the sealing ring (42) is positioned correctly Fig. 16. Its shoulder (arrow) should be facing the bearing (39).*

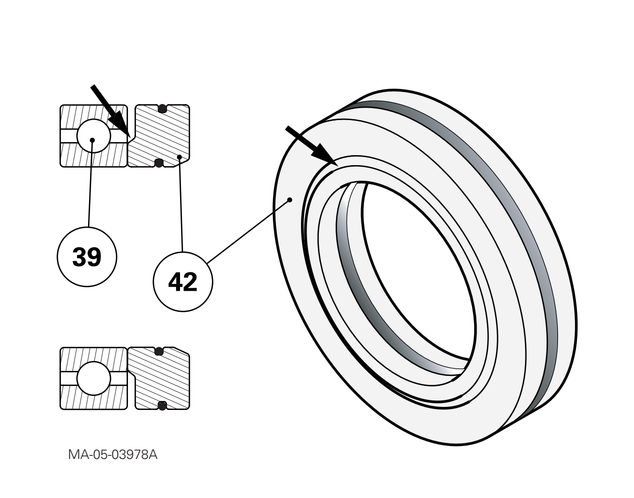

Fig. 16

70. Carry out steps 55 and 56 with the forward clutch.

71. Fit the hub (20) in the unit (14).

72. Slide on the discs (16) and thrust plates (15).

NOTE: *Ensure the discs and thrust plates are stacked in the correct order (Fig. 15).*

73. Fit the cover plate (40) with the snap ring (19).

74. Fit the circlip (18).

75. Refit the PowerShuttle assembly (see § C).

E . Final steps

76. Refit the PTO shaft in the transmission upper shaftline.

77. Refit the hydraulic control covers, and reconnect the hydraulic pipes and hoses.

78. Assemble the transmission on the engine side and rear axle side, applying Loctite 5206 or equivalent sealant to the mating faces (see chapter 2).

79. Top up the transmission oil level.

80. Carry out a clutch calibration (see Chapter 11).

81. Carry out a road test of the gearbox operation. Check that the hydraulics are functioning correctly and check for leaks.

F . Service implements

Implement available in AGCO network

- **ATP 3002: Belleville washer compression implement (Fig. 17)**

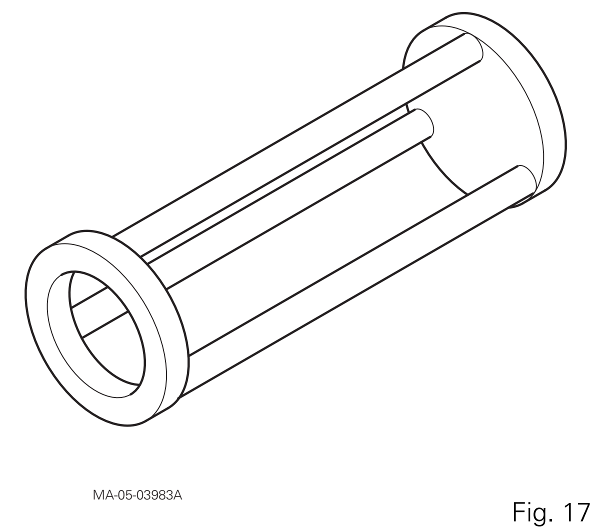

Fig. 17

5C12 - GBA25 - Powershift module

CONTENTS

A . General

The Powershift module is fitted on GBA25 Dyna-4gearboxes. It is fitted at the gearbox input and is driven directly by the engine. This module provides the GBA25 Dyna-4transmission with four ratios for shifting under load.

These four ratios are provided by two epicyclic gear trains, operating with two brakes and two clutches.

The ratios can be controlled with the Powercontrol lever (to the left under the steering wheel) or with the right-hand armrest lever.

Ratios are shifted in "Speedmatching" mode, where the most suitable ratio for shifting under load is automatically selected when changing range.

The brakes and clutches are controlled by proportional solenoid valves (N and L Fig. 1). They are fitted to a hydraulic unit to the front right of the gearbox that operates on the tractor 20 bar circuit (Fig. 1).

Fig. 1

B . Principles of operation

The Powershift module is made up of two epicyclic gear trains:

- The front epicyclic gear train, located on the gearbox input. This comprises a sun gear (36), a planet carrier (25), three planetary gears (48) and a ring gear (65). It is controlled by a brake and a clutch. Its ratio is 1.23/1 (speed multiplied) or 1/1 (train locked).
- The rear epicyclic gear train, located on the gearbox output. This comprises a sun gear (49), a planet carrier (30), three planetary gears (50) and a ring gear (29). It is controlled by a brake and a clutch. Its ratio is 1/1.5 (speed reduced) or 1/1 (train locked).

Front epicyclic gear train

The input shaft (10) of the module is linked to the planet carrier (25) of the primary epicyclic gear train. The sun gear (36) is either attached to the planet carrier (25) (clutch M engaged, epicyclic gear train locked) or to the gearbox housing (brake L engaged, input speed multiplied). Drive is transmitted by ring gear (65) to ring gear (29) of the rear epicyclic gear train.

Rear epicyclic gear train

Input drive is transmitted by the ring gear (29). The sun gear (49) is either attached to the planet carrier (30) (clutch O engaged, epicyclic gear train locked) or to the gearbox housing (brake N engaged, input speed reduced). The output shaft (47) is attached to the planet carrier (30), and is linked to the PowerShuttle.

Lubrication

The Powershift module is lubricated under pressure by a network of internal channels. Oil enters the upper main shaft of the gearbox, then travels through radial bores to the elements to lubricate.

The oil flows from the tractor hydraulic circuit (see chapter 9).

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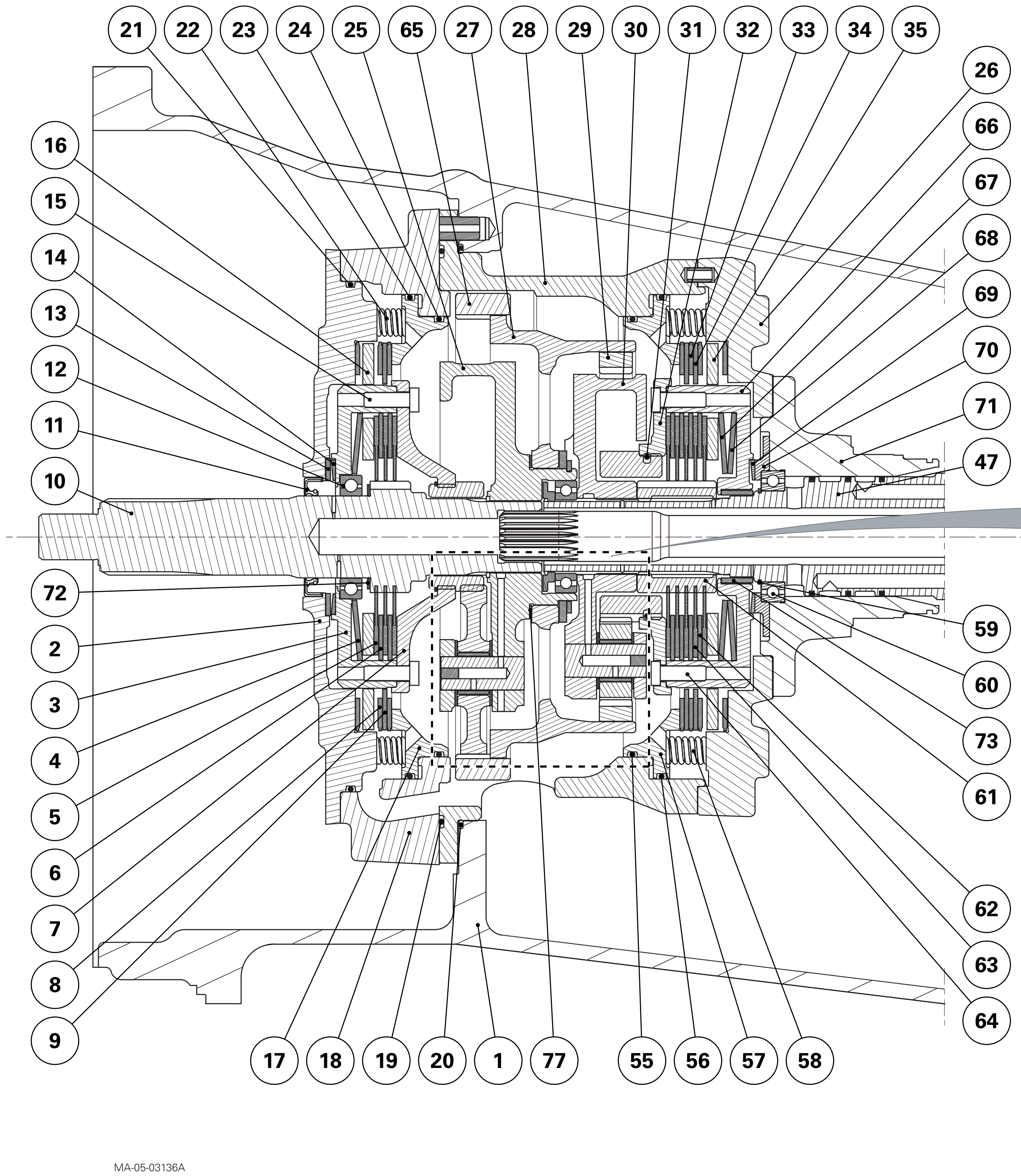
Parts list (Fig. 2)

(1) Housing
(2) Cover
(3) Clutch M housing
(4) Belleville washer
(5) Discs
(6) Thrust plates
(7) Clutch M cover
(8) Discs
(9) Thrust plate
(10) Input shaft
(11) Lip seal
(12) Ball bearing
(13) Friction washer
(14) Friction washer
(15) Screws
(16) Clutch M/brake L junction plate
(17) Brake L piston
(18) Powershift module front housing
(19) "O" ring
(20) "O" ring
(21) "O" ring
(22) Spring
(23) "O" ring
(24) "O" ring
(25) Front planet carrier
(26) Cover
(27) Ring gear carrier
(28) Rear housing
(29) Rear ring gear
(30) Rear planet carrier
(31) Snap ring
(32) Clutch O cover
(33) Discs
(34) Thrust plates
(35) Clutch O/brake N junction plate
(36) Sun gear
(37) Snap ring
(38) Needle bearing
(39) Pin
(40) Plug
(41) Friction washers
(42) Snap ring
(43) Bronze spacer
(44) Ball bearing
(45) Spacer
(46) Circlip
(47) Output shaft
(48) Planetary gear
(49) Sun gear
(50) Planetary gear
(51) Needle bearing
(52) Pin
(53) Plug
(54) Friction washers
(55) "O" ring
(56) "O" ring
(57) Brake N piston
(58) Spring
(59) Snap ring
(60) Ball bearing
(61) Clutch hub
(62) Thrust plates
(63) Discs
(64) Screws
(65) Front ring gear
(66) Clutch O housing
(67) Belleville washer
(68) Belleville washer
(69) Friction washer
(70) Spacer
(71) Bearing
(72) Spring washer
(73) Needle bearing
(74) "O" ring
(75) "O" ring
(76) "O" ring
(77) Washer

View of the assembly



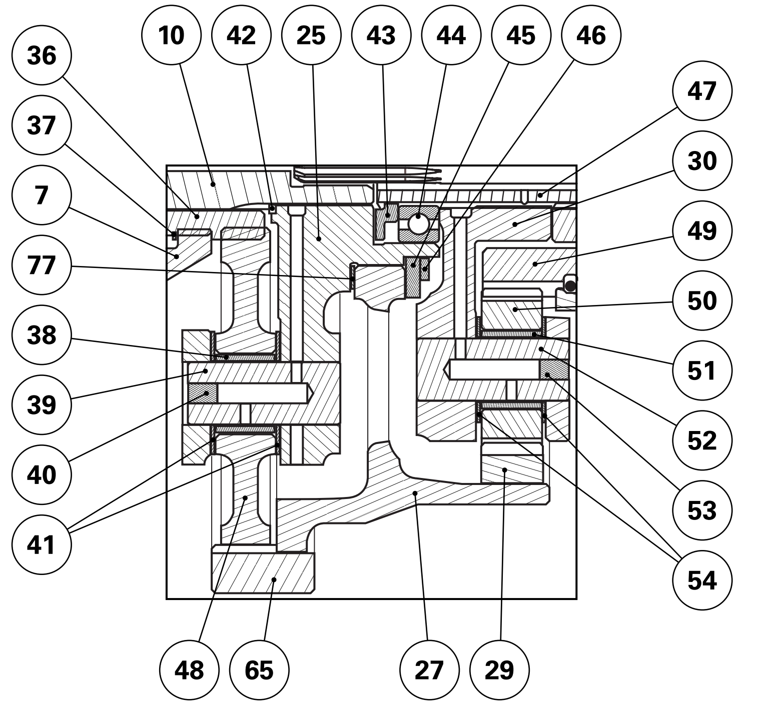


Fig. 2

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C . Kinematics

Parts list (Fig. 4)

(Av) Forward clutch
(Ar) Reverse clutch
(L) Sun gear brake, front epicyclic gear train of Powershift module
(M) Sun gear clutch, front epicyclic gear train of Powershift module
(N) Sun gear brake, rear epicyclic gear train of Powershift module
(O) Sun gear clutch, rear epicyclic gear train of Powershift module

Logic of the ratios (see table)

The four ratios are obtained by combining the two epicyclic gear trains. The front epicyclic gear train multiplies the input speed to 1.23/1, while the rear epicyclic gear train reduces the speed to 1/1.5.

Each epicyclic gear train may be engaged (multiplication or reduction) or locked (ratio 1/1). The two epicyclic gear trains are used in combination to obtain the four ratios A, B, C and D.

Clutch/brake operation (Fig. 3)

The brakes and clutches operate as a 1 brake/1 clutch set. The brakes (F) mesh an element to the housing (fixed), and the clutches (E) mesh two elements in rotation.

The clutches/brakes are controlled by a single piston (P). A junction plate (L) allows the clutch to be released when the brake is engaged, and vice versa.

When there is no pressure on the piston (position A), the Belleville washer (R) engages the clutch (E). When the piston (P) is actuated (position B), it engages the brake (F) and pushes back the Belleville washer (R) via the plate (L).

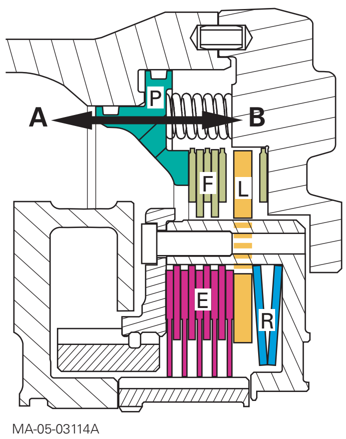

Fig. 3

(Fig. 3) Key

- Piston (P)
- Brake (F)
- Junction plate (L)
- Clutch (E)
- Belleville washer (R)

Kinematic diagram

Front epicyclic gear train   Rear epicyclic gear train

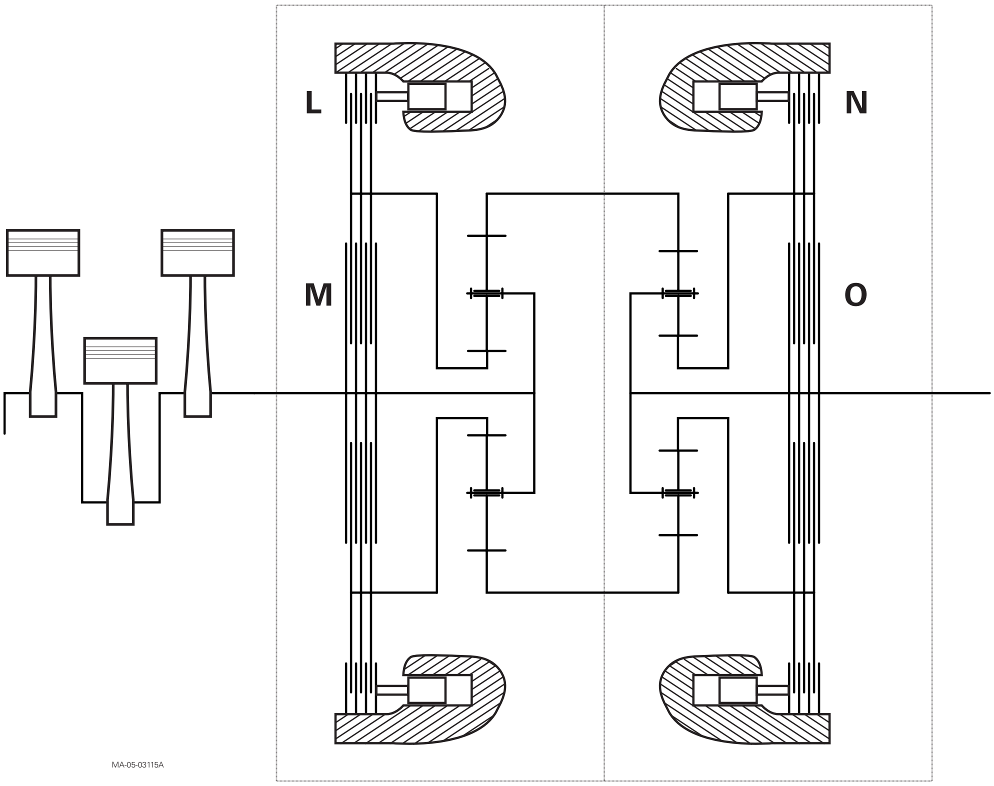

Fig. 4

Powershift ratio	Front epicyclic gear train		Rear epicyclic gear train		Solenoid valve		Clutches/brakes (X=engaged)			
	Status	Ratio	Status	Ratio	L	N	L	M	N	O
A	Direct drive	1/1	Epicyclic gear train engaged	1/1.5		12V		X	X	
B	Epicyclic gear train engaged	1.23/1	Epicyclic gear train engaged	1/1.5	12V	12V	X		X	
C	Direct drive	1/1	Direct drive	1/1				X		X
D	Epicyclic gear train engaged	1.23/1	Direct drive	1/1	12V		X			X

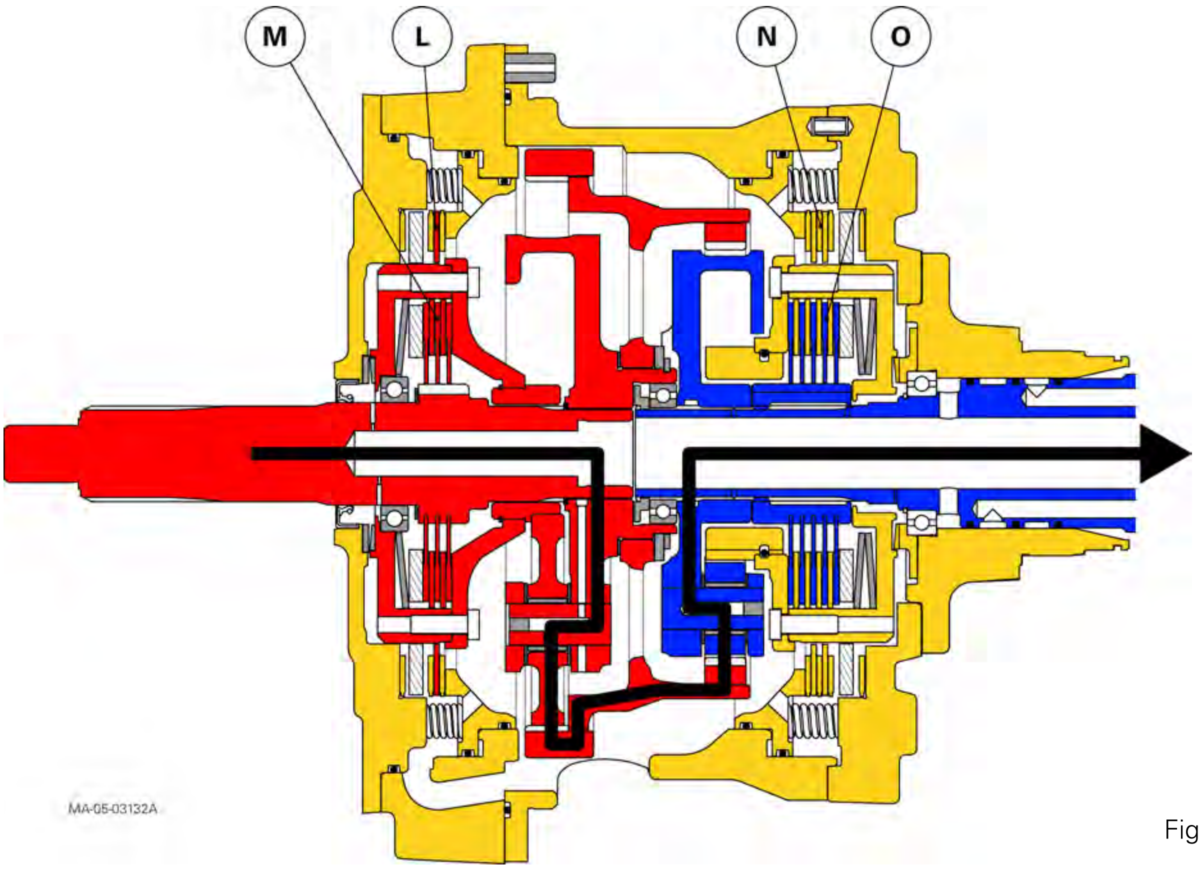

Fig. 5

Ratio A (1/1.5) (Fig. 5)

Brake piston "L" is not pressurised, clutch "M" is engaged and locks the front epicyclic gear train.

Brake piston "N" is pressurised. The sun gear of the rear epicyclic gear train is held in relation to the gear box housing, enabling the rear epicyclic gear train to reduce the input speed.

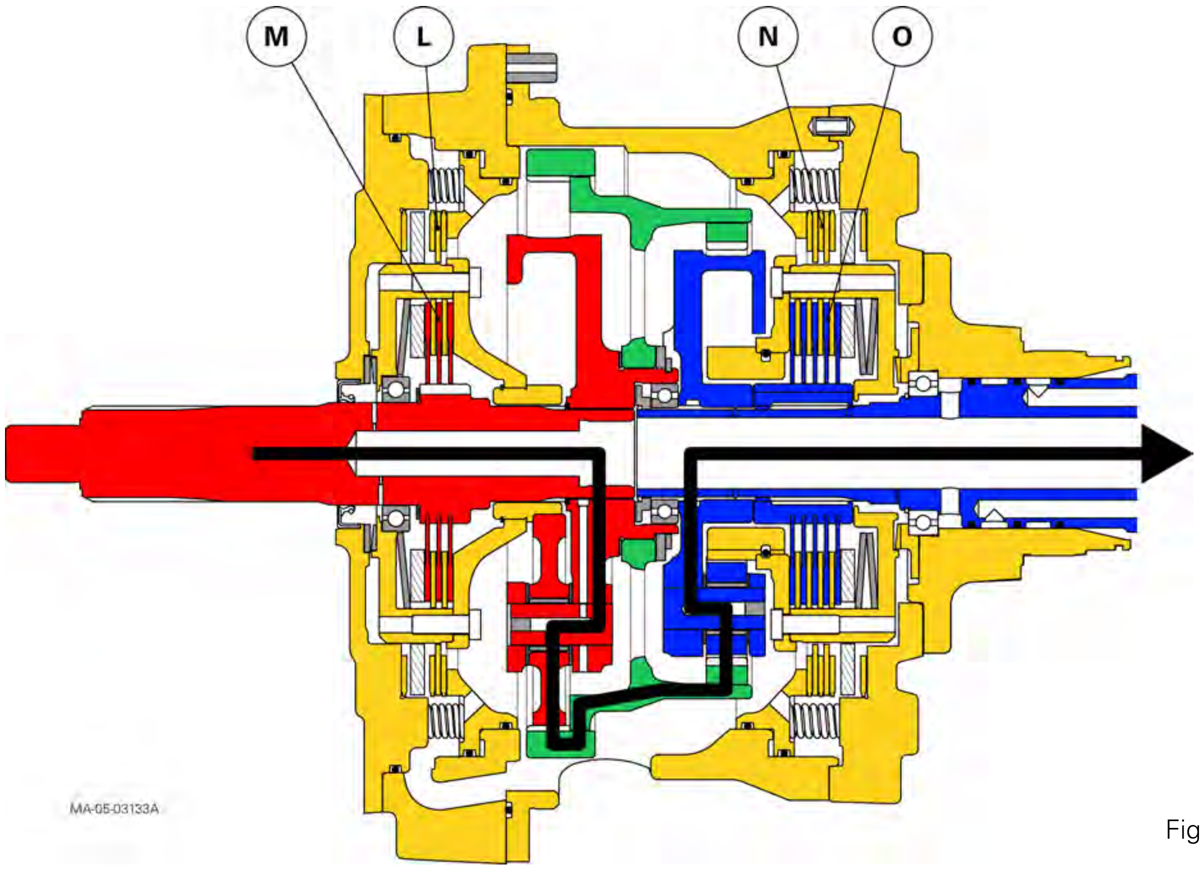

Fig. 6

Ratio B (1/1.22) (Fig. 6)

The two brake pistons L and N are pressurised. The sun gears are held in relation to the gearbox housing The two epicyclic gear trains are engaged. The front epicyclic gear train increases the input speed to 1.23/1 and the rear epicyclic gear train reduces the speed to 1/1.5, giving an overall ratio of 1/1.22.

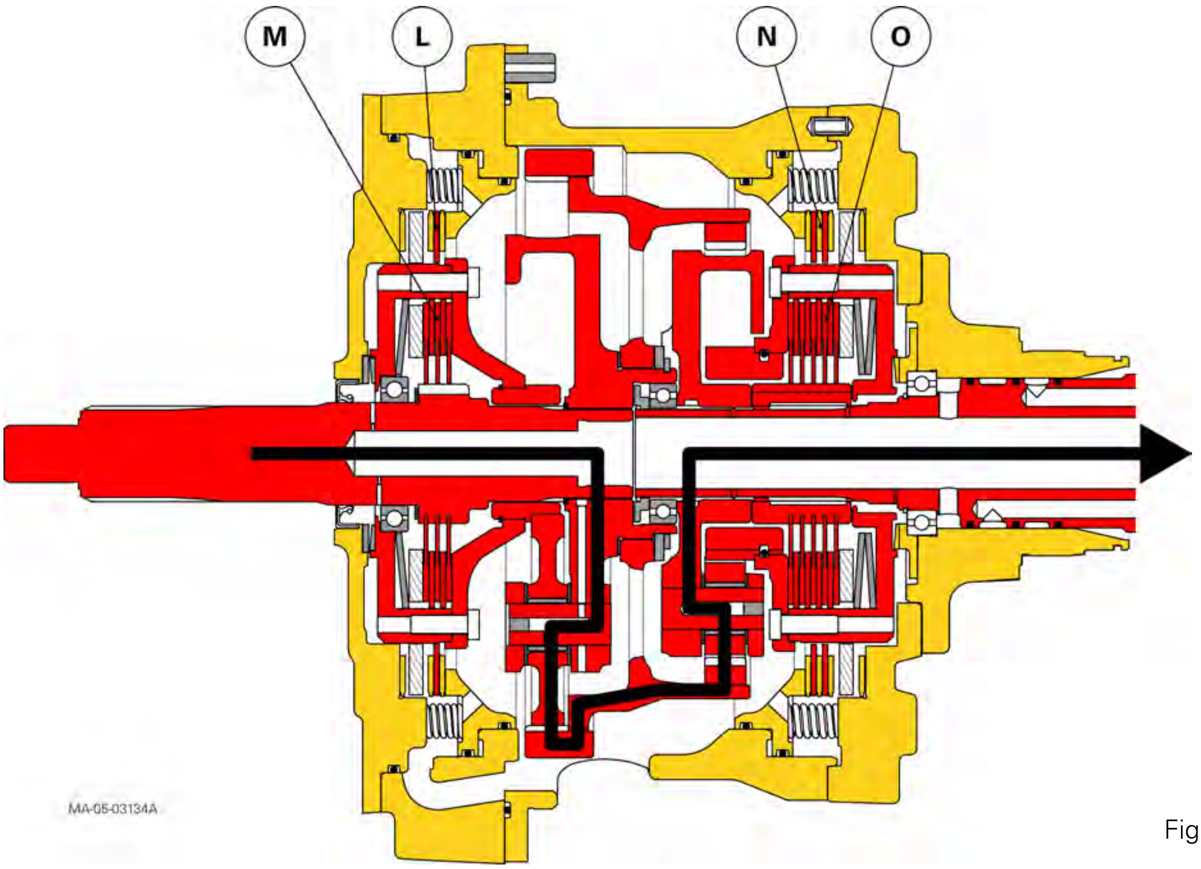

Fig. 7

Ratio C (1/1) (Fig. 7)

None of the pistons is pressurised, clutches "M" and "O" are engaged by their respective Belleville washers. Both epicyclic gear trains are locked and the input speed is identical to the output speed.

GBA25 - Powershift module

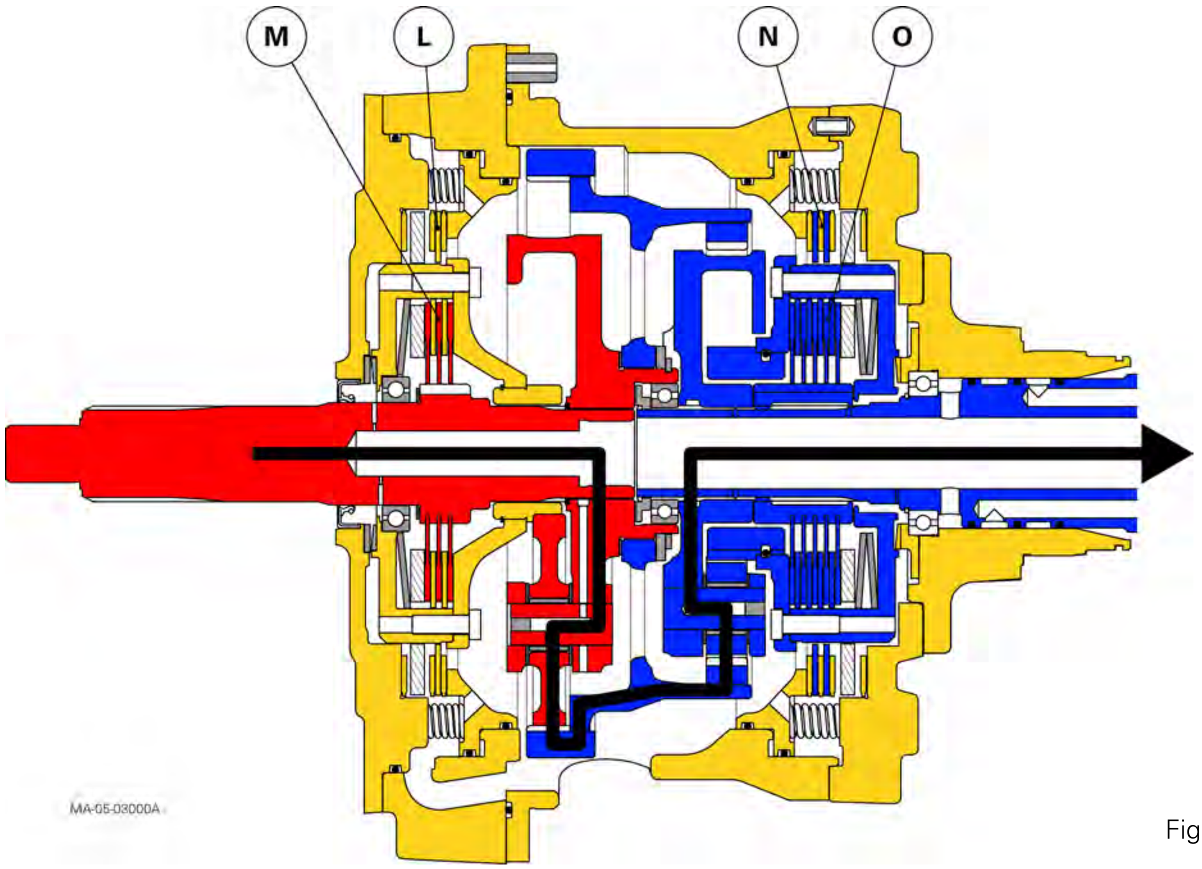

Fig. 8

Ratio D (1.23/1) (Fig. 8)

Brake piston "L" is pressurised, it holds the sun gear of the front epicyclic gear train in relation to the housing. The front epicyclic gear train multiplies the input speed to 1.23/1.

Brake piston N is not pressurised. Clutch "O" locks the rear epicyclic gear train; its ratio is 1/1.

D . Preliminary steps

1. Drain the transmission oil.
2. Split the tractor between the engine and the gearbox (see chapter 2).
3. Remove:
   - either the complete gearbox (if servicing is to be carried out on the whole transmission assembly)
   - or only the Powershift module from the unit, leaving the mechanical unit coupled to the rear axle (if servicing is to be carried out on the Powershift module or reverse shuttle only)
4. Remove (Fig. 9):
   - all hydraulic pipes fitted to the unit housing
   - the unit control hydraulic unit with its connecting pipes
   - the union and the lubrication pipe of the Powershift module
   - the PTO shaft

Fig. 9

E . Removing and refitting the Powershift module

Removal

5. If the whole unit has been removed (step 3), separate the Powershift module from the mechanical gearbox.
6. Rig up four makeshift legs on which to set the unit vertically, as shown in Fig. 10. Use an M14 screw or threaded rod, and weld on a nut to ensure a minimum distance of 120 mm between the unit and the work surface.

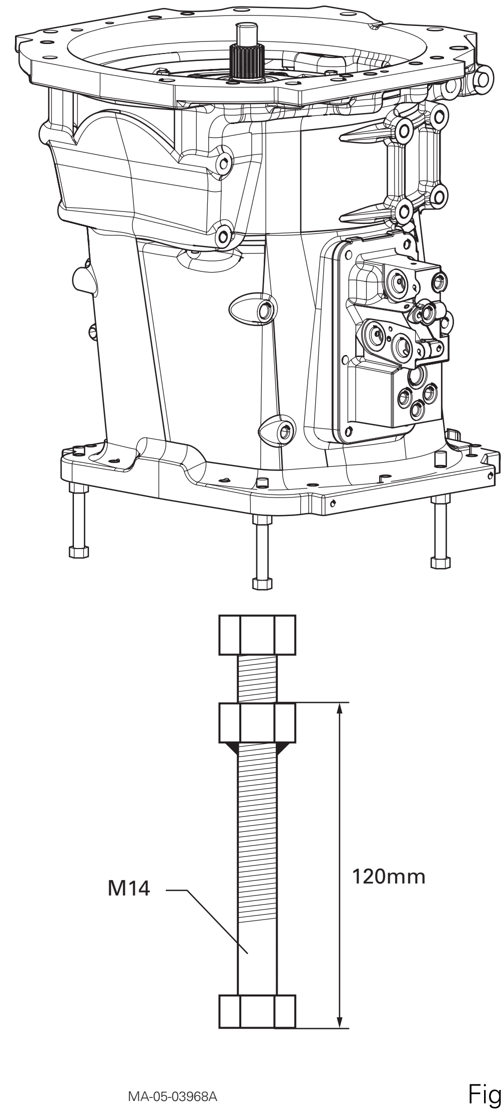

Fig. 10

7. Unscrew the two diametrically opposed screws (A) (Fig. 11)and replace them with two shackles to sling the gearbox.

   Important: *do not remove screws (C) (Fig. 11). They hold the front epicyclic gear train housing (D) (Fig. 11) in place.*
8. Sling the gearbox Powershift module using the shackles fitted in step 7.
9. Make a mark (R Fig. 12) on the housings to ensure the modules are refitted correctly.
10. Fit the Powershift module on a supporting fixture positioned on the forward clutch (Fig. 12).
11. Take out the screws holding the cover (26) on the housing (D).
12. Using the sling, lift and separate the front part of the Powershift module (Fig. 11).

    Note: *During this step, the brake, the clutch and the rear planet carrier stay on the PowerShuttle.*

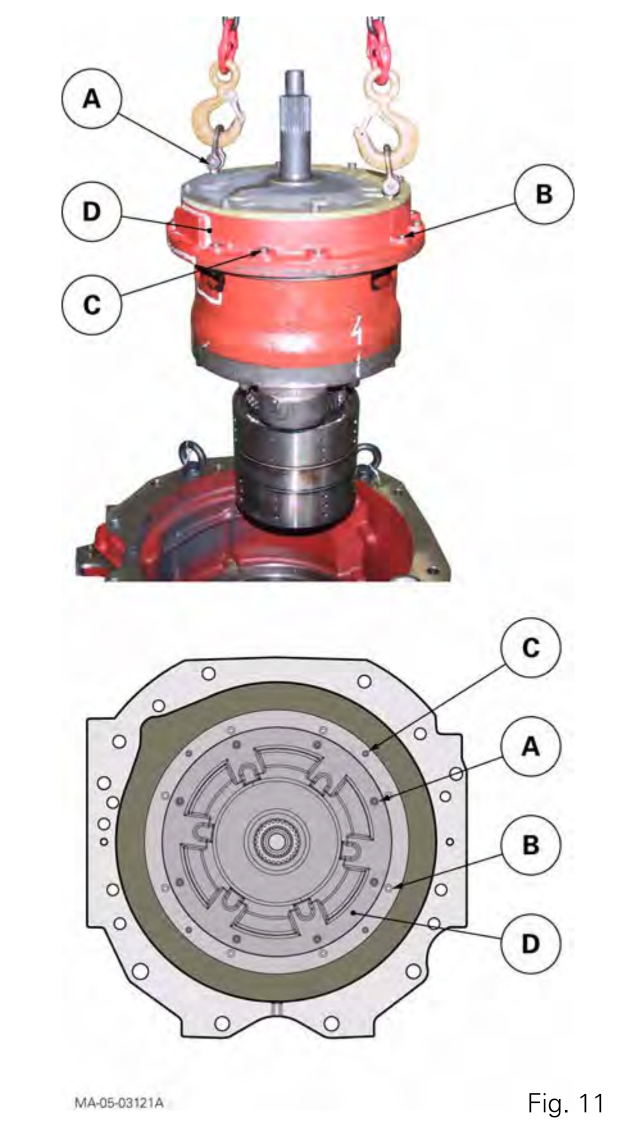

Fig. 11

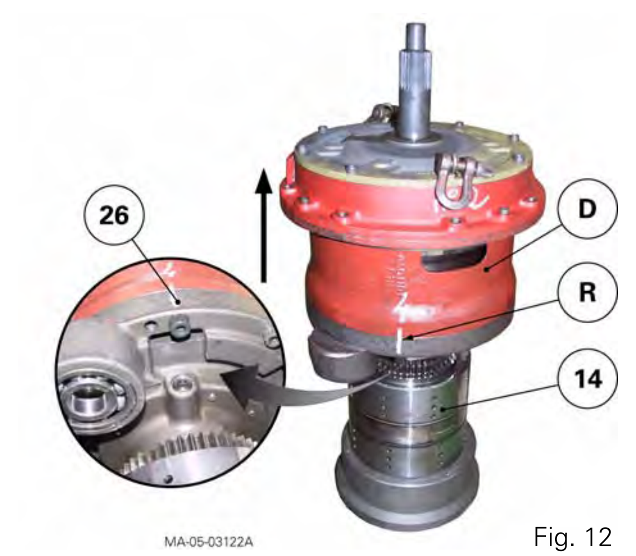

Fig. 12

Refitting

13. Sling the Powershift module as in step 8.

14. Check that the return springs (S Fig. 13) are present in the cover (26).

15. Carry out step 12 in reverse order, aligning the two parts using the mark (R Fig. 12).

Note: *Take care when inserting the planetary gears in the Powershift module brake piston (57).*

16. Fit the cover screws (26) to the Powershift module, after smearing them with Loctite 242 or equivalent. Tighten the screws to a torque of 66 Nm.

17. Clean the mating faces (Fig. 14) then apply Loctite 510 or equivalent sealing product.

18. Refit the "O" ring (J) (Fig. 14). Grease it lightly and fit it on the Powershift module.

19. Sling the reverse shuttle and Powershift module assembly. Fit the assembly in the unit housing.

20. Lower the sling, aligning the centring pin (L) with the port (Fig. 14).

21. Refit the screws (B) of the housing (D) (Fig. 11).

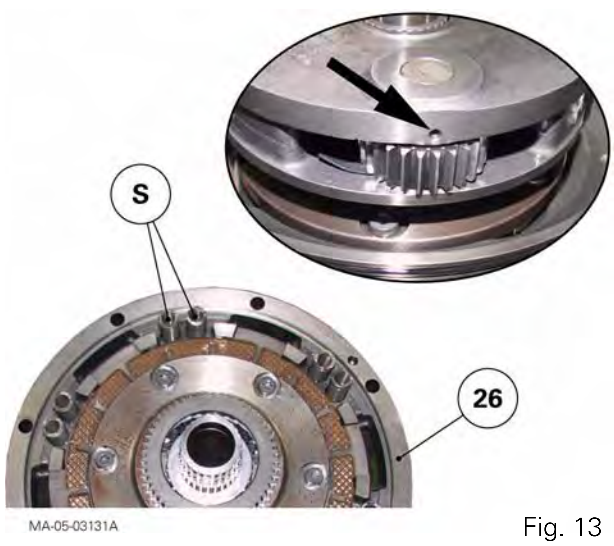

Fig. 13

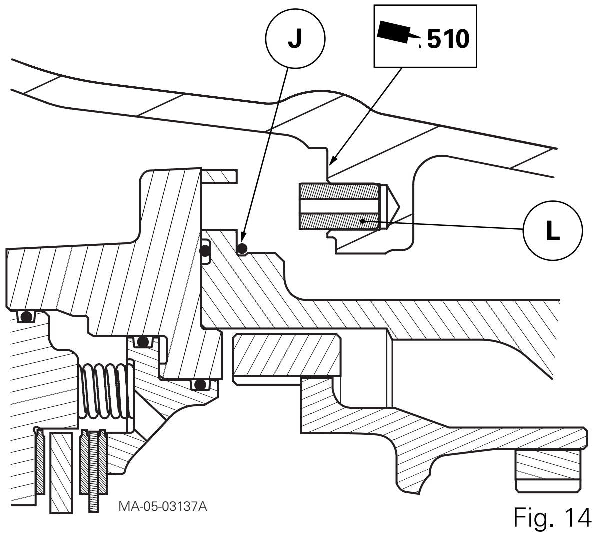

Fig. 14

F . Removing and refitting the Powershift module

Removing the Powershift module

22. Remove the piston (57) and the springs (58).
23. Place the section with the reverse shuttle on a suitable supporting fixture, with the cover (26) and planet carrier (30) facing upwards (Fig. 15).
24. Remove the planet carrier (30) (Fig. 15). To remove the planetary gears, see § G.
25. Take out the clutch O/brake N assembly from the cover (26). Retain the friction washer (69) (Fig. 16).
26. Remove the clutch hub (61). Take out the screws (64) to remove the clutch cover (32) (Fig. 16).
27. Mark the order of the discs and brake/clutch thrust plates before removing them (Fig. 16).
28. Mark the direction and remove the Belleville washers (67) and (68).

Fig. 15

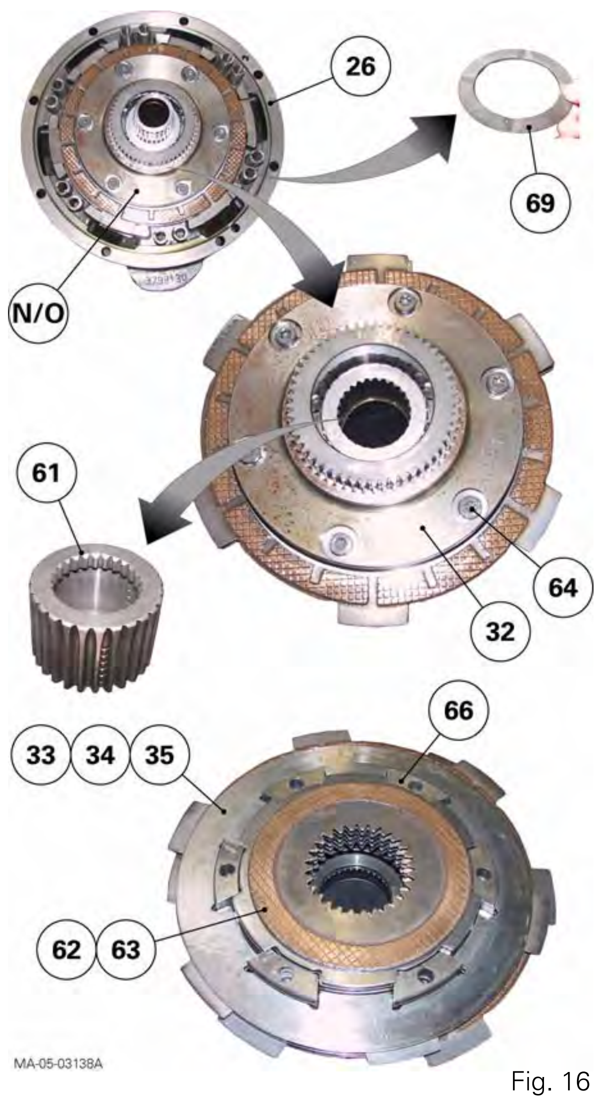

Fig. 16

29. If necessary, take out the needle bearing (73) of the clutch housing (66) (Fig. 17).

30. Place the front part of the Powershift module facing downwards on a suitable supporting fixture. Make a mark (G) on the housings (28) and (18) (Fig. 18).

31. Remove the screws from the housings (28) and (18) (arrow Fig. 18), then remove the housing (28).

32. Take out and discard the "O" rings (74) and (75) on the housing pilot ports. Discard "O" ring (19) and "O" ring (76) (Fig. 18 and Fig. 19).

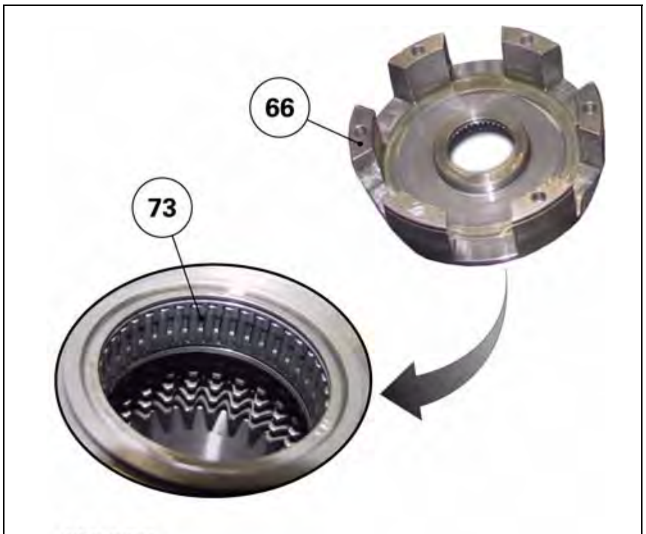

Fig. 17

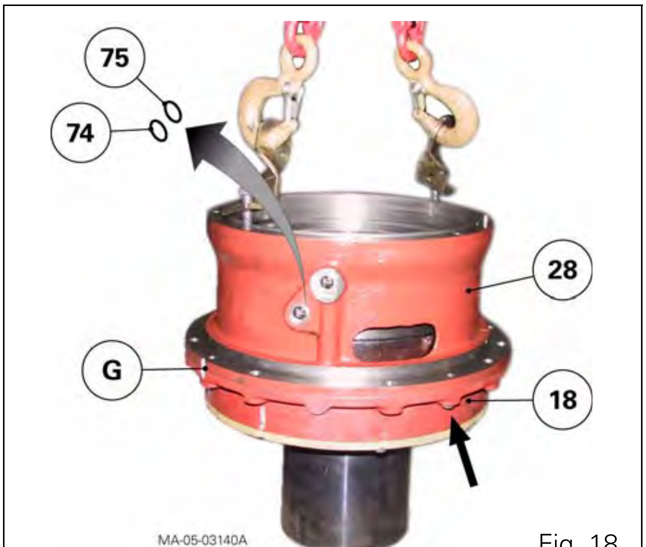

Fig. 18

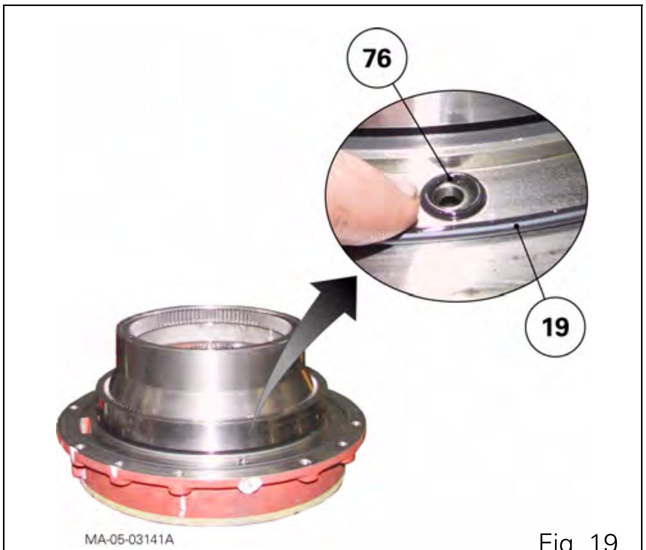

Fig. 19

33. Remove the ring gear carrier assembly (27), the two ring gears (29) and (65), with the front planet carrier (Fig. 20).

34. Remove the circlip (46) (Fig. 20).

35. Separate the front planet carrier from the ring gears (Fig. 21).

36. Retain the spacer (45) (Fig. 21).

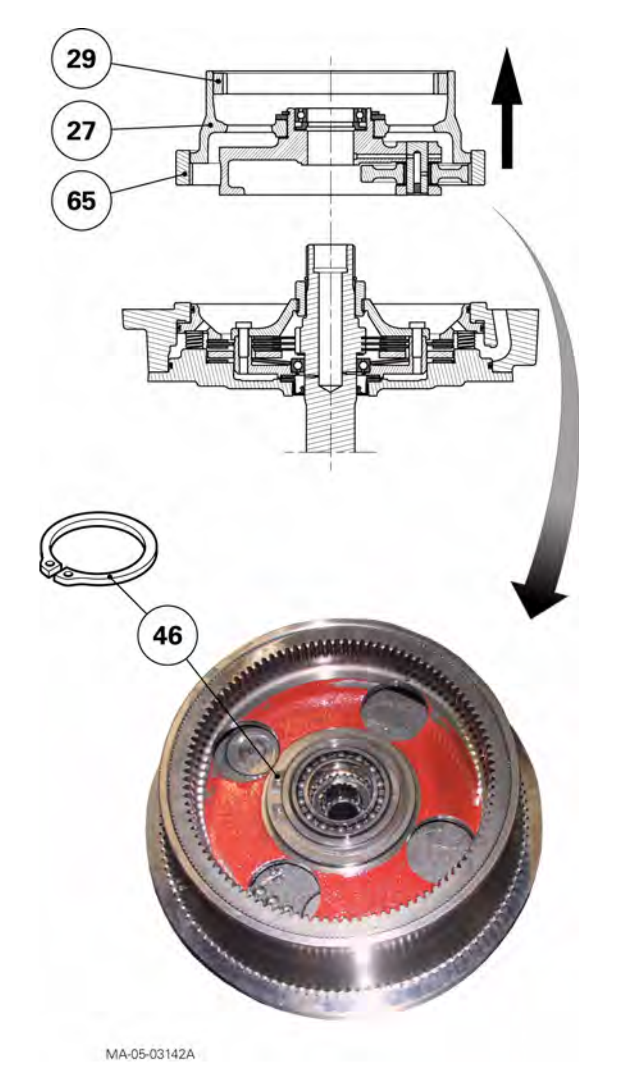

Fig. 20

Fig. 21

37. Remove the bearing (44), the washer (77) and the spacer (43) from the planet carrier (25) (Fig. 22). To remove the planetary gears, see § G.

38. Place the housing (18) on the shims, with the input shaft (10) facing upwards. Place service tool 3378012M2 (see § I) on the input shaft (10) so as to protect the lip seal (11) (Fig. 23).

39. Unscrew the cover screws (2) of the housing (18). Remove the cover (2) and retain the springs (22). Discard the "O" ring (21) (Fig. 23).

40. Remove the brake piston (17) from the housing (18). Discard the "O" rings (23) and (24).

41. Remove the friction washer (13). Remove the lip seal (11) (Fig. 23).

42. Remove the clutch M/brake L assembly from the housing (18) (Fig. 24).

43. Remove the friction washer (14) and the snap ring (42) (Fig. 24).

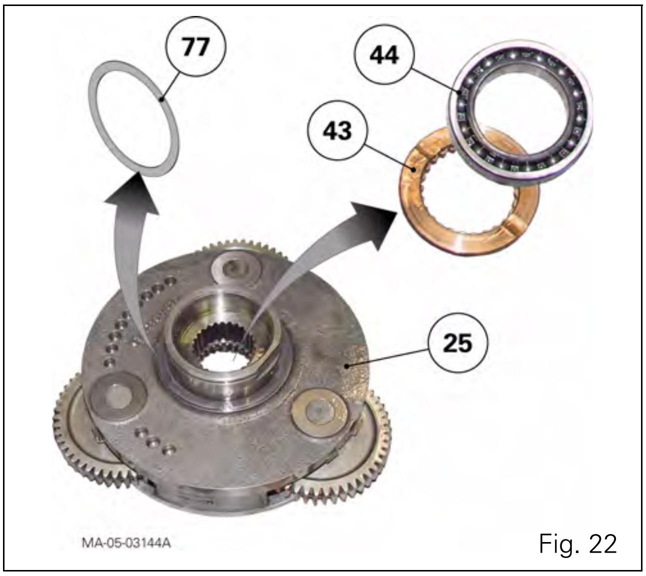

Fig. 22

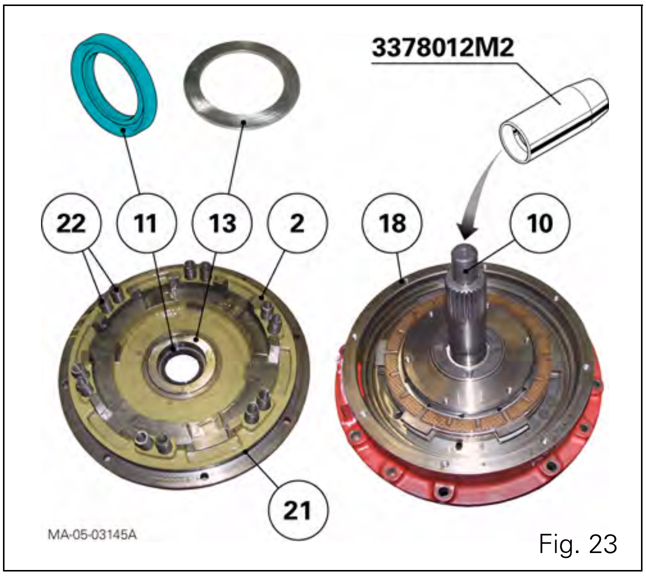

Fig. 23

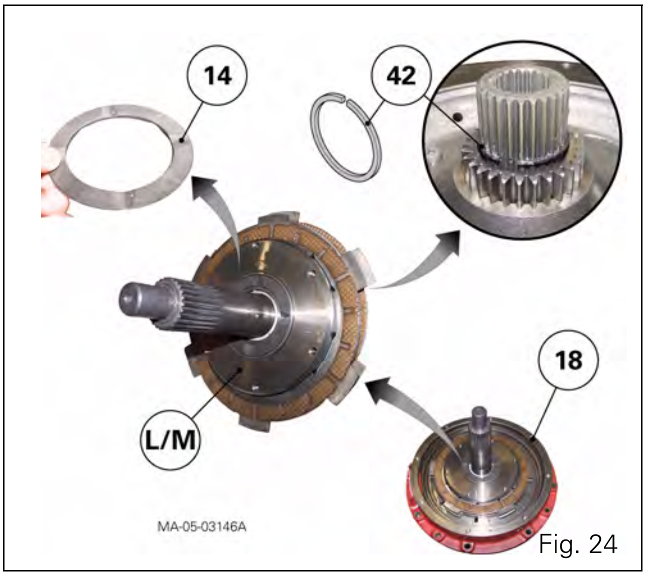

Fig. 24

44. Place the clutch M/brake L assembly on a supporting fixture. Take out the screws (15) to remove the clutch cover (7) (Fig. 25).

45. If necessary, take out the snap ring (37) to separate the sun gear (36) from the clutch cover (7) (Fig. 26).

46. Mark the order of the discs and brake/clutch thrust plates. Remove the discs (5) and thrust plates (6) of clutch M and the discs (8) and thrust plates (9) of brake L (Fig. 27).

47. Remove the junction plate (16) (Fig. 27).

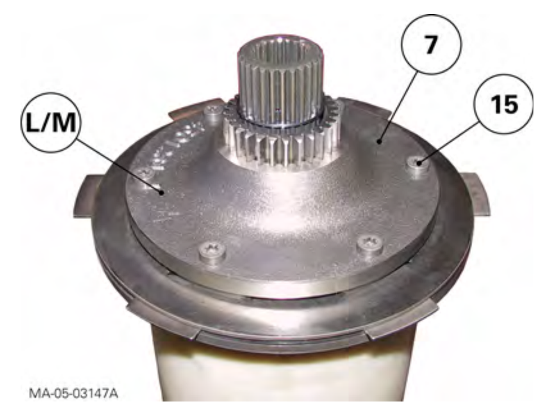

Fig. 25

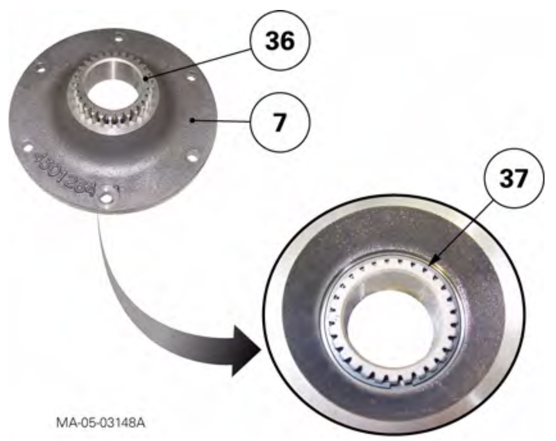

Fig. 26

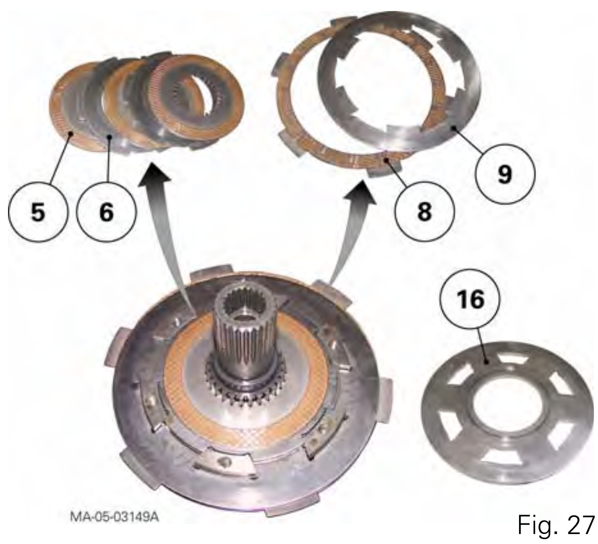

Fig. 27

48. Mark the assembly order then remove the input shaft (10), the Belleville washer (4), the spring washer (72) and the bearing (12) (Fig. 28).

Fig. 28

Refitting the Powershift module

49. Ensure all parts are in good condition. Ensure the clutch pilot ports and lubricating ports are clean.

50. Fit a new oiled "O" ring (4) on the Powershift module cover (2) (Fig. 29).

51. In the cover (2), fit a new lip seal (11) smeared with grease on the inside and oiled on the outside (Fig. 29).

52. Fit the springs (22) in the housings. Fit a disc (8) on the cover (2) (Fig. 29).

***Note:** If the brake discs or clutch discs have been replaced, they must be soaked for approximately one hour in a transmission oil bath.*

53. Fit the friction washer (13), with the grease removed and smeared with Loctite 648 or equivalent (Fig. 29).

54. Fit the Belleville washer (4), the ball bearing (12) and the spring washer (72) on the clutch housing (3). Slide on the shaft (10) (Fig. 30).

55. Fit the junction plate (16), the clutch discs (5) and thrust plates (6), and a brake disc (8) and thrust plate (9) on the clutch housing (3) (Fig. 31).

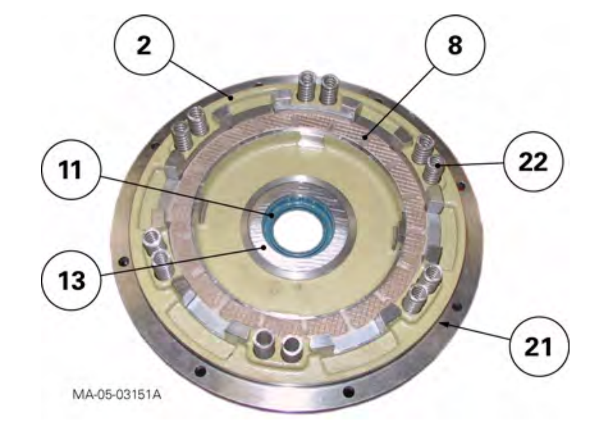

Fig. 29

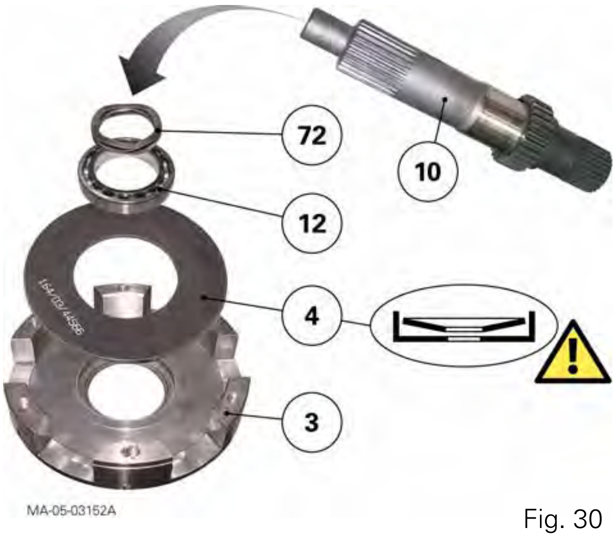

Fig. 30

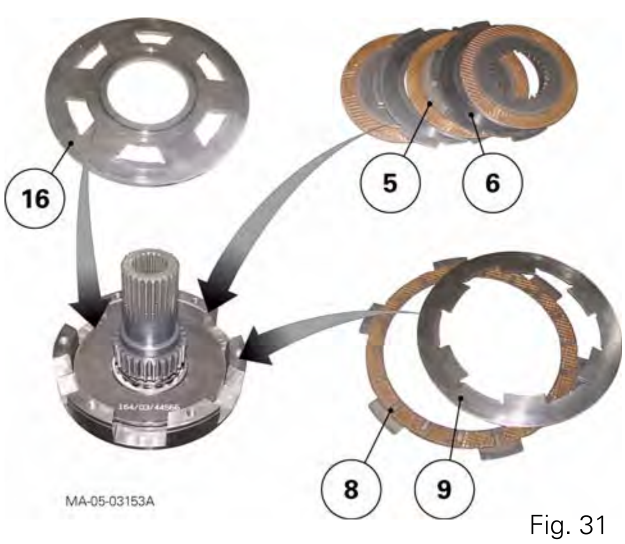

Fig. 31

56. Refit the clutch cover (7). Fit the screws (15) smeared with Loctite 242. Tighten to a torque of 33 Nm (Fig. 32).

57. Fit the snap ring (42) on the shaft (10) (Fig. 32). Fit the friction washer (14) smeared with grease on the clutch housing (3) (Fig. 33).

58. Fit service tool 3378012M2 (see § I) on the input shaft (10) so as to protect the lip seal (11). Fit clutch M /brake L on the cover (2), paying attention to the lip seal (11) (Fig. 33).

NOTE: *Place the cover (2) on a supporting fixture to position the input shaft (10).*

59. Replace the last disc (8) of brake L. Fit the brake piston (17) with new, oiled "O" rings (23) (24), in the housing(18) (Fig. 34).

60. Refit the housing (18) on the cover (2). Fit the cover screws smeared with Loctite 242. Tighten to a torque of 29-37 Nm (Fig. 34).

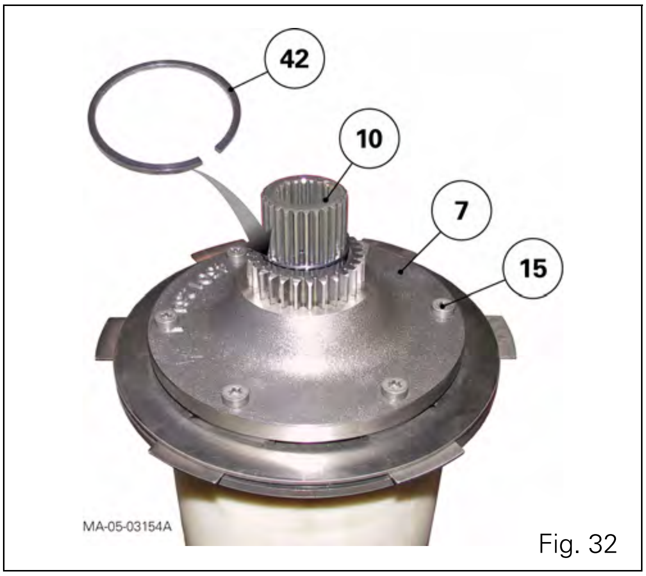

Fig. 32

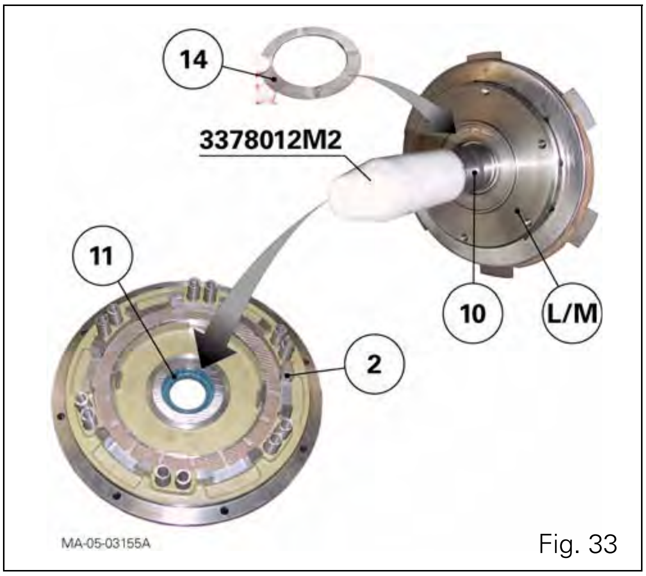

Fig. 33

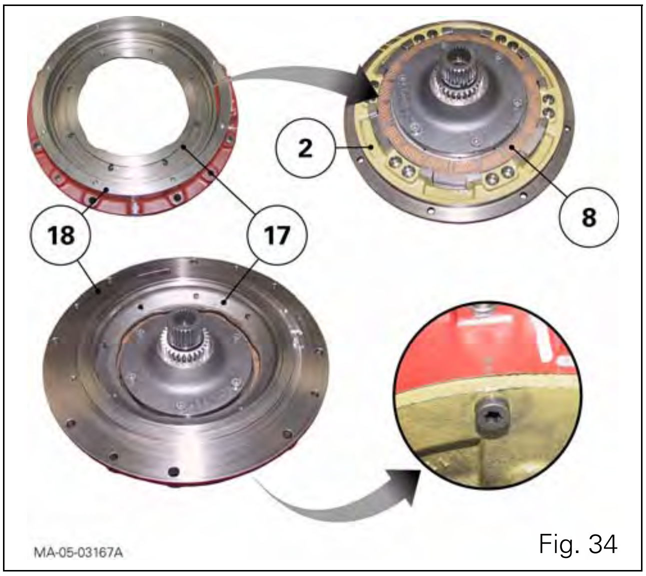

Fig. 34

61. Place the planet carrier (25) on the input shaft (10) (Fig. 35).

__Note:__ Turn the planetary gears (48) to engage them with the sun gear (36) and line up the splines of the planet carrier on the shaft.

62. Insert the spacer (43,) which should be smeared with grease, and the ball bearing (44) in the planet carrier (25). Fit the friction washer (77) (Fig. 36).

63. Position the ring gears (29) (65) and ring gear carrier (27) assembly on the planet carrier (25) (Fig. 37).

64. Fit the spacer (45) and the circlip (46) (Fig. 37).

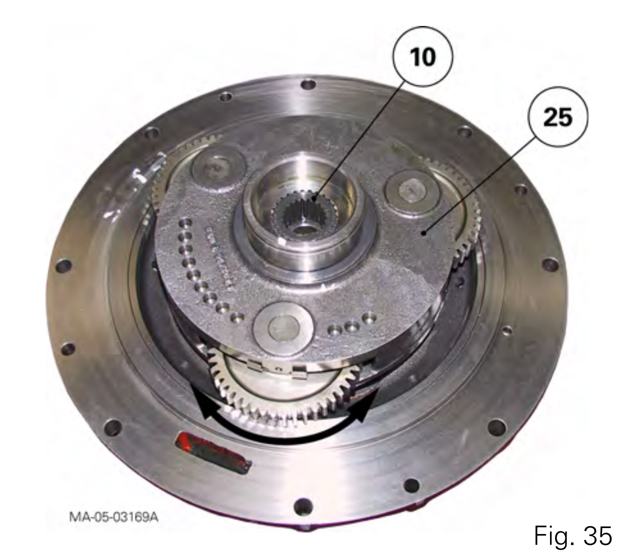

Fig. 35

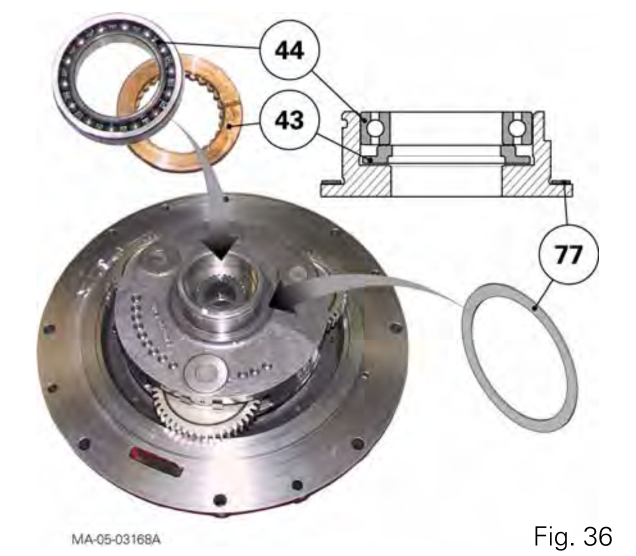

Fig. 36

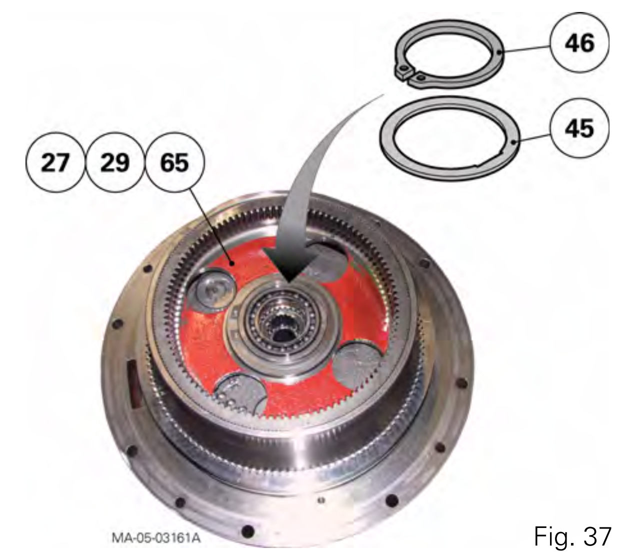

Fig. 37

65. Smear new "O" rings (76) and (19) with miscible grease and fit them on the housing (28) (Fig. 38).

66. Using a sling, position housing (28) on housing (18). Line up the marks made during step 30 (Fig. 38).

IMPORTANT: *Make sure that the "O" rings are correctly positioned.*

67. Fit and tighten the housing screws (18) and (28), smeared with Loctite 242.

68. Insert the brake piston (57), fitted with two new oiled "O" rings (55) (56), in the housing (28) (Fig. 39).

69. Fit two shims in the housing (28) to hold the ring gears and the planet carrier in place during assembly of the module and the reverse shuttle (Fig. 39).

70. Check that the needle bearing (73) is present in the clutch housing (66). Check its condition and change it if necessary (Fig. 40).

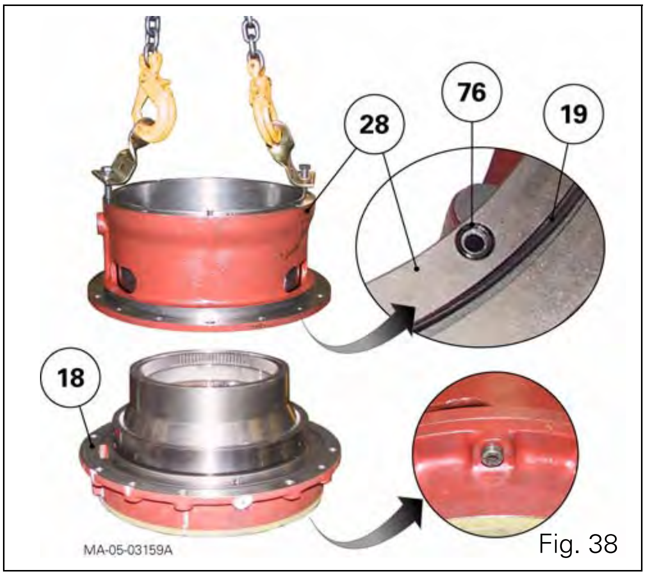

Fig. 38

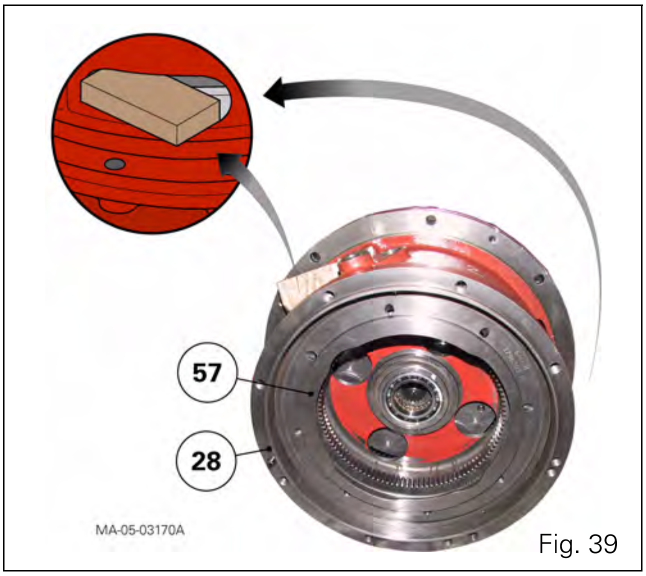

Fig. 39

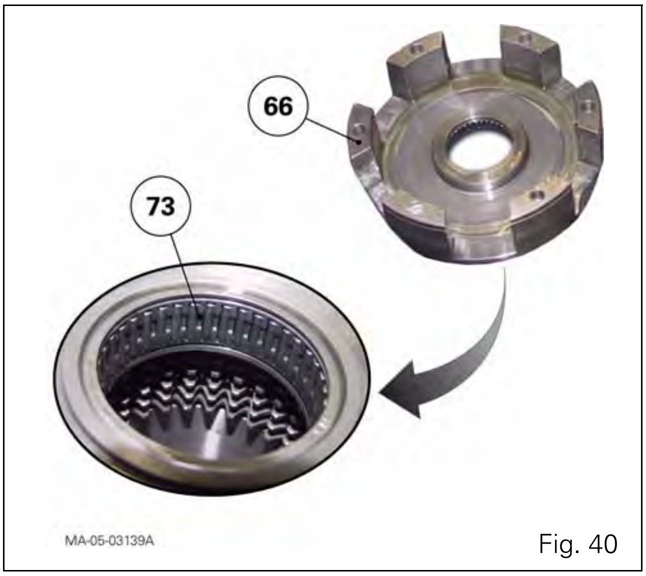

Fig. 40

71. Fit the friction washer (69), smeared with grease, on the cover (26). Fit a brake disc (33) (Fig. 41).

72. Fit the clutch housing (66) on the cover (26), followed by the hub (61), the Belleville washers (67) (68) and the junction plate (35) (Fig. 41).

73. Fit the clutch discs (63) and thrust plates (62).

Note: *If the brake discs or clutch discs have been replaced, they must be soaked for approximately one hour in a transmission oil bath.*

74. Fit the brake discs (33) and thrust plates (34) (Fig. 41).

75. Fit the clutch cover (32), fit the screws (64), smeared with Loctite 242, and tighten them to a torque of 33 Nm.

76. Fit the springs (58) in the cover (26) (Fig. 42).

77. Fit the planet carrier (30) on the output shaft (47) (Fig. 43).

78. Refit the Powershift module on the reverse shuttle (see § E).

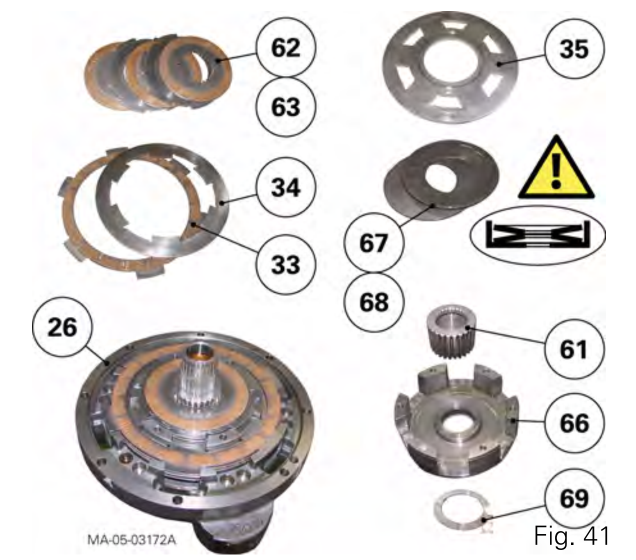

Fig. 41

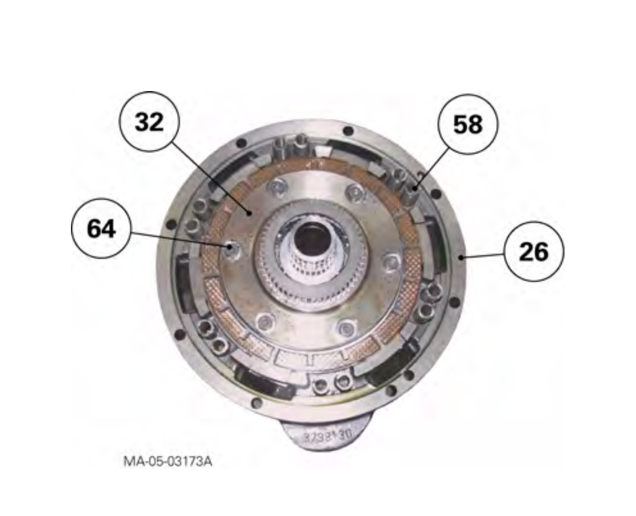

Fig. 42

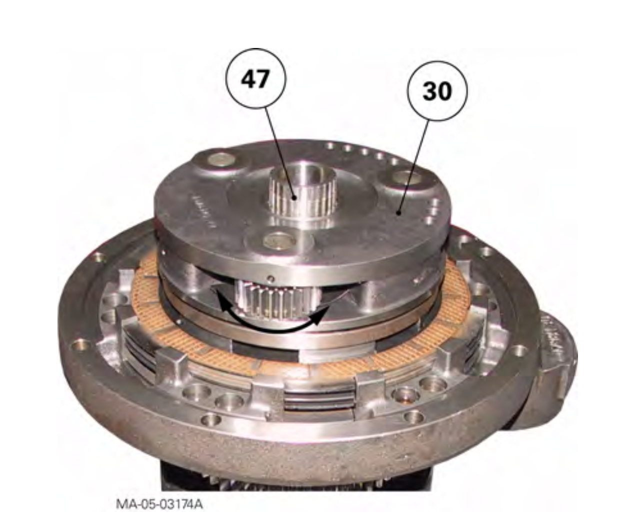

Fig. 43

G . Disassembling and reassembling the planetary gears

***Reminder:** The planetary gear pins are fitted already tightened in the thickest part of the planet carriers.*

The pins comprise lubricating ports that must be positioned facing the corresponding ports on the planet carrier (Fig. 44).

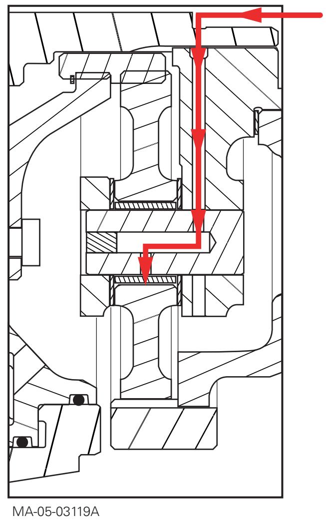

Fig. 44

Disassembly

***Note:** The disassembly principle is the same for all planet carriers. The following example applies to planetary gears in the front epicyclic gear train of the Powershift module.*

79. Place the planet carrier (25) in a vice equipped with protective jaws.

80. Using a suitable press and fixture, drive out the pins (39) from the planet carrier (25), pushing from the side where the planet carrier is thickest (Fig. 45).

81. Take out the planetary gear and retain the friction washers (41) and bearing needles (38) (Fig. 45).

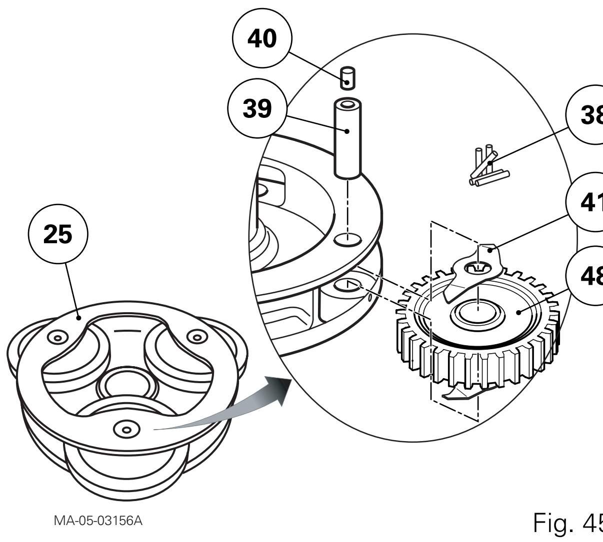

Fig. 45

Reassembly

82. Clean all the parts, check their condition and replace any that are defective.

83. Ensure the lubricating ports of the planet carriers and pins are clean.

***Note:** The pins of the planetary gears (39) are blocked by plugs (40). Check that the plugs are present. Fit new ones if any are missing (Fig. 44).*

84. Prepare the planetary gears. Fit the bearing needles in the planetary gears using miscible grease.

85. Place the planet carrier on a suitable supporting fixture. Fit the planetary gear (48) with the needle bearing (38) and the two friction bearings (41) (Fig. 45).

86. Insert the pin (39), then drive it in, using a suitable press and fixture. Insert the pin until it is flush with the planet carrier surface.

87. Check that the planetary gears rotate freely.

H . Final steps

88. Refit the PTO shaft (33).

89. Clean and check the condition of the gearbox hydraulic control unit (Fig. 46).

90. Check for the presence of "O" rings in the hydraulic unit ports (Fig. 47).

NOTE: *If the "O" rings have to be replaced, oil them slightly.*

91. Apply Loctite 510 or an equivalent sealing product to the mating face of the unit (Fig. 47).

92. Refit the connecting pipes, then the hydraulic control unit.

93. Fit the screws (Fig. 47).

94. Assemble the gearbox and the engine and rear axle (see chapter 2).

95. Top up the transmission oil level.

96. Carry out a clutch calibration procedure (see chapter 11).

97. Carry out road tests to check the operation of the gearbox. Check the operation of the hydraulics and make sure that there are no leaks.

Fig. 46

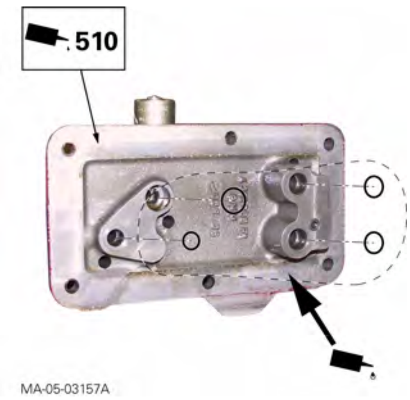

Fig. 47

I . Service tools

Tool available in the AGCO network

- **3378012M2 - Input shaft lip seal protector tool (Fig. 48)**

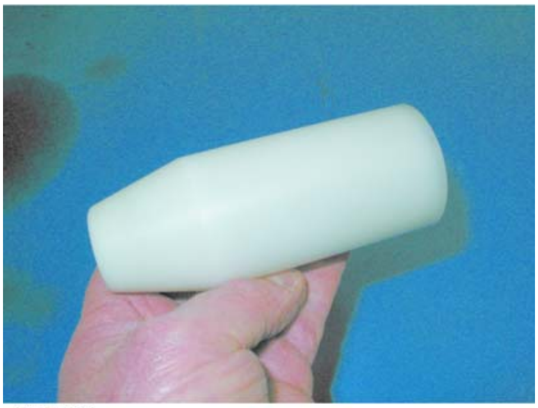

Fig. 48

5C13 - GBA25 - Robotic mechanical gearbox

CONTENTS

A . General

The GBA25 gearbox is fitted to tractors with Dyna 4 transmission. This transmission is fully automated. It allows shifting between all the ratios without declutching.

The gearbox is divided into two parts:

- The Powershift module, with four ratios for shifting under load (see relevant section)
- The robotically-controlled mechanical gearbox with four ranges.

The transmission assembly is controlled electronically by an Autotronic 5 calculator (see chapter 11).

Fig. 1

B . Principles of operation

The GBA25 Dyna-4 gearbox has 16 ratios. These are provided by 4 Powershift module ratios for shifting under load, and 4 mechanical gearbox ranges.

The mechanical gearbox ranges are controlled like a ratio for shifting under load.

The ratios are controlled by two levers:

- Powercontrol lever located under the steering wheel (1 Fig. 1)
- gear shift lever located on the armrest (2 Fig. 1).

The mechanical gearbox is located between the Powershift module and the rear axle. It comprises two shafts (upper and lower shaftlines), on which four gear trains with helical teeth rotate.

Input drive is supplied by the PowerShuttle and is transmitted to the upper shaftline.

Output drive is transmitted via the lower shaftline to a creeper unit or directly to the crownwheel and pinion.

Lubrication

The lubricating oil coming from the 5 bar valve of the tractor is sent to the gearbox lower shaftline and upper shaftline.

A network of internal channels directs the oil to the elements requiring lubrication.

Selecting ratios

Ratios are selected using two synchronisers, one single cone and one double cone. Each synchroniser is engaged individually.

The synchronisers are controlled by two selector rails and two forks. Each selector rail has a double-acting piston, allowing range shifting.

The selector rail pistons are controlled hydraulically via the tractor 20 bar circuit (arrow Fig. 2).

Four solenoid valves (L52, L53, L54, L55, see Fig. 2) located on the right-hand side of the gearbox control selector rail movement.

Four switches (L56, L57, L58, L59, see Fig. 2) inform the calculator of the selector rail positions.

NOTE: *The switches are pressed in by pins (130 Fig. 5).*

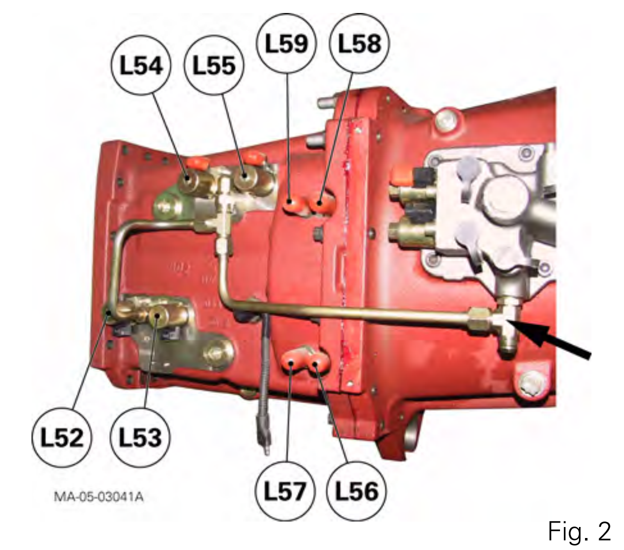

Fig. 2

Each range has a corresponding solenoid valve and switch (see table).

	Solenoid valves				Switches			
	L52	L53	L54	L55	L56	L57	L58	L59
Neutral	0 V or 12 V				12 V			
Range 1	12 V	0 V	0 V	0 V	0 V	12 V	12 V	12 V
Range 2	0 V	12 V	0 V	0 V	12 V	0 V	12 V	12 V
Range 3	0 V	0 V	12 V	0 V	12 V	12 V	0 V	12 V
Range 4	0 V	0 V	0 V	12 V	12 V	12 V	12 V	0 V

Parts list

(1) Primary shaft
(2) Bearing cone
(3) Bearing cup
(4) Shims
(5) Gearbox housing
(6) Cover
(7) Shims
(8) Bearing cup
(9) Bearing cone
(10) "O" ring
(11) Spring
(12) Lubrication pipe
(13) Secondary shaft
(14) Spacer
(15) Circlip
(16) Washer
(17) Shims
(18) Circlip
(19) Washer
(20) Shims
(21) Bearing cup
(22) Bearing cone
(23) Bearing cone
(24) Bearing cup
(25) Pinion
(26) Double pinion
(27) Bearing cup
(28) Bearing cone
(29) Bearing cone
(30) Bearing cup
(31) Pinion
(32) Needle bearing
(33) Washer
(34) Circlip
(35) Circlip
(36) Spacer
(37) Needle bearing
(38) Needle bearing
(39) Spacer
(40) Circlip
(41) Shims
(42) Circlip
(43) Pinion
(44) Spacer
(45) Pinion
(46) Bearing cone
(47) Bearing cup
(48) Pinion
(49) Ring
(50) Bearing cone
(51) Bearing cup
(52) Deflector
(53) Ring
(54) Sliding coupler
(55) Ball bearing
(56) Pressure connector
(57) Brake
(58) Spring
(59) Flange
(60) Hub
(61) Ball bearing
(62) Pressure connector
(63) Ring
(64) Spring
(65) Brake
(66) Cone
(67) Flange
(68) Snap ring
(69) Hub
(70) Sliding coupler
(71) Power take-off shaft
(72) Fork
(73) Selector rail
(74) "O" ring
(75) "O" ring
(76) Circlip
(77) Sleeve
(78) "O" ring
(79) "O" ring
(80) Plug
(81) "O" ring
(82) Circlip
(83) "O" ring
(84) Circlip
(85) Plug
(86) "O" ring
(87) Circlip
(88) Sleeve
(89) "O" ring
(90) "O" ring
(91) Snap ring
(92) Piston
(93) Spring
(94) "O" ring
(95) "O" ring
(96) Fork
(97) Pin
(98) Selector rail
(99) Castellated nut
(100) Screws
(101) Castellated nut
(102) Plate
(103) Screws
(104) Rail
(105) Locknut
(106) Rail
(107) Screws
(108) Castellated nut

(109)Castellated nut
(110)Screws
(111)Plate
(112)Circlip
(113)Shims
(114)Bearing cup
(115)Bearing cone
(116)Pinion
(117)Bearing cone
(118)Bearing cup
(119)Pinion
(120)Circlip
(121)Shaft
(122)Bearing
(123)Powershift module cover
(124)Reverse pinion hub
(125)Pin
(126)Plug
(127)Plug
(128)"O" ring
(129)"O" ring
(130)Pin
(131)Reverse pitch nut

View of the primary and secondary shaft assembly

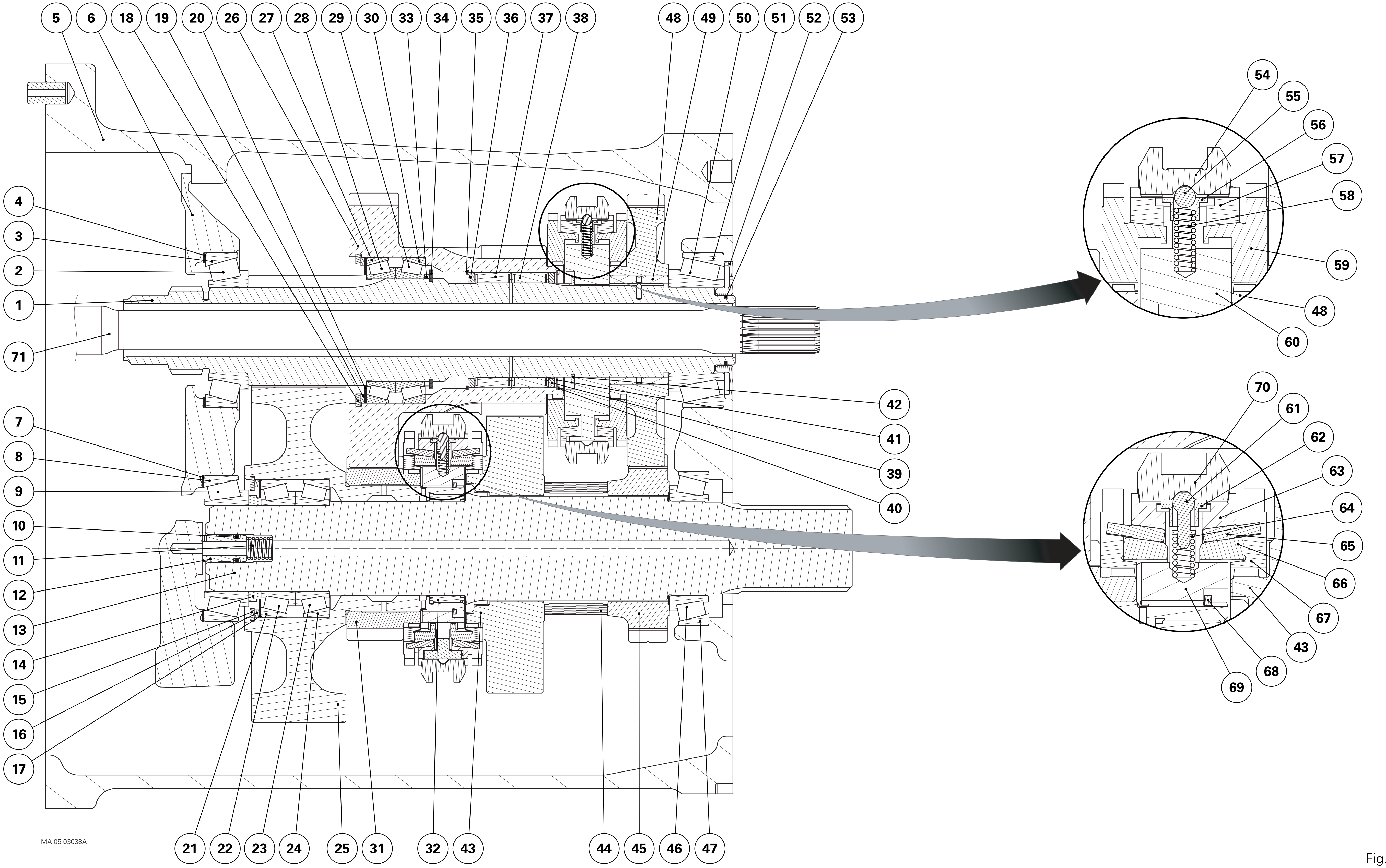

Fig. 3

View of the reverse mainshaft and synchroniser control assembly

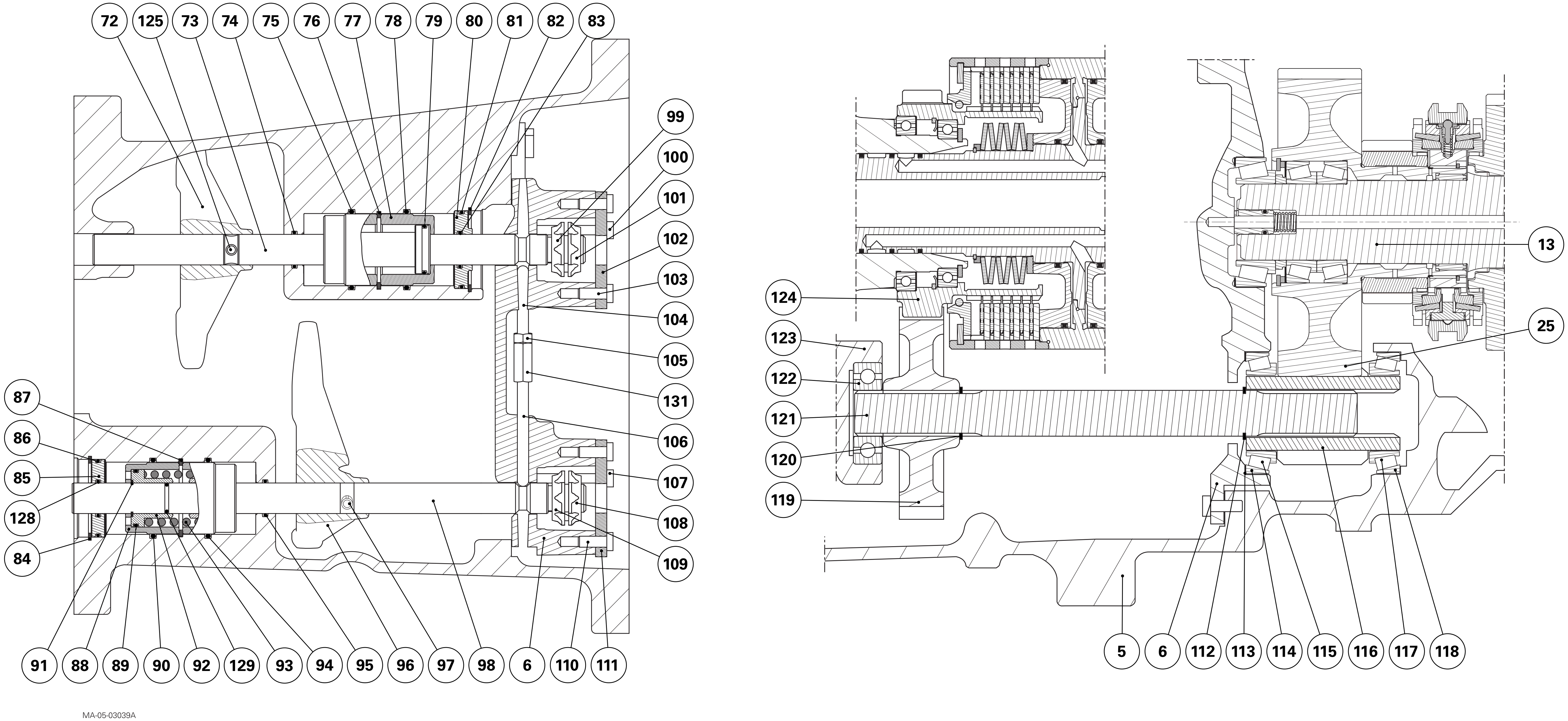

Fig. 4

Blown-up view of the robotic mechanical gearbox

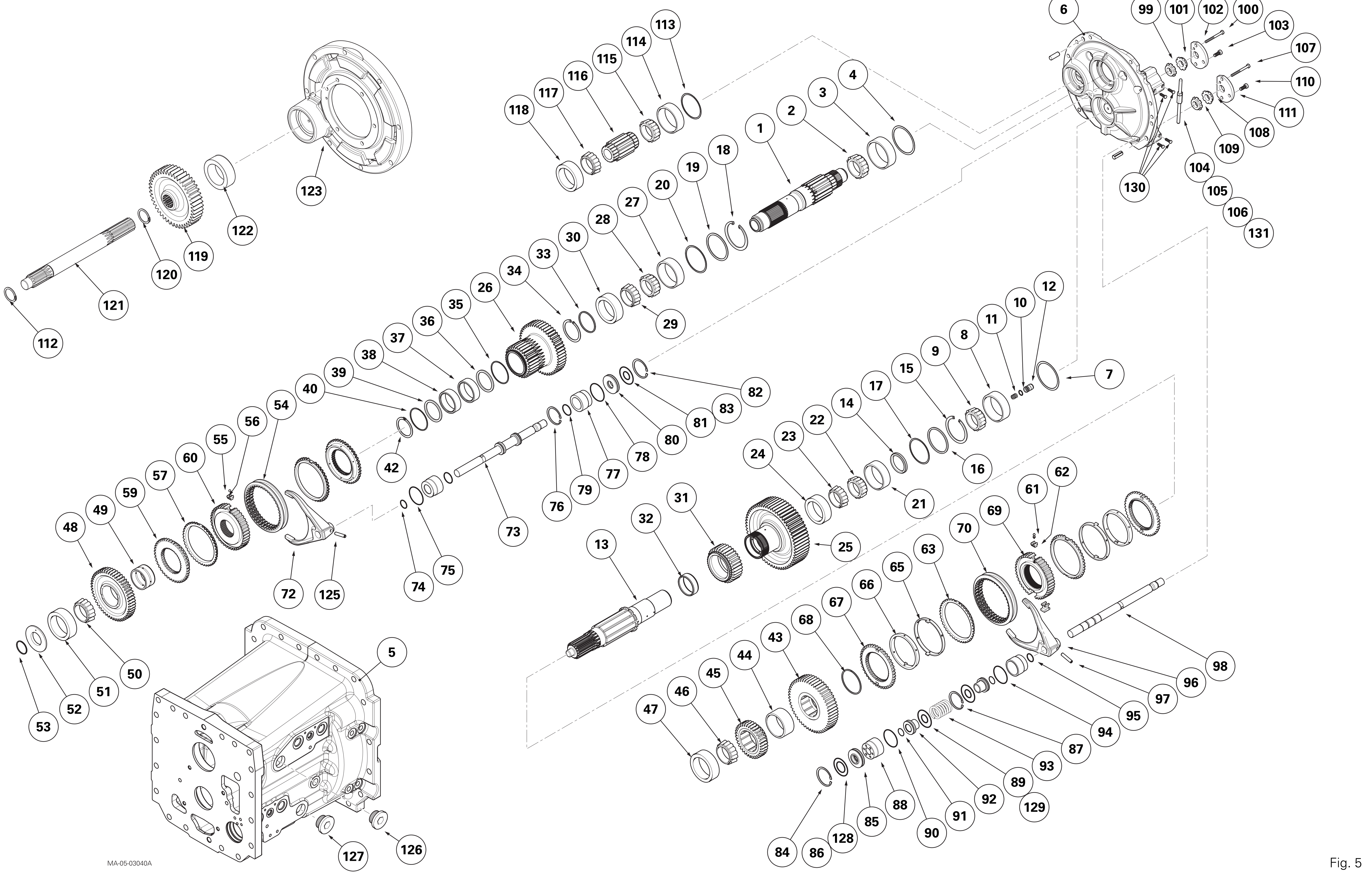

Fig. 5

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C . Description and kinematics of ratios

The robotic gearbox allows four ratios to be obtained with only four gear trains, two shafts and two synchronisers.

Kinematics (Fig. 6)

Range 1

The reduction is carried out on three gear trains.

The first gear train drives the second train via the 1st gear synchronisers, then the third train.

Range 2

The reduction is carried out on the first gear train. The 2nd gear synchronisers secure the 2nd gear pinion to the secondary shaft.

Range 3

The reduction is carried out on the third gear train. The primary shaft is secured to the 3rd gear pinion by the 3rd gear synchronisers.

Range 4

The reduction is carried out on the fourth gear train. The primary shaft is secured to the 4th gear pinion by the 4th gear synchronisers.

***Note:** In forward position, input drive comes directly from the PowerShuttle to the primary shaft (1).*

In reverse position, drive comes from the PowerShuttle via the pinions (124), (119) and (116) and the shaft (121). It enters via the second driven pinion (25), which is constantly meshed to the primary shaft (1) (see Fig. 4).

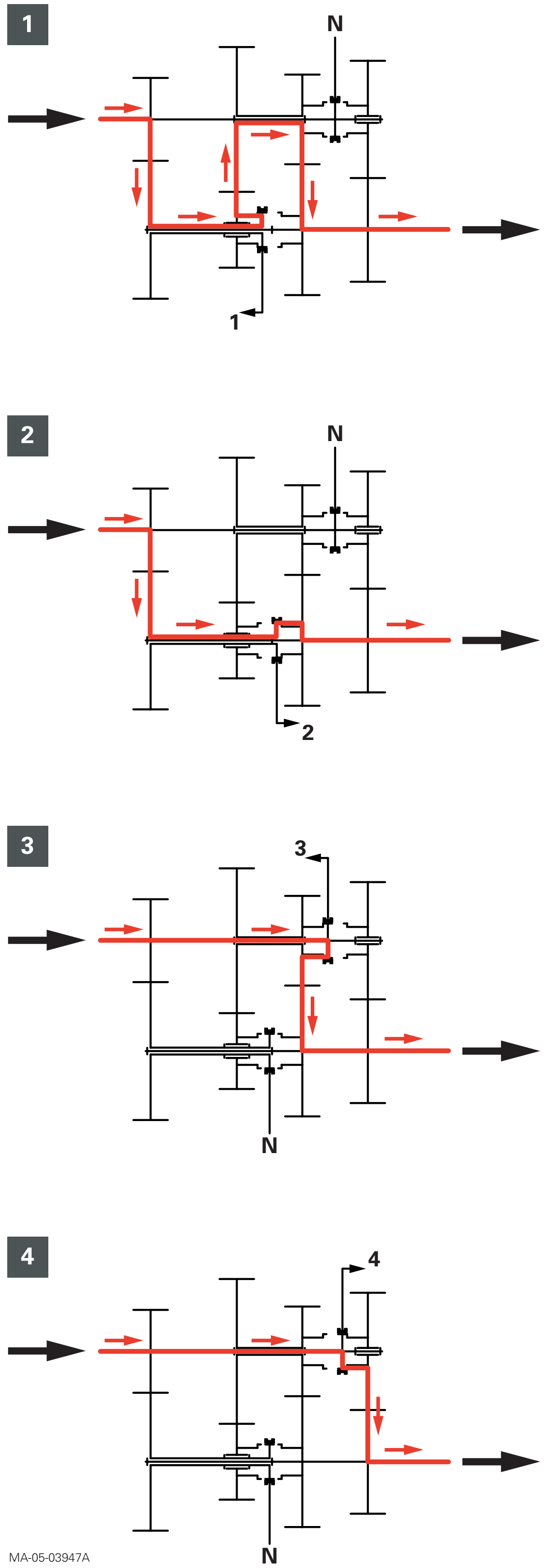

Fig. 6

Primary shaft (Fig. 3, Fig. 4 and Fig. 5)

The primary shaft (1) is splined to the PowerShuttle forward hub. It is supported by two taper roller bearings (3)(4) and (50)(51) Adjustment is controlled by shims (4).

The PTO shaft (71) is inserted through the centre of the primary shaft (1). This cavity in the shaft (1) also serves as a channel for lubricating oil.

The first and second driving gear is cut into the primary shaft (1).

The double pinion (26) turns idle on the shaft (1) and is supported by two taper roller bearings (27)(28) and (29)(30) and two needle bearings (37)(38). This pinion is supported on the shaft by shims (20).

The fourth driving gear turns idle on the shaft (1). It is supported by a lubricated bush (49).

Secondary shaft

The secondary shaft (13) turns on two taper roller bearings (8)(9) and (46)(47). Bores in the centre of the shaft (13) ensure proper lubrication. Adjustment is controlled by shims (7).

The pinion (25) turns truly on the shaft (13) and is supported by two taper roller bearings (21)(22) and (23)(24) and a needle bearing (32).

The pinion (25) acts as a bearing to the idle pinion (31). This pinion (31) is in direct contact with the pinion (25). A layer of oil ensures the mating faces are lubricated.

The pinions (43) and (45) are splined to the shaft (13). They are separated by a spacer (44).

Synchronisers

The single cone synchroniser located on the primary shaft (1) allows shifting between the third and fourth gears. Its hub (60) is splined to the shaft (1). It is held in position by a circlip (42) on one side and by the bearing cone (50) fitted tightly on the shaft (1).

By moving the slider (54), the shaft (1) is locked either:

- with the double pinion (26) (3rd)
- with the pinion (48) (4th).

The double cone synchroniser located on the secondary shaft (13) allows shifting between the first and second gears. Its hub (69) is integral with the pinion (25). It is held in position by the snap ring (68).

By moving the slider (70), the shaft (13) is locked either:

- with the idle pinion (31) (1st)
- or with the pinion (43) (2nd).

Selecting ratios (Fig. 4)

The synchronisers are controlled conventionally by forks (72) and (96) and selector rails (73) and (98).

The selector rails are controlled hydraulically. The selector rails are controlled by double-acting pistons.

On the selector rail (98) that controls the 1st and 2nd gear synchroniser, the piston (92) is damped by a spring (93) to give smooth shifting between ranges 1 and 2.

The selector rails are adjusted by tightening or loosening the castellated nuts (99)(101) and (108)(109). Once adjusted, the stops are held in position by screws (100) and (107).

An interlock mechanism comprising two rods (104)(106) and a locknut (105) prevents the selector rails from being engaged simultaneously. When one selector rail is engaged, the pin locks the other rail in a groove.

D . Preliminary operations

1. Drain the transmission oil.
2. Split the tractor in order to remove only the robotic gearbox (if servicing only concerns the robotic gearbox) or the complete Dyna-4 unit (then split the two housings) (see chapter 2).
3. Remove:
   - all hydraulic pipes fitted to the unit housing
   - the PTO shaft.

E . Removing and refitting the primary and secondary shafts

Removing the primary and secondary shafts

4. Rig up four makeshift legs on which to set the unit vertically, as shown in Fig. 7. Use an M14 screw or threaded rod, and weld on a nut to ensure a minimum distance of 120 mm between the unit and the work surface.
5. Position the unit on the legs, with the cover (6) on top.
6. Take off the covers (102) and (111). Unscrew the castellated nuts (99)(101) and (108)(109) (Fig. 8).
7. Retighten the safety finger rod (106) to its maximum (Fig. 8).

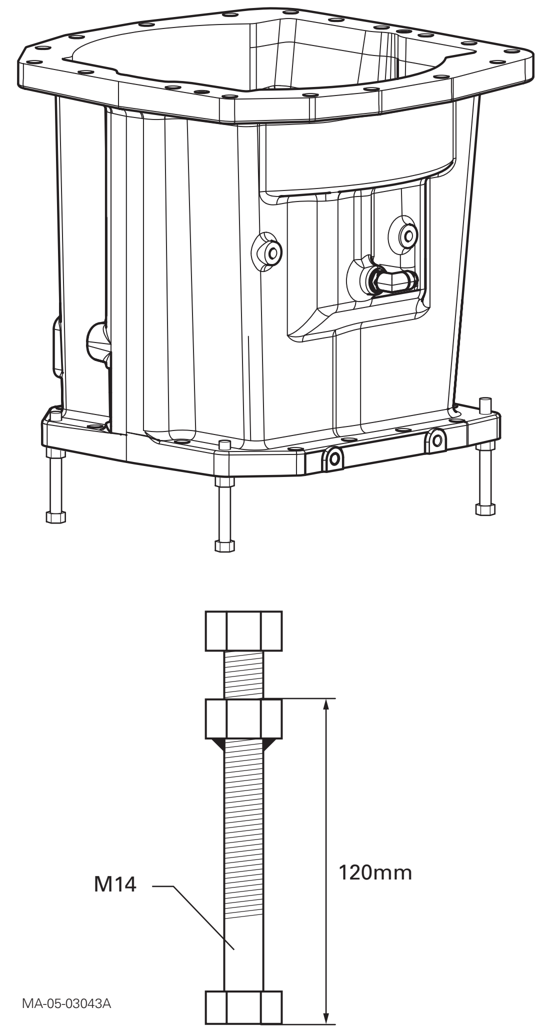

Fig. 7

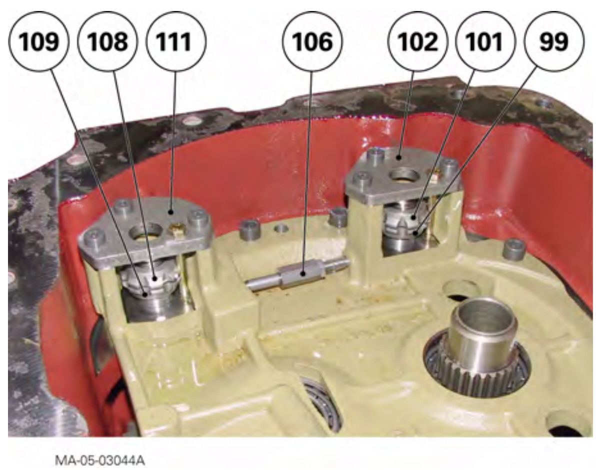

Fig. 8

8. Remove the two plugs (126) and (127) (Fig. 9).

9. Drive out the two pins (97) and (125) holding the forks on the selector rails (Fig. 9).

IMPORTANT: *The pins will fall into the gearbox housing. They must be recovered when the gearbox is disassembled.*

10. Remove the circlip at the rear of the gearbox (84 Fig. 10).

11. Using a plastic hammer, remove the selector rail (98) towards the rear of the gearbox (Fig. 10).

NOTE: *The rail control piston assembly is fitted to the rail and is removed with it. Part of the sleeve remains in the cylinder. If it must be removed, take off the circlip (87) and extract the sleeve.*

12. Remove the screws (A) from the cover (6) (Fig. 11).

13. Fit two screws (B) (Fig. 11) in the threaded holes in order to lift up the cover (6).

14. Remove the cover (6).

15. Recover the bearing cups (3), (8) and (114) and the shims (4), (7) and (113).

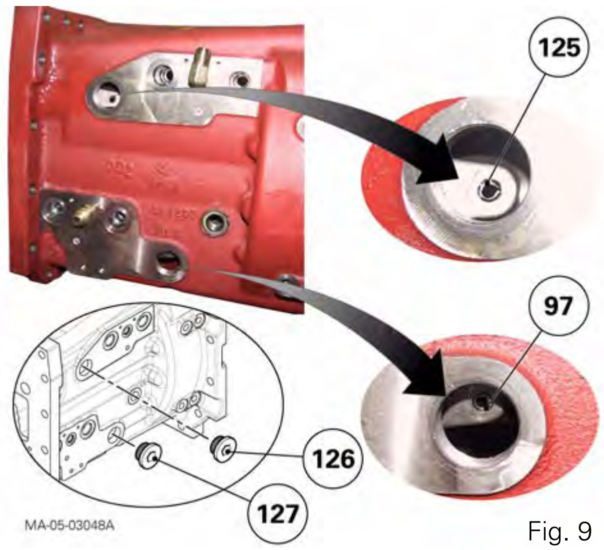

Fig. 9

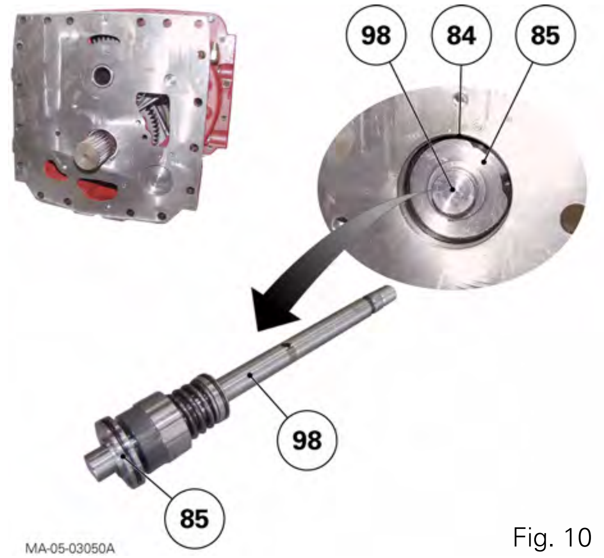

Fig. 10

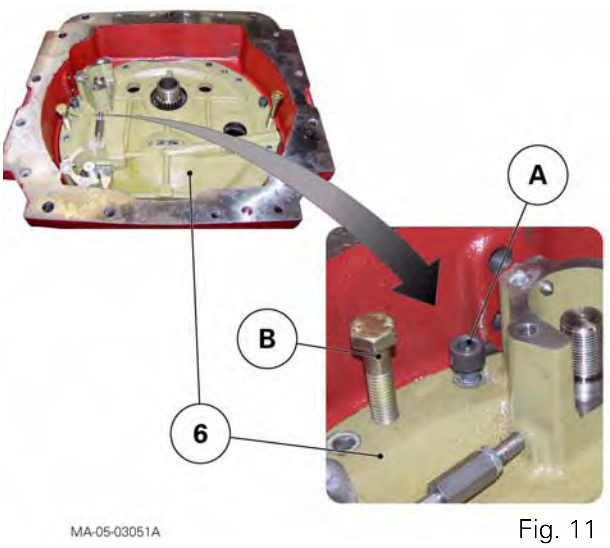

Fig. 11

16. Recover the lubricating pipe (12), the seal (10) and the spring (11) (Fig. 12).

17. Remove the circlip (82) (Fig. 13).

18. Using a plastic hammer, remove the selector rail (73) towards the front of the gearbox (Fig. 13).

***Note:** The rail control piston assembly is fitted to the rail and is removed with it. Part of the sleeve remains in the cylinder. If it must be removed, take off the circlip (76) and extract the sleeve.*

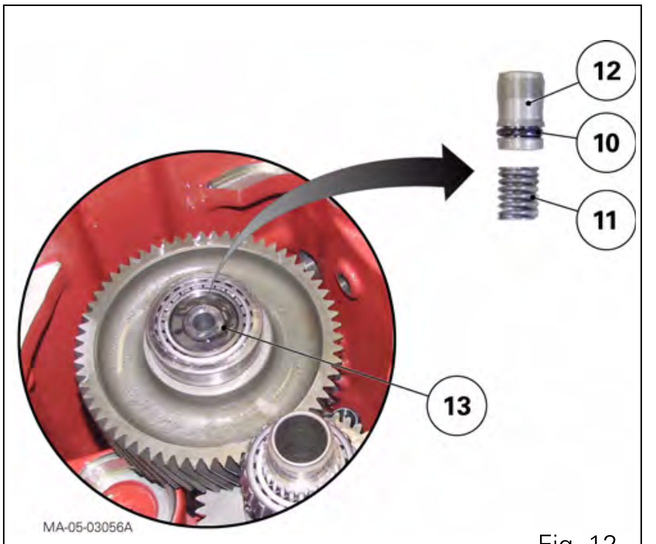

Fig. 12

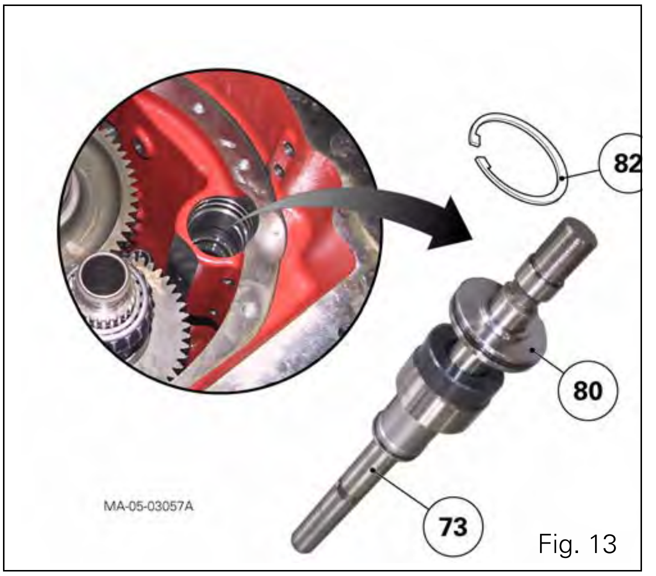

Fig. 13

Disassembling and reassembling the selector rail (98) (ranges 1 and 2)

19. Clamp the rail (98) in a vice equipped with protective jaws (Fig. 14).

20. Tighten the two pistons (92) in the vice to compress the spring.

21. Remove a snap ring (91).

22. Remove the pistons (92) and the spring (93).

23. Replace the seals (129) on the rail (98).

24. Carry out operations 19 to 23 in reverse order to assemble the selector rail.

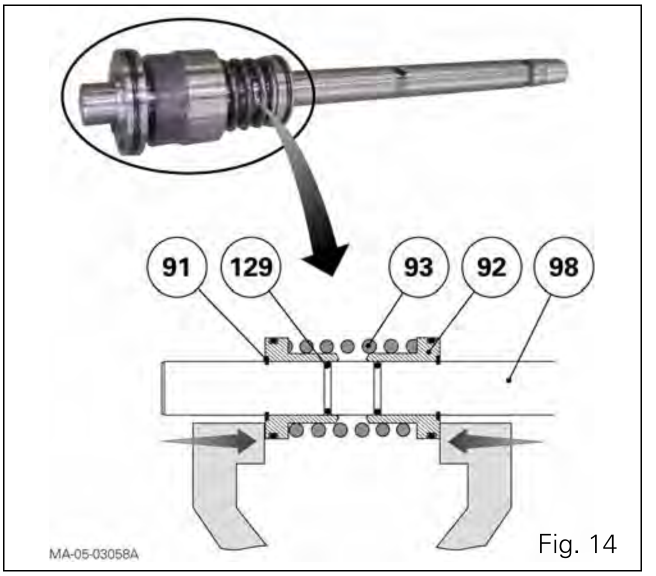

Fig. 14

25. Turn the forks (72) and (96) inwards in the gearbox to allow them to enter the housing (Fig. 16).

26. Place service tool ref. 3378804M1 in the primary and secondary shafts as on Fig. 15.

27. Sling the tool using a pulley hoist or a suitable lifting system. Extract the two shafts (1) and (13) from the gearbox housing.

__Note:__ Take care when the 1st/2nd gear synchroniser is passing beside the reverse shaft support.

__Note:__ The total weight of the two shafts is approximately 44 kg (lower shaftline = 27 kg, upper shaftline = 17 kg).

28. Remove the assembly and place it on a workbench. Remove the service tool and split the two shafts.

29. If required, extract the bearing cups (47), (51) and (118) from the gearbox housing.

30. If necessary, remove deflector (52).

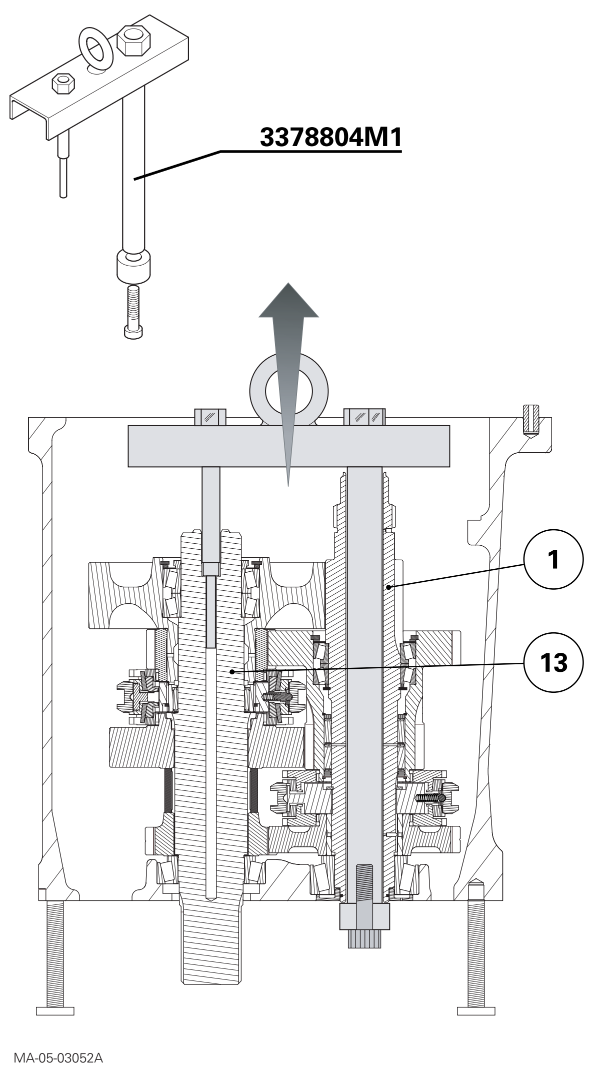

Fig. 15

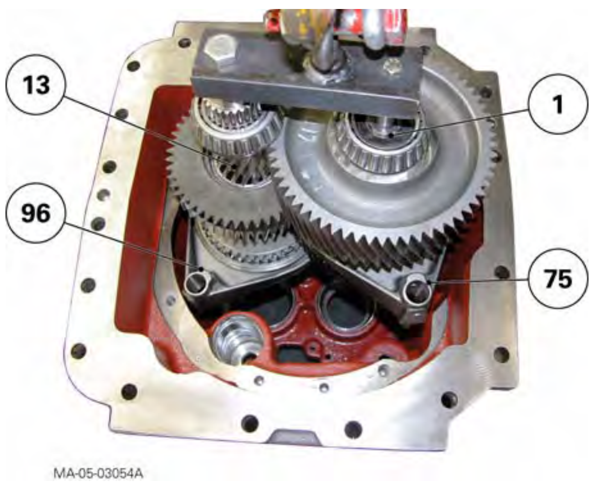

Fig. 16

Refitting the primary and secondary shafts

31. Ensure all parts are clean and in good condition. Check that the lubricating ports and range control ports are clean.

32. Replace all the "O" rings, greasing them lightly before assembly.

Note: *Do not forget to replace the "O" rings (74), (75), (78), (90), (94) and (95) in the selector rail bores inside the housing.*

33. Check the presence of the bearing cups (47), (51) and (118) in the housing (5).

34. Assemble the shafts (1) and (13); Place service tool ref. 3378804M1 as for operation 26 (Fig. 17).

35. Fit the forks (72) and (96) on the synchroniser sliders. The offset side of the fork must be turned towards the front of the tractor (Fig. 17).

Note: *The two forks are identical. They have the same reference.*

36. Fit the two shafts in the housing. At the same time, fit the reverse transfer pinion (116) fitted with the two bearing cones (115) and (117) (Fig. 17).

Note: *Ensure the pinion (116) is positioned correctly. The marks on the teeth should be turned towards the bottom of the housing (Fig. 18).*

37. Refit the lubricating pipe (12) fitted with a new "O" ring (10) and the spring (11) (Fig. 12).

38. If the sleeve (77) and the circlip (76) have been removed, grease the sleeve, insert it into the cylinder, then fit the circlip (77).

39. Thread the selector rail (73) with the lightly greased piston assembly into its housing (Fig. 19).

Note: *To help insert the selector rail into the fork, use a pin punch to hold the fork in place.*

40. Fit the plug (80) fitted with two new "O" rings (81) (83). Fit the circlip (82) (Fig. 19).

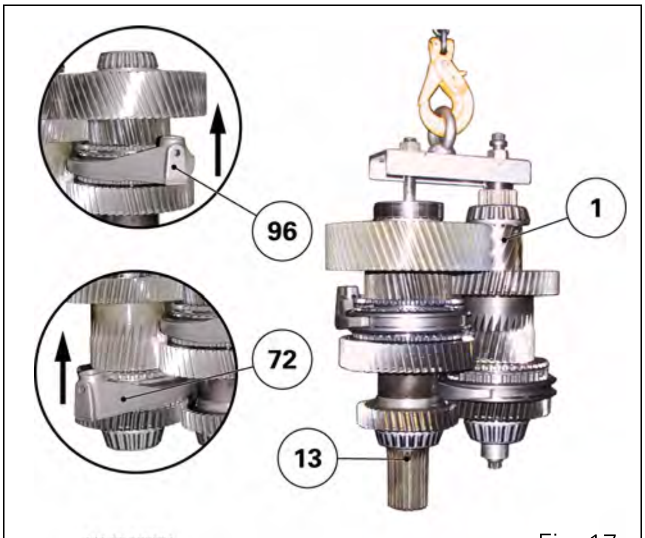

Fig. 17

Fig. 18

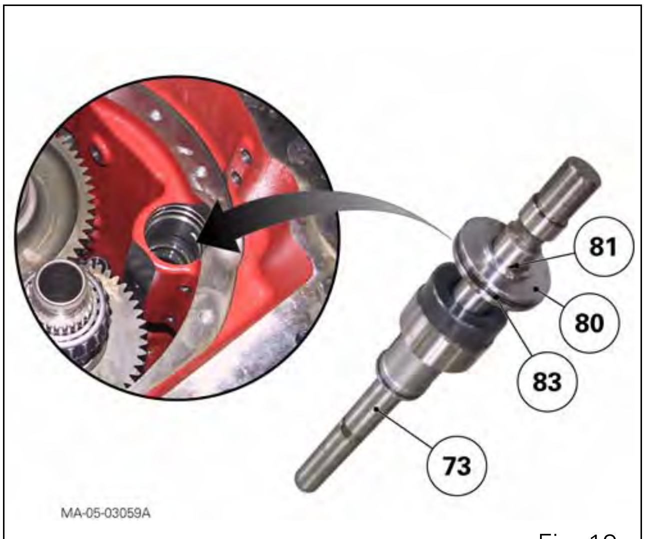

Fig. 19

41. If the sleeve (88) and circlip (87) have been removed, grease the sleeve, insert it into the cylinder, then fit the circlip (87).

42. Thread the selector rail (98) with the lightly greased piston assembly into its housing (Fig. 20).

NOTE: *To help insert the selector rail into the fork, use a pin punch to hold the fork in place.*

43. Mount the plug (85) fitted with two new "O" rings (86) (128). Fit the circlip (84) (Fig. 20).

44. Align the holes in the forks (72) and (96) with those in the corresponding selector rails (Fig. 21).

45. Insert new pins to attach the forks to the selector rails. Refit the plugs (126) and (127) (Fig. 21).

46. Check the interlock mechanism is in position and retighten the rods (104) and (106) to their maximum tightness (Fig. 22).

47. Fit the four switch thrust pins (130) using a bit of grease to hold them in position (Fig. 22).

48. In the cover (6), fit the bearing cones (3), (8) and (114) smeared with grease to hold them in position. Also fit:

- the original thickness of shims if the roller bearings have not been replaced
- the calculated thickness of shims if the roller bearings have been replaced (see § G).

49. Put the cover back on (6).

50. Fit the cover (6) screws (A) (Fig. 11) smeared with Loctite 242. Tighten to a torque of 57–77 Nm.

51. Refit the ring (52) (Fig. 20) with the lubricating port turned towards the top of the gearbox. Fix it in position with four punchmarks.

52. Adjust the selector rails and forks (see § H).

53. Adjust the interlock mechanism (see § I).

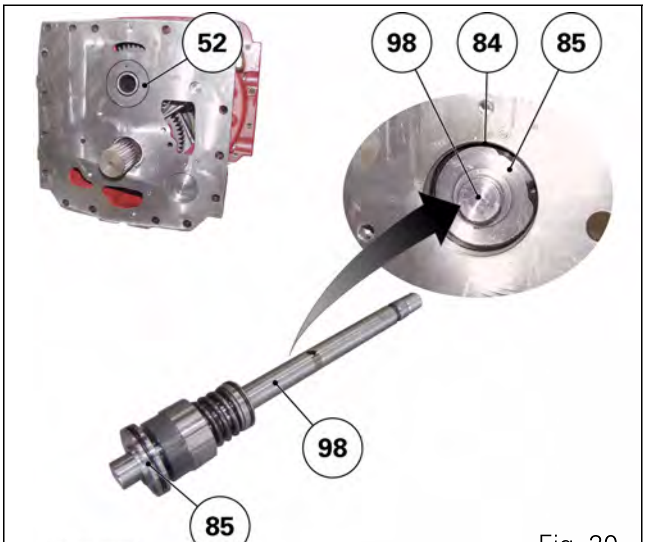

Fig. 20

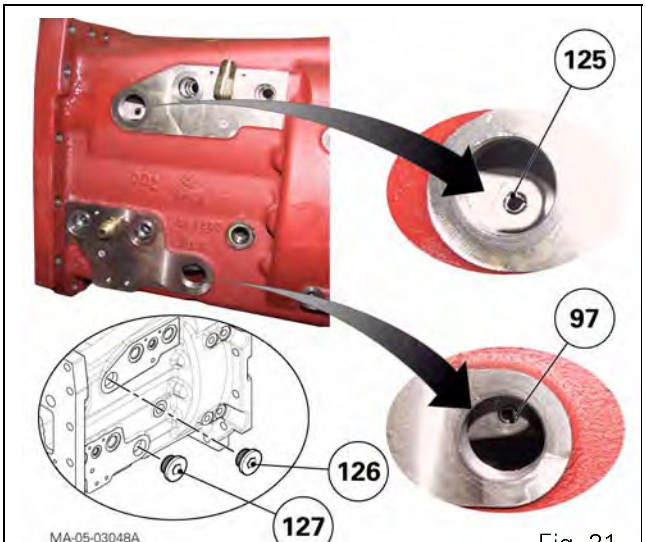

Fig. 21

Fig. 22

F . Disassembling and reassembling the primary and secondary shafts

Preliminary operations

54. Remove the primary and secondary shafts (see § E).

Disassembling the primary shaft

***Note:** The bearing cones (2) and (50) are fitted tight on the shaft.*

55. Position the shaft on a work surface with a suitable supporting fixture to hold the shaft in a vertical position.

56. Take off the ring (53) at the end of the shaft (rear axle end) (Fig. 23).

57. Fit a shouldered washer (arrow Fig. 24) at the end of the shaft (1) in order to fit an extractor.

58. Using the extractor, pull the pinion (48) and remove the bearing (50) and the pinion (48) (Fig. 24).

59. Recover the lubricating bush (49).

60. Remove the synchroniser assembly (60) (Fig. 24). Remove the circlip (42).

61. Take off the circlip (18) to remove the double pinion (26) (Fig. 25).

***Note:** The bearings (37) and (38) stay in the double pinion (26).*

The bearing cones (28) and (29) stay on the shaft (1).

62. Recover the washer (19) and the shims (20) (Fig. 25).

63. Remove the bearing cup (30) from the pinion (26). Check whether or not there is a shim behind the cup (Fig. 25).

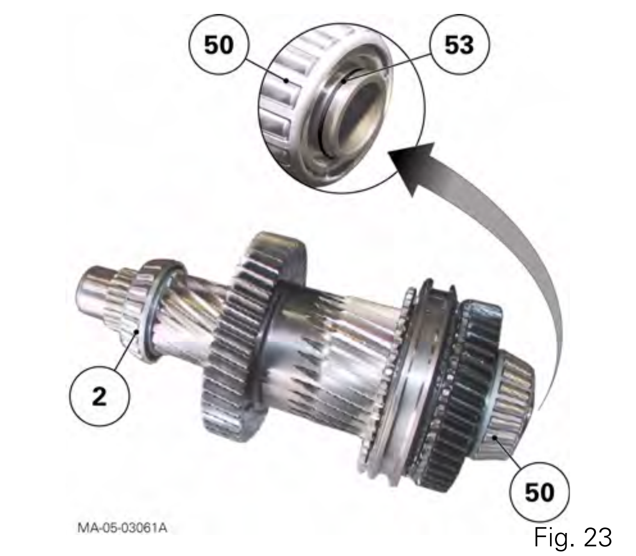

Fig. 23

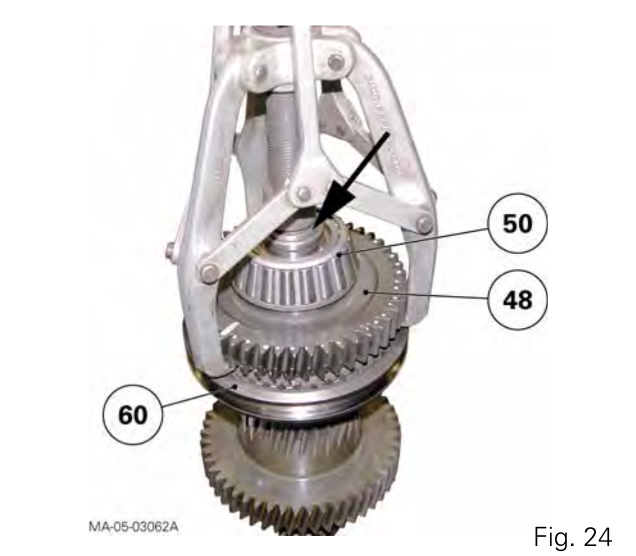

Fig. 24

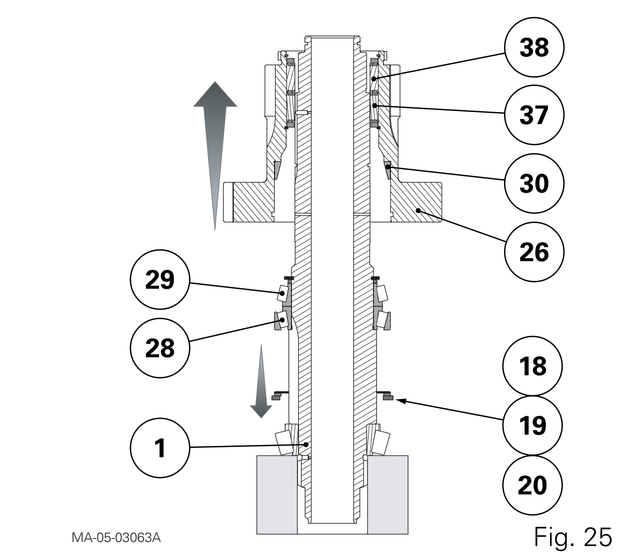

Fig. 25

64. Remove the snap ring (40). Take off the needle bearings (38) and (37) with the spacers (36) and (39). Remove the snap ring (35) if required (Fig. 26).

65. Remove the circlip (34), washer (33) and bearing cones (28) and (29).

66. If necessary, remove the bearing cone (2).

Reassembling the primary shaft

67. Pair up the cones (28)(29) and cups (27)(30).

68. Fit the bearing cones (28) and (29) on the shaft (1). Next install the washer (33) and circlip (34) (Fig. 27).

Note: It is assembled as an X. The cones are placed back to back.

69. Fit the cup (30) in the double pinion (26) (Fig. 27).

70. Check the presence of the snap ring (35) in the double pinion (Fig. 26).

71. Fit the spacer (36), greased needle bearings (37) and (38), and spacer (39) in the pinion (26) (Fig. 26).

72. Fit the snap ring (40) (Fig. 26).

73. Slide the shaft (1) into the pinion (26).

74. Fit the washer (19) and circlip (18) (Fig. 28).

Note: Do not insert shims to measure the clearance during this operation.

Shimming the pinion (26)

75. In order to position the bearings correctly, push and pull the pinion (26) while turning it.

76. Place a dial gauge feeler pin on the surface of the pinion (26).

77. Measure the clearance **A** at three points (Fig. 28). Calculate the average of the three readings.

78. Remove the circlip (18) and the washer (19) (Fig. 28).

79. Between the cup (27) and washer (19) insert the thickness of shims required to obtain clearance **A** (Fig. 28):

A = -0.05 to 0.05 mm

Shim to the maximum tolerance (low preload).

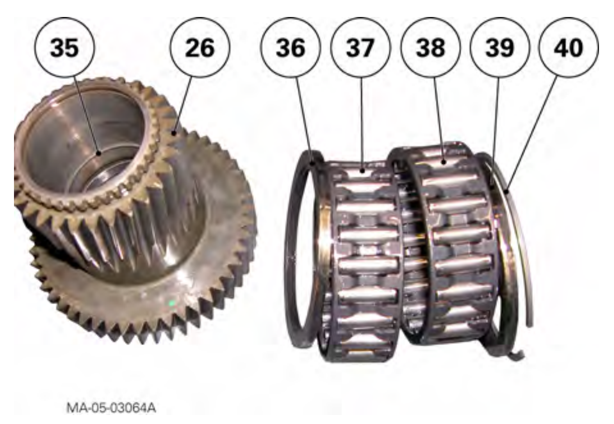

Fig. 26

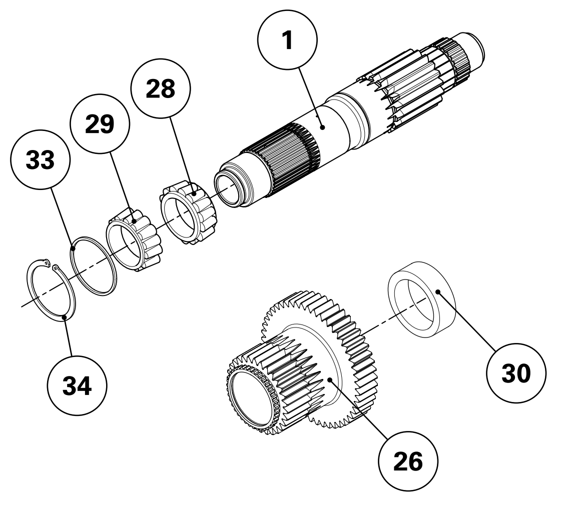

Fig. 27

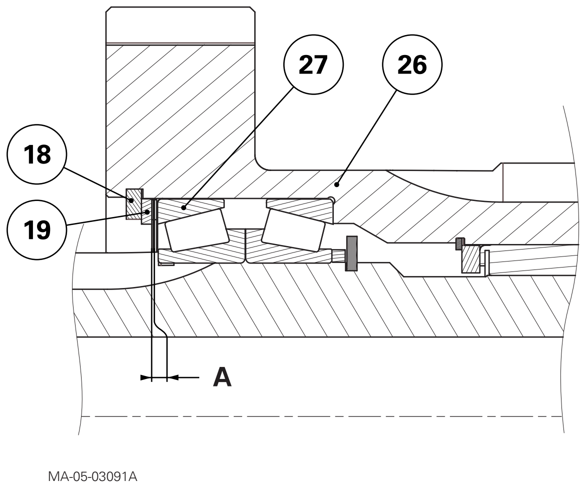

Fig. 28

Shimming the synchroniser overlap

80. Fit the thickness of shims set at operation 79.

81. Fit the circlip (42) holding the synchroniser in position (60) (Fig. 29).

82. Using a depth gauge, measure distance B between the mating face of the synchroniser (60) on the circlip (42) and the mating face of the pinion (26) (Fig. 29).

83. Ensure distance **B** does not exceed 16.33 mm:

- If **B**<16.33: the dimensions are correct.
- If **B**>16.33: take out one 0.40 mm shim (20) used to shim the pinion (26), and place it between the pinion (26) and the cup (30) (Fig. 30).

Note: *There are no intermediate shim sizes; use either the 0.40 mm shim or no shim.*

84. Once the shimming is complete, refit the synchroniser (60).

Note: *Make a paint mark to correctly align the lubricating ports on the synchroniser hub and the shaft (1).*

85. Refit the bush (49) and pinion (48) (Fig. 31).

86. Using a makeshift tool, fit the bearing cones (2) and (50) on the shaft (1) (Fig. 31).

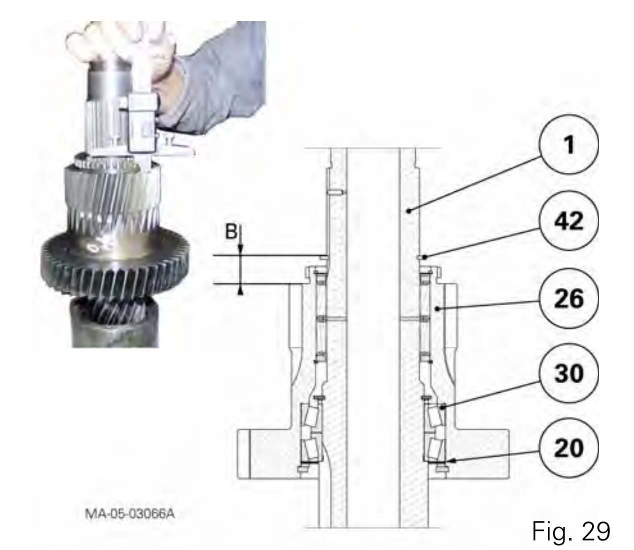

Fig. 29

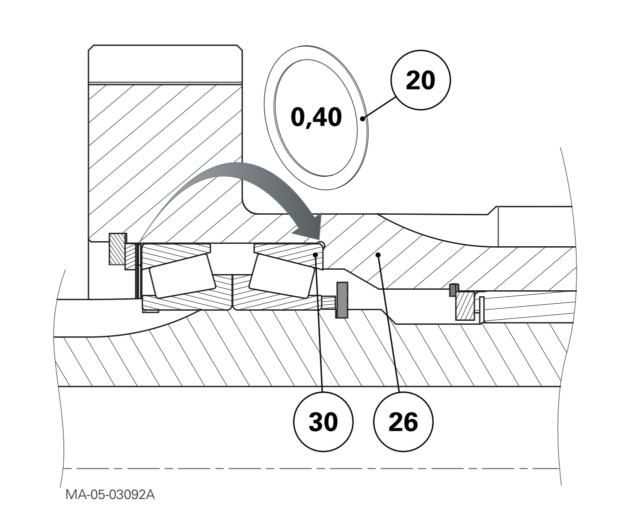

Fig. 30

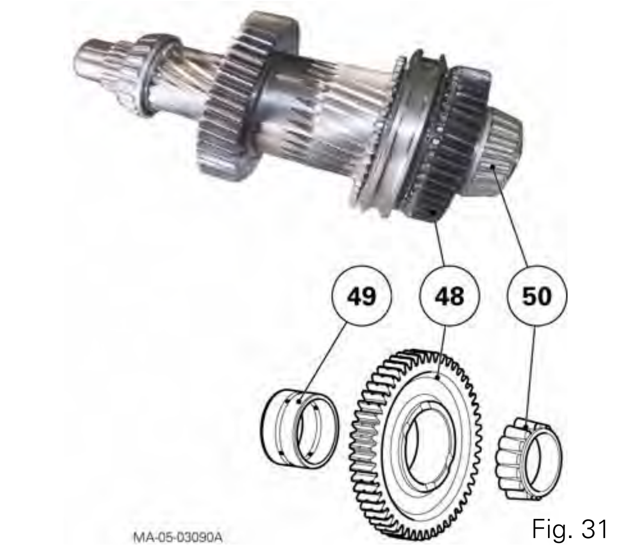

Fig. 31

Disassembling the secondary shaft

NOTE: *Take care not to pull the pinion (25) or the synchroniser will come apart. The bearing cone (9) is freely mounted on the shaft (1).*

87. Remove the bearing cone (9) and the spacer (14) (Fig. 32).

88. Fit the shaft vertically on the pinion (25). Pull the shaft (13) upwards with the pinions (43) and (45), taking care not to disassemble the synchroniser (69) (Fig. 32).

89. Recover the needle bearing (32) (Fig. 32).

90. Extract the snap ring (68). Remove the synchroniser (69) and pinion (31) (Fig. 33).

91. Turn over the pinion (25). Take off the circlip (15), washer (16) and shims (17) (Fig. 34).

92. Remove and pair up the bearings (21)(22) and (23)(24) (Fig. 34).

Fig. 32

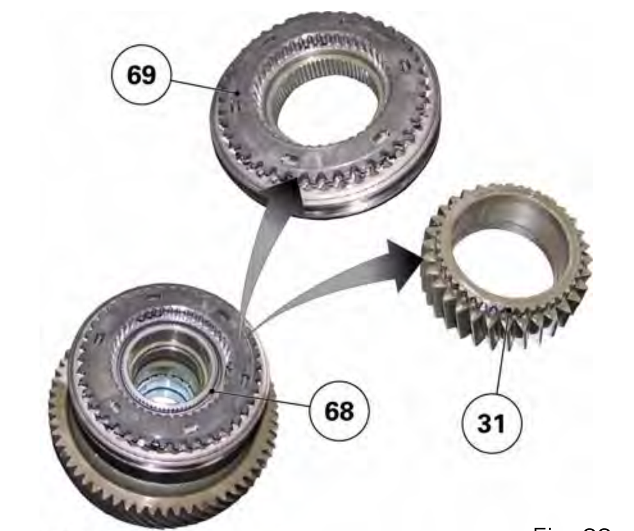

Fig. 33

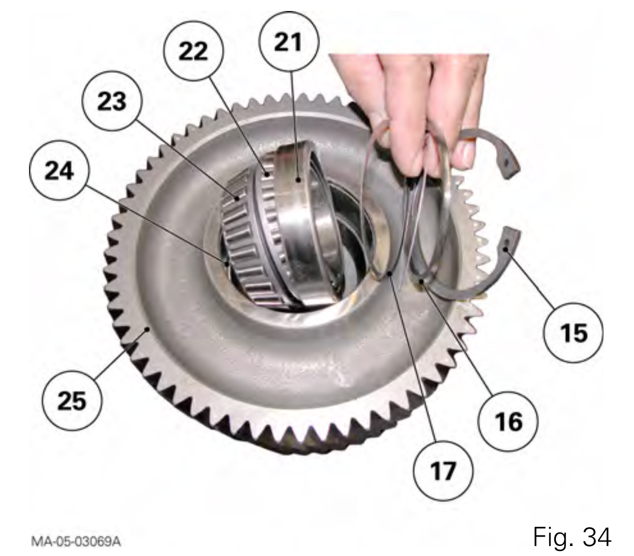

Fig. 34

93. Using an extractor, pull the pinion (45) and remove the bearing (46) (Fig. 35).

94. Remove the spacer (44) and pinion (43) (Fig. 35).

Reassembling the secondary shaft

95. On the shaft (13), fit (Fig. 35) :
- pinion (43)
- spacer (44)
- pinion (45).

96. Fit the bearing cone (46) using a makeshift tool.

97. In the pinion (25), fit the roller bearings (21)(22) and (23)(24) (Fig. 36).

98. Fit the washer (16) then the circlip (15). Do not fit shims (17) (Fig. 36).

99. Using a set of shims, measure the clearance **C** between the circlip (15) and the washer (16) (Fig. 36).

100. Between the bearing (21) and washer (16) insert the thickness of shims (17) required to obtain clearance **C** (Fig. 37):

C = -0.05 to 0.05 mm

Shim to the maximum tolerance (low preload).

Fig. 35

Fig. 36

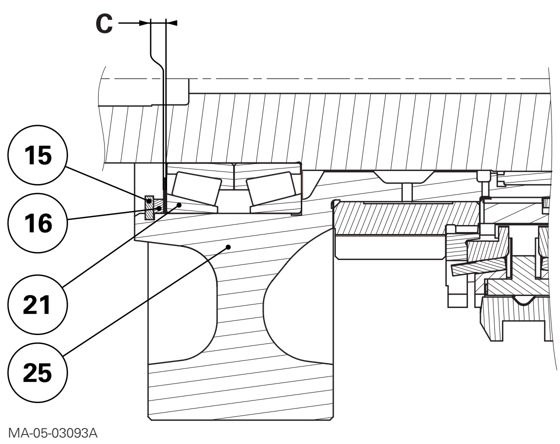

Fig. 37

101. On the pinion (25), refit the pinion (31), its inner surface lightly greased (Fig. 38).

102. Reassemble the synchroniser (69) on the splines of the pinion (25) (Fig. 38).

NOTE: *Make a paint mark to correctly align the lubricating ports on the synchroniser hub and the pinion (25).*

103. Fit the snap ring (68).

104. Fit the pre-greased bearing (32) (Fig. 38).

105. Position the pinion (25) on a support, with the synchroniser turned upwards (Fig. 39).

106. Thread on the shaft (13) assembled during operations 95 and 96, paying special attention when inserting it through the needle bearing (32).

107. Fit the spacer (14) and bearing cone (9) on the shaft (13) (Fig. 40).

NOTE: *Ensure the spacer shoulder is positioned the right way (Fig. 40).*

Fig. 38

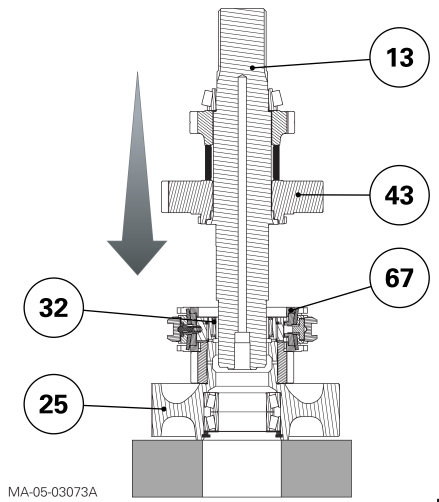

Fig. 39

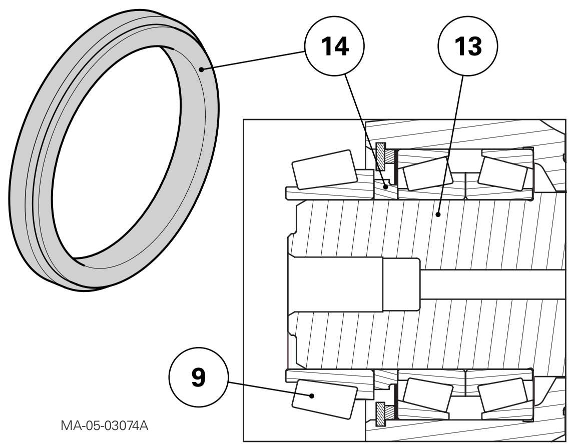

Fig. 40

G . Shimming the primary and secondary shafts in the housing

Shimming the primary shaft and reverse transfer pinion

108. Check the presence of the bearing cups (51), (47) and (118) in the gearbox housing (5) (Fig. 41).

109. In the gearbox housing (5), position the primary shaft (1) assembled during operations 67 to 86. At the same time, fit the reverse transfer pinion (116).

110. In the cover (6), fit the bearing cups (3) and (114) (assembled without shims) with grease to keep them in the cover (6).

111. Refit the cover (6) on the housing (5). Fit and tighten the cover screws (A) (Fig. 42).

112. Place a dial gauge feeler pin at the end of the primary shaft (1). In order to correctly seat the bearings, pull and push hard on the shaft while turning it (Fig. 42).

***Note:** To pull the shaft, use a lever positioned underneath the gearbox.*

113. Measure the clearance with a dial gauge. Calculate the thickness of shims required to obtain preload **P1**:

P1 = 0.05 to 0.10 mm

If possible, shim to obtain maximum tolerance.

Example if the clearance measured is 0.73:

0.73 + 0.05 = 0.78

0.73 + 0.10 = 0.83

The thickness of shims required will be between 0.78 and 0.83. Get as close as possible to 0.83.

114. Place the dial gauge feeler pin on the reverse transfer pinion (Fig. 43).

115. Using a makeshift bent rod (see Fig. 43), pull the pinion to correctly seat the bearings.

116. Measure the clearance with a dial gauge. Calculate the thickness of shims required to obtain preload **P2**:

P2 = 0.05 to 0.10 mm

If possible, shim to obtain maximum tolerance.

117. Remove the screws (A) and the cover (6) (Fig. 43).

118. Take out the primary shaft and reverse transfer pinion.

Fig. 41

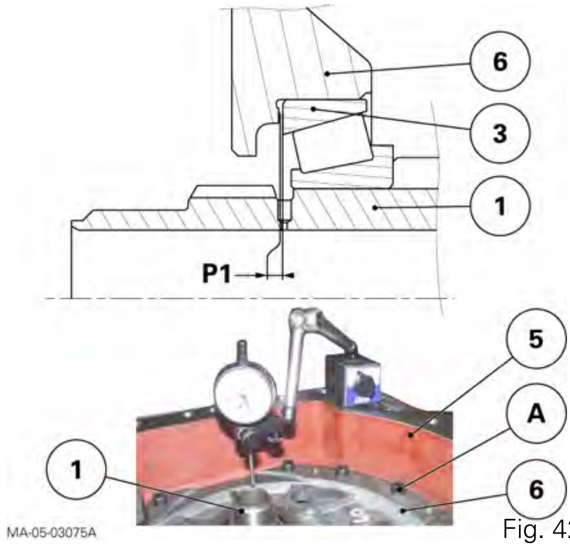

Fig. 42

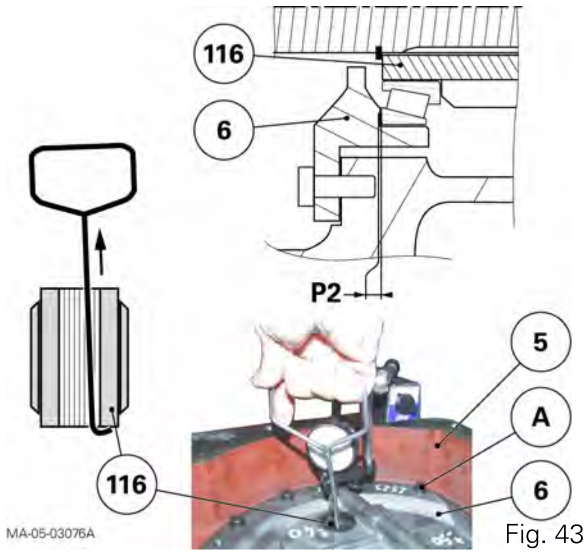

Fig. 43

Shimming the secondary shaft

119. Check the presence of the bearing cup (47) in the gearbox housing (5) (Fig. 41).

120. In the gearbox housing (5), position the secondary shaft (13) assembled during operations 95 to 107.

121. In the cover (6), fit the bearing cups (8) (assembled without shims) with grease to keep them in the cover (6).

122. Refit the cover (6) on the housing (5). Fit and tighten the cover screws (A) (Fig. 44).

123. Place a dial gauge feeler pin at the end of the secondary shaft (13). In order to correctly seat the bearings, pull and push hard on the shaft while turning it (Fig. 42).

NOTE: *To pull the shaft, use a lever positioned underneath the gearbox.*

124. Measure the clearance with a dial gauge. Calculate the thickness of shims required to obtain preload **P3**:

P3 = 0.05 to 0.15 mm

If possible, shim to obtain maximum tolerance.

125. Refit the shafts in the housing and fit the cover with the calculated shim thicknesses (see § E).

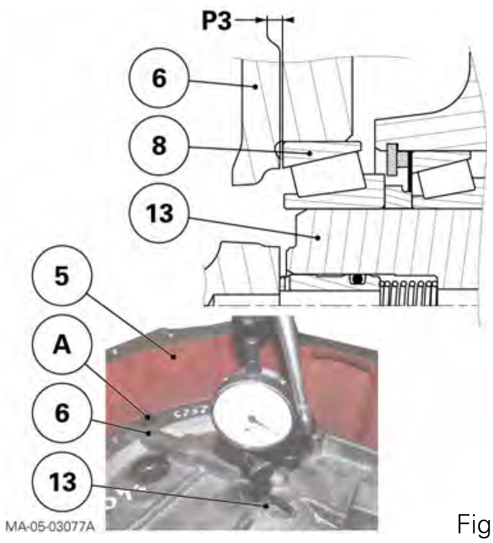

Fig. 44

H . Adjusting the selector rails and forks

To carry out this adjustment, the primary and secondary shafts must be correctly supported and shimmed in the housing.

Parts list (Fig. 45)

(L52) Range 1 control solenoid valve
(L53) Range 2 control solenoid valve
(L54) Range 3 control solenoid valve
(L55) Range 4 control solenoid valve
(L56) Range 1 switch
(L57) Range 2 switch
(L58) Range 3 switch
(L59) Range 4 switch

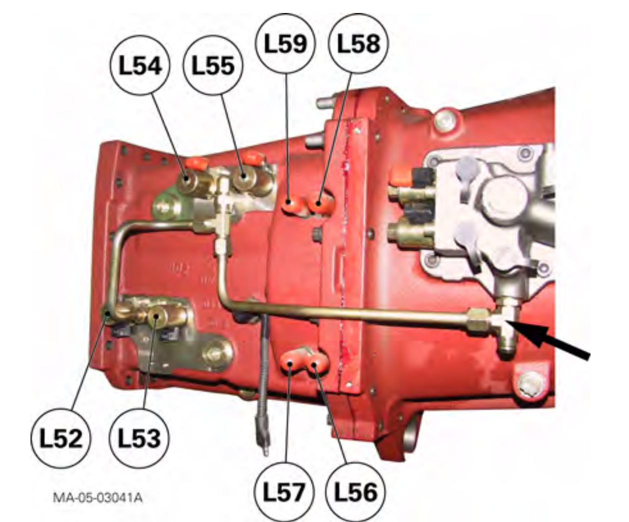

Fig. 45

Preliminary operations

126. Fit solenoid valves (L52), (L53), (L54) and (L55) (Fig. 45).

127. Fashion a union to supply the control circuit with compressed air at a maximum pressure of 4 bar (arrow Fig. 46).

128. Connect the selector rail adjustment tool ref 3378805M1 (see §L)

Fig. 46

Using the selector rail adjustment tool ref 3378805M1

General

The selector rail adjustment tool is used to supply the solenoid valves (L52), (L53), (L54) and (L55) of the gear box, in order to carry out various adjustments.

The range switches (L56), (L57), (L58) and (L59) can be checked once the selector rails have been adjusted and the switches fitted. Each LED on the tool corresponds to a switch.

Switches, LEDs/connectors (Fig. 47)	
Switch 1	Solenoid valve L52
Switch 2	Solenoid valve L53
Switch 3	Solenoid valve L54
Switch 4	Solenoid valve L55
Switch R	Solenoid valves L52, L53, L54 and L55
LED 1	Switch L56
LED 2	Switch L57
LED 3	Switch L58
LED 4	Switch L59

The switches on the tool supply the solenoid valves of the gear box. They work independently of the LED lighting.

The range switches light the LEDs of the tool. When a range is engaged, the corresponding LED for the range is lit.

***Note:** The switches are normally closed. When a range is engaged, they open the circuit and the implement reverses the signal to light the LEDs. When the switches are not connected, the four LEDs on the tool are thus lit.*

Connecting the tool

- Connect the tool to a 12V, 4A power supply (Fig. 48).
- Connect the connectors (1) to the solenoid valves and the connectors (2) to the range switches (Fig. 49). Each wire is marked with a number indicating the range concerned (see the following table).

Marks / Connectors	1	2	3	4
Solenoid valves	L52	L53	L54	L55
Switches	L56	L57	L58	L59

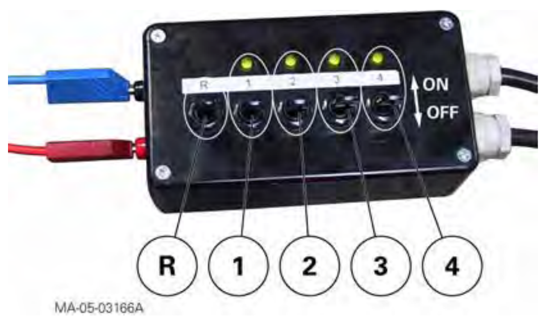

Fig. 47

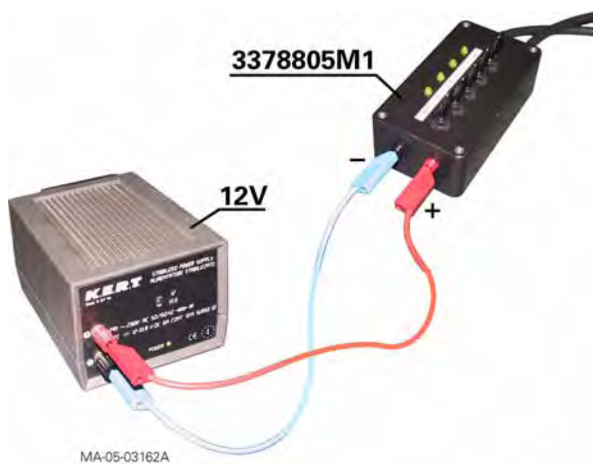

Fig. 48

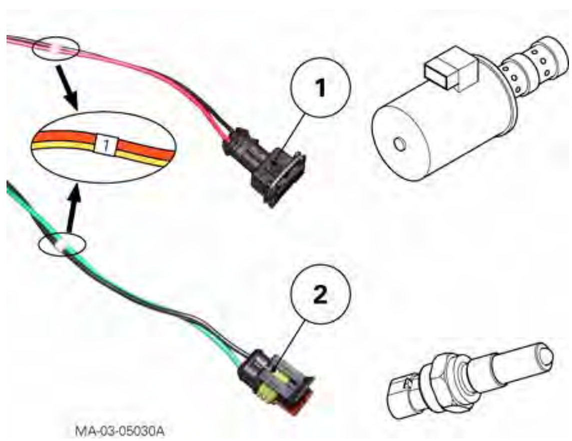

Fig. 49

Using the tool

- Supplying the solenoid valves

  Activate switches 1, 2, 3 and 4 one by one, in order to supply the solenoid valves required to adjust the selector rails. To return the two selector rails to neutral automatically, use switch R on the implement (4 solenoid valves supplied).

  For example (Fig. 50):

  Solenoid valve (L52) supplied by switch 1—the selector rail pushes switch (L56) and lights LED 1.

- Checking the switches

  Once the selector rails have been adjusted, fit the switches. Engage a range using the corresponding switch. The LED that corresponds to the range engaged should light up.

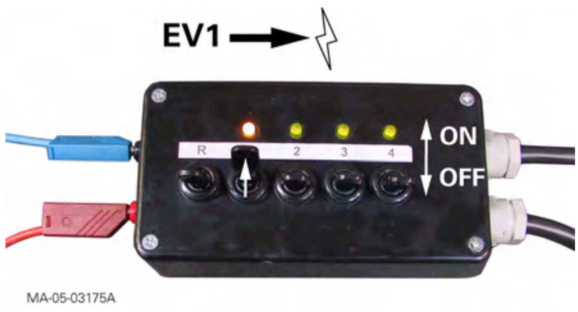

Fig. 50

Checking the selector rails before adjustment

Before adjusting the travel of the selector rails, it is important to check that their movement is within the permitted tolerances.

129. Using a depth gauge and a suitable fixture, check the following dimensions (see the table) (Fig. 51):
- **X1**: distance between face F of the housing and the end of the selector rail with the range 1 or 3 engaged,
- **Y** : distance between face F of the housing and the end of the selector rail in neutral position,
- **Z1**: distance between face F of the housing and the end of the selector rail with the range 2 or 4 engaged.

	Ranges 1 and 2	Ranges 3 and 4
X1	20.785 ± 1	21.830 ± 0.8
Y	32.215 ± 1.245	33.213 ± 1.093
Z1	43.625 ± 0.9	44.425 ± 0.8

If the measured dimensions are outside these tolerances, manually turn the gears using the reverse driving pinion (see Fig. 53), then repeat the measurements. If the dimensions are still incorrect, check that the selector rails and synchronisers have been fitted correctly.

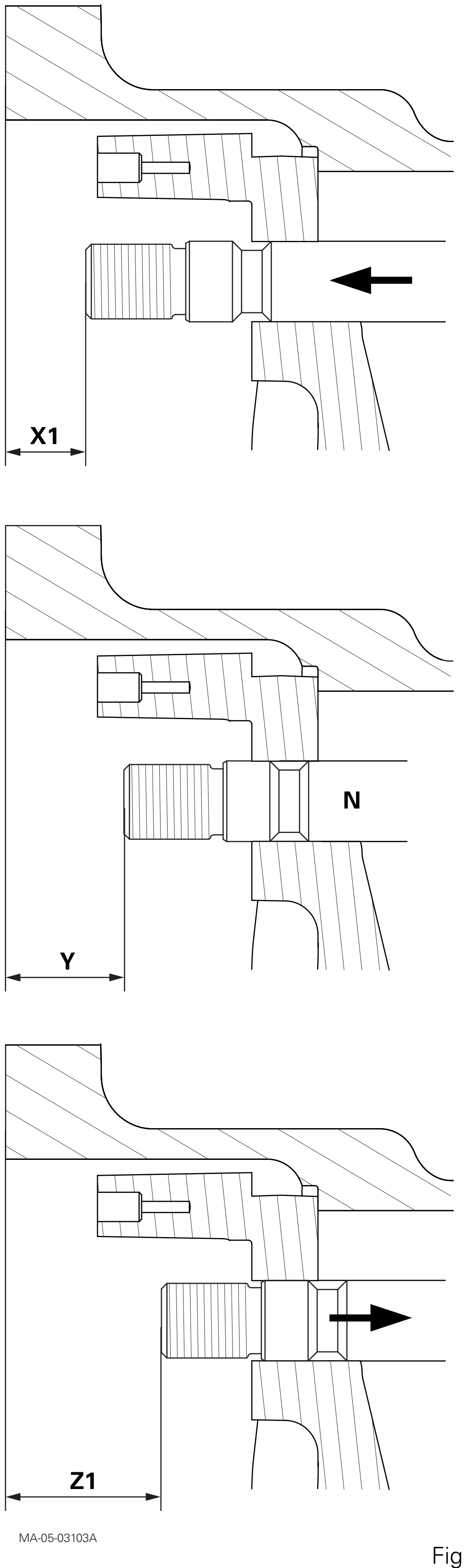

Fig. 51

Adjusting the selector rails

Adjusting the selector rail (98) (ranges 1 and 2)

130. Set the rail (98) to neutral.
131. Fit the castellated nut without tightening (109).
132. Engage range 2. (Supply L53) (Fig. 52).
133. Tighten the nut (109) up against the cover (6) (Fig. 52).
134. Reposition the selector rail to neutral. Screw on the nut (109) by two slots and line up the next slot opposite the hole of the locking screw (107).
135. With paint, mark the position of the nut (109) in relation to the cover (6).

***NOTE:** The synchroniser may not fully engage when the gearbox is not running.*
If this is the case, position the shaft (121) and reverse transfer pinion (119) and slowly run the gearbox while engaging the range (Fig. 53).

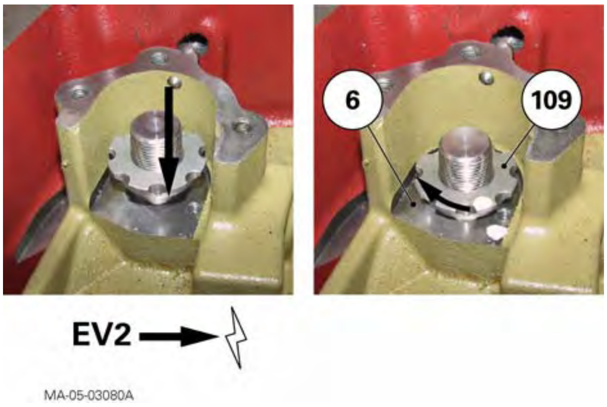

Fig. 52

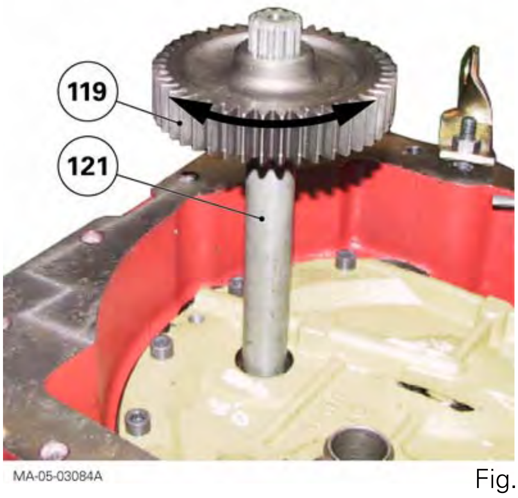

Fig. 53

136. Fit the castellated nut (108). Screw it on until it is almost touching the nut (109) (Fig. 54).

NOTE: Ensure the nut (109) stays in its set position and that the paint marks are not removed.

137. Fit the plate (111). Fit the screws (110) smeared with Loctite 242 or equivalent (Fig. 54).
Tighten to a torque of 29 - 37 Nm.

138. Engage range 1. (Supply L52) (Fig. 55)

139. Unscrew the nut (108) fitted home against the cover (111).

140. Reposition the selector rail to neutral. Unscrew the nut (108) by two slots and line up the next slot opposite the hole of the locking screw (107).

141. With paint, mark the nut (108) aligned with the mark on the cover (6) as in operation 135.

142. Insert the screw (107) to lock the nuts (108) and (109), aligning the marks made during operations 135 and 141 (Fig. 56).

143. Check for correct operation. The nuts should effectively act as a stop (Fig. 56).

144. Firmly fit the screw (107), lightly smeared with Loctite 242 or equivalent. Tighten to a torque of 12 - 16 Nm.

Adjusting selector rail (73) (ranges 3 and 4)

145. Repeat operations 130 to 144 with the selector rail (73) and nuts (99) and (101).

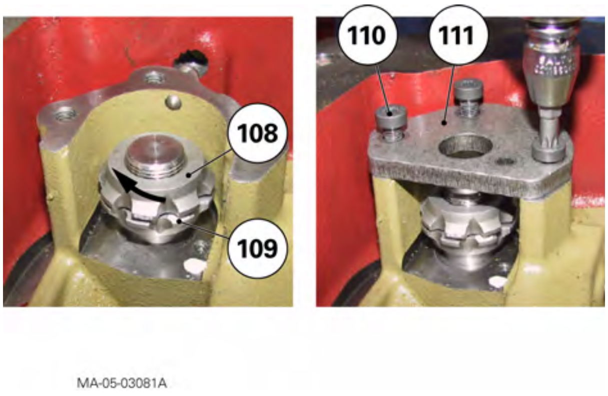

Fig. 54

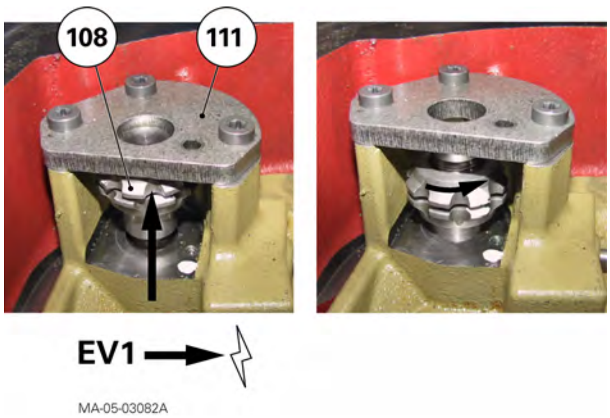

Fig. 55

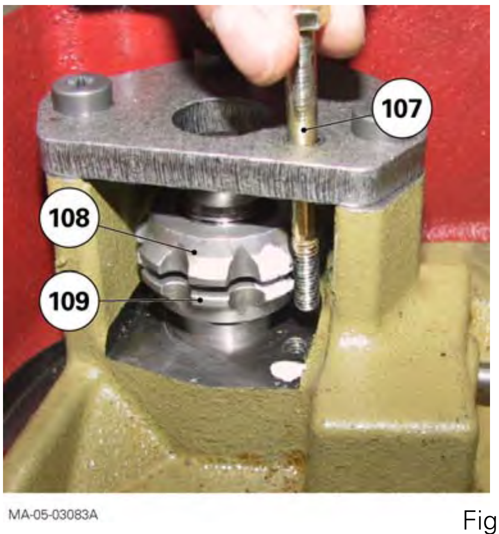

Fig. 56

I . Adjusting the interlock mechanism

Note: *This adjustment must be carried out after setting the selector rails (see § H).*

146. Screw home the rod (106) in the reverse pitch nut (131) (Fig. 57).

147. Using the selector rail adjustment tool ref. 3378805M1, engage a range on a selector rail and leave the other selector rail in neutral.

148. Unscrew the rod (104) until the lock reaches maximum axial clearance as shown in (Fig. 58):
J = 0.1 to 0.3 mm

149. Tighten the locknut (105).

Check

150. Using the selector rail adjustment tool ref. 3378805M1, engage a range on a selector rail.

151. Try to shift a range on the other selector rail. It should not engage.

152. Repeat the procedure with all the ranges.

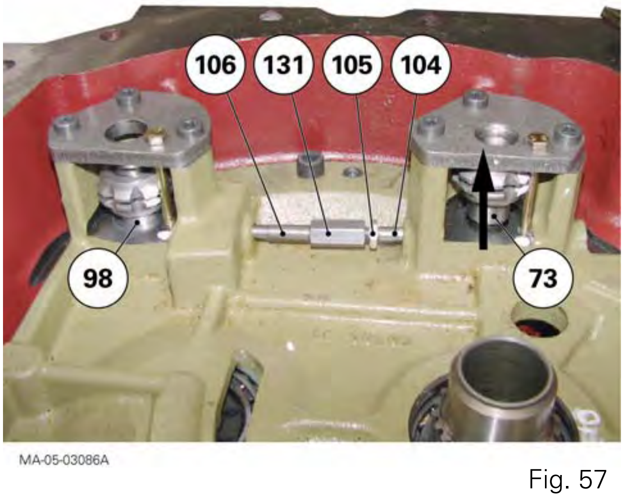

Fig. 57

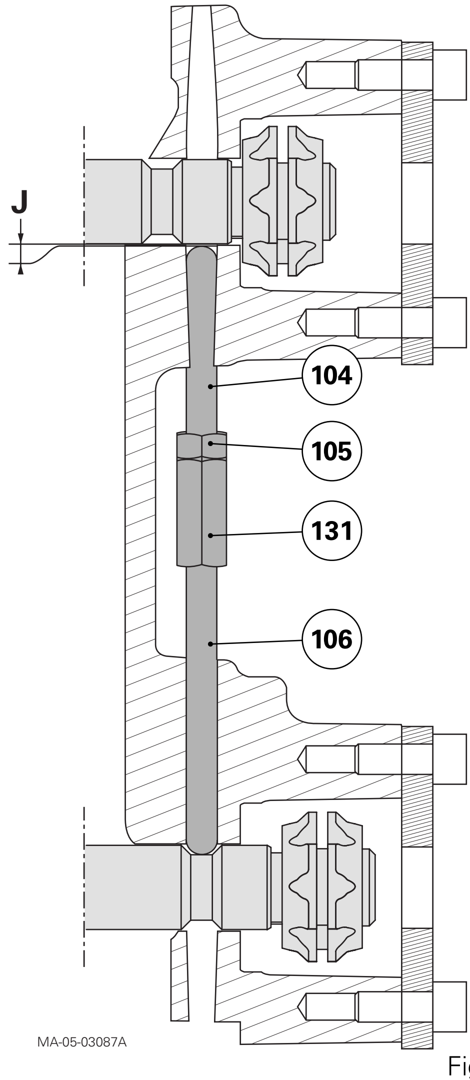

Fig. 58

J . Assembling the intermediate speed sensor

153. Fit the sensor (C) (Fig. 59) lightly smeared with Loctite 577 or equivalent.

154. Screw the sensor home on the pinion (25) without forcing it, then unscrew by ¾ of a turn.

155. Tighten the locknut to a torque of 5 - 7 Nm.

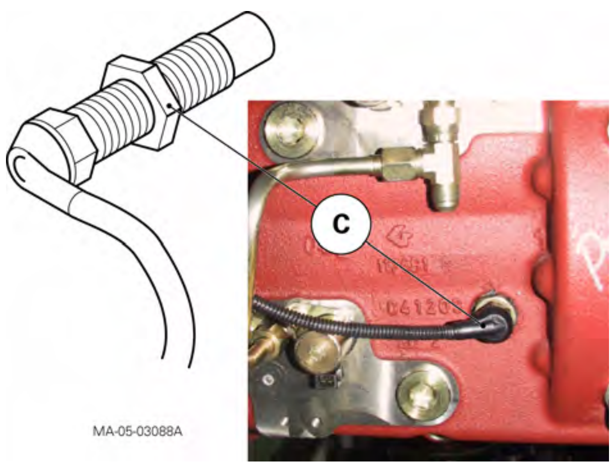

Fig. 59

K . Final operations

156. Fit the gearbox on the rear axle and engine.

157. Reconnect the harnesses and hydraulic pipes that were removed.

158. Check the level of the transmission oil.

159. Carry out a gearbox calibration (see chapter 11) and check the transmission for correct operation.

L . Service tools

Tool available in AGCO network

- **3378804M1: Gearbox shaft slinging tool (Fig. 60)**
- **3378805M1: selector rail adjustment tool (Fig. 61)**

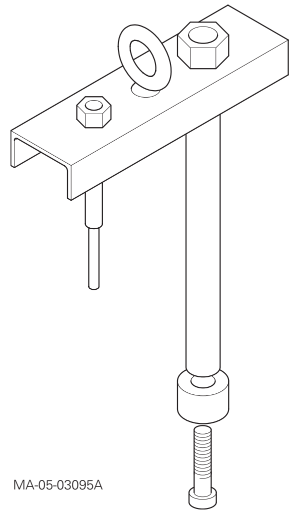

Fig. 60

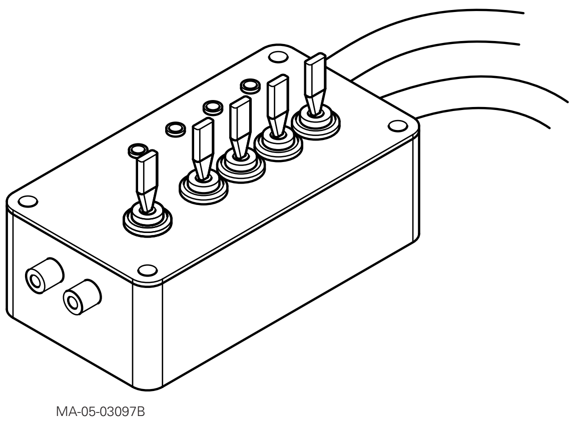

Fig. 61

5D10 - GBA20 - Creeper unit

CONTENTS

A . General

The creeper speed reducer consists of an epicyclic gear train with a planet carrier and ring gear assembly fitted at the rear of the main gearbox. It is controlled by a lever located on the cab console and linked by a cable to a rod fitted on the front right-hand side of the centre housing. This rod moves the coupler control fork.

***Important:** Creeper gears can only be selected if the main gearbox is in the Tortoise range.*

B . Operation

The coupler (8) is splined to the connecting shaft (21). Moving the lever "A" to Snail position (Fig. 4) moves the coupler (8) back and engages it with the planet carrier (1) via its external teeth. The speed of the shaft (21) is 1/4 in relation to the output shaft.

For normal gears, the gearbox output shaft is attached to the connecting shaft (21) when the coupler (8) is moved forward, thus ensuring direct drive.

When the creeper range is selected, the Snail indicator light on the instrument panel comes on.

When the Hare range indicator light flashes, this indicates to the operator that Hare position is engaged and shifting to Tortoise position is required.

The electrical signal corresponding to selection of the creeper range is transmitted via switch "C", which is fitted on the control unit (Fig. 4).

Parts list (Fig. 1)

(1) Planet carrier
(2) Friction washer
(3) Cover plate
(4) Lock washer
(5) Screw
(6) Snap ring
(7) Coupler ring
(8) Sleeve
(9) Planet gears
(10) Needle rollers
(11) Spacer
(12) Pin
(13) Gear plate
(14) Gear plate
(15) Stop plate
(16) Circlip
(17) Planet carrier assembly
(18) Friction washer
(19) Ring gear
(20) Centring pin
(21) Link shaft

View of the assembly

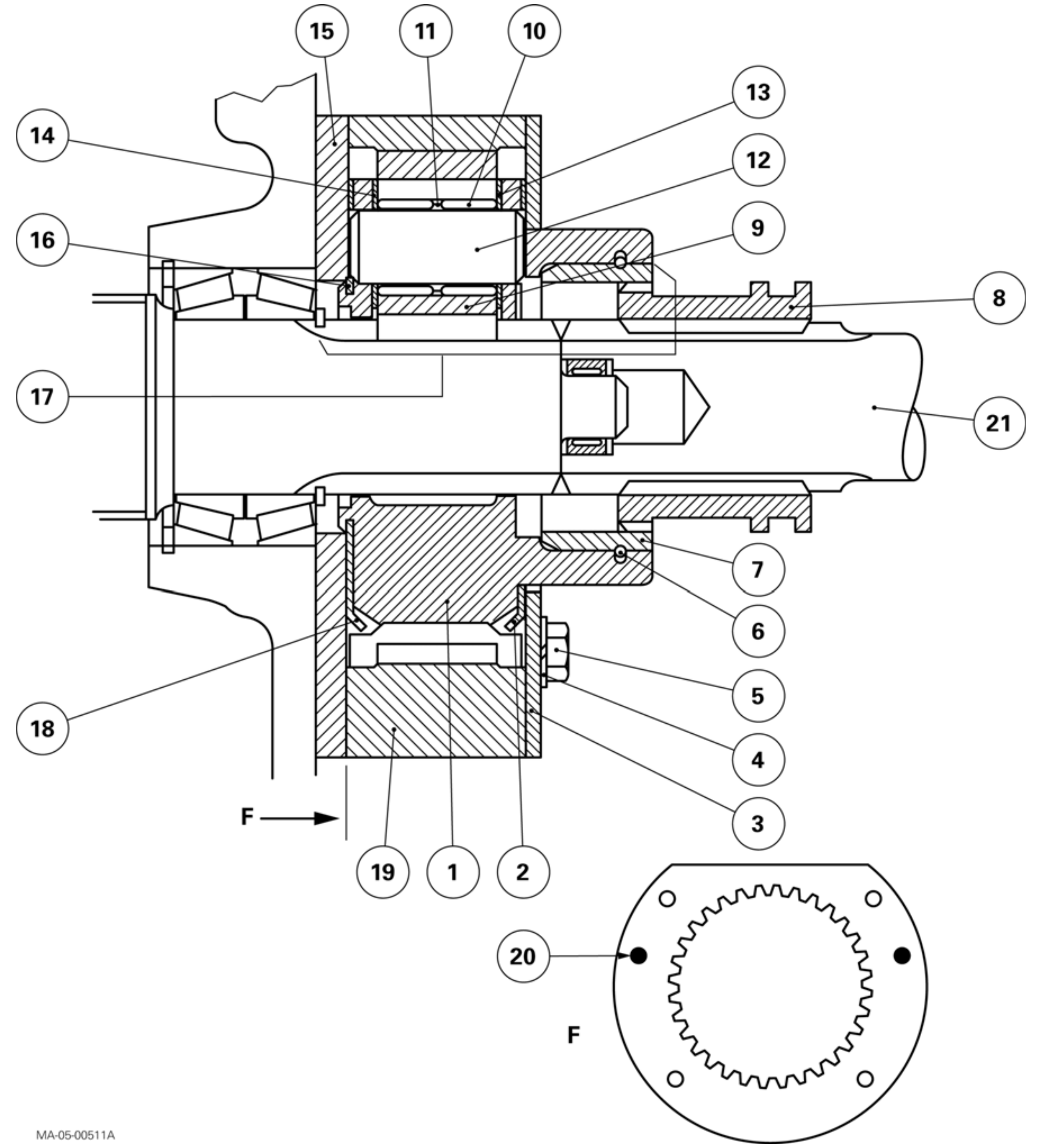

Fig. 1

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Parts list (Fig. 2)

(1) Planet carrier
(2) Friction washer
(3) Cover plate
(4) Lock washer
(5) Screw
(6) Snap ring
(7) Coupler ring
(8) Sleeve
(9) Planet gears
(10) Needle rollers
(11) Spacer
(12) Pin
(13) Gear plate
(14) Gear plate
(15) Stop plate
(16) Circlip
(17) Planet carrier assembly
(18) Friction washer
(19) Ring gear
(20) Centring pin

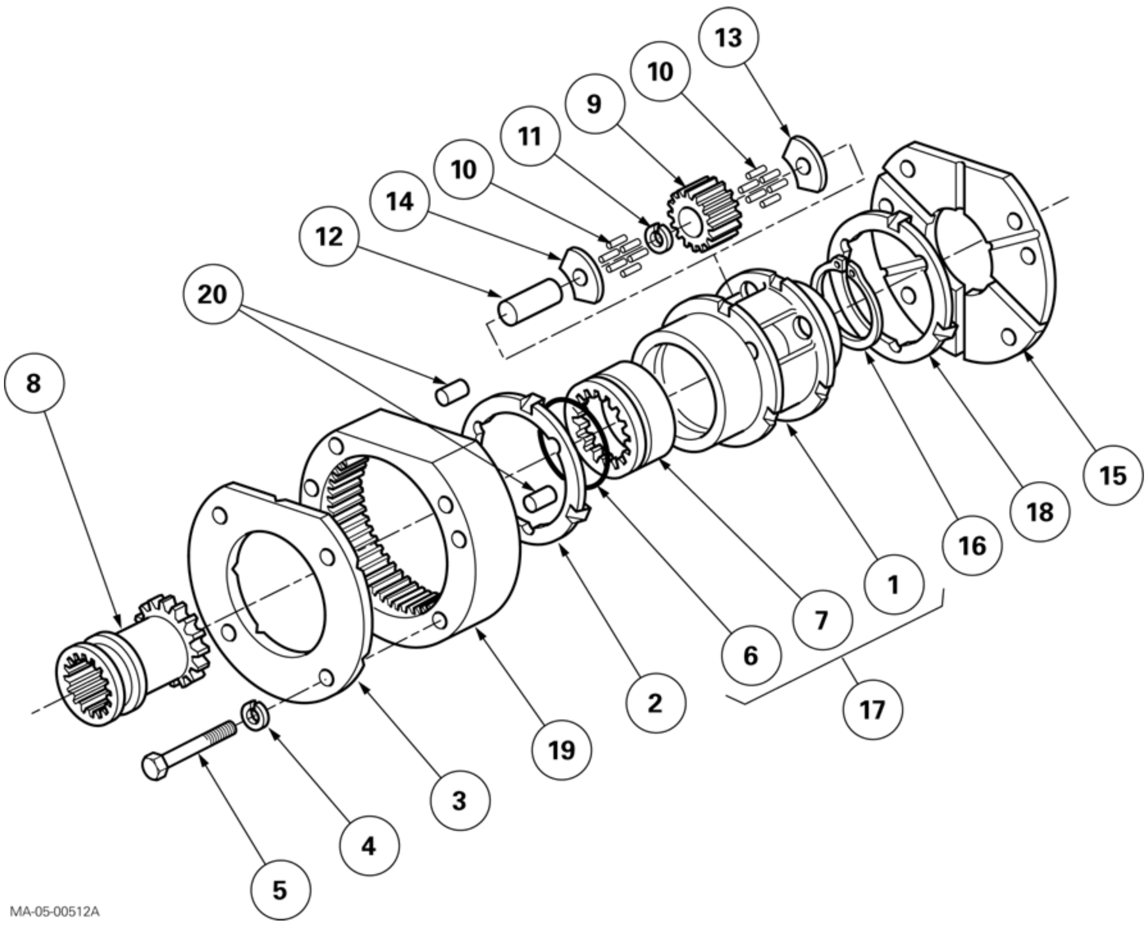

Fig. 2

C . Removing the unit and the ring gear

1. Take off the right-hand hydraulic cover plate and, if required, the left-hand hydraulic cover plate (see chapter 9).

2. Disassemble the PTO assembly.

- **2-speed PTO**

  Remove (see chapter 7):
  - the PTO top cover plate located at the rear of the centre housing;
  - the driving gear;
  - the intermediate shaft;
  - the PTO clutch.

- **4-speed economy PTO**

  Remove (see chapter 7):
  - the PTO top cover plate located at the rear of the centre housing;
  - the driving gear;
  - the intermediate shaft;
  - the PTO clutch.

3. Disassemble the sleeve / connecting shaft / coupler / assembly and the fork (see chapter 5).

Removing the unit and the reducer ring gear

4. Remove the screws (5) and the washers (4)

5. Remove the cover plate (3).

6. Take out the planet carrier assembly (17) and the friction washers (2) (18).

7. Remove the ring gear (19).

NOTE: *The centring pins (20) remain in the ring gear.*

8. Remove the stop plate (15) without pulling on the output shaft.

D . Disassembling the planet carrier

9. Remove the circlip (16).

10. Drive out the pins (12).

11. Remove the gear plates (13) (14).

12. Remove the planet gears (9).

IMPORTANT: *Replace the planet carrier (1) if the coupler ring (7) is damaged.*

E . Reassembling the planet carrier, refitting the ring gear and the unit

13. Check and clean all components. Replace those that are defective.

14. Refit the planet gears (9). Use miscible grease in oil to fit the needle rollers (10).

15. Refit the gear plates (13) (14).

16. Refit the pins (12), directing them as required to fit the circlip (16).

17. Fit the circlip (16). Manually check the axial clearance and rotation of each planet gear.

18. Position the stop plate (15) and the ring gear (19) on the housing (Fig. 3).

19. Fit the friction washers (2) and (18) smeared with miscible grease on the planet carrier (1).

20. Slide the planet carrier onto the output shaft.

21. Position the cover plate (3). Tighten screws (5) to a torque of 34 - 52 Nm.

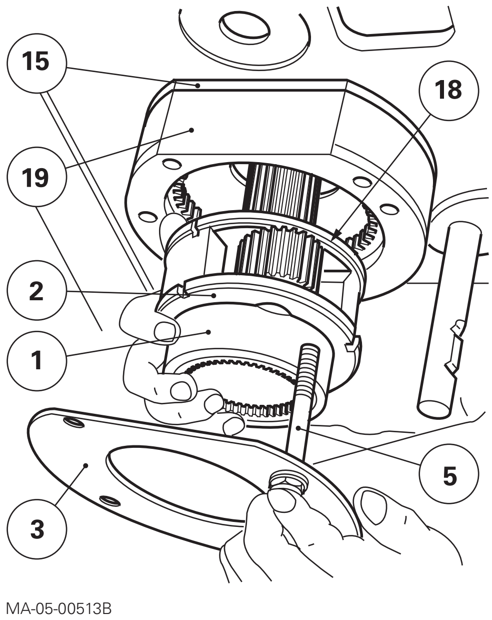

Fig. 3

F . Final steps

22. Reassemble the fork and the rear sleeve / connecting shaft / coupler assembly (see chapter 5).

23. Reassemble the PTO assembly.

- **2-speed PTO**
  - Refit the power take-off clutch (see chapter 7).
  - Refit the intermediate shaft, the driving gear and the PTO top cover plate (see chapter 7).
- **4-speed PTO**
  - Refit the power take-off clutch (see chapter 7).
  - Refit the intermediate shaft, the driving gear and the PTO top cover plate (see chapter 7).

24. Refit the left-hand hydraulic cover plate (if removed) and the right-hand hydraulic cover plate (see chapter 9).

25. Carry out a road test of the creeper unit.

26. Check PTO and PTO brake operation.

G . Adjusting the control

27. Place control lever A in the Snail position (Fig. 4).

Reminder: *The control lever may be located in two positions on the right-hand console, depending on whether or not an auto-hitch is fitted.*

28. Screw the clevis (1) level with the end of the threaded part of the cable (6) (Fig. 4).

29. Fit the clevis (1) onto lever A with the clip (7). Tighten the nut (2) (Fig. 4).

30. Screw the nut (3) on the sheath end (5).

31. Fit the sheath end and the Grower washer on the support. Tighten the nut (4).

Important: *Check that the cable is not pinched.*

32. Place connecting rod B in the "creeper" position (Fig. 5) (reducer dog (8) engaged towards the rear (Fig. 1)), fork locked.

33. Screw the clevis (9) level with the end of the threaded part of the cable (6) (Fig. 5).

34. Fit the clevis (9) to rod B using the clip (10). Tighten the nut (11) (Fig. 5).

35. Adjust the stop (12) with the nut (13), making sure that connecting rod B is still firmly locked.

36. Tighten the nut (14).

Important: *After tightening, check that the cable is not pinched.*

37. Check that the control is locked in the "direct drive" position.

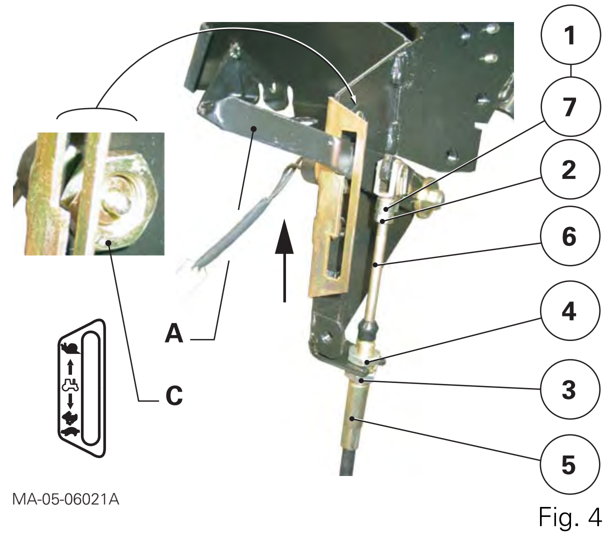

Fig. 4

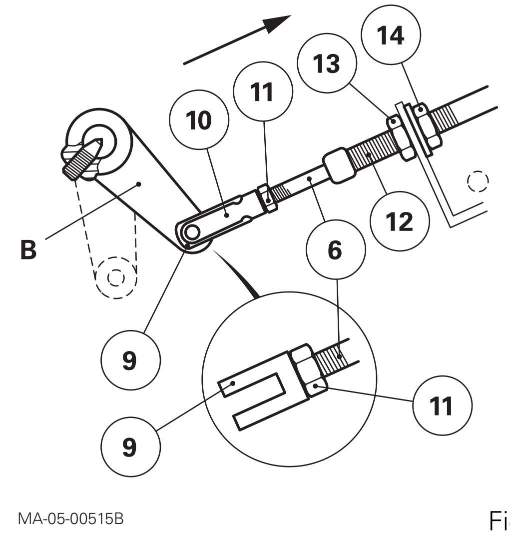

Fig. 5

5D11 - GBA20 - Super creeper unit

CONTENTS

A . General

The super creeper reducing unit (1) is located at the rear of the main gearbox (Fig. 1). It is fitted as an option.

It comprises:

- an input epicyclic gear train fitted with three planet gears
- an output epicyclic gear train fitted with five planet gears.

Each epicyclic gear train (input and output) consists of a sun gear/planet carrier/ring gear assembly.

Each ring gear (19) is machined in a single unit (Fig. 2).

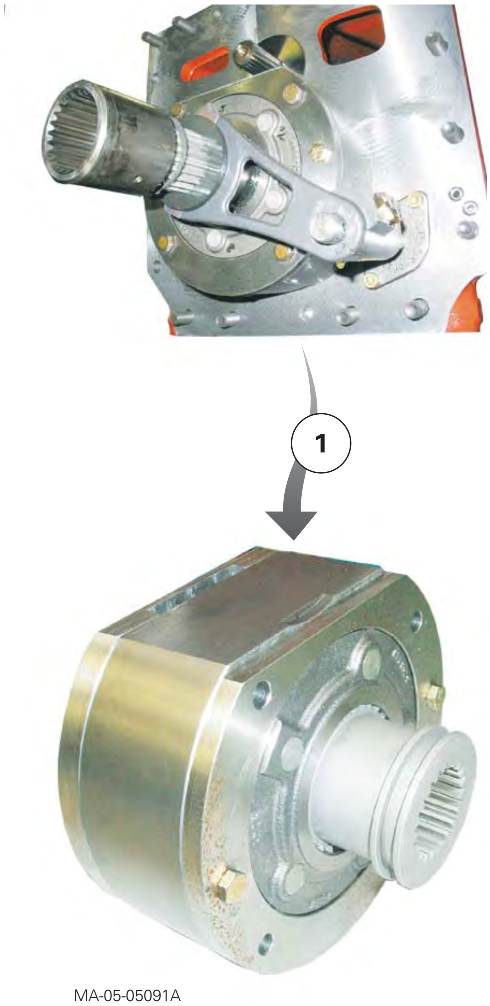

Fig. 1

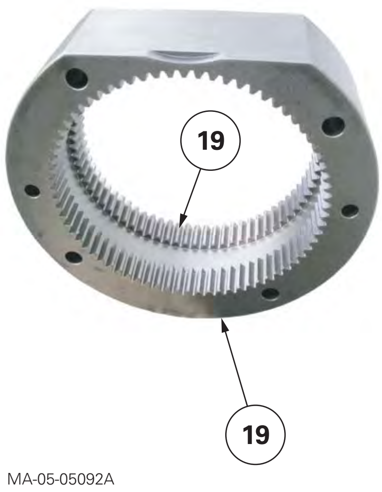

Fig. 2

GBA20 - Super creeper unit

Parts list (Fig. 3)

(1) Input planet carrier
(2) Friction washer
(3) Cover plate
(4) Output planet carrier
(5) Screw
(6) M8 screw
(7) Circlip
(8) Coupler
(9) Input planet gears
(10) Needle rollers
(11) Output planet gears
(12) Pins
(13) Input planet gear plates
(14) Sun gear
(15) Stop plate
(16) Input epicyclic gear train
(17) Output epicyclic gear train
(18) Folded friction washer
(19) Ring gear unit
(20) Dowels
(21) Link shaft
(22) Output planet gear plates
(44) GBA20 gearbox output shaft

View of the assembly

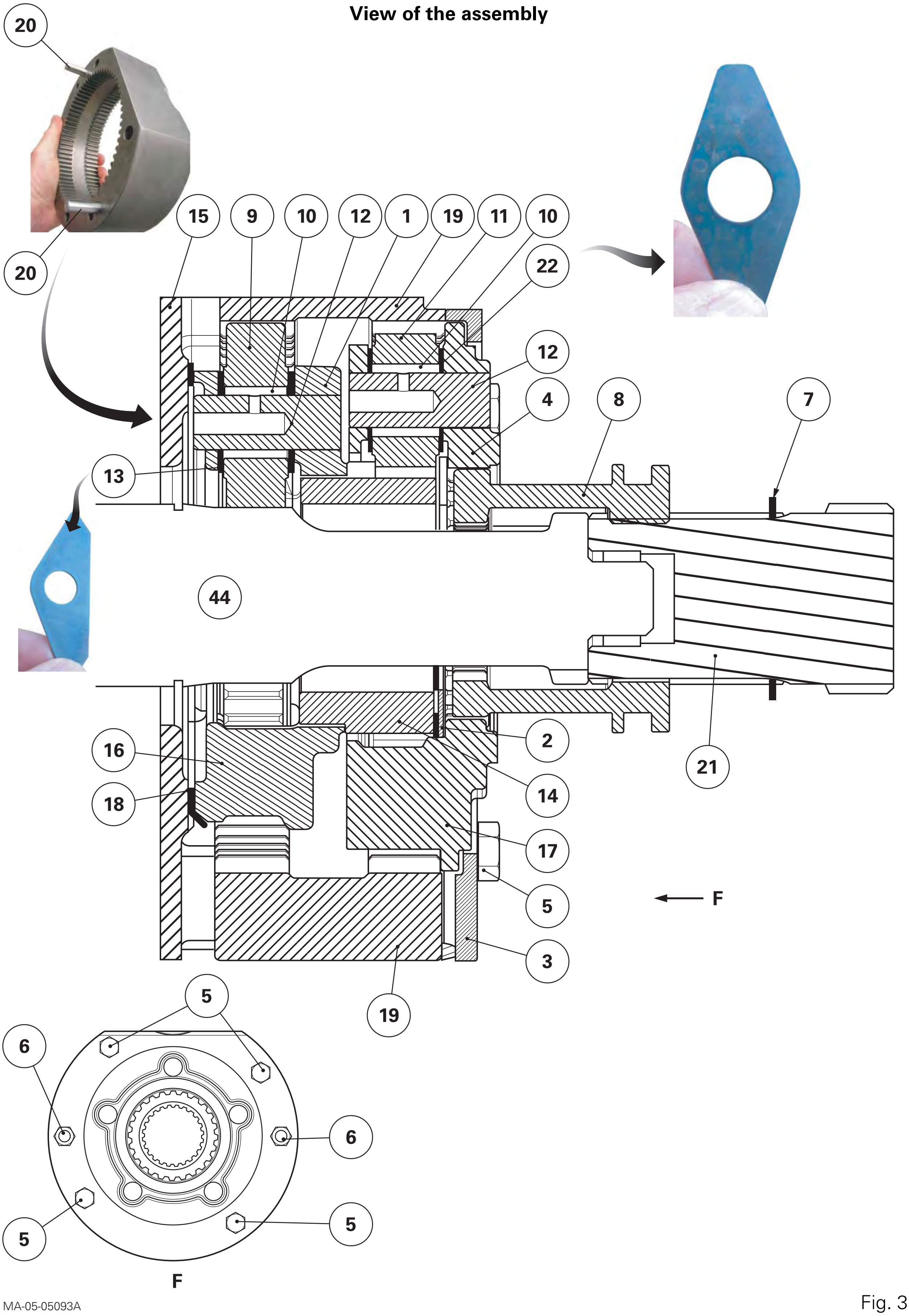

Fig. 3

GBA20 - Super creeper unit

Parts list (Fig. 4)

(1) Input planet carrier
(2) Friction washer
(3) Cover plate
(4) Output planet carrier
(5) Screw
(6) M8 screw
(8) Coupler
(9) Input planet gears
(10) Needle rollers
(11) Output planet gears
(12) Pins
(13) Input planet gear plates
(14) Sun gear
(15) Stop plate
(16) Input epicyclic gear train
(17) Output epicyclic gear train
(18) Folded friction washer
(19) Ring gear unit
(20) Dowels
(22) Output planet gear plates

Blown-up view

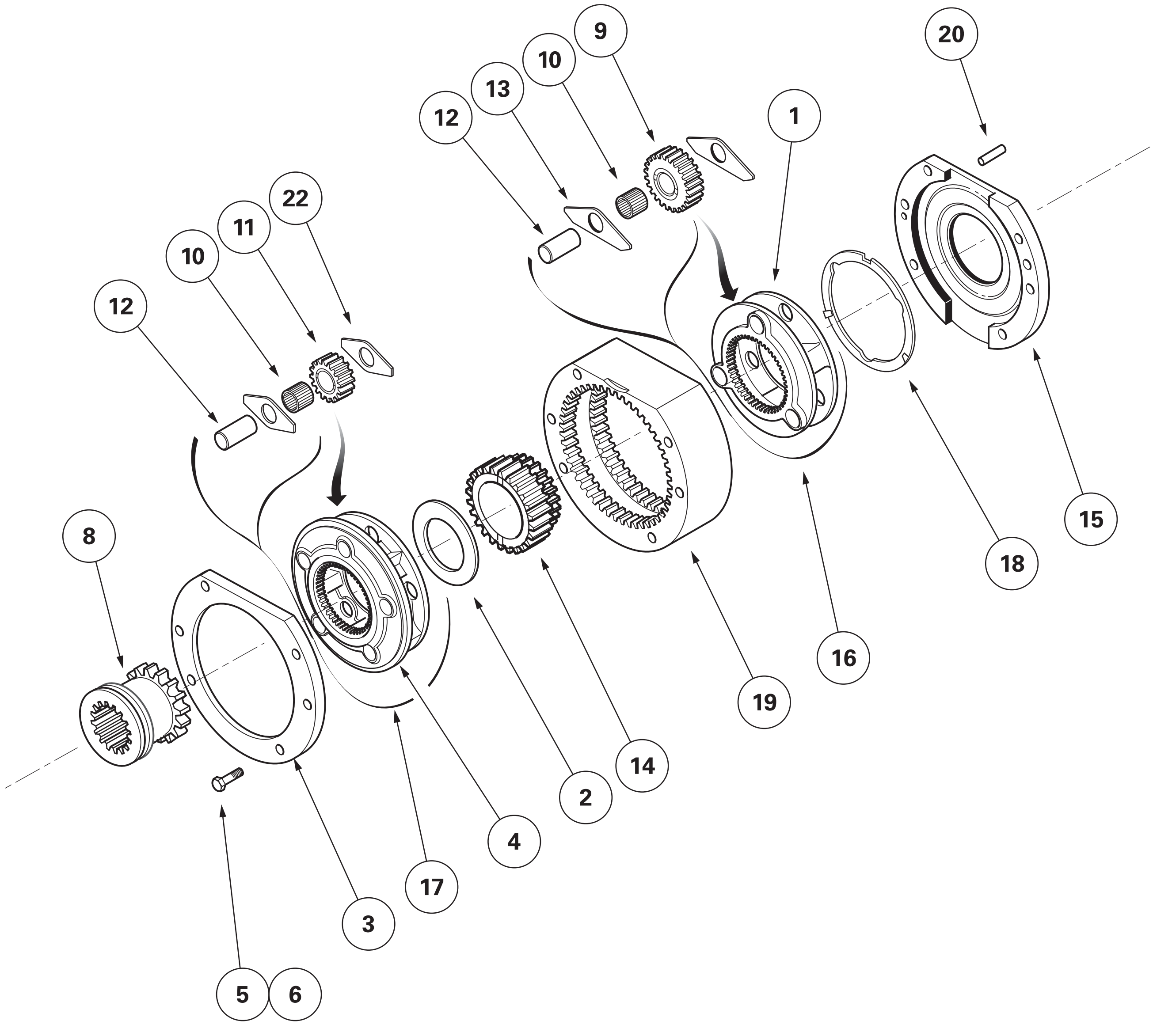

Fig. 4

B . Kinematics and operation

Kinematics

Kinematics of the input epicyclic gear train (16) (Fig. 5)

- Ring gear unit (19) blocked.
- Drive input via output shaft (44) of the GBA20 gearbox.
- Drive output via planet carrier (1).

Kinematics of the output epicyclic gear train (17) (Fig. 5)

- Ring gear unit (19) blocked.
- Drive continuity via sun gear (14).
- Drive output to rear axle via planet carrier (4).

NOTE: *The sun gear (14) is secured by splines on the planet carrier (1).*

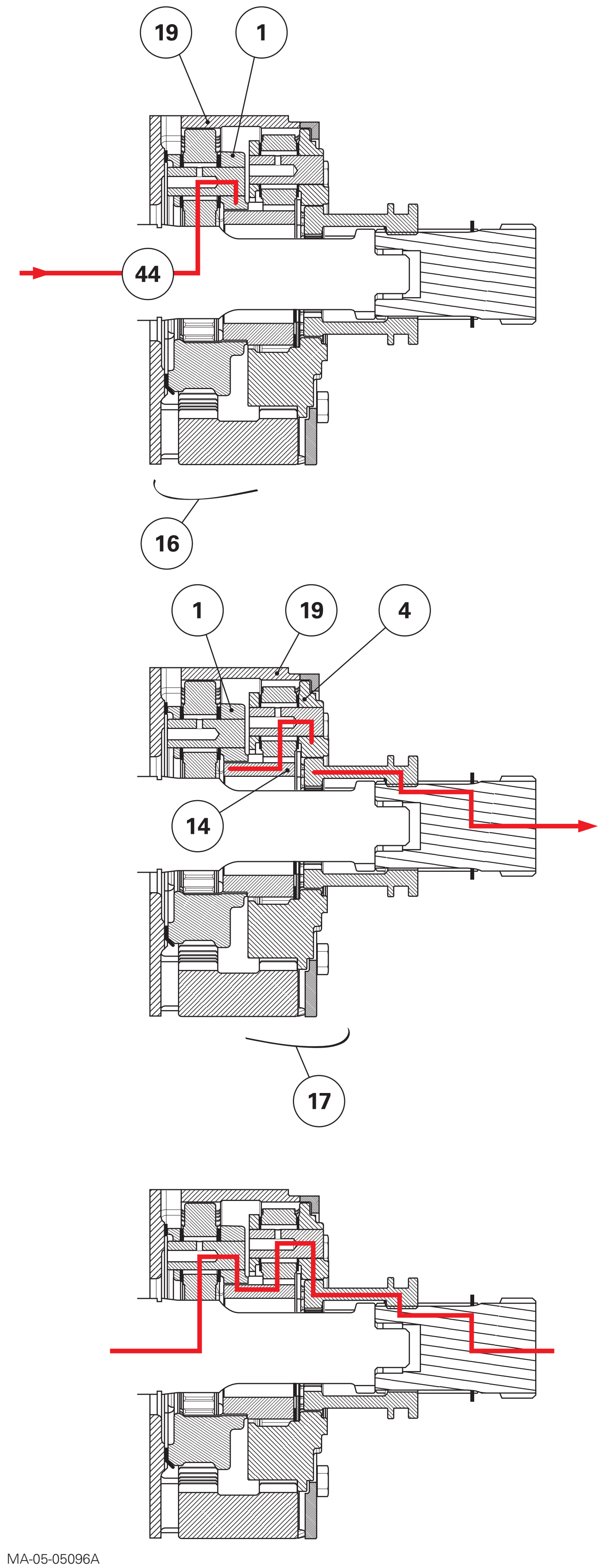

Fig. 5

Operation (Fig. 6)

The coupler (8) is secured by splines on the link shaft (21). Movement of lever A to Snail position moves the coupler (8) forwards and engages it with the planet carrier (4) via its external teeth. The speed of the link shaft (21) is 1/14 that of the gearbox output shaft (44). When the coupler (8) is engaged in the output planet carrier (4), the needle roller bearing (1) allows the link shaft (21) to turn at a different speed to that of the output shaft (44) (Fig. 6).

When the super creeper range is selected, the Snail indicator light on the instrument panel comes on. The electrical signal corresponding to selection of the super creeper range is transmitted via switch C, which is fitted on the control unit (Fig. 7).

In normal gears, the gearbox output shaft (44) is engaged with the link shaft (21) when the coupler (8) is moved backwards, thus ensuring direct drive (Fig. 8).

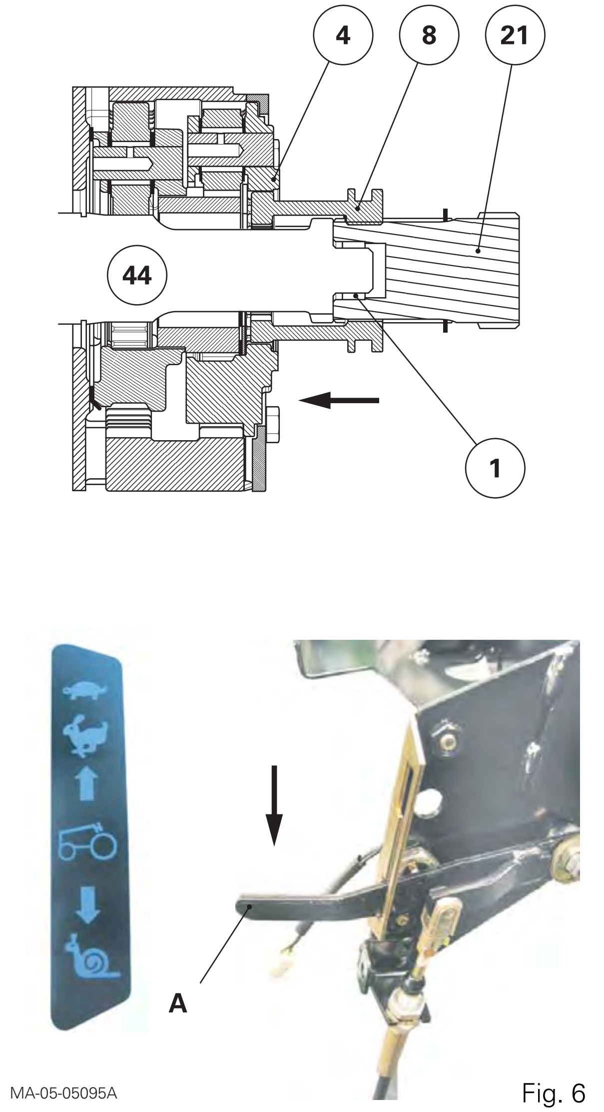

Fig. 6

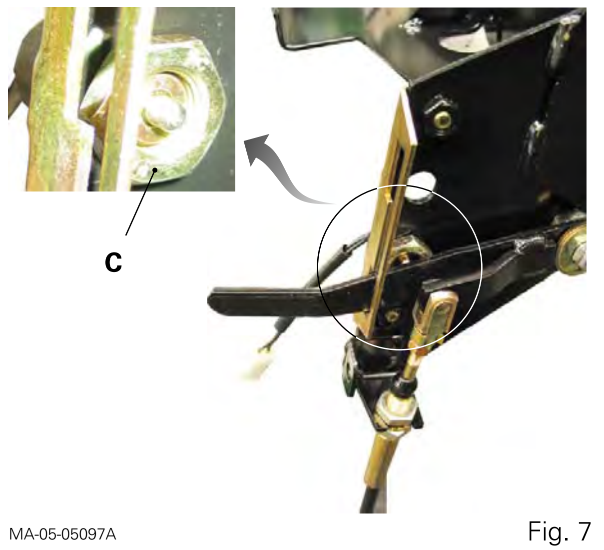

Fig. 7

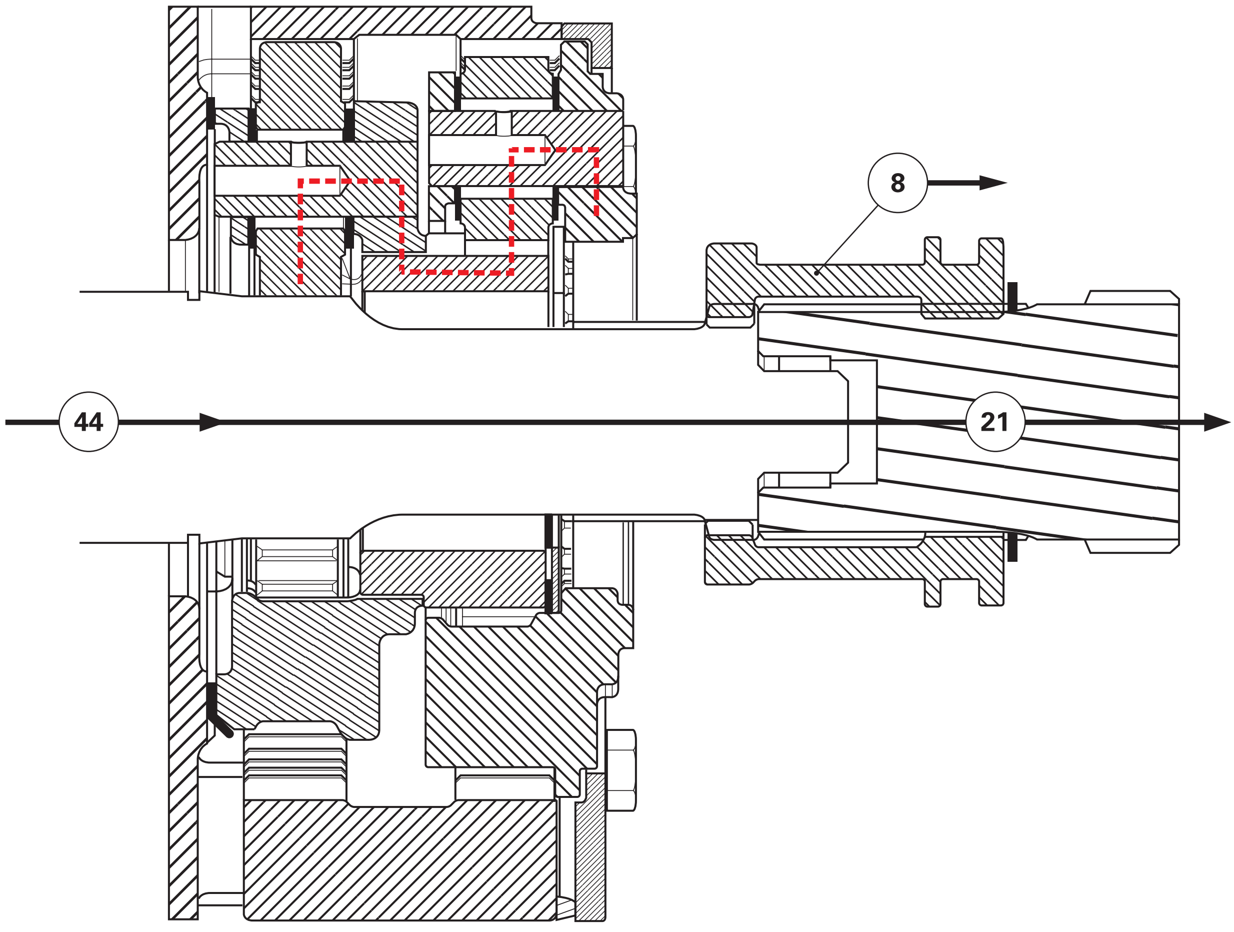

Fig. 8

C . Removing/refitting and disassembling/reassembling the epicyclic gear trains

Preliminary steps

1. Split the tractor between the gearbox and the rear axle (see chapter 2).
2. Remove (Fig. 9):
   - the counter-nut (26)
   - the adjustable lock (27)
   - the fork (28) and the coupler (8).

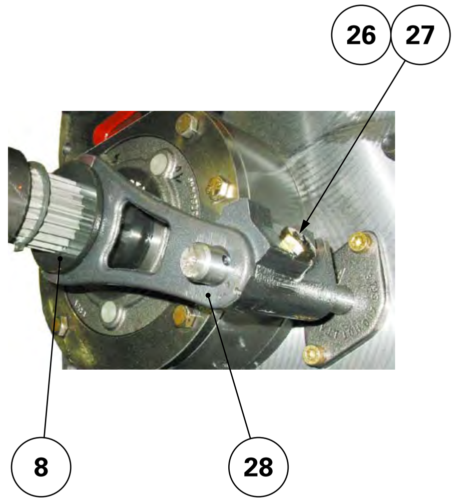

Fig. 9

Removal

3. Remove the screws (5).
4. Separate the super creeper unit from the gearbox. Place it on a workbench.

Disassembly

5. Remove the M8 screws (6).
6. Remove:
   - the cover plate (3)
   - the output planet carrier (4)
   - the sun gear (14)
   - the input planet carrier (1).
7. Recover the folded friction washer (18).
8. Separate the stop plate (15) from the ring gear unit (19).

   NOTE: *The dowels (20) are force fitted onto the ring gear unit (19).*

Reassembly

9. Check and clean all components. Replace those that are defective.

10. Check that all dowels (20) are present on the ring gear unit (19).

11. Assemble the stop plate (15) on the ring gear unit.

12. Lightly smear the folded friction washer (18) with miscible grease.

Position the folds of the friction washer face-to-face with the notches (Fig. 10).

Fit the friction washer up against the input planet carrier (1).

13. Refit:

- the input planet carrier (1)
- the sun gear (14)
- the output planet carrier (4)
- the cover plate (3).

14. Fit and tighten the M8 screws (6) to a torque of 25 - 35 Nm.

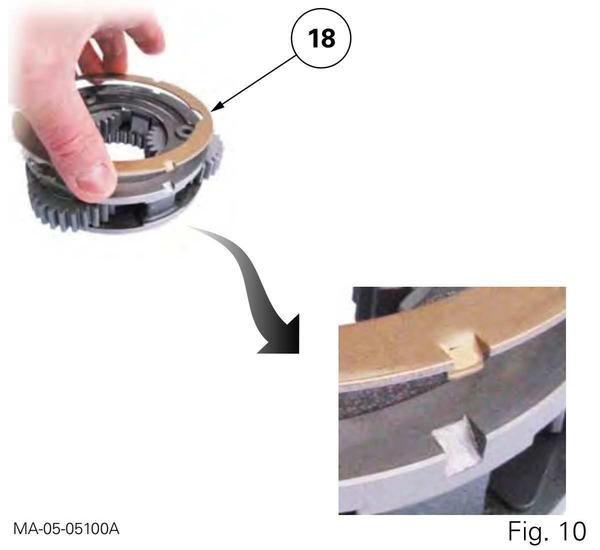

Fig. 10

Refitting

15. Assemble the super creeper unit on the gearbox.

16. Fit and tighten the screws (5) to a torque of 33.8 - 51.5 Nm.

Final steps

17. Refit (Fig. 9):

- the fork (28) and the coupler (8)
- the adjustable lock (27)
- the counter-nut (26).

18. Adjust the fork locking mechanism (27) (see Fig. 9 and chapter 5).

19. Reconnect the tractor between the gearbox and the rear axle (see chapter 2).

D . Disassembling and reassembling the planet carriers

Disassembling the input planet carrier

20. Position the input planet carrier (1) under a press and on top of a plate pierced with a hole to allow removal of the pins (12).

21. Drive out a pin using the press and a makeshift drift (Ø 12 mm) in the direction of the arrows (Fig. 11).

NOTE: The pin is force fitted into part E of the planet carrier (Fig. 11).

22. Remove the planet gear (9) and plates (13) from the planet carrier.

Recover the needle rollers (10).

23. Repeat steps 21 and 22 to disassemble the other two planet gears.

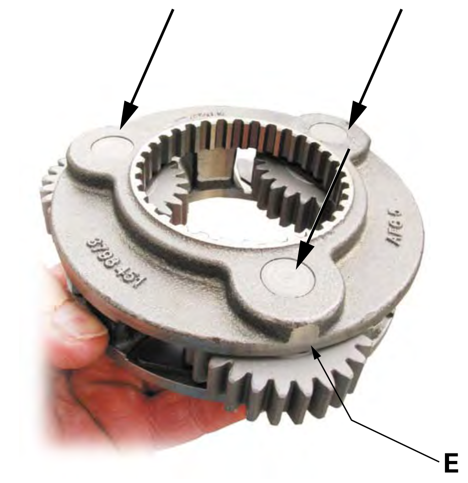

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Fig. 11

Reassembling the input planet carrier

24. Clean and check all components. Replace those that are defective.

Preparing a planet gear (Fig. 12)

25. Lightly smear the bore of the planet gear (9) with miscible grease.

26. Arrange the needle rollers (10) on the grease cartridge, taking care not to omit any.

27. Repeat steps 25 and 26 to prepare the other two planet gears.

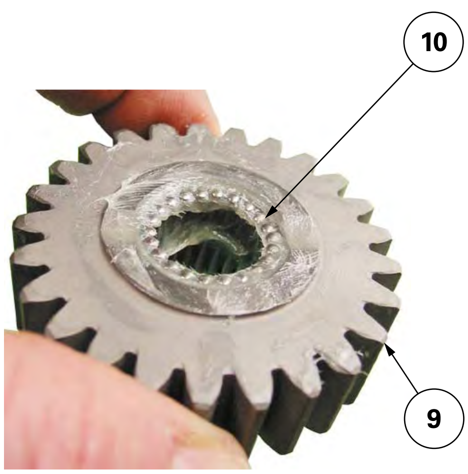

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Fig. 12

Fitting a planet gear pin

28. Place the input planet carrier (1) on a press.
29. Slide a planet gear (9), fitted with its needle rollers (10) and plates, (13) into the planet carrier.
30. Line up the planet gear and plates with the planet carrier pin hole (12).
31. Check that the axial channel and radial hole of the pin are not blocked.
32. Turn the axial channel inlet of the pin (12) as shown in Fig. 13.
33. Slide the pin partly into (Fig. 13):
- the input planet carrier (1)
- the planet gear (9)
- the plates (13).

Turn the pin. Turn the radial hole R as shown in Fig. 13.

34. Fit the pin (12) so that its blunt end is almost level with surface F of the planet carrier (Fig. 14).
35. Check manually on the planet gear (9):
- the presence of slight axial clearance
- the free rotation of the planet gear.

36. Repeat steps 29 to 35 to fit the other two pins.

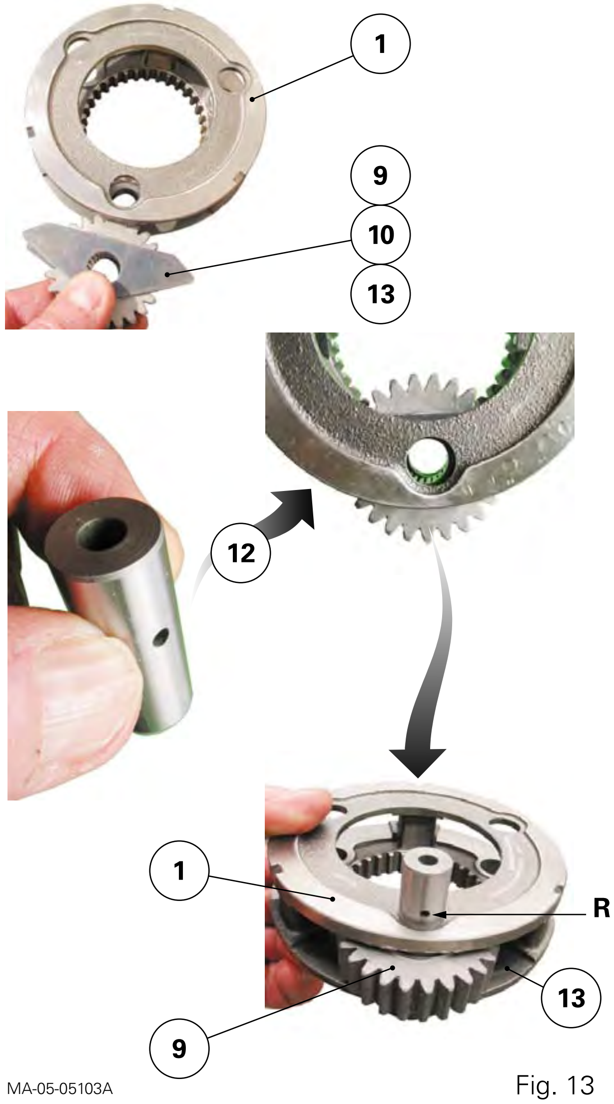

Fig. 13

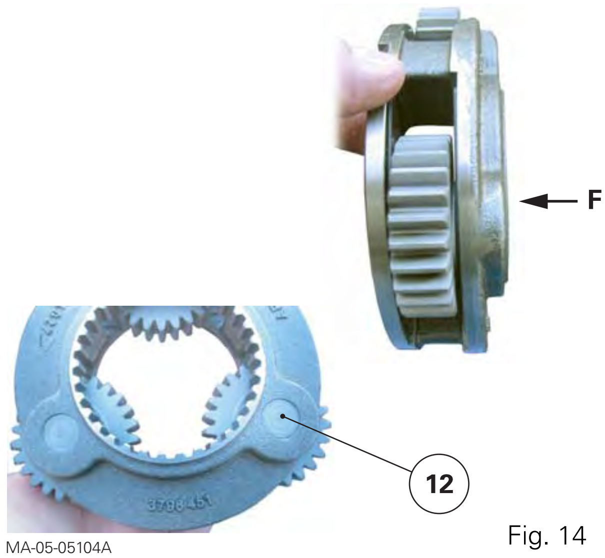

Fig. 14

Disassembling the output planet carrier

37. Position the output planet carrier (4) under a press and on top of a plate pierced with a hole to allow removal of the pins (12).

38. Drive out a pin using the press and a makeshift drift (Ø 12 mm) in the direction of the arrows (Fig. 15).

Note: *The pin is force fitted into part E of the planet carrier (Fig. 15).*

39. Remove the planet gear (11) and plates (22) from the planet carrier.

Recover the needle rollers (10).

40. Repeat steps 38 and 39 to disassemble the other four planet gears.

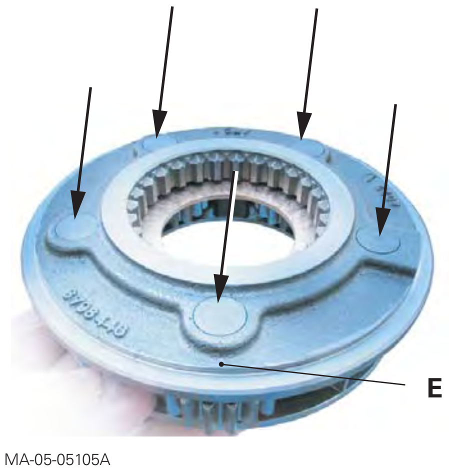

Fig. 15

Reassembling the output planet carrier

41. Clean and check all components. Replace those that are defective.

Preparing a planet gear (Fig. 16)

42. Lightly smear the bore of the planet gear (11) with miscible grease.

43. Arrange the needle rollers (10) on the grease cartridge, taking care not to omit any.

44. Repeat steps 42 and 43 to prepare the other four planet gears.

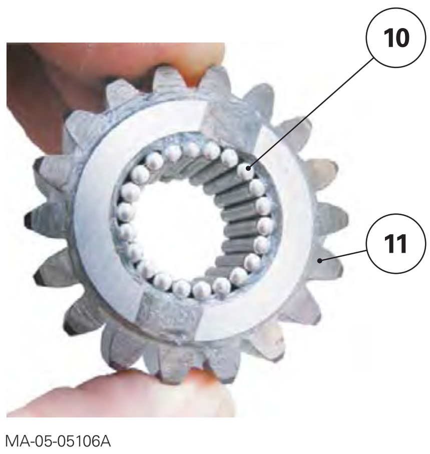

Fig. 16

Fitting a planet gear pin

45. Place the output planet carrier (4) under a press.

46. Fit the friction washer (2) into the base of the planet carrier (4).

47. Slide a planet gear (11), fitted with its needle rollers (10) and plates (22), into the planet carrier.

48. Line up the planet gear and plates with the planet carrier pin hole (12).

49. Check that the axial channel and radial hole of the pin are not blocked.

50. Turn the axial channel inlet of the pin (12) as shown in Fig. 17.

51. Slide the pin partly into (Fig. 17):
- the output planet carrier (4)
- the planet gear (11)
- the plates (22).

Turn the pin. Turn the radial hole R as shown in Fig. 17.

52. Fit the pin (12) so that its blunt end is almost level with surface F of the planet carrier (Fig. 18).

53. Check manually on the planet gear (11):
- the presence of slight axial clearance
- the free rotation of the planet gear.

54. Repeat steps 47 to 53 to fit the other four pins.

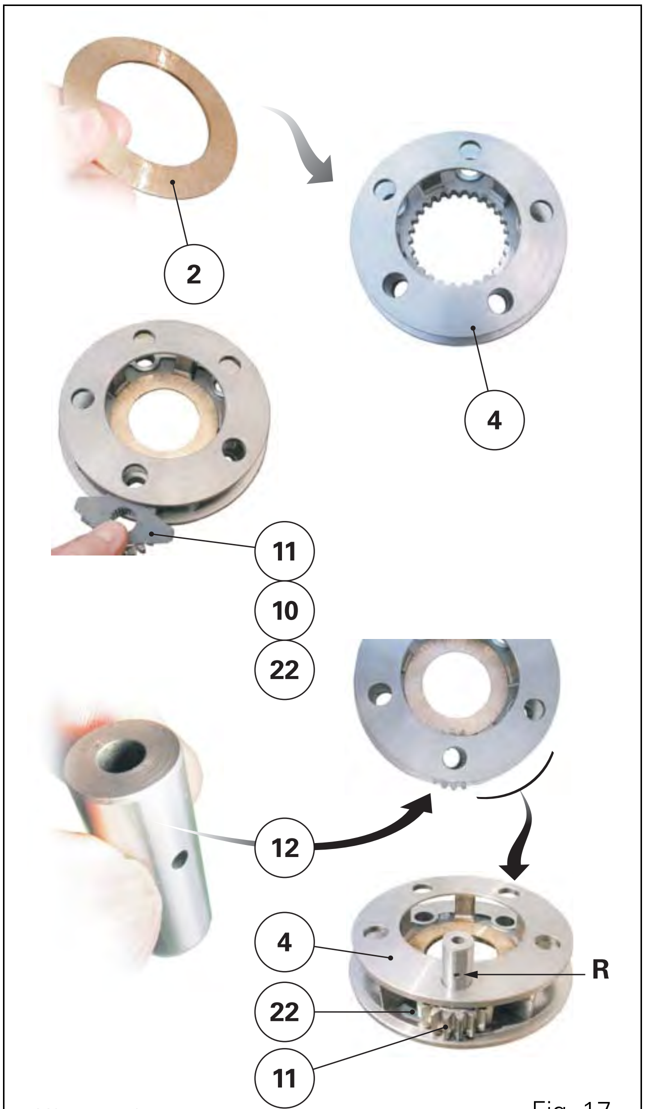

Fig. 17

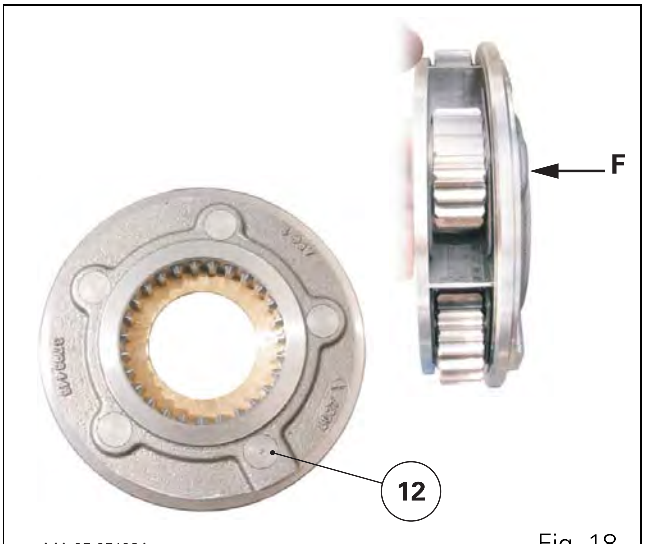

Fig. 18

E . Adjusting the control

Cab side (Fig. 19)

55. Place control lever A in the Snail position.

__Reminder:__ The control lever may be located in two positions on the right-hand console, depending on whether or not an auto-hitch is fitted.

56. Screw the clevis (1) level with the end of the threaded part of the cable.

57. Fit the clevis (1) onto lever A with the clip (7). Tighten the nut.

58. Screw the nut (3) onto the sheath end (5).

59. Fit the sheath end and the lock washer onto the support. Tighten the nut (4).

__Important:__ After tightening, check that the cable is not pinched.

Gearbox side (Fig. 20)

60. Place rod "B" in the "super creeper" position (Snail position, with the reducer dog (8) engaged towards the front, fork locked).

61. Screw the clevis (9) level with the end of the threaded part of the cable (6).

62. Fit the clevis (9) to rod B using the clip (10). Tighten the nut (11).

63. Adjust the stop (12) with the nut (13), making sure that rod B is still firmly locked.

64. Tighten the nut (14).

__Important:__ After tightening, check that the cable is not pinched.

65. Check that the control is locked in the "direct drive" position.

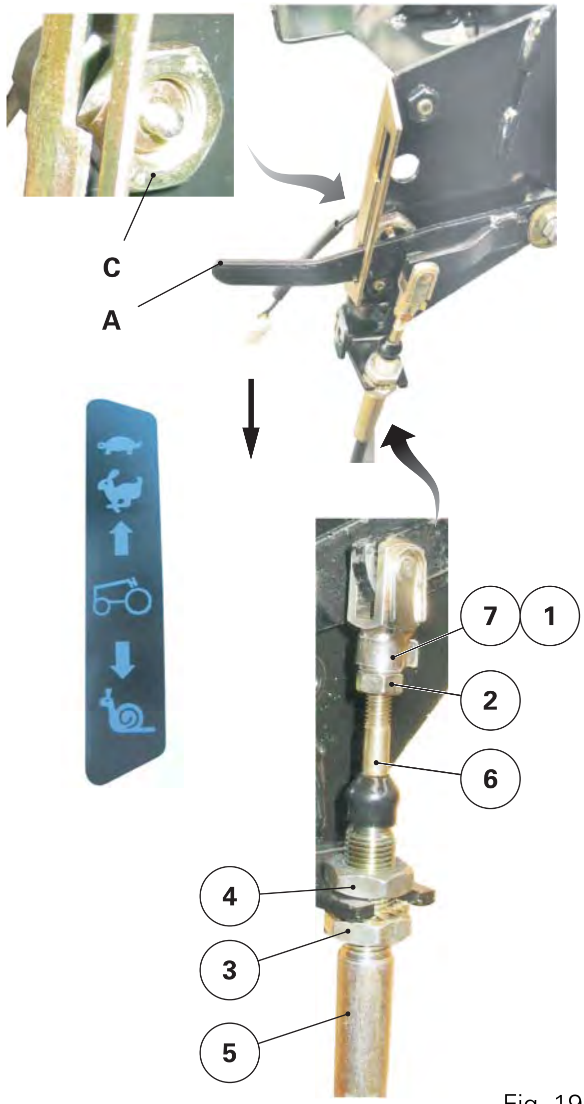

Fig. 19

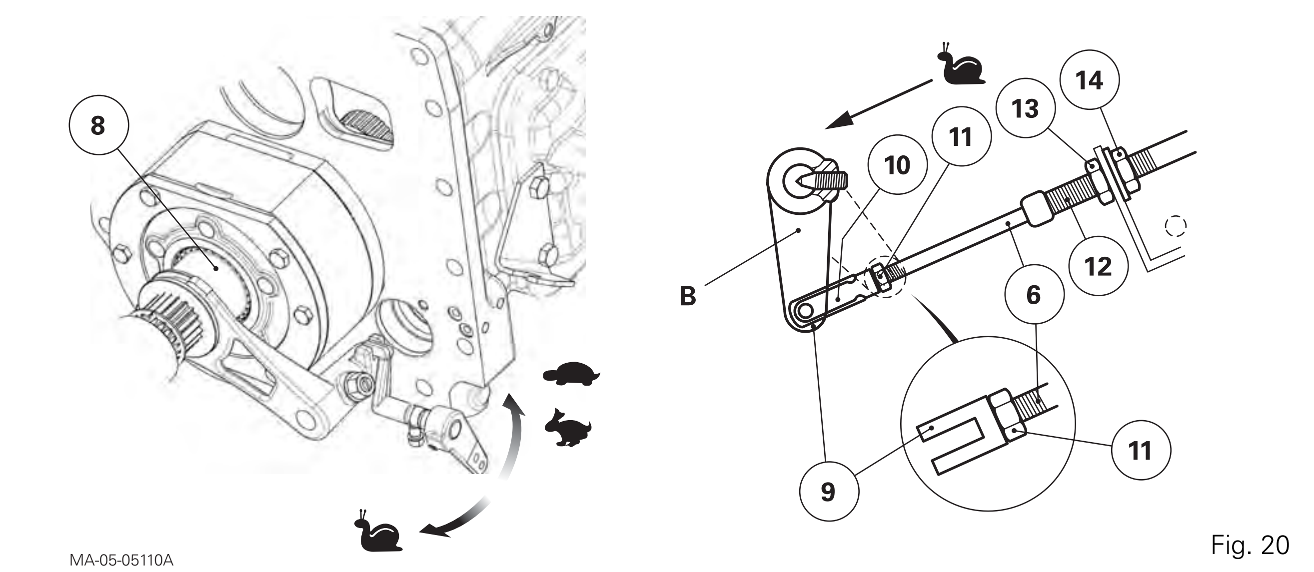

Fig. 20

F . General

The creeper speed reducer consists of an epicyclic gear train with a planet carrier and ring gear assembly fitted at the rear of the main gearbox. It is controlled by a lever located on the cab console and linked by a cable to a rod fitted on the front right-hand side of the centre housing. This rod moves the coupler control fork.

Important: *Creeper gears can only be selected if the main gearbox is in the Tortoise range.*

G . Operation

The coupler (8) is splined to the connecting shaft (21). Moving the lever "A" to Snail position (Fig. 4) moves the coupler (8) back and engages it with the planet carrier (1) via its external teeth. The speed of the shaft (21) is 1/4 in relation to the output shaft.

For normal gears, the gearbox output shaft is attached to the connecting shaft (21) when the coupler (8) is moved forward, thus ensuring direct drive.

When the creeper range is selected, the Snail indicator light on the instrument panel comes on.

When the Hare range indicator light flashes, this indicates to the operator that Hare position is engaged and shifting to Tortoise position is required.

The electrical signal corresponding to selection of the creeper range is transmitted via switch "C", which is fitted on the control unit (Fig. 4).

Parts list (Fig. 1)

(1) Planet carrier
(2) Friction washer
(3) Cover plate
(4) Lock washer
(5) Screw
(6) Snap ring
(7) Coupler ring
(8) Sleeve
(9) Planet gears
(10) Needle rollers
(11) Spacer
(12) Pin
(13) Gear plate
(14) Gear plate
(15) Stop plate
(16) Circlip
(17) Planet carrier assembly
(18) Friction washer
(19) Ring gear
(20) Centring pin
(21) Link shaft

View of the assembly

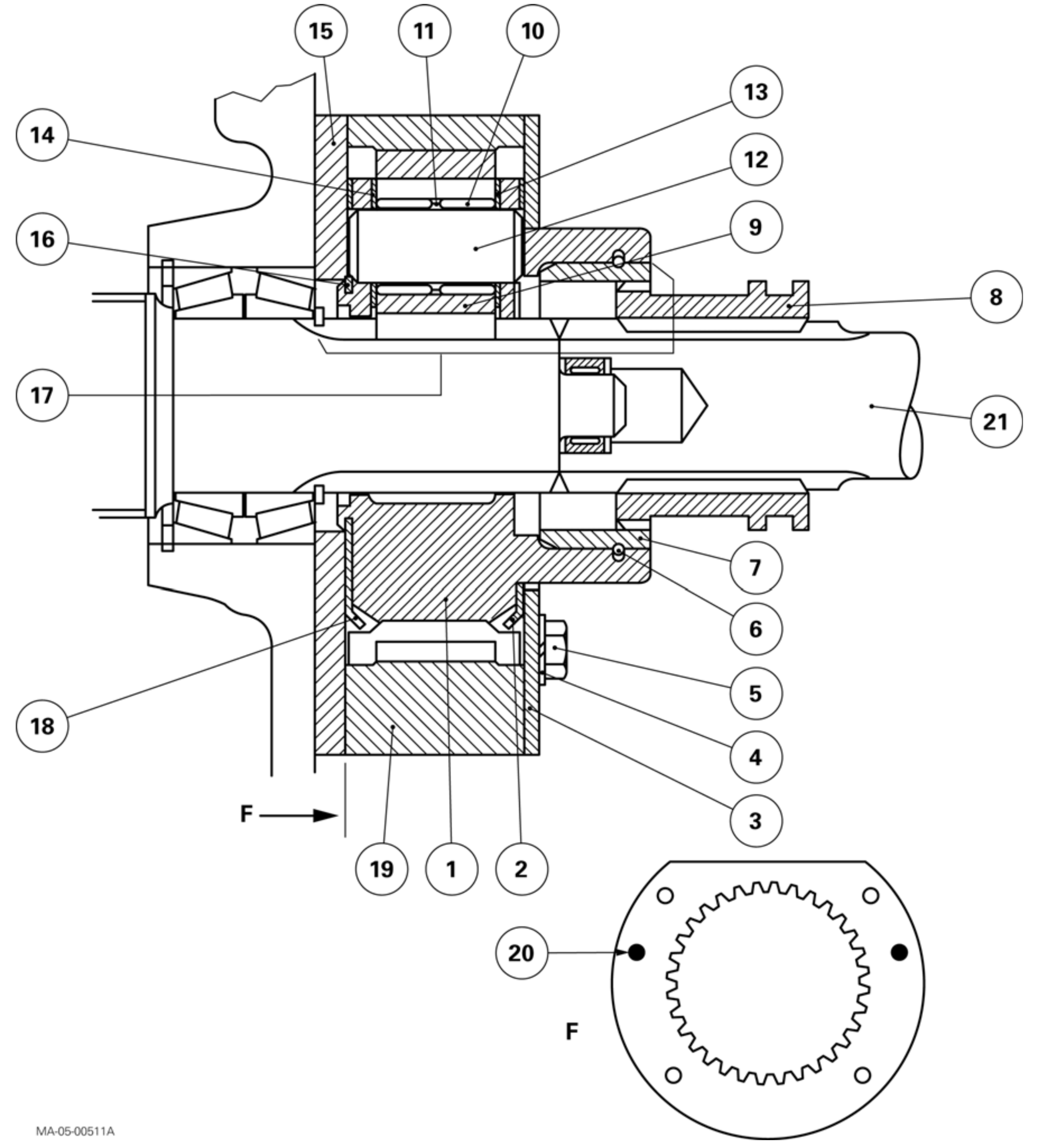

Fig. 1

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